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What are the Realities of Women in Engineering in Quebec?

Joys, Challenges, and Solutions

With the collaboration of:

Jennifer Petrela, Marie Eva Andriantsara, Jessica Bélisle,
Cristina Guzman, Jessie Morin and Morgane Vandel



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Louise Lafortune and Diane Gagné with the collaboration of:
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Introduction

► **The Realities of Women in Engineering: Joys, Challenges and Solutions**

The research findings presented in this book align with the work of two coresearchers who specialize in industrial relations and education (mathematics teaching) and share a focus on the underrepresentation of women in male-dominated fields. This project aims to enhance the recruitment, integration, and retention of women in STEM fields in companies where women make up less than 25% of the workforce. Contrary to neoclassical theories like Becker's theory of human capital and market segregation, the low rates of women in engineering cannot be explained by a lack of interest or an insufficient female workforce. Why, then, is the ratio of women to men in engineering still so low in 2024, and how can the phenomena behind it be explained? These questions serve as a driving force behind our research.

One explanation that quickly arises is systemic discrimination, which often makes indirect discrimination or discrimination stemming from existing structures and practices invisible. Which then begs the question: What can be done about it? It appeared that developing a model for raising awareness, recruiting and retaining women in engineering in the mining and oil sectors, and validating it with the people and human

resources departments (HRD) we met — but also with women working in engineering or university professors in this discipline — would bring a promising perspective to the project and make it transferable to other fields that employ STEM (science, technology, engineering and mathematics) professionals.

Our approach is based on deconstructing the myth of employment equality, noting that little progress has been made for women in male-dominated fields and the broader workforce (Gagné, 2022, 2024). Slow progress results from invisibility, lack of awareness and voluntary or involuntary resistance to the issues of systemic discrimination (Gagné, 2019). Additionally, women lack networks and role models in engineering, face a glass ceiling (social dimensions) and encounter barriers that are justified by presumed disinterest or the academic difficulties (personal and academic dimensions) inherent in engineering-related occupations.

The Canadian government aims for 30% of engineering graduates to be women by 2030, but progress has been slow. Achieving this goal is crucial for improving the realities of women in STEM sectors. Even if reached, specific efforts are still needed to recruit, integrate and retain women, particularly in the mining and oil sectors, which are the subject of this research. This research is designed to contribute to the discussion around ensuring that female STEM graduates are genuinely attracted to and retained by companies that value their STEM expertise and offer supportive conditions so that these women remain there and bring fresh synergy, creativity and innovation, along with their skills.

A process of deconstructing and reconstructing the myth of equality in employment is needed to build a fair, informed, equitable and inclusive society — and thereby contribute to the recognition of all STEM expertise and the integration of women of all cultures, ethnicities, origins, religions, sexual orientations and social situations, particularly in sectors that are still heavily dominated by men. This process is also key to growing recognition for women's place in society as a whole and reducing the persistence of inequalities, since the resistance and barriers that stand in the way of women's careers are still all too remarkably similar to those of the 1980s.

In the context of workforce shortages, attracting women to engineering in the oil and mining industries is urgent. Therefore, it is imperative for us to find ways of attracting women to the engineering field. Understanding and minimizing barriers is vital, as women constitute only 17.2% of engineers in the mining sector. In the refining sector, some companies hired several women in the late 1980s who are retiring or will be shortly. So how do we replace them? What actions should be taken? What support should we offer? Put another way: what are the biggest challenges in managing equality in the workplace?

The problem stems from changes in the labour market. On the labour market in February 1980 and 2024, Statistics Canada records: a 50.2% participation rate in 1980 versus 61.2% in 2024 for women; a 78.8% participation rate in 1980 versus 69.5% in 2024 for men; a 45.9% employment rate in 1980 versus 57.8% in 2024 for women; and a 65.3% employment rate in 2024 versus 73.3% in 1980 for men.¹ This illustrates a shifting social contract that is not only enduring, but constantly evolving; men are no longer the breadwinners and women are no longer the homemakers. Nonetheless, women continue to face obstacles in the job market, especially when it comes to accessing male-dominated professions. To this day, over 85% of women work in care and service sectors. In fact, according to Institut de la statistique du Québec, while gender diversity has held steady at $\pm 35\%$ since 2006 in the management sector, the same is true in the health care sector, with rates ranging from around 80% to over 70% in teaching and services.² The same stability is found in jobs in the natural sciences, where the rate rises from 21% to 24%, and in the so-called heavy trades and transport, where the rate hovers around 7.5%. Previous studies have identified several causes, such as prejudice and stereotypes, disparities in treatment, inequalities in power, as well as a lack of interest, understanding and knowledge of the issue of equity on the part of people working in male-dominated fields. It also underlines the important contribution of state action, which, when absent, leads to more of the status quo. Women face difficult workplace integration and mobility,

1. <https://www150.statcan.gc.ca/t1/tbl1/fr/tv.action?pid=1410028702>
<https://doi.org/10.25318/1410028701-fra>

2. <https://statistique.quebec.ca/vitrine/egalite/dimensions-egalite/travail/emplois-certaines-categories-professionnelles>

encounter barriers such as glass ceilings and glass walls, and experience a great deal of precariousness and deskilling. Where does this depreciation of women in the workplace come from?³ Haegel explains:

It is important to differentiate between two concepts, sex and gender, to understand this phenomenon. Sex is characterized by an anatomical difference between the two sexes (male and female). In contrast, the concept of gender is a social and cultural construct which defines normative masculine and feminine behaviours. The current state of research into sex does not allow us to assert such differences in behaviour. Sex difference in no way explains the inequalities accorded to men and women in the workplace.

The concept of gender is the key to this explanation. This concept refers directly to a set of implicit and explicit rules governing relations between men and women, which attribute gender-specific values and responsibilities to them. Women, for example, are systematically oriented towards health and education-related professions, while men are directed towards more technical occupations. (Haegel, 2020, p. 32)

In addition to developing a practical model for raising awareness and providing support, the aim of our research was to understand the strategies used by the management of companies in the mining and oil sectors to recruit and retain women, to gather the views of women committed to staying in the field, to identify strategies that help them and to validate the results and proposals with the people we met, as well as with HR managers, with a view to transferability to other employment sectors where women are in the minority. This book falls in line with efforts in the recruitment, attraction and retention of women in engineering. It aims to: 1) highlight strategies for recruiting women in engineering (studies and work) and retaining them in employment, as well as 2) more generally, bring to light strategies that help recruit and retain women in STEM (science, technology, engineering and mathematics) fields. This is why it seems necessary to bring together researchers, people working in both sectors studied and people working

3. Haegel, A. (2020). Tool 10. Equality of treatment between women and men. In A. Haegel, *La boîte à outils des Ressources Humaines* (pp. 30-33). Dunod.

to integrate women into STEM workplaces and academics. Bringing together women from different lived experiences — including Indigenous women and women from immigrant backgrounds — is a way of deepening our reflection and encouraging different partnerships to pursue research that leads to improved integration and retention of women in STEM fields. Raising awareness at the management level in various companies, people working in different community and social milieus and the academic and educational worlds will help to open wide-ranging dialogue that, in the long term, will promote gender diversity and even parity in STEM.

To meet the objectives of the research and to consider the issues and experiences of women working in the sectors under study, it became interesting to give a voice to women with various lived experiences, especially people from Indigenous and immigrant backgrounds. But first, as a research team, a question arose: Why did we ourselves not become engineers? Here are our stories.

► **Marie-Eva Andriantsara**

The reason I left my engineering studies had to do with the underrepresentation of girls in my chosen course. The underrepresentation of girls there was very intimidating. In a class of 25, there were only two of us that were girls. The fact that there were fewer of us meant that I felt out of place. However, after high school, I applied to study thermal engineering at university. Two girls and around 50 boys applied. There were only 30 slots available, and both girls were accepted. On the first day of school, when I learned that there were only two girls in the class, I was scared. I didn't stick with it: I turned up on the first day of school but never came back. The other girl went on and finished her engineering degree. I studied administration to come and teach at the university. If, that day, there had been some kind of mentor who had met with us to explain that yes, there are very few girls in the field, but that it was going to be okay, I think I could have stayed in that program. However, as we were instead scared off by being told that it would be difficult, the situation only added to my unease and anxiety. Then, when the university where I worked offered training in wood engineering, I wanted to enrol. I spoke to my supervisor about it, but she refused! She said: "You are a teacher, and it would be weird to be in the classroom with other students." I asked: "What's the problem?" She simply refused to register

me, so I couldn't enrol. So I continued to work. I came to Quebec to do a doctorate in administration. At one point, because I could not study wood engineering, I went to train in carpentry! That said, the situation has changed a lot in Madagascar since 2015. I now see that there are more and more girls studying across engineering fields. Companies have no trouble recruiting them either — they are not reticent. I do not know about their real-life experience in companies, as I haven't really had the opportunity to discuss their working conditions. Are they happy? What difficulties have they encountered? I don't really know, but when it comes to academic and workplace integration, I can see that the situation has changed compared to 15 or 20 years ago.

► **Jessica Bélisle**

For me, it was in high school that we had to make a decision, and to be honest, I didn't even know it existed. So, I went to the guidance office, and the careers I was offered were all traditional ones, including medicine and law. I had good grades, so I was leaning more toward the natural sciences to eventually go into medicine, but there was never any mention of the engineering field. It's as if my vision was closed off to anything that the people around me could do as a profession. We didn't get much information about that. The doors to that option closed right away in high school. I didn't like physics, so I ended up changing to the humanities — then I changed to police science, and I was almost finished. I had an injury, which meant I lost a year of police training because I could not take the final exams for my DCS (Diploma of Collegial Studies). Since I already had a DCS in the humanities, I went to university to study mathematics, which was the only program open at the time.

► **Diane Gagné**

I was a student who found school easy. Since my first year of primary school, I had always been at the top of my class, but always a bit of a rebel, and not so much studious as curious and daydreamy. It was in Grade 10 — when it became obvious for me to opt for advanced mathematics, given my academic achievements — that I hit my first wall. Had it not been for my teacher, William, I would have failed. For the

first time, I needed to work to succeed! I passed my course but with the equivalent of regular math. So I took a disliking to the subject. Quite naturally, in Grade 11, I chose the “law, drama and geography” track. To hell with math, and thanks to William, I had enough to get into CEGEP if I wanted to. In college, I was admitted to the humanities program with math. I wanted to continue my studies in journalism or law. It was the transit strike that put an end to those ambitions. I lived completely in the east end of Montreal, in Pointe-aux-Trembles, and my mother didn’t have a car. At the same time, a cashier position was open at the credit union on my street corner. I applied and got the job. I got married, and that was that.

The story could have ended there, but I guess there are such things as detours! I changed jobs some six years later, working in production control at the Petro-Canada refinery, now Suncor. I went back to school part-time at HEC Montréal (Hautes Études Commerciales), hoping to get a bachelor’s degree in human resources management. Before I finished my studies, operator positions (now petrochemical technicians) were not only finally open to women, but six of them were specifically reserved for them. I applied for and got the first female operator position at the Montreal refinery. Staying an operator was out of the question. After more than 15 years as a petrochemical technician and having experienced the ups and downs of life as a woman in a predominantly male environment, I opted to go back to school, first in human resources management and then in labour relations, on the strength of my 12 years of union experience — and because I was very comfortable in the role of union representative.⁴ I didn’t become an engineer because I actually didn’t like applied sciences. What I liked about working as an operator was the challenge of being a woman in a man’s world, and of paving the way and proving that, as a woman, you could be an excellent petrochemical technician. Which, by a wonderful coincidence, led me to a career in teaching. My research and interests stem from this atypical background.

4. I could write a significant life story with this professional passage. I have seen it all, but what an experience!

► Louise Lafortune

To understand why I didn't become an engineer, you need to know that I was born in 1951, attended high school from 1964 to 1968, CEGEP from 1968 to 1970, and I studied for my bachelor's degree in mathematics from 1970 to 1973. Since my father was a doctor (who died in 1960), I was good at math and generally good at school, I was headed for medicine. But I couldn't see myself in that environment. I loved mathematics, and it took me until the end of CEGEP to affirm my choice and refuse to go into medicine. The reason I didn't go into engineering was that it had never crossed my mind. I wasn't familiar with the profession, and I didn't know anyone practising it, never mind women in the field. I have a vague recollection — I don't know if it was before I started my bachelor's degree in mathematics or during my studies — but I used to think that to go into engineering, you had to be a “genius”, and the word was relatively scary. Parallel to my mathematics studies and teaching, I was a travel guide in Quebec (1972-1977) and taught at an Indigenous college (Collège Manitou, 1976-1977). I have always considered myself a (cautious) adventurer, and I imagine that engineering would have opened more doors of adventure for me than being a math teacher. I have been forced to live my adventurous life differently. When I hear women say that they use their imagination, their creativity and their innovation faculties in engineering, I envy them. However, it was an internal battle for me to go into mathematics and not medicine, so there really should have been one or more people talking to me about it and telling me that I had everything I needed to go into engineering. I was 15 in 1966, and I don't think there were many women in engineering. It was never offered to me as an option.

► Jessie Morin

To the question, “why did not I become an engineer?”, the answer is simple: I didn't know anything about the profession, no one in my entourage practised it, and there were no role models in the popular culture I consumed. So the choice never crossed my mind. In light of the knowledge I have acquired over the past fifteen years, and as a result of my participation in this project, I don't believe that any additional source of information at the time would have prompted me to make a different decision. My first “future” choice came in 2007, when I was

in Grade 11. Having passed advanced mathematics the previous year, I had to decide whether I wanted to continue my schooling by adding physical sciences, chemistry and Math 536 to my timetable or, instead, completing the core courses with drama workshops and enriched sports classes. At the age of 16, my decision fell on what seemed to me the most entertaining and exciting. My choice was made, and I was already moving away from the world of natural sciences. I went on to CEGEP in 2008, starting a DCS (Diploma of Collegial Studies) in languages, literature and communication, but finishing with a diploma in human sciences. For people from Sept-Îles, there were four choices for those wishing to pursue university studies following their time at the North Shore institution. Many of my friends opted for the natural sciences to pursue a career in the health field. Very few wanted to become engineers. With the misconception that the natural sciences automatically led to a career in health care — which was not at all what I aspired to — I took a particular interest in history. Fifteen years later, I earned a bachelor's degree in history, teacher certification, a master's degree in history and soon a doctorate in Quebec studies. I had found my calling. While a lack of information at the outset may have contributed to the fact that I'm not an engineer today, it's my passion for the humanities that explains my career choices.

► **Jennifer Petrela**

Around 1987, as I was nearing the end of my high school studies, students were given an aptitude test. The results suggested three careers, which were completely outside my interests and strengths. However, guidance counsellors were poorly trained and short in number back then. They didn't have time to listen to us — they just made us sit in their office for 10 minutes so they could read the test results out loud to us. They didn't prepare for the meeting, and they didn't know anything about our grades, extracurricular activities, or interests. When the 10 minutes were up, they wished us good luck and asked us to let the next person in. The parents of some of my friends filled this void by advising their children and showing them around universities. My parents were not academics, so I was the only one in the family interested in studying. If I had wanted to become an entrepreneur like them, they would have been happy to support me. However, they were incapable of guiding me, and it didn't occur to them to suggest a mentor from among their

acquaintances. Today, the Quebec government funds *Academos* — a mentorship platform that guides high school students — which didn't exist at the time. Consequently, I chose my field of study at university on my own, based on the only criterion that seemed remotely objective: my grades. Clearly, in Grade 11, my best mark was in history, so I enrolled in a bachelor's degree program in history. It's a beautiful subject that continues to interest me, but I had no more desire to work in this field when I left school than when I enrolled. On the other hand, my master's degree — which I began after taking two years off to work and travel — is in environmental health.

► Morgane Vandel

As a member of the research team, one of the first things this project has brought me are questions about my own choices of direction. I'm originally from France, and I'm currently a doctoral student in philosophy at UQTR. Right from the start of this project and the first interviews, when we asked engineers about what led them to this field and their motivations, I couldn't help but answer these questions myself (in my head, of course) to analyze and compare our paths: what attracted me to philosophy? What stimulates me in this field, motivates me and keeps me there? And my answers seemed, surprisingly, relatively close to those of the women we met: a certain epistemic curiosity, a desire to understand how things work and a desire to be useful, in one way or another, to society, to help people. So, I had to ask myself: why didn't I become an engineer, too? Like many of the women we met, I had always been good at school and had always done very well in all my subjects, so much so that when it came to choosing my *baccalauréat*⁵, all specialties were open to me without restriction. Up until then, and ever since I was a little girl, I had been convinced that I would take a Bac S (science) to become an astrophysicist or ethologist, and I could already see myself working at CERN (European Organization for Nuclear Research) or studying marine mammals around the globe. Naturally, those close to

5. To put it simply, in France, a *baccalauréat* is a diploma equivalent to the one obtained at the end of high school in Quebec. At the end of the year called *Séconde* (first year of *lycée*, generally 15-to-16-year-olds), students choose between the general *baccalauréats* L-Literary, S-Scientific and EzS-Economic and Social (in recent years, the system has changed). Students then spend two years (*Première* and *Terminale*) preparing for the Bac in their chosen specialty and graduate the year they turn 18 to begin post-secondary studies (university or other).

me and my teachers also tended to steer me towards scientific fields that offered more career prospects than literary ones. Many of my friends went on to study for a Bac S. However, against all odds, driven by a growing curiosity for the study and analysis of texts and a desire to explore these fields of research further — and in particular philosophy, courses that weren't taught until the final year of high school — I decided to go for a Bac L (literary). Although they were reluctant, my parents always allowed me to choose my own way and supported me as best they could. My mother insisted that I major in mathematics so that I could keep a foot in the sciences. So I graduated with honours from the literary baccalaureate program with a major in mathematics (a very strange combination, I grant you) and went on (not without a few detours) to study philosophy at university.

There are many reasons why team members did not become engineers. This diversity served us well in co-constructing the various stages of the research. Their differing and complementary experiences and knowledge helped shape the research specifications and shed unique and relevant light on an issue that is still of interest today.

The book is divided into six parts: Part 1) Contextualization, including the issue, literature review and research methods, Part 2) Synthesis of results, including joys and motivations for each group of women encountered: women working in engineering, female engineering professors and female engineering and STEM students, Part 3) Synthesis of results, including challenges and difficulties for the same three groups of women as in Part 2⁶. A supplement has been added to this section with results from human resources professionals, one specializing in the realities of Indigenous people and the other in the realities of women from immigrant backgrounds, Part 4) The equity and inequities experienced or perceived in engineering and STEM, the different perspectives of EDI, women's self-perceptions, women's contributions to the engineering field and the perceptions of some men working in engineering, Part 5) Strategies and solutions are proposed by the people we met for education, business and society, including parents, in which mentorship is addressed as a particular strategy, and Part 6) Recommendations are presented, with two competency frameworks and a practical model.

6. This part could be difficult to read, and the facts reported can be disturbing; the authors prefer to underline this.

As a team and even as individuals, much has been learned. The generosity of the people we met and the difficulties that were always present touched every member of the team. On more than one occasion, some team members were confronted with memories that were not always positive. Nevertheless, the testimonies of the team members included in the conclusion show that there was learning — the complementarity of disciplines and experiences was both beneficial and enriching.





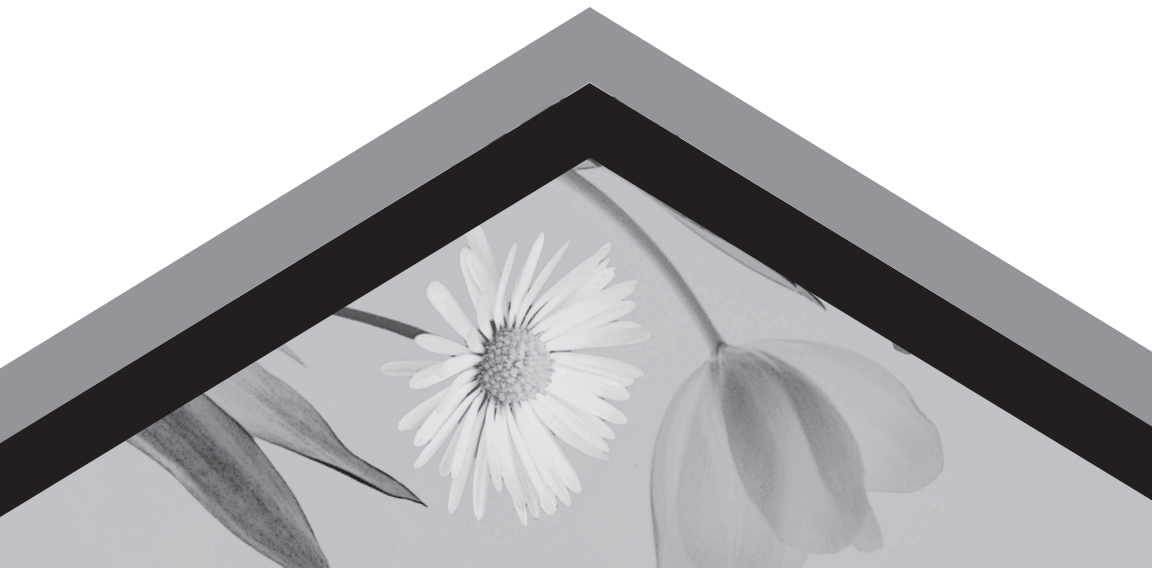
PART 1

Contextualization



Chapter 1

**Women in engineering in fields
where they are largely in the
minority: the issue**



Despite the array of laws and regulations aimed at countering discrimination that could have foreshadowed a clear reduction in discriminatory practices and the advent of equity in the workplace, we must admit that in all spheres of work — although some environments are more affected than others — inequalities do persist, with all their concomitant negative effects (Gagné, 2014).¹ The growth of mixed-gender workplaces in Quebec's male-dominated sectors has been very, if not too, slow. This is especially true in STEM (science, technology, engineering and mathematics) fields, particularly in refining, gas and mining. This slow growth has contributed to the wage gap that persists between men and women.

The Canadian government has set a target of achieving 30% female engineering graduates by 2030. However, progress toward this goal has been sluggish — even in 2023. Meeting this target, however, could ensure advancements in improving the realities of women in STEM in the companies that employ them. Even if this objective were to be met, efforts must be made to effectively recruit, integrate and retain women in these companies. While the Canadian goal is commendable, our project aims to ensure that women graduating from university in STEM fields are genuinely inclined to choose companies that will not only hire them for their expertise, but also provide conditions conducive to their retention, enabling them to contribute synergistically, creatively and innovatively with their unique skills. Contemporary society requires more diverse expertise, which includes women from various cultures, ethnicities, backgrounds, religions, sexual orientations and social circumstances (Lafortune, Groleau, Deschênes et al., 2022).

The research we conducted focuses on the refining and mining sectors, where female representation is below 20%. In the refining sector, many women were hired in the late 1980s, many of whom are approaching retirement, which begs the questions: How do we replace them? What actions are necessary, and what support should be offered? Similarly, in

1. Including the *Canadian Charter of Rights and Freedoms*, the *Quebec Charter of Human Rights and Freedoms*, equal opportunity programs, the *Pay Equity Act* and sections 87.1 and 87.3 of the *Act of Labour Standards*, which prohibit unequal treatment clauses.

the mining sector, only 17.2% of employees are women, underscoring the significance of identifying and comprehending the barriers hindering gender parity.²

The aim of this qualitative research is, therefore, to understand the institutional context in these sectors and contribute to perfecting a system that does not allow for significant progress in terms of professional equity. The approach we have adopted stems from the observation that access to this job market is limited and aims, within a broader framework, to equip the various people working in the fields of human resources, engineering and STEM.

This first chapter devoted to the issue is divided into four sections. The first section presents the current situation. The second section deals specifically with the challenge of gender-balanced workplaces. Sections three and four deal with two key aspects of the challenge of gender-balanced workplaces: the evolution of measures that promote the presence of women in male-dominated fields and the factors limiting women's choices regarding entry into engineering and STEM fields. Finally, the last section looks at the state of STEM education for girls and women.

► 1. Current situation

Meynaud, Fortino, and Calderon (2009, pp. 16-17) observe that, unlike their female counterparts, men who constitute the minority in female-dominated environments “often benefit from ‘glass escalators’ that propel them into the most esteemed and well-compensated sectors within these fields.”³ This dynamic deprives women of lucrative and secure employment opportunities in Canada, as the oil, gas and mining sectors rank among the highest-paying in the Canadian economy (Kaplan, 2022). Consequently, women in STEM are less inclined to pursue careers in the chemical, petrochemical, refining, gas and mining industries. Despite the considerable economic potential of these sectors, women remain underrepresented (approximately 30% in these

2. <https://www.quebec.ca/emploi/informer-metier-profession/explorer-metiers-professions/21330-ingenieurs-miniers-ingenieures-minieres>

3. Christine William (1995) coined the ‘glass escalator’ concept to represent a fast, minimally challenging route, such as taking an elevator or escalator rather than using a staircase to climb one or more floors.

sectors, compared 48% in Quebec's job market),⁴ notwithstanding the benefits their presence could yield for companies (CoeffiScience, 2019). Similar disparities persist in science and engineering disciplines in Canada, where women remain a minority (Brière, Deschênes, Belletête, Langelier, Gauthier, Tanguay, 2019). Indeed, “despite increased representation over the past decade, women still constitute a significant minority in natural sciences, technology, engineering and mathematics (STEM). [...] Women hold only 23% of all STEM positions in Canada” (Eugène, 2019, p. 1).⁵

The difficulty is that enrolment in university programs is generally still far from parity, when it comes to women and men. For example, in 2020-2021, girls and women are in the vast majority in bachelor's degree programs in health sciences (78% of enrolments), humanities (76%) and education (73%). In the natural sciences, they account for 43% of bachelor's degree registrants. In engineering, 23% of enrolments are female (Chair for Women in Science and Engineering in Quebec, 2022).

It is also worth highlighting a few specific situations. First, some engineering programs are more popular among women than others: technical and university programs in food engineering, is one, with 58% women students and biological and biomedical engineering is yet another, at 56%. For the time being, these are still small programs, with few students in total. Female and male representation is roughly equal in chemical engineering, and the proportion of women enrolled in programs approaches 30% in civil engineering. The least popular engineering programs for girls and women are electrical engineering (13%), mechanical engineering (15%) and computer engineering (16%). These last three programs and civil engineering are among the engineering programs with the highest enrolment rates (Chair for Women in Science and Engineering in Quebec, 2022).

Several research projects have examined the subject for almost 30 years, yet the situation shows no sign of changing. Despite the measures put in place, women remain underrepresented, so these measures do not seem to be working. “This situation [the underrepresentation of women in

4. In the chemical sector, women account for just over 40% of workers, helping to raise the average for the petrochemical, gas, refining and mining sectors.

5. <https://www.acfas.ca/publications/magazine/2019/02/femmes-recherche-au-quebec>

STEM] has changed very little over the past two decades, due in particular to the low proportion of women from the upcoming generation of students entering these fields “. (Eugène, 2019, p. 1) The same is true for Forbes (2019), which states that the oil industry remains among the least diversified in the economy, despite recent efforts to promote and encourage women’s participation. Several remedial initiatives date back to the 1980s, but the levels of girls’ and women’s participation in engineering studies remain low, barely exceeding 20% (National Workforce Survey Report - Engineers Canada, 2022). In the mining sector in 2020, women held 13.5% of jobs — from 2014 to 2020, this percentage had risen from 11.2% to 13.5% (AMQ, 2020). This means that women in the mining industry are still a long way from parity. It is easy to understand why they feel isolated in a male-dominated environment and doubly isolated, as they often work in remote areas with atypical schedules.

This situation is likely to persist, as there is still a double standard in education. Young girls are not educated in the same way as young boys. How society, the community and those around them educate women does not really help them choose or aspire to become leaders. To this end, the KPGM report (2015, p. 5) refers to “the difference in the education of young women and young men: [...] 86% of women remember that growing up they were taught to be kind to others; 44% learned to be a good leader; 34% learned to share their point of view. Today, three quarters (76%) of women would like to learn more about leadership and have more leadership opportunities” (free translation). Jiménez and Rodríguez (2017, p. 8) argue that “the gender gap begins when students have the opportunity to choose electives. Normally this occurs in secondary education and continues throughout the educational process, worsening the situation. [...] During this period, adolescence, when students have freedom of choice, this is the time when stereotyped gender roles permeate them the most” (free translation).

Considering the context of a labour shortage and the 2017 OECD report,⁶ it is pertinent to question this underrepresentation of women in the labour market, particularly in STEM-related fields. McGrath

6. The 2017 OECD report shows that in many Western countries, girls study longer than boys, yet they do not enjoy the same opportunities to access quality jobs or progress in the professional sphere. When they actually do, they often do not persist, since in the gap between formal equality and de facto equality, therein lies the challenge of the gender-balanced workplace.

and Marinelli (2012) assert that there is a need to increase the proportion of women in the oil, gas and mining sectors to address the shortage of qualified personnel. According to KPMG (2019) and McGrath and Marinelli (2012), there is a need for management in engineering fields to implement strategies that promote the professional integration and development of women in their sector to increase the number of women working in the industry.

In the same vein, COPAS Editor (2021) suggests that — as one of the significant challenges facing society today is the shortage of labour — the need to hire more women in the gas, oil and mining industries is real, considering that this is a workforce that industries can no longer deprive themselves of in order to remain competitive. There is, therefore, an urgent need to find ways of attracting women to engineering, particularly in the fields of the future: “Worldwide, employment in the energy sector is expected to grow from 18 million in 2021 to 26 million by 2050. [...] Women make up half of this country’s talent pool, so companies in the sector must not overlook the opportunity to take advantage of a vital resource to fill crucial roles” (COPAS Editor, 2021, free translation).

Having more women in STEM seems imperative, since the advantages of working on mixed-gender teams are real: it improves innovation, increases productivity and generates higher profits. Following the Boston Consulting Group (BCG), it has been argued that the most significant gains in innovation are achieved by diverse management teams, including gender diversity (COPAS Editor, 2021).⁷ Some of the reasons given in the COPAS (2021) report are that a diverse workforce creates an attractive working environment, signals to investment companies that social responsibility, skills, innovation and collaboration are more highly valued and encouraged. Yet, to date, it has been statistically demonstrated that these sectors (oil and mining) are still too male-dominated in engineering, especially when it comes to senior management positions — and this situation underscores the challenge of gender-balanced workplaces.

7. https://copas.org/wp-content/uploads/COPAS_Summer2021_SinglePages.pdf

► 2. The challenge of a gender-balanced workplace

The challenge of a gender-balanced workplace is rooted in, but not limited to, the transformations of the labour market resulting from the evolution of the social contract in the 1970s: men are no longer the sole providers, and women are the sole carers.⁸ To understand this social phenomenon — the challenge of the gender-balanced workplace — it is crucial to study its history and analyze its deployment in these sectors. That way, we can identify the actions and levers that will enable us to develop strategies that counter systemic discrimination and thereby promote women's access to more secure and better-paid jobs (Gagné, 2019).

According to Gagné (2022), the definition of a gender-balanced workplace used is the one specified by CIATF (intervention council for women's access to work) in its report on the concerted national strategy (2011, p. 15): "Gender balancing refers to the process of integrating women into predominantly male occupations, as well as integrating men into predominantly female occupations, depending on the workplace." It is derived from the concept of gender and is achieved when a rate of plus or minus 35% is reached. This is not an insignificant choice because when viewed in this way, gender diversity in the workplace moves away from views that favour diversity management over the promotion of gender diversity (Gagné, 2022). This deliberate choice stems from the fact that Gagné (2019, p. 96, citing Meynaud et al., 2009, pp. 22-26) assumes that women are not a stigmatized minority. The implementation of diversity management policies is often to the detriment of professional equality, which is still too often taken for granted. Diversity management frequently obscures institutional or organizational bottlenecks, as well as the dynamics of gender, class and race relations, perpetuating inequalities in career paths.

8. This topic of gender roles alone would merit its own chapter. However, as this is not the purpose of this book, others will have to take on the critical analysis of this shift.

The numbers speak for themselves: there is still no critical mass,⁹ and peer pressure is, according to several studies, still to this day, the main pitfall. In this regard, women report that their credibility is still to be “regained”, since the resistance and barriers that stand in the way of their journey are still all too remarkably similar (Gagné, 2019). As Lagacé (2021, p. 1) put it, “they [women] are perpetual pioneers [...] champions who have no right to make mistakes.” From this point onwards, women have faced several obstacles linked to the job market, economic and social contexts, and personal traits. In this way, fostering a gender-balanced, equitable and inclusive workplace becomes a collective challenge. This involves (re)seeing the systemic issues (the absent or missing network of women in the mining and oil sectors), the lack of understanding of what systemic discrimination is (“I am not sexist, but...”) and the challenge of the gender-balanced workplace in the traditional work model, including organizational practices and culture (Gagné, 2022). That is why, like Brière et al. (2019), Gagné (2019) and Lafortune, Groleau and Deschênes et al. (2022), we need to consider that a concerted effort of collective reflection is necessary, as the various studies listed demonstrate the many benefits that flow from the arrival of women in traditionally male environments.

► **3. From the Charter of Human Rights and Freedoms to equal opportunity programs (EOPs) and equity, diversity and inclusion (EDI) policies**

The persistence of employment inequalities over time requires us to understand how they can be explained. According to Gagné (2017, 2024), the main cause is the triad of prejudices, stereotypes and ideologies. It therefore becomes helpful to tackle the causes behind the persistence of the glass ceiling (sticky floor) and to understand this managerial evolution from the missed opportunity of equal employment opportunity (EEO) and pay equity programs (Chicha &

9. Green (2004, citing Dahlerup, 1988) defines the theory of critical mass as follows: a group that is in the minority in a larger group can only emancipate itself from the existing norm or act differently to bring specific projects to fruition once it reaches a certain threshold, equivalent to a third. The size of the minority would therefore play an important role in the ability of elected women to work towards the substantive representation of women — in other words, their willingness and ability to act to ensure that women’s collective needs are more widely considered.

Charest, 2013) to the implementation of equity, diversity and inclusion (EDI) policies. To this day, nearly 85% of women work in just three sectors: education, care and services.

From a broader historical perspective, Gagné (2017, 2024) argues that the persistence of these inequality phenomena can largely be explained by the phenomenon of systemic discrimination: a form of discrimination that renders invisible indirect discrimination or discrimination arising from existing structures and practices. Take, for example, within patriarchy or a male-dominated culture, the prejudices, stereotypes and ideologies conveyed in the workplace and recruitment network.

The concept of intersectionality (Lafortune, 2024 a-b) adds sensitivity to the various forms of discrimination experienced by women and the different contexts in which they move. Moreover, this concept of intersectionality enables a cross-analysis of the different grounds for discrimination, which the *Universal Declaration of Human Rights* aims to counter. This is a significant contribution in a context where strategies for equality between women and men, notably programs aimed at gender diversity and parity in employment — including equal opportunity programs (EOPs), pay equity programs (PEPs) as well as equity, diversity and inclusion (EDI) programs — have their origins in this original declaration of individual rights, now referred to in many countries (including Canada) as human rights. The following chapter, which presents the theoretical framework used in this research, will review the components of these various measures to promote gender diversity in the workplace.

► 4. Factors influencing women's career choices in STEM

According to several studies, including Gagné (2022), Brière et al. (2019), Anemeje (2014) and Galbreath (2011), women working in male-dominated environments generally encounter career-limiting obstacles that have an impact on the achievement of their ambitions and some of the company's organizational goals. Williams, Kilanski and Muller (2014, p. 445) put forward this explanation: "There is a persistent managerial myth that women stagnate mid-career and end up quitting their jobs in large companies." According to Forbes (2019),

gender equality is not perceived by some in corporate management as an organizational value, meaning they tend not to even consider improving women's numbers in the workplace.

In a study conducted by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the factors influencing women's career choices in STEM are presented along four dimensions: individual (personal), family, school and social (including organizations). However, several other possible dimensions can be used to delimit this subsection of the problem. Adopting UNESCO's vision and grouping the problematic elements concerning the factors influencing women's choices under these four dimensions enables us to cover the essence of the existing theoretical issues presented in the next chapter. Notably, the individual dimension refers to, among other things, the biological dimension — to women's psychology, values and the integration or non-integration of stereotypes and prejudices. The family dimension includes aspects such as values or beliefs according to the culture and education of the parents, as well as the economic situation of the immediate family. The school dimension relates to experiences in the educational process, teachers' perspectives and the quality of teaching. The social dimension includes cultural and social aspects of gender equality and gender stereotypes (Jiménez & Rodríguez, 2017, pp. 11-12). We will include components related to the labour market and work in this social dimension.

► 5. Realities in education: math phobia and math anxiety

From consultations with math-phobic youngsters over eight years, it was possible to establish that both boys and girls experience mathematics anxiety. However, girls express it more openly. For many boys, this is performed as indifference, a way to avoid sharing their mathematical difficulties publicly (Lafortune and Solar, 2003; Lafortune and Pons, 2004, Lafortune, 2024a-b).

The anxiety that girls express more readily than boys can sometimes become hard to bear, leading to a fear of math, also known as math phobia. Fear of mathematics is an affective state characterized by feelings of aversion and panic towards the discipline. It can easily lead to

avoidance when it ends up creating unbearable tension. It is conceivable that people who have undergone traumatic experiences in mathematics would be prepared to reorient their careers to avoid these embarrassing, even agonizing, situations. Math phobia has two facets: it can be an affective state characterized by anxiety, discomfort and fear that prevents people from engaging with mathematics. Intense or less intense emotions can inhibit people from concentrating and performing to the best of their ability. On the other hand, countering the adverse effects of mathematics anxiety may also bring about positive results, characterized by excitement and challenge, possibly leading to pride and even pleasure in mathematics (Lafortune, 1992a-b, 2004).

Since attitudes towards mathematics tend to worsen as young people progress through school, paying particular attention to words or behaviours that may imply a lack of ability, or that certain emotions are misplaced, becomes crucial. These gestures or words impact girls' career choices, especially if they had once considered going into a STEM (science, technology, engineering and mathematics) field (Lafortune, Groleau and Deschênes, et al., 2022, texts 2, 5 and 16).

► 6. PISA surveys: The situation in Canada and Quebec in mathematics and science¹⁰

Every three years, Canada and Quebec take part in an international test called PISA (Programme for International Student Assessment), with a break in 2021 due to the COVID-19 pandemic. This assessment program was created by the OECD (Organisation for Economic Co-operation and Development). In 2022, the main field assessed in the PISA tests was mathematics.¹¹ The OECD report ranks Canadian students among the world's top performers in mathematics. Reading and science were the secondary domains assessed.

10. CMEC (2023), *Conclusions from PISA 2022*, Canada: CMEC.

11. <https://www.newswire.ca/fr/news-releases/un-rapport-de-l-ocde-classe-les-eleves-ducana-panami-les-plus-performants-au-monde-en-mathematiques-808678426.html>

A total of 81 countries took part in the assessment, with 5,000 to 10,000 students from at least 150 schools in each country.

- Quebec students particularly excelled in mathematics, ranking at levels comparable to some of the top-performing countries and economies in the assessment.
- In Canada, performance in mathematics varies considerably by gender, with boys achieving higher average scores than girls. A similar trend was observed in several other participating economies and countries.
- In reading, girls consistently outperformed boys, both in the Canadian context and internationally. In science, on the other hand, girls and boys performed similarly.

These results show that Quebec performs very well in mathematics and science. The results also show that girls are more afraid of failing than boys. The question then arises: do girls lack self-confidence, or do boys have too much self-confidence? Even if most girls lack self-confidence, it is not appropriate to conclude that all girls lack confidence. Nevertheless, it would be important to strike a balance between attributing success to effort and competence and attributing failure to inability and lack of effort. It is a combination of effort and skill that ensures success. How can we raise awareness of the traits that foster success in math, science and technology, and attract more women to STEM?

► 7. In a nutshell

The problem as laid out demonstrates that women's reluctance to pursue a career in STEM may be caused by their collective and individual perceptions of the lack of opportunities to climb the ladder and reach positions of high responsibility. Indeed, the higher the positions in the hierarchy, the fewer women there are. This is the concept of the "glass ceiling" introduced by sociologists — an invisible but very real barrier (Bakhti, Boisseau, Herman, et al., 2017). Lafortune, Groleau, Deschênes and their team concur, asserting that the presence of a glass ceiling makes it difficult for women and visible minorities to reach high-level positions (Lafortune, Groleau, Deschênes, et al., 2022). This is also what Anemeje (2014) maintains: men are more likely to reach managerial positions in corporate STEM fields than women.

This underrepresentation of women in positions of authority is generally associated with issues such as motherhood, prejudice and stereotypes, family responsibilities, morality and corporate culture. “Even though it varies from country to country, [female underrepresentation] stems from biases or prejudices that a good leader is always associated with masculine traits and characteristics” (Jiménez & Rodriguez, 2017, p. 21-22, free translation). This also stems from the low numbers of women who can serve as role models in decision-making positions (Ordre des ingénieurs du Québec, 2022). Nevertheless, the KPMG study (2015) shows that several women could be role models for young girls. “Many of them have propelled businesses, governments, academic institutions and other organizations to new heights. They have shown other women the possibilities and power they hold. However, for all their achievements, these women represent too small a percentage of global leaders” (KPMG, 2015a, p. 2).

► Conclusion

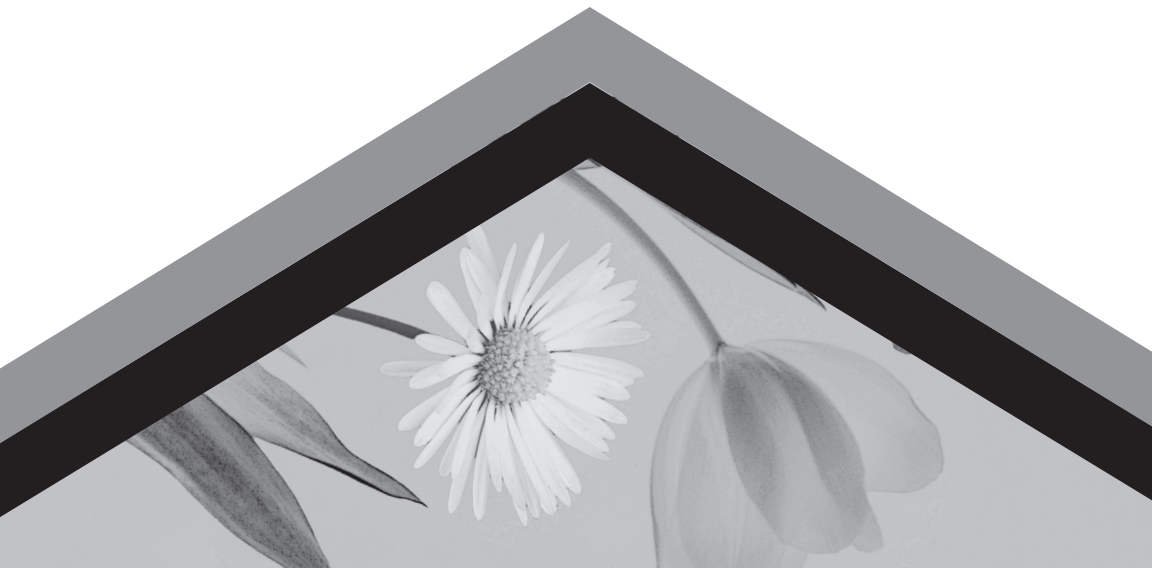
In short, things are improving in science and engineering, even if curricula and professions are still gendered. However, as female representation in bachelor of science and engineering enrolments in Quebec grows slowly, we still need to work on changing the false perception that these professions are more appropriate for men than they are for women.

To achieve this, it would be necessary, on the one hand, to improve working conditions and work-life balance for women scientists and engineers and, on the other, to improve the image of these professions by raising their profile and showing role models of scientists and engineers who are thriving in their careers. As vectors of change, many non-profit organizations and educational institutions, supported by government bodies, have been working actively since the 1980s to improve the situation. More recently, government bodies have endorsed Engineers Canada’s goal of 30% female engineering graduates by 2030 across Canada. The *Manifesto about Women in STEM (science, technology, engineering and mathematics)* (Lafortune, Groleau, Deschênes, et al., 2022) also proposes positive solutions to improve the representation of women in engineering, physics and computer science so that they can flourish in these professions.



Chapter 2

**Women in engineering in fields
where they are largely in the
minority: literature review**



A man is considered competent beforehand, until he demonstrates his incompetence.

A woman is deemed incompetent until she demonstrates her competence.¹

Yseulis Costes

This chapter presents part of the literature review that helped to focus the theoretical framework on which the research is based.² It has been designed to identify the processes and interactions between players in the world of work that lead to progress or, on the contrary, bottlenecks in terms of professional equality, which has been identified as the challenge of the gender-balanced workplace (see Chapter 1). Based on the concept of access to employment, it is possible to determine the theoretical challenges and issues involved in retaining women in these predominantly male professions and trades to gain a better understanding of women's career trajectories, the reasons behind their progress and the main barriers to women's retention. Some of the causes (individual, organizational and contextual) linked to mobility and retention issues for women are also addressed.

In line with Gagné (2022) and Brière et al. (2019), theoretical thinking largely stems from the success of the correctional officer environment, considering that it is an exceptionally closed and challenging environment given the clientele, organizational culture and issues related to physical strength. The study by Brière et al. (2019) shows that progress has been rapid (now representing nearly 40% of the workforce, women are making a career there with a retention rate of almost 95%). This success is multifactorial. Recruitment and promotion procedures have been reviewed, measures to facilitate family-work balance have been adopted and correctional officers have been offered appropriate training. It is important to remember that “everyone worked together to bring about a change in culture and behaviour, including clear guidelines on hiring, harassment, the use of appropriate language, a broader

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1. Haegel, A. (2022). Tool 10. Equal treatment of women and men. In A. Haegel, *La boîte à outils des Ressources Humaines* (pp. 30-33). Dunod.
 2. A detailed description of the literature review is available in Gagné, Lafortune and collaborators (2024). *Situations de femmes en ingénierie dans des secteurs où elles sont largement minoritaires: rapport de recherche*.

recruitment pool, etc. [...] Women have been empowered to take on more responsibility for their own lives. [...] Women have been integrated into work teams and are doing the same work as their male colleagues, the only exception being strip searches” (Gagné, 2022, summarizing Brière et al., 2019, p. 165-190).

It has also been considered that while the (re)production of discriminatory organizational and cultural practices is more the work of the dominant group, what Young (1990) calls cultural imperialism, it has to be said that people marginalized in this way also participate in maintaining these situations by implementing individual strategies that are all too often still linked to personal choices, such as becoming “one of the boys” or a mother figure (Comité Équité de la Société de philosophie du Québec, 2014).³ Understood in this way, fostering a gender-balanced, equitable and inclusive workplace becomes a collective challenge. This is especially important given the inequalities of power, particularly bargaining power, and the lack of interest, understanding or awareness of gender diversity (Gagné, 2022).

Two dimensions were selected to build the theoretical context. The first one, related to access to the job market, concerns barriers to employment and inclusive practices. The second is staffing: a human resources management practice referred to in more contemporary terms as human capital management. The presentation on barriers to employment and inclusive practices will draw on the four dimensions identified by UNESCO — the individual or personal, family, school and social dimensions — to illustrate the main components. Concerning staffing (human capital management), the focus will be on recruitment, retention and mentorship.

► 1. Access to employment for women in engineering

The interest of this research was to mobilize the team of researchers’ multidisciplinary and transdisciplinary fields of study based on feminist theories to take stock of barriers and inclusive practices. Although several other possible dimensions could have been used to delimit this literature review, adopting UNESCO’s vision and grouping the

3. Pamphlet found on the committee’s Facebook page and accessed on February 15, 2020. https://www.facebook.com/comiteequitespq/?ref=page_internal

problematic elements concerning the factors influencing women's choices under these four dimensions enables us to cut through to the essence of existing theoretical issues. In particular, the individual dimension refers, among other things, to women's psychology, values and the integration or non-integration of stereotypes and prejudices. The family dimension includes aspects such as values or beliefs according to culture, parental education and the economic situation of the immediate family. The school dimension relates to experiences in the educational process, the teaching staff's outlooks and the teaching quality. The social dimension includes the cultural and social aspects of gender equality and gender stereotypes (Jiménez & Rodriguez, 2017, pp. 11-12). In this social dimension, managerial components related to the labour market and work will be included. In the same vein, it is essential to peer deeper, and not limit ourselves to the systemic issues of the traditional work model, including organizational practices and culture, gender discrimination, the glass ceiling or sticky floor, stereotypes, family-work-life balance, lack of mentorship, gender role conflicts and pay inequality.

Furthermore, family and educational backgrounds are presented as the first sources of influence, followed by components linked to social and managerial dimensions. We conclude with the main components related to personal dimensions.

1.1 Family dimension

The aim here is to identify the family dimension by theoretically (re) understanding the influence that family members, particularly parents, can have on certain women's career choices and some difficulties regarding family-work-life balance.

Influence and support from family and friends

Several writings maintain that parents primarily influence boys' and girls' behaviours and preferences (Ainane, Bouabid & Sokkary, 2019; Leaper & Friedman, 2007). As per Leaper and Friedman (2007, pp. 568-569), three types of parental influences emerge: "First, parents tend to be stricter about gender conformity with their sons than with their daughters (see Leaper, 2002). Second, parents with traditional gender attitudes may be more likely to encourage sexist play

in their young children than parents with egalitarian attitudes (Fagot, Leinbach & O'Boyle, 1992). Finally, fathers are more likely than mothers to adopt traditional gender attitudes and encourage sexist play (Leaper, 2002; Lytton & Romney, 1991)” (free translation of Leaper & Friedman, 2007, pp. 568-569).

In concrete terms, this can lead to insinuations such as boys are better than girls at math (when this is not the case: see PISA tests, OECD, 2022) and thereby influence their children's development as regards ideals and values. It may also mean allocating care and household tasks to girls while boys are given more maintenance-related tasks. Leaper and Friedman “understand that frequent use of these generics can transmit and reinforce gender stereotypes in children” (2007, p. 567, free translation). The same authors also note that “girls with egalitarian parents perform better academically, particularly in math and science, than girls with traditional parents” (Leaper & Friedman, 2007, p. 577, free translation).

Thus, following Vidal (2015), interactions within the family environment (parents, siblings, extended or blended family) and social environment (daycare, kindergarten, primary and secondary) influence children's tastes, aptitudes and personality traits according to the masculine and feminine norms of the society in which the child is raised (*Enseigner l'égalité*, s.d.)⁴ According to Diamond and Stebleton (2019), social class can act as an additional hurdle for women because, in most cases, a woman from a low-income family will face more difficulties in managing her tuition fees. As underscored by Brière et al. (2019), parents' lack of knowledge of their children's academic background can also be a barrier to the choice of disciplines such as science, engineering or mathematics, even if the fact that girls can attend university seems obvious to them.

In short, “educational choices are not gender neutral and are marked by rational cost-benefit calculations for students, in combination with social influences (family, peers and teachers) that create early expectations during gender socialization” (Vieira do Nascimento, Mutize and Chinchilla, 2021, p. 24). In addition, when women have access to higher education, they experience high levels of stress due to exams and assignments. This goes hand in hand with the pressure to perform

4. <https://enseignerlegalite.com/petite-enfance/stereotypes-sexuels-chez-les-tout-petits/>

and the sense of incompetence often felt by female students (Lafortune, Groleau, Deschênes et al., 2022). Consequently, the support of those around them becomes essential.

Support for family-work-life balance

Referring to family-work-life balance, Brière et al. (2019, pp. 117-118) point out that “motherhood, in general, is perceived as problematic in many engineering contexts [...]. Despite the willingness and support of organizations that allow flexible working hours, women in engineering conceive that it is difficult to manage to balance family and professional life well without giving up their performance and career progression.” According to the same study, most women working in male-dominated fields who have children also have a partner who is very involved in family life. However, their involvement varies. “Some are simply caregivers, others do almost everything” (p. 40). It should also be noted that the sharing of tasks has not yet experienced a full shift to equality. “We do not say that women ‘do their share’. The woman does it because she has to, and the man ‘does his share’” (p. 41).

William’s (2018) study argues that in the US, most mothers grapple with the conflicting demands of work and parenthood without significant support from state or corporate partners and that difficulties still need to be resolved in balancing professional ambitions with motherhood. The decision to have a child is said to be a barrier to accessing positions of responsibility. Coleman (2020) notes that when a female manager becomes a mother, her ability to perform her job properly may be questioned. Similarly, according to Lafortune, Groleau and Deschênes et al. (2022), when women occupy both the roles of employee and mother, reproaches such as wanting to have it all are still too often levelled at those who climb the ladder of professional success. To be a careerist is thus to put social pressure on family life (Lafortune, Groleau, Deschênes, et al., 2022).

1.2 School dimension

The educational dimensions that can influence women’s decisions encompass the educational processes chosen, including the role of parents — particularly for young children. The academic perspective, from

the point of view of female students and professors, and the accessibility of STEM (science, technology, engineering and mathematics) studies are also discussed here.

Influences from early childhood

According to Piraud-Rouet (2017), boys and girls are born with the same abilities, which are then shaped by their environment. Following Vieira do Nascimento et al. (2021, p. 24):

The degrees obtained by students will have a radical influence on their future career paths. If fewer women graduate in science, technology, engineering, and mathematics, they will not have access to high-income professions in these fields. [...] The data suggest another element that affects educational and occupational outcomes beyond individual action alone. These rational incentives are not gender-neutral, as the socialization of gender roles primarily conditions the perceptions of young boys and girls. In short, educational decision-making is not impartial when it comes to gender. It is subject to rational cost-benefit calculations for students, in combination with social influences (family, peers and teachers), that create early expectations during gender socialization.

Thus, education, the family and the social environment all play a leading role in reinforcing or not reinforcing stereotypes and influencing the choice of studies and careers (CSF, 2018). Both primary and secondary school teachers are a source of inspiration for and influence on their students.

Role of the teaching staff

According to Leaper and Friedman (2007, p. 567), “teachers can influence children’s gendered view of games, school subjects and sports by identifying them with one gender or the other” (free translation). The same authors (2007, p. 578) note that “several studies show that teachers may pay more attention to boys than to girls in the classroom. In particular, when several activities benefit boys, such as construction games, sports and video games, which help boys develop spatial skills

and abilities in science and mathematics” (Leaper & Friedman, 2007, p. 578), citing Serbin, Zerkowitz, Doyle, Gold & Wheaton, 1990; Subrahmanyam & Greenfield, 1994 (free translation).

Teachers’ beliefs in the superiority of men in mathematics and women in language become a significant disadvantage, as young girls are not guided towards or made aware of STEM (science, technology, engineering and mathematics) subjects (Bakhti, Boisseau, Herman, et al., 2017).

Difficulties encountered in academia

According to Vieira do Nascimento et al. (2021, p. 29), “worldwide, only 30% of university researchers are women, although more and more women are enrolling in university [...]” In most OECD countries, “there are more male than female students pursuing master’s and doctoral degrees, which is an equity and policy issue in itself” (Vieira do Nascimento et al., 2021, p. 30). “Regarding scientific research output, women published only 29.8% of journal articles. [...] Women are underrepresented in prestigious publications compared to men. Underrepresentation is accentuated in highly competitive articles, which attract the highest rates of bibliographic references” (Vieira do Nascimento et al., 2021, p. 29). Moreover, the same study shows that “the time female assistant professors spend looking after children penalizes them when it comes to tenure. Tenure takes longer to obtain, and applications are often less competitive. It is also mentioned that the overall picture shows a shortage of women at the top” (Vieira do Nascimento et al., 2021, pp. 36-37).

According to data collected by the research team (Gagné, Lafortune and collaborators) in October 2023, on the various websites of Quebec universities, out of 1,043 engineering professors, only 150 were women, or 14.38%. This category of teaching staff includes both men and women, tenured, assistant and associate professors. Of the 12 Quebec universities, one had no female professors, while two had less than 5%.

1.3 Social dimension

The components of the social dimension that can influence career choice in STEM include the cultural and social aspects of sex equality, prejudices and stereotypes, society’s expectations of women, recruitment and retention issues, corporate policies in both the private and

public sectors and international mobility requirements. In an effort to synthesize, we have chosen to group several aspects and develop four components in this book: socialization effects, lack of role models, the glass ceiling and patriarchy.⁵

Society believes that men excel more than women in STEM fields (science, technology, engineering and mathematics), but this is not the reality (Lafortune, 2024a; Lafortune, Groleau, Deschênes et al., 2022; OECD, 2022). However, girls are not born less interested in science than boys. Although there is a tendency to conceive of differences between men and women as innate, meta-analyses on psychological differentiation between the sexes demonstrate the phenomenon of the social construction of gender.

From an early age, according to Leaper and Friedman (2007), it is possible to observe a preference in children for certain activities, roles and objects traditionally linked to gender. This team also mentions awareness of how others look at girls and boys. Thus, when surrounded by other people, children are more likely to act in a gendered way than when alone. The same team also found that in a male-dominated society, behaviours associated with masculinity are more highly valued than those associated with femininity. Similarly, when a woman adopts a masculine behaviour, it may be valued, whereas the reverse is untrue. Influence comes from four main sources: the family environment, friends, the media and school (Leaper & Friedman, 2007).

According to Leaper and Friedman:

Factors influencing gender perception fall into four broad categories: 1) sociostructural factors, including the division of labour and the prevalence of patriarchy in society, 2) social and interactive factors affecting the types of opportunities and incentives children enjoy, 3) cognitive and motivational factors shaping the way children interpret and act on their world and 4) biological factors including average physical differences between the sexes that may (or may not) be relevant to the performance of certain roles and activities. Biological factors include

5. Additional information on this research is available in Gagné, Lafortune and collaborators (2024). *Situation des femmes en ingénierie au Québec dans des secteurs où elles sont largement minoritaires: rapport de recherche.*

gender-related hormonal influences that affect the nervous system. While this team acknowledges the impact of biological factors, their study emphasizes the human capacity for behavioural plasticity about existing environmental opportunities or constraints (See Leaper, 2000b; Wood & Eagly, 2002). (Leaper and Friedman, 2007, p. 564, free translation)

Consequently, the choices made by men and women young and old are strongly influenced, even conditioned, by the individual's environment and culture: this is known as the socialization effect.

Lack of support networks and glass ceiling

The literature review shows that women's reluctance to pursue a career in STEM may also be caused by their collective and individual perceptions of the lack of opportunities to climb the ladder and reach positions of high responsibility. This issue also exists in academia, where "women are less likely to obtain leadership positions in research centres and administrative leadership positions at their home university" (Brière et al., 2019, p. 34). Indeed, the higher the position in the hierarchy, the fewer women there are. This is the concept of the "glass ceiling" introduced by sociologists, which is an invisible yet very real barrier (Bakhti, Boisseau, Herman, et al., 2017).

According to Coleman (2020), leadership roles are disproportionately occupied by men in the workplace. Yanosek, Abramson and Sana (2019) mention that one of the major difficulties experienced by women in the oil and gas industry is getting a promotion to a management position. Lafortune, Groleau, Deschênes, et al. (2022) concur that a glass ceiling makes it difficult for women and people from visible minorities to reach high-level positions. This is also what Anemeje (2014) maintains: men are more likely to get managerial positions in the corporate STEM field than women.

This underrepresentation of women in positions of authority is generally associated with issues such as motherhood, prejudices and stereotypes, family responsibility, morality and corporate culture. And "despite varying from country to country, [it] stems from biases or prejudices that a good leader is always associated with masculine

traits and characteristics” (Jiménez & Rodriguez, 2017, pp. 21-22). This underrepresentation also stems from the fact that there are very few women who can serve as role models in decision-making positions (Ordre des ingénieurs du Québec, 2022). However, the KPMG study (2015) shows that “many women could serve as role models for young girls. Many have propelled companies, governments, academic institutions and other organizations to new heights. They have shown other women the possibilities and power they hold. Yet for all their achievements, these women represent too small a percentage of global leaders” (KPMG, 2015, p. 2).

For their part, Gagné and Bellemare (2021) identify glass walls as an additional obstacle, reflecting that in companies where women manage to reach the highest positions, they are too often in non-strategic departments (e.g., administration and communications). These glass walls differ from the glass ceiling, which refers to the barriers excluding women from the highest levels of the corporate hierarchy. This is why Lafortune, Groleau, Deschênes et al. (2022) argue for increasing the visibility of positive female role models in engineering and developing policies to encourage the presence and active participation of women in the multiple sectors of engineering.

Another critical issue is the need for more allies and networks in the STEM field (De Paoli & Ellemers, 2022). “One of the main challenges women face once employed is the lack of a network and the resulting isolation. Certain habits or behaviours of men in the workplace, and the mistrust they may have towards a woman in a traditionally male occupation, can make it more arduous to create links between colleagues, an essential element of successful professional integration” (CoeffiScience, 2019, p. 21). This lack of networking has negative effects and stems from the culture of patriarchy.

Culture of patriarchy

The culture of patriarchy finds its essence in the idea that the man should be the provider and the woman should stay at home to look after the home and family (Williams, 2018). Predominantly male networks in the workplace nurture male dominance in positions of responsibility (Coleman, 2020). For example, among men, networking is linked to membership in clubs, sporting activities and informal networks, which

are sometimes difficult for women to access (Coleman, 2020; McGrath & Marinelli, 2012). This organizational culture and male dominance would, therefore, create difficulty in building a woman's professional identity. Brière et al. (2019, p. 117, citing Saavedra et al., 2014) give as an example: "The results of an interview study conducted with 39 female engineers in Portugal highlight that women have to negotiate their professional identity and find it difficult to emphasize their femininity in an environment marked by a dominant form of masculinity."

Mentorat Québec reports that the McKinsey report (2006) revealed another challenge for women working in traditionally male environments, stating that "women do not get the same direct, candid feedback on their performance as their male counterparts." This article also notes that "women systematically receive less feedback related to professional results. This deprives them of an important source of useful information. As a result, it limits their capacity for development."⁶ The oil and mining sectors are no exception to these practices.

Indeed, the oil and gas industry is dominated by a culture of patriarchy and fails to establish a natural place for women, despite efforts and advances for women's breakthroughs in this field (Williams, 2021). Male domination of oil industry management teams legitimizes the culture of patriarchy. The oil industry's elite is made up exclusively of white men in the United States. This situation makes it difficult for women to gain a voice or a place in the industry (Williams, 2021). Shirt, Kim and Coady (2022, p. 9) concur: "Because the energy sector has been nearly male dominated for so long, much information about job opportunities, as well as the transferability of skills, seems to continue to circulate through family and professional networks, which are still predominantly male."

From this culture of patriarchy emerge prejudices that are still current, according to Ainane et al. (2019, p. 6, free translation): "More than two thirds of respondents with professional experience in science and engineering believe that engineering-related fields are better suited to men. Over 40% identified gender as a barrier. This suggests that the general perception is that there is still room for improvement when it comes to equal opportunities" in the oil, gas and mining industries.

6. <https://mentoratquebec.org/le-mentorat-au-feminin-trois-reponses-pour-les-mentorees-3-3/>

What is more, according to Brière et al. (2019, p. 120), “when tasks have to be distributed within a work team, there is a gendered division, as early as university studies.” This is also reflected in the positions predominantly held by women: “Most women employed in the oil industry perform duties related to general office functions, public relations, administration and secretarial work. This means that women are underrepresented in units and departments that require technical and engineering skills” (Gian, 2013, p. 99).

The various components of these three dimensions influence the so-called personal or individual dimensions.

1.4 Individual (personal) dimension

The individual dimension refers to issues experienced by women in their personal lives that have repercussions in their professional lives. Components such as identity construction, stereotypes, self-confidence, motivations and perceptions will be presented here. This section will also include some realities concerning Indigenous women and women from immigrant families.

Girls’ identity construction

A strong relational dimension influences girls’ identity construction. Girls attach great importance to their interpersonal relationships in the validation of their identity. Thus, girls act to gain acceptance and even appreciation from their peers and the people around them. Consequently, girls appear to be more disciplined in the face of rules (Enseigner l’égalité).⁷ According to Bouchard, St-Amant and Tondreau (1997), this greater obedience is linked to better integration of gender relations, notably because sexism works against them. Greater or lesser adherence to gender stereotypes will inevitably influence academic success and career choices. According to Williams (2018), the three main reasons women choose a STEM career are: 1) to be role models for their children, 2) having a love of the profession, and 3) their determination as well as enthusiasm for a successful career. Diamond and Stebleton (2019) believe that “motives that were to serve people rather than to gain status or earn money” would outweigh other reasons for

7. <https://enseignerlegalite.com/secondaire/stereotypes-de-genre-au-secondaire/>

choosing a STEM field (science, technology, engineering and mathematics). Thus, the key principle behind developing a science-based identity could involve this need to thrive in relationships marked by altruism and might have less to do with a desire for outside recognition (e.g., economic success and social status), hence the underrepresentation of women in STEM fields (Diamond & Stebleton, 2019). This differing need for recognition could colour certain perceptions linked to a lack of self-confidence.

Lack or absence of self-confidence

According to Ainane et al. (2019), although women perform as well as men, they are more likely to drop out. In addition to family reasons, the main reason would be that they do not feel they have the skills or traits needed to work in science or engineering (Ainane et al., 2019; Cech et al., 2011; Stratchan et al., 2018). Brodeur et al. (2023, p. 37) note that “it is true that, generally speaking, girls do not have long-acquired self-confidence. Female students need to know an answer before they say it, whereas I have male students who can answer even if unsure.” One result of this need for certainty is that they may believe their skills are insufficient to achieve high positions (Stratchan et al., 2018).

Based on previous research, Lafortune (2024a, drawing on Lafortune, 1990, 1992, 1993, 1997, 2003) identifies two responses to self-confidence in succeeding: 1) attributing success to effort and failure to lack of ability, and 2) attributing success to ability or competence and failure to lack of effort. According to various studies, many girls fall into the first category and many boys into the second. Nevertheless, the secret to success is to attribute it to effort and skill. This means that the fact that girls attribute their successes to their efforts and their failures to their inability leads to a difficulty in perceiving themselves as competent, but rather hard-working, organized, efficient and much more. Working on girls’ causal attributions is essential to boosting their self-confidence, especially as they set the bar far too high for themselves when it comes to even considering moving into STEM fields.

According to Brière et al. (2019, p. 116), “some feel they have to prove themselves more than their male colleagues, or that some supervisors will ‘test’ them more and will not trust them from the start: ‘Supervisors will wonder if you ‘fit’ in the factory. Do you know what it’s like? Do

you know how noisy it is, how hot it is? That everyone wears work clothes?” This kind of questioning, rarely discussed with a male colleague, can indeed sow doubt by overestimating the drudgery of the job. However, according to Brodeur et al. (2023, p. 22), women do not always seem to be aware of this phenomenon: “More than a third (42%, including 45% in engineering and 36% in science) of female student participants did not feel they had to prove themselves anymore at their internship than a male colleague. However, half (50%) of female engineering students gave examples in interviews of situations where they had to prove themselves more than a male colleague during an internship, compared with 14% in science.”

Women want to become leaders but are hesitant. They do not necessarily see themselves as having leadership qualities.

Women aspire to lead but hesitate. Why is this? Being a leader is a career goal that seems achievable for most women. Six out of ten women (64%) aspire to become senior managers of a company or organization, and more than half (56%) aspire to sit on the board of directors of a company or organization. However, at the same time, women are reluctant to take on leadership roles. More than half (56%) of all working women said that, as women, they were more cautious about taking on leadership roles. Six out of ten women (59%) sometimes find it difficult to see themselves as leaders (KPMG, 2015, p. 9, free translation).

On this subject, according to a study by Burjek and Rafter (2017), 73% of HRM (human resources management) executives in the USA are women, compared with 43% in marketing and 27% in IT (Coleman, 2020, p. 236). These gender disparities could result in a lack of confidence among women in engineering (Anemeje, 2014).

Does this lack of confidence stem from the notorious impostor syndrome? This term was first coined in 1978 by psychologists Pauline Clance and Suzanne Imes in a study of professional women in clinical settings. It refers to a persistent feeling of inadequacy despite evidence of competence and success. People with impostor syndrome doubt themselves and fear that others will discover that they are not as intelligent or talented as they appear. They often attribute any success to

luck and cannot internalize their achievements. This phenomenon can affect high-achieving individuals. This partly could explain why women would be uncomfortable asking for promotions, taking jobs beyond their expertise and accessing leadership positions (KPMG Blog, 2019).

However, on the Mentorat Québec website, three situations illustrate that women's lack of confidence does not necessarily stem from the women themselves.⁸

In a Working Mothers Research Institute report, a CEO observes that men who have mastered only 10% or 20% of what it takes to take on a new role feel comfortable applying.⁹ Conversely, women expect to master 90% of what is required before they do so. Many commentators conclude that women are more risk-averse than men. However, a study of 1,000 professionals by Tara Sophia Mohr suggests otherwise. Mohr reminds us that girls are rewarded for following the rules in Western societies, while boys are often applauded for breaking them. Mohr's research shows that as long as women see the skills listed to fulfill a role not as requirements (rules) but as fields where they could realize their potential, they apply for them, too.

At the same time, a McKinsey study finds that men are often hired or promoted based on their potential, while women are hired for their achievements. This phenomenon leads women to apply for jobs they are already qualified for. After all, time and effort are not infinite; you could put them where the chances of success are highest.

This raises the issues of lack of self-confidence and internalized stereotypes.

8. <https://mentoratquebec.org/le-mentorat-au-feminin-trois-reponses-pour-les-mentorees-3-3/>

9. https://www.workingmother.com/sites/workingmother.com/files/attachments/2019/06/women_at_the_top_correct_size.pdf

Internalized stereotypes

One of the main reasons women tend to avoid STEM careers is that fields such as engineering and technology have historically been male dominated, not least because men are responsible for much of the development of these industries (Pelissero, 2022).

But there is more. According to Eugène (2019), “[...] by the age of six, girls have integrated the stereotype associating intellectual genius with men and are less likely to choose a game if it is presented to them as being for the ‘very, very smart.’” This can lead them to avoid fields that tend to be associated with intellectual giants, such as mathematics, physics, or even philosophy [...], where women are also in the minority”. Banchefsky, Westfall, Park and Judd (2016, p. 95) agree: “The perceived incompatibility between femininity and science is a recognized problem with negative consequences for women.”

For Lafortune, Groleau, Deschênes et al. (2022), this results from institutions built by and for men, inhibiting women’s full potential. This is also argued by Anemeje (2014), who asserts that men have traditionally set the tone for the various businesses associated with technology and engineering. As a result, the public perceives work in this industry as monotonous, requiring physical effort and not demanding a high level of skill (Pelissero, 2022). Stereotypes associated with the constraint of conforming to the male identity would, therefore, be necessary, as would the masculine perception of engineering ingrained in people’s minds (Anemeje, 2014).

The fact that only some women choose to persist in STEM careers would also be reflected in a need for more female role models and reference points (Anemeje, 2014; Bakhti, Boisseau, Hermann, et al., 2017). Some textbooks are still imbued with these old stereotypes, “such as that girls are less manual than boys” (Lafortune, Groleau, Deschênes et al., 2022). According to Coleman (2020), women are also perceived as playing a relatively passive support role, while men are assigned more active roles. This leads to the internalization of the belief that men are more effective managers than women (Coleman, 2020).

1.5 Issues specific to women from immigrant backgrounds

The literature still lacks an understanding of the problems faced by women from immigrant backgrounds and the actions taken to support them (Diamond & Stebleton, 2019). Cumulative disadvantages resulting from the intersection of gender and racial or ethnic identity are also said to constantly hinder the careers of female professors (exclusion from professional networks, lack of support, questioning of skills, etc.) (Brière et al., 2019, p. 35).

One obstacle to hiring immigrants is that many companies require Canadian experience (Le Moulin Microcrédits, 2022). Also, even when they get a job, there is an income gap between immigrants in Canada and their non-immigrant counterparts, and a gap in career progression between women from immigrant backgrounds and non-immigrants (Le Moulin Microcrédits, 2022). “People from immigrant backgrounds make up more than half of STEM graduates in Canada, but only a small percentage of them are employed in positions that are commensurate with their skills”. (Le Moulin Microcrédits, 2022) Many women from immigrant backgrounds leave the STEM workforce to pursue trades in other fields or care for their families (Immigrant and International Women in Science, 2020).

1.6 Issues specific to Indigenous women

A survey conducted by the First Nations Human Resources Development Commission of Quebec (FNHRDCQ) in 2016 highlighted persistent personal and systemic barriers preventing Indigenous women from accessing training and entering non-traditional trades. “Three of the main barriers identified are Indigenous women’s poor knowledge of non-traditional trades and the strong perception of racism and discrimination felt by women” (CDRHPNQ, toolkit for Indigenous women in non-traditional trades, 2019, p. 1).¹⁰

10. https://cdepnql.org/boite_a_ouils/trousse-a-ouils-les-femmes-autochtones-dans-les-metiers-non-traditionnels/

Understanding and getting to know specific values and various elements characteristic of Indigenous cultures and their representation at work could help break down certain so-called systemic barriers and facilitate their social and professional integration. In many Indigenous cultures and nations, introversion, modesty, humility and discretion are highly respected character traits (CDRHPNQ, 2019; Deschênes, 2022). Their relationship with time is different, and so is the value that Indigenous peoples place on respect for time. Deschênes (2022, p. 36) illustrates this with a question asked in an interview by an Indigenous worker: “Why do we have to finish everything today when we also have tomorrow to do it?”¹¹ “Access to education and employment remains difficult for many Indigenous people, both men and women. There are many reasons for this: lack of self-esteem, mistrust of institutions, prejudice in the workplace, *The Indian Act*, etc.” (CDRHPNQ, 2019, p. 21).

Indigenous conceptions of the environment and the community imply that the community comes before the individual. As a result, family values, traditional activities and the role of elders in the community are fundamental, even a priority, and the way people work is less hierarchical (CDRHPNQ, 2019; Deschênes, 2022). “Indigenous women play a very important role concerning children and traditionally bear family responsibility. Moreover, the family occupies a significant place in Indigenous society. Indigenous women must get involved in their communities or personal projects, thus demonstrating leadership. Balancing work, studies, family and personal life can be very demanding for any woman” (CDRHPNQ, 2019, p. 21).

Indigenous communities face unique socioeconomic challenges (Deschênes, 2022, p. 32) and their residents are far from privileged. *The Indian Act* imposes a regime of guardianship on Indigenous peoples and places enormous constraints on them. “Guardianship means constraint, dependence, lack of autonomy and deprivation of certain rights and freedoms, particularly around wills, access to property and the free disposal of certain personal assets. This situation contributes to exacerbating the socioeconomic reality and popular beliefs about Indigenous people” (CDRHPNQ, 2019, p. 21).

11. Interested readers may consult the work of Émile Deschênes (2022), *L'insertion sociale et professionnelle des travailleurs autochtones*, published by Éditions JFD, as the research report by Gagné, Lafortune and collaborators (2024).

► 2. Management practices: Staffing (human capital management)

According to Barraud-Didier, Guerrero and Igalens (2003), HRM practices contributing to the retention of human resources are akin to people management activities, which make it possible to gather, retain and use skills to serve the organization's objectives. In addition, Tremblay and Wils (2005) argue that retention practices in human resources management also encompass activities that enhance the individual contribution of employees as part of a collective effort to achieve a common goal.

Concerning the factors that can facilitate the hiring, integration and, therefore, retention and advancement of women, the literature most often emphasizes individual strategies such as an egalitarian attitude, the development of response and survival reflexes, quality of work, commitment and motivation, and consultation. Following Chicha and Charest (2013), this leads us to believe that when laws and regulations are not coercive, the results of equality access measures are “missed opportunities”. Women suffer from the phenomenon known as “mental load.” They have to juggle daycare schedules that do not match their atypical working hours, and/or they refuse to work overtime on weekdays to attend multiple family appointments, forcing them to work these hours on weekends or at night. As a result, integration and mobility are complex for them. The glass ceiling resists their upward trajectory, and they obtain few or no promotions. Finally, they often occupy entry-level positions that are unskilled, less qualified or precarious. It appears that exemplary government practices as a hiring organization — clear directives concerning concrete results and not results of means concerning equal access, more coercive measures in the event of delinquency, etc. — could be strategies to be implemented by the various levels of government, in concert with players in the field.

That said, much has been written about the importance of human resources management (HRM) measures, such as the awareness that must precede the hiring of women in a traditionally male-dominated sector, the adoption of personalized onboarding measures that enable new employees to familiarize themselves with the work context and the company's habits and customs, as well as meetings with certain key people (e.g., human resources representatives, first-line supervisors and

those providing training, where applicable). Quebec's *Ordre des conseillers et conseillères en ressources humaines* also strongly recommends information sessions on both sexual and psychological harassment (Gagné, 2022).

The difficulties experienced by women in the STEM sector have concrete consequences. In particular, their professional careers could progress more slowly than their male counterparts. Furthermore, balance seems hard to achieve, as do jobs requiring more creative innovation. The situation often creates job dissatisfaction and a sense of professional stagnation. As a result, few women succeed in reaching management positions (Jiménez & Rodriguez, 2017). These concrete consequences combined with the systemic issues (the absent or missing network of women in the oil and mining sector), the lack of understanding of what systemic discrimination is ("I'm not sexist, but...") and the challenge of the gender-balanced workplace show that there are specific difficulties in applying even initially well-intentioned policies. "The kinds of comments criticizing not awarding a job to a woman just because she is a woman (called positive discrimination) build a dichotomy between technical decisions based on merit (deemed gender neutral) and any policy requiring the hiring and promotion of women (deemed sexist and advantageous). The consequence of this paradox is that the only way to prove one is neutral and objective is to hire a white man for a job" (Williams, Kilanski and Muller, 2014, p. 454). Similarly, this team points out that no matter how much management wants to, it will only help if the right policies are implemented. "So the company's top management may say they care about diversity, but when it comes to operations management, I think they just do not see it. They do not see us" (Williams et al., 2014, p. 454). So Gagné's (2019) questions remain relevant: Is the environment ready? What interventions should be prioritized?

To complement these managerial practices, we briefly present a few concepts or theoretical aspects for adequate staffing and retention processes.¹² The seven aspects addressed are: 1) inclusive practices,

12. These processes aim to: reduce inequalities, promote a gender-balanced workplace, respect the principles favouring equal treatment, revisit staffing processes (training, recruitment and retention), combat stereotypes and biases and take into account the constraints associated with balancing family, work and personal life. As with the previous section, interested parties can get further information by consulting the research report published in November 2024 by Éditions JFD.

2) equity, diversity and inclusion (EDI), 3) the triad of prejudices, biases and stereotypes, 4) microaggressions and their impact, 5) salary inequities, 6) family-work-life balance and 7) mentorship. In conclusion, we emphasize the importance of considering mentorship as a supportive practice that facilitates retention and career progression, not only as a retention tool but also as a promotion strategy.

2.1 Inclusive practices

The literature reviewed indicates that organizations have a central role in facilitating the hiring and integration of women in traditionally male or mixed-gender environments (Ibanez, 2015, cited in Brière et al., 2019). The structure and culture of an organization will necessarily influence women's career paths. Good human resources management practices must include recruitment methods, training, career and mobility management, work-life balance, promotion criteria and performance appraisal. Organizational culture must not tolerate incivility, harassment or conflict. Rules to this effect need to be clear, known and applied, and above all, they need to have consequences to eliminate some of the obstacles women encounter. What is more, Chicha's research has shown that a critical mass of women facilitates their integration and mobility.

According to Gagné (2022, p. 100), many people working on the periphery of the oil industry "believe that the underrepresentation of women is due as much to the persistence of sexist prejudices around physical ability and technical skills as to the rapid decline of the sector (loss of credibility for this type of job) and recruitment methods (training and work environment)." Younger respondents, including those who participated in the focus group, mentioned that this could be due to a generational divide in the workplace.

Two aspects of inclusive recruitment practices will be discussed here: EDI (equity, diversity and inclusion) as well as prejudices, biases and stereotypes. However, in relation to inclusive retention practices, three points deserve the attention of human resources managers: 1) the work climate, i.e., the existence of microaggressions and their impact, 2) the compensation system (pay inequities) and 3) the difficult balance of family, work and personal life.

2.2 Equity, diversity and inclusion (EDI)

First, unlike equal opportunity programs, EDI-related policies and programs are not presented as a performance measure, but remain linked to the organization's mission. For example, the institutional policy (UQTR, 2022) of Université du Québec à Trois-Rivières considers EDI to be a concept that links the principles of equity, diversity and inclusion, and is not a simple addition of these concepts.¹³ Articulating the concepts that underpin equity and diversity enables us to think about diversity in light of the discrimination suffered by people from social groups who encounter obstacles to realizing their full potential. It also allows us to consider their possible underrepresentation within organizations from a horizontal perspective (differences between administrative, training or research units) as well as a vertical perspective (career progression, decision-making spaces, job titles and working conditions, educational and academic backgrounds). Articulating equity, diversity, and inclusion principles also allows us to think about the measures needed to correct historical and persistent inequities and to include people and the plurality of experiences, ideas, worldviews and perspectives that have historically been marginalized. The principles of equity and diversity — articulated around the concept of inclusion — also invite us to consider, when developing corrective measures, elements linked to trust in the establishment, accessibility and individual as well as institutional security (culturally sensitive establishment). Diversity is a result of fully taking equity and inclusion into consideration across an organization. However, according to Gagné (2024), it is also essential to remain sensitive to the issues of equity, diversity and inclusion (EDI) and the importance of the gender dimension in countering the effects of prejudices, biases and stereotypes.¹⁴

13. <https://oraprdnt.uqtr.quebec.ca/vrsg/Reglementation/208.pdf>

14. Term used in its sociological context referring to the needs of each gender. Women experience inequalities at several levels: economic (poverty, wealth, financial capital, income, etc.), physical mobility (less access to personal means of transport, parental restrictions, etc.), heavier family and mental loads (siblings, work-life balance, etc.), and professional mobility (choice of fields of study and jobs, presence of glass walls, difficult career ascension, presence of glass ceilings, etc.) (Gagné and Bellemare, 2021).

2.3 Triad: Prejudices, biases and stereotypes

While prejudices and stereotypes were addressed in the previous section and in the posing of the problem, the role of biases was absent. Prejudices, stereotypes and biases stem from personal traits, culture, education and experience, influencing perceptions and decisions. In staffing practices, it is essential to be aware of these factors from the outset of the recruitment process and the needs analysis stage to match the ideal candidate's profile (knowledge, skills and attitudes) with the job description. Considering the impact of this triad on staffing processes, it is worth highlighting here the impact of biases, mainly unconscious gender biases.

These biases may exclude women in management positions from participating in specific meetings with strategic implications for an organization (McCormick, 2016). As energy sector professions have traditionally been dominated by men, knowledge transfer and the succession process in this environment occur in male networks to which women have virtually no access. Moreover, while “men tend to be judged on their potential, [...] women are generally assessed based on their past achievements, particularly when recruiting for management positions. Female candidates are, therefore, more called upon to ‘prove’ that they meet the qualifications of a position...” (Ordre des ingénieurs du Québec, 2022, p. 31). This practice is also reflected in the lower credibility and recognition that tend to be associated with female achievements: “The results expose the existence of a form of bias towards women researchers: articles published by women and co-edited by other women are systematically less cited in the literature, both in the health field and in SG” (Brière et al., 2019, p. 35). Similarly, reaching decision-making positions is difficult: “When you become a boss, it is disturbing. Because almost all the employees are men, having a woman as supervisor bothers them. However, it is not because we are in engineering; it is the relationship to authority” (Brière et al., 2019, p. 121).

2.4 Microaggressions

The Canadian government defines the concept of microaggression as follows: “Microaggressions and prejudices are subtle, and often unconscious, verbal or physical interactions between people [...] of different

cultures, beliefs or genders. Even without malicious intent, these comments or gestures remain hostile or negative. They can lead to a sense of rejection and mental health problems in those who are subjected to them.”¹⁵ For her part, Lafortune (2022, p. 267) cites Parker et al.’s (2019) definition of “microaggressions” to refer to “unconscious, involuntary comments or gestures that may appear harmless. [...] subtle actions that send inappropriate messages and build on other words or gestures and, thus, lead to career changes, lack of self-confidence, self-deprecation...” Microaggressions can also refer to brief, mundane, everyday verbal, behavioural and environmental indignities. Comments may be intentional, unintentional or subtle. Still, they demonstrate a hostile and prejudicial bias towards a marginalized person or group and can create a negative environment and potentially adverse health effects. Therefore, inclusive staffing practices cannot avoid this issue, especially in a context that aims for gender-balanced workplaces.

According to Petrela (2021), microaggressions provoke mixed emotions, creating significant discomfort. These include confusion, fear and discouragement, as well as anger, hostility and resentment. The impacts of microaggressions, though often downplayed, can be long lasting, with negative consequences for both the individual and the organization, such as loss of motivation, breakdown of trust and even disengagement from a workplace or relationship. Similarly, “new graduates often arrive at the workplace without understanding the systemic nature of the barriers women often face. In such cases, women may assume that any difficulty is their fault. The energy sector workplace is rife with microaggressions against women. Women in managerial positions have reported that they are subject to taunting behaviour from their male managerial colleagues, which becomes increasingly burdensome over time” (Coleman, 2020). “Female engineers mentioned sexist behaviour in certain specific situations, for example, with certain customers or on construction sites” (Brière et al., 2019, p. 125). This type of aggression is indeed widespread since, according to the Ordre des ingénieurs du Québec, “[...] 45% of female engineers report that they have been victims of gender discrimination in their professional careers, which is much more than in the general population...” (Ordre des ingénieurs du Québec, 2022). However, this situation seems to be known and tolerated by some workplaces: “One of my first days [at a uranium company], a lady in the company’s human resources department told

15. <https://www.cspc-efpc.gc.ca/events/microaggression/index-fra.aspx>.

me... ‘You know, there are many men in our camps, and you are going to be in situations where you are going to be very uncomfortable, and people are going to say things to you that you might not like’ [...] I was told that the work environment was unsafe for me — but I had to be prepared for it” (Shirt et al., 2022, p. 6). One of the examples collected by Brière et al. (2019, p. 125) relates to a flagrant lack of respect and intimidating behaviour experienced by one of the respondents:

“I had arrived at the site during the men’s break. They were all sitting along the wall. [...] It was the second or third time I had been whistled at on the site. For me, that is a line you do not cross [...] When the person whistled at me, I looked at him, I went up to him, and I said: “Sir, if you came home tonight and your daughter, who is about my age, said to you, ‘daddy, today I got whistled at onsite,’ you would certainly call [the guy] a dick. You have just done the same thing with me, so I would ask for the same respect you’d give your daughter...” Not a sound — it was over.”

When faced with this kind of behaviour, deciding which attitude to adopt is hard. According to Petrela (2021), confronting or responding directly to a microaggression involves demanding a discussion on a sensitive subject to explain the effect of the microaggression. If, in addition, the person who committed the microaggression reacts negatively, more demanding actions may be required. However, responding indirectly also requires energy. If, for example, choosing to report the incident to a third party (a supervisor or colleagues in human resources), they may be asked to gather evidence or explain the incident, perhaps several times (Petrela, 2021), which could discourage a person from doing so along the way.

“Part of what makes microaggressions so powerful and harmful is how harmless they seem at the time and how often bystanders ignore them. None of us wants to appear petty, so instead of naming the microaggression for what it is, we sometimes downplay our discomfort, attributing the incident to a misunderstanding and hoping that everything will go back to normal” (Petrela, 2021). This can lead to a perverse effect of not even being aware of these unacceptable behaviours, as Coleman relates: “Women in management positions who have worked for a

long time in the presence of cultures of stereotyping and discrimination against women tend to internalize these stereotypes and cultures” (Coleman, 2020). What is more, the discrimination women experience when being hired for positions of responsibility is subtle and unconscious, based on management’s internalization of stereotypes, assuming that women are not suited to these types of positions (Coleman, 2020).

2.5 Pay inequity as a non-inclusive practice

Several studies mention wage inequity. The existence of wage disparities between men and women in the STEM job market is real and may discourage some women from entering the field (McGrath & Marinelli, 2012). Others insist that the gender wage gap is a significant deterrent for women seeking to enter and remain in these jobs (Forbes, 2019; Pelissero, 2022). Moreover, according to Strachan et al. (2018), there is still a prejudice that women perform less well than men at work, which would justify lower pay. Another barrier that can lead to pay inequity is the choice of sectors in which women work. The distribution of women in the industry varies according to subsector: “We note that the soap, stain remover and cosmetics subsectors have more women than men, whereas petroleum and coal manufacturing, basic chemical manufacturing and resin manufacturing — which generally produce better-paid jobs — have less than 20%” (CoeffiScience, 2019, p. 12).

2.6 Family-work-life balance as an inclusive retention measure

“Measures that facilitate work-life balance include developing policies conducive to flexible schedules and remote work, offering telemedicine services and providing subsidized cafeterias as well as workplace daycare. Such measures will help to retain the workforce and promote professional advancement” (Ordre des ingénieurs du Québec, 2022, p. 20). This is also supported by Williams (2018), who argues that “wellness” programs and continuing education can help with work-life balance. Similarly, reorienting businesses towards considering family responsibilities would be an interesting angle for the future (Williams, 2018).

To conclude this literature review on the realities of women in STEM (science, technology, engineering and mathematics), it seems appropriate to mention the mentorship strategy, which could not only help retain women in the sectors under study, but also help them break through the glass ceiling.

2.7 Mentorship

Effective mentorship could help women highlight their strengths and self-promote: “Self-promotion also comes into play in job applications, interviews, performance appraisals and a wide range of other areas in which individuals are explicitly or implicitly invited to evaluate their own performance. In a series of experiments, Christine L. Exley and Judd B. Kessler found that, for equal performance, women rated their achievements less favourably than men. Moreover, women often attributed their success to external factors (good colleagues, chance) rather than to their own abilities” (*Le mentorat au féminin*, 2021).¹⁶ These observations are supported by research in the field. In a study of female engineering students after their first year, Dennehy and Dasgupta (2017) report that 11% of those who had yet to be assigned a mentor during the school year had terminated their studies.

In contrast, those associated with a mentor were all as engaged in their studies as they had been at the start of the year. Moreover, a year later — after the second year of study, during which no mentorship took place — rather than closing, the gap had widened. Students who had had a mentor in their first year were just as likely to consider engineering studies in their second year, while their unmentored counterparts were more pessimistic than ever.

Even if short-lived, a mentorship experience positively affects women in a predominantly male field. Furthermore, a survey of female and male engineers conducted by the Ontario Society of Professional Engineers (2018) revealed that one of the top two barriers to career advancement identified by participants was the lack of role models or mentors (45% women vs. 19% men). It is, therefore, desirable to set

16. <https://mentoratquebec.org/le-mentorat-au-feminin-trois-reponses-pour-les-mentorees-3-3/>

up a mentorship program or a formal sponsorship system within the organization to ensure that it is accessible to all those who wish to avail themselves of it (Ordre des ingénieurs du Québec, 2022).

When it comes to integration, one of the invisible obstacles cited by many is the lack of a network. The results of a meta-analysis (Mickey, 2019) carried out in academia underline how informal networks are more effective than formal job listings, inviting people to collaborate on research projects and creating connections with government and industry. Networks are also used to exchange project ideas and raise the profile of their users. However, women — particularly racialized women (who were one of the populations in this study) — often need to be included in robust networks in male-dominated environments such as STEM. Hence the relevance of mentorship, whose supportive, individualized accompaniment enables mentees to better integrate into their milieu, gain recognition and perform well within it. It is partly through this mechanism that mentorship increases the presence of women in leadership positions, enables them to develop professionally as well as personally and helps to reduce the gender pay gap (Adams, Steiner and Wiedinmyer, 2016).

Also, negative perceptions of mentorship are created when mentors lead their mentee to conform to the gendered female model that prevails in their company or social environment. This can happen to both female and male mentors, as female mentors sometimes seek to prevent their mentees from experiencing the same abuses they have suffered. However, certain mentalities have evolved, and the gendered female model to which the (often older) mentor tries to make the (usually younger) mentee conform no longer exists.

Despite certain limitations, mentorship is an excellent strategy to help you know what to do and what not to do. It is both an integration and retention strategy, as it usually helps to reassure a newcomer. For mentorship to be effective beyond encouragement and for the relationship to work, the mentor should have the same fundamental values as the mentee. Moreover, given their seniority and experience, mentors often have social capital — i.e., significant influence and connections — which gives them the legitimacy to confront stereotypes rather than perpetuate them. In doing so, the mentor would go beyond helping the mentee

achieve short-term goals, covet a promotion or survive in a harmful environment, and aim for longer-term outcomes, including greater well-being for the mentee in a more equitable ecosystem for everyone. Promotions and advancement opportunities are not gender neutral.

On the contrary, human beings tend to feel more comfortable with people who are similar to them: this is the phenomenon of homophily. In the world of work, homophily is reflected in the fact that men in positions of authority are more likely to encourage and promote other men than women, even if their merits are equivalent. Furthermore, since more positions of authority are held by men than by women, men advance faster.

Supporting women in leadership positions through mentorship and recognizing their excellent work helps ensure their leadership type is respected.

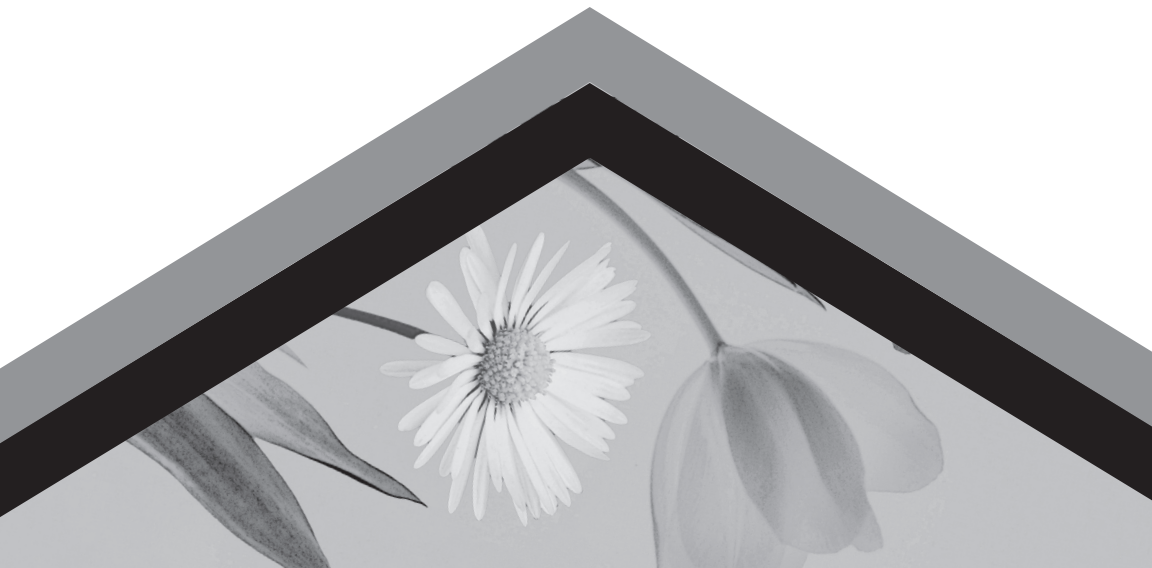
► **Conclusion**

This context opens the door to several questions. Theoretically, women in STEM still have a long way to go. In practice, this chapter aims to demystify certain aspects of the lives of women who have chosen engineering and the motivations and challenges they have faced. This literature review shows that it is time to act because the conditions of women in the STEM world, particularly in engineering, can only be improved by concerted action from different quarters.



Chapter 3

Research approach:
conceptual model



Research is a process of acquiring knowledge based on collecting and analyzing empirical data to describe, explain and understand a phenomenon. In this case, the challenge of gender-balanced workplaces in engineering in the mining and petroleum sectors is being addressed to facilitate women's recruitment, integration and retention. This chapter presents the research methods used, i.e., the logical approach and rational process mobilized to demonstrate the rigour of the chosen path. After a brief reminder of the research objectives, the following concepts will be addressed, in order: the type of research conducted (qualitative), the different paradigms that guided the approach (including emerging theory), the methodological steps, the sampling planned and carried out, a summary of the tangible results, methodological reflections and considerations, as well as ethical aspects and the principles of inclusive writing used throughout this project.

► 1. Project objectives

The project's objectives are fourfold, the first being to gain a better understanding of the phenomenon of the lack of gender diversity that persists in a specific sector, with the aim of achieving feasibility within a tight timeframe despite one or more measures being put in place. The second was to give a voice to a wide range of people working or involved in the targeted sectors. The third objective was to validate the results and proposed tools with the people we met and organizations concerned with women working in predominantly male environments. Finally, recommendations, competency frameworks and a practical model will be proposed for the education sector, workplaces and society in general.

1.1 Objectives

- Learn about the professional lives of women working in engineering, whether in companies or as university professors — motivations, supports, obstacles, difficulties, etc. — in fields where they are largely in the minority, mainly oil and mining.
- Find out how a few female high school, CEGEP and university students perceive their motivations, the support they received, the obstacles and difficulties they encountered during their studies or when choosing a STEM (science, technology, engineering and mathematics) field or, more specifically, engineering.

- Find out how female human resources representatives perceive the working environment for women in engineering sectors where they are largely in the minority.
- Identify the women's perceptions of EDI (equity, diversity and inclusion).
- Record the women's perceptions of themselves regarding their intellectual, technical, empathy, listening, collaboration and communication skills, as well as their attitudes.
- Provide information on the realities of Indigenous women and women from immigrant backgrounds.
- Gather the thoughts of a few men on the realities of women working in engineering, taking into account their experiences.
- Gather information on the perception of women's contributions to engineering and society from all participants.
- Analyze a few engineering-related websites to see how women and ethnic diversity are represented.
- Identify solutions for education, business and society.
- Propose recommendations for the education system, business and society.
- Draw up two competency frameworks to be developed for the coaching and training of women working in engineering and for women and men working in male-dominated fields.
- Develop a practical model that takes results into account, combined with an EDI-sensitive, intersectional, sociopedagogical and socioprofessional equity approach.

► 2. Qualitative research

Given the issue (Chapter 1) and the theoretical framework used (Chapter 2), an exploratory qualitative study proved to be the most appropriate way of grasping organizational processes and women's experiences in various sectors. This was especially true as it was also a question of going beyond statistical knowledge to gain an understanding of the phenomenon of retention in its entirety. Qualitative data proved relevant, serving to provide explanations, offer nuance and clarify a process or pathway.

The research is rooted in the environment and follows an inductive model, focusing on interactions and interrelationships. As such, the responses obtained during the interviews helped revive the questioning and deepen the statements. The objectives pursued called for an approach aimed at transferability rather than generalization. This is why, in the research carried out, recommendations, two competency frameworks and a practical model were developed with a view to transferability to various companies and educational institutions associated with the STEM (science, technology, engineering and mathematics) field.

The research does not provide initial hypotheses as such, but rather propositions or presuppositions that generally lead to working hypotheses towards the end of the research. The recommendations go beyond the workplace and the education sector to form a broader project designed to help solve a systemic problem. Therefore, proposals for future research projects are formulated.

Finally, recognizing the importance of giving women working in engineering a voice, this research led to emerging theory (defined below). This paradigm enables theoretical elements such as recommendations, competency frameworks and a practical model to emerge from the participants' own words in relation to existing theories.

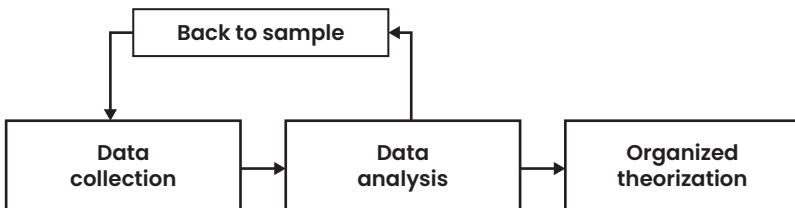
► **3. The various paradigms guiding the approach, including emerging theory**

In this subsection, the various theoretical models underpinning this research project are summarized in three points that take into account the previously identified objectives. Firstly, it is important to give people experiencing situations of inequality a voice. Secondly, following the example of Brière et al. (2019), the contribution of institutionalist and strategic feminist theories — to which are added the concepts of intersectionality developed by Blige (2009) (intersectionality will be defined later in the chapter) and agentivity as advocated by Guilhaumou (2012) — is essential, considering that the project wishes to counter a phenomenon penalizing women and that these women do not form a homogeneous group.¹ Thirdly, emerging theory is the foundation of

1. Agentivity is a person's ability to act intentionally on themselves, others, and their environment.

this methodological approach, considering that emergent statements take the form of recommendations intended to be “a short synthesis of content” (Paillé & Muchielli, 2010). These recommendations are used to model a process of representation of a real or possible situation, enabling a better understanding of its nature and evolution. This process can be used to analyze an existing system or to design a new one (Legendre, 2005, in Lafortune, 2012, 2008c).

This research concept has its roots in the scientific and professional literature, namely Glaser and Strauss’s grounded theory (1967), the foundation of qualitative research. Grounded theory is used to generate a theory from empirical data and reflect observed reality concretely (Strauss & Corbin, 1994). Detournay (2021) refines this approach by adding the concept of emergent fit, which she translates as transversality and has its own analysis. As for the contribution of Paillé (1994), it deals with the concept of “research-action-training,” where the research dimension is linked to the scientific approach and aims to advance knowledge. The “action” dimension is the central term, where the research team and subjects are associated with a common approach. The training dimension leads to a renewal of practices by creating a forum for reflection that combines theory and practice to bring about lasting changes in certain beliefs and practices, whether in education, business or organizations.



Source: Emerging theory (Lafortune, 2004c, pp. 297-298)

The approach used in this project is associated with emerging theory as defined by Lafortune:

Emerging theory is an approach that enables theoretical discoveries to be made primarily through the action of the environment under study, which acts on its own study. The environment helps us to better understand ourselves and to be better understood. It can propose an issue, redirect research and intervention in a more fruitful direction, and criticize and validate research results. Emerging theory is the fruit of interaction and co-construction between people in the field and the research team. It represents a means of co-constructing a theory about a new concept [...] because it uses the elements constructed in the group as statements and returns them to the group for confrontation and improvement while drawing inspiration from existing theories. (Lafortune, 2004c, pp. 297-298)

In the process, the people we met reflected on their realities and that of others in their community, had certain realizations, made connections, offered observations and so on. They contributed to providing results intended to lead other people to repeat this process of reflection and awareness-raising. The data were subjected to a process of analysis, interpretation and validation before leading to the formulation of recommendations, two competency frameworks and the development of a practical model.

► **4. Feminist, institutionalist and strategic theories**

Following Gagné (2019) and Brière et al. (2019), the analytical framework was developed from feminist theories. The complementary nature of the paradigms selected enables the construction of a conceptual model that takes into account the fact that the difficult act of gender balancing is explained by the logic of action (strongly influenced by strategic, institutional and contextual dimensions) and recognizes certain tensions between the different zones of influence on the protagonists and the range of their choices (Gagnon, 1991, pp. 88-91). The factors influencing women's choices and their four dimensions refer, in

the case of external components, to the legislative framework, representativeness, the ideological orientation of the various people involved in male-dominated sectors, social as well as economic change and the various strategies implemented. Internal components relate to organizational structures. Understood in this way, this operational model takes into account the various personal, family, school and societal dimensions as well as the contexts, structures and ideologies of the people involved (all factors that can explain the difficulty of achieving gender diversity), and enables a critical analysis of the gender relations present in organizational processes and practices (Code, 2000).

According to Brière et al. (2019),² poststructuralist feminist theories:

1. Stress the importance of going beyond the study of women's trajectories to understand the systemic factors influencing their paths (Calás & Smircich, 2009; Lansky, 2000)
2. Conceive organizational practices as the result of gender-sensitive processes and emphasize the contextual and cultural dimensions of organizations (Lee-Gosselin, Brière & Ann, 2013)
3. Show that organizations are not open and accessible spaces where success is based solely on personal competence, will and effort, but rather spaces where androcentric and heteronormative power relations are at work (Bhavnani, 2007)
4. Promote an intersectional analysis which, in addition to considering the various inequalities that influence women's trajectories, highlights women's varied experiences (Palomares & Testenoire, 2010)

Lafortune et al. (2018, p. 46) and Lafortune (2022) enrich these remarks by explaining intersectionality as follows:

According to Bilge (2010), the development of intersectional thinking emerged from a rejection of ethnocentrism, the invisibility of racial issues in feminist debates and the lack of problematization of sexism in antiracist movements. Aiming for an intersectional perspective rejects the projected image of women's homogeneity as a group and

2. https://frq.gouv.qc.ca/app/uploads/2021/05/pc_cm_s.briere_rapport_femmes-metiers-hommes.pdf, page 5.

stresses the importance of considering relations of class, race, ethnicity, religion, sexual orientation, etc. (Mohanty, 1984). An intersectional approach has developed from the desire of feminist movements to understand the multiple oppressions that affect women's lives in different and direct ways. Analyses based exclusively on "gender" are insufficient to describe the complexity of social interactions and the interweaving of gender, race, class, sexual orientation, ethnicity and religion.

According to Brière et al. (2019, p. 6): "Intersectionality operates at two levels: at the microsocial level, it allows us to analyze the effects of inequalitarian structures on people's lives, while at the macrosocial level, it questions how systems of power are involved in the production, organization and maintenance of these inequalities" (Bilge, 2010, p. 60).

The concept of intersectionality adds sensitivity to the various forms of discrimination experienced by women and the different contexts in which they move. Moreover, the concept of intersectionality enables a cross-cutting analysis of the different grounds for discrimination, which the *Universal Declaration of Human Rights* aims to counter. This is an important contribution in a context where gender equality strategies and in particular gender balance and parity programs — equal opportunity programs (EOPs), pay equity programs (PEPs) and EDI (equity, diversity and inclusion) — are rooted in this original declaration of individual rights, now referred to in many countries (including Canada) as human rights (Gagné, 2022).

As in the study by Gagné and Bellemare (2021), the systemic approach contributes to understanding psychosocial factors such as stereotypes and concepts of psychosocial theory (the in-group and out-group of Tajfel, 1979 and Allport, 1979). Data analysis considers the influence of personal traits and socioeconomic context, as well as individuals' experiences, to better understand their impacts on women's social and professional paths and the discrimination experienced by women and individuals from the target groups.

The systemic approach is defined by Chicha (1989, p. 85) as "a situation of cumulative and dynamic inequalities resulting from the interaction of individual or institutional practices, decisions or behaviours, with detrimental effects, intended or unintended, on the members of

targeted groups.” This definition combines discriminatory effects of different origins over time. Discrimination can be direct when it refers to social values expressed openly through certain rules or behaviours, e.g., Black Americans being excluded from certain public places not so long ago. Discrimination is indirect when it relates more to the social values imbued in economic, educational and family institutions. This form of discrimination is expressed through behaviours widely accepted by society, e.g., the non-recognition of skills and qualifications acquired abroad and a preference for Canadian work experience (Chicha-Pontbriand, 1989; Jackson, 2002). Indirect discrimination, therefore, takes the form of seemingly neutral policies and practices, which nonetheless produce inequalities and disadvantages for those excluded from the group for which they were designed (Agocs, 2002).

In developing the practical model, there was a concern about its transferability to various companies that hire women working in STEM fields. This project is, then, part of an intersectional perspective sensitive to EDI (equity, diversity and inclusion). Following Crashaw (1989) and Masson (2015), the practical model invites us to consider all women according to the types of discrimination they may experience.

► 5. Research methods

The research process meets the criterion of rigour (Lafortune, 2006, 2024). The use of qualitative data and qualitative analysis generally serves to provide explanations, offer nuance and clarify the research process or path. For this reason, the data collected were triangulated with the theoretical literature presented in the previous chapter, where necessary. Interview protocols were validated as a team. The synthesis of results was also validated with participants and consulting organizations. Ethical certification was obtained. The number of people interviewed was increased in order to reach a form of data saturation (mainly for women working or studying engineering) and to meet a wider range of respondents, including men working in engineering in the mining and petroleum sectors, with a view to ensuring greater transferability of the recommendations and tools proposed.

In a research approach, the aim is to use tools to achieve objectives. It is, therefore, important to ensure consistency between objectives and data collection instruments. Generally speaking, qualitative research

concerns credibility rather than validity (Fortin, 2017; Proulx, 2019) and reliability. Thus, the data collection instrument is credible and valid if it is developed on the basis of reflection and analysis that demonstrate coherence (intention-instrument links). Reliability means showing that results are not the outcome of circumstance and are justified and not based on strict intuition (Kemp, 2012). The protocols were then submitted to the Research Involving Humans Committee (Research Ethics Board) and to all research team members to ensure the results' reliability and credibility.

Based on the conceptual framework, a semi-structured interview guide was developed. Questions were formulated around each dimension or component. Data collection took place from February to August 2023. The principle of data saturation determined the number of interviews required. The quest for diversity among participants in terms of age, family situation, region and ethnicity ensured a heterogeneous sample. The approach included mainly individual interviews (women in engineering, university professors and people in human resources management) and a few group interviews. Group interviews were conducted with female students, a few female university professors and most men we met. The interviews lasted an average of one hour each (see Appendix 1 for an example of the protocol used with women in engineering).

In addition to data collection through interviews, a validation process was carried out with participants who had indicated their desire to be involved at the end of the interview. During this validation process, summaries of the results (more or less 10 pages) were sent out so as not to overload the people who had taken part. The comments received were considered and included in the final research report.

Summary of methodological steps

1. Hiring a team of research assistants and research professionals: six women from various fields such as mathematics, management, philosophy, engineering and Quebec studies.
2. Team research training: methodological aspects, interviews, interview protocols, transcriptions, interview coding, merging of coding and syntheses.

3. Reading and taking notes on texts from the literature and coding these notes in relation to the issue's definition and the theoretical and methodological contexts.
4. Organizing and conducting interviews for all participants with a researcher and a research assistant or professional, an expert mentor conducting others.
5. Transcribing, coding, merging and synthesizing.
6. Producing the report for the funding agency, including the financial framework.
7. Drafting the research report.
8. Validating findings and main results with interviewees.
9. Writing the book resulting from the research with a popularization approach and writing the final report.

► 6. Research sample

In qualitative research, Savoie-Zjac (1989) specifies that data are collected from people considered to have relevant competence regarding the research issue. Sampling is then said to be “theoretical” (Glaser and Strauss, 1967, cited by Savoie-Zjac, 1989) rather than statistical. Participating subjects are generally volunteers — they are not chosen at random. Deslauriers (1991, citing Baud, 1984) points out that, in qualitative research, the sample is non-probabilistic and seeks to reproduce the overall population as closely as possible, considering its known characteristics. Bearing in mind the types of samples used in qualitative research, the project sample includes typical cases, which provide information based on a few cases deemed representative of the whole, politically important cases, which draw attention to particular situations that have an influence on the whole, and finally, nearby cases, those that are easily accessible. It should be borne in mind that in a voluntary sample, a certain type of person participates: people who are interested in the subject, involved in their environment and think they will benefit from it. It is, therefore, impossible to generalize, as the people we met do not represent the entire target population. However, they are often familiar with it. Hence, it is possible to explore what these people think of the reactions of others.

6.1 Sample description

As part of this research, 105 people were interviewed in semi-structured sessions: 95 women, including 25 from immigrant families, 4 Indigenous women, and 10 men.

Here is a breakdown of these people according to whether they were women working in engineering, engineering professors or high school, CEGEP or university students:

- 39 women working in engineering, including 12 from immigrant backgrounds and 2 Indigenous women
- 17 female engineering professors, including 4 from immigrant backgrounds
- 29 students:
 - 16 university students, including 8 from immigrant backgrounds
 - 5 CEGEP students, including 1 Indigenous student
 - 8 high school students
- 6 women working in human resources
- 4 women with particular specialties, including one from an immigrant background and one Indigenous woman
- 10 men working in or studying engineering, four of them from immigrant backgrounds

Tabla 3.1 Sample age distribution

AGE RANGES	14-20	20-30	30-40	40-50	50-60	60+	Retired women	Unknown ³
NUMBER	13	18	7	24	16	3	3	21

3. People were free to answer this question, and the researchers respected any preferences or misgivings.

What was planned and what was achieved:

POPULATION GROUP	WHAT WAS PLANNED (68)	WHAT WAS ACHIEVED (105)
Women working in engineering	40	39 women (12 from an immigrant background, 2 Indigenous)
Engineering professors	0	17 women (4 from an immigrant background)
STEM students	24 (12 de secundaria., 12 de CEGEP, 0 de universidad)	29 (16 university including 4 from an immigrant background, 5 CEGEP including 1 Indigenous woman, 8 high school)
Human resources	4	6
Special expertise	0	4 women (including 1 from an immigrant background and 1 Indigenous)
Men working in engineering	0	10 (including 4 from an immigrant background)
Included in other categories		
Women from immigrant backgrounds	4-6	25
Indigenous women	4-6	4

6.2 Sampling rationale

To achieve these objectives, we had to meet with:

1. Women in engineering working in the mining, gas and refining sectors at different stages of their careers. Women new to the field to solicit information about their recent experience: motivations for their career choices, obstacles or levers encountered along the way. Mid-career women to provide feedback on changing attitudes and policies within different institutions and companies, as well as perceived obstacles that do or do not hinder their career progression and that of their female colleagues. Women at the end of their careers to gather their opinions based on their experience and their views on the most promising levers for improving the attraction to, as well as retention and promotion of women in their work environment.
2. Female university engineering professors at different stages of their careers. These women provided information on their career paths in teaching and business, as well as on the paths of female engineering students (barriers and retention).
3. Women working in human resources to learn about the strategies used to recruit and retain women in STEM (science, technology, engineering and mathematics) fields, to identify the particular skills of these women and to understand what is being done or will be done to continue recruiting and retaining new women. In addition, mentorship programs are increasingly recognized for their ability to reduce barriers. If it is found that the strategies employed to date include the promotion of mentorship, whether formal or informal, in such a case, analyzing the efforts made to gauge their success and possibly propose improvements will have been relevant.
4. Female high school, CEGEP and university students in STEM fields contribute to a better understanding of their situation and strategies for raising awareness of engineering as a career choice.

5. Women offering diverse expertise on the realities of Indigenous women, women from immigrant backgrounds, and women working in other fields such as construction and oil transport to better ensure the transferability of recommendations to predominantly male workplaces.
6. Men (engineering practitioners, professors and students). These meetings helped to gather their opinions and perceptions of the realities of women in the engineering sector and reality check the recommendations.

6.3 Organizations involved in the consultation process

A number of organizations became involved at various stages of the project, helping to recruit participants and contributing to the validation process. The organizations that have agreed to be named are:

Consulting organizations

- AFFESTIM (French-speaking association for women in science, technology, engineering and mathematics)
- CO^{lab} (social innovation and digital culture)
- CIAFT (intervention council for women's access to work)
- QMA (Quebec Mining Association)
- Francogénie (Quebec network of immigrant engineering professionals)
- Coefficiency
- Mentorat Québec

► 7. Summary of tangible research results

This research presents avenues for intervention that take into account various types of discrimination based on the stereotypes and prejudices encountered by several women from different ethnic and cultural backgrounds. The practical model offers proposals arising from the interviews, particularly in the form of conditions to be put in place to promote the recruitment and retention of women in engineering. The mentorship component considers the principles of inclusive

mentorship based on an understanding of intersectional dynamics. In an inclusive mentoring relationship, the person mentoring a woman in STEM ensures that she is offered feedback.⁴

The tangible results of the research have taken three forms:

- Recommendations for action in education, the workplace and society in general to promote gender balance and parity in the workforce (Chapter 19)
- Two competency frameworks for coaching and training women working in engineering as well as for women, but also men, working in male-dominated fields (Chapter 20)
- A practical model for companies and educational institutions to promote awareness, recruitment and retention of women in STEM (science, technology, engineering and mathematics) fields while bringing a new perspective to the project, as it is transferable to other STEM employment sectors. This model includes the outlines of a mentorship program. The practical recommendations include a potential analysis grid for corporate websites (Chapter 21).

In developing the practical model, there was a concern about its transferability to various companies that hire women in STEM fields. Moreover, as this project is part of an intersectional perspective that is sensitive to EDI (equity, diversity and inclusion), the practical model invites consideration of all women according to the types of discrimination they may experience.

► 8. Reflections and methodological considerations

The overall research process raises several methodological reflections and considerations:

- The project achieved its objectives, and then some: more people interviewed (50% more), as many people as planned in each category, more female engineering professors, a website analysis with a questionnaire, and interviews with men working in engineering.

4. <https://mentoratquebec.org/le-mentorat-au-feminin-trois-reponses-pour-les-mentorees-3-3/>

- The data collected from women in engineering have reached saturation point, with the latest interviews providing nothing particularly new.
- The people we met were volunteers, so they showed an interest in taking part in the research, concern for *The Realities of Women in Engineering: Joys*, a desire to see the situation change, a need to share their point of view, openness to change, and willingness to share their experiences, both good and difficult.
- In addition to achieving the objectives and preserving the richness of the data, a detailed research report has been made available, and a book accessible to a wider public has been produced. This decision was made over the course of the project to give greater scope and visibility to the results.
- Some populations we did not meet with may be able to add to the research data, specifically:
 - women who have left the engineering field for various reasons associated with working in this field, including, as identified in the literature, experiencing isolation, microaggressions, impostor syndrome and harassment in various forms
 - company directors, to explore their vision of the future for women in their industry
 - key people in government, to explore what could be done on the political and legislative fronts
- One of the research questions was how the people we met perceived EDI (equity, diversity and inclusion). Their interpretations were very diverse. This provided an opportunity to identify different perceptions of EDI, which were not always clear-cut and precise. Nevertheless, the question allowed us to explore the perceptions that the women we met (and some of the men) had of discrimination and equity.

► 9. Ethical aspects

This investigation was approved by a research ethics committee at Université du Québec à Trois-Rivières and a certificate bearing the number CER-23-296-07.19 was issued on March 7, 2023. For any questions or complaints of an ethical nature concerning this research, participants could contact the research ethics secretariat at Université du Québec à Trois-Rivières by telephone at 819-376-5011, ext. 2129, toll-free at 800-365-0922, ext. 2139, or by e-mail at CEREH@uqtr.ca. An informational letter was sent to each person contacted. Each participant signed a consent form.

► 10. The principles of inclusive writing used throughout this report

The writing of the research report and the book leans into inclusive writing practices that go beyond making a text gender neutral (Lafortune, 2024a, 2024b). Here is the background:

Background to the inclusive writing process

- Writing that considers the place of women and men in texts
- Writing in which the masculine and feminine are often found side by side in the text can overwhelm it
- Using an approach that does not make the text too heavy for a wide audience
- Using an approach that is readable for the widest audience
- A writing approach in which all people (regardless of gender, culture, ethnicity, socioeconomic status, disability, religion, etc.) feel challenged by what the text says
- Writing in a way that does not bow to hierarchy or power...

The principles used in this text are⁵:

1. Using gender-neutral writing;
2. Ensuring a fair distribution of feminine forms: women and men have an equal place;

5. Some principles were inspired by Vachon-L'Heureux and Guénette, 2006.

3. Making sure the text is intelligible so that anyone can recognize who it is about;
4. Using the Government of Canada's Inclusionary as a reference,
5. Making sure that what is written resonates in the spoken word;
6. Making sure that what is written is what will be read;
7. Providing content that is not only aimed at the mainstream;
8. Avoiding, if not eliminating, prescriptive forms, i.e. *it is necessary...*, *one should...* or imperative verbs;
9. Avoiding absolute positions that leave no room for other ideas, avoiding saying what to do as if there were only one truth;
10. Making proposals, encouraging choice and reflection;
11. Avoiding over-generalization;
12. Ensuring that the whole of society feels included in what is being said.





Part 2
Results Summary:
Motivations and Joys



Chapter 4

Perspectives of women
in engineering working in
sectors where they represent
less than 25% of the workforce:
motivations and joys



Interviews were conducted with women working in engineering (39), 12 of whom were from immigrant backgrounds, and two Indigenous women.¹

Women not from immigrant backgrounds working in engineering in industry

Of the 25 women we interviewed, at least 3 were retired at the time of the interview, and at least 18 were still working. Of these, 8 worked (or have mainly worked) in the petrochemical industry, 11 in mining and at least 2 in other industries (manufacturing, pulp mills, etc.). They ranged in age from 20 to 70. Interviews were conducted via Zoom or in person at Université du Québec à Trois-Rivières or Université du Québec à Chicoutimi. The women interviewed worked mainly in industry and on construction sites.

Women from immigrant backgrounds with engineering training

The 12 interviews with women from immigrant backgrounds working in engineering were conducted with women from Belgium, Bolivia, Colombia, Ivory Coast, Cuba, Ecuador, France, Peru and Venezuela. Some had immigrated to Canada from other countries or had studied elsewhere. These women's fields of training included topography, agronomy, chemical engineering, water engineering, electrical engineering and mechanical engineering. In Quebec, they were either looking for work, studying or not working in their field of training (for

1. The decision to talk about women in engineering rather than women engineers stems from the fact that, in Quebec, the title "engineer" is a professional qualification. As such, the use of the title "engineer" is regulated and reserved: use of the title is governed by the Engineers Act and the Professional Code. The title "engineer" is reserved exclusively for members of the Ordre des ingénieurs du Québec. As the women we interviewed were not asked whether they were members of the Ordre des ingénieurs du Québec, they cannot be referred to as "women engineers," just as men cannot be referred to as "engineers" for the same reason. Expressions such as the following are used: women working in engineering, women in engineering. According to the Ordre des ingénieurs du Québec, the proportion of women in engineering has risen from 4% to 15% in 30 years, which nevertheless makes it one of the professions where women are the least well represented in the province. Data: <https://www.oiq.qc.ca/publication/femmes-en-genie-par-ici-le-guide/>. Reserved title: https://gpp.oiq.qc.ca/Start.htm#t=L_Ordre_et_le_titre_reserve.htm

example, one was a mail carrier), and if they were working in their field, it was either chemical or water engineering. They ranged in age from 25 to 50, and 3 of them were members of the Ordre des ingénieurs du Québec.

Indigenous women in engineering

The two Indigenous women in engineering were between 40 and 50 years old and came from different communities and regions. Both specialized in civil engineering and were involved in their communities in some way. Interviews were conducted via Zoom.

The questions asked of these women focused on the following aspects:

- Satisfaction with their work;
- Their education and career paths;
- Sources of motivation, stimulation, inspiration and challenge regarding choosing engineering;
- Barriers and obstacles encountered during studies and career;
- Solutions to be considered mainly concerning the awareness, integration and retention of female engineers in the field;
- Reflections on EDI (equity, diversity and inclusion);
- Women's contributions to engineering.²

► 1. Satisfaction and career path

The women we met expressed their satisfaction — albeit with nuance — with their career choices. Nineteen different women expressed their opinions.

All of the non-immigrant participants expressed a high level of satisfaction with their careers, giving a score of over 7/10. Six even gave a perfect score. The main sources of satisfaction were related to the diversity of positions, the opportunities offered in the engineering field, passion and stimulation, feelings of usefulness and accomplishment as well as the match between career path and expectations. However, a

2. The results of the last three interview questions (strategies, EDI and future prospects) are presented in Chapters 11, 13, 15, 16, 17 and 18.

few reservations were expressed: obstacles that slowed down their careers and missed professional opportunities due to family and parental choices. What is more, despite the enormous strides made, there is still a lack of understanding of certain realities linked to women and the family.

The career paths of women from immigrant backgrounds with engineering backgrounds were described as relatively satisfactory. The person expressing the most satisfaction planned to return to her country of origin to start her own business. Dissatisfaction was attributed to the challenges of being an immigrant, such as not working in their field of training, combined with the difficulties of being a woman in a male-dominated field. Some of these participants, being in a minority in their workplace, reported that they occasionally faced situations qualified as unpleasant. One of them specifically mentioned racism.

In their own words:³

All the women I know in my field are as satisfied as I am — we are all happy (In10).

I like what I do, there's a good work atmosphere (In28A).

I'm pretty satisfied. I'm not at 10, but I would say at a 7-8. The extra 2 isn't because I haven't had any professional opportunities, it's because I've made life choices as a woman. Family life and all. If I hadn't had children, I'd probably have reached a higher position. I'd probably have moved up [...but] I'm super satisfied with my job. But I see opportunities coming up, and I can't take them. [...] Of course, normally, in a career, men often become superintendents or directors in their thirties or forties. I may have that opportunity in my late fifties [...] when my children are grown up, or older. I don't know if I'll still have that momentum when I get there (In13).

Women from immigrant backgrounds generally perceive The Realities of Women in Engineering: Joys as average. There are still fewer of them, and as women from immigrant backgrounds, they are still very much in the minority in the workplace. They are sometimes subjected to unpleasant situations by a small number of colleagues, such as insistent glances or racism (In19IM).

3. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

Coresearchers' reflections

The women we met working in engineering were satisfied and even very satisfied with their work. The degree of satisfaction was less pronounced among women from immigrant backgrounds. To complement this study, it would be interesting to know what happened to the women who left engineering and why they did not pursue their careers in engineering.

► 2. Motivations, stimuli and inspirations

Research participants highlighted the circumstances that motivated, stimulated or inspired them to take on the challenges associated with engineering work. Thirty-five different women talked about it. A wide variety of factors related to industry, family, friends and the individual were raised as motivating or inspiring factors leading to the choice to pursue engineering studies and careers.

2.1 Having parents or relatives in the field

More than a third of participants (14/39) reported having relatives in the engineering field and emphasized that this had been helpful. The presence of such friends and family facilitates relatively direct contact with the profession and provides personalized advice. Above all, it provides real, concrete knowledge of the engineering field and role models that young women often lack. In other words, support in the form of encouragement is a motivational factor in the pursuit of a career in engineering.

In their own words:⁴

I didn't have any female role models, it's just that my father is an engineer, in another field, so maybe that helped. And finally, when I made my choice, I realized that I was from a family of engineers. But they're all men, I'm the first girl. There's my father and my cousins (In15).

4. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

I had two uncles who were engineers and I was attracted to their work [...] and I] wanted to do what they were doing (In311IM).

Everyone in my family is educated. The people I rub shoulders with are engineers, doctors [...] In fact, everyone around me has a post-secondary education (In38IM).

My boyfriend's aunt is a senior engineer who allowed me to do internships in mining. So I had an inside [contact]. She really motivated me to do my master's degree [...] in mining. [...] She helped me a lot in getting into this field. I got a lot of help from a woman who was a senior in the field (In1).

My father is an engineer himself, so I started talking to him about it. It seems he'd never taken it for granted that I'd be interested in engineering either. [...] He put me in touch with engineers [...] in different fields (In7).

My uncle is an engineer and a prof. He's the only one I could confide in about my decision. [...] He's very open. He told me it's excellent — water and the environment are the future. He was the one who supported me when I moved to Montreal. I did everything in secret (In25IM).

My parents were proud that I had chosen a career in agricultural engineering (In311IM).

A cousin who studied petroleum engineering was an inspiration to me (In19IM).

In my family, my mother motivated me by saying that we women are capable, because [...in my country], it's a very macho environment. It's easier for men than for women (In34IM).

My mom wanted me to study nutrition at the end of CEGEP, but during my last semester there, I realized that I was more into math than biology [...and I chose a field] related to the environment (In25IM).

Coresearchers' reflections

Having people from engineering or scientific fields in their entourage seems to be a key factor in steering someone towards their field. This phenomenon is observed in other areas of study and work. Parents, therefore, strongly influence their child's choice of STEM (science, technology, engineering and mathematics) field. Conversely, family and friends can influence someone not to choose certain career paths. How can we create an openness among parents so young people can explore a broad spectrum of possible careers?

2.2 Being good at school and doing well

Also, being good at school and getting good grades is a factor in choosing an engineering major. This takes the form of a passion for and interest in scientific subjects, the natural and formal sciences in general, but also sometimes applied sciences and technical work. Curiosity often accompanies the choice of engineering, manifesting itself in a desire to understand how things work, solve concrete problems and provide tangible solutions.

In their own words:

In my science, physics and chemistry classes, I was over the moon. I was so happy, I loved it so much (In15).

It was a natural thing to do for me because I loved chemistry (In4).

I was attracted to applied science because I'd tried other programs that were more pure science (In13).

Initially, I liked science in general. I'd done architectural engineering but already liked math (In8).

Even then, I was interested in engineering. I went on to study construction engineering. It made the most sense to me after architecture (In12).

Ever since I was little, with my father and my cousins, I have been involved in mechanics. With my cousins, if we had to fix the bikes [...] I was there for it. My dad's toolbox was my favourite toy. I wasn't motivated by girls' games [...], so I liked assembling and disassembling things to find out how they worked (In37IM).

I've always liked mathematics and problem-solving, and in engineering, that's what I'm looking for: to solve problems [...], a problem that has a concrete impact (In7).

Coresearchers' reflections

The contributions of teachers are also very important, particularly when it comes to instilling a love of science and mathematics. In the PISA tests taking place in 65 countries (2022), 33% of 15-year-old students say they feel distressed by mathematics. The level of anxiety expressed is higher among girls than boys. It also appears that teachers with math phobia are less attentive to their students' needs and tend to react negatively when questions are asked or difficulties in understanding are mentioned. This kind of reaction can also be found in other areas of science and can sometimes prevent students from pursuing the sciences.

2.3 Guidance process and open houses

The guidance process is also an important trigger for high school presentations on engineering careers or STEM (science, technology, engineering and mathematics) careers. Some of the women we interviewed recalled open houses and visits to universities, laboratories and factories, where they met and talked directly with professionals.

However, a significant lack of knowledge about the field persists. Some women confided that they did not know what they were getting into when they chose their career path. The lack of certainty and the multiplicity of choices can be perceived as destabilizing. While this lack of knowledge can be a source of curiosity and determination to explore the field, some women we interviewed would have liked more information to better target their decision to study a specific field of engineering.

In their own words:

At my CEGEP, it was at a recruitment open house that the rector of a university present at the time, rather than trying to sell me his programs, looked at my personality type and interests to identify a field of study in line with [what] might interest me. It was the first time I'd ever heard of industrial engineering. And it clicked (In27).

I knew I was going into engineering, but I didn't know what field. When I went to this open house, I saw a booth where there was no one: the mining booth. There was no one around, but a woman was there hosting the booth. It intrigued me. [...] Right from the first year, things clicked, and I was really lucky to have met this woman (In10).

My science, physics and math teachers were the ones who planted the seed (In30).

I didn't even know what the profession was. When I took my career tests, I had the right profile, which led me to discover my profession (In20).

I had applied for engineering, but I didn't know much about the field. I didn't know anyone, I didn't know any engineers (In26A).

I'm not one of those people who thought when I grow up, I'll do this. I've always had trouble deciding what I wanted to do. [...] I was lucky that I could do a lot of things in my studies because I was good at them. [...] I was spoiled for choice. I hesitated between a lot of things, medicine, law. In science [...] I loved mathematics. [...] At some point, I had to choose. [...] [I chose engineering because...] I had trouble with things I couldn't see or touch. [...] [In engineering], I saw what could be built. I could see how projects materialize (In38IM).

Coresearchers' reflections

Whether or not engineering was a choice that had already been considered, special encounters sparked the desire for these women to go into this field. All kinds of visits and open houses have the potential to ignite such a desire in young people. These meetings are essential in greasing the wheels of STEM recruitment.

2.4 Task diversity and the outdoors

This field's diversity of tasks and possible experiences are important stimuli. The diversity of teams, types of work, creativity and innovation all contribute to intellectual stimulation and constant learning, as well as continuous progress, all of which are highly appreciated as things that make the work rewarding and dynamic. The women we interviewed were also positive about the wide variety of tasks, positions and promotion opportunities offered by engineering.

Other factors specific to engineering were cited, such as the possibility of working outdoors, being able to live in the countryside rather than in the city, having a solid job, the technical nature of the profession, the human dimensions of the profession, enjoying teamwork, etc. Some also cited the possibility of national or international mobility, the interest in meeting different people or opening up to other cultures.

In their own words:

I was interested in going into production [because I wanted] it to be really concrete (In2).

I chose geological engineering because of the outdoors. It's funny: it's maybe less obvious in other branches of engineering, but for this one in particular, the outdoor factor really appealed to me. Being outside, onsite, working on large-scale projects — that's what attracted me (In13).

Growing up, I saw myself more in a rural area than in the city, which also led me to pursue mining engineering (In7).

The opportunities it opened up, the profession was wide-ranging and appealed to me in terms of the outdoors, scientific work and the sheer amount of work involved (In26A).

I originally went into industrial engineering [...] for the human side of the discipline [...], to make a difference in a person's day (In27).

Another thing I love is working with a team. Always working with the same people (In7).

When I was very young, I loved to travel, and my mother advised me that surveying would be a good way of satisfying this desire and getting paid for it. Topographical engineering enabled me to do just that [...] [in two Latin American countries]. I was sent to places I would never have gone in my life if I hadn't had the degree, and I'm very grateful for that (In32IM).

We were a bit like nomads, never in the same place, moving from one place to another (In37IM).

Coresearchers' reflections

Engineering is a field that opens many doors, especially for those who want to work outdoors, travel or lean into the human dimensions of work. How do these types of opportunities increase the chances of attracting girls when they know about them and are properly explained?

2.5 Other motivations: environment and working conditions

Many were also attracted to some of the special working conditions offered in engineering. First and foremost, the competitive salary, the wide range of career opportunities and the potential for career advancement were key factors. The work atmosphere was also an attractive feature.

Environmental and ecological aspects were also considered motivational. Being able to concretely participate in making a positive impact on the environment through engineering and its heavy industries has proven to be a determining factor. Therefore, respect for personal and ethical values and concern for the environment were significant sources of motivation.

The Polytechnique massacre (1989) was also seen as a source of motivation to prove that as a woman, it is possible to make it as an engineer.

In their own words:

I didn't know what I wanted to do, but I knew it was a field that opened many doors and provided many job opportunities (In28A).

Because in the department where I work, my "bosses" are women, I feel they want to help me progress. I get the impression that they want to help me achieve my goals (In25IM).

Being able to meet different people, working in a big company and being able to move around and travel — which I did at the beginning of my career [...]. [I met] a lot of people (In24IM).

I've always felt really respected. I've always felt that way about all women (In16).

There's a lot of cultural diversity. You speak English, French and you learn [a lot] (In1).

In terms of people's attitudes, it's really good and I'm really happy to have the work environment I do (In7).

I like the cultural and intellectual buzz, because there are people from all over, of all nationalities [in my workplace: from France, Germany, China...]. It's interesting that there are so many different nationalities (In24IM).

I like not doing the same thing all the time. [...] I'm involved in everything from project management and drawing up blueprints to engineering permit applications. [...] I'm really learning a lot [...], I'm really lucky (In1).

Basically, you have to like to be challenged and to be put into different situations all the time. For someone who likes routine, this might not be the environment I'd encourage them to go into. Besides, you're always learning. I've been working for 22 years and there's not a day when I don't learn (In30).

What I really liked [...] was the intellectual aspect, continuous progress and learning. There are other advantages in the factory, like the morning adrenalin. You arrive in the morning, and you never know what's going to happen, it's never the same from one day to the next, there's no point in planning your day, because in the end, that's not at all how it's going to turn out (In24IM).

It's an exciting field. It's a chance to do something exciting in a profession, to discover new things, to take part in projects that are often innovative. It's [...an opportunity] to learn a lot, to grow, to work as part of a team (In36IM).

I was working on real-life issues and I found that everything was inter-related and that fascinated me (In26A).

It's really my love of the environment and animals that led me to want to do this job [...]. It's a mining company. It's not related to the environment, but I think that by doing good things for a company that works in an industry that's harmful to the environment, that's where you can make an impact (In1).

I think the Polytechnique tragedy was a motivating factor, because I told myself I was going to keep going. Horrible things happened, but that's in the past and now we're proving as girls that, if that's what we want to do, we'll do it (In15).

Coresearchers' reflections

Reading all the comments made by these women working in engineering makes it possible to appreciate their passion and interest in their work. Since this part of the results gives a taste for what it's like to be involved in engineering, it would be possible to use these comments to encourage young women to choose this field of studies and work. How can we mobilize them? Possibly through video vignettes or the development of short texts for discussion.

► 3. Help and support

Part of the interviews focused on what guided their decision to move towards an engineering profession, while considering support from spouses and close friends. Eighteen different women expressed their views on this subject.

The support of family and friends was one of the factors that steered women towards a career in engineering. A father's support was fundamental in discovering the profession, putting one woman in touch with male engineers from different fields after she had expressed an interest in the sector. A spouse's support made it easier to balance family, work and a personal life, albeit with certain sacrifices. It appears necessary to relieve women of some of the pressure of parenthood (or simply to distribute it equitably) and to enable them to progress in their careers. All seemed very grateful for the efforts made by their spouses, qualifying them as wonderful or extraordinary. Generally speaking, the support of friends and family, such as spouses or parents, appeared essential to the family-work-life balance.

Support within the company was also deemed important: from management, a welcoming work team or colleagues who become informal mentors. Young, open-minded male colleagues who collaborated easily with women were just one of the factors that encouraged integration into teams. In some respectful environments, it was an advantage to be a woman. These environments did not give women the impression of being less good than men, while offering everyone the right to not know everything. This was helpful if, in a company, the hierarchy was open and the company limited male colleagues' sexist behaviour.

At the start of a career, integration into a company that was open to immigration helped build self-confidence in learning new tasks. It was conducive to find sympathetic allies in the integration of women in a company that expressed pride in having a woman engineer on the team. Some participants mentioned having received support within their company or during their studies. Some participants said they benefited from the help of a mentor at the start of their career, or had the remarkable support of female colleagues to better settle into their position, for example, after a promotion. For many of them, women's support for each other onsite was a major factor in their career development, giving them a sense of belonging and boosting their self-confidence. This openness was also reflected in management's awareness of the situation of women and the application of certain supportive conditions, such as flexible working hours.

The ease of employment and financial benefits this sector offers were seen as incentives, such as high salaries and the possibility of obtaining scholarships. There were advantages associated with the private sector over the public sector, such as the ease of obtaining arrangements and accommodations.

Harassment and sexism in engineering is being seen in a new light, accompanied by a change in behaviour. This new awareness has also come from women, who are beginning to question certain behaviours in the interests of equality.

An Indigenous participant stressed the importance of reaching out to Indigenous communities. Being an Indigenous woman was considered an asset in such cases.

In their own words:

[My partner] was a pharmacist, [with] a variable, more flexible schedule. He took care of our child a bit (In23).

My partner was wonderful. He put up with a lot, he was present, so it worked out well (In13).

I have an extraordinary partner in this respect. [...] He's even changed jobs and companies to be able to slow down a bit to make things work with our family (In30).

My children are still young, but if someone offered me part-time work, I'd jump at it. I have a lot of work and a partner who takes care of the kids a lot, but still (In24IM).

I'd never have done it if I hadn't had my parents' support. So that's the foundation. It takes a village to support a woman engineer (In5).

My parents [...] have always supported me financially [...]. They have always supported me in my choice (In24IM).

What's helpful is that my male colleagues are quite open-minded, rather young and there's a dynamic that's really inclusive [of women] (In1).

In some companies, being a woman was more an advantage than a disadvantage, even in a male environment (In27). For example, the men didn't give me the impression that I wasn't as good as them [...] I had the right not to know everything (In27).

I started in the field because the company that hired me was committed to [...understanding] the job in action. During my early years, I found myself onsite, driving a van and managing guards, workers, site managers and sometimes people who could have been my father. It was quite challenging, actually. [...] It's true that we're talking about a very male, macho environment, but [...] I met people, men, who trusted me and helped me. [...] I'm not going to say they protected me, but they had my back. [...] I had [...] a boss who felt that women had their place (In38IM).

There's a lot of that mentality here: you can ask any question, there's no unhealthy competition, everyone wants to make it work, so people are open and available (In30).

They were very open to my requests for job flexibility, and for a few years, under the supervision of this boss, I could work like that: in and out whenever I wanted. I didn't often work fewer hours, but in my mind, it changed everything (In16).

It's important to have good working conditions and a good salary (In28A).

Before my internship was over, I even had a job [...] on offer. Finishing [your] degree with a job in your pocket [is attractive] (In30).

I was very lucky, I didn't have any difficulties. [...] My degree was recognized because there are a number of schools [...] in my country] that have signed agreements with Quebec. [...] But I know it's not a common path here. I'm aware that not everyone finds a job quickly, especially one equivalent to what they had in their country of origin (In38IM). It's not super multicultural where I work, although I haven't felt discriminated against. But I know it exists (In38IM).

When I went to [XYZ...], what also interested me was getting to know the [Indigenous communities...] and I knew we were in [Indigenous] lands, and it was something that interested me to be in contact with the local population, that's what fulfilled me culturally. For a non-Indigenous person who isn't interested in these issues, it's less relevant. For me, it was a plus (In28A).

Coresearchers' reflections

Many women in engineering have received support from their families and spouses, and they enthusiastically emphasize this. This kind of support is important if for anyone pursuing a career that demands constant work, concentration, creativity and teamwork. How can we raise awareness around women's significant contributions to engineering when they are supported?

► 4. Reactions from family, friends, society and colleagues

The interviews also explored the reactions of family and friends, as well as society's and colleagues' perceptions of engineering as a career choice. Twenty-nine different women were interviewed.

Women working in engineering talked about the reactions of their loved ones (family, parents) to their choice of engineering as a career. More than half of these reactions were positive, ranging from encouragement to support or directly to a sense of parental pride. Some reactions were positive despite a lack of knowledge of the field. Parental support was also expressed in several ways: while most participants mentioned encouragement, this support also manifested itself in the form of paying for studies or a certain openness. This pride sometimes

came from a match between the career choice and the parents' image of their child, such as a mother who always said her daughter would do a male job or a mother who always maintained that her daughter would not need a man. Some positive reactions were independent of career choice, being more a matter of finding a job their child would like. The prestige associated with university studies was also a factor, which was very positively perceived.

Negative reactions were more akin to surprise and temporary incomprehension than real disapproval. However, this surprise and incomprehension was construed as a lack of support, and although parents often eventually changed their minds, these reactions and remarks were perceived as destabilizing.

Prejudices around the engineering sector still exist, mainly regarding its environmental impact, especially when it comes to the mining and oil industries.

Women from immigrant backgrounds talk about the different reactions of those close to them when they announced their career choice and desire to immigrate. Some parents were worried or disappointed, while others accepted their daughter's choice. One participant went through the immigration process secretly to avoid facing her parents' disapproval. In another case, when her decision to undertake studies and a career in engineering was announced, family members did not hide their concerns, but also did not dissuade her. Families did not always understand the steps required to enter the professional world in Quebec, especially if the woman was already an engineer in her country of origin.

Friends' reactions to the announcement of their career choice were fairly neutral, with a few positive and encouraging reactions.

As far as society's perceptions were concerned, there did not seem to be too much prejudice against women in engineering, and if there was, it tended to be positive. Society seems to see women in engineering as a minority, but no less competent than men. So, there is a great deal of pride in being an engineer. Women in engineering appear to be highly regarded by society.

Despite all the positive feedback, the stereotype that women are not interested in engineering persists. As a result, women are more likely to be drawn to health-related fields when they are good at school. Women are often associated with social skills, such as caring for others or being diligent and conscientious in their work. On the other hand, women in science are still perceived as having no family, no ties. Even if we are very aware of the realities of women in scientific fields, we may still find that some people harbour prejudices about the place of women in STEM (science, technology, engineering and mathematics).

Society also lacks awareness around, seriousness about and consideration of the issues facing women in engineering, such as pay inequity.

According to some of the women we interviewed, the situation has improved. Women in engineering are better listened to, and universities offer more adequate support. Compared to their countries of origin, women from immigrant backgrounds reported being treated well in the Quebec workplace, with more respect and equity.

However, colleagues' perceptions of women in engineering seemed to differ according to age. While there was good overall integration of women alongside open-minded, young and dynamic male colleagues, it was not always the case with more experienced engineers, who reported a perceived lack of credibility and insufficient listening to women. However, it seems that, more recently, some men are recognizing women in engineering for their skills and respecting them after all. Attitudes are changing, and surprisingly so. It is possible to find allies in different sectors.

In their own words:⁵

Everyone was very proud of me (In1).

My mother was very proud and always said to me, "you, my daughter, are going to do a boy's job" (In23). [My father] was so proud of me (In4). My parents, no matter what I would have been into, they would have been happy (In30).

5. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

One mother always said that since [she was] born, [she didn't] need a man [...]. So she was very happy that [she] could [stand] on [her] two feet (In4).

I think there was a sense of pride, it has a good reputation, it's a renowned profession (In28A).

I could have chosen anything [...], they wanted me to do something [...] it was mostly "find something you like and do it" (In2).

They wanted us to go to university to have better conditions than they had (In22).

They were all very surprised (In16). They didn't understand (In27). Many thought I wouldn't succeed (In16). My father wasn't happy (In10). I remember finding it a bit annoying [disappointing] to hear that (In13).

My stepdad didn't agree [...], but my parents finally agreed — they understood. My mother was a little disappointed that I didn't go into nutrition, but that was fine (In25IM).

I went through the immigration process in secret because otherwise [my parents] wouldn't have supported me. I didn't tell them I was going into engineering [...in a specialty they wouldn't have accepted]. They knew I'd chosen engineering, but maybe industrial or something in Montreal, but not in Quebec City, on my own (In25IM).

I come from a very proud family, so they didn't hide certain difficulties from me, not about engineering [...but] about the fact that it's a very male-dominated environment, and they warned me that it wouldn't be easy to make my mark every day. But I still received enthusiasm and encouragement (In36IM).

In Canada, I see women [...are] equal to men (In34IM).

A woman in Quebec is much more recognized for her intellectual abilities, her ability to run a business (In4).

I don't think I've had any setbacks. I didn't perceive any prejudice or hear anyone say that because I was a girl, I couldn't do these things (In22).

Pretty much everyone has a poor view of mines. Especially when you come out of school, most people, especially from my generation, associate mines with pollution! (In10).

The environmental dimension has started to get a bit bigger. [...] People are really starting to think about ecological footprint, and there's more and more talk about climate change. Honestly, now that I'm back in Quebec, in a completely hostile climate, I find it completely crazy [...]. I feel embarrassed to say that I worked for that company (In4).

He tells me quite simply, and for him it's normal, "oh, but you're so brilliant! Imagine if you'd been a man, you'd have been so smart! [In spite of this,] I never felt that I was less intelligent because I was a woman (In7).

I'm around men at work who are pretty much like me: they are conscientious, take notes. [...] It seems that the guys are sometimes a little less diligent than the girls, but that's not what I notice where I am (In15).

When it comes to pay inequity, I tell them it's annoying [disappointing] that we have a pay gap, but the reality is what it is. We make jokes about it, but they know it's annoying and it's true. Sometimes, I get angry with my friends, I say, "I'm angry now, I don't want to hear those jokes" (In1).

The first thing that surprised me was respect. I find that men are respectful of women in the workplace. More so [than in my country]. They don't talk nonsense to me. It may also have something to do with the legal framework here, but I really appreciate their respect for women. And in the company, [...] I see a lot of women around me who have power. [...] I find that encouraging (In38IM).

Some men are quite open-minded, the younger ones who have a more open, cooperative dynamic (In1), but with the senior engineers, it's not the same (In1). But as soon as I opened my mouth and the guys saw that I was a consultant and knew what I was talking about, they were very respectful towards me (In16).

Coresearchers' reflections

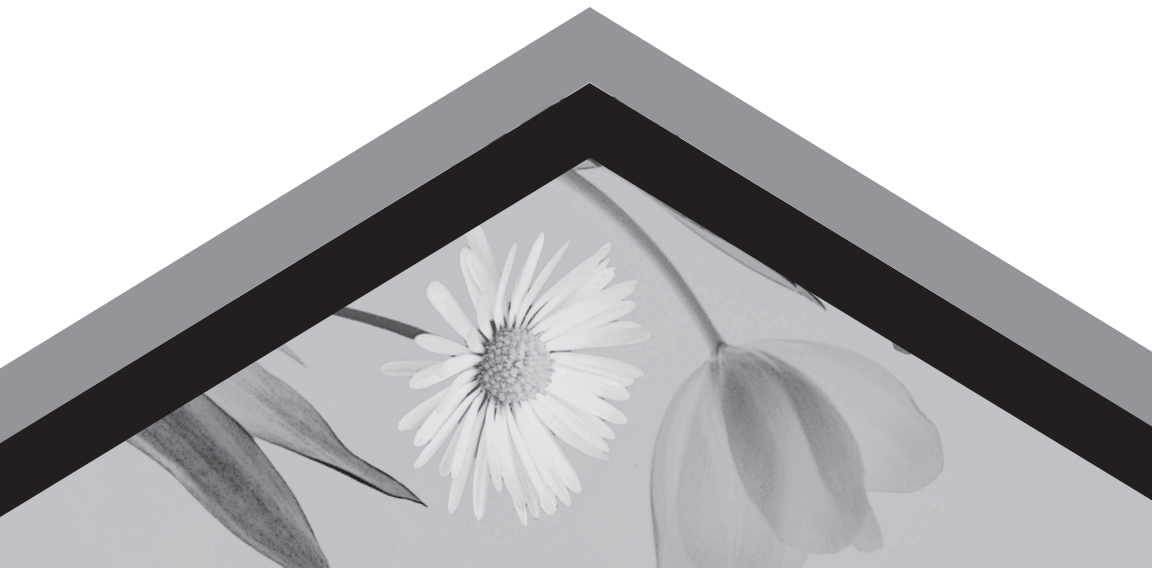
The women we met did not face too much disapproval regarding their decision to go into engineering. Therefore, it is possible to believe that those who did face discouraging remarks did not choose related fields. Going against family wishes requires a great deal of determination and inner strength. What can be done to better inform parents about and sensitize them to a girl's choice of engineering as a career?

It is true that there is still discrimination in Quebec, and that girls are not encouraged enough to choose a STEM (science, technology, engineering and mathematics) field. However, it seems that the situation in Quebec is more equitable than in other countries, according to women from immigrant backgrounds.



Chapter 5

Perspectives of female professors in engineering, where women are largely in the minority: motivations and joys



This chapter presents the results of 17 interviews with female engineering professors, four of whom are from immigrant backgrounds. The interviews were conducted at several higher education institutions: Université du Québec à Trois-Rivières, École de technologie supérieure, Université Laval, Université du Québec à Chicoutimi, University of Alberta and École polytechnique. The teaching fields explored were mechanical engineering, industrial engineering, electrical engineering, materials engineering, chemical engineering, computer engineering, civil engineering, software engineering and information technology. The professors, two of whom were retired, ranged from 25 to 70 years old.

The questions focused on the following topics:

- Motivations, satisfactions and supports in choosing engineering and in the transition from engineering to teaching;
- The difficulties they encountered and those they perceived in their students;
- Solutions to be considered, mainly concerning the awareness, integration and retention of female engineers in the field;¹
- Reflections on EDI (equity, diversity and inclusion);
- Self-perception and women's contributions to engineering.

► 1. Motivations, stimuli, satisfactions and inspirations

The female engineering professors we met expressed their satisfaction with their career choices and what motivated them to make their decision. All the women (17) spoke on this subject.

The university professors were generally highly satisfied with their careers, which they reported as 1) satisfying their curiosities around the workings of the world around them, 2) meeting their human connection needs, 3) connecting them to continuous learning, and 4) offering a stimulating and progressive work environment. The freedom of teaching and research was also a good incentive. Thirteen out of seventeen participants rated their career satisfaction at 8/10 or higher. Of

1. The results of these last three parts of the interviews are presented in Chapters 11, 12, 13, 15, 16, 17 and 18.

these, five went so far as to give a 10/10. Satisfaction with teaching was very high, but less so with research. The stress of research work was not always easy to bear, but overall satisfaction was high.

For almost half of the participants (8/17), parental influences or people close to them played a crucial role in their choosing engineering. Whether it was having a father or grandfather in engineering, a grandmother who managed everything, a father who was a mechanical technician, uncles in engineering, a father who was a mechanic, or a grandmother who was a professor, these influences were significant. The advice and inspiration from people outside their immediate circle also played a key role in guiding their future.

Decisive events such as open houses, positive career advice, internships, discovery workshops, etc., led them to choose engineering. Moreover, some of these women engineering professors were interested in science — particularly mathematics and physics — while they were young and doing well at school.

For women, choosing engineering underscored their interest in scientific applications — their practical and applied aspects — as well as explaining physical phenomena. They spoke of their curiosity, desire and thirst to know how things work, alongside a strong association with teamwork.

The women interviewed said it explicitly: they wanted to help people, improve society and change the world through teaching and engineering. They had a passion for problem-solving and putting solutions into practice. What motivated these women was the desire to creatively contribute to a field of cutting-edge technology and innovation, to make a scientific contribution that impacts society.

For female professors from immigrant backgrounds, satisfaction levels varied and seemed to be particularly linked to their experiences. However, female professors from immigrant backgrounds experienced emotional dependence: approval and recognition from third parties played an important role in keeping their motivation high. Even if the fact that there were engineers in these women's entourage advantaged them in pursuing a profession in engineering, the good salary and social prestige associated with this work motivated their choosing the field.

In their own words:²

Satisfaction

This career satisfies their curiosity about how things work and their desire to contribute to helping people (PI1).

Industry didn't deliver the same satisfaction: it wasn't unsustainable, it just wasn't ideal (PI1). Teaching helps you to keep learning (PI3). I really like the work environment I'm in (PI4). A very stimulating and progressive career brings satisfaction (PI5).

For professors from immigrant backgrounds, the level of satisfaction has never been consistent (PI9IM), let's just say that up until the moment I arrived here, it wasn't very strong. A feeling of having missed out on everything. [...] And at one point, one of my sisters said to me, "but listen, I googled your name, and you're everywhere! You've done so many things. I've seen your presentations, everything! [...]" That allowed me to take a step back and say to myself, "OK [...], it's not that bad" (PI18IM).

Family influences

Having a father working in engineering may have influenced my decision (PI1): with a father in the field, I knew what an engineer was. I didn't need to look it up, and that certainly contributed to my choice (PI5). A father who was a mechanical technician and manager in a company with a large engineering component influenced my choice (PI6).

I used to work with my dad, and there was a woman in engineering there, and I thought she was cool. She had a career in a man's world and I found that inspiring (PI6).

My scout leader — who had done literary [studies] and was good at science and regretted [not going into science] — told me: "if you do science, you can always go back to literature, if you go into literature, you're stuck there." And that's really why I decided to go into science (PI18IM).

2. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

Interest in and passion for scientific subjects

I've always been fascinated by science. I loved math and physics. I wasn't as good at chemistry and biology, but I was very good at math, I really liked it, so that's really what inspired me (PI3, PI15).

Curiosity about scientific applications

I really liked physics, but I wanted it to be more applied [I went on to engineering, but] it was hard to choose between physics and engineering. [...] I liked physics because I liked to understand things a bit, to fix them, to dissect them (PI1). I was always the one who went looking for data and wanted to show [... or] be able to give an explanation. [I studied in this field...] because I liked explaining (PI4).

Willingness to improve society, change the world

The appeal of engineering lies in helping people, fulfilling their wishes and those of society as a whole. Becoming an engineer is a practical way of fulfilling that desire to help people. That's my primary motivation. The desire to help people is added to the desire to contribute to making a better life for everyone in society. There's no greater dream than that for me (PI5).

This desire translates into a feeling of helping people live better. It's not physical, like in medicine, but when you help people or society move forward, you solve problems (PI16).

Coresearchers' reflections

As with women in engineering, having parents in the field (mostly men) contributed to their choice of this field.

Female engineering professors do not say it often, but research grants contribute to their desire to learn. Participating in various conferences allows you to present your research results and, in so doing, help change the world. This aspect of the job makes a real difference to the work done in the industry. University education helps satisfy curiosity and the impulse to help people.

► 2. Choosing teaching over industry

The women we met shared on their choice of engineering education over industrial engineering work. Thirteen different women expressed their views on the subject.

Accepting a professorship was attractive for these female engineering professors, especially as it would allow them to conduct research. What is more, being a university professor would open up the possibility of meeting young girls, taking action to keep them in engineering and even attracting others by inviting them to participate in various motivational and promotional activities. Choosing a university career is linked to the possibility of achieving family-work-life balance relatively easily. In fact, research and teaching help achieve this balance, as the schedule offers flexibility, even if teaching is done within a fixed timetable.

These women worked and taught in very varied fields, including mechatronics, aerospace, decision theory, artificial intelligence, satellite structure, mechanical vibrations, aircraft engine turbines, hydraulic turbines and dynamic systems.

In their own words:

Teaching provides opportunities for human connection and to satisfy the impulse to help people understand (PI1). Even though the industry actively sought women, teaching attracted me the most (PI2). I decided to go into teaching because part of my personality likes helping people (PI2). Sometimes I miss racking my brain with an engineering problem, being part of a team. When I hear my engineering friends talking about what they're doing at work, sometimes I think, "Oh, it would be fun to go back into the field", but at the same time, the satisfaction of feeling like I'm helping my students and seeing that they understand something, I don't think I'd get that elsewhere. It's really an everyday dilemma (PI6).

When I was studying, I didn't have many women as teachers, and being a teacher might be a good opportunity to be a bit of a role model for these young girls and show them "you can go into engineering and you can succeed even if there aren't many women — it's not a problem, there's room for us" (PI6).

Coresearchers' reflections

For some of these academics who had worked in industry before becoming professors, it was not easy to report why they made this change or choice. Sometimes, they reported missing industry-related tasks, but the pleasure of teaching seemed to be a stronger motivator.

It is important to have female professors in engineering to attract female students to these fields of study, but having women working in engineering in industry is also very useful for providing inspiring role models. So there is an important complementarity between both careers.

► 3. Support from family and friends in the workplace and at school

The women we met mentioned the help and support they had received from various sources. Eleven different women spoke on the subject.

They also mentioned their mother's support being important in enabling them to pursue their studies, company onboarding and academic integration processes, as well as support from peers and their thesis supervisors.

Some women were committed to the cause of women in engineering, such as: belonging to an association concerned with the realities of women in STEM (science, technology, engineering and mathematics), directing or being involved in an intervention or research chair on women in STEM, and getting involved in her department or university to advance the situation of women students. Their commitment not only helped female students but also assisted them in understanding their realities. Being eligible for scholarships and financial aid of all kinds also helped them pursue their studies.

Finally, other positive aspects noted by the participants as being motivating for choosing engineering: the growing number of female students, an ever more inclusive world, the blossoming of young women, better integration in studies and work than before, and the possibility of getting involved in fields in the biomedical and environmental sectors.

In their own words:

Family support

I lived with my mother, who was very open-minded and told me, “if you’re interested, go for it, you’re capable” — she said it from the heart [...] — “but go all the way.” At one point, I was discouraged and had thrown all my books in the garbage can. She put all my books back on the table and said, “you finish your semester. You’ll see after your semester” (PI2).

Helpful integration processes

Care was taken under the leadership of a team leader who helped young people — he helped us learn and understand (PI5). There was nothing in the [university] environment (PI5).

Nothing was done to facilitate my integration as a woman [...], but nothing prevented me from feeling integrated either (PI6).

Support from people in the workplace or at school

During my studies, I was a bit of a fifth wheel because there were four guys, so I didn’t fit in, but with them it was always good [in terms of respect] (PI2).

If I hadn’t worked on [the issue] of women in science and engineering, I don’t think I would have succeeded in engineering, because I had to understand what I was going through, or if I was encountering difficulties in my career, I had to understand in order to move forward. That helped me a lot personally (PI16).

Other positive aspects

I wasn’t particularly apprehensive about that (sexism). Maybe I was naive (PI1).

Today’s critical mass allows us to start changing things. We’re not yet in the parity zone, but it’s starting to change things, and not just for women — today, we’re thinking about disabled people and racialized people (PI5).

I think they (female students) integrate relatively well. I’ve never felt that the girls were alone, put in some corner (PI11).

Coresearchers' reflections

It is interesting to note that getting involved in the cause of women in STEM (science, technology, engineering and mathematics) contributes to understanding your own situation. This can be interpreted in different ways: understanding the choice to go into engineering, understanding the influence of certain sometimes respectful, sometimes sexist or inappropriate words and gestures along your path (having the inclination to withdraw or let certain dubious remarks pass, or choosing to get into the game and speak the same language as male colleagues...). What are these realizations? What impact do they have on career development? A collective effort in which women who are invested in the cause of women and girls in STEM share inspiring testimonials could be one pathway forward.

► 4. Reactions from family and friends, perceptions of society and male colleagues

Female engineering professors talked about the reactions of their loved ones and families to the news of their career choice, as well as society's and male colleagues' perceptions of women in engineering. Fourteen different women spoke on the subject.

Some women spoke of the positive reactions of family and friends to the announcement of their career choices, such as encouragement, pride, openness and support, even if the parents knew little about engineering. Sometimes, given their previous choices, there were a few surprises. When families were helpful and supportive of their daughters, stereotypes had less of a negative impact on career choices and the decision to stick with them.

As for society's perceptions, professors denounced the still present prejudices and stereotypes regarding women working in engineering: a lack of understanding of engineering, portrayals of women similar to male engineer stereotypes, perpetuation of a form of stereotyping that results in women being perceived as odd and women preferring human-centric engineering fields.

According to female professors, female students seemed to thrive in engineering as women. They pointed out that they did not seem to encounter any particular difficulties, and there were university resources to support them.

Prejudices and stereotypes on the part of male colleagues were reported: difficulty in finding a thesis supervisor or being part of a research team assuming a possible pregnancy, not taking female students seriously, women's skills being considered less solid than men's, sexist behaviours — yet there was hope regarding new male colleagues. Some women had a pessimistic view of The Realities of Women in Engineering: Joys, particularly the persistent presence of certain gender stereotypes.

In their own words:

Family reaction to career choice

My grandmother was a gas station attendant, sole owner and a widow (PI15). The women were happy [...] my aunts and the people around me were very proud (PI2).

I don't think it was very positive or very negative. It wasn't a surprise [...] it was a bit of an expectation of what I was already heading towards (PI1). I don't think it was a surprise. My parents [...] were used to me making choices that were a bit off the beaten track (PI6).

Company perception

I think it's still perceived that women who go into engineering [...], it's because they [fit the] "genius [...]" mould, as if there were a profile, something idealized or associated with genius (PI1).

If women in engineering posted photos of themselves saying, "I'm an engineer, this is what an engineer looks like," there would still be comments like, "you're way too cute to be an engineer!" (PI5).

In academia [...], there are very few women [in engineering] and the situation is the same as when I was a student; [...] one factor that leads to fewer women in engineering is perhaps related to stereotypes [that are perpetuated...] (PI7IM).

Women in engineering are seen as "weirdos." We should just stop talking about it [...], it's like we're stigmatizing the fact that there aren't enough women in engineering. There are too many women in medicine. Why

Perspectives of female professors in engineering,
where women are largely in the minority: motivations and joys

isn't there a stigma attached to the fact that there aren't enough men in medicine? Why don't we stigmatize the fact that there aren't enough men in teaching? [...] We focus on women, then forget about men (PI3).

Society, in general, doesn't necessarily have a good opinion of engineers, male or female (PI6).

Perception of male colleagues (prejudices, stereotypes)

The difficulty of finding a thesis supervisor or being hired by a research team comes from the "risks" of pregnancy: it's not official, but it's what's done all too often (PI1).

A bias exists: a man is an expert, but a woman is not (PI3). Colleagues in the field think that a woman's place is in the office (PI11).

There have been changes because the old farts are gone (PI14).

Coresearchers' reflections

It is often said that women in engineering seek out human- and environment-related work and choose sectors associated with the biomedical field or environment. However, it is important to remember that women's contributions are essential to the mining and petroleum sectors, helping them to reduce pollution and benefit from solutions that only women could provide.

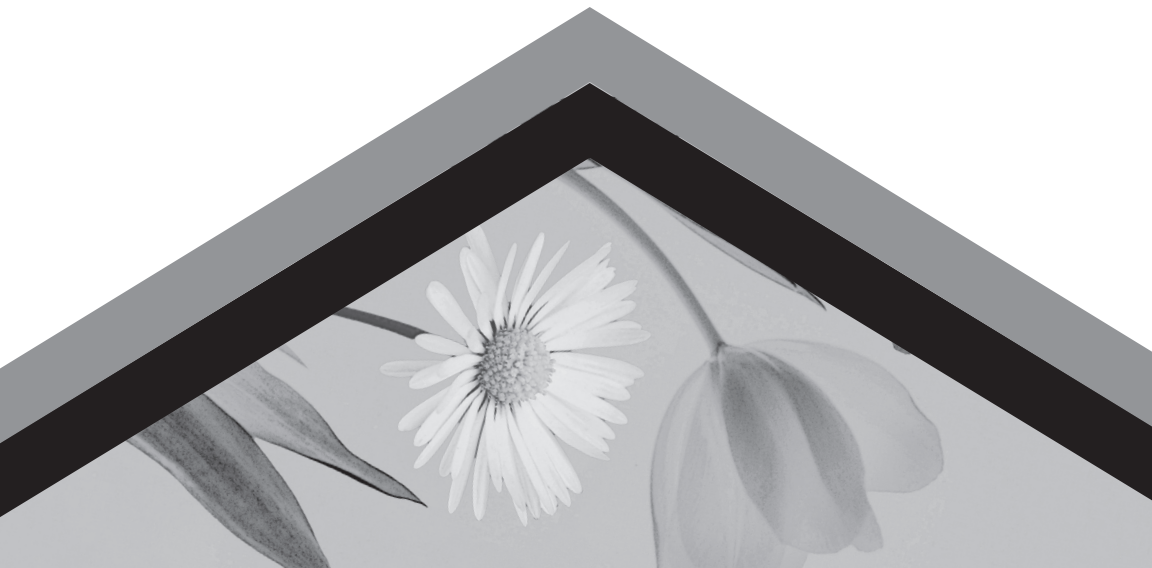
One idea raised was just how much the realities of women in STEM (science, technology, engineering and mathematics) are on the agenda and talked about. Why is it on everyone's lips? Surely, this is something we need to think about collectively in order to respond to such remarks.

A lot is expected of the new generation of men. How can we integrate them into our thinking?



Chapter 6

The realities of
female students in STEM, from
high school to university:
motivations and joys



In this research project, we planned to meet female high school, CEGEP and university students enrolled in programs leading to STEM (science, technology, engineering and mathematics) careers. The university students were all in engineering fields. Of the 29 students we met, 16 were studying engineering at university (eight of whom were from immigrant backgrounds), five were enrolled in CEGEP and eight in high school.

Student interviews were conducted at Université du Québec à Trois-Rivières, Université Laval, Université du Québec à Chicoutimi and École de technologie supérieure. Their fields of study were aeronautics, electrical engineering, engineering physics, chemical engineering, geological and mining engineering, mechanical engineering and civil engineering. The eight immigrant students came from Colombia, Ivory Coast, France and Tunisia. They ranged in age from 20 to 40.

Of the five CEGEP students interviewed, one was a science student enrolled in engineering at university and hoped to go on to a master's degree in administration. Another was in the natural sciences and hoped to become a veterinarian. The third, who had begun her studies in engineering, chose to stop halfway through after being harassed by one of her classmates. She planned to resume her studies in engineering. Another was a student in a university transfer program in engineering.¹

The eight high school students can be categorized as follows: one student did not have much experience, apart from a job in the health field. She reported liking helping others and anything to do with chemistry and medicine. Another wanted to be a psychiatrist. The third wanted to do her CEGEP studies in natural sciences, aiming to go into astrophysics and reported liking anything to do with space. One student had no real idea of what she wanted to do later, and was enrolled in a natural sciences program. Another was in an international studies program (ISP), will study science, literature and art at CEGEP, and reported wanting to pursue research in science and mathematics.²

They were asked questions about:

- Their study path;
- The motivations, satisfactions and supports that motivated them to choose engineering (or a STEM-related field more generally);

1. Only the paths of four of the students were known.

2. Only the paths of five of the students were known.

- Difficulties encountered;
- Solutions to be considered, mainly around awareness-raising, integration and retention of women working in engineering, but also of girls in STEM-related fields of study;³
- Reflections on EDI (equity, diversity and inclusion);
- Female students' self-perception and women's contributions to engineering.

► 1. Factors influencing the choice to study engineering or STEM: Satisfaction, motivations and various forms of support

The students we interviewed talked about their satisfaction with their choice of engineering studies and the motivations that guided them toward STEM (science, technology, engineering and mathematics) fields. Twenty different students gave their opinions on the subject.

Overall, 10/16 of engineering students were satisfied with their choice of studies (between 7 and 10 on a scale of 10). Nevertheless, receiving additional information would have helped them refine their choice of specialty. Being able to lean into their creativity and curiosity contributed to their satisfaction with their decision.

As a CEGEP student, it is not easy to talk about how satisfied you are with your choice of studies: some students were thrilled, while others were still unsure. From these interviews, it seemed an important factor was to have an impact on society.

There were many reasons cited for studying engineering:

- The diversity of the work and tasks involved, and the field's multidisciplinary nature.
- The dynamic, practice-oriented work environment and the opportunity to work outdoors were attractive factors.
- Family members working in engineering or scientific fields were a great source of inspiration.

3. These last three parts were covered in interviews. The results are presented in Chapters 11, 12, 13, 15, 16 and 18.

- Encouragement from the family contributed to the pursuit of this type of study.
- A change in mentality regarding the acceptance of women in this field was noted.
- Passion for the field, its practicality and the satisfaction of curiosity were motivating factors.
- Curiosity and the desire to know how things work were motivating factors.
- Compensation and benefits that promise financial security.
- The ease of learning scientific subjects compared to literary ones provided improved confidence in abilities gained via internships.
- The motivation and stimulation to pursue engineering studies served to break down stereotypes associated with women. This was amplified among women who reported not wanting to be boxed into a traditional female role.

Students talked about the assistance and facilities they benefited from:

- Female students supported each other throughout their years of study. Moreover, some male-dominated study and work environments made room for women.
- Some female students had a good experience of the guidance process through open-mindedness and gender-neutral programs.
- Open houses organized by universities were particularly helpful.
- The support and good will of people in the company and over the course of their studies (help from professors, colleagues and management) in integrating or retaining employees were facilitating factors.
- Supportive relationships with parents and friends were observed and reported as being important.
- Despite possible prejudices, some female students said they would not dream of leaving a male-dominated field. There were dedicated to achieving their goals.

In their own words:⁴

Satisfaction with choice of studies

I chose to the best of my knowledge. If I had to do it all over again, [...] I might have gone into pure physics: [...] there's the biophotonics concentration that would be better suited to my choices (EU6). I chose the best option given what I knew then, but it's certain that if I were allowed to start a new bachelor's, [...] I might go into computer science. But I'd never done any programming before coming to university, so I couldn't have known (EU7).

I wanted to know how to develop and how to make things. I saw the big factories and companies, and I realized that design engineering was for me [...]. I even used to take appliances apart (EU13IM).

I'll at least be able to make a small change in the world (EC2).

Motivations for pursuing engineering studies

I chose this field because I was looking for one that mixed pure science with engineering. Pure science with a little more applied science (EU6).

I went into engineering physics [... for its] multidisciplinary aspect (EU7).

I always wanted to be an engineer. [...] In Grade 11, I learned that you could do engineering and that it encompassed everything. [...] Engineering opens up a multitude of possibilities, as well as a certain creative freedom (EU1).

I don't like sitting at a desk, I like standing up and moving around (EU4IM). I like to find out what the components we see are used for [...], I also like projects (EU3IM).

My father is a mechanical engineer, so I'm definitely used to engineers. Also, in CEGEP [...] I had the same professor twice and got along well with her. [...] That definitely influenced my decision (EU7).

I chose engineering because my father is a scientist, so I grew up in that. [...] [...] I chose] electrical engineering because where I come from, there's a big problem with electricity, which affected me quite personally (EU2).

4. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

My eldest sister is a doctor, my second is a civil engineer and my mother is an elementary school teacher [...]. They have been the greatest inspirations for me. [... They have] shown me that I can also do what they do (EU14IM).

Ever since I was a little girl, I've been very passionate about aeronautics. [...] I said I wanted to be an astronaut and that sounded crazy to people, but let's just say I stuck to my dream and made it a reality (EU14IM).

I really enjoy being in problem-solving situations and the idea of applying solutions (EU1).

I can say it's a privilege [to work in engineering...]. It's a pleasure to be well paid (EU4IM).

My high school physics and chemistry teacher told me that I'd never be able to do it. I can say that I've met a few women who made me want to keep going and understand that I have my place... These women were [extraordinary] because of their work, their aura and their expertise, they really shone. I told myself that if it's possible for them, it's also possible for others. But for that, you have to work. [...] First of all, you're a woman in a society, an immigrant and black. [...] In my case, that pushes me to work more (EU9IM).

There weren't many girls initially, but we really stuck together. I think we motivated each other — we supported each other a lot, we also had guy friends with whom we got along well, and we did well. [...] For the past two years, there have been a lot of female first years: 12 of them would start out and half would leave (EU7). (Reference to years after 2020.)

Coresearchers' reflections

For the women in engineering and female engineering professors we met, parental support or having a family member working in engineering served as an inspiration and was a very important factor in choosing to go into engineering or STEM (science, technology, engineering and mathematics). Parents, therefore, have a role to play, whether or not they are in this field. What can be done to raise parental awareness of the realities of women in STEM and to raise awareness of the importance of minimizing the perpetuation of stereotypes?



Being told “you will not be able to do it” can be discouraging for some students, but for others, it is simply a challenge to prove their abilities and prove them wrong. Considering the possible negative impacts, how can we ensure that words of discouragement or presuming incompetence are no longer uttered?

The testimonials of these young women have demonstrated that mutual support during their studies was important and did in fact exist. So how can we prevent a culture of competition from taking root?

► 2. Perceptions and reactions of family and society around career choices in engineering or STEM

The students we met expressed their views on what family, friends, colleagues and society think of women who choose to work in engineering. Eight female university students had their say on the subject.

Two opposing types of reactions were highlighted regarding the behaviour of close friends and family when their choice of career path was announced (seven students reporting this): acceptance and understanding on the part of the family, or a lack of understanding of their choice of studies and career. A stereotypical view of engineering would lead to a lack of support. However, it seems the situation is tending towards change, despite some persistent difficulties.

The students from immigrant backgrounds who went on to study engineering generally lacked support from their families. When their career choice was announced, some families reacted negatively (at least half the students we met mentioning this). There was social pressure to think about marriage and family at their age. In some communities, girls were encouraged to pursue education and careers where they would not have to work and study too long in order to start a family.

The Realities of Women in Engineering: Joys is not always easy because of a credibility problem. They are pressured to prove themselves and carve out a place in this field, which entails yet another mental load.

This can sometimes lead to self-doubt. What is more, engineering work has a reputation for being rough and dirty: another barrier to choosing this field.

In their own words:

As far as my parents are concerned, there wasn't much of a reaction, because in our family you choose what you choose, and if you'd taken up dance it would have been the same. But other family members expressed disappointment, like the aunt who wanted me to follow in her medical footsteps (EU2).

My father tried to discourage me [... saying,] "you won't be listened to" [... and,] "you'd be better off going into health care" (EU12).

The situation is changing, as younger professors can also be found in educational circles, encouraging girls to pursue engineering studies (EU12).

I didn't have parents telling me, "come on, you can do it, you can do it" (EU17IM).

In the Canadian context, what I liked most was that they considered my ideas. I'm not just there to be given instructions, but also to contribute [to the common effort] and learn. This has given me more self-confidence and helped me believe more in my knowledge, because it's valuable for the laboratory. What I have experienced proves that we are good enough to be part of the engineering pool that has always been dominated by men (EU14IM).

Some female supervisors invite us to wear make-up for a presentation, supposedly to look good (EU9IM).

Coresearchers' reflections

Unsurprisingly, there were three types of reactions from these young women's friends and families: acceptance, reluctance and indifference. How can we deconstruct the stereotypes rooted in family circles so that young women have their autonomy and can make informed choices according to their aspirations, passions and skills, without having to fight against stereotypes?



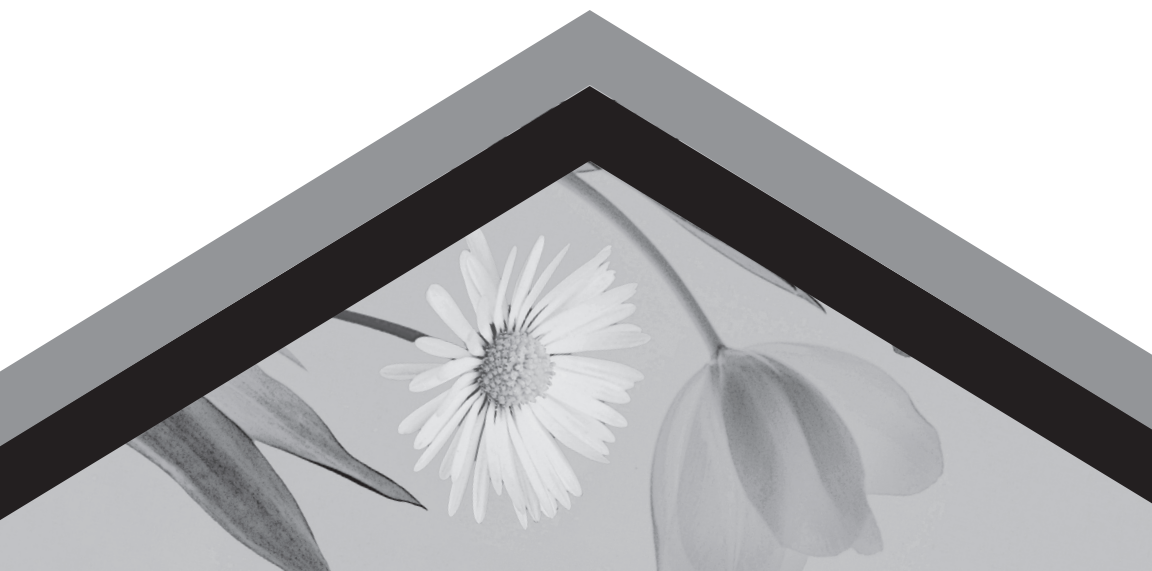


Part 3
Results Summary:
Obstacles, Challenges
and Difficulties



Chapter 7

Perspectives of women in engineering working in sectors where they represent less than 25% of the workforce: obstacles, challenges and difficulties



The interviews we conducted were with women working in engineering (39), 12 of whom were from immigrant backgrounds and two of whom were Indigenous.¹ Of the 25 women not from immigrant backgrounds, 8 worked (or have mainly worked) in the petrochemical industry, 11 in mining and at least two in other industries (manufacturing, pulp & paper, etc.). The 12 women from immigrant backgrounds working in engineering hailed from countries including Belgium, Bolivia, Colombia, Ivory Coast, Cuba, Ecuador, France, Peru and Venezuela. Their areas of training were topography, agronomy, chemical engineering, water engineering, electrical engineering and mechanical engineering. The two Indigenous women came from different communities and regions. Both specialized in civil engineering and were involved, in one way or another, in their communities. The content of the interviews was diverse. What is presented here concerns the obstacles they encountered in different forms.

► 1. Obstacles linked to the guidance process and family aspirations

Among the difficulties and obstacles faced by the women we met who work in engineering were those linked to the guidance process and studies.

1.1 Difficulties linked to the guidance process and studies

Some difficulties they faced were specifically associated with the guidance process and studies. Fourteen different women expressed their views on the subject. The first difficulty was around guidance and

1. The decision to talk about women in engineering rather than women in engineering stems from the fact that, in Quebec, the title “engineer” is a professional qualification. As such, the use of the title “engineer” is regulated and reserved: use of the title is governed by the *Engineers Act and the Professional Code*. The title “engineer” is reserved exclusively for members of the *Ordre des ingénieurs du Québec*. As the women we interviewed were not asked if they were members of the *Ordre des ingénieurs du Québec*, they cannot be called engineers, just as men cannot be referred to as engineers for the same reason. Expressions such as the following are used: women working in engineering, women in engineering. According to the *Ordre des ingénieurs du Québec*, the proportion of women in engineering has risen from 4% to 15% in 30 years, which nevertheless makes it one of the professions where women are the least well represented in the province (data as of June 23, 2023).

an apparent lack of knowledge concerning engineering fields. When the women did well at school, they were generally directed towards care-related fields (health, medicine) rather than engineering or STEM (science, technology, engineering and mathematics). Generally speaking, engineering professions were rarely presented to women as a possible option. Female students lacked information about the field, were unfamiliar with it and were not encouraged to pursue it.

The stereotypes they encountered gave a false image of the engineering profession and were sometimes a deterrent. When jobs were advertised, they sometimes came with warnings about the work involved as a way to inform women about what to expect when entering the sector. This was perceived as either helpful, paternalistic, discouraging, or dissuasive.

Other difficulties were associated with their studies, such as moments of discouragement linked to a heavy workload and performance demands to achieve the required grades. A certain anxiety emerged from this kind of pressure.

Their difficulties, in their own words:²

As a girl, I was good at school, so I was told “you’re going to be a good doctor.” It was stuck in my head that I was going into medicine (In7).

There are few female role models in engineering, which means that the field is unknown to women, making it hard for them to see themselves having a career in it, and sometimes they don’t know that it’s even an option (In21).

The technical aspects, the field-site aspects of the job are often assigned to men. It’s kind of stereotypical. But I feel like it’s a good fit for me just the same. I’m not that much of a technical person (In28A).

When I was young, I used to say, “No, no, I’m tough, I can do it! [...]” The questions I was asked were always very negative, like, “what if you come across a guy who’s like that? Who says that? etc.” Afterwards, in my actual work experience, I didn’t experience it like that (In2).

2. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

Sometimes, you feel a bit like a loser compared to the others — it's like the impostor syndrome. You feel like you don't deserve your spot, other people are sometimes super in-demand and you feel like you're not that in-demand, and maybe you shouldn't be there (In1).

1.2 Difficulties faced by women from immigrant backgrounds

Women from immigrant backgrounds expressed difficulties linked to prejudice and stereotypes when choosing their career path. For people who had immigrated, the obstacles to be overcome in pursuing engineering studies stemmed from prejudices around working conditions, e.g., ones that portray engineering work as dirty, arduous and physical. There is still discrimination against women from immigrant backgrounds, despite efforts to make room for them.

Their difficulties, in their own words:

The women worked more on operational aspects [... like] pressing the little button on a lever without getting too dirty. Women tended to go for cleaner work. [...] But, at the time, I liked it (In37IM).

No matter what is done to integrate women, systemic discrimination exists, and we have to accept it (In37IM).

Working in the oil industry, it was very exhausting. I knew that this work was for other people. The oil and gas extracted was not headed for Canada, but for other countries (In32IM).

Maybe two girls were in my class, even in chemistry [...] I was on my own, with all the advantages and disadvantages which that entails (In24IM).

I liked engineering, but I also liked physical activity, and I had friends who leaned towards that. I thought I'd do both entrance exams (engineering and fitness). I passed both. I thought engineering would require an intellectual effort, so I chose it. Later, I doubted my choice, because I saw my friends having fun in fitness [...] while I was doing nothing but studying (In37IM).

1.3 Difficulties faced by Indigenous women

One Indigenous woman emphasized the lack of knowledge and representation of engineering in their communities. The important thing was to be able to imagine oneself in the field and grasp what engineering could bring to the community — this was the decisive element in their decision-making process. For these reasons, Indigenous women may be more interested in the humanities and social sciences than in STEM (science, technology, engineering and mathematics) fields.

Their difficulties, in their own words:

In Indigenous communities, I think it's really unknown as a profession. I don't think it's something that's promoted. I think it's unknown among young girls in the communities, even young boys for that matter. It won't cross their mind and that's why they won't put effort into becoming an engineer (In26A).

Also, consider where you will work afterwards: can I return and work in my community? Are there jobs for engineers? (In26A)

Indigenous people tend to choose to work in the helping professions. I can study that and return to my community and help. But as an engineer, you don't see how it can help, it's less tangible, perhaps (In26A).

For Indigenous people, engineering requires pure science and applied math. Is this a barrier? Does it explain why more Indigenous people choose the humanities, social work and teaching? I don't know (In26A).

Of course, to go into engineering, you have to work hard. That's what the barriers are: you have to be hard-working and you have to get good grades (In28A).

It's very demanding, and if I had to do it all over again, I wonder if I'd even do it. I didn't like the program at all — it's meant to divide students into who will continue and who will stop there. [...] It wasn't interesting, I had a programming course... it was too demanding (In28A).

Coresearchers' reflections

While it may be well-intentioned (ensuring that women know what to expect when they enter the industry), conveying the profession's difficult aspects to women in advance can also be seen as paternalistic, discouraging and even dissuasive. Therein lies the paradox: paternalistic or genuinely helpful?

The situations against which women are warned are indeed situations that exist in engineering, but they also happen elsewhere in life. Why is this so important in engineering?

Women talk about the workload and demands of studying: how do men perceive these demands? What are the differences and similarities between women's and men's perceptions of academic demands?

► 2. Industry challenges

Several other types of challenges regarding working conditions are encountered by women in the industry. These include unsuitable equipment, isolation, impostor syndrome, the glass ceiling, pay inequity and discrimination. Thirty-six different women expressed their views on the subject.

2.1 Poor adaptation of clothing and equipment

One of the difficulties encountered by women in industry was the poorly suited equipment. Women's morphology differs from men's, and safety outfits and equipment, for example, are not always adapted to them: they are either too big or too wide, which can cause safety problems. Few women mentioned this, as it seems that women currently have greater access to suitable clothing and equipment. However, the prices charged are higher than those suitable for men.

In their own words:

The fact is, there was never enough equipment that fit me. [...] There's a gender component to working with women. This is also true for short men (In6).

2.2 Feeling isolated: Impostor syndrome

Some difficulties encountered were due to the simple fact of being a woman in a male environment and finding oneself in the minority: there were feelings of inferiority, unpleasant feelings of not fitting in (impostor syndrome), pornographic calendars on display and excessive sexualization.

Some women found it hard to feel fully integrated into their teams, where they felt excluded and isolated. Their challenging integration may have led to missed employment opportunities. The feeling of isolation was reinforced when women found themselves on their own explaining sexism and gender discrimination to their colleagues and teams, or raising awareness around these topics.

Workplace vocabulary was found to be too often gendered, which contributed to this discriminatory exclusion, such as referring to a team as “the boys” — which makes the women in the group invisible — or using the term “family man” to describe the way a team leader behaves with his colleagues. This terminology reinforced the exclusion of women and their sense of isolation — of not belonging.

These difficulties, in their own words:

I find that the orientation, the first day [working for a company], makes all the difference [...], just, “OK welcome, we’re glad you’re here.” Sometimes, people didn’t even know I was being onboarded (In24IM).

On a mine site, a woman had unbuttoned her blouse. I didn’t say anything, but I thought she’d learn. You don’t do that onsite — if you do, they won’t listen to you anymore (In26A).

You don’t quite fit into the social circle (In11). Of course, if I’d been more self-effacing, it might have been harder to fit in. Sometimes, I had to speak much louder than if I’d been a guy (In26A).

Women aren’t part of the boy’s club: there’s also lady’s night, but in my case, when the work crew goes to men’s night, well, I can’t go [I won’t be admitted] (In11).

This difficult integration leads to missed employment opportunities: Did I feel that I wasn’t part of the boy’s club, and that’s why I didn’t get the job? Well, I’d say so, even now. It’s a reality (In 23).

Sexist terminology reinforces the exclusion of women and their sense of isolation: It's used a lot at the mine and I question people who say, "My boys, this, that." I asked my team leader: "Are there any girls on your team?" "Yes, there are girls." "Then why do you say my boys?" "That's a good question, I've always said that..." When you say "my boys," it denotes a closeness, a feeling of attachment and there's something positive about that expression, rather than when you say "my employees" — there's a greater distance, it's more formal. I don't think anyone has come up with another expression, so we continue to say "my boys" (In15).

2.3 Difficulties making oneself heard and lack of credibility

Women find it hard to make themselves heard. There is a real difference in treatment between men and women on teams. Certain behaviours are exclusionary, and some women have difficulty finding their place. Some women adapt their behaviour to fit into a male-dominated environment: they feel the need to take on a role and adopt less gendered, less feminine behaviours in order to be taken seriously.

Many participants reported a lack of consideration and credibility on the part of their colleagues or superiors. This manifested itself in difficulties in making themselves heard, a devaluation of their skills, a lack of confidence in their abilities, a lack of credibility and a feeling of always having to prove themselves. The demands placed on them were always higher because they were women. This was accompanied by a feeling of not being taken seriously and of being constantly tested.

Women could not just be as good as their colleagues — they had to be better. This created a double standard: according to some, women had to work harder to build credibility. They worked longer and harder. It also seemed that the extra commitment and demands were not recognized. Sometimes, a woman would do all the work, and her male colleagues got all the credit. This reinforced the feelings of incompetence and impostor syndrome to which women are so often subjected. There were two main consequences of such behaviour: the need for women to prove themselves — with the impression that more is being demanded of them — and impostor syndrome.

Some women fought less for their ideas and let go more easily. Some tried to convince a male colleague to submit their views for them. There were also situations where there was increased competition between women.

But strategies have their limits: some men would take advantage of the situation to “steal” ideas from their female colleagues, who would then lose recognition for their work. The lack of recognition for women’s work in engineering is so entrenched that it seems to constitute an obstacle to professional self-affirmation, even when they have an engineering degree.

Gender and age stereotypes persist: an older man was seen as more competent than a younger woman. Criticism was frequently levelled at women’s (often unfounded) hyper-emotionality to discredit/ridicule their remarks, such as being told they were experiencing PMS (premenstrual syndrome).

These difficulties, in their own words:

You try to prove your point, but you don't do it like a man, and that's not acceptable in a male environment (In23). If you try to defend something, you talk too much. If you defend it with passion, you're emotional. But he raises his voice — he's emotional, too. [...] I was the only woman on the executive committee, so there was never a good way, it was difficult to raise personal points of view. And then, oh, but if a man says it! That changes everything. It became a “running gag”: the idea was to convince a colleague outside the meeting, he'll say it and it'll go down, and I'll be left in peace (In23).

If there was a chance of getting a good position, some women made sure to hold onto it and keep the other women away. It was horrible, you know. And if they realized you were succeeding at something, instead of supporting you and saying OK, one powerful woman with another powerful woman, it would be nice to empower two women, they would make sure to push you aside. Horrible perspective in those days (In5). Women fight amongst themselves to keep their hard-won positions instead of helping each other and aiming higher (In5).

When invoking International Women's Day (March 8) with colleagues, the first reaction of 95% of men was: “Then when is men's day? Why do you have this? You have all the rights, etc.” It's embarrassing that, when I talk about women's rights, the first thing people say to me is,

“what about men?” When I point out that there are inequalities in the world, and that Canada isn’t too badly placed when it comes to equity, the responses are different: “I guess it’s OK to have a day for it.” But I found it peculiar to have to justify it rather than [... to get responses] like “good job” and “we’re happy to have women in the company” (In7).

As young women, we have a big [deficit] of credibility, and that’s pretty obvious. We stand out less in meetings, yet it’s totally different when a senior man speaks. I have colleagues who are environmental coordinators and they always have more baseline credibility than me because I’m a woman. It’s not supposed to be normal, but it’s considered as such [...] To boot, the more experience men have, the less they’ll value a woman’s experience (In1). To believe it for yourself, you have to hear people say: “Get out of your office, you don’t know anything about it, go and see the site” (In28A).

Credibility is hard to gain. I’ve always felt that challenge (In23). Because you’re younger and a woman, people don’t necessarily trust you, they test your limits (In2). It was more difficult with my boss — he was testing me, and I felt like I was always being tested as if it were a competition (In28A).

A man can be shocked, and it will just look masculine. The woman who expresses shock [... for] things that don’t work gets told she has PMS (premenstrual syndrome) right away. We get ridiculed (In8).

Regarding some actions, they do it nicely, it’s not necessarily mean-spirited, but at the end of the day, it’s because they think [... a woman is] not capable [of acting] on her own or they want to talk to you and the way they approach us is stupid (In1).

Women have to prove themselves because there’s always the fear of being criticized for being less good because you’re a girl. I’ve always felt a bit like that, that I had to be better than my colleagues at the same level to be recognized in the same way they were (In16). This creates a double standard: a man can be incompetent at a job, and that’s fine, but a woman has to prove she’s competent to get the job. I think there are still biases like that today (In15).

I could say that for a long time, I suffered from a kind of impostor syndrome due to being in the minority. I’ve worked on this syndrome and read up on it, but I know that when you’re in the minority, it’s very real (In11).

2.4 Glass ceiling and pay inequity

The women we interviewed raised glass ceiling issues. In some companies in the oil industry, there is a lot of prejudice against hiring women, considering that they may be pregnant or have to look after children, have to go to daycare or be absent due to childhood illnesses. As a result, women progress more slowly up the corporate ladder, as they have fewer opportunities to ask for pay raises, and so on. Because of these prejudices, women are less likely to ask for what they want regarding career advancement or pay raises. And if women do not ask for what they want, initiatives for change in their favour will not materialize. Women often sacrifice in a relationship, since they often earn less. Men keep their jobs and benefits, while women simply have to adapt.

Almost half of the female participants surveyed were relatively aware of a gender wage gap to their disadvantage. Male colleagues were paid as much or more than women for equivalent tasks or tasks associated with lower pay. However, since salaries were fairly secret, not all these women were very well informed about the extent of the inequity. There was certainly inequality in terms of salaries, but it was not always easy to verify or prove, as asking about salaries remains taboo. Companies seem to make it difficult, if not impossible, to access this kind of information. As reconciling this hard-to-swallow fact is so difficult, some women preferred not to think about it and remained in denial. The inequity therefore lies in the inability to negotiate your salary.

An Indigenous woman we interviewed also raised the issue of pay inequity, having been told by an employer that her salary would be lower than it should be because, according to him, she did not pay taxes.

These difficulties, in their own words:

It was difficult because I was always told, “you’re good, you have extraordinary evaluations,” but they would take “buddies” of guys from the outside and [hire] them for management positions. And what could I do? (In23).

As far as wage demands are concerned, men are more inclined to make requests. So women are penalized. [...] That reminds me of when I was adjusting a salary for a young man. He asked me for much more than I could offer him. I told him, you did the right thing by asking me. [...] That’s how it works (In20).

Particularly in industry, males earned much more than females (In23).

My male colleagues will be paid the same as me, but for being in consulting or different fields. [...] Currently, I'm paid the same as my colleagues in lower-paid fields (In1).

We don't really talk about it between colleagues... I'd be inclined to believe that this gap still exists, but I don't have any proof (In2). On my team, we don't talk about salary, it's hard to broach the subject. But I'd say that the pay gap is generally there (In1).

I will tell you something terrible, but when I thought about it, I said to myself, "I'd better not know the salary of my male colleagues who do the same thing as me" [...] However, I feel that I wasn't always paid at the level I should have been, but I had no way of knowing. You can't always work with the feeling that you're being paid less than the other person, and since you can't know for sure [it's hard to do anything about it] (In16).

A colleague said: "I want you to know that you are grossly underpaid." After these words, I went the very next morning [to ask for a pay raise] and within 5 minutes [... my salary] was increased by 20%, which means they knew I wasn't paid enough for what I was doing (In16).

As Indigenous people, we still hear all too often, "since you don't pay taxes, we'll give you a lower salary," and I'm a bit against that because it has no real impact on the employer (In26A).

2.5 Family-work-life balance and geographical isolation

Geographical isolation is also a major issue when it comes to recruiting women, as the places where companies want to send them to advance their careers are very far away. This further complicates the family-work-life balance. Beyond the geographical issue, working hours themselves remain very restrictive and require the understanding and help of a spouse.

Managing parenthood, particularly during pregnancy, is also a major challenge. Many women are faced with a dual requirement: 1) the need to be present and committed to their job, while remaining close to

their family life and 2) a strong prejudice against women who choose to continue working on rotations after having children. This situation is emotionally difficult to manage. From a practical point of view, managing pregnancy itself is very complicated, given the particularities of engineering employment in certain sectors, whether due to geographical isolation or preventative leave. Accommodations are difficult, and few are made. From the very start of pregnancy, the difficulties start mounting, and women quickly feel that they are being sidelined. In addition to the feeling of being sidelined, maternity leave, with its lack of accommodation, is often seen as a lost year in terms of experience — an absence and erasure from the organization for a time that sometimes results in missed promotion opportunities that correspond to the profile of certain women. The return from maternity leave also poses a problem, as women sometimes have to prove themselves again and assert themselves to regain their pre-leave reputation. The lack of childcare spaces is also a major issue for women in engineering, making the balance of parenthood, family and work all the more difficult. Some will even quit their jobs, or even their careers, because of all these constraints.

These difficulties, in their own words:

In one case of fly-in-fly-out employment,³ it wasn't easy as a couple. Occasionally, I gave up my job to work closer to my partner. [... That's what women do] to make it work (In13).

I had two children. The [fly-in-fly-out work] wasn't easy. I did it for a while, even with my young children. [...] When the children reached school age, I gave my supervisor an ultimatum and asked to be transferred to the south, as the mines were in the north. They accommodated me, creating a position for me to work remotely from the south (In13).

I had a 17-4 schedule: 17 days on site, 4 days [off]. So, I was tired of living a bit on the sidelines and not being able to anchor myself anywhere. [...] Everyone was with their family, and I'd arrived there young. I had to create a network, and it was difficult (In28A).

3. Fly-in-fly-out means work for which companies temporarily transport their staff to a remote location or site (mining or hydroelectric operation) and then bring them back home for a rest period. This could be 7 or 14 days of work for 7 or 14 days of rest or some other combination. This seems to be a way of avoiding having to house staff and their families permanently.

[You have to] be well supported by your partner, depending on the situation, because otherwise women don't progress (In23). For example, at the mine, the hours are really weird [...]. Another problem is getting a place in daycare and adapting your schedule [accordingly] (In7).

In part-time work, the workload doesn't decrease, so you work fewer hours but have as much work (In2). Everyone who tried it quit because they were disadvantaged in so many ways (In2).

I hadn't had [a break] or a weekend for 13 weeks. I said, "[...] can I have my Sunday?" My boss replied: "When I tell you you've got time off, you'll be off. Now you're working" (In23).

Everyone almost said we were unworthy mothers for leaving our children in the south (In13). This situation is emotionally difficult to manage because a mother [who leaves her family] is abominable (In13).

As soon as a woman has children, it becomes more complicated than for a man, even today (In10). Women are forced to change the nature of their work [...] and go on sick leave from the first day [pregnancy] is announced (In10). From that [point of view], something could be done. Let them make me work shorter hours [...] or other accommodations]. [...] I couldn't go back [to my job]. I was removed from the site (In23).

At one point in my career, I went on maternity leave in November. I'd worked my whole year, but I got a 0% pay raise the following year. It was considered as if I'd left, even though I'd worked 11 months out of 12. So, there was a time when it wasn't [taken into account], but it has improved (In30).

When I returned from maternity leave, I had to prove myself again to my boss and convince him that I could work in the south (In13).

Some women don't return to work because they don't have daycare (In7). It's hard to see trained, competent colleagues who can't come back to work, not because they don't want to, but simply because they don't have daycare (In7).

Comments from women from immigrant backgrounds

Women still have children and are mostly responsible for them. My children are still young. If someone offered me a part-time job, I'd jump at it. I have a lot of work and I have a partner who takes care of [our children] a lot, but still... (In24IM).

When we first got to Canada, as we both had the same degree, we decided that my husband would take the first steps with the Ordre des ingénieurs du Québec and [... that after obtaining] his license, I would start taking my own steps. But when the time came, I already had my job and was happy with it, so I decided not to take the necessary steps (In31IM).

The hardest part of my career, really, was when I was pregnant. I was literally stuck in a closet and my partner was always bugging me, saying, "You're in your closet." It was as if I didn't exist anymore. I wasn't fired but I was removed from my position and it was as if they didn't know what to do with me, even though I had a lot to offer. Obviously, there was a bit of flexibility [regarding work-life balance] and I don't think employers have any choice but to go a bit more towards that (In24IM).

They weren't necessarily great experiences. Sometimes I felt like I'd been taken for a ride, especially when I returned from maternity leave. That was the worst experience, because I was told, "you're going to such and such a place, you're going to have such and such a position," and there was already a person in the position [assigned to me...]. That was in 2010 (In24IM).

Coresearchers' reflections

By examining the observations of all these women from different backgrounds and professional experiences, an intersectional approach is needed both in training and developing corporate policies. This means that women do not form a homogeneous group and experience different forms of discrimination.

Developing equity between men and women is a task for society as a whole, not just for women. The community is responsible for bringing about change.



Companies do not readily open the door to making their pay scales known, as the subject remains taboo. Since prejudices about women influence many women, as they expect pay raises to be offered to them and because their self-appraisal of the value of their work seems lower than that of their male colleagues, women ask for pay raises less often than their male colleagues. Some prefer to remain in denial, unaware of their colleagues' salaries, yet continue working knowing they are underpaid. However, if they do not take initiative in this area, changes in their favour may never materialize.

How can we not penalize women working in certain sectors of the mining or oil industry — who have to go on preventive leave as soon as they become aware of their pregnancy, sometimes even as soon as they want to conceive — given the dangers to the health and safety of the unborn child? How can all pregnancy-related work situations not be treated in the same way?

The shortage of childcare spaces is a major issue for women in engineering, making the balance of parenthood, family and work all the more difficult. What can be done about it?

► **3. Sexist or inappropriate comments, remarks and gestures**

Several participants (25/39) reported having been subjected — either at university or during their careers in industry — to inappropriate remarks or comments about their status as women, sometimes accompanied by sexist or inappropriate gestures, which in some cases could be characterized as sexual assault.

3.1 Sexist comments and inappropriate gestures during studies

During their studies, some women in engineering talked about the sexism they experienced at university and the remarks they were subjected to during this period. Some of these sexist jokes and posts would not pass muster today. They do not seem to have hindered advancement in their field, as many did not react to these inappropriate remarks.

Perspectives of women in engineering working in sectors where they represent less than 25% of the workforce: obstacles, challenges and difficulties

Even if they had not been raped, the women interviewed experienced other types of disturbing aggressions, such as having their buttocks grabbed without consent, being subjected to close and inappropriate contact that created discomfort, or hearing crude remarks about their physique — all in line with a hypersexualization of women's bodies. These remarks were destabilizing and created insecurity. Women were also victims of rumours about alleged sexual activities, which damaged their reputations.

Women from immigrant backgrounds reported the same reprehensible behaviours during their studies outside of Canada, as well as many obstacles based on stereotypes and sexist prejudices from students or professors towards female engineering students, hindering their retention. They also reported sexist or inappropriate remarks, gestures and harassment abroad, particularly concerning women's intellectual abilities. They shared how they felt openly denigrated.

In their own words:

There are sexist jokes that wouldn't pass muster today and sexist publications in the school that weren't very fair to women. [...] Our way of getting through it was to laugh about it and just get on with it. We weren't into confrontation and telling guys to stop making those jokes (In16).

Sometimes you question yourself when you're studying and certain people behave badly, like grabbing your butt [...]. And then you think: "What am I doing here? Do I want to continue studying with these people? Do I want to potentially work with these people?" (In7).

Sometimes you get your ass grabbed at a party by someone you know from your everyday life, and it doesn't have to be a very serious act to make you question yourself and feel less safe around these people. It can be getting your ass grabbed, them being too clingy, or comments about your body, unsolicited comments, or [...] another person comes along and just stares at your boobs and says, "oh, you've got nice boobs! ... Oops, I shouldn't have said that..." and walks away. And then you're like, "what the hell!"

A guy who says, "oh yeah, I slept with such-and-such a girl, etc." when it's not true, but it changes how others will look at that girl (In7).

Comments from women from immigrant backgrounds

When I was at university, the guys would say: “Why don’t you go and cook? Go find a husband instead of being here.” And that was in 2002 or 2003. [...] The professors were even ruder than the guys with us, for example, they made a classmate cry by saying: “What are you doing here? This is not your place” (In3IM).

Professors were very clear about their position on women, for example: “I’m sure women will come in last.” He was surprised that I got the best mark. For him, only men could get good marks (In34IM).

Coresearchers’ reflections

It is not easy to read these women’s words, which can also be found in the next section. Some people may think that these situations are things of the past, but the inappropriate, unseemly, disrespectful words and gestures are still common today. What can we do to change behaviours, but above all sexist and racist thinking, when they are still so entrenched?

3.2 Sexist comments and inappropriate in the industry

Even today, unfortunately, inappropriate remarks and gestures do not stop upon leaving school. The results show that it is common for women in a male environment to have to deal with sexist remarks and discrimination in hiring. The women interviewed had to set boundaries, which was not always easy, as male-dominated milieus could feel oppressive for many. Some sexist remarks were not made in front of these women, but they would hear about them later. More than half the participants (16/27) reported being directly on the receiving end of sexist or inappropriate comments, remarks or gestures during their careers in the industry.

Women are subjected to derogatory remarks and comments on a number of levels: being called “little lady”, “cute little gal” or “gorgeous”, being asked for a bikini parade, oral sex or being asked to sleep in a hotel, all of which are examples of contemptuous remarks. These comments demean women and call into question their place in the industry.

Other seemingly innocuous remarks also create a certain unease, especially when women are still reduced to a hypersexualized object. Such comments remind them and make them feel they are women before engineers. The women we interviewed expressed embarrassment, discomfort and the degrading nature of such commentary and situations. Participants from immigrant backgrounds shared similar stories about sexism in the industry. It should be noted that, in their cases, inappropriate comments and gestures could also be tinged with racism, which is likely to create further discrimination.

Harassment in the workplace does not only take the form of sexist and inappropriate remarks or gestures. In one case, it took the form of a boss questioning his female employee's skills and relentlessly cutting her off, contradicting her, interrogating her and expressing scorn in relation to files for which she was responsible. As a result of this psychological harassment, the woman was forced to take a leave of absence, but after two years of recorded testimony and events, the man was found guilty of harassment.

Examples of embarrassing situations also abounded. When interviewed, some women answered quickly and in the affirmative when asked if they have had to deal with inappropriate remarks or gestures. However, what emerges above all is a generally heavy atmosphere for these women, the insistent glances, the comments on their looks. And even if the comments were not made in front of them, the looks were enough to make it clear. These situations were often experienced in the context of the mines, with their geographical isolation and fly-in-fly-out work, making women easier prey for stigmatization.

Some participants did not encounter inappropriate or sexist language, but were aware that it existed.

In response to these situations, many women stressed the need to be strong and to know how to set boundaries. On the other hand, some of them still observed mimicry and sexist jokes on the part of women in order to adapt and fit in. This approach was seen as a way of avoiding harassment and sexist remarks, but unfortunately, it does require a certain stooping. Over time, some women assimilate sexist comments and actions and manage to trivialize them. This is another way of ignoring these remarks, remaining in a kind of denial about what is or has been experienced while considering that it is not pleasant. While many

women relativize how they look at these situations, some improvements can be noted in a changing society, particularly thanks to #MeToo. Young interns who do not want to accept certain unacceptable behaviours or comments are helping to raise awareness among women with more experience.

In their own words:

You shouldn't be offended by guys' jokes because there are so many of them (In23). These are sexist comments not related to women in engineering but to women in a male environment. They'll often make comments about women [...], but sexist comments are often made in a male environment (In11). You have to know where to draw the line, because the male-dominated atmosphere can be a burden for some women: the guys look at them. They'll comment on their looks and everything. They won't do it in front of you, but you'll hear about it afterwards (In13).

Being called "little lady" (In29) or "pretty little gal" (In1) by colleagues, or "you could have been a schoolteacher or nurse like the others" (In11). "We'd like you to come and do a bikini parade" (In15), or in mining work: "Do you do blow jobs?" (In15). At a summer job in a forestry camp, the camp leader kept calling me "gorgeous" (In15). Other seemingly innocuous remarks also create a certain unease: There was a gentleman who passed me in the stairwell and told me I lit up the stairwell (In15). I had to take off my coat [and there was a worker who said to me] "you could take off more than that, we're going to turn the heat up" (In12). It's not very pleasant (In12), it's a bit degrading (In1), I felt really bad about it, and I didn't like it (In15).

I don't think I was sexually harassed, but when someone said something, I didn't necessarily care (In22). Those kinds of slightly sexual jokes, just for laughs, [we get over it], but it creates discomfort (In2). Even if it's a minority, [it's] a disturbing minority (In15).

Despite some improvements in a society that is changing with #MeToo (In2), there persists a certain powerlessness and difficulty in seeing how it could change [...]. It's so normalized that people don't necessarily understand why they might get reprimanded at work for it (In1). Yet, these situations must be addressed because they are unacceptable (In15).

I was told I didn't belong there, especially in the factories. [...] "Women are better off at home" (In24IM).

Perspectives of women in engineering working in sectors where they represent less than 25% of the workforce: obstacles, challenges and difficulties

When I was in consulting engineering in 2017 or 2019, the older engineers would give disrespectful looks because you had to wear fancy clothes (In25IM).

In the mining sector [...], I felt watched. My accent was noticed, and it was hard to cope with the stares, even if there was nothing else (In25IM).

I can't say there wasn't this kind of talk. I haven't come across any misogynistic remarks anywhere in my career. I've probably been particularly pampered, but I have heard it said [... in] testimonials from other women, like: "You could bring us coffee" (In36IM).

In other countries, aggression towards women is very high, mainly because we're seen as objects (In32IM).

3.3 Making a complaint

In one case, action was taken against a male colleague who had made inappropriate advances, and the reported situation was not isolated. When action was taken against the aggressor, a certain amount of guilt would arise when he would lose his job. Some women expressed the importance of reporting the aggressor to stop further aggression and protect other possible victims. Other women expressed the view that, in some cases, the aggressor would minimize what he did to make the victim feel guilty — to make her question herself — saying that this act was intended to be kind.

In their own words:

Action was taken against a man who had made inappropriate advances (In27). In an internship situation, a man came up behind me, touched my shoulder, and said, "oh my god, you're really beautiful," but he was in my personal space. It wasn't overly serious, but I didn't feel good about it, so I went to talk about it. Basically, it was just that they were compliments, but they were made in my personal space with inappropriate touch (In30).

When measures are taken, a certain amount of guilt also emerges: I went to talk about it and because of me, he lost his job (In30), while remembering that if I don't talk about it, he'll do it to others, and that's no better either (In30).

At first, I didn't dare, but then I told a few people around me, and they said, "oh yes, he [also] harassed such and such." You feel bad, but you have to talk (In8).

You need to be tough (In1) or be able to take a little but know how to set boundaries (In13).

Coresearchers' reflections

Reading this part of the research results is not easy. It is true that women report satisfaction and joys in their work, even in this environment where they are underrepresented. However, many report microaggressions. What can be done to eradicate them? What is the role of women in this? What is the role of men? What is the role of education, companies, governments and society in ensuring that men and women work harmoniously in engineering?

Some women tend to minimize microaggressions. However, if they are not reported, they will be perpetuated.

► 4. Obstacles and difficulties in integrating women from immigrant backgrounds

Women from immigrant backgrounds discuss the difficulties they faced in their studies and professional situations. Eight different women from immigrant backgrounds shared their experiences.

4.1 Prejudice and intersectionality

It is not always easy to distinguish between obstacles due to being a woman, immigrant status, or the job market at the time of arrival in Quebec. Women with engineering training and an immigrant background face additional hurdles to landing an engineering job, for a variety of reasons: the economic situation, merely being a woman, being an immigrant (having to undertake lengthy procedures to have diplomas recognized, etc.), having taken a career break and age. Integrating

into Quebec society by continuing engineering studies means facing the prejudices associated with studies done outside Canada, which may not have the value they deserve. In this sense, these graduates receive very little recognition.

Once they reach Canada, women from immigrant backgrounds with engineering degrees and work experience in engineering outside the country find it difficult to make the most of their qualifications and work experience. They end up with technical tasks that are far removed from their expertise. They find it hard to carve out a career for themselves, see a future for themselves, and understand how managers perceive them. Degree recognition is difficult, if not impossible in some cases. Lengthy and unclear bureaucratic processes for recognizing diplomas obtained outside Canada are major obstacles. There is a lack of support to help new arrivals complete the administrative formalities required to find a job, access the health care system and find housing.

The standard set by the Quebec system for the recognition of diplomas and prior learning makes it difficult to integrate women from immigrant backgrounds into the engineering field. Moreover, unfamiliarity with this standard becomes another obstacle in the Canadian context. The requirement to pass the *Ordre des ingénieurs du Québec* exams and to demonstrate knowledge of the French language becomes a factor limiting the possibility of finding employment in this sector.

The difficulty of balancing family, work and personal life places a heavy mental burden on women from immigrant backgrounds, making the process of having their degrees recognized both difficult and time-consuming. To succeed professionally, it takes great determination, discipline and financial resources for women from immigrant backgrounds with engineering degrees and children.

Some of the women we met said they would appreciate support from organizations that help people from immigrant backgrounds find jobs in their fields. Indeed, their husbands seemed to receive far more help than they did.

In their own words:

I would say that it's not easy for me to determine which of the obstacles I encountered were the most significant. Did I feel I was encountering an obstacle because I was a woman? I didn't really feel that way at the time. Because I was an immigrant? [...] For me, it's difficult to sort things out, to untangle everything (In36IM).

Since I arrived, I've started working, but not in my field (In32IM). I'm an agricultural engineer in my country. I worked [in my country] in research for ten years. I've never worked in Quebec as an agricultural engineer (In31IM).

For people coming from outside Canada, people think we don't have good universities (In31IM).

I studied engineering [... in my country] many years ago. I graduated in 1989. When I came to Canada in 2006, I went to university, but they told me that because I had finished a long time ago, I had to start all over again to get my degree. They wouldn't recognize any courses, so I had to start from scratch. I tried for one semester but realized I wasn't willing to make such a sacrifice — it was hard (In37IM). It would be helpful to offer facilities to women who come with an engineering title. The evaluation process for degree recognition in Quebec is very long, [...] difficult and expensive. There are a lot of barriers [...], in addition to the difficulties associated with integrating into a new life outside your own country (In31IM).

I wondered about registering with the Ordre des ingénieurs du Québec, whether it was useful or not for my professional future. In the end, I found it difficult and complicated to have to (re)prove [...] to show that I had a degree in engineering when there are mutual recognition agreements [between my country] and Quebec (In36IM). Registering with the Ordre des ingénieurs du Québec, I realize a posteriori [...] that maybe I should have done it even if it wasn't directly useful to me, because a title is something that is important here too, [...] from a salary perspective (In36IM).

We come here and know that our trade is on a list of professions that are in demand in Quebec [... but] there's no one to help us. [...] For example, we wanted to join the Order of Engineers, but we've been here for 18 years, and we've tried. But it's been very, very complicated, and that's why we've stopped trying, we've decided not to do it anymore

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(In34IM). I came here when I was 17, I didn't speak French, so I had to learn it. They didn't recognize my high school education, so I had to redo my studies. I cried a lot. It was frustrating — it was THE frustration of my life (In25IM).

It's difficult, because there are obstacles for everything. For example [...] taking a test, if you don't pass, you have to study again. [...] In my opinion, it's a bureaucracy that is poorly designed, instead of helping (In32IM).

I remember that when we arrived [...] we went to an employment assistance centre. They started with my husband and found him a job in agricultural technology, but I was told: "You don't need to. We'll find you a job, any job. There's a pastry shop where we need to fill a position. There's also a bakery..." But I didn't agree! I didn't want that. I wanted a job, at least as a technician. They didn't want to help me the way they helped my husband. [...] I saw it as sexism, [my husband] was more important than me (In31IM).

My husband finished his career and returned [... to my home country]. He found a job — then I went to find him. Women's positions are highly contested. The priority is for men in this field. It is not said directly, but between a woman and a man, the man has priority (In37IM).

4.2 Proving your worth as a woman from an immigrant background

Women from immigrant backgrounds reported a lack of listening and consideration on the part of corporate management, which they perceived as greater than that experienced by Canadian-born women. They felt they had to prove themselves even more. And it was all the more difficult for them when they were in a job interview, where embarrassment would often take over. Like other women, they had to prove their skills and learn not to make mistakes, but they reported feeling they had to do this to a greater extent than their Canadian-born colleagues.

These difficulties, in their own words:

As women from immigrant backgrounds, even when we have all the answers, we're so uncomfortable dealing with a manager or a senior engineer that we say nothing, or we say it while sweating. That's what we lack at school or university [... learning skills around] persuasion, the art of communicating (In25IM).

I don't know if it's just my perception, but I have the feeling that I always have to prove myself and that I don't have the right to make mistakes. That's why I try to let go, to tell myself that I'm wrong sometimes [...] I'm not perfect. But I feel like I have to monitor for mistakes. I have to raise my voice, look dominant and take up space. I like the challenge, but at the same time, it's exhausting. [...] I think it's like that everywhere, you have to make your mark. [...] You can't make mistakes, but I also know that to make mistakes is to learn. It's not easy (In25IM).

When there is a question to ask, instead of asking me, people go and ask him while I'm presenting the exhibition. Even my supervisor was uncomfortable — he didn't know what to do. He told me: "Next time, I won't come, so people will just talk to you." [...] That experience was the one that marked me the most (In25IM).

The feeling of having to prove myself, of being constantly on alert, of having to do more than my colleagues (In36IM).

I was in customer service [... and] when a male customer came in, he went straight to a male colleague [...]. Customers assume that a man has more knowledge than a woman (In37IM).

Words like intersectionality are becoming fashionable: [...] you're a woman in a society, you're an immigrant, you're black. [...] My upbringing gave me no choice but to excel or to be good at what I do. [...] It was explained to me that this was how life worked (In38IM).

Once, there was this worker, a mechanic [...] I wanted to help him by giving him some advice. He exploded, brought his supervisor to me, and there was a big confrontation. [...] "Who are you to come and give me orders?" And I was calm and didn't want to do anything wrong (In25IM).

I didn't understand and still don't understand why at university, the male-female ratio wasn't that out of sync in the sciences. In my engineering school, I think we were like 40% girls to 60% boys [in my

major]. But when you get into the world of work, it changes completely. In fact, you go to a 20-80 ratio. [...] I don't understand why women [...] do better than men [...] and disappear from the landscape (In38IM).

I don't know why, it may be a simplistic interpretation on my part. However, I always think a woman is less likely to trust herself than a man. She has far more doubts about her ability to succeed or to balance, for example, a personal and a professional life. [...] When I accompany someone as a mentor, I find that they often have all the qualities in the world, and most of the time it's women from immigrant backgrounds I'm accompanying: [...] often the key is to give them this self-confidence, which they don't always have (In36IM).

If a woman climbs the ladder and reaches a position much higher than a man who may have made, for example, the same mistakes as her, she won't be subject to the same criticism as other women, because she is seen as the sole standard-bearer for all women [... If she suffers a setback,] people will say: "Well, she was a woman" or "we gave her a chance" (In19IM).

4.3 Language barriers, racism and discrimination

Depending on their country of origin, women from immigrant backgrounds may face a language barrier to employment in Quebec. Some women we interviewed reported that positions were given to other people, despite their expertise in the field. Language barriers included their language level, proficiency and sometimes their accent.

It appears difficult to retain women from immigrant backgrounds, often due to a lack of openness on the part of the host society. There is also racism, discrimination or a lack of openness, particularly for women from a mixed-race or black immigrant background, which leads to isolation from both male and female colleagues.

These difficulties, in their own words:

I could certainly take on a professional job, but I don't think my French is good enough (In34IM).

The government is open to immigration [...], but in everyday life, people don't treat you [with open arms]. Of course, it depends on each person's cultural level. It's different for people who have travelled and are interested in other cultures, compared to people who have never left the country, or have only spent a few days at an all-inclusive resort in Cuba. These people [are not very sensitive to] cultural exchanges or [may be] closed-minded people who ask themselves: "Why should I accept immigrants?" (In37IM).

I have good colleagues, but sometimes there are people who aren't happy that I'm an immigrant. [...] Some people don't even want to talk to me. I think it's a prejudice around someone coming from a country they don't know. [They think that] I've taken away a job that could go to someone else, or they want the same job as me. Inwardly, it bothered me a lot. [...] As a woman from an immigrant background, I don't want to have any problems (In34IM).

I've been told that some companies don't hire immigrants and only accept Quebecers — I haven't had that experience, but it's something I've heard (In25IM).

Coresearchers' reflections

Women from immigrant backgrounds talked about the difficulties they experience in their engineering or related work. In their own words, they experience situations similar to those of Canadian-born women, but with greater acuity. That is what they perceive. Other situations stem from their status as women from immigrant backgrounds, such as a lack of cultural awareness, which can cause discomfort in interviews, negative attitudes towards their immigration status and difficulties with the language (acquisition and accent). How can we find solutions to all the difficulties experienced by women from immigrant backgrounds in engineering? How can we take their specific experiences into account?

► 5. Concluding thoughts

Coresearchers' reflections

After three chapters describing the motivations and joys of women working in engineering, reading about their difficulties helps us to understand why some women leave the sector, and why women who hear similar comments do not want to choose a STEM (science, technology, engineering and mathematics) field. Women may be tempted to choose scientific studies, but thinking about the isolation that can come with being a woman, the prospect of hearing inappropriate and discriminatory remarks, having to defend oneself and fight to take up space can be a deterrent for many. How do you get people to read up on the situation and lead a discussion that motivates women to go into STEM?

Another issue is how to get society – boys and men alike – to accept that women should choose fields with a strong scientific and masculine component. This is important if, over time, parity is to become the norm.



Chapter 8

**Perspectives of female
engineering professors in
sectors where women are a
significant minority: obstacles,
challenges and difficulties**



This chapter presents the results of 17 interviews with female engineering professors, four of whom were immigrants. The interviews were conducted virtually or at higher education institutions: Université du Québec à Trois-Rivières, École de technologie supérieure, Université Laval, Université du Québec à Chicoutimi, University of Alberta and École polytechnique. The teaching fields explored were mechanical engineering, industrial engineering, electrical engineering, materials engineering, chemical engineering, computer engineering, civil engineering, software engineering and information technology.

The questions we asked these women for this chapter concerned the difficulties they have encountered and those they perceived in their students.

► 1. Challenges, difficulties and obstacles encountered by female professors as engineering students or by their own students

Several of the female professors we met spoke about the barriers, difficulties and obstacles faced by female students over the course of their studies, in line with their own. Twelve different women shared on the subject.

1.1 Isolation difficulties and the role of secretary

Female students report often feeling alone in a male-dominated group, although things have gotten better. In laboratories and teamwork, female students often find themselves relegated to the role of secretary. Some female students are considered incapable of doing the work, while some male students do not want to work with girls.

These difficulties, in their own words:

There's the difficulty of always feeling like the only girl in the group, of realizing that there are no other girls around, it becomes tiresome to always be the girl in the group, to blend in, then to be like a guy, to be one of the boys. A girl may want to be part of the group, but she'll always feel different. Then she's always reminded that she's a girl, [it's

impossible to] forget. It's the same thing as a prof [...]. When I was in the union, I used to say thank you so much for reminding me that I'm a girl, I must have forgotten (PI3).

Female students still say, "yeah well, you know, when we get into groups to do team projects and all that, often we don't get to do hands-on stuff or code ourselves, we end up in the role of secretary." I was shocked, but some students said that to me again not so long ago, and I was shocked to know that in 2022, we were still in that position (PI5).

Girls are told "because you're a girl, because you'll never be able to do it" (PI9IM).

One time, I was in the lab, and we had to do a particular circuit, and I could hear the guys working behind me. I turned around and said: "By the way, I'm listening to what you're saying and it won't work [what you want to do...]." Then, they looked at me and said: "Hey, women and electronics, it's like on a pirate ship — there's no place for it." In the end, they realized I was right (PI6).

1.2 Recruitment difficulties

There are also difficulties in recruiting female students to choose engineering. Even if there is advertising, it is rarely targeted at women. Young women often choose engineering fields that focus on health and the environment. It would be important to support them, as these are societal issues.

These difficulties, in their own words:

The university does a lot of promotion at CEGEPs to recruit new students, but it's not targeted recruitment for girls, it's general awareness-raising. The names of engineering programs don't always reflect the trade's content, making an education in engineering less attractive (PI17).

Women have few role models and little knowledge of the field, so it becomes difficult to take an interest in it because it's not something we're necessarily presented with as women at a young age. I'd say the difficulty lies in finding a role model or trying to find yourself through another

woman who might be in the same situation, another female engineer (PI6). When I was interested in mechanics, my father seemed to move right past me and show my brother that stuff (PI6).

Girls choose health and the environment. [In fact...], they choose high-impact engineering fields, they want to make a difference. [...] The issue is that it's complicated. Biomedical engineering, and even environmental engineering, are complicated fields. [...] I'd like them to be supported in this, because these are societal issues. They choose it because it interests them, but they're not the easiest engineering fields or the easiest applications. [... It would be important] to inform them and support them, because they're competitive engineering fields (PI3).

1.3 Sexist comments and gestures of a sexual nature

Female students are sometimes confronted with sexist comments or gestures of a sexual nature made by professors and students. These sexist comments and gestures are sometimes compounded by sexist prejudice and discrimination, for example, a professor choosing not to supervise a doctoral student on the grounds that she might be or become pregnant.

These difficulties, in their own words:

Some male professors were inappropriate, saying things like "hey guys!" [...] We had to make them aware of such remarks, like not saying "hey guys" to get our attention. Then they'd say, "but that's because girls always pay attention" (PI2).

A fantastic student in one of her courses came to me at the end of a class to tell me she was going to drop the course. The reason was that she had been the victim of rape. It was too hard for her to be in a classroom surrounded by guys. She left and eventually came back. [This female student and female professor] talked at length, which probably helped her. Women's rights are a work in progress. Progress is precarious (PI14).

I find that in engineering, there are jokes related to rape, it's frequent enough, but not too frequent, but still [...]. The language takes the form of getting fucked by the exam, or getting raped by the exam, language like that that is not in good taste (PI1).

Even professors, during their studies, had to deal with inappropriate comments or gestures: people were always trying to test us with dirty jokes to make us feel uncomfortable. Over time, we became thick skinned (PI2).

At the start of a new academic year, I was sold at auction. They auctioned off the few girls who were there. [Not the men] no, no! They sold the few girls in the program. [...] But these are things we wouldn't do, we don't accept anymore. [...] I remember it wasn't a very pleasant event (PI2).

One of the things you hear, especially at the PhD level, is supervisors not hiring PhD students because they're going to get pregnant, they're going to take maternity leave. It's known, but it's not official (PI1).

1.4 Lack of confidence and work-related prejudices

There is the lack of confidence among women and the difficulty of seeing a future for themselves in the engineering world. Too many female students think they are incapable. There are also a number of stereotypes about engineering professions, e.g., that it is such dirty and laborious work. Even if some prejudices have a basis in reality, there is some exaggeration.

These difficulties, in their own words:

I think that they think they can't do it. And yet, they're better than many others, but they don't really know it. It's a matter of telling them that engineering is so broad that they can find their niche [...], whatever their aspirations, whatever their personality (PI1).

Engineers plan, think and calculate rather than make things with their hands. Some aspects of mechanical engineering may fit certain stereotypes, but it's disproportionate (PI1). Too often, mechanical engineering equals oil, equals engines, equals dirt. [...] maybe it's the way it's sold. I think it's a question of perception (PI1).

I'd tell them that women can find their place and try to take the lead of a role model, someone they know in the field. And to ask questions, not to be afraid of being different. We're all different, regardless of gender identity [...]. And I think that as women, it's perhaps a generalization, we're more perfectionist, so we're afraid of not being perfect at times, and in engineering, you have to make mistakes to learn (PI6).

Coresearchers' reflections

Today, female students should no longer find themselves acting as secretaries in laboratories or during group exercises. How can we make professors aware of the situation?

How can we ensure that degrading sexist comments about women are no longer part of the conversation at university? How can we bring about lasting change?

► 2. Difficulties in teaching as an engineering professor

Women professors report encountering difficulties as engineering educators. Twelve women shared their views on the subject.

2.1 Lack of credibility with, and respect from, their students

Several professors pointed to a lack of credibility vis-à-vis their students, including expectations of flexibility in grading and questioning their skills. Although it is rare, our interviewees reported that in class, some students indulged in jokes that they would not say in courses taught by male professors. Women, considered more empathetic, are sometimes the victims of disrespectful behaviour.

These difficulties, in their own words:¹

Some students didn't expect a rigorous, methodical woman who doesn't fit into the good-mother discourse (PI2).

There have been a few occasions when I've been in the lab, explaining things to students, and a student has turned to the male assistant for approval (PI6).

One female professor gave the example of a student who even e-mailed her back to tell her that she probably hadn't understood his text and to make recommendations (PI15).

1. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

2.2 Integration difficulties and isolation

The women professors we interviewed reported difficulties around integrating into the teaching team and experiencing isolation and loneliness, particularly when in a management role. Too often, female professors' ideas would be denigrated by a colleague or other female professors, and would only become interesting when presented by a male colleague. Some institutions have failed to deal with complaints of abuse of power or subtle aggression that threaten the integration and tenure of women in STEM (science, technology, engineering and mathematics) fields.

These difficulties, in their own words:

Male colleagues don't easily give credence to women's ideas: maybe he didn't agree because he was being told by a woman (PI9IM).

Sometimes I do feel a bit alone, and I'd like a bit more female presence (PI6).

You don't get greeted in the corridor because you're a girl. [...] It's little things like [...] that which undermine credibility. I had a conflict with a male professor — also, once again, having to do with culture shock — who criticized me for not doing my job and went all the way up to the vice-rectorate. The vice-rector supported me, I was doing my job, but maybe he didn't agree because he was being told by a woman (PI10).

Talking about sustainable development in an assembly, a professor said, "well there, that's DD (large breasts)." He said, we should send a woman, you know, DD to go with bra size (PI13).

Some colleagues in the field think that a woman's place is in the office (PI11).

After six years, I was about to become a professor and he didn't like it... It was December 19 and my contract wasn't renewed. On top of that, he sent a message to all the profs, all the staff, saying bad things. It was really hard. [...] The sidelining lasted 4 months, turning the students against me and so on. [...] The university initially tried to help me a little, but threatened other professors who worked with me. [...] The union told me, "we'll never do anything against you," which was not true, so shortly afterwards I had to leave (PI18IM).

2.3 What female professors demand of themselves

Female professors tend to be more demanding of themselves, pushing well beyond their limits to be accepted, feeling that they have less of a right to make mistakes. However, some of these demands also come from the management teams who hire them as professors and impose stricter requirements on them than their male peers. Certain microaggressions can be linked to the mere fact of being a woman and holding a management position in an institution, as well as being a woman from an immigrant background. Being a woman seems to be less of a problem than being from an immigrant background.

These difficulties, in their own words:

One female professor had to seek industry experience to be hired, whereas other male professors didn't have to, or were paid in the form of industry internships: For me, it was completely different, I was told: "Go and work in industry, find yourself a job, then when you've done your time, we'll hire you" (PI13).

When she was first hired, a female professor faced stereotypical comments from a few male colleagues. Today, the hiring committee is more open-minded [...] and women even sit on the committee (PI9IM).

One barrier I've experienced as a woman is the barrier I think many women put up for themselves. They are more demanding of themselves. They feel they have less of a right to make mistakes (PI18IM).

Some female academics from immigrant backgrounds have trouble getting their male colleagues to listen to them. In her case [...], to get [... a message] across to her male team members, she had to resort to their line manager (PI9IM).

He totally exploited me — he was on the committee for three years. Guess who spent three Christmases in a row reviewing all the grant application evaluations for him without ever getting any recognition? But in the end, I tell myself it was extremely formative (PI18IM).

Coresearchers' reflections

Stereotyping women in engineering is not a thing of the past, despite changing attitudes. Some institutions have failed to address complaints of abuse of power or subtle aggression that threaten the integration and retention of female engineering professors. How can we ensure that these complaints are dealt with fairly?

The professors' comments echo those of other women working in the industry, who point out that, all too often, women in engineering have to work twice as hard to carve out a place for themselves and gain acceptance.

► 3. Difficulties in the industry prior to engineering education

The female engineering professors we interviewed reported experiencing difficulties in industry before becoming academics. Not all, however, worked in industry before entering engineering education. Twelve women spoke out on the subject.

3.1 Sexist or inappropriate comments and gestures

Some participants reported sexist or inappropriate comments, remarks or gestures, or shared the harassment they experienced in the industry, such as: only getting the interview because they were women, or being reminded of their household duties. They have developed ways of protecting themselves in these moments of insecurity: ignoring inappropriate comments, blending in with the crowd, ignoring micro-aggressions and developing self-protection mechanisms.

These difficulties, in their own words:

“You got the interview just because you’re a girl” (PI1). One colleague was named after her breasts [...]. That’s how she was referred to. Not necessarily in front of her (PI1).

All my life, there’s been a lot of stuff that’s been said, that’s been done and that, it’s my nature, I haven’t dealt with, because I have a compartmentalizing capacity that tells me, “this is important, this isn’t.” And all the

big junk associated with the fact that I'm a woman, it went straight into the "it's not important" pile and it happened naturally. If, at the time, I'd been asked if I was discriminated against in any way, I'd have said "no," because I never associated any of it with the fact that I was a woman. Now, I look back on these things and think "yeah, well..." I don't know that if I'd been a guy, I'd have gone through all this. I might have gone through some (things), but probably not all of it (PI5).

It seems to me that I tried not to make too many waves (PI1). When there's a sexist comment, if you're there all the time, replying or saying, "but you shouldn't say that," you become like the police, then you're less a part of the team (PI1).

I was in a research meeting [... on the phone] at ten past three. I remember the time. And then the gentleman said to me: "Make sure you prepare supper for your children." Silence. He realizes I'm not saying anything and says: "And for your husband too, of course" (PI3).

When I was recruited, the head of the department said, "and you're a woman too!" I've always had to defend myself in a man's world. What does being a woman have to do with the job you've just offered me? Why do they feel obliged to make a comment, to make corny guy jokes (PI3)?

This makes you develop a kind of thick skin, or you become sexist yourself. You make the jokes yourself, because you get so many of them that you become just like them. Then you say to yourself, "Come on, that's not funny. You can't do that. You can't beat them on their own turf." You have to try to elevate the debate, but sometimes it's tempting to play their game — again, it's the feeling of wanting to belong to the group (PI3).

The most unpleasant thing I experienced was direct advances from a boss [...] someone high up in the company who took advantage of a moment when no witnesses were around to make advances (PI5).

The mining and oil sectors are particularly harsh environments [...]. These are confined environments with a large majority of men and few women. [...] They are particularly conducive to assaults on young women. And I'm not making anything up, because I talk with a lot with female students, and whenever I get the chance I ask them about their internships: "How did it go? Oh, you don't want to do an internship at such and such a place? Why?" There's harassment and aggression in these environments, particularly because of the nature of the environment. What can we do? (PI5)

3.2 Feelings of isolation

The women we interviewed — unable to join the boy's club that also exists in universities — experienced a sense of isolation (not being listened to in meetings, feeling devalued by exclusionary remarks, not being recognized for their skills, being exposed to pornographic photos, hearing sexist remarks, not being regarded as a scientist but as a woman, etc.) Unfortunately these feelings are not a thing of the past, despite movement in the right direction and the fact that it is normal to be a woman in engineering today.

These difficulties, in their words:

All the time it's little comments, little insinuations, little things that are maybe more or less related, not necessarily personal, but just general (PI1).

Sometimes in conversations [...] no one hears you or listens to you, it's not like you're there mumbling, you're saying it the way everyone else is, but no one takes notice (PII).

It didn't just happen at the start of my career, and it still happens today, even though I've had a career spanning several years, it's still difficult for me to get my message across in a group. I'm very often the only woman in a group[...] And when I come up with an idea, it's often not listened to, it's hardly ever heard. Except by the guy next to me. And the guy next to me will repeat my idea, and suddenly everyone goes, "oh yeah, that's great!" I'm certainly not the first person to say things like that, but to this day [in my fifties], I've got decades of experience, I've seen it all and around a decision-making table, I'll make a proposal and my proposal just isn't heard. [...] I say to myself: "Am I doing something wrong? [...]. Am I the problem? Or is the problem all around me?" (PI5).

I think that women who have this ability to become aware of what's going on as they go along [end up leaving...]. There may be some who have thick enough skin to get through it. My mode of self-protection is more like: I do my compartmentalizing and, once it's in its compartment, it's over, I don't think about it anymore. [...] I'm afraid that not only will it cause women to leave, but I think the fear of it will prevent women from starting (PI5).

Everyone always talks about hockey, socially. I don't really care about hockey. [...] There are also discussions about [...] video games, [... it becomes frustrating] to have video games mansplained to me [especially when I'm familiar with them...]. "I've played that video game and I like it," and then they just assume that I haven't played it and start explaining it to me. [... Even when I say:] "Well yes, I've played it." Then even when you say you've played it, that barely even registers (PI1).

I remember a conference: we were a group of women and I asked them the question: "Are you often the only woman on your team?" [...] In smaller meetings, they found themselves all alone, in the all-too-visible minority [...] by their appearance. They were dressed like guys with shirts and pants, but they experienced it that way because of their looks. [...]. I think we have to be able to get past that. But [...] they have to stand up for themselves, [...] our girls have to be taught to respond (PI2).

In my career in industry, it wasn't easy, [...] it was a time when I lacked confidence, when I didn't know how to do the job [...]. I had the impression that the guys around me knew (PI16).

Have I thought about leaving the field? Yes, to teach, to become a physics teacher (PI16).

Back then, my boss used me. He'd bring me into meetings where he thought things might get heated, because I'd find myself calming things down. I was an eye-catcher too. [...] Sometimes it helps to be a woman. [... As I've heard my share of] annoying (inappropriate) jokes, I've learned — like all women on the job — to make my own (PI16).

At a scientific conference, they don't necessarily look at the scientist. That's the other gaze, I realized a little later. It's the gaze of a man towards a woman. It doesn't go away, it's always there. [...] In any case, it adds to the difficulties for women, in my opinion, especially when you're young (PI16).

3.3 Feelings of inferiority

The female professors we interviewed experienced moments when they were made to feel inferior, such as feeling tested, having to prove their competence and perceiving that the demands on a woman to prove her worth were greater than those on men.

For women who worked in industry before becoming professors, recruitment challenges came in the form of sexist job interviews, some with attempts at dissuasion, even, and a paternalistic approach, with the assumption that women could not possibly know what they were getting into when they applied for engineering-related positions.

Wage inequity was reported as an issue in industry, although it may be less of a factor in university jobs that benefit from collective agreements.

These difficulties, in their own words:

Some colleagues [...] don't take me too seriously, but at the same time I've just started in the company, so I can understand. But I don't know if a man starting out in the company would be taken more seriously (PI1). "I had a good CV, you didn't, that's why. It's not because I'm a woman that I got the interview [...]." You must fight a bit, and sometimes you don't have the time, the energy or the will to do it (PI1).

These men must also look within because I think their bias is that a man is an expert, not a woman. So, I think the media have a big role to play (PI3).

Evaluation criteria are based on the "white male" stereotype, and often what women have, what they do and how they do it don't fit neatly into these criteria. This is detrimental to recruitment and career advancement (PI5).

There are men who make very unpleasant advances on girls. But when you look at the amount of comments like, "oh, but we know you got the job because...", and [...], there are all sorts of things that come with that like, "because you're 'cute' [...]." These are derogatory remarks (PI5).

As a woman [...] you arrive with a credibility deficit [...], you're less credible because you're a woman. So [...] carving out a place for yourself takes a little longer. I'd say there's a good chance I wasn't invited to give a plenary conference, whereas a man might have been. [...] You must be stubborn (PI16).

3.4 Family-work-life balance as perceived by female professors who have worked in industry

For the female professors we interviewed who had worked in industry before switching to teaching, balancing family and work (schedules, fly-in-fly-out work, mental load, etc.) was not easy. There are stereotypes that need to be broken down, yet family-work balance in engineering is no more difficult than in the health sector. One of the main difficulties is around motherhood and getting promoted, which can sometimes lead to resignation. As for fathers, it is not always easy for them to cope with comments if they want to take extended paternity leave.

These difficulties, in their own words:

I've already been asked in an interview, to be a project manager, if I'd be interested in going out to construction sites. Basically, that's what I wanted to do, and they said: "Yeah, but construction sites are dirty, there's a lot of mud, are you going to be able to go?" Back then, I was a bit younger and I didn't reply, but I was really insulted. I said to myself: "I'm dressed clean for the interview today, but why are you asking me this question? Would a man be asked the same question? [...] If I'm in engineering, if I come for an interview to be a project manager, it's because I've read the job description and I know that a construction site isn't clean all the time" (anecdotes from 2014-2015). During this interview, I saw that the colleague of the person who asked the question was uncomfortable. He seemed to say: "You're very stupid to ask that question" (PI6).

At the end of my studies, I often thought that they were indirectly trying to find out if I wanted a family, [what my marital situation was], if I wanted children, if I had any. In my opinion, that's not a question to ask, it's nobody's business, it's my personal life. It was asked in a subtle way, like: "Do you have any issues that might mean that sometimes you have to take time off work?" [...] It was never directly said, but I felt it (PI6).

A friend [...] told me: “Don’t wear your ring if you’re going for an interview, those are the things they look for when they have to choose between a man or a woman in your age bracket...” (P6).

More than 30 years ago [... at a] job interview, the recruiter in Canada [... asked me] if I could work evenings and weekends and I wasn’t hired (PI9IM).

I often hear young women say, “I don’t want a career in science because I want to have a family” What’s the connection between the two? By the way, you’re more likely to be at home looking after your family in a STEM career than in nursing. [Nurses] think they can care for their family by being a nurse, but they can’t. It’s much better to become an engineer if you want to have time for your family (PI5).

In the industry, young women go on maternity leave for a year and when they come back, they don’t have the same job. [...] It’s as penalizing as it gets (PI2).

In our current workplace [...] despite the changing situation for women in engineering, I recently heard of a pregnant colleague who was going to resign [... because] her line manager was frustrated by the fact that she was pregnant and therefore not productive (PI10).

When a father explained that he was finally going to take more time than normally allotted to parental leave for fathers — which only lasts a few weeks — because he was going to split the leave a little with his wife, his boss laughed, a hearty laugh, as if it were a joke (PI13).

Coresearchers' reflections

With hindsight, some women become aware of the sexist words and gestures they were confronted with. Some were accustomed to letting disgraceful, unseemly and even degrading remarks pass. In their industry careers before becoming professors, this was a way of blending in. These events were put out of their minds and forgotten, even if it was difficult to experience them at the time. Denial was a way of staying in the field. It is therefore possible to think that some women could not or cannot accept living in an environment where sexism is so prevalent, and decide to withdraw, resign or ask to work in the office. Being a woman in a predominantly male environment is difficult, even if there has been change. For example, pornographic calendars are no longer on the walls since women have dared to ask the question: "If it were your daughter, how would you feel?"

► 4. Concluding remarks

Coresearchers' reflections

Even though only a few of the women we met had been teaching at the time of the Polytechnique massacre (1989), the event seems to have left its mark (two women we met remember it vividly, being professors at the time). Some speak of a form of post-traumatic stress. The after-effects have yet to be identified, as few women speak of them, and many did not live through the events of 35 years ago. Even if the media remind us of it every year, even if the after-effects remain, they are not always easily identifiable.

There are historical challenges associated with girls' schooling compared to boys' before the advent of CEGEPs (pre-1968). Women having little access to engineering studies before 1968 may explain why there are so few women professors in engineering. If few women study engineering, few become professors, especially with a doctoral requirement.

Some comments suggest that becoming aware of sexist comments or gestures at the time they are experienced can lead to leaving engineering or its teaching, or not venturing into it at all. Some women spoke about this, saying that they generally let the jokes or inappropriate gestures slide, but in hindsight, they realized that this is what enabled them to survive in such a world and not quit.



Chapter 9

The realities of female
STEM students, from high
school to university: obstacles,
challenges and difficulties



In this research project, we planned to meet with female high school, CEGEP and university students enrolled in programs leading to STEM (science, technology, engineering and mathematics) careers. The university students were all in engineering fields. Of the 29 students we met, 16 were studying engineering at university, eight of whom were from immigrant backgrounds, five in CEGEP and eight in high school.

Interviews with university students were conducted either by Zoom or at universities. They came from Université du Québec à Trois-Rivières, Université Laval, Université du Québec à Chicoutimi and École de technologie supérieure. The engineering students' fields of study were aeronautics, electrical engineering, engineering physics, chemical engineering, geological and mining engineering, mechanical engineering and civil engineering. The eight students from immigrant backgrounds hailed from Colombia, Ivory Coast, France and Tunisia. They ranged in age from 20 to 40.

Of the five CEGEP students interviewed, one was in science, enrolled in engineering at university, and hoped to go on to a master's degree in administration. Another was in the natural sciences and hoped to become a veterinarian. The third, who had begun her studies in engineering, chose to stop halfway through after being harassed by one of her classmates. She planned on resuming her studies in engineering. One student was at CEGEP in a university transfer program to study engineering.¹

The eight high school students can be categorized as follows: one student did not have much experience apart from a job in the health field. She liked helping others and was interested in all things chemical associated with medication. Another wanted to be a psychiatrist. The third was seeking to do her CEGEP studies in natural sciences, wanted to go into astrophysics and liked everything to do with space. One student had no real idea of what she wanted to do later on, and was enrolled in natural sciences. Another was in an international studies program (ISP), will be enrolling in science, literature and arts at CEGEP, and wanted to pursue research in science and mathematics.²

1. Only the paths of four students are known.

2. Only the paths of five students are known.

They were asked questions about:

- Their study path;
- The motivations, satisfactions and supports that led them to choose engineering (or a STEM-related field more generally);
- Difficulties encountered;
- Solutions to be considered, mainly concerning the awareness, integration and retention of women working in engineering, but also of girls in STEM-related fields of study;³
- Reflections on EDI (equity, diversity and inclusion);
- Self-perception and women's contributions to STEM.

The female students we interviewed pointed to obstacles linked to prejudices and stereotypes, as well as discrimination they had experienced or observed in their studies in both engineering and STEM (science, technology, engineering and mathematics).

► 1. Stereotypes and prejudices in the guidance process

Lack of awareness of engineering as a career choice is one of the main barriers to attracting women to an engineering-related education. Awareness campaigns that encourage women to stay in the engineering sector are insufficient. This lack of awareness stems from prejudices fostered during educational counselling.

Stereotypes and prejudices conveyed by students, guidance counsellors and professors about female students can lead to a lack of recognition of their aptitudes and abilities, in addition to proving discouraging for those pursuing engineering studies.

There are prejudices on the part of guidance counsellors and teachers. Some say that women need a strong mind to keep going and that there is no place for sensitive women. By saying “good luck”, skills are no longer emphasized, but rather unforeseen events beyond a woman's control.

3. These last three parts were covered in interviews. The results are presented in Chapters 11, 12, 13, 15, 16, 17 and 18.

These observations, in their own words:⁴

The guidance counsellor said: “You’ll never be able to make it in math, so choose another career” (EC4).

When we say engineering, it’s not a female figure that comes to mind, you think directly of a man (EU4IM).

The lack of communication about educational guidance and STEM career opportunities in CEGEPs limits the attraction of girls because it’s not promoted. I feel like I didn’t even know it existed (EU1).

I only got into natural sciences because my guidance counsellor told me it was the only way to [become] a veterinarian (EC2).

► 2. Obstacles from family and friends

Within family and friend circles, stereotypical barriers persist concerning the chosen field of study, particularly as regards STEM. Some girls question whether they should pursue a predominantly male-dominated field, wondering if it is “normal”.

The family environment is not always helpful. A deep-rooted culture suggests that women are better off in fields associated with humanities, administration or certain care areas. These fields have traditionally been reserved for them. It is difficult to change this culture, but it is possible.

The absence of women who have studied engineering and pursued a career in their direct circles poses obstacles for girls making educational choices.

Girls in high school and CEGEP are already thinking about the mental loads and workloads that await them from family. For them, these are obstacles to a career or education in engineering. They see themselves as having major family responsibilities. And as some want to change the world, having a family may be perceived as an obstacle.

4. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

In their own words:

From a family point of view, the woman will probably have more obligations if she's pregnant or has a child. I think it's also very socially expected that the women should be the one to take [responsibility], to bear more of the burden, when it comes to family care. [...] I know that this is clearly an issue for the future. What's more, if you want to build a career, then as we say, change the world, be proactive, it's clear that having a family and therefore having these responsibilities is a bigger hindrance (EC1, ES2, ES3).

Mechanics were always men in children's books (ES2). I think that's mainly because it's been ingrained in the culture for so long. Then, even today, it's hard to change things, to tell ourselves that it's OK to have girls who like science, that it can be done, that it's not impossible (ES1).

One of her friends asked her: "Why pursue a degree for men?" It baffles me that this way of thinking is so automatic, and even worse, this comment came from a woman. You'd expect women to support women (EU14IM).

► 3. Stereotypes and prejudices against women in engineering

A lack of understanding of the realities of the profession scares women during their studies. Hearing about stereotypes creates anxiety about how they will be listened to in the workplace and how seriously their abilities will be taken. As a result, there is a tendency to normalize sexist comments and adapt to such environments, despite the hostility.

Stereotypical perceptions intrinsic to young girls hinder their retention in pursuing STEM studies in CEGEP and high school. In general, women work harder than men in their studies. Girls have to work hard, while for boys, it is acceptable to give up and not make an effort. Girls internalize this view very early and must quickly develop their autonomy.

Assuming the role of secretary in group work makes it difficult for female students to take on active or management roles on teams.

In their own words:

They say that women when they're in engineering, they've got big, calculator-like brains, but they're not "human". [...] I was the best in the class, and it caused a fuss. The boys didn't like me being ahead of them, being the best. Guys don't like it when women do better than them — if a man [does well], it's OK, but if it's a woman, it pisses them off. One prof said: "That one, we've got to hold her back a bit because if we don't, she'll take over" (EU13IM).

There's a tendency for girls to justify — or pretend they don't mind — comments that make them feel uncomfortable. There's a tendency to minimize sexist comments (EU13IM).

Some professors say that "if you're prepared to be with a bunch of guys, it's not so bad. It depends on the girl — you need a strong mind to persevere. A person, more sensitive women, I don't think they're people who would be able to do their schooling in such an environment and then, especially afterwards, you work and it's also an environment like that." "Good luck," said some of our professors (ES7).

I think that, for a guy who doesn't try as hard, it's less frowned upon. [...] He's just going through the motions, and it's no big deal. But for a girl it means you're not in charge of your future, you're not up to the task, you're not responsible. All that, I think hits home more for girls than guys. [...]. Maybe with girls, we want them to take responsibility early, to settle down, to be independent really early, which I don't think is necessarily expected of boys (EC1).

Regarding taking on the role of secretary: In my first and third years, I was the only girl, but that's fine. Then there were meetings where there had to be a president and a secretary who took notes. Twice it happened that in the first meeting, they said: "We need ONE president and ONE secretary." And then everyone turned to me to take the notes (EU6).

Prejudices and stereotypes persist, meaning that a woman would have to display masculine traits to work in engineering: In the more physical professions, I think women take on male behaviours [...]. In such a male profession, you're necessarily going to believe that she's masculine and that she's going to act like a man (ES7). I'd rather work with guys than girls because it's a lot less complicated (EC4).

► 4. Sexist comments and unacceptable gestures

The women we interviewed reported situations where, as students, they had to deal with sexist comments or inappropriate gestures, not often carried out in front of them, but which they would hear about from other sources. For them, this constituted a lack of respect. It was not necessarily that a large number of students would make disrespectful comments, but that others witnessing the ones who did would not adequately respond, as if to condone the unacceptable remarks.

In their own words:

I've rarely had problems face to face [...], but sometimes I've heard [... some] guys say things: [...] some guys don't have much respect for us. I'd say there are less than five of them. But one or two guys will say things, and then the other guys will just accept it. Maybe they don't condone it, but they won't say anything to the others (EU7).

They're not particularly respectful of us — they've learned to accept us as individuals who live alongside them and have no choice but to accept (EU6).

For example, we have a friend who's been sexualized a lot by these guys. The guys [only see the sexual side of her] and then [... they say] "she's so stupid, it doesn't make sense" (EU6), or comments like: "Is she your friend? Oh yeah, she really looks slutty" (EU7).

Two French people are in our classes, and the professors make fun of them. They laugh at their names. [...] The professors say things like: "Is it sunny where you're from? It's winter here." We've had some Africans this year. I'm the only one who talks to them. [...] The others don't talk to them at all (EC4).

At school, for example, you hear professors say: "Come on, guys." [...] There are two groups: one for girls and one for boys (EC4).

After an assault: If I'm stared at in the same way I was stared at when all this happened, I think I'll go right back there [...]. After it happened, I stayed for a year studying [...]. All the guys who were in my class didn't talk to me anymore. [...] Also, the support from the adults was non-existent — they wouldn't even listen to me [...]. But that's OK, it made me a stronger person (EC3).

► 5. Fear of isolation

The mere knowledge that women are in the minority in these fields can be a deterrent to pursuing STEM studies. There is a sense of isolation that discourages the pursuit of engineering studies. Fear of isolation plays a major role in the retention of female students and can explain why some drop out.

In their own words:

I'm afraid I won't be able to connect with my classmates. Then, I even looked at the people who were working in data technology here. I've talked to several girls who are in the program [...and] being the only girl makes group work hard. That's certainly a fear, but I tell myself that I want to get over it because that's what interests me (EC1).

Whether you like it or not [...], when you're not part of the team, you're less likely to promote your ideas, get promoted, etc. You have to work a little harder to show that you're there. (EU1).

"Ah, that's weird", "there aren't many girls in that field" or "you'll have to work hard, it's difficult," whereas I don't think there are many guys who get told [... similar things] (EC1).

It's mostly men and that's still a real perception. [... Considering] that there are 80% men and 20% women, you're not going to say to yourself: "Oh, this place is for me." You're going to ask yourself: "Am I normal for wanting to go there?" (ES7).

Finally, I think what annoys me most is the fact that I don't often have real exchanges with people. [... As I] don't necessarily have the same interests as the others, I'm a bit left out (EU1). I think it can be helpful to have a fresh perspective (EU1).

► 6. Negative attitudes and aggression

A lack of empathy towards women, certain types of aggression they may experience, difficult academics both in terms of requirements and effort and the impostor syndrome are all obstacles to the retention of young women in engineering studies. What is more, the lack

of attention paid to girls who are victims of sexist aggressions and the risk of rejection they run after reporting the aggressor are traumatic and have a major impact on victims.

The female CEGEP and high school students we interviewed reported having to deal with sexist, racist as well as inappropriate comments, remarks and gestures. Some professors were condescending. Others failed to consider that women were in the minority in their classes. A lot of comments about girls who choose a typically male environment were observed, including people qualifying it as weird, requiring hard work and being difficult.

These difficulties, in their own words:

If you're faced with a man who's overly sexual, you've got to respond, right away and in the right way (EU17IM).

We had to send a photo of ourselves with a little presentation for an article. [...] So I sent him a photo of my LinkedIn profile picture. I didn't send a picture in a bathing suit [...]. I e-mailed it, and [...] he replied: "You look like a real slut in your photo" (EU9IM).

I was really scared, I felt like I didn't belong. Then, when I arrived onsite, I experienced what we call sexual harassment. Some comments really [destabilized] me (EU17IM).

During my internship, in addition my work not being acknowledged, I was confronted with [...] a kind of negligence and bad faith on the part of male colleagues. For example, her name was never mentioned in a report submitted, even though she did all the work, i.e., a lack of official recognition (EU9IM).

It's really intimidating when [...] I'm onsite, people look at me strangely because I'm a woman. When she would see another woman there, she was surprised: "When I find out that it's actually the secretary, [...] I'm a bit disappointed, but glad to have met her" (EU17IM).

Once, there was an altercation between a female student and a prof. The student raised her hand and gave her opinion, but the professor kind of just kept going, so I ended up raising my hand to give my opinion, to say, "c'mon, it makes sense what she's saying." The prof replied: "No, no, miss, I'm not talking to you." It was quite condescending. I don't know if he would have responded the same way to a guy (EU7).

I've probably been called a "bitch" by these guys [a few] times without me knowing it. There's also a culture [related to the fact that] "the other guys don't want to get involved," they don't want to say anything to us because they don't want to get in the middle of it. We don't know exactly what's being said. We know that it's absolutely degrading towards us because several people [have admitted it to us] (EU6).

► 7. Impostor syndrome

Needing to display "masculine" traits to work in engineering and experiencing impostor syndrome are also obstacles, as is the prospect of having to reconcile family planning with the desire for a career in science.

Similarly, in the industry, persistent prejudices and stereotypes mean that women may feel obliged to play up masculine traits, to "act like a man". Some girls feel a sense of inferiority, that they do not belong and have to demonstrate their skills (impostor syndrome).

These difficulties, in their own words:

I'm an anxious person and I've had a bit of impostor syndrome since I started my degree. I don't know if it's something girls feel more in this area. I mean, I've got good grades, but I don't know why I feel I don't deserve them, that I don't know what I'm doing (EU6). [... Sometimes] I say to myself: "My God, do I really deserve the grade I got?" (EU7).

Sometimes, I'm in meetings where I feel uncomfortable expressing my point of view on a topic because I feel like I don't have the authority to speak. This happened to me recently because we had to change software, and it's obvious that in the lab, I'm the best qualified to talk about software — the others are in biochemistry. And there they were saying things that didn't make sense, but I was unable to speak up and say my piece because I felt I didn't have the authority to talk about it. [...] This is a good example of impostor syndrome (EU6).

What really intimidates me is when others have all the confidence in the world. [...] Like the two guys I was with at that meeting. They're two people who really don't, on the surface, have impostor syndrome: they feel they belong and they have the right to speak (EU6).

I notice all the time that when people have questions, or even when professors come to see our team, it's always him [a teammate] who gets spoken to first. So, I always have to go the extra mile to make my presence known, even if it's not even the part he did in the lab — I did it. He doesn't even understand what he's talking about (EU1).

One student recounted how she struggled to complete her lab work, but the female professor assumed she presented lab work from the previous year: It really affected me, because it was like I was taking credit for someone else's work when I spent all day doing it (EU4IM).

There's this built-in prejudice [...]that a guy is going to be better for the job (EC1).

I have the impression that when a woman is in engineering [...] she has to prove she's good. She's not just going to turn up and everything will go well for her. She has to show that she's part of the team (EU14IM).

What scared me was not being up to the job. It's as if, basically, in my head, I don't see why I'd be good at my job when I was one of the best in my [previous studies] (EU17IM).

We were only three girls out of 50 students when we started, and in the end, when we graduated, all three of us finished. This means that we girls can do it. [...] Even being] a minority, [...] we are] not a minority in ability. So we must never be intimidated or quit just because we're women (EU14IM).

► 8. Difficulties attracting women to industry

Female university students face problems stemming from the reception and integration of women, particularly during internships.

Certain comments made towards female engineering students can be considered discriminatory, sexist or inappropriate. These include inappropriate remarks of a religious nature made to veiled women. In addition to religious commentary, judgments about dress — even between women — can be destabilizing in the workplace. Added to this is the fact that male colleagues name work machines using vulgar terms with sexual connotations — not to mention the jokes that allude to women's bodies.

Clothing and equipment are not always suitable for women, and those that are tend to be much more expensive.

These difficulties, in their own words:

When I first got to the company to do my internship, the way they saw me was quite different, and they downplayed me a bit, [if I may] say so. I'm a trainee and I don't have the experience of people who've been there for 30 years — that's normal, I understand — but I had the impression that I didn't really have a voice in a lot of things. I'm someone who doesn't insist too much either, so when it's [time to say no], I say, "no problem" (EU2).

If we're not allowed wear our crosses, she's not allowed to wear her dirty thing here (her veil) (EU2).

Sometimes, women can harm each other. I experienced this at my internship last summer, it was an internship in an office, I dressed the way I wanted [...]. It came to my attention that someone didn't like the way I dressed, even though I was careful [...] to wear long-sleeved shirts and skirts that reached well below mid-thigh. Then I learned that it wasn't a man, but a woman who had said that about me. [...] It really made me uncomfortable. [...] After], I made sure to wear long pants and turtlenecks (EU7).

Male colleagues name work machines with vulgar terms: for example, calling a machine an orange bitch (EU8).

Regularly [...], you get whistled at, or you walk around and say something like, "that's not right," but they'll just contradict you, then say: "You don't know what you're doing, let me do it" (EU12).

I've had people say to me in interviews: "Oh yes, we'll definitely hire you, you're a woman." It's nice to get preferential treatment, but once you're hired, I get the impression that it's a bit harder to get people to listen to you, to put forward your opinions. I have the impression that we always have one more step to take to convince people [...] that we're capable and that we know what we're doing (EU6).

For the project, I had proposed a method for making a prototype. A guy said: "No, we're not going to do that, that's not right," and two weeks later, he came back with the same idea: "Oh, I've got a brilliant idea, we're going to do that." It was the same idea, [I had] proposed two weeks ago (EU7).

As an obstacle, I have a friend who got her bachelor's in electrical engineering and I think she had applied to a company, but [...] she was told] that the work was rather manual. The subtext was that this kind of work was for men. Maybe they doubted a woman's ability to [do] the job? (EU3IM).

All personal protective equipment is for men. [...] As soon as you've got a bit more hips, you come in with pants, they don't fit you. It's a bit silly, but that's the reality. My hair must be covered by my helmet, but there's no room for it. [...] You feel even less welcome (EU8).

My boyfriend, who's also an engineer, goes to Costco and manages to buy \$20 pants. But me, I'm small. [...] I have to go somewhere else to buy \$200 pants. Everything automatically costs more for a woman [...]. What's more, employers who supply equipment don't always understand our sizes. They say: "Because of you, I have to make a special order" (EU12).

The company would give everyone an amount, then say: "Go to such-and-such a store — you'll find something for the right price." I went to the store, and the women's boots were twice the price of the men's boots. [...] The employer said to me: "Ah, but you're the first to say that everyone else has always been within the price range" (EU8).

► 9. Issues raised by students from immigrant backgrounds

The female students we interviewed reported having to deal with sexist and inappropriate comments, remarks and gestures in the school environment. In the workplace, sexist and disrespectful comments are intimidating and destabilizing and negatively affect the retention of women from immigrant backgrounds. Faced with sexist remarks, it is not always easy to know how to respond. Disrespectful and sexist comments make women feel out of place and present them with major challenges.

We also observed a lack of good will towards women and between women, as well as lack of good will towards women on the part of male colleagues during internships, feelings of inferiority and impostor syndrome, as well as low numbers of women in the workplace.

Among female students from immigrant backgrounds, prejudices and stereotypes seem to be the main obstacles to attracting girls to engineering courses. There appears to be a certain obligation to study for educational or literary fields.

These difficulties, in their own words:

I've seen here that most women stop their studies at CEGEP, perhaps [because of the belief...] that engineering is for men (EU13IM).

I think historically women tend to go into educational, literary and administrative fields, and men are more into engineering or business. Girls [...] realize this and are more likely to go into fields "meant" for girls (EU14IM). We really need to break the stereotype that women are more into administration (EU13IM).

In her home country, one participant points out that it is the older professors who have this deep-rooted stereotypical view that girls cannot do well in engineering: "You'll never be able to do it anyway" (EU9IM).

[They] have to face loneliness, being far from their families in a sometimes hostile environment and being far from their home environment to [realize] their dream of getting their Canadian degree. At university, specifically in engineering, girls have more problems integrating because of prejudice and stigmatization (EU13IM).

Coresearchers' reflections

There are young women today who are experiencing situations like those reported by women working in engineering and professors in the field. We are not talking about events that happened 10, 15 or 30 years ago, but rather right now. What do we think of this situation? What has changed? What's interesting is that these women understand what is happening, that they are talking about it and they are ready to take steps toward change.

When female students are confronted with inappropriate comments, they wonder if men are challenged with similar remarks. It would be a good idea to organize mixed discussion groups so that both female and male students can talk about what it is like to study engineering or STEM (science, technology, engineering and mathematics).



The realities of female STEM students, from high school to university:
obstacles, challenges and difficulties

What could the content of these discussion groups be? How could such meetings be organized, made effective and followed up on?

Female students do very well and even better than most boys, so if they encounter difficulty, they then face negative remarks, which begets performance anxiety. Girls do better, and if they start their studies in engineering, they finish them (except perhaps those who experience harassment or aggression). Why do so few of them choose this sector despite excellent grades? As they say, it does not take many men in a group to create a bad atmosphere for women because the other men do not react sufficiently. How can we get these bystanders to buy in?



Chapter 10

Perspectives of human resources specialists in the engineering sector on the issues of Indigenous women and women from immigrant backgrounds



Over the course of the project, a series of meetings were held with women who expressed their views on the presence of women in engineering from three different angles: six women specializing in human resources, mainly in the mining and oil sectors, one specializing in the realities of Indigenous women, and one specializing in the situation of women from immigrant backgrounds. These women do not work in engineering.

The questions put to these women cover the following:

- Their perceptions of the realities of women working in engineering (attractions to the field and difficulties encountered);
- The solutions they would put forward for both companies and women themselves.¹

► 1. Human resources (HR) specialists

The six women we met — all human resources specialists — work in sectors where women represent less than 25% of the workforce, particularly in the mining and oil sectors.

The presentation of research findings from interviews with women working in HR offers some thoughts on the state of play: motivations and stimuli (satisfactions, inspirations and supports) as well as barriers, challenges and obstacles (apprehensions, stereotypes, prejudices, discrimination, microaggressions, etc.)

1.1 Women in certain sectors

There is a low percentage of women in the mining and oil sectors, so there is work to be done to integrate more women into these sectors. What is more, despite the pride of companies that do hire many women, they mainly work in office environments.

1. All the solutions provided by these women can be found in Chapters 15, 16, 17 and 18.

In their own words:²

It's true that I'm currently interested in women in the mining sector, because it's 50% of the population and not 50% of the workforce in this sector (mining), and I'm talking about all types of academic backgrounds, not just the sciences: we don't have many. [...] There are companies for whom it's a success story, companies that boast outstanding figures, but [if you dig] a little deeper, you realize that these women are mainly found working in offices. At the administrative level, we have parity without any problem, but at the operational level, when you look [... more deeply], there's a lot to be done on that side when it comes to integrating more women (HR5).

Coresearchers' reflections

What can be done to get women out on job sites and not just doing administrative work? It is likely that many women will take on administrative work to work remotely and take care of family duties, but companies and society are depriving themselves of all their creativity and innovation.

1.2 Motivations and stimuli

Culture- and people-oriented management makes staff feel like they are contributing to the company's improvement. This is a motivating aspect for women working in HR, especially for their own career development.

Women are susceptible to making a difference in STEM (science, technology, engineering and mathematics) fields. This means that the presence of inspiring and mobilizing leadership contributes to the retention of women who, in such an organizational culture, gain recognition.

Also, when a woman applies for a job, she is usually hired and has a good salary and benefits.

2. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

Coresearchers' reflections

The type of leadership exercised at the top has an influence on the mobilization of women below, and probably not only women. What are the traits of inspiring leadership?

1.3 Barriers, obstacles and difficulties faced by women in engineering, according to HR specialists

The first obstacles encountered by women are mainly associated with career choice. They tend to be health- and environment-oriented, with little knowledge of engineering fields. Above all, they are confronted with prejudices and preconceived ideas, such as that the mining and oil sectors are major polluters and require a great deal of physical effort.

Women generally choose engineering specialties that focus on health and the environment. This makes concern for the environment an impediment to choosing a career in the mining and oil industries.

Guidance counsellors need to gain more knowledge of the engineering fields associated with the mining and oil industries, which means that, currently, young girls are rarely directed towards these scientific fields. Girls need to be sufficiently exposed to scientific fields to gain a greater understanding of them. Along the career selection pipeline, a filter is created. In specific sectors, such as mining and refining, this filter is very opaque, and consequently, very few girls graduate in this field of study. It is difficult to hire them because very few finish their studies in these fields.

Engineering jobs — especially work associated with the mining and oil sectors — needs to be presented more throughout high school. Some of the people who publicize these jobs promote prejudices and preconceived ideas that discourage many women from going into engineering. There are still a lot of prejudices associated with the mining sector, e.g., dirtiness, smelliness and pollution. Environmental concerns mean that these sectors are only popular with few women. What is more, these professions are presented as requiring a great deal of physical effort, yet these fields have evolved a great deal, and the machinery does much of the heavy lifting, so to speak.

Girls' education emphasizes their human-centred qualities to the detriment of their scientific skills and their excellent academic performance in math and science.

In their own words:

But what I find abnormal is seeing so many girls going to university compared to guys and then, whoops, there's like a natural movement towards other sectors, medical or "whatever," but not engineering (HR5, HR1).³

Environmental concerns are an obstacle to choosing a profession associated with mining: Comments such as "the mining industry is a big polluter" (HR1, HR2).

Mining jobs are pitched very little at the high school level. We work hard to raise awareness around related trades and sometimes they're presented [in an inappropriate way, like]: "You're going to work in a hole — it stinks, it's dirty." A woman might not be attracted to that. Whereas today [it's true that] they don't go to work in high heels, but things have still changed (HR5).

The environmental aspect is an obstacle to choosing a profession associated with mining. Mining has a bad reputation and there's education to be done on this subject to attract more people to a career in the mining industry (HR2).

Sometimes, it's perceived as too physical, even though there's only one mine left in Quebec that works in the traditional way (HR1, HR5), and no one works with a shovel (HR2).

At the primary and secondary levels, women and young people, but mainly women, are not super exposed to science (HR1).

Even when a girl does very well in math and science, the talents she is recognized for are still kindness and helping others [while having superb] grades in science and math (HR1).

3. The codes in brackets share testimonials from people who have made similar comments but not necessarily verbatim.

Coresearchers' reflections

Women are very concerned for the environment, which is important to consider. How can we take this concern into account and capitalize on their ideas to counter the polluting aspects of the mining and oil sectors?

Guidance counsellors convey prejudices, both about girls' interests as well as the mining and oil sectors. What could be incorporated into their educational path to more accurately present these sectors, particularly to girls? In addition to a general lack of knowledge of the mining sector on the part of guidance counsellors, there is a tendency to propose STEM (science, technology, engineering and mathematics) careers to boys more than to girls. This reflex of guiding young girls towards traditionally feminine educational paths is a hurdle to women's access to STEM professions. There is a double prejudice to counter: girls' skills and a lack of knowledge of the mining and oil sectors.

1.4 Barriers and obstacles to the integration and retention of women in STEM and engineering fields

Barriers and obstacles include: the fact that women are dealing with a male-dominated environment, the demands of the environment, the demands they place on themselves, men who explain their work to them despite their skills and experience, a difficult family-work-life balance (especially in fly-in-fly-out work), unsuitable equipment and clothing and pay inequity.

Coping with a male-dominated environment

Women are not allowed in the boys' club — the informal network that exists outside work and is one of the gateways to promotion. Several women we interviewed noted this and expressed their desire to benefit from such a network.

In some situations, being in a predominantly male environment, women tend to adopt masculine behaviours to gain acceptance, but this kind of behaviour sometimes turns to their disadvantage and becomes a source of hostility from some male colleagues.

In their own words:

Men get together in groups of guys, play hockey together, become friends, [then, if there's] a promotion to be given, well [management will] think [of this or that person] because it's their friend (HR4).

In fact, it's similar. Of course, it's not an easy world. The mining world is very much a man's world, [...] there are few women in management positions. There are a few, but only a few, when you look at the proportion of men there (HR5).

Some female engineers seem to think that to be good, you have to be tough, because it's a man's world (HR1).

I don't know how to explain it, but I've seen it a few times in the last two years: women arriving and probably to fit in with the team and in a man's world [...], I see this mimicry behaviour [acting like a man...]. But coming from a woman, it doesn't fly, and it wouldn't fly any more with the guys, but between themselves, they're more tolerant. You have to be yourself (HR5).

Taking her place and asserting herself

Even today, women in engineering still find that they must carve out their own place and assert themselves more to gain recognition from male colleagues. Some women feel the pressure of having to put in more effort to work in engineering. Only sometimes do they feel listened to in meetings. This often manifests itself as needing help to speak up. They feel devalued by comments that exclude them. They have trouble getting promotions. Too often, they find themselves in positions for which they are overqualified.

In their own words:

When you're a woman in a man's job, you have no right to make mistakes (HR5). It's a long road [...]. More is asked of them, more quickly. Not all the time, but all the same (HR5).

Generally speaking, women are more interested in trying to please [in order to] respond to what people want from them (HR1).

If women find themselves in positions for which they are overqualified, then there is a loss in terms of job quality because they accept tasks that are not theirs to do (HR1).

Dealing with mansplaining to an experienced woman

Even women working in human resources are victims of mansplaining (when a man explains to a woman how to do her job). Women are too often judged as not having enough skills, and their male colleagues take the liberty of explaining to them how to do to the job, despite the women's qualifications and experience.

In their own words:

Men have things to say, they're important. I call it "mansplaining," I've been here a few years, you can imagine I'm not 20 years old. I've been doing this for over 25 years and when I first got here, they were explaining my job to me because there were no other women and the guys explaining it to me didn't come from the field at all (HR4).

Experiencing a difficult family-work-life balance

There are also difficulties in retaining women in employment, which is referred to as the "revolving door syndrome." In other words, a lot of effort is put into hiring women, but the lack of effort invested in integration and retention measures means that many change jobs.

Balancing work and family is difficult when schedules are atypical, as in the case of fly-in-fly-out work, which leads not only women but also men to make other choices when it comes to starting a family. Some women do not leave the sector but ask to be demoted to take on less responsibility — with fewer benefits and less professional fulfillment — and thus dedicate more time to their families. This is the case with the new generation of young people in the workplace, both men and women, who are demanding working conditions that promote family-work-life balance, but it is proving costly for companies to put in place.

In their own words:

What I've observed a lot is the revolving door syndrome among women: we often work hard to attract female workers, but they don't stay. There's a lot of work to be done to welcome them (HR5).

Too often, women limit themselves, we don't dare, we don't go, we're afraid of... etc. I saw a steelworker quit [...], not even waiting for another job. She quit because she didn't feel up to it. But it wasn't a question of capability, it was just that the demands were completely disproportionate. [Sometimes] it's a reflex to step aside to make room. I think it's feminine. [...] I haven't seen many men move aside to make room (HR5).

When both people (in a couple) can do fly-in-fly-out work, it's often the man who will do it and the woman who will stay at home. This prevents her from advancing in her career, from having salary opportunities comparable to men. The woman is often her own worst enemy because she's the one who makes the sacrifices. We see it a lot here, there are several young women who came to work and when the time came to have a family, they were the ones who stayed at home because often for couples who do fly-in-fly-out work, [it's usually the woman who ends up in the office] (HR4).

Family constraints fall more on women. So there are couples who have found themselves both doing fly-in-fly-out work, and they've asked themselves the question: "Do we do 14-14 and never see each other? How do we manage that? It's not feasible. With the arrival of children, we often lose women (HR1). A woman recently accepted a promotion because her children got older. However, there was a ten-year gap in her career during which she completely downshifted to be able to manage having a family. Then her boyfriend got a big job in the mines. He was the one doing the fly-in-fly-out work (HR1).

When we talk about fly-in-fly-out work, there are a lot of ideas floating around the camps about women spending 14 days with a group of men. There are a lot of things left unsaid about this, even though it's no different from any other work context. Of course, women have lunch, dinner and supper with colleagues, which they don't necessarily do when they work in downtown Montreal. But I think that for women, it's a constraint because there's pressure from their spouses. I've heard several times that there is pressure from spouses to know how things are going and what they're doing on Saturday evenings, etc. (HR5).

Not having the right equipment and clothing

Obstacles also arise from what companies do or do not provide in the way of suitable and safe equipment and clothing for women.

In their own words:

Even if adapted clothing does exist, companies often find it too expensive: It has to be made for women — it exists today, but not everyone is aware of it. As it costs a bit more, companies don't want to go there (HR5). What is more, if a woman is operating heavy equipment and has to climb onto a truck that's very high up, a very small woman needs a stepladder (HR5).

Living with pay inequity

In the sectors studied, there is generally equity at the point of hiring, but as careers progress, it seems that men are more comfortable asking for pay raises. At the same time, most women tend to wait for their skills to be recognized and for the raise to come from company management. The lack of recognition, being listened to or appreciation for efforts made lead many women to underestimate their potential and their agency, with widening wage gaps as a result over the years.

There are few integration initiatives in companies, and they take little account of the fact that women are in the minority and often need exceptional integration support beyond their existing programs. These integration processes could also address the matter of salaries from the point of view of the pay raise process.

In their own words:

In terms of pay equity: At XXX, we operated with scales based on people's experience. So when people were hired, there was equity. But I think that where it can come into play is women's ability to ask for pay raises afterwards. [...] In the end, there's an imbalance that's created, because the speed at which people move up the salary scale can be different between men who will go for it, who will ask for and accept proposals versus women who take less [initiative] or who are more in "I'll wait until I'm recognized and given [a raise]" mode (HR6).

Coresearchers' reflections

Women are crying out for a network like men often have. How do you create a women's network? What is the role of the various stakeholders in creating such a network?

What actions should be taken? There is a double prejudice to counter: women's skills are undervalued, and there is a lack of knowledge about the mining and oil sectors.

As far as salary inequity is concerned, how would it be possible to develop a salary progression policy that considers the expertise developed?

As for the lack of daycare, the proposed solutions include launching a social debate on the issue. Although the lack of childcare is an ongoing debate, such a social debate, summit style, for example, would be a way of speeding up progress on this issue.

Although it is difficult to achieve pay equity in the engineering industry, how can we still get women to learn how to negotiate their salaries and the raises to which they are entitled, in an environment that is very discreet about salaries in general? The lack of recognition, being listened to, and valuing their efforts have led many women to underestimate their potential and their agency, resulting in an ever-widening wage gap.

1.5 Assaults and microaggressions experienced by women working in engineering as reported by human resources (HR) specialists

There is a prevailing sexism that makes it difficult for many women to feel at ease in this male-dominated environment. This lack of respect contributes to their isolation. Certain comments are unacceptable, such as being told that a woman's place is on the calendar, invitations to maintain a friendship on Facebook when it is actually an attempt at seduction or unsolicited pornographic photos sent to a woman's phone. And then, there are women who leave their jobs without sharing, or sharing very little, about the harassment they suffered. Some women speak out against the attitudes of men who reduce their loud or angry comments or firm positions to their hormonal cycle or menopause. It is very frustrating for them. While many women give up, others are more reactive. In addition to the lack of good will towards women, in some

environments, there is a lack of support between experienced women and new arrivals. It is as if new recruits have to prove themselves, go through the same hurdles and fend for themselves.

In their own words:

A female engineer during her internship, descending the shaft [in the mine... all huddled together] in an elevator with 25 people [one on top of the other, receives a comment from] her immediate superior who whispers in her ear that “one of the most frequent fantasies, in the mines, is to fuck underground.” It’s a bad start when your “boss” says that to you (HR1).

“A woman’s place is on the calendar” (HR1).

You were cute — do you want to add me on Facebook, do you want to go on a date? (HR3).

Just recently, I saw that a guy had sent photos to a young girl’s phone. In the end, he was fired and that’s okay, but not so long ago, we probably would have let it slide, since there wasn’t as much awareness, as much campaigning saying, “this isn’t acceptable.” It’s unacceptable to wake up one morning and see a photo of something you don’t want to see from a work colleague on your phone. But there are lots of little gestures that are insidious and not as blatant as that, and they won’t be make the rounds (HR5).

When I see women first get to the mining sector, they often seem interested, but they leave and won’t say why. And when you ask them questions, they’ll say, “family stuff,” but they won’t give the real reasons, because they don’t want to make trouble. Maybe something happened, but they won’t say (HR5).

I’ve often heard women in the engineering field say that when they’re a bit assertive, “ah well it’s hormonal, she’s menstruating” or [...] “it must be that time of the month.” [...] I often hear women say: “Can I be more than a uterus? Is there any way that what I’m saying will be acknowledged and that they’ll stop bringing me back all the time to: Don’t forget you’re a woman” (HR1).

Emotional outbursts are less tolerated among women than among men. They can get carried away more quickly in the workplace and it’s tolerated, it’s a frustration (HR1).

When I started my career 30 years ago and I was doing my job posting rounds and going into the mechanics' lunchrooms, and there were calendars of naked girls, I really didn't think it was cool and being only 20-something years old at the time it took courage for me to say, "this morning, I'm throwing them in the garbage" (HR5).

Women don't support each other as much as you'd think. I've heard that before. An engineer who had tried to talk to another [was told...]: "Look, I've made my own way, you make your own and don't come crying to me." I've heard this quite often: "Go your own way, I'm not going to pity you. I've made my own way, so I'm not going back, I'm not going to take care of you" (HR1).

Coresearchers' reflections

When human resources (HR) specialists spoke to us, some of their comments detailed women working in engineering, while others concerned themselves in their HR work. Being in HR in an environment in companies where women are not commonplace on worksites, when they do go there, they experience situations similar to those women in engineering or female technicians face.

It is true that women working in industry or on building sites hear remarks that are not always respectful – or entirely unacceptable. Female HR specialists are also faced with situations that are not always easy to deal with, as they navigate a predominantly male environment. They also must take action to gain recognition and respect.

As women are not always supportive of each other, mentorship makes perfect sense for new recruits.

► 2. Indigenous women specialist

In the research process, some women were not involved in engineering, but had expertise that was essential for advancing our thinking. One of these areas of expertise concerned Indigenous women. This interview aimed to understand the reasons for the underrepresentation of Indigenous women in engineering.

2.1 Obstacles and difficulties

Indigenous women in engineering are scarce — sometimes entirely invisible — even in fields associated with health or biology. One barrier that affects both Indigenous men and women is the engineering workplace itself. Engineering fields are equated with breaking the earth and damaging it, which is not acceptable to Indigenous cultures. This obstacle is all the more significant for women, whose specific role is to protect life and the environment.

Respect for Indigenous cultures and nature, as well as the presence of Indigenous female role models, are critical factors in attracting Indigenous women into STEM (science, technology, engineering and mathematics) fields. It is hard to want to move into these fields if there is not a real willingness to take Indigenous perspectives into account, that is, to treat the land, the environment and the territory as living elements.

Some men still hold traditional views of Indigenous women. Stubborn prejudices persist due to a lack of education or information. However, the new generation brings new ways of thinking and perspectives.

In the world of education, microaggressions can occur in the classroom, such as mocking rituals specific to Indigenous cultures or making off-putting generalizations.

Other barriers exist in companies that are linked to a lack of flexibility in human resources management, particularly regarding the importance of family and community for Indigenous women.

In their own words:

Indigenous women in engineering are scarce, or entirely invisible. That's not because it's a male profession, because nowadays there are plenty of Indigenous women in male professions, such as on construction sites in the north. The problem is linked to a cultural limitation that is still there today and which also affects men. Logging and mining are equated with damaging the earth. It will be difficult to recruit Indigenous women into these fields, but it's precisely by working in these areas that women can make a difference (SA).

Even in fields associated with health and biology, in the Indigenous milieu, even there, we don't manage to exceed 20% [females] (SA).

Some men have a traditional view of Indigenous women. However, the new generation brings a new philosophy (SA).

In engineering, it seems impossible to work in this field if there is [...] no genuine willingness to accept our perspective, our different way of seeing things. In engineering, when Indigenous women enter the job market, they encounter rigid structures. That's not part of our reality. I was talking to [Indigenous] women yesterday, and they're unable to pass on Indigenous values or talk about them in their classrooms (SA).

Coresearchers' reflections

Indigenous women could contribute to changing certain practices through their ecological concerns for preserving the land, fauna and flora in Quebec's northern climes. Their ways of thinking and visions of the future are important for opening our eyes to environmental perspectives. How can we integrate them into our social, political and economic thinking?

2.2 Origins of obstacles and difficulties

Obstacles and difficulties take different forms, sometimes relating to culture and tradition, the geographical location of Indigenous territories, lack of knowledge about the reality of Indigenous women, their bad experiences in certain environments that affect their reputation, and microaggressions.

One of the obstacles that worries both men and women is the engineering workplace in mining or forestry: anything to do with extraction.

It seems complicated to want to move into STEM (science, technology, engineering and mathematics) fields if there is no real willingness to consider Indigenous perspectives, i.e., to treat the earth, the environment and the territory as living things. What is more, some of the women we interviewed reported having negative experiences with men.

In their own words:

Approach Indigenous people with a holistic view of their territories, because it's physical, it's mental, it's spiritual. So the place where [... Indigenous people live], when it's depressing, their body will suffer because they risk [... becoming diabetic with] inner anger and then [frustration for lack of...] control over housing [...] over the refrigerator [...] over anything. [... Looking] outside, it's depressing to see (SA).

In society, there are still a lot of prejudices that manifest themselves in different ways, like reading or hearing, "go back to your reserve" or [... finding yourself with] four deflated tires on your truck. What's the message? Or hearing people say without lowering their voices: "I'm pissed off that there are seats reserved for Indigenous people" (SA).

The treatment of Indigenous employees, especially professionals, is pitiful. It's like a professor who has a bad experience at a university because of his origins. Then [... management wonders why they] have trouble finding Indigenous employees (SA).

There are situations of microaggressions in the classroom, such as a teacher saying to a young girl: [...] "I hear that you kiss [...] trees." The girl was quick to quip back: "I see Quebecers in Montreal going around hugging trees. Back home, I don't see that, do you?" (SA).

There are also off-putting generalizations to report, for example, when it comes to residential schools: "You're an Indigenous person — you must be able to tell us about residential schools" (SA).

Indigenous women, in their classrooms, are not able to think or talk about Indigenous values. [...] Ministry programs [... do not prepare children for autonomy], whereas here, it's crucial to get children there (SA).

Do women in STEM fields feel safe? Isn't the competition too tough? Doesn't prejudice play a role in driving women away? [...] I've met girls who studied engineering, then chemistry, then physics. Most of them have had bad experiences with men (SA).

In our communities, it's the family, it's the community that comes before everything else. [...] In engineering, when women enter the job market, they encounter rigid structures that are not part of our reality (SA).

Coresearchers' reflections

How can we take Indigenous ways of thinking into account? How can we consider the ways of thinking of women who are reluctant to choose STEM fields, particularly engineering in the mining and oil sectors? What can be done to counter prejudices and stereotypes about Indigenous peoples, particularly those held about women, as well as their histories and their concerns?

► 3. Specialist in women from immigrant backgrounds working in engineering

In the research process, some of the women we interviewed did not work in engineering, but had expertise that was essential for advancing our thinking. One of these areas of expertise concerned women and access to work, especially women from immigrant backgrounds.

3.1 Steering women towards care-related fields

In education, guidance begins in early childhood, and young girls tend to gravitate towards professions or trades related to care, human contact and service. This bias has existed in our society for a long time, and still seems to be very prevalent today.

In their own words:

The people around them are not always very encouraging. Women are told: "You know, it's a challenging career [...] where there are a lot of men [...] because you know that in a few years, you're going to have children, that's going to be your priority, raising your children. [...] We're going to get older too, and you're going to have to become our support, you're going to have to take care of us. Wow are you going to advance in a sector where performance is really at the forefront? You'll have to work more than 35 hours a week." Comments suggest that these are predominantly male jobs, and that they should stay that way (SI).

3.2 Engineering under the radar

Our first observation concerns the underrepresentation of women in STEM (science, technology, engineering and mathematics) — a long-standing issue. There are few women in STEM, and there are even fewer women from immigrant backgrounds. Therefore, it is important to adopt an intersectional approach to consider all forms of discrimination. In this case, we are dealing with double discrimination (being a woman and having an immigrant background), which means that the issues at stake and the strategies to be implemented vary.

In interviews, women from immigrant backgrounds reported a lack of awareness around traditionally male professions and few opportunities to discover them growing up. Although there seem to be several initiatives underway in Quebec, not all girls have access to awareness-raising and discovery workshops. Since the environment is not always very supportive and encouragement is geared more towards ensuring that women give priority to the family and raising children, this acts as an obstacle to girls choosing STEM careers. Despite changes in society concerning family-work-life balance, it is still often women who take on the lion's share of domestic and parental tasks, and it is difficult for companies to make the necessary adjustments.

In their own words:

It is important to deconstruct stereotypes and prejudices and offer everyone — girls and boys, young men and women — the chance to make a choice based on their interests and skills rather than on a social construct (SI).

It is necessary to have ambassadors who will talk about their experience [...], their lived experience that really brings the person and the situation to life. More persistent people will be much more sensitive to the experience of another person's lived experience than statistics, theoretical information presented in leaflets or broadcast on the airwaves (SI).

3.3 Taking advantage of the pandemic and workforce shortages

In the wake of the pandemic, companies have been keen to retain their female workforce. As a result, these companies are prepared to respond to certain needs, such as those related to family-work-life balance. This requires a change in mentality, and the current situation is an opportunity to create openness to and progress for women's work, as well as for women from immigrant backgrounds. Both women and men benefit from the labour shortage.

In their own words:

Right now, [companies] want to keep their labour force, especially women, and they're open to incorporating certain levers into their employment contracts to meet their needs. In fact, this is what we're seeing [regarding] the issue of work-family balance, which mainly affects women, but which is becoming a collective issue because, in the end, it meets both the needs of women and those of fathers, who are still very much a thing. So there's a whole political issue that needs to be taken into consideration by [companies] (SI).

3.4 Falling victim to expertise denigration and harassment

Women often have to deal with comments that denigrate their expertise. They are often met with resistance and mistrust, which calls their skills into question. In addition to not matching their levels of education, areas of expertise and interests, the fields of activity on offer are generally precarious and unsatisfactory in terms of remuneration.

All too often, women find themselves alone in their study cohort or job, surrounded by men. They experience isolation. This isolation makes it difficult for women to form alliances in a competitive environment. In addition to the competition that negatively affects their retention, some women leave their jobs because of sexual harassment. And very few women dare lodge a complaint for fear of losing their job. Those who do face cumbersome procedures and the risk of being further stigmatized. In the end, they prefer to withdraw their complaint or leave the sector to escape the situation.

Many women who have studied abroad arrive with very high-level degrees, but they are not recognized for their actual value. This means that the de-skilling caused by the non-recognition of degrees means that many women must go back to school to get a degree in Quebec and enter the job market. They are generally directed towards traditionally female environments, far from those in which they were accustomed to working. What is more, they are often directed towards short training courses (e.g., a DVS [Diploma of Vocational Studies]), offering them an education that falls below their actual skill level.

In their own words:

In the construction sector, when women leave (nearly half of them) after 5 years, the main reason is because they have experienced sexual harassment (SI).

There is a lot of assault and a lot of touching, unfortunately, even today. Very few women go and file a complaint because they often want to keep their jobs, so they tell themselves that: "If I go and file a complaint, [...] I'll be stigmatized, I'll be found out, and so I won't be a part of my team anymore." Unfortunately, they will endure the situation and stay on their team because they want to keep their job (SI).

Unfortunately, assaults are rarely reported, because there are so many meetings and questions at different stages of the process that, unfortunately, many of them don't even complete it because they're under so much pressure, they're constantly called upon to relive these moments, which are difficult for them. Under the current process, they're under pressure [to repeat the situation they reported], so they'll often prefer to withdraw their complaint and give up on this area of employment as well, to escape the situation (SI).

Women are confronted with comments that denigrate their expertise and are told: "I want to be served by a male mechanic because he'll know how to do the job. You're a woman, you don't know how." These prejudices, deeply rooted in our society, make it difficult for women to remain in the industry as engineers.

When a selection committee realizes that it's a woman standing in front of them, certain biases automatically set in. [It's] not just the person's skills that [are considered], but the fact that she's a woman: "Is she married?"

Does she have children? Is she a single parent? Is she going to come onto our team with an extra load that will ultimately become a burden on the company?” (SI).

Immigrant men, even if their skills are not 100% recognized, will still be directed towards educational courses that will keep them in their professional sector, but [in positions below their] qualifications. In this way, they will remain in an engineering sector with the status not of engineers, but of technicians [...] with less recognized skills. In the case of women, they are really being moved from one sector to another, with their skills being undervalued and disqualified (SI).

3.5 Sacrificing for the children’s future

Some women come to study in Quebec, carrying the burden of having to return to their home countries with good degrees. Others have the burden of financially supporting their families back home. What is more, in many cases, the wives stay in Quebec to raise the children, while the husbands return home because their degrees and experience are not recognized. It is a sacrifice — a way of offering their children a future.

In their own words:

In many cases, it is the wives who stay in Quebec to raise the children while the husbands return to their countries of origin. Of those who immigrate, 55% are women. Sometimes, the male partner is unable to integrate. The husband returns to his country of origin, but the wife stays behind with the children. It’s a real situation [for men...] who arrive with degrees in engineering, medicine and so on. And since there’s no recognition of prior schooling, they go back home, but the wife will make the sacrifice of staying with her children to offer them a much better education here in Quebec. The woman will stay here and then work in a sector that is not her original area of expertise, sacrificing for her children (SI).

3.6 Leveraging inclusive practices

Setting up communication networks would help ensure that women feel involved in STEM (science, technology, engineering and mathematics) professions/education. For example, in advertising campaigns, job or educational ads, using inclusive or gender-neutral writing could help all women feel called upon.

When inclusive practices and policies are developed, it is the role of management and boards of directors to ensure that they are applied throughout the company. These practices and policies should consider the fact that there are few women in STEM and even fewer from immigrant backgrounds. Therefore, it is essential to adopt an intersectional approach that takes into account of all forms of discrimination.

In their own words:

When there are inclusive practices and policies, the work team must conform and adhere to them. Of course, this takes several months, even years, but it's the whole issue of guidelines coming from above that ultimately consolidates the change in mentality in these so-called male-dominated environments (SI).

A Quebec woman will hold the same job with a bachelor's degree, while an immigrant woman will hold the same job but with a master's degree. [...] The immigrant woman's overqualification won't get her a better job, but it will at least give her access to the job market (SI).

Coresearchers' reflections

Women from immigrant backgrounds are largely unaware of the mechanisms for lodging complaints in situations of inequity or sexual harassment. These mechanisms need to be better known amongst all women, and support should be offered to ensure a safe procedure that produces results.

More than men, women from immigrant backgrounds face the non-recognition of their qualifications. Those educated in STEM fields are often directed towards traditionally female jobs. ▼

This is a consequence of prejudices and preconceived ideas around women being more suited for work in a predominantly female environment – which are greater for women from immigrant backgrounds than for women born in Quebec.

Taking advantage of the labour shortage is one avenue to consider, as companies want to keep their employees – including their female employees – and are willing to consider accommodations for family-work balance.

► 4. Conclusions for all results

Coresearchers' reflections

In the context of labour shortages, women are part of the solution. As in other historical contexts, women often fill the male labour gap.

An intersectional approach is essential to ensure that measures are adapted to the various issues (women, Indigenous women, women from immigrant families). Many forms of discrimination overlap. Not all women are treated equally and equitably. Women are not a homogeneous group.

Opting for a gender-based analysis approach (GBA)⁴ and rolling out an EDI (equity, diversity and inclusion) approach in the workplace would provide solutions to realities of inequity.

Developing a tool to support companies in analyzing the specific needs of women (non-immigrant, Indigenous, immigrant) could help them adapt and making changes that take intersectionality into account.

Organizing threefold support – the company, an expert organization and the women working in these predominantly male STEM (science, technology, engineering and mathematics) environments – is an avenue worth pursuing.

4. GBA is a cross-cutting, structural approach to understanding how institutions, policies and the socioeconomic context can favour or disadvantage certain groups (Relais-Femme, 2007).





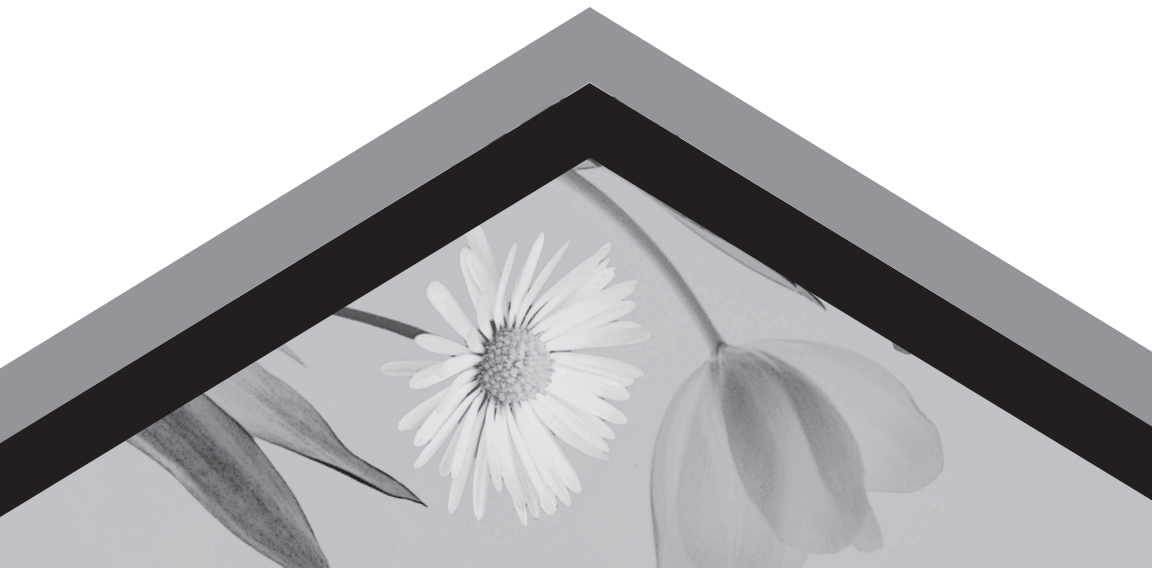
Part 4

Equity and Inequity



Chapter 11

**Employment equity/inequity:
perceptions of the concepts of
equity, diversity and inclusion**



Perceptions of EDI (equity, diversity and inclusion) were explored through the words of women working in engineering, women engineering professors, women studying STEM (science, technology, engineering and mathematics) in high schools and universities, and women working in human resources.

The respondents can be categorized as follows:

- 29/39 of women working in engineering expressed their views on this issue;
- 20/29 students commented on this question;
- 11/17 female engineering professors spoke out on this issue;
- 4/6 women in human resources expressed their views on this issue.

In February 2023, several debates were taking place about EDI and specific grant programs and their development in universities. The idea of inserting a question on the subject then arose. In the interview protocol, this was an optional question, i.e. it was asked only if time allowed. High school and CEGEP students needed to be more familiar with the concept. Similarly, from the very first interviews, it was noticeable that most people did not know what EDI was. The interview was not the place to explain it, considering that the meaning attributed to EDI is unique from one person to another, even for those familiar with EDI programs. It was agreed to approach the selected remarks according to the interviewees' perceptions of the concepts of discrimination and equity.

► 1. Knowledge of EDI programs and measures in place

The first question asked whether the participants were aware of the EDI programs that universities had introduced in recent years. More broadly, the question was intended to find out if these participants had any knowledge of programs aimed more specifically at employment equity.

The acronym EDI was generally little known by participants, as were EDI programs (equity, diversity and inclusion). EDI was sometimes interpreted as “for equal skills, hire a woman”. This could be a source of confusion, since the concept was associated with “positive discrimination,” independent of point of view.

Some of the participants — while not familiar with EDI programs — understood that such an approach has always been considered fashionable in and advocated by their company (In13).

Some women from immigrant backgrounds were not aware of EDI programs but felt that if they had known about them — or had received help in the form of mentorship, for example — it would have proved helpful for them during their engineering education (or in the future) (In31IM, In32IM, In34IM).

Despite the initial observation that most participants were unfamiliar with the acronym EDI, several of them shared examples of measures or programs aimed at equity, diversity and inclusion underway at their company or university:

One company ensured that every sub-group within the company was represented and included in promotions (In2). This led to the observation that there were more and more women in their company (In2, In8).

There were training courses for staff, as well as prayer rooms and designated time off for cultural celebrations (In4).

In addition, there was a scholarship program for women (In9).

The strong presence of people from immigrant backgrounds was viewed positively (In14). This went as far as setting up recruitment campaigns abroad, which helped to diversify teams (In27).

A company that already had a program specifically aimed at women tended to extend it to diversity in general (In30).

One company had a diversity and inclusion program that brought together women's networks or LGBTQ+ networks, i.e., networks through which the various members of the group present within the organization got to know one another and created dialogue around identity-related

issues. The company had been running this program for ten years. The program's networks were optional — members were free to join or not (In33).

The university provided EDI awareness training for students from visible minorities, as well as audible minorities (e.g., language, accent) (PI9IM).

A female professor also recalled her early career in the 1970s and the massive movement to hire women: It was the Year of the Woman in 1975 and lots of companies wanted to hire women. One company [in the oil industry...] looking for women in the engineering field, said: "You're going to be technical representatives, you're going to get a salary account, an expense account, etc." (PI2).

Coresearchers' reflections

EDI (equity, diversity and inclusion) programs mean that there are more and more women in certain companies, thanks to equitably distributed promotions, scholarship programs for women and so on. However, these programs sometimes extend to diversity in general and overlook the realities of women, who make up half the population. How can we ensure that these programs consider the situation of women who do not form a homogeneous group?

► 2. Opinions on EDI (equity, diversity and inclusion) measures and programs

Several participants shared their views on EDI measures and programs.

Overall, several participants were quite positive about certain EDI measures or programs:

- These programs were often seen as necessary to deconstruct prejudice and ensure equity.
- Students with an optimistic viewpoint pointed out that they gave women opportunities to assert themselves.

Employment equity/inequity: perceptions of the concepts
of equity, diversity and inclusion

- The principle of “for equal skills, hire a woman” is necessary to encourage women to move into certain job categories. It is a shame, but it is essential if we are to move towards equality.
- There is a false impression that the problem of women has been solved. EDI prospects are positive but were often perceived negatively.
- The need for EDI policies to move things forward was emphasized, but this should be temporary.

Other comments were more nuanced, or negative:

- The “for equal skills, hire a woman” principle is not a good idea — some students pointed out that recruitment should be based on skills.
- Other opinions were more nuanced and saw it as a necessary evil: these measures are, unfortunately, the only solution to achieving equity in employment.
- Certain measures were often associated with positive discrimination, which was often misunderstood by participants as an ineffective surface solution.

In their own words:

The inclusion of such programs in today's world is necessary (In5).

It's good to know that there are groups that promote diversity with support groups you can turn to when you feel vulnerable in any way. It's important to publicize them so that people know they exist and can make use of them (EU14IM).

Talking about homosexuality is still taboo: the only time I've ever heard of a gay man in engineering [... that a man] came out as gay, was a medical student who was doing a master's in engineering. It's totally taboo, even today, [as] it was five years ago. Is that changing? Yes, but there's still a lot to do (PI16).

I don't think we have a choice precisely because it's challenging to settle social issues and you can't force it. You can't force someone not to be misogynistic, not to be racist — you have to integrate as many people as possible from diverse backgrounds (gender, sexual orientation, whatever) so that these people at least find their way into the milieu (EU1).

Some people are discriminated against, so we have no choice but to impose constraints and push a little towards equality. However, I think both women and minorities can't wait for the day when we don't need to force integration and inclusion (EU7).

It's like a lie to say you have equality (EU5IM).

It's necessary because the people who make the decisions must be forced to a certain extent. I think it's temporary in the sense that once there are enough people, some parity or equality, decisions will naturally be more egalitarian. But I think that to change this critical mass must be reached, we need more solid frameworks for making it happen (PI1).

Do you try to integrate diversity for the good of the company or to [make it look good...]? Do we do it [... out of obligation] or because they really want to do it? If it really helps the plant and it's progressing, those are good ideas, but if it's just to look like we've got more diverse [... people] working there... I don't see the need (ES7). There are still gender inequalities [...], there are some people who still think that men should have more opportunities than women. There's still work to be done on the barrier side (EC2).

The principle of "for equal skills, hire a woman" is not a good idea because I want people to look at what I'm capable of doing, not because I'm a woman (In22).

Coresearchers' reflections

The measures associated with EDI (equity, diversity and inclusion) were food for thought among the women we met. Some saw their usefulness, while others dreamed of the day when they will no longer be necessary. But how can we ensure that women are remembered in diversity? An intersectional approach is essential. How can this be combined with EDI programs?

Indeed, no measure should favour the unqualified.

► 3. Limits of EDI-sensitive programs for more significant employment equity

Many participants pointed out the limitations they saw in the measures and programs in place to promote employment equity.

There was a rejection of all forms of discrimination because, even if it is qualified as positive, it is still discrimination. Quotas, as understood by the women we met, diminish the perception of the skills of the women involved.

The importance of recognizing skills over and above gender was an element that emerged in both positive and negative opinions of EDI. Nevertheless, programs based on the principle of “for equal skills, hire a woman” have their place in the world of engineering. Some women feel that this type of measure should be put in place to attract more women to engineering.

Nevertheless, there are fears that this kind of measure could be abused or misunderstood. Some women fear that they will be favoured to the detriment of their skills. Women fear losing credibility: this could affect their self-confidence. Women could end up doubting their skills and legitimacy to hold a position and find themselves having to prove themselves in an environment that struggles to accept them entirely. So, favouring a particular group, such as women, is seen as a source of imbalance and discomfort in the long term if it puts other groups at a disadvantage.

Several initiatives appear to be more focused on “looking good,” but in practice, they fall short of EDI’s aims. EDI programs can sometimes be too superficial and theoretical, especially when it comes to winning grants.

According to the students we met, some EDI programs are imposed or forced because they are fashionable or are a government requirement. With proper support, these programs can succeed. It is not enough to say that there will be an EDI program, but preparation is needed to welcome the groups concerned by these programs — otherwise, they will fail. Some organizations involve women in the selection process

to project an image of equity, diversity and inclusion (EDI), but all too often, this appears to be merely window-dressing — the genuine willingness to hire women is only sometimes there. It is a way of relieving guilt.

As mining companies are predominantly male, it is possible, indirectly and subtly, that there is bias in the hiring process, even if they advertise as supportive of EDI programs. The goal of increasing the number of women in the oil industry has yet to be well perceived, as many have understood the need to favour women in hiring without understanding that the matter of skills remains at the heart of the approach. Some men may feel their job security is threatened if too many women enter a field.

Even though there are scholarship programs that reward women more, there is a fear that the pendulum will swing back. For the sake of parity, this is important, but these measures should be withdrawn after a particular time to avoid creating further injustices. Specific programs and policies in EDI have been very much encouraged, which means that in some areas, white heterosexual men feel invisible and silenced in the interests of diversity.

The participants suggested elements to be considered to enhance the natural and positive impact of employment equity measures. More than ever, the distinction between equality programs and those associated with EDI needs to be brought to the fore. Some confusion perpetuates prejudices that become barriers to employment. At present, the “for equal skills, hire a woman” measure is not always perceived positively. It could have an impact on the self-confidence of women who are told that they have been hired because they are women and not because of their skills. Therefore, it is important to reassure people who are resistant to gender equality and diversity and to make them understand that they will not lose their place by opening to diversity and women.

A range of intermediate positions are proposed, as follows: 1) the importance of education in EDI processes to counteract the prejudices that prevent society from genuinely opening up to other cultures, 2) the need to set up programs that would only involve women in engineering, but still conduct a collective reflection to identify the consequences, 3) communicate expectations well and open up more discussion around situations that involve discomfort associated with issues of gender, culture, religion... and find concrete solutions to the

problems raised, 4) separate the issue of gender equality from the issue of diversity, 5) raise awareness of racialized women in the workplace, 6) bear in mind that women are not a minority and that their issues concern the whole of society, and 7) EDI committees would benefit from including more people from diverse backgrounds.

In their own words:

The famous quotas, comments like “you’ve only been hired because you fill the quota” or scholarships [...] that are specifically for women, well, that’s sexist. That whole culture, the comments about that, the point of view of “you can’t be competent” is hurtful. “They’re not going to hire incompetent people just to fill quotas” (PII).¹

On the one hand, I’m against positive discrimination because it’s awful for self-confidence. My father used to say this to his students: they didn’t get the job because they were good — they got the job because they were a woman or a person of colour (PII8IM).

Measures based on the principle of “for equal skills, hire a woman” have their place in the engineering world because sometimes there’s a bias towards men, so competence is very subjective (In15), meaning this type of policy is something that needs to be done, it’s one of the solutions (In10) to attract more women to engineering.

I wouldn’t want to see equity pushed to the point where it becomes more important than competence (In16). With equal skills, I think, yes, it’s good, but not to favour a woman because she’s a woman (In20). It’s essential to judge talent and ability and nothing else (In 5).

I’m not in favour of these programs. I recently hired [a woman...] and someone said, “you hired her because she’s a girl” and [...] I said, “no, I took her on because she could do the job, because she was the best” (In24IM).

What I see is that we hire people from diverse backgrounds, but then what do we do to include them? [... It requires] changing individual mentalities, but how do we do it collectively? (In7).

1. Quotas are indicators of positive discrimination policies. It is worth pointing out that the confusion surrounding quotas (positive discrimination) and the principle of “for equal skills, hire a woman” helps to perpetuate false perceptions about the competence of the women being hired.

Regarding the EDI programs that universities are rolling out, they aren't a good idea because they force people to hire women. Forcing people has never been a good idea. People are going to do what they want. [But when] it's almost half and half (women and men), things go extremely well. Everyone communicates. There's a good dynamic. [But in a field of work where the guys [...] aren't ready for that dynamic [it's more difficult...]. Also, forcing a separation [... between women and men], I'm not interested in that. [...] We're stronger when we work together. Divided, we become weaker (EC3).

This must not be limited solely to recruiting women or immigrants, disabled or LGBTQ+ people. EDI must also be accompanied by measures that educate workers to respect women in the workplace (EU9IM).

Some companies make it their duty to meet with women who submit their CVs, but with no commitment (HR4). This is a way of easing their guilt. If there's a woman's CV, you're obliged to meet her, you're not obliged to hire her (HR4).

We've got EDI, then we've got white men saying, "well, I'm discriminated against now." There's a lot of malaise across the board [...], it's an unhealthy discourse that we have, rather than [holding] a constructive discourse, we have a divided discourse, and that's dangerous (PI3).

In the questionnaire, there was an EDI question: "Have you experienced discrimination because of EDI?" — and then it listed women, visible minorities, etc. One of my colleagues intervened [...] he said verbatim that "the only people who are victims of racism in Quebec are white Catholic men." Here's an example of a [person] who is resistant to the whole EDI concept (PI1).

It's essential to know how to mix things up a bit. I understand that everyone wants to be represented. I can understand that, and I'm all for it. But we mustn't forget [certain groups] either, that poor blond guy, he's not necessarily racist, homophobic, misogynistic and all that (EU9IM).

Even when a company has an equity program, it's never 100% fair. It's humans evaluating other humans (In20).

Some people have closed minds. And it's not because they want to, but because they're ignorant. It's necessary to educate people (In5).

Once again, I say it all the time, when we think about women's progress in engineering, it shouldn't be a women's problem. [...] And the people responsible for solving this problem are not just women. It's society's problem [...], and it's everybody's responsibility to solve it. [...] And the same can be said for racialized groups and so on. What's more, it's essential not to forget that women are not a minority. [...] Yes, we're a minority in STEM, but not in society (PI5).

Coresearchers' reflections

It is important to separate the issue of gender equality from the issue of diversity. It is essential to expose the realities of women in the application of EDI programs, particularly in STEM. It is important to remember that women are not a minority and that the issues of gender diversity and parity concern the whole of society. How can we ensure that EDI programs are not just a fad, a means of obtaining grants, or another way of "looking good"?

► 4. EDI and Indigenous women

It seems more difficult for an Indigenous woman to find a job. And yet, the integration of Indigenous people can help move us towards shared values. In employment equality programs or those focused on EDI, Indigenous people are subjected to derogatory remarks and criticism regarding the benefits and scholarships reserved explicitly for them. The education system is not adapted to Indigenous women, and does not help them pursue higher education or steer them towards STEM fields.

In their own words:

EDI programs are imposed and don't really help. [...] At one time, it was about living together, at another time, it's something else [...]. Other programs can help identify problems and bring out the truth. Quebecers and Canadians can't say they don't know what [... what Indigenous went through] here. [Commissions bring ideas, but] no real tools [...], no real steps that lead to real recognition of First Nations. [...] These are big issues, and there's a lot to do, there's a lot of hope, and [...] today it's late for and with Indigenous peoples. We need co-construction, we need co-teaching, we need collaboration [... for] true solidarity. That

will be true reconciliation. Finally, the real work, the truth, must be transformed alongside the population, including the educational and work environments (SA).

Yes, with equal skills, I'll give preference to an Indigenous person, not because I have a policy, but because that person will be closer to my company's values. Is it the same for a non-Indigenous organization? I don't know (In26A).

I was also told, when I was studying that I had applied for a bursary from [name of organization], and I had been able to do an internship on a building site — it was intended for Indigenous people — and they said, “ah! you've got special privileges, you're Indigenous” [...] Since my mother is non-Indigenous, I'm part of both cultures, so I said, “Yeah, that's true” (laughs). I may indeed have some “special privileges”. Since my father is Indigenous, I had access to that, and I took advantage of it (In28A).

The other thing I heard this winter, which I think is very relevant, is that it's a bad idea to put First Nations on the same footing as immigrants when talking about minorities because we're not immigrants. So, there's something a little touchy about these programs. I need to find out how they distinguish between immigrants and Indigenous peoples (In26A).

The education system is not adapted to Indigenous women because I think the biggest obstacle for Indigenous women is knowing that they have added value (In6).

Many Indigenous women would like to have the chance to study and have a career in STEM. However, this seems almost impossible at the moment, since even basic living conditions on reserves are difficult (EC3).

Coresearchers' reflections

It is essential to bear in mind that, while Indigenous people are a minority, it is inappropriate to categorize them with people from immigrant backgrounds. To do so would be to overlook the issues specific to their cultures and their contributions to the histories of Quebec and Canada.

► 5. EDI and women from immigrant backgrounds

It is difficult for a woman from an immigrant background to find a job in the field she was educated for. The main difficulty in integrating people immigrating to Canada is the recognition of their degrees and work experience abroad. Some of the people we met suggested that people from other countries might not have the same safety standards, which complicates the recognition of prior learning.

Stereotypes about women from immigrant backgrounds persist. It is sometimes necessary for them to assert themselves to gain acceptance and to make a place for themselves in a male-dominated environment. Some companies are open to people from immigrant backgrounds. However, even if a company hires several people with this lived experience, it is no guarantee of equality and integration for women.

The situation varies from company to company. Some companies integrate people from immigrant backgrounds well, while others do not really, for reasons linked to discrimination — despite labour shortages.

In their own words:

There's a prejudice. At one point [in a rural area,] there was an [engineer from a Latin American country], and it didn't work out. We brought him to Montreal, and it worked out very well. So, it seems that rural environments are different (In20).

The main difficulty in integrating people from immigrant backgrounds is the issue of degree recognition (In6, In16). Sometimes, [...] without having the title, [these people] can [do the same tasks in rural areas] (In16). To qualify this point, people from other countries may have different safety standards, which could be one of the issues complicating the recognition of prior learning (In14).

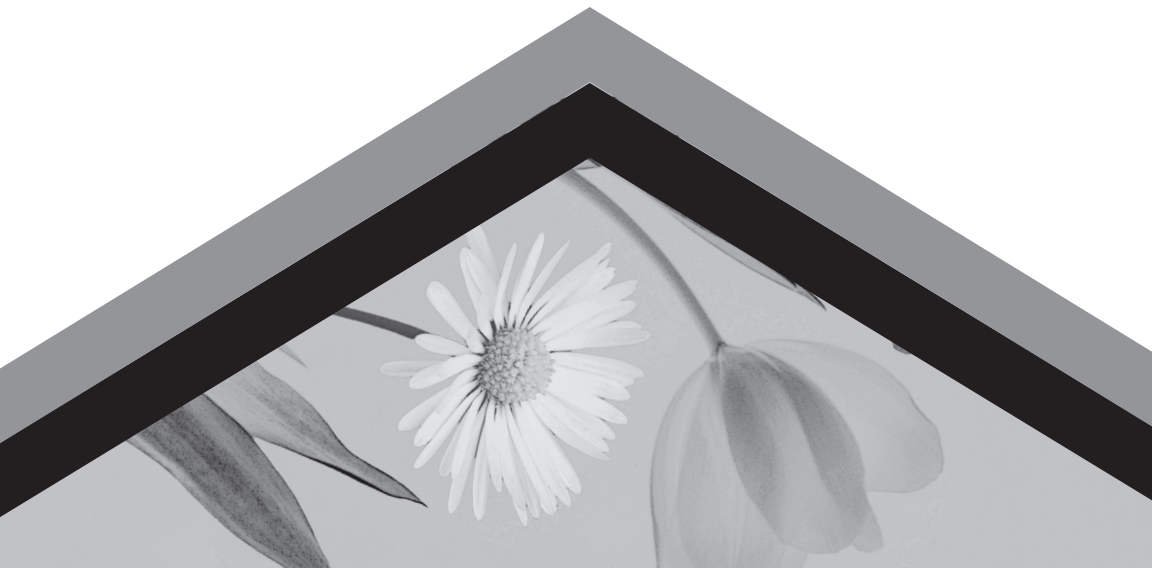
Coresearchers' reflections

What comes up most often for people from immigrant backgrounds, particularly women, is the recognition of prior learning and degrees. Although this is more of a political issue, it is still relevant to ask what could be done to speed up the process while maintaining the level of safety required in Quebec.



Chapter 12

Women's self-perceptions



During the interviews, a question was asked about the self-perceptions of the women we met. This question sought to ascertain the type of traits these women attributed to themselves. They chose three traits that represented them (as women working in engineering, as professors and as students). The responses obtained have been classified into five categories: intellectual skills, technical skills, listening and empathy skills, communication and collaboration skills, and finally, traits more related to general attitudes or personality traits. The 85 participants interviewed here have been divided as follows: 39 women working in engineering, 17 female engineering professors and 29 female students (including 16 university students, 5 CEGEP students and 8 high school students). It is important to note that they were asked to name three traits. This was a way of separating the traits that these women attributed to themselves. It is possible that the choice of limiting participants to three traits influenced the results. A wider selection would probably have led to different results. In addition, one classification was chosen, but others would have been possible. This classification could, therefore, be called into question. Within each category, the expressions used are placed in descending order, from those most often named to those used only once.

Coresearchers' reflections

A study by McKinsey (2019) finds that men are often hired or promoted more for their potential, while women are hired for their achievements.¹ The phenomenon leads women to apply for jobs for which they are already qualified. Dedicating a chapter to women's self-perceptions is one way of providing food for thought on the subject. This reflection will be pursued in further research to explore in greater depth the meaning women give to the words they use to describe themselves.

This chapter looks at how women perceive themselves. This was only a tiny part of the interview. The results open the door to further research into women's self-perceptions, with explanations.

1. <https://www.mckinsey.com/ft/-/media/mckinsey/featured%20insights/gender%20equality/the%20present%20and%20future%20of%20women%20at%20work%20in%20canada/20190602-women-matter-2019-vf.pdf>

► 1. Intellectual skills

The intellectual abilities that the women we interviewed attributed to themselves were:

- Rigorousness, perfectionism (In11, In13, In20, EU2, EU6, EU7, EU13IM, EC2, In24IM, In38IM, PI8IM, PI2, PI5, PI13, PI15, In28A);
- Creativity (In9, In20, EC4, EC1, PI6);
- Attention to detail (In13, In25IM, PI6);
- Good objective analysis skills (In29, PI1, PI2);
- Having good ideas, being good (EU6, EU7);
- Logic (In22, ES7);
- Good memory (In22);
- Intelligence (In26A);
- Demanding (PI5);
- Convincing (In13);
- Rational (In12);
- Intellectual and moral rectitude (PI10);
- Integrity (PI15);
- Sticktoitiveness (PI11);
- Innovativeness (In15).

Among the participants, 30/85 attributed intellectual ability traits to themselves. These included:

- 13/39 women in engineering (In9, In11, In12, In13, In15, In20, In22, In24IM, In26A, In25IM, In28A, In29, In38IM);
- 9/17 female engineering professors (PI1, PI2, PI5, PI6, PI8IM, PI10, PI11, PI13, PI15);
- 8/29 students (EU2, EU6, EU7, EU13, EC1, EC2, EC4, ES7).

Coresearchers' reflections

Expressed in different ways, more than a third of the women we met named traits associated with rigour and creativity, including logic, intelligence, high standards, intellectual rectitude, innovativeness and attention to detail. These traits were evenly distributed between the three types of women we met. How do we interpret the fact that many women see themselves as rigorous, perfectionist and creative?

► 2. Technical skills

The technical skills that women attributed to themselves were:

- Organization (In16, EU2, EU13IM, In24IM);
- Fastidiousness (In9, In19IM, PI4);
- Excellence (In7, EU7);
- Action/solution-oriented (In1, In2);
- Hands-on (PI1), knowing how things work (PI2);
- Efficiency (EC4);
- Competency (In10, In22, ES7);
- Ability to make decisions (PI16);
- Strategic (In5);
- Manual (PI1);
- Productivity (In16).

Among the participants, 19/85 assigned themselves traits related to technical skills. They included:

- 10/39 women in engineering (In1, In2, In5, In7, In9, In10, In16, In19IM, In22, In24IM);
- 4/17 female engineering professors (PI1, PI2, PI4, PI6);
- 5/29 students (EU2, EU7, EU13IM, EC4, ES7).

Coresearchers' reflections

For almost a quarter of these women, the technical skills that stood out are associated with excellence, organizational skills, efficiency and competency. It was mainly women working in engineering who have attributed these skills to themselves. At first glance, this comes as no surprise. Even if the lack of self-confidence comes out in different ways in the research results, could it be a contradiction that women describe themselves as excelling, organized, efficient and competent? Women have to apply their skills because they often feel they are pioneers, and their right to make mistakes is limited.

► 3. Listening and empathy skills

The listening and empathy skills that women attributed to themselves were:

- Sociability/humanity (In 12, In15, In16, In20, In27, In37IM, In28A);
- Empathy (In1, In5, In24IM, PI4, PI6, PI14);
- Good listening skills (In 27, PI10);
- Helpfulness (In22, PI1);
- Accessibility (In28A);
- Sensitivity (PI10);
- Understanding (PI14);
- Accommodating (PI8IM);
- Kindness (In4);
- Altruism (PI1);
- Having a big heart and wanting people to be happy (EC4);
- Inclusiveness (In15);
- Attention to the people around them (PI4);
- Interpersonal skills (PI11);
- Closeness to people (PI16);

- Aptitude for teaching (PI17);
- More focused on teaching than research (PI13);
- Active volunteering (PI4).

Among the participants, 23/85 attributed traits to themselves that were related to listening and empathy. These included:

- 12/39 women in engineering (In1, In4, In5, In12, In15, In16, In20, In22, In24IM, In27, In28A, In38IM);
- 10/17 female engineering professors (PI1, PI4, PI6, PI10, PI11, PI13, PI14, PI16, PI17, PI18IM);
- 1/29 student (EC4).

Coresearchers' reflections

Nearly a quarter of the women we met displayed listening and empathy skills. This manifests itself in social and human skills, understanding, attentiveness to others, sensitivity and kindness. Often, the traits attributed to women are those of listening and empathy (23/86), yet these skills – often associated with women – were less commonly evoked than their intellectual skills (30/86). How can this be explained?

► 4. Communication and collaboration skills

The communication and collaboration skills that women attributed to themselves were:

- Pro-teamwork (In2, In6, In17, In20, In21);
- Communicativeness (In11, EU10, PI9IM, PI17);
- Collaborativeness (In4, In30, PI4);
- Leadership (In29, PI8IM);
- Bringing people together (PI5, PI16);
- Reliability (In10, In12);
- Openness to advice (ES2);
- Justice-oriented (EC4);
- Involvement in social causes to raise girls' awareness (EU10).

Among the participants, 20/85 attributed traits to themselves that were related to communication and collaboration. They included:

- 11/39 women in engineering (In2, In4, In6, In10, In11, In12, In17, In20, In21, In29, In30);
- 5/17 female engineering professors (PI4, PI5, PI16, PI17, PI19IM);
- 3/29 students (EU10, EC4, ES2).

Coresearchers' reflections

Nearly a quarter of the women we met consider themselves pro-teamwork as well as collaborative and that, when it comes to communication, they exercise a form of leadership and tend to bring people together. How can companies take advantage of these important traits in a system where all forms of expertise should interact to drive innovation?

► 5. Attitudes and personality traits

The majority of self-assigned traits related to attitudes or personality traits and were classified into four subcategories: 1) a strong, positive attitude and personality, 2) a form of passion and commitment to the work, 3) a fair personality, aware and concerned about others as well as social issues, and (4) more nuanced/negative, a good knowledge of shortcomings or a lack of self-confidence.

Traits denoting a positive attitude and strong personality:

- Persistent (In23, In29, EU1, EU2, EU7, EU8, EU14IM, ES3, In25IM, In37IM, PI15, PI17);
- Determined (In17, In20, EU1, EU2, EU7, EU8, EU11IM, EU14IM, EU17IM);
- Resilient (In33, EU13IM, In26A);
- Dynamic (In7, In17, EU8);
- Energetic (In30, PI3, PI5);
- Tenacious (In21, In33, PI11);
- Confident/self-assured (In11, In21, EU3);

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- Initiative-taking (In2, EU10);
- Entrepreneurial (In1, In33);
- Motivated (ES3, PI8IM);
- Enjoying challenges (EU3, In25IM);
- Speaking their mind (In8);
- Stubborn (In23);
- Committed (In15);
- Combative (In13);
- Courageous (EU13IM);
- Putting their heart and soul into it (PI2);
- Firm (In29);
- Rebellious (In29);
- Proud (In25IM);
- Loyal (In10);
- Unresponsive to mockery (EU8);
- Managerial (In4);
- Independent (In20);
- Bold (In5).

Among the participants, 38/85 attributed their traits to having a positive attitude and a strong personality. Among them were:

- 20/39 women in engineering (In1, In2, In4, In5, In7, In8, In10, In11, In13, In15, In17, In20, In21, In23, In25IM, In26A, In29, In30, In33, In37IM);
- 7/17 female engineering professors (PI2, PI3, PI5, PI8IM, PI11, PI15, PI17);
- 11/29 students (ES3, EU1, EU2, EU3, EU8, EU7, EU10, EU11IM, EU13IM, EU14IM, EU17IM).

Coresearchers' reflections

Over 40% of women gave themselves traits denoting a positive attitude and strong personality, using words like persistent, determined, dynamic and energetic. These women saw themselves positively when it comes to energy and dynamism, as well as in their perseverance and determination. How can we harness all this potential for the advancement of engineering and STEM (science, technology, engineering and mathematics) in general?

Traits denoting a form of passion and commitment to their work:

- Passionate (In8, In30, EU2, EU3, EU10, PI8IM, PI3);
- Curious (In8, In21, In29, EU1, EU3, EU6, EU10, PI3);
- Hard-working (In23, In27, EC2, In19IM, In37IM, In38IM, PI15);
- Thirst for learning and discovery (EU3, EU6, In19IM, In37IM, In38IM);
- Serious about work (PI9IM, PI5);
- Diligence (EU9IM);
- Independent learner (EU1);
- A holistic view of problems, seeing problems from different angles (PI6).

Among the participants, 22/85 self-attributed traits denoting passion and commitment to their work. They included:

- 9/39 women in engineering (In8, In19IM, In21, In23, In27, In29, In30, In37IM, In38IM);
- 6/17 female engineering professors (PI3, PI5, PI6, PI8IM, PI9IM, PI15);
- 7/29 students (EC2, EU1, EU2, EU3, EU6, EU9IM, EU10).

Coresearchers' reflections

A quarter of women saw themselves as passionate, curious, hard-working and with a thirst for learning. These traits are essential to the advancement of STEM fields. These women are a force to be reckoned with: how can workplaces better respond to, or even better channel, this thirst for learning that emerges from passion and curiosity?

Traits denoting a personality that is fair, aware and concerned about others and social issues:

- Open-minded (In9, EU1, PI14, In28A);
- Humble (In1, In15, In16);
- Honest (In21, EU9IM);
- Authentic (PI6);
- Positive/realistic (In2);
- Optimistic (EU17IM);
- Calm (In22);
- Gentle (In25IM);
- Patient (EU10);
- Flexible (EU7);
- Fair (In4);
- Showing that anything is possible (EU2);
- Lucky (EU17IM).

Among the participants, 17/85 attributed traits to themselves that were related to social issues and concern for others. Among them were:

- 10/39 women in engineering (In1, In2, In4, In9, In15, In16, In21, In22, In25IM, In28A);
- 1/17 engineering professor (PI14);
- 6/29 students (EU1, EU2, EU7, EU9IM, EU10, EU17IM).

Coresearchers' reflections

Nearly one in five of the women we met considered themselves open-minded, honest and authentic. Using different words, these women described themselves as open-minded, patient, flexible, honest, authentic and with a sense of justice. To go further on this point, it would be interesting to explore the meaning given to "open-mindedness": how does it manifest? How is it assessed in different environments?

More nuanced/negative traits indicating a good knowledge of shortcomings or a lack of self-confidence:

- Having a masculine personality/behaviours (dissociating oneself from emotions when solving a problem and having an objective vision would be associated with a masculine personality) (EU8, EU9, PI14, PI15);
- Introverted (In20, PI13);
- Lack of confidence (EU17IM, EC2);
- Not too rigorous (ES4);
- Working until the last minute (ES4);
- Procrastination (ES3);
- Marginal (In24IM);
- Very solitary (EU2);
- Fearful and insecure (In37IM);
- Anxious (In7, EC2);
- Impatient (In26A).

Among the participants, 15/85 attributed more negative traits to themselves. Among them were:

- 5/39 women in engineering (In7, In20, In24IM, In26A, In37IM);
- 3/17 female engineering professors (PI3, PI14, PI15);
- 7/29 students (ES3, ES4, EC2, EU2, EU8, EU9, EU17IM).

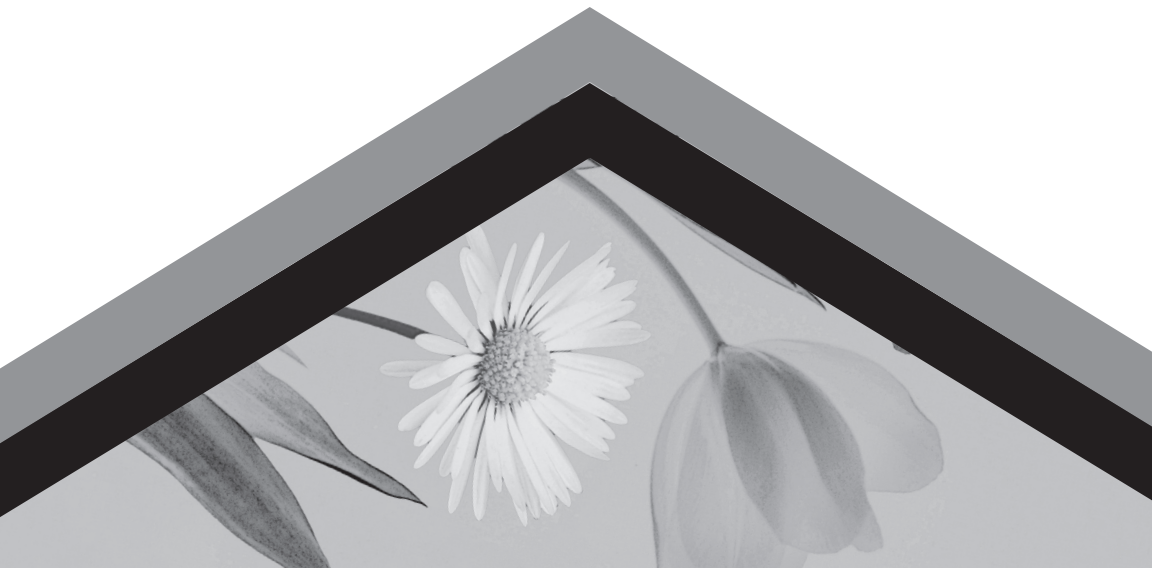
Coresearchers' reflections

Having a masculine personality and masculine behaviours were placed among the somewhat nuanced and even negative traits because they were presented that way in the interviews. However, why would stereotypically male attitudes and behaviours be classified as unfavourable? What acculturation strategies do girls deemed to be "high achievers" use to receive recognition from their male colleagues, such as acting "like one of the boys?" This is an area for further research, as is male colleagues' perceptions of women in engineering.



Chapter 13

Women's contributions
to engineering



Over the course of our interviews, the various groups we met with shared their views on women's contributions to the engineering field.

► 1. Women's contributions to engineering according to women working in the field

From the 19 out of 39 women working in engineering who commented on the contributions of women to the field, several key points emerged. Generally, they noted that women tend to be more precise, rigorous, creative, meticulous, careful and clear in their work compared to most men. Women are determined and contribute to productivity with efficiency and transparency, often taking the time to fully understand situations before acting. They add value across sectors with their patience, calmness, organizational skills and ability to step back and generate ideas that positively impact an organization. Women are known for their rigorous approach to tasks.

In addition to task performance qualities, women place great importance on the quality of interpersonal relationships, bringing sensitivity and empathy to group dynamics. They advocate for a more humane approach to interactions and excel as communicators and managers of interpersonal relations. Their focus on teamwork fosters the collaboration needed to solve problems. Women's upbringings often foster interpersonal and social competencies, while men's upbringings typically encourage competitiveness.

Women bring a unique perspective, a new way of thinking, and diverse approaches to issues, often proposing original solutions based on their different experiences. This approach is distinct from, yet complementary to, that of men. While men can also be rigorous, meticulous, and humane, women apply these competencies and traits to engineering in a unique way.

The discussion also extended beyond gender diversity to Indigenous women and women from immigrant backgrounds, highlighting the richness these diversities bring to teams, offering new perspectives and improving work dynamics, helping underrepresented individuals and groups feel integrated and respected. This breaks away from the stereotypical image of engineering. Cultural, ethnic and gender diversity

fosters exchanges and collaboration, begetting new viewpoints. Overall, diversity is seen as very positive and rewarding, with financial benefits arising from the quality of solutions it brings.

Indigenous women in engineering instill confidence in Indigenous customers, facilitating contact and presenting a community spirit. They bring community and family values to the table that enrich society and the business world. They are less self-centred, more open as well as humane, and are committed to giving back to future generations and supporting their communities.

In their own words:

As women, we bring patience, calm, and perspective. [...] Men surround us, and that makes them gentler and more polite. They formulate their ideas more clearly so that they speak properly. [...] We're like mothers who bring more order to everything (In25IM). I don't like to get into clichés either [...], but it's true, the women I met were quite meticulous, quite detail-oriented, even if that can sometimes be a disadvantage. [...] I find them rigorous. [...] I've noticed that working with a woman in the sciences means having that kind of rigour. It's a kind of solidity, actually. There's something solid about it. [...] Even if men work just as well, I often find that men give the impression that they do things with a light touch and always pull it off. It's sometimes irritating (In38IM).

Women care about others (In7). For example, I put myself in a third party's shoes and say to myself: "If I don't understand, then someone who doesn't have as much knowledge [as] the customer won't understand either" (In28A).

It may be [...] upbringing, but it's difficult to generalize because we each have our own personality, our own experience, our own background. [As far as women go], there's a bit more listening overall, I'd say [...]. It's very much in the realm of teamwork that I find their contributions most significant (In36IM).

I think they bring other ways of looking at things that I don't think are better or worse, I think they can be complementary (In27).

I have the impression that we're more grounded in our discussions. We see further ahead. I can't say exactly [why], but I have the impression that it works better (In15).

I have friends who work in other divisions, and they have the impression that there's a certain profile that's put forward a lot, [that of] the white man who's a bit..., not pretentious, but a bit of a know-it-all [...]. And it's not appreciated in that division, not just by women, but by anyone who doesn't fit that description (In7).

Indigenous women in engineering, I think, can create trust with an Indigenous customer. [...] There's a familiarity that's more easily fostered. Often, I speak in Innu, which makes for a certain ease in our approach (In28A).

If there were more of them [Indigenous women], I think it would bring all the values that are the opposite of capitalism: community values, sharing values, and family values, which should be more prevalent in our society and in the business world. Giving back [to future generations] and supporting our communities. To be less self-centred. Recently, I went to a convention with Indigenous women in business. We had a panel where we [could] talk. I liked what one woman said during her talk, she said: "Did you see what they said? Indigenous women in business, they wear all kinds of hats: like superheroes, we want to make a difference and we want to help our communities." I think that's what it would bring: more Indigenous women into these fields (In26A).

Coresearchers' reflections

While comments from these 19 women in engineering highlight significant contributions, it is important to acknowledge that not all women make similar contributions to the field. However, the complementarity of competencies and attitudes is crucial. In this regard, the contributions of women – including Indigenous women and women from immigrant backgrounds – are vital for fostering greater creativity and innovation in engineering.

► 2. Women's contributions to engineering, according to female professors teaching in the field

Of the female engineering professors, 9 out of 17 (at least half) also commented on women's contributions to the field. Women in engineering often exhibit passion, thoroughness and creativity. They come to meetings prepared and efficient, and they are organized and effective in their studies. Their holistic approach complements how men approach the work. Women can empathize with others, bringing a necessary human aspect to engineering.

In their own words:

The women really have a passion for it — they're not girls who got into it by chance. In fact, they've always wanted to do this in some way (PI4). I've got students who recently created a little app for menstruation for women who have problems with it. [...] They use their knowledge for issues that affect women more (PI4).

Women come to meetings better prepared than men [...], perhaps because they have less self-confidence [...], they speak the truth and find solutions (PI16).

I'd say women have a much more holistic approach to things. [Girls] will look around and see what the impacts are, etc. [...] They have an approach of looking at things as a whole and trying to consider the impacts on society [...], but I find that guys still haven't developed much of this more holistic way of dealing with problems (PI5).

I think we find it easier to consider the other. When we [... have to make] a design, we have to take into account a lot of scientific and electrical parameters. However, there's the human parameter which is super important in engineering because the design [...will be] used by humans and [...] we have more capacity to put ourselves in other people's shoes, [we women]. We have a sensitivity that is more developed in general, and this sensitivity can help us to consider others and the human dimensions of things (PI6).

Coresearchers' reflections

Female professors in engineering, like women in the field, believe that women bring a human dimension to the profession in various circumstances. Both groups emphasize the importance and necessity of complementarity between women and men. How can we maximize this complementarity in professional situations?

It is important to qualify discussions about women's contributions because women and men are not homogeneous groups. How can we ensure that traits often associated with women are recognized as equally valid as those typically attributed to men?

► 3. Women's contributions to engineering and STEM fields according to female students

A portion of female students (9/29) expressed varying views on the contributions of women to engineering and STEM (science, technology, engineering and mathematics) fields in general (5 university students, 3 high school students and 1 CEGEP student).

There are not enough women in engineering. The program is considered difficult for female students. It is seen as a job for boys. Women's presence is not always welcomed in students' environment and the experiences of women in engineering are not very attractive. It would be good to make society understand that women have their place and that they are important for engineering and STEM fields.

Women in engineering can contribute innovations and adjustments adapted to their needs based on their experiences as women. Women in STEM have a different way of seeing and analyzing the realities, which can help enrich debates and interactions.

Women have different qualities from men. For example, they are often quite meticulous, which can be helpful. They can multitask, which contributes to their efficiency. They provide gentleness and balance. It could behoove companies to have female representation, ensuring that management knows and recognizes the diversity of the audiences to be reached — both women and men.

In their own words:

Even if there are congratulations from friends, there are also remarks to the effect of: "Good luck! I hope you end up liking it." Society considers it to be a guy's job (EU3IM).

The need to understand women's contributions to engineering and STEM is as much for guys as it is for some girls. [...] The place of women is very important because, without women, there could be a lot of problems. We have our place, we're people, and we have emotions, too. And just because we're not guys doesn't mean we can't do the same thing they can. [...] But things have improved. There's been a lot of improvement since the 1990s, but there's certainly still a lot to do (ES2).

Women in STEM bring a different way of thinking [...]. Sure, some guys think differently than girls. One of the profs even said it [to our group] when we first arrived: "You've got a girl — use her. She doesn't think the same — she thinks differently from you. It can give you a different way of seeing things." This is indeed the case. [...] I think a lot about everything. [...] I imagine it a lot more in my head/I take more time before I start touching [anything]. I think about it a lot more, or I'll write down the steps I have to take. Some of the guys will do that too. But I think that's also a bit more of a female trait, taking your time (EC3).

The presence of women in the industry helps to ensure that they are well represented in the challenges to be met. So if a man sets up a program for women, it may be less suitable and less well received within a company (ES1).

Coresearchers' reflections

The students' comments show the value of educating, hiring and retaining women in business, as they make a significant difference. How can we make this clear to society, companies and women?

► 4. Women's contributions to engineering according to women in human resources

Women in engineering, female professors in the field, female students and women in human resources (5/6) reported findings associated with the contributions of women in engineering.

In general, women bring more humanity and respect to working relationships. They approach situations with a holistic vision, rigour, reliability and discipline (especially as they have no right to make mistakes). They are concerned with quality, with “doing things right,” and they take care of their equipment. Women bring richness and diversity to the table, because they do not think in the same way as men. They often have different points of view and different solutions.

Companies seem to be in favour of developing training programs to promote the integration of women, but also seem to lack the means and arguments to convince women. They do not always know where to start, but most are in favour of EDI (equity, diversity and inclusion) and are open to the female workforce.

Beyond what women bring to the engineering field, the diversity offered by Indigenous women and women from immigrant backgrounds also has added value. Each person, with her or his knowledge, values, colour, flavour and way of seeing things, contributes to diversity, different ways of thinking and the clash of ideas. So it is vital to embrace diversity with all the richness it brings. It is impossible to do without this richness.

In their own words:

It is important to consider that feminine traits have their strengths (HR1).

Women bring a more human perspective and also a slightly different way of doing things. Often, they'll take the technical dimensions and all that into consideration, but they'll also [...] [propose a way of seeing] a trend that's more holistic. That's what I've seen so far. A certain holistic way they handle things. The ones I've seen — and I've seen a lot of them — are much more rigorous and [methodical]. In their heads, there's no room for error, so they're very disciplined and super reliable. You can count on them, and it'll be done very well. All [the women] I've worked with in the last ten years, in the mines, that's what I've observed (HR4).

Women aren't born knowing how to drive four wheelers. Riding a snow-mobile doesn't come naturally, but what I hear afterwards is that it makes them better operators because they're more careful, they're mindful, they take care of their equipment, they pay more attention to noise, but it takes a while to get there [...] They're asked to do more, faster, not all the time, but still (HR5).

Women are an asset to teams: more conscientious and eager to do things right (HR5).

It's good to have more and more women in companies, and the concept of respect is much more prevalent and all that. It's good for the mining industry. [...] I haven't thought about it, but it brings diversity in general, richer exchanges when you're in a team meeting. It's not the same parts of the brain working (HR5).

Very few (companies) said they weren't interested. Most people are interested. Some say: "We don't have many. We'd like to have more." But it seems that the less you have, the less you attract. They don't seem to know where to start looking for a more female labour (HR5).

I think each person — with their unique knowledge, values, perspectives and experiences — brings something valuable to the table. Do women contribute something special? Certainly, because they have a different perspective, but it's no more scientific than that. I think that what makes a team or a company rich is really the diversity of ways of thinking, the clash of ideas. I think that's what's important. [The fact that there are more and more women], I think it's necessary in all spheres of organizations (HR6).

If you ask me about women, Indigenous people and newcomers alike, Quebec can't afford to deprive itself of this wealth of knowledge, competencies and different ways of thinking. The mining sector is the same. It's not because there's going to be a lack of men — it brings wealth (HR5).

Indigenous women are really few and far between. There are a few more Inuit women in the mining sector. Of course, as far as subcontractors are concerned, sometimes we have more because when it comes to catering and accommodation, it's all women. But otherwise, when it comes to operations as such, there are very few Indigenous women compared to the number of men (HR5).

There's also the issue of transgender people, going into the men's locker room and the women's locker room. Gender management becomes a bit of a headline issue because of that, and then it leads to discussions [...] about safety [...]. All the different situations [...] bring out] old comments: "Today, I'm going to be a girl." There are supervisors who say: "I feel like a woman today" (HR1).

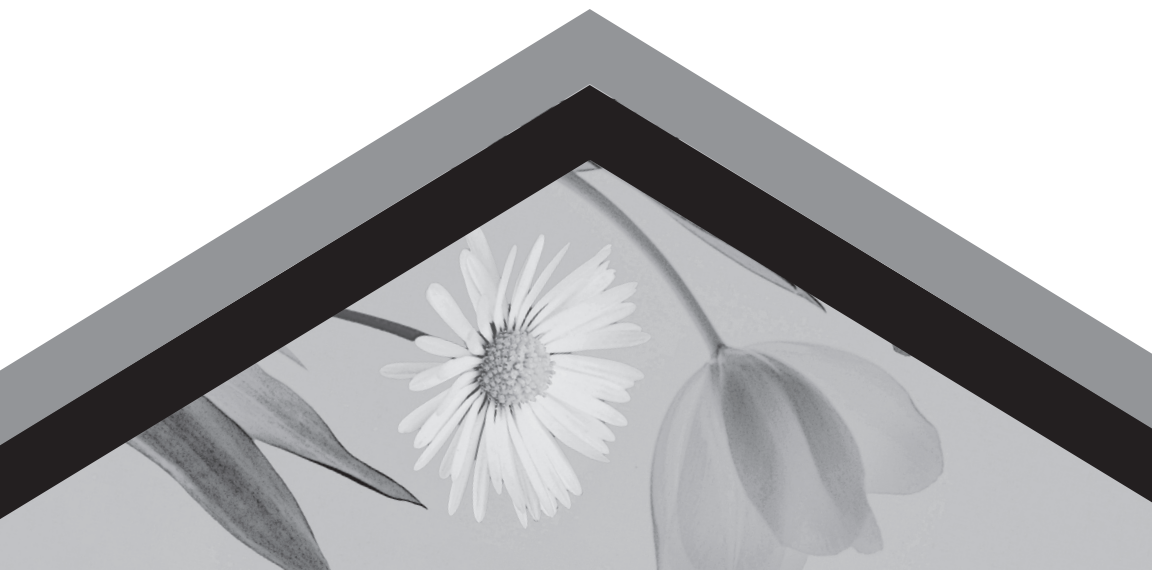
Coresearchers' reflections

From these comments, it is possible to deduce that women tend to be seen as meticulous and working towards a job well done. There are few of them, and they want to be appreciated by management and colleagues alike. This puts them in a position to assert their competencies and their specific contributions – and not all women are necessarily aware of this. How can we address the issue of women's contributions to engineering and STEM (science, technology, engineering and mathematics) fields so that they dare to venture into them in greater numbers?



Chapter 14

**Some men's views on women's
contributions to engineering**



During the research project, it seemed important to conduct interviews with men working in engineering to find out how they see the situation of women in the field, and thus contribute to the research, help confirm some of the women's comments and add nuance.

Ten men took part in interviews, four of them from immigrant backgrounds. Of these ten men, six worked in engineering, one taught engineering and three were students. In view of the small number of men interviewed — as well as to ensure confidentiality and preserve their anonymity — they are referred only as to being from the engineering field. The engineering fields these men were involved in include computer science, applied mathematics, civil engineering, electrical engineering, chemical engineering, mining engineering and mechanical engineering. The respondents ranged from young students to retired men.

Here is what the men had to say about how they perceived women and their contributions to the company, as well as the scenarios we proposed to them:

- For example, in a team consisting of six people, including one woman, it seems that the woman is often designated to take the notes. What do you think of this situation? Have you ever witnessed it? How should you respond?
- Women report having witnessed or received inappropriate sexist remarks/jokes from male colleagues. For example, here are a few comments made during interviews: *“A woman on a construction site is like a woman on a pirate ship: she has no place there.”* *“Excuse me, but I need professional advice. When I need a recipe, I’ll let you know.”* *“You’re really smart for such a pretty girl.”* *“It must be that time of the month again.”* What do you think of these remarks? Have you heard them before? How do your colleagues respond? How do you respond? How should you respond?
- A colleague tells you how uncomfortable she feels about another member of your team misbehaving. Example: *“He stands very close to her, follows her and talks to her insistently. Makes inappropriate comments about her looks, etc.”* How do you respond? Have you ever witnessed such comments or behaviour? How would you respond?

- A new team leader has just been hired. She is a woman. She is quite direct and exercises a leadership style that does not seem to please the whole team. How would your colleagues respond? How would you respond? What responses would be appropriate?

Other questions covered:

- Pay equity, promotion requests and maternity leave;
- EDI (equity, diversity and inclusion) and measures including “for equal skills, hire a woman”;
- Suggestions for strategies, solutions for improvement and mentorship.¹

► 1. Men's perceptions of women's traits in the engineering field

One of the aspects explored in interviews with men working in engineering was their perceptions of women in their field. Six of the ten men interviewed addressed this question.

Women are more likely than men to be good listeners and, in many cases, even to put themselves in the other person's shoes to make sure they understand. Often, they ensure that what is being said resonates, by putting themselves “in the shoes of.” This interpersonal communication — in which women are better at listening and putting themselves in the other person's shoes — eases the burden on a team when it comes to reaching agreements and solving problems collectively.

The fact that women often take on the task of notetaking may be due to the fact that they are better listeners than men, more careful and more rigorous too. It may also be because they spontaneously take notes for themselves. However, notetaking by women is not always systematically requested, and many men claim a certain sharing of the role.

Women have achieved positions of authority thanks to their ability to communicate and resolve difficult interpersonal situations. These qualities are important, but men possess them too. They would be traits that people in management positions possess in general. Assertive

1. The solutions section has been integrated into chapters 15, 16 and 17.

women with a direct style can create a certain imbalance regarding the stereotypes associated with women. They are generally appreciated, and if they take their place more, they will help other women move into STEM-related fields.

In their own words:

Women are better listeners and tend to [...] put themselves in the other person's shoes. [...] It's true that men tend to [...] operate] as if they were talking to another male colleague and thinking: "How come he doesn't understand what I'm saying?" (HI2).

Taking notes, if it happens, is not done systematically [...] they take notes, so at some point the men will say, "well that's OK." [...] They take far more notes during meetings, conferences and training courses, and men take far less (HI1).

When we set up teams in laboratories, for example, girls will do the reports. [...] Some of them have developed the ability to say no and to say: "We'll do them together. Are you going to do them or are we really going to do them together?" But there are some girls who will accept to do it (HI3).

For notetaking, we've seen it many times. It's ridiculous, but it's true. When you're in a meeting, by default, everyone looks at each other and the girl says: "OK, I'll take them." [...] It's like: "You girls are more orderly, we're messier when it comes to taking notes" (HI10).

Notetaking by women is a practice that's been going on for a long time, but it's not the right thing to do. That's the kind of thinking we've been working from (HI9).

I think there's laziness [on the part of the guys]. One of the things I've discovered is that when I'm the one running the meeting, I take the notes, and then I like to run the meeting and get it where I want it. However, if you give someone else the responsibility of taking notes, then some things aren't noted down exactly as discussed, or it's not quite [accurate] (HI10).

Women have an advantage when it comes to interpersonal communication and when it comes to communication [altogether]. When it comes to communicating, [...] they have a] greater facility [...] in conveying

what they have to say on a technical level. At least, that's been my experience. So, I was lucky enough to have mixed-gender technical-sales teams, which was a real pleasure (HI1).

Of course, we have different manager profiles. We have the hyper-precious ones who want to control and look down on you. We've seen a lot of that. We've also seen managers who say: "Don't ask me for details. I don't care and this is what I want." I don't know if a woman who comes in [with similar comments] will be perceived differently than a man. Of course, if she's tough, she's a little boss, we've had a few. [...] It certainly shakes things up a bit if she's tough. I tend to think it'll generate more respect than anything else. I think people like it because it's a tough business, and you have to be able to hold your own (HI10).

I've seen a lot of women come up through the ranks. They're excellent engineers, excellent managers, fantastic people, great colleagues. I like them a lot. Now, how do we make sure that the message trickles down? [...] Giving them the chance [...], I don't see that as a big challenge (HI10).

The message is that there's a future in engineering and in any STEM field [...], there's also room for you, the women who doubt yourselves. Maybe it's not always obvious, but there's room. We welcome them, and we want to mentor them and integrate them into our way of doing things. [...] I think we're all growing here (HI9).

Coresearchers' reflections

While acknowledging qualities generally attributed to women such as listening and interpersonal communication, the men we interviewed qualified their comments by considering that, in management positions, both men and women benefit from having such traits. Perhaps it is the way related skills are used that differs between men and women. Perhaps it is also the stereotypes that are conveyed, which presuppose a way of acting in which women should not assert themselves in the same way as men.

Considering what the men we met said, women seem to be appreciated. In fact, there should be more of them. These words come from the men who agreed to take part in these interviews, and it is reasonable to think that they are open to equity between men and women. How can we use the openness of the men we met to create such openness on a wider scale?

► 2. Difficulties and obstacles encountered by women in engineering

Men in engineering (9/10 of them) answered questions about the difficulties and obstacles some women face in the field.

2.1 Witnessing aggressions towards women

Participants shared witnessing several aggressions towards women in the workplace: managers who put women's looks before their competencies. However, it is not easy to decide how to respond to inappropriate comments or gestures. Reporting a colleague to management is not easy, especially if there is a fear of losing your job. If the witness is not in a position of authority, it is also difficult to report. It is tricky to tell a colleague to watch their language. It is important to make it clear that what is being said is wrong so that it does not happen again, but it seems easier to remain passive in the face of a reportable situation. When it is a friend who makes off-putting comments, it can be easy or difficult, depending on the type of friendship. Men who are not confrontational by nature do not approach these situations easily. However, there is an effort to be made by men. It is easier now to file a complaint because there are mechanisms in place, and a certain level of awareness is already there. However, there is a lack of official mechanisms.

There are also men who are willing to talk without necessarily reporting a situation to management. However, if a woman asks a man for help, according to one of the men we interviewed, she may actually get help in reporting inappropriate behaviour. It seems that assaults would have to be repetitive in the workplace for a man to decide to respond, pointing out that the woman would have to complain to be respected.

In their own words:

I've seen fellow managers who were very macho and sexist, who put a woman's looks before her competencies. That didn't sit well with me (H11). For me, if I heard something like that, I'd say straight away: "What are you talking about?" It'll depend on what's being said [of course], but [... don't hesitate if] what's being said [...] isn't acceptable at all. [It] will depend on how he responds too, whether we have to go higher [up] or not. I think that a long time ago, it was like that, we didn't say anything, we just let it happen [...]. If you don't put a stop

to it right away, the person feels comfortable with what they're saying. If we don't make them understand that what they're saying isn't right, they won't change (HI1). I'm trying to go back [in time]. I want to give this example of a colleague. It was tricky at the time to go ahead and say: "Keep quiet, that's not how it works, watch your language." Firstly, I wasn't in a position of authority over him, and secondly, I think I'd have been the one to take the blame. [...] Now it's much easier. We have mechanisms, and we've raised awareness (HI1).

It would be nice to have official reporting mechanisms because sometimes it can be uncomfortable. He's your friend, and you don't want to hurt his feelings. Not everyone has it in their nature to confront. I admit it, I'm generally passive in life. I'm not the type to criticize a lot, and I don't usually complain, but I know that you have to make an effort [...], just remaining passive isn't enough (HI6).

Of course, if it's nastiness directed directly at a girl, I'd obviously disagree with it, but how I'd respond is hard to say. Obviously, I'd want to come to [this girl's] defence, but I can't exactly predict how I'd respond because it hasn't really happened to me. At least, I haven't been aware of it (HI6).

I think [...] I'd respond very differently depending on [the person making the remark], whether it's someone I know or someone I don't know. If I knew them, I'd have no problem making a comment like: "In any case, you're not the one [... who'd get the job], given your level of open-mindedness." But if it's someone I don't know or don't know very well, then I'm not going to be too crazy either. I'd say: "Well, she probably had the level required for the job, and that's normal." I'd be nicer about it (HI8).

I'm the type not to be a peacemaker but I'd just say: "We're not going there. Stop it." "It's that time of the month." "No." "That's enough." I wouldn't talk to my boss unless the girl next to me said so. Otherwise, I don't think I'd initiate something like that (HI10).

It's not something you just let slide, you really have to intervene in the moment. [...] If it's something that happens repeatedly, you should respond, but in the moment, I'd leave it. But if she (the woman) sees that it's happening all the time, that it's a repetitive event coming from a certain person, I think yes, she can ask for help, we're always going to be there [...] I think she has the same option as the rest of us to ask for help if needed. But it's important to say it: it's totally true. We can't let things like that slide (HI9).

Coresearchers' reflections

Taking these men's interviews into account, it is clear that responding to disgraceful or unacceptable comments from colleagues is not always easy. Although it is important to do so, confronting a colleague is not so simple. Even so, some men are willing to support a woman who wants to complain. What could be done to move men to respond to inappropriate words and gestures?

2.2 Sexist comments and jokes

When there are sexist comments, when men intervene, those targeted pull themselves together. When talking privately with women, psychological harassment situations are brought up. The comments are generally not said to hurt, but what is said is inappropriate. Sexist remarks tend to come from machine operators and less from men in engineering.

Today, sexist remarks are relatively subtle. For example, they are said when women are not around, even though women hear about them or talk about them. There no longer seem to be sexist photos on the walls. This is now forbidden. However, some people get around the ban by going to websites or installing suggestive backgrounds on their computers, despite the existence of firewalls.

There has also been an evolution in racist remarks. There are far fewer than before. Officially, there is zero tolerance. However, some men still lack understanding of the fact that some words and gestures are inappropriate.

In their own words:

Often, when you intervene, people pull themselves together. It was less condescending towards women and more sexual, I'd say, without necessarily attacking anyone. The comments are, in general, rude. Jokes like: "You're backing up, you're going to back up into my face." Because in a mine, a shovelling face is referred to as a face. There were a lot of comments like that. And we had to intervene quickly because when we spoke privately with certain women, there were potential cases of psychological harassment. [...] I don't remember hearing things like:

"This is no place for women." But it was much more like, "hey little lady!" — always with a tone [...] that was not necessarily meant to hurt [...], but that came out badly (HI5).

I don't remember hearing that it's not a woman's place to be an engineer. Among the group of engineers, [... the sexist remarks] came more from operators. I've seen the arrival of female operators, and it took a few years for them to be accepted. There was a lot of sexism towards them. As for the engineers, [...] there was a lot of sexist talk behind their backs. Not so much questioning their competencies, but it was sexist (HI4).

I'm talking about the 1980s [...] the playmate photos on the walls. That's the kind of thing we banned because respect isn't just [stopping telling jokes], even if they're guy jokes, we [had to] make it clear that it wasn't done (HI4).

More recently, the comments have become relatively more subtle. I'd say that when I talk to my colleagues in mining, we have the same difficulty. I think we've gone beyond direct attacks, we're into something more subtle or [... more] guy jokes [that are said] when women aren't there, but the women hear about them [...] Essentially it's a bit of a general culture of people who are going to like mechanics or who are going to like cars. [...] I find that when you look at the car industry, it's still very sexist. We're kind of continuing that model (HI5).

Today, I can't recall hearing a racist joke in the last ten years, at least not in my current environment. There's been an evolution, zero tolerance. As far as women and sexism are concerned, I think there are still things on web pages that operators leave open. They manage to get around the fact that there are firewalls that prevent people from going to certain sites, or they use suggestive backgrounds. There's still work to be done, I think (HI5).

I have a concrete example, experienced recently. We have a huge vacuum cleaner in the mine garage, and the people in the garage had named it Susie, but it wasn't because it reminded them of their sister or their mother. So that's the kind of thing that's a bit [biased], it's not a direct attack, but [...] we're not in 100% neutral mode. We're not in an environment that's fertile for people to fulfill themselves. What can we do? Of course, we have zero tolerance, but when we [asked questions] about this element, the supervisor thought it was funny. He said:

“There’s no one here called Susie. It wasn’t against anyone here.” I think there’s still a lack of understanding of what can be said or done and the potential consequences (HI5).

Coresearchers’ reflections

Over the past 30-40 years, the situation regarding sexist jokes and comments has moved in a positive direction. However, these remarks are made with more nuance, which makes them harder to report. Some men would like to respond, but if bosses accept or tolerate such comments, it is hard to call them out. How can we make sexist comments and jokes a thing of the past?

2.3 Prejudices, stereotypes and a lack of attention paid to women in the workplace

There are situations that are difficult to interpret, such as the example of a woman appointed to management who gets to her position in a company quite quickly and receives a lot of criticism. Is it because of her management style, a lack of competencies or because she is a woman? Regardless, it seems that it is still difficult for a woman to occupy a management position.

In some situations, women’s ideas are not listened to, and in others, they are stolen or used by others. However, these situations are difficult to recognize and report.

Some men are aware of the weight women carry in terms of prejudice and stereotypes. Some are ready to move from a passive to a more active, responsive and vigilant approach to defending women and being part of the solution to gender inequalities and social pressure.

To this end, we need to organize active awareness-raising campaigns that are compulsorily supported by institutional circles and interactive, with testimonials, experts and role models expressing open-minded points of view.

The problem lies in education at school, in the family, in society, in the media and even in the content of children's films. So it is important to intervene and provide training at the root of the problem rather than when unfortunate gestures have already occurred.

Aggressions towards women are sometimes unconscious. Certain gestures, however derogatory, are not perceived negatively. They are sometimes seen as protective. The impact on women is not always properly assessed.

In their own words:

There are situations that are difficult to interpret, such as the example of a woman appointed to management who was competent but had risen too fast. I treated her like a male branch manager. I know it bothers me [still] because, let's say, I didn't do her any favours. I would have treated a male branch manager the same way. And it was difficult. I felt bad for her because it was clear that they hadn't done her any favours by appointing her so quickly to this position of responsibility. [...] In her case, I think it was one of the mistakes made in the past, promoting women too quickly to positions of responsibility (HI1).

I think that if it's a woman who has a position of power in a male environment, it's more difficult (HI9). When there was someone who people didn't think was qualified for promotion and that person got the promotion, people associated that with the fact that she was a woman [...]. If it had been another minority, they would have said that's why, if it had been the son of an executive it would have been the same. I'm not sure it was because she was a woman. In the mining industry, there's a desire to give more promotions to women, and that's well known (HI5).

It must exist, certainly, amongst men who are a bit macho. They think solutions can't come from a woman (HI2).

What we've realized doing small pilot projects with certain groups is that often when people realize the impact it has on someone, [...hearing things like]: "Hey my little princess." Often, people don't see that it's negative. They even think they're treating the person well (HI5).

Coresearchers' reflections

For men, it seems that it is not always obvious when someone is mistreated because she is a woman. Some men suggest that women experience as much difficulty in certain situations as men. What is more, certain behaviours are perceived as positive and protective when they are actually condescending towards women. How can we make it clear that certain gestures do not help women feel at ease in certain environments where patriarchal culture prevails, or in certain male-dominated fields for that matter?

2.4 Lack of protection for women by companies and organizations

Many know women who have suffered harassment in the workplace. It seems that companies have a role to play and a responsibility to assume in this area, which is not always taken into consideration. The same applies to universities. Not protecting a woman in engineering because the professor who harasses her is professionally untouchable — on the pretext that he is a source of funding — is unacceptable (e.g., an example cited from 2016). Zero tolerance is, therefore, essential.

Participants reported what they have heard about women. Regarding what women may experience, certain things are of a more sensitive nature and disturbing. What is more, some remarks seem to be made when women are not present. Today, however, men are more careful about what they say.

There are still “guy groups,” like in an operations department, for example, who say disgraceful things, but without malice. This creates a rather unhealthy environment for women.

When it comes to pay equity, there do seem to be disparities. A man and a woman with ten years of experience and comparable competencies may still not be paid the same.

In their own words:

I've worked with several women who've suffered harassment in the workplace. There is a problem. I think that the institutions and companies where we work have a role to play and a responsibility, which they don't assume. For example, if it's clear that a woman [engineer] and

a man engineer, doing the same job, are not [treated as] equals, there's a responsibility and a fault on the part of the company's management. It doesn't help to eliminate [certain] reactions and comments (HI1).

I had the experience [...] of working with a woman engineer who was suffering from workplace harassment. The university did nothing to protect this woman engineer. It protected her professor because he was a source of research funding. That was seven years ago — quite recently — and there was already awareness around the issue, and the labour standards boards had mechanisms in place then to lodge complaints, etc., which had been done. [...] This prof is still there, and he's certainly continuing [his harassment]. He had a reputation for doing it not only to the one I accompanied [but] to many. So the organization has a key role to play, in my opinion. Zero tolerance! If there is no zero tolerance, it's going to continue, and some people will take advantage of it (HI1).

Regarding what women may experience, there are things that are more sensitive in nature and more disturbing. I've heard people say: "You're smart even though you're cute," and things like that. That's the kind of stuff I think I've heard. And there are a lot of things that are said when the person isn't there. In fact, a lot more is said when the person isn't there (HI10).

I have the impression that a man with ten years' experience could, I don't know if it's through his powers of [persuasion] or not, negotiate a better salary [whereas] a woman who comes in from the outside with possibly the same competencies [will never be able to ask for that salary] (HI4).

If you know, or suspect, that you're at a level below what you should be earning, it means you're going to have to fight your way up. [...] "Don't take it for granted that because you've done a great job you're going to get the salary [that goes with it]." You've got to make that point clear (HI1).

I would suspect that girls tend to be less inclined to go in with a knife between their teeth [to meet] the manager and say: "It's time. You're giving me a raise, and this is what I'm worth." [Women would be more likely] to say: "This is going to be difficult. I might just piss him off for the next year." But you won't get what you don't ask for it! (HI10).

Coresearchers' reflections

Companies have a role to play in zero tolerance and pay equity. Men's persuasiveness or negotiating aptitudes/habits seem to be more promising than women's when it comes to negotiating a pay raise. It would be great if women could develop negotiation strategies. However, even if they had the skills to do so, would the pay raises they obtain be commensurate with their competencies? Open and transparent salary policies would be a sound management practice so that everyone can compare their salary. As legislators have stipulated, it is the responsibility of the company's senior management to ensure pay equity.

2.5 Injustice and appropriation of women's work

Some participants recounted situations where a woman came up with an idea that a man would then claim as his own, but the same seemed to happen to men, too. What is more, idea theft occurs in many fields, not just engineering. In situations where another person takes credit for an idea, that person may make it their own, as well as validating the person who came up with it.

In a situation where a woman feels her ideas are less valued, many of the men we met consider, firstly, that this can vary depending on how the idea was originally formulated. It is a situation that can happen to a man too. It is not necessarily something that only happens to women. But often, it is women who have difficulty asserting themselves and their ideas. Finally, it is easy to spot the type of person who specializes in appropriating other people's ideas for their own purposes.

Referring to mentorship experiences, one participant pointed out that more women than men participated in mentorship programs. Some women have difficulty asserting their contributions to companies.

It is to women's advantage not to take it for granted that they will get a pay raise without asking. If women feel they are not getting the pay they deserve, it is up to them to ask for it and not take it for granted that because they have done a great job, they will get the pay they deserve. Too many women do not ask for a pay raise for fear of being frowned upon by company management.

In some situations, people who approach a mixed-gender team with at least one man on it tend to address the man, even if he is not the one qualified to answer. This results in discomfort, especially when the man in question points out that he is not the one in charge of the case, and people continue to speak only to him.

In their own words:

Precisely [... for this man], he was in the habit of taking credit for the work of a woman engineer and making it his own, but that happens to men too. Situations where an idea proposed by a man isn't taken up straight away, and in the end, there's another man who's closer to the boss, who proposes the same idea and right away, it's taken up. This probably happens more often with women because there can be a whole political issue at stake in meetings, especially when you come up with something a little more divergent and still want to find a solution. It's not always easy to contradict the group, but I'm sure it happens (HI1).

You see a certain type of person who's good at doing that, appropriating other people's ideas. Does it just happen to women? I couldn't say. I think it can happen either way in the current context. But I can think of some people in our company who are very good at taking other people's ideas and making them their own, then selling them to their bosses as their own (HI10).

Often, guys are more inclined to assert themselves because I imagine that in society generally, we're more inclined to talk because we've been brought up that way by generations and generations before us. And so in an environment like engineering, where we're mostly guys, it's bound to be even harder, given that it's already not easy [for women] to assert themselves and their ideas in everyday life (HI8).

If there's someone who internally [...] wants to validate people or who's going to be more of a leader, he'll bring those ideas [to others]. He'll say: "This person has [... proposed] this point, we should look at this solution to move forward." Unfortunately, there are others who think more of themselves than of others. Indeed, it can happen in this case: no matter what idea is taken up, if it's been put aside, they'll put it forward to make themselves look better (HI9).

I remember in one class, [...] there were two women and three men. We were doing an assignment, and we were pitching all our ideas. [...] They didn't want to impose their ideas, but at one point, we had to say: "And you, what do you really think?" [...] I get the impression that they're sometimes afraid of asserting themselves (HI7).

Coresearchers' reflections

It seems that both men and women have their ideas stolen by people who know how to claim them for themselves and make them more attractive. These are unique personalities. Others know how to make the most of other people's ideas without necessarily making them their own. In addition, some men point out that women are sometimes afraid to assert themselves, and self-assertion has a learning curve.

2.6 Perceived loss of career progression during parental leave

When it comes to the loss of career progression during parental leave, the views of some of the men we met were quite similar. It would be an injustice if people on parental leave for a few months or a year were not to earn a promotion or a raise and only to receive a salary adjustment linked to inflation. Other points of view emphasize that there will always be inequalities between men and women.

If there are no proper regulations governing career progression, it will be difficult if not impossible to attract many women to engineering. Absence from work due to extended maternity or paternity leave may be weighed subjectively when assessing salaries.

Therefore, it is important to consider women's contributions to society and not penalize them for their desire to have children or for their career path. Implementing a salary scale that takes their situation into account would be one way to do this.

In their own words:

I think if a man took a year to do something else and came back [to work], he wouldn't get promoted. I think promotions are associated with performance. What's been delivered, what's been done. So women must go back to the same salary, taking inflation into account of course (HI1).

If you haven't worked and you haven't delivered, I don't see why you should get a promotion other than for inflation. Not getting your job back once you've taken leave or finding an inferior position can also be a problem, which I think can also explain the differences in pay (HI2).

Paternity leave is shorter than maternity leave, so in the end, if a couple has a child, the man is less affected. I put myself in the company's shoes and I say to myself that it's just logical that if someone isn't there for a year when they come back, [they] should be at the same position as when they left (HI6).

There will always be inequalities between men and women because men take less time off for paternity leave, whereas women take longer. There has to be a balance and I seriously believe that women have a lot of weight on their shoulders [...] From that point of view, salaries should go up whether you go on leave or not (HI7).

It's a complicated issue. It's going to bother companies and I can understand why. [...] I think that's why some companies don't want to hire women of childbearing age. [...] But if we don't put regulations in place that say we can't do that, we'll never have women in engineering (HI8).

It's the same thing in the end for the rest of us, I mean for men too. We've been given 18 weeks of paternity leave. [...] If the man] is gone for half the year, he's going to deliver half. [...] And I haven't necessarily seen a big difference (HI9).

In some cases, pay equity is taken seriously: In our company, we take pay equity seriously. It's reviewed every year at the board level and our board has almost reached parity. [...] What I've heard from women in the 28-40 age bracket who want to have children or already have children is that sometimes they feel bad negotiating a salary knowing that next year they'll be leaving for a year (HI5).

Women's contributions to society should be considered. [Their careers] shouldn't be penalized. But I think it is like that, but it shouldn't be like that. So women shouldn't be prevented from having the possibility

of motherhood and, at the same time, from having normal career growth. I think there's a lot of work to be done in this direction. [...] We need to change the rules so that women can be mothers at some [given] time and succeed in their careers [at the same time] (HI3).

Coresearchers' reflections

Comments around the loss of career progression during maternity leave fall into two very disparate categories: either the company cannot afford a promotion or raise if the employee is on maternity leave, or on the other hand, it is essential to find a way of recognizing women's contributions to society. How can we reconcile these two perspectives?

2.7 Difficulty balancing work and family

In addition to maternity leave, family-work-life balance is difficult to manage, especially in a context where some companies or work teams have variable schedules from very early in the morning to late at night. Presumptions about young women wanting to start a family can be an obstacle to career advancement. It appears that some company management teams anticipate that, if they give a long-term management project to a 28-35-year-old woman, it is almost certain that she will not complete it, or that she will suspend management of this project because she will want to start a family.

In their own words:

Difficult work-life balance

There's not much room for work-life balance. We like people who work hard and get up early in the morning. 7 o'clock is a bit late. You have to be there early. Of course, if you work hard, you'll be there until at least 5 o'clock. If you arrive at 6:30 and leave at 5, that's a decent day. I know you have a family, and that's [equally] true for the guys and the girls. [...] The girls really struggled with it — they said we're leaving [we're quitting] because of it. Are there guys who have left [because of this], I couldn't say, but I think it weighs less [on them] on average (HI10).

To be 100% transparent, when you give a project to a woman aged 28 to 35, and if it's a project that lasts 3 to 4 years, of course we ask ourselves the question, not just for a woman, but for any individual aged 28 to 35-40. Are they going to leave for six months because they haven't yet started a family? Of course, we ask ourselves that question (HI5).

I have the impression [...] that there are fewer women raising their hands to go straight into operations, and what I've seen in the mining industry is that once you've done operations, the chances of promotion are much greater. [...] If you take two people who have six years of experience, but one of them has managed a team of mechanics for two years, and the other has only done projects, if there's a higher position in the organization, chances are it will potentially help [the former] (HI5).

Coresearchers' reflections

Family-work-life balance is a significant issue, but in the industry, there does not seem to be much room for it. Also, the type of tasks performed by men may give them opportunities for promotion that women who limit themselves to working in offices do not really have. Where do companies stand on this issue? How can we ensure that women are not limiting their careers when they want to start a family? Having a network of available childcare facilities is essential, but it does not seem to be the only factor to consider.

2.8 Other obstacles: conditioning, isolation and immigration

Women's career choices are not always the same as men's. Boys, under social influence, are more likely to dream of becoming airplane pilots, engineers and doctors. Girls are more likely to choose nursing or social service careers. This is basic conditioning that needs to change.

Some participants noted that women feel isolated in engineering. They feel alone in a man's world, where it is still too demanding to fit in.

Being a woman from an immigrant background complicates professional integration. Some women are more disadvantaged because of their origins or culture.

In their own words:

More than 20 years ago, when I was really, really young, people used to ask me: "What do you want to do in life?" For the rest of us, they'd suggest airplane pilots, engineers, doctors, and things like that. It was like segmented, not necessarily segmented, but very, very divided even at that age. Let's take a girl who was in my class for example. She's going to be a nurse because she had already [internalized] the image of nursing from an early age. You go back to when you were young, [... it was already compartmentalized] and then, trying to bring that back from the other side, trying to put it back on an equal footing, it gets more and more difficult, as the years go by. We'd have to go back almost to basics to say, can we make things freer? (HI9)

There are many who give up because they feel alone, who don't want to progress any further, who stop there because it's becoming too much for them. I can understand them, but from that point on, I don't know how we can go about trying to help in that area [attracting women, retaining them and helping them progress in their careers] (HI9).

An important point I forgot to mention is a person's origins. I've had the opportunity to work with African women, and that's an extra dimension that complicates integration because it's not the same culture. [...] In my opinion, they are more disadvantaged than a European woman who comes to live here (HI1).

Coresearchers' reflections

Stereotypes are deeply rooted in childhood. Influences come from family, school and society. School and the guidance process are often singled out, but parents also convey stereotypes before children start school. What can be done to reduce the effects of stereotypes and prejudices in the long term?

► 3. EDI (equity, diversity and inclusion) and employment equity programs from the perspective of men working in engineering

Some of the men we met addressed this issue (9/10). Here is a summary of what they had to say about training, recruiting women with equal competencies and offering support to women who are harassed.

Where training is compulsory, it helps to raise awareness of harassment, racism and sexism. In general, training courses open a different perspective on discrimination, sexism and inequalities. They help us realize how women can be affected by subtle gestures that might have previously gone unnoticed.

Regarding the principle of “for equal skills, hire a woman,” it seems that this can backfire on the woman, who appears to be hired exclusively because of her gender. However, if nothing is done to hire more women, change will take a long time. This practice is a way of accelerating that change. Others believe that it is difficult to identify whether two people — a man and a woman — are equally qualified, the process remains quite subjective. Some men mentioned that there are cases of women who have done very well without having worked for it, simply because they were women.

A final aspect with which many respondents had similar views was around the intention to support a woman who is being harassed and to report it. In the past, this probably would not have happened, but today it is easier, given the awareness-raising mechanisms put in place in recent years. The will to eliminate harassment is there, but there are habits — like certain jokes — that are difficult to change.

Coresearchers' reflections

These men's thoughts on the “for equal skills, hire a woman” principle are nuanced, and it seems difficult to assess a clear-cut position. Being hired for your competencies and feeling that way are necessary to maintain and increase self-confidence, but without action, change will take time. This issue is as much a debate among men as it is among women. What can be done to ensure that women are valued and recognized for their contributions to the world of engineering?





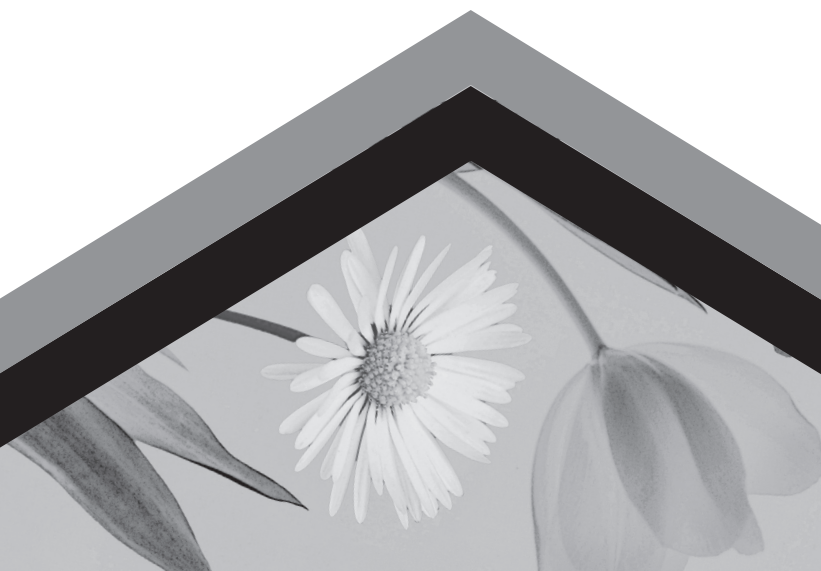
Part 5

Strategies and Solutions



Chapter 15

Strategies and solutions
to promote the recruitment,
attraction, integration and
retention of women
in engineering



During the interviews, all participants provided ideas for strategies and solutions to promote the recruitment, attraction, integration and retention of women in the engineering field and, more broadly, in STEM (science, technology, engineering and mathematics). These strategies and solutions were provided by women working in engineering, female professors teaching in the field, female students from high school to university, female human resources specialists, a woman specializing in the realities of women from immigrant backgrounds and another specializing in the realities of Indigenous people. Several men were also interviewed and provided their suggestions.¹ This chapter deals with strategies and solutions for education.

From a school perspective, we discuss reasons young girls would be attracted to engineering, how to raise awareness of engineering, the importance of presenting role models, how to deconstruct stereotypes and prejudices linked to career choices, thoughts on how to support girls' and women's self-confidence, ways of raising awareness among boys and men, ways of countering stereotypes and prejudices (as well as sexist or racist comments), a few strategies to integrate into teaching practice and what could be done for Indigenous communities and women from immigrant backgrounds.

The people who provided suggestions for what schools could do, from primary school to university, were: women in engineering (29 In), female engineering professors (10 PI), female high school to university students (10 ESCU), HR specialists (5 HR), a specialist in the situation of women from immigrant backgrounds (1 SI), an Indigenous specialist (1 SA) and men with links to engineering (4 HI). A total of 60 different people provided these strategies for implementation in the school system.² Reflections from the coresearchers complete each major theme of the proposed strategies.

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1. The people who submitted proposals are identified by category, as follows: women in engineering (In), women engineering professors (WEP), high school and university students (ESCU), human resources specialists (HR), women from immigrant backgrounds (SI), Indigenous women (SA), men with ties to engineering (HI).
 2. In this book, the results of the research have been synthesized, and it is not always possible to identify the categories of people or the individuals who provided these ideas. The full results can be found in the research report: Gagné, D. and Lafortune, L. and collaborators (2024). *Situation des femmes en ingénierie dans des secteurs où elles sont largement sous-représentées: rapport de recherche.*

► 1. The case for attracting girls to engineering

Reasons girls and women are attracted to engineering include the diversity and challenges it offers, openness to creativity and innovation, opportunities for advancement, project completion and production. It is a life of learning. In addition, it is a good idea to help young women pursue their passions and interests, as well as their desire to take on new challenges. Engineering offers many social and salary benefits to consider, along with ease of hiring, attractive career progression prospects, a diverse environment and good working conditions. A different means of attracting them would be to normalize the “try something else first” approach applied to fields other than engineering before committing. This would be a way to avoid putting pressure on young girls, offering them the opportunity to go and try out other fields before committing to engineering.

In their own words:³

It's not monotonous. There are always challenges (In2).

There's room for creativity and innovation (In20).

Engineering provides the opportunity to realize and produce projects in which women can participate. It's a life of learning (In5).

Women should do what they love (In15).

If any women have a facility for and like science, I highly recommend it (In30).

You have to like working as a team. You have to like challenges (In30).

Despite many advantages, it is necessary to qualify the reasons for choosing the field and not deny reality: You can't be afraid of getting dirty, you can't be afraid of thinking like a guy (In23).

To attract Indigenous women, it is essential to point out the positive spin-offs for their communities: It's a profession that really allows us to have a positive impact on the development of our communities. [...] I'm always amazed to see where it takes me and where it can take me (In26A).

3. Only a few quotes have been chosen to avoid repetition. The codes beside them do not confer importance.

Coresearchers' reflections

The reasons for choosing engineering do not stop with those listed above. In a class discussion or in a group of girls considering engineering or STEM (science, technology, engineering and mathematics) more generally, providing reasons to choose engineering is not always a good idea. It is better to propose educational activities in which the students themselves provide their own reasons for choosing STEM — they will understand them better and integrate them into their thinking better. Reasons provided by adults do not always have the desired results.

► 2. Raising awareness of the engineering field

In addition to exploring the reasons for choosing engineering, it is important to raise awareness of this field through promotional interventions in schools, e.g., stimulating interest through company visits via career days at CEGEPs and high schools, conferences and workshops, women presenting their career paths at schools, and raising awareness among relevant university staff to provide explanations to students on the various paths available. In addition to company visits, opportunities to work for a company — even on a volunteer basis — could help students gain a better understanding of the trades and the work environment during their studies. This could involve rethinking internships and company visits from high school to university.

Awareness-raising should start in high school to attract more girls into engineering, particularly to counteract the stereotypes associated with engineering. However, there is sometimes a shortage of female engineers for one-off, time-consuming interventions. Training for guidance counsellors should be geared in this direction. The main challenge is to make girls understand that engineering work is not as male as they think.

Information and awareness programs — implemented with continuity and recurringly — are essential for young people. There is still a lot of awareness raising to be done. It is for the new generation that it is important to aim for a change in mentalities about the place of women in engineering: organizing open houses for the different levels of education — from primary to university — and setting up an

awareness-raising program that is pragmatic and demonstrative of engineering work, that attracts girls by showing the creative and innovative aspects that open doors to entrepreneurship. Some girls would like to combine engineering and entrepreneurship, but there is no model or guidance that concretely explains the possibilities of bringing them together.

Awareness-raising initiatives in various training environments that raise awareness among, integrate and retain women choosing the engineering field seem insufficient. It is becoming important to publicize these trades and professions at trade fairs, conferences, etc. The activities already implemented in schools (probably not enough) lack regularity and recurrence. They are not structured enough, remain too occasional and guidance counsellors and teachers lack training as well as information on the subject.

Other possible avenues:

- Emphasizing the human side of the profession, making it more attractive to girls.
- Using videos and other means to present the work as it is.
- Having more female professors in universities would be an advantage in getting girls to choose higher education in STEM fields.
- Deconstructing stereotypes through the media and giving more visibility to women in engineering so that they become role models.
- Promoting engineering and raising awareness among young people, both boys and girls, via modern media that they are highly active on, i.e., social media.
- Considering returning to career choice courses where young people can learn more about themselves and explore various trades. It is not just career tests that help to understand your profile — a trusting relationship with a guidance department can also facilitate these choices, especially if counsellors are free from prejudice.
- Proposing one day a year dedicated to women in engineering who represent less than 25% of the workforce in both universities and companies.

In their own words:

Promoting [...], telling [girls] not to be afraid of going into environments that are perhaps a little less traditional (In30).

We need to be better prepared to present the different options to young people because we know typical trades but not others (In30).

Simply helping them without hiding possible obstacles [...] and giving them the confidence to keep going (In36IM).

Advertising in schools is important [but also on] social networks (In32IM).

I've already had the opportunity to visit [factories], and the more human contact you have, the easier it is to ask questions (In2).

For example, if someone sees a mine firsthand, they may fall in love with it. What's the mining engineer doing in there (In24IM)?

It would mean going back to career choice courses [where young people] worked on their profiles [to] get to know themselves better and know that this branch really [suits] their personality (In15).

The main issue [is to] make young girls understand, very early on, that engineering is not as male as they might think. [...] You have to start very early, I think, to instill in young girls that they can be engineers (PI7IM).

We also need men's help. They still have a big impact on society. [Men are not comfortable] when we talk about feminism. [...] If we could get them on board [...], I think it would help [...] to normalize the fact that women can do as much as men (ES3).

You don't see women in engineering every day on TV shows. I know there are posters at the university to encourage engineering studies. I think it's usually guys on those posters, but it would be nice to see some girls (EU7).

I have the impression that even the human dimension, which you can clearly seek out, isn't emphasized. Maybe that puts off a lot of girls who [...want] to find it in these programs (EC1).

Giving schools tools and videos that present careers honestly. This is the place where we can raise awareness among young women because they'll hesitate, they'll find themselves saying: "We're going to end up in a male environment, it won't be easy to find my place, I don't necessarily want to be a pioneer" (HR1).

Coresearchers' reflections

Several strategies suggest organizing visits to schools or getting women working in engineering to act as representatives, either alone or with men. With the small percentage of women in engineering, one-off initiatives are extremely time-consuming. Women in engineering are under pressure from all sides, both from the education system and from their companies, which want women to sit on various committees. So how can schools take advantage of the expertise of these women and men to demystify their work and make them want to get involved? Social media and short videos are great solutions, especially if they are accompanied by teaching sheets with ideas for activities. What is more, the training offered to guidance counsellors should inform them not only about the different possibilities engineering has to offer, but also about the realities of girls in this field.

► 3. Deconstructing stereotypes and prejudices about career choices

To encourage girls and women to choose STEM (science, technology, engineering and mathematics) fields, we need to deconstruct stereotypes about career choices: changing the way career choices are presented to girls, deconstructing prejudices and stereotypes linked to scientific professions (there are options besides medicine), deconstructing stereotypes that factory work is physically difficult, popularizing the profession to highlight its creativity and usefulness, raising awareness of a diversified and little-known profession, presenting engineering as an achievable career, showing how concrete the tasks are, presenting role models and having women working in the field speak to girls to facilitate identification.

Deconstructing stereotypes and prejudices around engineering means promoting the diversity and variety of opportunities offered by this field, without forgetting its human dimension, its social impact and its potential to change the world: helping women gain confidence and see themselves in the engineering field, showing that it is possible to balance family, work and a personal life, changing the way engineering is taught by making use of girls' interpersonal skills, showing attractive career advancement opportunities and salary conditions and fostering family support and encouragement to be able to overcome behaviours that perpetuate stereotypes.

To attract more girls to engineering, we need to ensure that the examples used in secondary and even primary education demonstrate the opportunities available to them. This means revising the communication and guidance approach. Presentations to students need to communicate diversity, especially with girls studying in traditionally male programs.

In their own words:

It's important to deconstruct the prejudices and stereotypes associated with scientific professions, since just because you're a good at school and you're a woman doesn't mean medicine is your only option (In7).

In factories, there's no heavy physical work because even the guys don't want to do it anymore — and what a girl can do, a girl can do too (In16).

The aim is to introduce young girls to the field of engineering, since it is so unknown [...] so that they see that it's something that's very attainable [...] because women don't see themselves there. They can't see a future for themselves there (In10).

I think girls are not well informed when it comes to the engineering fields out there. [... Also, it would be important] to allay their fears about math. Probably even boys and girls would choose applied math, and girls and boys would be more likely to choose engineering (In34IM).

I think it's the human dimension that's appreciated. [Doctors treat people, but with what? With equipment developed by engineers] (PI11).

Change the way engineering is taught and apply different competencies such as interpersonal and communication competencies (PI16).

It can be useful not to hide the fact that these are very demanding studies in terms of workload: You have to be prepared to put in the effort [...] “work hard, play hard” [...] It’s a lot of hours and all that, but you get recognition, it’s rewarding and motivating, but it’s still demanding (In30).

Coresearchers’ reflections

Women do not always feel welcome in engineering, and they choose certain fields without really knowing them. What can be done to strike a balance? It seems important to present the field of engineering with all its diversity, creativity and demands. It is also important to bear in mind that society, the family and men and women alike all stereotype predominantly male fields.

Choosing an engineering field requires a mathematical and scientific education from primary school onwards. Many young people – boys and girls alike – are “afraid of math,” feel anxious about the subject and experience math phobia. Action is needed to reduce the negative effects of these emotional responses.

► 4. Supporting girls’ and women’s self-confidence

To support girls’ self-confidence, it is necessary to promote knowledge and competencies in communication, emotions management and the development of social competencies from high school through to university. These competencies help them deal with conflict and situations where they or other women are not listened to. By developing such competencies, women learn to stand out and assert their competence. Added to all this is the idea that more women professors in engineering would have an inspiring effect on others undertaking graduate studies in STEM fields. It is a way for girls to see themselves in these fields and believe that they can succeed there.

Believing in yourself means not doubting your abilities, knowing that efforts deserve positive rewards that can translate into recognition for a job well done, not necessarily praise from others. This means that women need to set boundaries, respect them and make sure they

are respected. We need to help girls learn to assert themselves in this male-dominated environment. It is also important for them to feel that the faculty is there to support them and put them at ease.

In their own words:

Although they're passionate, you have to know where to draw the line. Don't accept the unacceptable (PI18IM).

What we're lacking is the art of communicating well [...] because that gives us confidence and self-confidence when we speak [...]. We're lacking that at school or university, persuasion, and the art of communicating. Even [in terms of] non-verbal communication too (In25IM).

Certain competencies help us deal with conflict, like putting things into context when conflict arises [...] because I started crying when I called my supervisor. [...] We need to be trained in how to deal with conflict, how to deal with guys who are rude or look at us too [insistently] or don't listen to us (In25IM).

I've built a lot of character over the last four years. With my friends [in high school], I was at ease, but as soon as I was with people I didn't know, I put myself in a corner. I didn't assert myself. [...] Then in CEGEP, I had no choice but to assert myself in projects. You talk to so many guys that at some point you have no choice but to become a bit of a "guy," [...] but I learned [...] to assert myself. Today, I'm no longer impressed by them (EU7).

Coresearchers' reflections

If girls give the impression that they lack confidence in their ability to succeed in scientific fields, this perception does not just come from themselves – they are victims of prejudices and stereotypes, it is a form of conditioning.

The lack of self-confidence in girls and women is often cited in the literature as a reason why they do not choose fields with a strong mathematical and scientific component. However, the latest PISA survey shows that in Quebec, girls and boys have similar skill levels in science. In mathematics, girls are lagging slightly behind boys. ▼

However, many boys and girls still have difficulties in math and science. Girls express a lack of confidence and anxiety about mathematics — boys express little or none, but that does not mean they do not feel it.

It is important to relativize comments suggesting that girls lack self-confidence. Asking questions like: How do girls and boys express their fears of failing math and science? What could be done to improve the situation for both girls and boys? For a start, stopping saying, “don’t worry, it’s easy,” would be one way of getting young people to associate failure with obstacles in problem-solving situations. Learning is not easy, learning requires effort. It would be a good idea to remind them of this relatively often.

And when things are unacceptable, it is not always easy to respond. But responding can be learned. Workshops on the subject — from high school to university — would be an avenue worth exploring.

► 5. Raising awareness among boys and men

Raising awareness among men and society about The Realities of Women in Engineering: Joys is an important avenue that can be pursued in a number of ways:

- Educating both girls and boys to convince them that both have a place in engineering;
- Raising awareness among men (and professors) around the need for the better integration of women, paying particular attention to language used;
- Deconstructing society’s stereotypes of women in engineering and raising awareness of The Realities of Women in Engineering: Joys (aggression, harassment);
- Raising awareness and informing men about The Realities of Women in Engineering: Joys and the need for change;
- Using an educational approach that reaches out to the female population;
- Training men working in engineering to be open to diversity in their projects;

- Creating exchange spaces for women and setting up discussion groups so that women can share their experiences and give each other advice on how to deal with unacceptable situations;
- Getting men involved in the cause, too, by involving them in raising awareness of the issues involved in integrating women into engineering studies.

In their own words:

We also need to educate men, give them training and raise their level of awareness. [...Getting] men to adapt [...is as] important as giving women the courage to move forward (PI8IM).

There was always language from certain professors that was inappropriate, saying things like, “hey guys!” It’s true that it used to be guys, but now there are girls in classes (PI2).

We haven’t put a lot of emphasis on women in the engineering field, even though the number has increased a little over the years. I haven’t done a survey, but I doubt very much if the perception has changed much (PI5).

There are many men who don’t understand, and because of this, they feel threatened — they even feel attacked. So [it’s important to be careful about the approach] so as not to risk increasing the feeling of threat or irritation [which can] become downright counterproductive (PI5).

Coresearchers’ reflections

During the research process, it became necessary to meet with men (engineering workers, engineering professors and engineering students) to get their points of view in an effort to qualify or validate certain research results. This decision proved fruitful and was in line with what many women wanted: to raise awareness among boys and men of The Realities of Women in Engineering: Joys (see Chapter 14).

Although the men we met were already open to the cause of women in engineering, their comments confirm the idea that broader thinking will lead to a society that opens the door to women in STEM (science, technology, engineering and mathematics) fields.

► 6. Offering scholarships and financial aid

Providing scholarships and financial aid helps to retain girls in STEM (science, technology, engineering and mathematics) fields. Boosting the attractiveness of engineering education involves offering scholarships, financial aid and job guarantees, as well as creating cohorts of female students.

In their own words:

Scholarships could be awarded at the end of each session to make up for the lack of enrolments (EC4).

In DVS (Diploma of Vocational Studies) cohorts, it would be good to offer scholarships, subsidize salaries [provide a minimum wage to study], pay for studies and guarantee post-academic employment (HRI).

Coresearchers' reflections

Some students point out that when these scholarships are for only girls, they do not always feel comfortable. They insist that they want to be recognized for their competencies. Nonetheless, these girls-only scholarships are a way of restoring a form of balance.

► 7. Countering stereotypes, prejudices and sexist or racist remarks

Universities can take steps to actively combat sexism in their establishments by developing mandatory training courses. Faced with a lack of respect from male colleagues — or a failure to listen to or recognize women's competencies — universities would do well to be firm about enforcing rules and possible sanctions. There is a lack of education for children from an early age to show that girls and boys are equally free to do what they want in life.

Strategies to help girls take their place and feel at ease include helping them learn to assert themselves in this predominantly male environment. It is also important for them to feel that the faculty is there to support them and put them at ease.

In their own words:

There is currently compulsory training [on eliminating sexism], but basically, they don't do anything if people don't [take] it (In7).

Coresearchers' reflections

While it is true that organizing face-to-face training requires time, energy and human as well as financial resources, it does have the advantage of generating awareness, interaction and positive confrontation (not clashes) that make people think and can lead to change. The question then arises: What is the value of compulsory or non-compulsory online training? Research or a survey on the subject could provide some answers.

► 8. Strategies for positive academic change

Strategies for academic institutions to encourage and support women in their chosen fields of study include:

- Helping girls in environments where they are in the minority and reducing impostor syndrome. To do this, it would be good to:
 - normalize making mistakes during learning so that students stop feeling bad about their mistakes;
 - foster attitudes that demonstrate confidence in women's competencies in scientific fields;
 - make staff aware of their own prejudices, both in institutions and in the workplace;
 - change the male image of engineering and ensure that work teams are egalitarian and inclusive;
 - raise awareness among women, as well as among professors and men, reassuring them that the increase in the number of women in the workplace is not a threat and will not close doors to them.

Strategies and solutions to promote the recruitment, attraction,
integration and retention of women in engineering

- Providing a safe and fulfilling school and work environment.
- Creating the conditions for harmonious and respectful communication so that men and women are willing to work together.
- Communicating information that reflects reality, rather than embellishing the type of work to be done, without blackening the picture because failing to present reality will hinder retention later on in their studies.
- Adapting group work by creating small work groups in which girls feel comfortable interacting. Getting boys used to working with girls. There seems to be little effort to get boys to understand how to work with girls. Accommodation often comes from women.

In their own words:

Raising awareness among staff both in institutions and in the workplace [...] around their own biases [...] would lead them to be able] to respond to these biases or [at least] to be aware of them (EU1).

Requiring the presence of girls on team projects. [...] Increasing] awareness that men and women have something to contribute to the field of engineering (EU1).

It's important to promote awareness among young girls to convince them that it's normal [for there to be] women in engineering. They have their place, but also among professors, apparently, so that they understand that we're not threatening (EU6).

On teams, it adds to the dynamic if it's more mixed. Maybe it would be better, not just because there would be more women, but also because the guys would start to get used to working with women. [...] It's like the first generation where women are going into these fields (EC3).

Coresearchers' reflections

It was mainly students who came up with ideas for positive academic change. These students feel like pioneers. It is true that the number of women in certain STEM fields has stagnated at around 20% for the past 20 years or so. However, women have been and are still working in STEM. How can we make these fields more widely known without having to tour schools?

Some students advocate mixed-gender teamwork. They really want boys and girls to feel comfortable working together. Mixed-gender group work from primary school onwards would help to raise awareness and encourage people to coexist better.

► 9. For Indigenous women at school

To trigger their interest in engineering, it is important to remind Indigenous women about the positive spin-offs for their communities. In addition, it is essential to advertise in Indigenous communities, as this helps with recruitment.

Training programs have already been explored to raise awareness among work teams around the realities of Indigenous people. It would be important to implement these types of programs on a recurring basis. The idea would be to set up annual cohorts with a view to developing and securing longer-term management positions for women. There is a definite interest in advancing women — all women — in the world of engineering and STEM, with a particular focus on Indigenous inclusion.

In the programs offered, it is important to provide course content on the cultures and realities of Indigenous people, with guest speakers from Indigenous peoples and assignments related to their cultures. What is important is that this integration of Indigenous culture into the curriculum is felt to be sincere and not inserted to meet educational or political demands. The management of university educational establishments has a role to play in advocating Indigenous ways of thinking and in encouraging their staff to do the same.

In their own words:

It's vital to promote engineering in Indigenous communities because it's not well known among First Nations, and to make them understand that it can really help our communities (In26A).

To get Indigenous women into engineering, it's a big battle, [because] engineering education has to change. University educational institutions have a role to play in promoting Indigenous ways of thinking and encouraging their staff to adopt them (SA).

Coresearchers' reflections

All these reflections on the realities of Indigenous people in relation to their integration in STEM fields call for in-depth exchanges to ensure that Indigenous ways of thinking are built into the school curriculum — from primary school to university.

► 10. For women from immigrant backgrounds at school

For women from immigrant backgrounds, it is important to provide a framework for the recognition of university degrees, particularly for women who obtained their qualifications in their country of origin. Along with the recognition of professional credentials, it would be important to speed up the process of obtaining permanent residency or citizenship.

At present, the workforce shortage is an advantage, as women from immigrant backgrounds are finding it increasingly easy to find employment without needing to excessively prolong their studies. It is important to take account of competencies and professional experience — and not just to “exploit” people from immigrant backgrounds — in view of current job market needs, where women are sometimes overqualified for the job on offer while at the same time earning lower-than-appropriate wages.

In their own words:

What we're asking of the government is that there should be more supervision and that universities should apply the law on the recognition of prior learning. This is a very important step because at the high school level, in training centres and CEGEPs, the results are certainly very relevant. However, unfortunately, at this level of schooling, these are short programs that will lead to DVs (vocational diplomas) and not to university diplomas (SIs).

In the context of labour shortages, this trend is slowly changing because now it's immigrant students who are called upon at the end of their degree, and they are offered a job and citizenship (SI).

Many foreign students — especially [...] in aeronautics and aerospace — study in Quebec. At the end of their bachelor's or master's program, they can be hired automatically by an Ontario company with an immigration process already underway. [...] Unfortunately, in Quebec, [it's] a much slower process. [...] Here, we're currently seeing a lot of temporary work permits, which is still a trend that has been accelerated, but what we're seeing is that in the end, foreign students prefer to go to Ontario because they still give them their citizenship via an accelerated and much more advantageous process (SI).

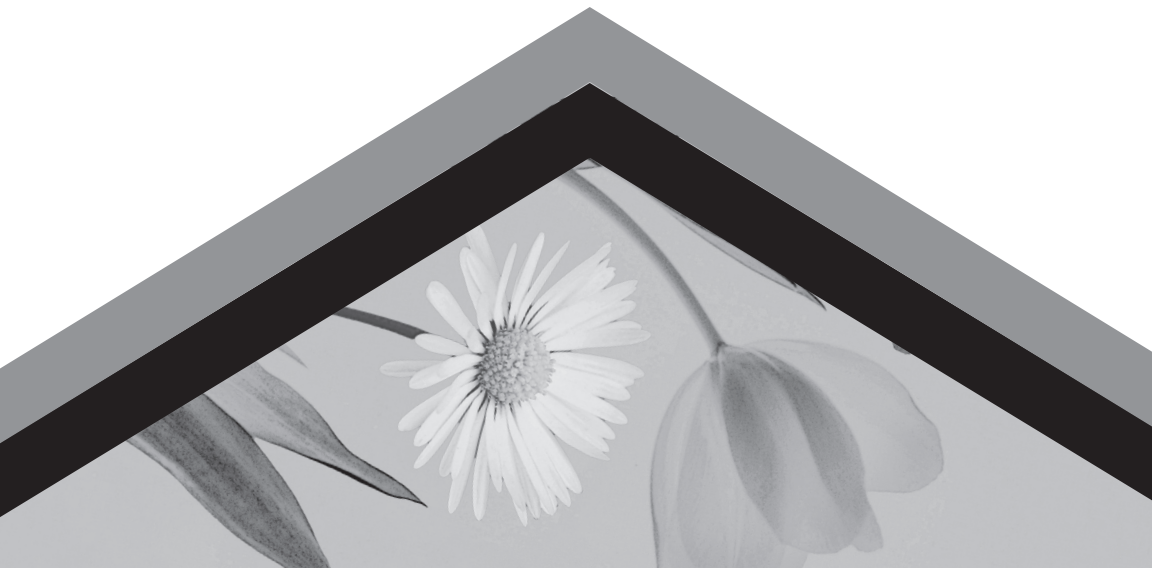
Coresearchers' reflections

Recognition of prior learning is an important issue for the integration of women into STEM fields. How can we ensure that recognition of prior learning is effective and respectful of competencies? How can we take into account training acquired in other cultures to contribute to innovation via the sharing of ideas?



Chapter 16

Strategies
and solutions to
promote the recruitment,
attraction, integration and
retention of women in
engineering companies



During the interviews, all participants provided ideas for strategies or solutions to promote the recruitment, attraction, integration and retention of women in engineering and, more broadly, STEM (science, technology, engineering and mathematics). The people who provided suggestions for what industry and business could do were: women in engineering (16 In), female engineering professors (10 PI), female high school to university students (11 ESCU), HR specialists (6 HR), a specialist in the realities of women from immigrant backgrounds (1 SI), an Indigenous specialist (1 SA) and men with ties to engineering (5 HI). A total of 50 different people provided these strategies for implementation in the industry and business sectors.¹

► 1. Developing and implementing antisexist policies and measures

Developing and implementing antisexist policies means reprimanding inappropriate behaviour, being able to dialogue with management and putting in place internal measures to resolve situations. It requires management to be willing to take on board such testimonies and to act accordingly, without forgetting to implement preventive measures to avoid aggression and harassment. This means creating and maintaining a working climate where women feel safe and fulfilled, in an environment where they feel they are listened to. These policies would enable antisexist measures to be put in place and policies to be drawn up along the same lines. This would make it possible to take maternity situations into account and to respond to comments that would suggest that women have been hired solely because they are women, which forces them to prove their competencies.

For antisexist measures to be put in place, it would be important to form working committees that take charge of demands and decision-making so that they are truly reflected in the workplace. This could mean creating charters of respect and antisexist measures. In these charters, companies could set boundaries and specify what they find acceptable or unacceptable.

1. The people who provided proposals are identified by category: women in engineering (In), female engineering professors (PI), female high school to university students (ESCU), HR specialists (HR), women from immigrant backgrounds (SI), Indigenous people (SA) and men with engineering connections (HI).

In their own words:

Antisexist measures would have direct consequences for punishing inappropriate behaviour (In7).

My boss talked to him and forbade him from coming and talking to me again. I think it was the right thing to do (In15).

The first thing, I think, is to discuss it with the people in place, in positions of authority (In16).

Measures still need to be taken to ensure that women don't feel left behind when they return from maternity leave (PI7IM).

Sometimes, it's hard to hear certain things. [...] I think there's a responsibility [that belongs] to companies to try to raise awareness [...] and also to reprimand because, more and more, we've started to use respect charters (HI9).

Coresearchers' reflections

As many people say, if policies are drawn up, it is very important that they are applied in the real world. Some companies have already begun to do this. How can we ensure that all companies have the means to achieve equity and equality in all its forms? If companies take concrete action, women will not have the sole burden of responding to sexist gestures or remarks.

► 2. Fighting wage inequality

Aiming for pay equity between men and women is essential to encourage the retention of women in engineering. One way of achieving this would be to publish the salaries associated with different levels of skill and experience so that you can refer to them and assess your own salary. Salaries for women from immigrant backgrounds also need to be reviewed. It would also be important to help women not to hesitate to ask for pay raises, as they generally obtain them easily. Finally, we still need to rethink the rules governing pay during maternity and paternity leave, as such leaves widen the wage gap for women.

In their own words:

It is suggested that a salary scale should be published, and on this scale, they could [also] ask for the type and publish it. [...] But you must really pay attention [...] to each other's tasks. [...] It might help women to demand more [equitable pay] (In16).

Coresearchers' reflections

An open, known and available pay policy with career progression mechanisms would help promote pay equity.

► **3. Facilitating family-work-life balance**

In fly-in-fly-out jobs, ways are to be found to facilitate the family-work-life balance by arranging the schedules of both members of a couple so that they alternate and can thus take turns looking after the children. This also means finding ways to ensure that women are not the only ones penalized regarding career advancement — schedule adjustments are to be shared, as is the parental burden. Even in cases where accommodations are possible and proposed, they remain difficult to access, so it is necessary to make them truly accessible and effective. It is often a question of convincing company management of women's ability to remain effective despite these accommodations.

Strategies are proposed to facilitate reintegration after maternity leave. These include keeping in touch with the company during leave and being able to attend meetings virtually. More thought needs to be given to family-work-life balance and the support that ought to be put in place. The situation has evolved a great deal, and some companies are making various accommodations available for women working in engineering who become mothers — before or after giving birth. It would be good to know about them and spread them to other companies. Added to this is the importance of how to help young mothers see their children grow up, especially if they have to travel a lot. Last but not least, having childcare is essential to staying on the job. Some companies purchase childcare spaces in existing centres. That said, this does not create new childcare spaces for other families.

It is, therefore, important to make both women and men aware that having children will not be an obstacle to continuing a career in engineering. Raising men's awareness of the issue of women in engineering is also important.

In their own words:

Before, there wasn't much work-life flexibility, but I don't think employers have a choice anymore [...] it's just a question of adapting, it's a question of mentality. I think it's going to take another generation, not mine, but the one after (In24IM).

There's been an openness to remote work since the pandemic, and I think that's a huge advantage. [It's important to] trust people. [Management] is afraid that people won't work when they do so remotely, but I think we work twice as much when I see the hours we put in, and we're so much more focused on certain activities (In24IM).

I have a colleague who has had his second child, and his wife has had to stop working because there are no childcare spaces [...]. The company could have daycare centres with advantageous conditions to at least help the spouse who stays at home (In10).

Some companies buy daycare centres and finance them. For each child of an employee, they donate between \$5,000 and \$10,000 a year (In7). But the problem is that no new spaces are being created, so it's other families elsewhere who can't find spaces [...], which are being taken away from them (In7).

I think that in my case, what I found most difficult was convincing my bosses that I was capable of doing the work remotely. It took the pandemic to convince them that I could do it without being at the mine (In13).

In the strategies put forward to facilitate reintegration after maternity leave, it was suggested that an employee should be able to keep in touch with the company: to hear what is being said, to follow developments and not have to catch up on everything, [otherwise] it's excessively damaging for your career. [...] To witness what is being said [...] just to listen to what is happening [...], it allows you to stay in the team dynamic [and] not get left behind — being present for a few key moments while you're away (PI2).

Coresearchers' reflections

Family-work-life balance is very important not only for many women but also for men of the new generation. Remote working has opened up some interesting possibilities for this balance, albeit with certain difficulties. And there is also the lack of childcare spaces, which does not help. How can we ensure that both women and men find harmony in their family and professional lives?

► 4. Adopting inclusive recruitment and promotion procedures

Adopting inclusive recruitment and promotion procedures helps to counter the persistence of lexical bias in job advertisements. It is essential to write these ads inclusively so that women, Indigenous people and people from immigrant backgrounds feel included. If someone is right for a job, they should feel called upon, whether they are male or female.

There are strategies associated with recruiting and retaining more women. This involves focusing on certain recruitment strategies. In implementing these strategies, the role of human resources departments would be to pursue initiatives with employment centres, get involved in formal and informal education and get plugged into community and social networks from a promotional perspective. To increase the number of Indigenous women in the mining sector, we need to disseminate information about the sector, develop appropriate recruitment procedures, train Indigenous women workers in remote mining areas and then integrate them into companies. Finally, it is becoming necessary to promote diversity and equity, particularly in companies that perceive this necessity as a constraint. Training is essential to change this constraint mindset.

Subsidies are needed to help hire women, Indigenous people and people from immigrant backgrounds in business. But money alone is not enough. An effective integration process is essential to ensure that people have an enriching and rewarding experience.

In their own words:

Any advertising should be presented without bias (In14).

Some strategies involve initiatives with employment centres to attract women who are unemployed or precariously employed in 14-hour-a-week jobs at minimum wage. They were trained to become heavy machinery drivers. This took them from a precarious employment status with a salary of \$20,000 a year to \$80,000 a year because, in the mining sector, salaries average \$106,000 a year (HR1).

When it comes to hiring, if there's a woman's CV, you're obliged to meet her. You're not obliged to hire her, but you have to meet her. However, women are sometimes interviewed without being given an equal opportunity to be hired (HR4).

In unionized environments, people will confuse equity with equality. Just because I give you a 10-foot stepladder and the other guy a 3-foot one, it's not equal, but you're both going to be able to reach the equipment at the top. It seems that sometimes people see it as a constraint (HR5).

Coresearchers' reflections

Despite the fact that, for many years now, recruitment campaigns and job descriptions have had certain obligations around equity and inclusion, they are not always reflected in reality. So how can we make it happen?

► 5. Promoting dialogue, contributing to the deconstruction of sexist prejudices and stereotypes and providing training

Companies need to encourage dialogue and contribute to deconstructing sexist prejudices and stereotypes in the workplace by developing spaces for dialogue with male colleagues and thus recognizing male colleagues who are open to the cause. In this dialogue, responding to inappropriate comments, no longer allowing yourself to be taken advantage of and not hesitating to respond or take action with management

are necessary to put an end to such comments. Dialogue with colleagues is important in setting boundaries around what is acceptable and what is not.

Deconstructing stereotypes and prejudices about feminism serves to limit many men's fears about it. Rather than putting the onus on women, companies could take more responsibility in this area. Dialogue remains essential, however, if we are to work towards inclusion for all and adopt an empathetic approach to problems.

In some cases, it is important to have a resource person to mediate so that women do not have to shoulder the responsibility of resolving all the difficulties they face on their own.

Strategies to eradicate discrimination and sexism can take the form of:

- Implementing strategies that facilitate integration into the profession and adaptation to a male-dominated environment, offering organizational support to all women, including Indigenous women and women from immigrant backgrounds.
- Providing information on existing programs so that they can be publicized, disseminated, maintained and further developed. This could take the form of a best practices guide (or one on existing practices) for effectively integrating women into engineering environments where they are clearly in the minority.
- Adopting antisexist measures and policies and creating spaces where women can express their discomfort and sexist experiences.
- Encouraging women to trust one another and ensuring that decisions taken are implemented.
- Ensuring an increase in the number of women by implementing objective, authentic and transparent recruitment procedures, women-centred outreach initiatives and training to raise awareness of the realities of women — including Indigenous women and women from immigrant backgrounds — in the engineering field.
- Offering training courses to raise staff awareness of harassment — such courses already exist, but they should be mandatory.

In their own words:

Dialogue is essential to set boundaries around what is acceptable and what is not: "Can we say that to you? Or not? Is it okay? What do you think?" [...] I often reassure them [...] Sometimes it's a bit more borderline. I just say: "Well, if you've been hesitant to say it, maybe ask yourself why, and you'll understand what's wrong with what you're saying" (In7).

Just because we say the word "feminism" doesn't mean people should be scared (In7).

Being told that to be good, you have to be tough because it's a man's world (HR1) is both a solution and a problem.

Encouraging women in business to express themselves: In fact, as in any type of profession, I'd have one message to share: Dare to go for it! Dare to believe in yourself, dare to bring your ideas to the table, and dare to speak up because your voice is out there, it deserves to be heard! [There are many] kinds of people, personalities and ways of being, so dare to take your place in a way that suits you and don't be forced to play a "game" to find your place at work. Personally, I'm very much into authenticity and transparency, and I hate power plays or role-playing to achieve your goals (HR6).

Something I didn't mention: I see women come into a sector [where they're in the minority], and often they're interested, but they'll leave and won't say why. When we ask questions, they'll say, "family stuff," but they won't give the real reasons because they don't want to make trouble. Maybe something happened, but they won't say. One of the challenges is to get the information, find out [what really happened] and ask questions. In human resources, if we take a form and ask ourselves what we could have done differently if we just look at the first layer and never scratch the surface, we'll never know (HR6).

A training course has already been set up to develop competencies in integrating women into [our] sector. This training project was set up in collaboration with [a university teaching institution...]. It was a three-part project: for women, for men and for groups. There were a lot of concepts of tolerance and diversity, but there were also the specific needs of women in companies, particularly in the context [of our companies], in relation to fly-in-fly-out work (HR5).

Things have changed a lot in recent years too. In my company, ZZZ, we now have compulsory training every year. When it comes to harassment, etc., it's not accepted. We're told to talk about it as soon as we hear something like that. It's not necessarily just women, but it seems to me that there are examples of this sometimes, remarks like: "You're intelligent, even though you're pretty." I'm made aware of this every year, and that's why I'm more likely to respond on the spot (HI1).

There's training for all employees [on] racism, harassment, etc. It's updated every year. It's done online, [you watch it] on your own, in 45 minutes. There are scenarios, and then we're asked questions about how we'd respond. There are no right or wrong answers. It's really self-training to bring us up to date every year (HI2).

We need to offer mandatory training because most of the people who are going to [attend these virtual training sessions] will be people who are already aware (HI8).

Women have risen through the ranks, and women who were treated as [...] "dummies" [have become bosses]. [...] Operators have learned to tread lightly, knowing that they're going to be their boss very soon (HI10).

Coresearchers' reflections

At the end of the 1990s, there was little talk of in-company training to limit or eradicate sexist or racist gestures and discourse. Today, there is a lot of talk about it, which shows that society is really changing. However, questions remain. Should such training be compulsory? How should it be carried out – face-to-face or virtually? What is the value of such training in bringing about in-depth change to organizational values and culture? Internal working groups could be set up, or external consultations carried out, to develop tailor-made training programs that do not perpetuate prejudices, stereotypes and discrimination.

► 6. Implementing corporate integration support strategies

The implementation of integration support strategies in companies could take the form of discussion forums for women, Indigenous people and people from immigrant backgrounds so that they can share their difficulties and create a network they feel a part of. It is important for companies to take cultural differences into account and help all women along the way.

One strategy for integration could simply be for men to adapt their vocabulary to make it more inclusive and thus avoid talking about “the guys.” The need to create a work climate that allows women to be heard and to express themselves also arises. To grow in an environment where women are in the minority, it is essential for them to stay true to themselves and not to cower before the gaze and judgment of male colleagues

To integrate women into engineering environments where they are largely in the minority, they need access to clothing that fits their physique and work tools that conform to their morphology. Women also need access to spaces — even housing — reserved for them, especially when working in remote areas.

In their own words:

I don't have many opportunities for interaction in my divisions, but in others, it brings me into contact and provides me with other, different approaches (In7).

Giving new employees real confidence fosters a sense of integration, and that can be the key: to feel supported [...] and to be present, to listen (In30).

A female boss helps an employee to take her place by asking: “What do you think?” (In25IM).

Increasing the information we give to immigrants, women from immigrant backgrounds, about how they can find support throughout their journey: before they arrive, during their [integration] and job search phase, but also afterwards, once they've started working somewhere new [...]. At least in Montreal, there are a lot of resources (In36IM).

The women were stuck wearing clothes from the store that supplied the [...] men. They were too big, and they didn't fasten properly. It didn't work from a safety point of view (HR1).

On some work sites, if a woman wants to, there will only be women in her house. It's a question of [...] safe spaces (HR4). We also had to set up separate locker rooms. From the point of view of physical and psychological safety, this is essential (HR1).

Coresearchers' reflections

Company management cannot ignore the importance of implementing integration strategies for all women in their companies. Examples of such strategies exist. How can these strategies be shared, implemented and evaluated?

It is true that women are very much in the minority in some engineering sectors. However, providing the right clothing and equipment for them is a matter of workplace health and safety.

► 7. Sharing women's strategies to help others adapt to their environment

One idea that often emerges involves sharing women's strategies to help others adapt to this environment, as some women tolerate sexist remarks in order to continue working there. Others adopt more head-on strategies, such as responding to inappropriate remarks with their own comments, or simply by replying in the same tone as their interlocutor. Even though women are prepared to respond and no longer let themselves be bullied in certain oppressive situations, it is still a burden they should not have to bear alone.

Among women, there is also the phenomenon of behavioural conformism: modifying your behaviour to adapt to a male-dominated environment by minimizing certain traits linked to femininity, e.g., the way you dress, behave and expresses yourself. However, this strategy quickly proves to be unproductive and a disservice to women, who come across as less than authentic. Staying true to your values and not hiding your interest in feminism is the attitude to adopt if it reflects your deepest values.

Feeling obliged to go through a male colleague to get your point of view across — otherwise, it will not be taken seriously in meetings — can yield positive results, but doing so creates an imbalance that penalizes women. To deal with different situations, you need a strong personality and the ability to express yourself openly.

Creating groups of female workers is important for retention in the industry. Forming groups of women workers as soon as they are hired contributes to their development and their retention. There is also the possibility of creating women's teams for Indigenous women, among others, so that they feel they do not have to do what men do to succeed. Cohorts of women would help combat isolation, especially when they work in remote areas, and enable them to study and work together, thereby compensating for their minority presence.

In their own words:

There are attempts to form a women's group, such as an all-women equipment operator program. [... It seems that if women have] training close to home, it gives them immediate access to a job, so they'll go for it. If, on top of that, they're in a group of women, it's going to be a really different dynamic than if you're two girls in a group of 20 men (HR5).

I visited [places where women engineers are clearly in the minority] this spring [...]. In particular [where...] there was an all-female team [...]. I thought that was really great, and they probably want to remain a women's team. No doubt there's also positive discrimination when they choose their team members. But this kind of team is an exception (HR5).

When I was at another [company], we didn't have many women, and we didn't have many First Nations women. What we did to make it work was to hire four of them on the same team, and we told our contact there that these were positions that didn't require any specialization: "You're going to find us some women, you're from there, you're going to find us some women's CVs and we're going to hire them all on the same team so that something develops and they don't feel all alone." We managed to hire four women for a team of six, and it was a great success, even if it was fly-in-fly-out work (HR4).

Coresearchers' reflections

Some women express the need to do what men do in order to succeed. What makes them feel this need? It would be interesting to ask whether some of the women who leave engineering or the girls who do not go are, in part, those who do not want to conform to a style (dress, speech, gestures, etc.) or behaviour that does not suit them.

► 8. Appointing women to management positions

Companies stand to gain from making the presence of women in engineering more credible. Appointing more women to management positions encourages other women to enter the field and perhaps bring a more humane and inclusive management style. Some people in human resources claim that women lack the skills to be promoted. So, it is simply a question of finding a way to develop these skills among women so that they can be promoted rather than simply sticking to the status quo.

Hiring women to management positions involves creating professional co-development groups in the human resources field and encouraging the creation of women's teams in workplaces where they are in the minority.

In their own words:

Women have been at the top for quite a long time. Giving women credibility: there are a lot of women doing it, there are a lot of men who have started to do it more and more (EU2).

When I started in the business [...], I really saw the boy's club. I'm convinced it exists, and when I was confronted with it, I started reacting and saying: "Oh no, it won't work like this!" And yes, there are going to be women hired because I have power when it comes to recruitment, and yes, if there is a complaint of sexual harassment, it will be dealt with, and it will be dealt with seriously (HR4).

It might be interesting to set up co-development groups for women new to the job [...]. They always end up saying: "I thought I was alone" (HR1).

Onboarding is planned for all employees, and people will do their health and safety training largely at home. Then, they'll meet with human resources and engineering people to talk about the realities of the operation, plant people, community relations people, and so on. It lasts a day or two [...]. It's the same whether it's a man or a woman (HR3).

Where I work, I find that there are a lot of women in managerial positions, much more than what I experienced in XXX. I don't know if it's because, as you say, they know how to communicate better and manage teams better or if it's because they want to have more women in management positions, but in any case, I find that in all the teams where I work, things are going very well. I'd say we had a former boss who has now left, who was really popular and really appreciated, both within the company and with customers. [...] I think she really knew how to manage her teams. Really, it was like becoming a family, and everyone got on well together (HI2).

Coresearchers' reflections

There is a shortage of women in management positions. However, when they do hold these positions, they are generally very successful. Pooling women's management strategies with those used by men could contribute to a reflection on the traits of the type of leadership and management practices that are most relevant, particularly in sectors where women are underrepresented.

► 9. Analyzing corporate websites

While rolling out this project, it became clear that it was important to carry out an analysis of engineering-related company websites. It was an opportunity to reflect collectively on the iconographic and textual discourses conveyed by these sites, mainly in the mining and oil fields. The aim of this analysis was to find out how different groups were represented, including men/women, people from immigrant backgrounds and Indigenous people, as well as what inclusive approach was used, if any. The aim was also to find out how companies consider certain practices associated with EDI (equity, diversity and inclusion). The

work stems from a content analysis of eleven (11) websites.² The results are presented thematically, with particular attention paid to the way women were portrayed: their posture, position, interactions and the way they are addressed. A few remarks are also made about Indigenous people and people from immigrant backgrounds.

9.1 Gender representations

- The representation of women in photos varied from website to website. While they were slightly outnumbered by their male colleagues in general, they were virtually absent on some websites (SW2, SW3, SW8, SW11). Since the need for female role models in engineering plays an important role in the desire to pursue a particular career, websites that do not offer female role models do not help young female students identify with and choose such fields.
- Several photos showed women in portrait mode, i.e., facing the camera and posing (SW3, SW6, SW9, SW11). As a result, women are not perceived as being active in their environment, compared to male representations. Some sites, however, showed women performing an action, on the move. This was not a pose for the photographer — it was more representative of reality (SW1, SW2, SW4, SW5, SW7, SW10).
- Women appeared in images in specific settings. Typically, these settings were related to career, culture, community and environment. They were often excluded from supervisory settings. Functions involving heavy equipment, leadership, boards of directors, maintenance work, skilled trades and operator positions were most often represented by men. Women were present in the company sites analyzed, but not in all job types or functions (SW1, SW2, SW3, SW5, SW7, SW9).

2. Each website is associated with a random number from SW1 to SW11. If a website is not mentioned, this does not necessarily mean that the findings are not attributable to it, either positively or negatively.

- Women were often shown alone in photos, while men tended to work as part of a team. This does not help women feel included in teamwork. Instead, they are isolated. This type of representation suggests that there is a form of camaraderie between men on worksites and that women are very little involved. By showing that a large majority of men are on the worksite, on teams and in action, women will be led to believe that their own social circle on the worksite will be restricted (SW7, SW9).
- In the websites analyzed, the women featured in the photos appeared young (20-45 years old). This suggests that, in general, women are new to the mining and oil sectors, compared to the men shown in all age groups, implying that they bring experience.
- Several websites featured videos. In some of them, women were present and granted equal speaking time to men. They participated as much as men in testimonials about work experience (SW5, SW7, SW9). The condition of women working in traditionally male environments was also addressed in this type of medium (SW1, SW4). In this way, these sites emphasized a desire to recruit women. One of the websites featured videos and articles about women's experiences in remote areas (SW5). These videos can have a positive effect on recruiting women.
- Some websites mentioned initiatives implemented by the company to integrate and retain women. For example, using gender-neutral language in job listings, presenting a work-life balance program, etc. (SW4, SW6). However, the vast majority of sites analyzed made no mention of programs or practices implemented to integrate women.
- Some websites worked to deconstruct gender stereotypes, presenting, for example, a photo of a father with his child (SW10). Sometimes, family-work balance was addressed by promoting arrangements that displayed the blossoming of professional, family and personal life without perpetuating the image of maternal responsibility (SW4, SW9). On the whole, however, women and men were presented as falling into traditional gender roles.

9.2 Discourse on Indigenous communities

- When Indigenous people, such as women, were integrated into the visual fabric of the website, their representations were limited to career categories associated with culture, community or environment (SW3, SW5, SW7, SW9).
- Some sites were translated into an Indigenous language. This is one way of highlighting the company's commitment to integrating these cultures (SW1, SW3, SW5).
- Four out of eleven websites gave greater prominence to Indigenous communities. The work experience of these people and their integration into the company were visible in the audiovisual materials. For example, a man explained racist behaviour in the workplace. Another educational video showed the importance of understanding Indigenous issues for a positive future. The use of videos to illustrate these realities reflects an interactive, integrative and inclusive approach (SW1, SW3, SW5, SW7).

9.3 Discourse on visible minorities

- Visible minorities were present in the photos of almost half the sites (SW1, SW2, SW4, SW8, SW9). In contrast to the “women” and “Indigenous” groups, it seems that these people were relatively homogeneously incorporated across sections of the analyzed websites. When they were present, they were in action. Sometimes, they were relegated to a specific “Diversity and Inclusion” section (SW6) specifying the programs put in place by the company for the integration and retention of people from diverse backgrounds (SW6).

This website analysis gave rise to the idea of producing a questionnaire for the evaluation or self-assessment of corporate sites wishing to raise awareness, integrate and retain women in their corporate staff.³

3. The questionnaire is appended.

Coresearchers' reflections

Websites that do not feature female models do not help young female students identify with and choose related areas. If women are present, they should also be in action, with or without men. They could also be depicted in supervisory positions. When women are presented alone and men are in a team setting, it does not help women to feel included in teamwork. This type of representation suggests that there is a form of camaraderie between men on worksites, and that women are very rarely included.

It is good to see that, in most of the videos, women are granted equal speaking time to men. It is a way of emphasizing the desire to recruit women.

When Indigenous people, just as women, are integrated into the visual fabric of a website, their representations are too often limited to career categories associated with culture, community and the environment. The work experience of Indigenous people and their integration into certain companies are visible in audiovisual documents. At this point, there is a real voice for Indigenous people. The importance of understanding Indigenous issues for a favourable future is addressed. The use of videos to illustrate these realities demonstrates an interactive, integrative and inclusive approach.

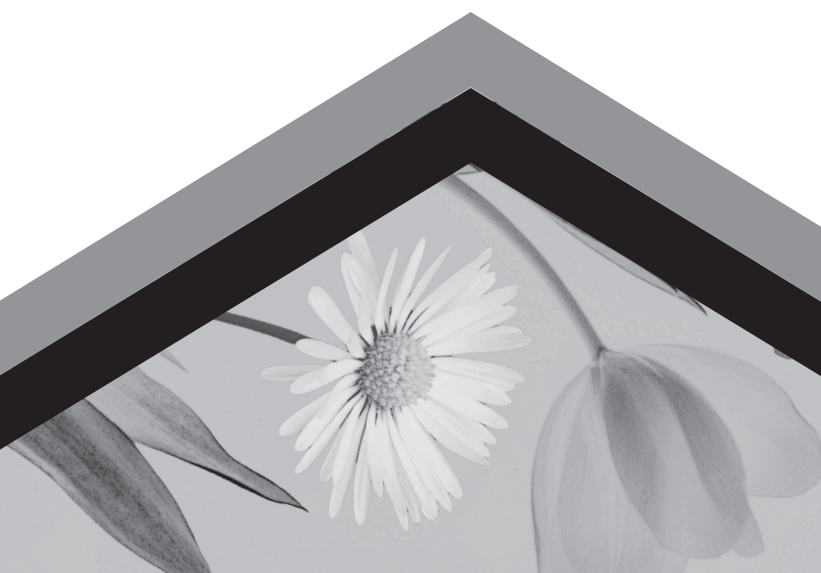
Visible minorities are present in the photos of almost half the sites. Unlike the "women" and "Indigenous" groups, it seems that these people are relatively homogeneously incorporated across the analyzed websites. When these people are present, they are in action.

All these findings suggest that companies, as well as educational institutions, would do well to review their websites and make changes to project a better image of equity, diversity and inclusion. The appended questionnaire is one way of carrying out this self-analysis and self-assessment.



Chapter 17

Strategies and solutions to promote the recruitment, attraction, integration and retention of women in engineering for companies and parents



During the interviews, all participants provided ideas for strategies or solutions to promote the recruitment, attraction, integration and retention of women in engineering and, more broadly, STEM (science, technology, engineering and mathematics). The people who submitted proposals for solutions for society in general were women in engineering (7 In), women engineering professors (2 PI), an Indigenous specialist (1 SA) and men with ties to engineering (8 HI). A total of 18 different people provided strategies to be implemented in relation to society in general. The strategies proposed here are directly related to companies. However, ideas relating to society are proposed in the sections dealing with the academic and business spheres, which are indeed integral parts of society.

► 1. Deconstructing societal stereotypes at school

In education, it is important to deconstruct the gender stereotypes induced in early childhood. It is a matter of taking this issue into consideration from elementary school onwards, gendering less in education and leaving more room for girls. This requires toys that go beyond stereotypes (dolls and trucks), ones that develop creativity, construction processes and various technical aspects.

Starting to talk to girls about engineering as early as daycare or kindergarten helps to promote the field and change attitudes because, once again, it is at these early ages that gender stereotypes are apprehended and internalized by children. When it comes to educating children, promoting gender equality as part of the values transmitted from an early age helps to bring about long-term change. For example, from infancy onwards, we suggest teaching little girls to respond and defend themselves, changing the perception of masculinity and teaching boys to express their emotions and sensitivities.

In their own words:

It goes back a long way to childhood, in fact. [...] Women are brought up to fit into a framework, men are brought up to fit into a framework. The day we understand that it's not like that, that's not how it works, we won't have this problem anymore. When you get to the end of high school, telling girls that they should go into [scientific] subjects — it's

too late. Right from the start, telling boys to, “be strong, grit your teeth, don’t cry,” and girls, “my princess, you’re beautiful, be gentle, be nice,” it starts from there (In38IM).

Little girls are taught so much about taking care of babies, animals and cuddling, whereas a little boy is taught to be [tough] with trucks and LEGOs [...] I think it starts from that far back and that’s what creates inequalities at work in the long run (In1). So it would be important to let young girls have more LEGOs, [the right to] kick, [to have] trucks (In1).

To develop creativity and construction skills, etc., that starts in childhood, buying stereotyped games and telling [a little girl], “you have to take care of a baby,” not [telling her instead] “you can build, you can do other things” (In15).

Encouraging young girls to take apart electronic devices [...], encouraging them to do so rather than discouraging them (PI6).

Coresearchers’ reflections

The idea that young girls should be encouraged to play all kinds of games, manipulate construction materials and so on, is not new. It is often associated with the development of geometric and spatial competencies. Both girls and boys can develop similar competencies if their educational activities are aimed at this kind of learning.

► 2. Promoting role models for women in STEM (science, technology, engineering and mathematics)

It is a matter of putting forward models of women in STEM fields in societal representations and not just for promotional purposes. While having female and male engineers in their entourage may have been a motivating or at least facilitating factor for some of the women we met, others pointed to the absence of role models as something relatively penalizing. This means that it would be beneficial to make engineering accessible to a wider audience that does not have the chance to rub

shoulders with women or men in engineering. Working on the way this profession is portrayed in the media and other TV dramas helps to deconstruct gender stereotypes.

We need to provide young people with female role models to help them see a future for themselves in STEM fields. Too often, images and videos show men at work, making it difficult for girls to see a future in these fields and say: “I belong there”. Role models are also needed in university engineering education.

In their own words:

The vast majority already have engineers in their circle. So, for the women who don't, it's [... about finding out] how to put them in touch with these role models. Let every family have an engineer (laughs) (In7). It would be important to provide approachable models (In7).

It is suggested that young people be integrated into this celebration [of International Women's Day] by showing the achievements of some [of them] (In5).

When we show images and videos, often what we see are men working on projects, so it's hard to see ourselves there and say: “I belong there” (PI6) (see website analysis, Chapter 16).

Coresearchers' reflections

Changing the way we depict women in general will influence the way we perceive women in STEM (science, technology, engineering and mathematics). It is a process that helps to deconstruct gender stereotypes and change the way society perceives women.

► 3. Using the institutions and organizations working on the issue of women in STEM

Using bodies and organizations that are sensitive to women's issues — particularly in STEM fields — is a way of making them aware of antisexist issues and the need to value women's competencies, as there is a certain consternation around the lack of awareness

of antisexist issues in society in general. This awareness is essential and one of the keys to changing mentalities and improving the realities of women in the workplace.

There is a relative and gradual awareness of these issues on the part of men, thanks to the dialogue initiated by women. Even if there is still work to be done, a majority of men seem ready to think about these issues. It is therefore necessary to talk about them and to carry out studies on the subject. The Ordre des ingénieurs du Québec could play an important role in the inclusion of women. In addition, it would be important to support bodies concerned with the issue of women in STEM and perhaps to create some specific components linked to education and industry.

Coresearchers' reflections

Creating an exhaustive list of organizations working on the issue of women in STEM (science, technology, engineering and mathematics) and bringing them together could allow them to discuss their actions and specialties and thereby coordinate various activities that encourage women to choose STEM fields.

► 4. Raising awareness of antisexistism and the need to value women's competencies

There is a certain consternation arising from the lack of awareness of antisexist issues in society in general. For example, inappropriate gestures and remarks in the workplace are too normalized. Awareness-raising is one of the primary challenges in changing mentalities and improving the realities of women in the workplace, as well as in valuing their competencies. What is more, there is a relative and gradual openness on the part of men to these issues. It would be good to initiate dialogue around the situation of women by highlighting the importance of March 8, for example.

In their own words:

Inappropriate gestures and remarks in the workplace are so normalized that people don't necessarily understand why they should be reprimanded at work (In1).

This highlights the importance of raising boys' awareness of women [... because] the more we can raise young men's awareness of the fact that a woman can [be] an asset in a predominantly [male] profession [...], the more open they will be to seeing women as an asset (In1).

On the subject of March 8, let's take the liberty of saying: "You know, it hasn't been like that for a thousand years either. It's quite recent in our history that these rights have been won, and they're not for all women. If we think of Indigenous women, they didn't have these same rights at the same time as white women, etc." [...] "If we look more broadly in the world, women's rights are not the same as white women's rights. We're fortunate to be in Quebec, etc." [...] and when we do raise [this awareness], people say: "I guess it's okay that you have a day for this" (In7).

Coresearchers' reflections

In recent years, there has been an increase in social awareness of the realities of women in STEM, and men are taking part in this reflection. How can we take this social awareness further?

► 5. Making sociocultural considerations for Indigenous people

Sociocultural considerations must be made for Indigenous people in the educational system. For example, many Indigenous students make several stops along the way to start a family, and it is often at the age of 35 that they are ready to return to school.

In the school system, prejudices can be countered in various ways, for example by presenting a history of Indigenous cultures in different courses, from primary school to university. It is not just up to Indigenous people to change mentalities and counter prejudices. For

example, university administrations have a role to play in organizing awareness-raising events. It is not just a matter of asking Indigenous teachers to raise awareness. What is more, some courses could offer ecological and environmental perspectives — it is up to universities to create them while building bridges with Indigenous peoples.

In their own words:

For example, [it's unthinkable] to expect a school career that starts in kindergarten and goes all the way through to university. [...] The education system and universities will have to accept [this realities] (SA).

To raise awareness of Indigenous cultures, I start my lectures with a video on Indigenous history because we need to have a shared vision of history. What's being taught to 20-year-olds today has [already] been taught at university, in elementary school, in high school. It's not great stuff about Indigenous people, or it's too little. It's that we're still an invisible people. It's important to use history to understand why we are the way we are and why we're so wary and reluctant to mix with Westerners for work. Of course, there are still a lot of prejudices (SA).

Coresearchers' reflections

What we have said about the intermittent schooling of Indigenous people also applies to other women who start families and want to return to school in their thirties or forties. The question then arises: How can we, as a society, facilitate these transitions?

► 6. Avoiding discrimination against women from immigrant backgrounds

In the workplace, it is important to deconstruct prejudices and express that a woman from an immigrant background has not been hired because she is an immigrant and a woman, but because she has the competencies required for the job.

In their own words:

It's important to deconstruct the idea in the workplace that this immigrant woman was hired because she's an immigrant woman, she was hired because she has the right competencies, but yes, with equal competencies, we prioritized her application [...], and that "with equal competencies" remains ultimately the priority issue. We're never going to hire an immigrant woman who doesn't have the competencies. That's something which really bears repeating because there are a lot of prejudices out there. [...] Once migrant women or immigrants are integrated, they will often experience a form of discrimination, a form of harassment, telling them: "You've been hired because you're an immigrant, and in the end you stole the job from a friend of mine, who had her qualifications and competencies" (SI).

Coresearchers' reflections

These considerations about people from immigrant backgrounds are just as valid for women in general but also Indigenous people. All too often, it seems that if someone who is very much in the minority is hired, it is because they have been given priority and their competencies have been given very little consideration. These persistent prejudices are harmful to everyone. It is important to deconstruct them because we are not doing anyone any favours if someone does not have the skills for the job.

► 7. Making considerations for human equity

On various levels, human considerations around equity are necessary:

- It is in women's interests to fight for pay raises and not leave it to company management. This involves a learning curve for many women.
- For men, it would be important to make them aware of what psychologically or verbally constitutes an assault on women in the workplace by asking them, for example, what their response would be if such situations happened to their daughter, or to girls in their entourage.

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- It is necessary to denounce any situation where the ideas of a woman or any other person are ignored or “stolen” by others who appropriate them.
- Notetaking should be the responsibility of the person organizing the meeting, or they should designate someone to do it, even before the meeting. On university teams, it would be important to encourage equitable notetaking between girls and boys in group work situations.
- As long as society does not resolve the problem of daycare and its accessibility, women will continue to suffer injustice, and it will always be difficult for them to be fully involved in their work. It is essential to have a societal debate on daycare.

In their own words:

There's an extensive campaign right now [where] we're trying to get into people's heads: "Would you want your daughter to work here?" And that's the angle we're trying to take [and ask]: "It's okay to make comments about the girl you find "cute" who's not in your family, but would you want your colleague to say that about your daughter?" That's kind of the angle we're trying to take right now (HI5).

As for notetaking, if someone is organizing the meeting, the organizer should take notes or at least be responsible for having already appointed someone (HI10).

On the subject of women taking notes in meetings, I'd say that in 40 years, there's been a considerable evolution. At the start of my career, yes, it was almost natural to assign them this kind of role. I'd say that in the early 1990s, things started to change quite a bit and their presence increased too (HI4).

Until our society gets this sorted out, it's going to be hard for women [to get fully involved in their work], and that's unfair (HI1).

Coresearchers' reflections

Ask yourself: "Would I want my daughter to work for the company that hired me?" This is a good question to start thinking about the dimensions of sexism and racism in a company.

The availability of affordable childcare has been an ongoing debate for decades, and the lack of available spaces is still an issue, penalizing women who want to work. It is a public policy issue.

► 8. Encouraging the involvement of Indigenous communities

Indigenous communities must be involved in mining development, not simply as advisory groups, but as decision-makers and their expertise must be considered. For mining projects already underway, it is essential to promote integration, compromise and offer employment opportunities.

For new projects, it is important to consider the opinion of Indigenous communities (even if they refuse) and to integrate them as true financial partners, while recognizing their autonomy and independence. It is important to recognize and promote Indigenous expertise so that projects align with them, are in line with their values and recognize Indigenous people as decision-makers.

Indigenous women need at least one role model, mentor or even Indigenous professor to motivate them to go into a STEM (science, technology, engineering and mathematics) field, whether that's at CEGEP or university. For example, to get Indigenous students to accept an invitation to talk about their culture and their vision of nature in class, it is necessary to ask them privately and help them prepare a teaching capsule on the subject, thereby creating cultural safety.

In their own words:

I don't think we'll be able to close all the mines anyway, and we have mining needs that aren't going to stop tomorrow. To follow up on that, I know that Indigenous communities — among others with mining projects already in operation — want these companies to be exemplary corporate citizens who involve communities through jobs, partnerships

Strategies and solutions to promote the recruitment, attraction, integration and retention of women in engineering for companies and parents

and economic spin-offs. The best example that amazes me is every time you go into the camp [of this company], and all the signs have been translated into Innu. That's basically a step forward. I think there are great things to be done (In26A).

As for new mining projects, that's another matter. How will they be carried out? Does it have a major impact on the region? There are some projects that communities don't want to hear about at all because they affect their land too much. And then, when they say they're interested, how do we get them involved? Maybe they don't just want maintenance or cafeteria jobs anymore — maybe they're also asking to be financial partners, to enjoy spin-offs and to build real economic security for our communities. That's how I see the mining sector (In26A).

I think we need to build up a body of Indigenous professional expertise that will enable us to be there at the start of the project so that the projects align with us (In26A).

It is essential to have Indigenous mentors and professors in college and university training to create cultural safety. [...] Many Indigenous women already serve as role models or mentors in the STEM field (SA).

Coresearchers' reflections

Considering the expertise and vision of Indigenous communities is essential to the pursuit of engineering work in the mining and oil sectors. Much remains to be done to reconcile cultures with different pasts, diverse ways of thinking and evolving realities. There is also the question of how to make room for Indigenous women in engineering — a field that is difficult for most women to break into.

► 9. Considering the realities of women from immigrant backgrounds

Antisexist measures, policies and actions need to be put in place in organizations to encourage the hiring and retention of female engineers in the mining, oil and gas sectors. One of the main difficulties identified by women from immigrant backgrounds is the complexity of obtaining recognition for diplomas and the challenge of making the

most of competencies and experience acquired outside Canada. It is only natural, then, that one of the main solutions should be to facilitate these procedures and to trust people and their educational pathways.

Networking should also be a priority to increase the retention of women from immigrant backgrounds. It would be good to help develop a network, particularly for racialized women, as early as possible during their studies, rather than waiting until they are in the market for a new job. It is also important to support non-French-speaking people from immigrant backgrounds in adapting to their new language landscape.

In their own words:

It's not always about the difference between men and women. It's about having this mutual trust in each other's backgrounds, even if they're not very similar — trusting in the fact that an immigrant has indeed studied, has proved their professional worth beforehand and is capable of integrating into a culturally different context (In36IM).

For linguistic adaptation, practice is required: if you don't practise, you gain absolutely nothing. If there was a course where you could sign up, [...] volunteer to practise in the afternoon [...], which would be wonderful, it would be an excellent exercise to do (In32IM).

On the question of equity, [...] [it's] not because I'm a woman that I should be paid less than a man. It's the person's ability that should prevail, what we can contribute as individuals or as professionals, not because I'm a woman or a man (In37IM).

Coresearchers' reflections

For women from immigrant backgrounds, it seems to be mainly the recognition of prior learning that is lacking, as well as the tight deadlines to get that done. Political will is needed to achieve this.

► Conclusion

Receiving little mention was the idea of pursuing research to gain a better grasp on *The Realities of Women in Engineering: Joys in environments where they are clearly in the minority and to explain the lack of their attractiveness to women* — but it did come up a few times.

We need to talk about it to study it because it's relatively new to be studying all the issues that women can experience at work (In1).

Coresearchers' reflections

In conclusion, the idea of pursuing research to understand *The Realities of Women in Engineering: Joys in environments where they are largely in the minority* was raised very little, yet it remains a factor. This avenue is essential if we are to go further in understanding the situation, especially for women who are leaving the profession and who are difficult to reach.



Chapter 18

A strategy for recruiting,
attracting, integrating and
retaining women in engineering:
mentorship



During the interviews, all participants provided ideas for strategies and solutions to promote the recruitment, attraction, integration and retention of women in engineering and, more broadly, STEM (science, technology, engineering and mathematics). Suggestions for mentorship were received from: women in engineering (19 In), female engineering professors (10 PI), female high school to university students (8 ESCU), HR specialists (3 HR), an Indigenous specialist (1SA) and a man with ties to engineering (1HI). A total of 42 different people provided specific input for a mentorship program.

► 1. Summary of results

Mentorship can be an effective way of attracting girls to engineering studies and retaining them, especially when it involves girls who are fellow students, people from the same field of study or someone from a professional or academic background that is relatively similar to that of the mentee. These could be female mentors who have completed one or two more years of study than the mentee. For post-graduate students, research supervisors can also act as mentors, supporting and guiding students on their academic and career paths.

With a view to implementing effective practices, mentorship programs to facilitate integration and retention are offered to both men and women. Mentorship is also important for female students and workers from other cultures. In effect, a mentorship program benefits the work environment and career path. It is a way of offering support and making mistakes less dramatic. Mentorship programs are perceived positively as a springboard, great encounters, an idea to pursue and useful for professional integration as well as personal and collective enrichment. However, there is a lack of groups for women to share ideas in these male-dominated environments.

There are negative perceptions of mentorship in the case of poorly trained (or not trained at all) mentors and mentors who tend to convey their concerns rather than provide strategies for integrating into and thriving in the workplace. That said, under certain conditions, mentorship is a good strategy for helping people know what to do and what not to do. It is both an integration and retention strategy, as it

usually helps to reassure a newcomer. For mentorship to be effective beyond encouragement and for the relationship to work, the mentor must share the same basic values as the mentee.

Informal mentorship also exists and can be very beneficial. While mentoring is essential to foster support, integration and interaction, it must also be inclusive and free of prejudice, hence the need for good training, structure, etc.

Supporting women in management positions through mentorship and recognizing the excellent work they do helps to ensure that their type of leadership is respected.

It is important to ensure that the mentor enjoys the tasks entrusted to her, is fully committed to the mentorship process and works closely with the mentee: sharing experiences and difficulties, being patient, inspiring, understanding, listening to as well as answering questions and explaining how the engineering environment works regarding women. It is an opportunity to provide tips on how to adapt to and increase awareness around the challenges of the environment.

Men's involvement in mentorship seems to be beneficial for discovering certain work realities through interactions in a predominantly male environment. At the same time, the women mentored become models of success. In addition to this mentorship, the Ordre des ingénieurs also offers mentorship, which is very useful in helping young female graduates find their feet in the world of work.

In their own words:

It helps to have someone's experience to answer your questions (EC4). Mentorship is a good strategy to help you know what to do and what not to do (EU4IM).

When it comes to the mentorship program, I don't think it should just be women mentoring women. Sometimes, when it's a man mentoring a woman, it helps a lot with integration (HR1), not only as regards women but also men (H11).

The qualities of a mentor are: she has the experience, [...] she has patience, [...] a lot [of boldness and courage] for a woman. [...] To be] a leading woman who really cares about her ideas, is quite inspiring and understanding (In1).

A mentor reflected my qualities back to me [...], and she was able to identify my qualities and help me find my way in my first job (In1).

I haven't experienced any formal mentorship, but I consider that every person I've worked with has mentored me. [They taught me something, and I consider mentorship to be something they gave me [advice] — they trained me. For me, that's mentorship. I don't think formal mentorship would have helped me [more] (PI18IM).

I benefited from a mentorship program, which opened me up to a new network [...]. It's someone I'm still in touch with today, who has even become a friend (In38IM).

In a mentorship situation, we talk about technical subjects, if I have questions [...] — otherwise, we can also talk about career development (In7).

In a company, in a one-year mentorship program, there are a lot of activities organized in this program: dinners, activities to get to know the area [...]. It allows us to create a network of contacts right from the start (In18).

Helping someone feel more confident, [...] for me, is often key. In any case, that's what I do when I'm mentoring someone. [...] Most of the time, it's women from immigrant backgrounds that [I mentor]. I find one thing to be consistent: they all have doubts about their abilities. So, my trick is to give them the self-confidence they don't always have (In36IM).

Suppose a woman goes on to work mainly with men. In such a case, it would certainly be helpful to be mentored by a man in the profession, but to be mentored by a woman would provide a good example of another woman who has succeeded and grown in the profession (ES7).

A mentor can support a girl who doesn't necessarily want to rock the boat. However, some unacceptable things may be happening to her, so she should be able to talk about it, but if she doesn't have a trusted resource person to go and talk to about it, [she may keep quiet or withdraw...] (PI1).

It's been one of the best things I've had in my career [...], I think it's been a springboard (In1).

It helps keep me in my job (In7).

From formal to informal mentorship: I had a sponsor, but I never met him. [...] He was appointed as a sponsor, but the sponsor also had to want to be a sponsor. [...] I didn't go to him during my year, although I loved my team (In24IM).

[It would be nice to provide mentorship] from one man to another [...]. If there were men who took time with [... other men who felt threatened] to explain why we do things the way we do, maybe the message could get through better (PI5).

Coresearchers' reflections

Mentorship programs are seen as beneficial. However, questions remain. What are the effects of compulsory mentorship, for both mentees and mentors? What role can informal mentoring play? What kind of training is needed for mentees? If there is no obligation, how can we get experienced people involved in mentorship programs?

Informal networks can be very effective, serving to share project ideas and raise the profile of their users. Yet women — particularly racialized women — are often left out of powerful networks in male-dominated fields such as STEM (science, technology, engineering and mathematics). Hence the relevance of mentorship, whose supportive, individualized accompaniment enables mentored women to better integrate into their milieu, gain recognition and perform well. It is partly through this mechanism that mentorship increases the presence of women in leadership positions.

Mentoring women in STEM is important to help recognize opportunities for promotion and advancement that are not gender neutral. On the contrary, human beings tend to feel more comfortable with people who are like them. In the world of work, this is reflected in the fact that men in positions of authority are more likely to encourage and promote other men than women, even if their merits are equivalent. And since more positions of authority are held by men than by women, men advance faster. How can we change this trend?



Negative perceptions of mentorship are created when mentors seek to lead their mentees to conform to the gendered female model that prevails in the company or social environment. This can happen with both female and male mentors, as mentors sometimes seek to prevent their mentees from experiencing the same abuses they have suffered. However, certain mentalities have evolved, and the gendered female model to which a(n) (often older) mentor tries to get a(n) (often younger) mentee to adhere does not contribute to changes in culture or mentality. How can we change this mentorship trend?

A variation of this risk occurs when a mentor – still with a view to helping her mentee – encourages her to confront gender stereotypes by going the extra mile. For example, a woman in engineering whose competencies are questioned more often than those of her male colleagues may be told to work harder than they do to prove her merit beyond all doubt. Or a mentor may advise a mentee who is experiencing gender-related microaggressions to ignore them, to “get over it,” to avoid confrontation that could worsen the aggressor’s behaviour. How can we show that such advice does not help the mentee?

In addition to encouraging the mentee to submit to a derogatory, unfair or even toxic situations, in certain circumstances, the mentor sows doubt in the mentee’s mind as to her lucidity in the face of the microaggressions she is subjected to.

This is why training is needed for mentors and mentees, to avoid assigning a mentor or a mentee without explanation, real interaction or relevance. While mentorship is essential for fostering support, integration and interaction, it must also be inclusive and free of prejudice, hence the need for appropriate training, proper structure and so on. What is more, when it comes to discrimination and microaggressions, mentors who have taken part in training can help mentees distinguish their responsibility from that of the institution or environment. They empower women by clarifying what they can and cannot change.

In fact, a mentor who advises a mentee to adapt to a harmful situation rather than looking for ways to challenge it risks perpetuating the injustices with which the female mentee is dealing.





Part 6

Perspectives



Chapter 19

Recommendations
for education, companies
and society



This chapter presents recommendations for both education and business aimed explicitly at finalizing the report on the recruitment, attraction and retention of women in STEM (science, technology, engineering and mathematics), particularly in fields where they represent less than 25% of the workforce. Other recommendations are general and concern all sectors and society.

The recommendations put forward here are based on the synthesis of all the research and, in particular, on the solutions and strategies proposed by the people we met: women working in engineering, female engineering professors, STEM (science, technology, engineering and mathematics) students, specialists in human resources, Indigenous people and the realities of women from immigrant backgrounds as well as men working in engineering.

► 1. Recommendations mainly for education

Some recommendations are aimed primarily at the education sector, though not exclusively.

- **Recommendation 1: Promote a sociopedagogical or socio-professional equity approach**

Establish the conditions necessary to foster an intersectional, EDI-sensitive (equity, diversity and inclusion), sociopedagogical or socioprofessional equity approach. The principles of such an approach are:¹

- **Principle 1:** Reviewing internal policies to ensure that they are free from both direct and indirect discrimination.
- **Principle 2:** Using inclusive language and inclusive writing.
- **Principle 3:** Working to raise women's awareness of the plurality of experiences of discrimination.²

1. Principles adapted from Lafortune and collaborators (2015) and Lafortune and collaborators (2024).

2. Principle adapted from Corbeil, Pâquet-Deehy, Lazure and Legault (1983) and Corbeil and Marchand (2010a).

- **Principle 4:** Promoting an EDI (equity, diversity and inclusion) perspective in all interventions.
- **Principle 5:** Supporting the transition from individual experience to collaboration and interaction.³
- **Principle 6:** Creating openness to diversity.
- **Principle 7:** Considering heterogeneity and diversity as ways to support collaboration and interaction.
- **Principle 8:** Believing in the potential of women to learn, succeed, perform, create, innovate and contribute to the advancement of companies.
- **Principle 9:** Countering stereotypes in ourselves and others.
- **Principle 10:** Avoiding categorization and generalization to limit the perpetuation of stereotypes and prejudices.
- **Principle 11:** Promoting and encouraging openness to feedback and change.
- **Principle 12:** Agreeing to co-construct in collaboration, but also in diversity, whatever that may be.⁴
- **Principle 13:** Adopting an intersectional perspective and considering — in our actions and words — all people, whatever their gender, ethnic origin, social class, culture, sexual orientation, religion, age, level of education, socioeconomic situation, legal status, disability, language, etc.
- **Principle 14:** Adopting a position of reflective-interactive practice in relation to our own prejudices, attitudes, actions, words, etc.
- **Principle 15:** Acknowledging that all social groups, including women, are not homogeneous.

3. Principle inspired by Corbeil, Pâquet-Deehy, Lazure and Legault (1983) and Corbeil and Marchand (2010a).

4. See Gervais and Lafortune (2024).

- **Recommendation 2: Take stock of inspiring approaches by and for women in STEM (science, technology, engineering and mathematics)⁵**

Within French-speaking Canada, an exhaustive review was drawn up of all programs implemented, research carried out and writings produced by and for women in STEM over the past 40 years. This review examined both organizational and pedagogical strategies, as well as the promotion of STEM careers. The goal was to make this information readily available and encourage the creation of innovative activities that go beyond those already designed, implemented, and evaluated.

- **Recommendation 3: Encourage change in those who work with girls but also with boys**

Despite all the efforts and work put in over the last few years, it is clear that not all the programs we have implemented have produced the expected results. It is indeed necessary, if not essential, to intervene with girls and young women to interest them in scientific fields and to make them understand that prejudices against them are unfounded. Other actions are needed to achieve this. If actions are taken with girls, but stereotypes and prejudices are perpetuated in schools (teaching and guidance services), families, the media and society in general, then these one-off actions with girls will not have the desired effect. In an effort to ensure that everyone involved feels called upon by the lack of attraction girls have towards STEM fields and to institute lasting changes in society as a whole, greater emphasis needs to be placed on the social analysis of gender issues and the realities of girls and women in STEM. It is essential to build sustainable changes aimed at encouraging girls from an early age to choose apprenticeships in these fields and ensure a significant presence and participation of women in STEM professions, particularly in environments where they represent less than 25% of the workforce (e.g., in the oil and mining sectors). This requires long-term coaching and promotion programs that ensure that girls and women make educational and career choices that are free from prejudice and stereotypes (Williams, 2021). It is equally important that

5. Recommendation inspired by Lafortune, Groleau and Deschênes et al (2022).

these changes also address what is being done with boys, raise awareness of certain words and actions, and lead to profound changes in stereotyped and prejudiced thinking.

- **Recommendation 4: Present role models to girls and women in a way that is original and relevant to today's world**

Provide role models for girls and women, not forgetting that there are 1,700 elementary schools and 400 secondary schools in Quebec alone, 193 of which have both levels. There are 48 public and 70 private CEGEPs. How can women in engineering pay attention to all these young people? Women in engineering say it is impossible to get into every classroom in Quebec to talk about their experiences. That is why it is important to carry out training-accompaniment initiatives for teachers, professors, guidance counsellors, company directors and men and women working in companies. Doing so would be beneficial in moving practices in the direction of professional competencies that accompany change and attitudinal competencies of women and men — ones that are related to entrepreneurial ways of doing things (see next chapter). Models could be presented to girls in educational institutions, using videos and teaching sheets that explain how to facilitate reflection and discussion.

- **Recommendation 5: Use the results of this research to stimulate discussion in various circles⁶**

Provide research results in the form of short texts on different themes and lead discussions on the same themes according to the following workflow: a reading intention, feedback on these intentions, a discussion on the content of the text and questions on actions to be implemented.

Setting a reading intention

- Based on the title of the text, what predictions can you make about the topic or content covered?
- What do you already know about the subject or the content of the text?
- What information do you think you will be able to access?
- What else would you like to know?

6. Recommendation inspired by Lafortune, Groleau, Deschênes et al. (2022).

What are the Realities of Women in Engineering in Quebec?

- What are you looking for in the text you are about to read?
- Are you looking for a solution or solutions to a problem you already know about? What is this problem?

Follow-up on reading intentions

- Think about your predictions. Did they prove or disprove themselves? Explain your answer.
- Think about your reading intention. Has the objective been achieved? If so, justify your answer. If not, what is disappointing, and why?

Reflection after reading

- What do you retain from this text?
- What did you learn from this reading that was new to you, that you did not know before?
- What realizations does this reading arouse in you?
- What might you change in your attitudes, words and opinions as a result of reading this book?
- If you had an idea to put forward for discussion, what would it be and why?
- What do you think your colleagues or team members would think of this type of text?
- Who should read this text? For what purpose?

Questions about actions

- What strategies or actions would help improve the situation of women in STEM?
- What policies could be adopted to improve the situation of women in STEM?
- What are the advantages of promoting a better situation for women in STEM?
- How can we raise awareness — among parents, school staff, scientists, company directors and managers, women and men — of the realities of women in STEM?
- If you had to intervene, how would you improve how women are guided towards STEM? How would you improve retention? Family-work-life balance?

► 2. Recommendations mainly for companies

Some recommendations are aimed primarily at companies, but are not exclusive to this sector.

- **Recommendation 6: Examine the systemic barriers women face in moving towards inclusive practices**

The systemic barriers women face are difficulties that prevent them from being recruited, promoted and paid equitably for equivalent or even superior work. Indeed, the structure and culture of an organization can influence the career paths of women in STEM. Inclusive human resources management practices involve diversified recruitment methods, training, career management and mobility aids, as well as concern for family-work-life balance, equitable promotion criteria and fair performance evaluation. Such an organizational culture does not tolerate incivility, harassment or conflict. It is important to adapt the rules so that they are clear, known and applied. Above all, there must be consequences to eliminate some of the obstacles faced by women, according to the various people we met. The review of practices by people in the field who advise specialized organizations on the realities of women in STEM (science, technology, engineering and mathematics) is a practice that needs to be introduced.

- **Recommendation 7: Revise corporate websites for equity by presenting STEM careers in a way that attracts women, without prejudices or preconceived ideas**

A review of websites becomes an opportunity to reflect collectively on the iconographic and textual discourses conveyed by the sites of different companies. The aim of such an analysis is to acknowledge how different groups are represented — men/women, people from immigrant backgrounds and Indigenous people — and to develop an inclusive approach. It involves asking questions about how women are represented, about Indigenous women and women from immigrant backgrounds, as well as their posture, position, interactions and the way they are addressed. The themes to be taken into consideration are representations of gender, discourses concerning Indigenous

communities and those concerning visible minorities. To carry out this analysis or self-analysis, a questionnaire has been provided in the appendix and explained in Chapter 16.

- **Recommendation 8: Encourage mentorship by making room for STEM pioneers⁷**

Develop a mentorship program involving pioneering women working in STEM or who have been conducting research on women in STEM for a long time. This program would include initial and ongoing training for new mentors and implementation strategies as well as broad dissemination of resources and benefits in terms of family-work-life balance, retention of women working in STEM and encouragement to engage in these areas.

- **Recommendation 9: Set up mentorship programs for girls and women in STEM**

Developing mentorship programs in all environments where girls and women come into contact with STEM: high schools and CEGEPs, the places where girls and young women begin to orient their career choices, universities where peer mentorship can be decisive for retention, first jobs in the field and career progression. These programs would be combined with both initial and ongoing training for mentors, offering implementation strategies as well as widespread dissemination of resources and benefits in terms of incentives to engage in these fields, family-work-life balance, retention and progression.

► **3. Recommendations for both education and companies**

Other recommendations are aimed primarily at companies but are not exclusive to them.

- **Recommendation 10: Encourage the formation and analysis of groups to reflect on professional practices: a reflective-interactive practice**

Promote a reflective-interactive practice by forming practice analysis groups, professional codevelopment groups, learning communities or communities of practice that hold meetings

7. Recommendation inspired by Lafortune, Groleau, Deschênes et al (2022).

where work, meetings, leadership and management practices, as well as teaching and training practices are discussed with a view to changing these practices, considering:⁸

- Prejudices and stereotypes are conveyed at school, in the workplace, in the media and in families
- Women’s contributions to STEM (science, technology, engineering and mathematics) and the need for them in a changing world where all human resources contribute to the betterment of society

Through this reflective-interactive practice:

- Encourage school staff who teach scientific or other disciplines to reflect on their teaching or intervention practices to realize the influence they can have on girls’ and women’s educational and career choices
- Open scientific fields and reflect on the stereotypes and prejudices that are conveyed in various high school and CEGEP courses and that influence girls’ career choices

In a company setting, this reflective-interactive practice means:

- Setting up mixed and inclusive focus groups to build on what has already been achieved and develop a co-constructed analysis of issues to innovate in terms of inclusive and equitable practices
 - Providing training on reflective and interactive professional practices, with a particular focus on unacceptable gestures and language
 - Investing in the resources needed to counter stereotypes and prejudices
- **Recommendation 11: Provide reflective-interactive training for men**

Offer moments of collective reflection to men working in engineering, using research results in the form of scenarios. Depending on the moments chosen, include women to encourage interaction. Men need to become allies: “Concrete

8. See Appendix 2 for explanations.

actions by a company's management and well-established integration processes foster a rewarding and enriching experience in terms of professional development. The presence of male allies is also essential to create an internship environment where female students can develop a sense of trust" (Brodeur et al., 2023, p. 6).

► 4. Recommendations for all sectors and for society as a whole

Lastly, some recommendations concern all sectors and society in general.

- **Recommendation 12: Create a central body for provincial initiatives**

Review all the activities and initiatives carried out in Quebec in various sectors and launch an organization that would bring these initiatives together. This would be an opportunity to see if these initiatives are reaching everyone who is working with girls to encourage (and sometimes discourage) them from choosing STEM fields. Some initiatives could benefit from other projects. Projects may merge. Some projects could inspire companies or institutions.

- **Recommendation 13: Organize general meetings on intersectional issues concerning women in STEM⁹**

Bring together women from diverse backgrounds to innovate in addressing the realities of women in STEM and consider the disparities in these multiple groups: Indigenous women, non-heterosexual women, women from various STEM fields, women scientists who worked during the COVID-19 pandemic, pioneers in STEM and so on. A summit on all women in STEM — focusing on intersectionality and EDI — would enable French-speaking Canada to position itself as a constructive force working to ensure that women in STEM can take their rightful place.

9. Recommendation inspired by Lafortune, Groleau, Deschênes et al. (2022).

- **Recommendation 14: Reflect collectively on what girls and women in STEM say about their confidence to succeed**

Several research studies over the past 40 years have reported that girls' self-confidence in their STEM success is lower than that of boys. However, girls do as well as boys in science, and boys do slightly better in mathematics (OECD, 2018, 2023). Girls think they need excellent grades before deciding to go into STEM. A collective reflection on this supposed lack of confidence needs to be organized. Could it be that girls lack the confidence to succeed? Is it the boys who overestimate their competencies? What would be the balance between the two?

- **Recommendation 15: Work collectively to balance career and family life for women in STEM¹⁰**

Write a brief based on this research, which would serve as a basis for discussion with community, government and university organizations, as well as private companies, so that women scientists can contribute to the development of society and are no longer penalized for their family-related life choices. Propose and implement large-scale strategies for a truly supportive family-work-life balance for women working in STEM so that they can plan for a family life that goes hand in hand with a possible career in the field without suffering repercussions.

- **Recommendation 16: Continue research on the realities of Indigenous people**

It would be important to continue researching the realities of Indigenous women and men to understand their cultures and find ways of ensuring that the engineering field — in the mining and oil sectors — takes their viewpoints and realities into account.

10. Recommendation inspired by Lafortune, Groleau and Deschênes et al. (2022).

- **Recommendation 17: Continue research into the situation of women from immigrant backgrounds, particularly in engineering**

It is true that the present research reports on the realities of several women from immigrant backgrounds who would like to continue their work in engineering, taking into account their relevant education. However, it is difficult for them to have their achievements be recognized and transfer the competencies they have developed. We, therefore, need to find ways to encourage their integration into society by recognizing their education and the contributions their learning and expertise make to society.

- **Recommendation 18: Produce a documentary for the general public**

Draw inspiration from documentaries — *Picture a Scientist* (USA), *Ms. Scientist* (Canada), and *40 femmes en 40 semaines* (*40 women in 40 weeks*) (Polytechnique) — to propose a documentary or series of documentaries to be shown on *Les Grands Reportages* on ICI RDI or similar programs.

Coresearchers' reflections

Such recommendations require the collaboration of various partners from the worlds of education and industry, as well as political, economic and social entities. It is a major project of collective work and reflection that benefits not only women but, above all, society as a whole, which needs all forms of creativity to innovate in the STEM (science, technology, engineering and mathematics) fields.



Chapter 20

Competency frameworks for companies and educational institution management and their staff: fostering an organizational culture that facilitates the recruitment, integration and retention of women in STEM



To foster an organizational culture that facilitates the recruitment, integration and retention of women in STEM (science, technology, engineering and mathematics) — particularly in fields where they represent less than 25% of the workforce — two frameworks of professional competencies are proposed: one for accompanying change in corporations and the other for changes and reflections to be carried out by staff members in companies or educational institutions.

The definition of competence used here is the ability to act based on the effective mobilization and use of a set of diversified resources, both internal (knowledge, experience, skills, interests, etc.) and external (colleagues, team management, management of companies or educational institutions, document-based resources, materials, etc.) (MEQ, 2001). Becoming a competent person implies (Le Boterf, 2001):

- Knowing how to act and respond in a particular context, i.e., knowing how to deal with the unexpected and the new (initiative, creativity).
- Knowing how to combine and mobilize resources in a work situation (construction, integration).
- Understanding why and how a person succeeds or fails (learning process, metacognition).
- Being able to use or transpose competencies in other contexts (adaptation, autonomy).

► 1. Framework for accompanying change in corporations and educational institutions: Eight professional competencies (Lafortune et al., 2008a)¹

The proposed framework of professional competencies for accompanying change is aimed at people who are accompanying a process of change, either in a company or in education. It is in the interest of those who accompany change to appropriate the foundations of the change to be implemented. This reference tool is also intended for all those who play a coaching role in their environment (organizations,

1. Reference taken from: Lafortune, L. with the collaboration of Chantale Lepage and Franca Persechino (2008). *Des compétences professionnelles pour l'accompagnement d'un changement. Un référentiel*. Quebec University Press.

companies or other establishments) and who wish to improve the way they intervene, further develop their competencies, question their practice model or improve their professional action.

The framework is made up of eight professional competencies for change management. These competencies are exercised in situations, in interaction with others and in an environment with its own culture and habits. Here are the eight proposed professional coaching competencies, with a few explanations. A future project could further develop these competencies and provide the means to implement them.

- **Competency 1: Adopting a posture of change management**

This competency requires an understanding of the change that needs to be implemented, particularly in creating an environment where women and men can flourish while changing certain practices that devalue women from all walks of life.

- **Competency 2: Modelling a reflective-interactive practice in change management**

Putting yourself in a position to reflect on your practices as a leader, manager or organizer of teams so that work teams can reflect on their own practices and interactions and adapt them from an EDI (equity, diversity and inclusion) perspective.

- **Competency 3: Taking the emotional dimension into account when accompanying change**

This competency means acting in a professional capacity, considering the emotional dimension, to distance yourself from what is happening on an emotional level, to understand the situation and to implement solutions adapted to the situation.

- **Competency 4: Maintaining reflective-interactive communication in the preparation and facilitation of the change process**

This reflective-interactive communication aims to disseminate the orientations, foundations, issues and possible effects of the changes to be implemented while stimulating collective reflection on the subject.

- **Competency 5: Implementing professional collaboration to support a process of change**

This professional collaboration presupposes a commitment to collaboration, cooperation and consultation to build a shared vision of change.

- **Competency 6: Implementing action projects to support a change process**

Together with the staff, it is possible to set up action projects to encourage the process of change. This means fostering the mobilization and development of a culture associated with accompanying the women involved in the company.

- **Competency 7: Applying evaluative practices to actions implemented as part of the change process**

These evaluative practices are aimed at questioning people working in the company about their perception of change and its progress in the workplace.

- **Competency 8: Exercising professional judgment by acting ethically and critically**

This competency requires open-minded, critical judgment of your own actions as well as those of others working in the company — both men and women. This means avoiding all forms of discrimination, hasty judgments, inappropriate words or gestures.

► **2. Competency framework focusing on attitudes to be developed in work situations aimed at respect, equity and speaking up in companies and educational institutions: Eight professional attitudinal competencies (Lafortune et al., 2015)²**

Focusing on attitudes to be developed in the workplace, the framework of professional competencies is aimed at women and men working in various STEM (science, technology, engineering and mathematics) fields to promote the recruitment, attraction, integration and retention of all women, particularly in environments where they represent less than 25% of the workforce. Those responsible for company management, personnel management or work teams, as well as educational leaders can take advantage of this framework to accompany a change in attitudes among their staff, particularly to improve ways of doing things, interactions, communication and professional actions. Some competencies have already been built up by the people concerned — others are still being developed. Becoming aware of their state of evolution is important when it comes to influencing individual attitudes.

- **Competency 1: Mobilizing your own internal resources to change your attitudes**

Mobilizing internal resources means getting to know yourself in situations that require action, either to have your competencies recognized or to help others achieve them.

- **Competency 2: Developing teamwork with a view to co-construction**

Co-construction in teamwork means considering the ideas of others to build joint projects.

2. Reference adapted from: Lafortune, L. with the collaboration of L. Gervais, A. St-Cerny, B. Lacharité and D. Fournier (2015). *Accompagnement-formation d'une pratique réflexive-interactive féministe: le cas de Relais-Femmes*. Quebec University Press.

- **Competency 3: Communicating amidst complexity and diversity**

Work situations are complex (but not necessarily complicated). They call for reflection-interaction to act with respect towards women, men and diversity (culture, ethnic origin, religion, language, disability, etc.) and from an intersectional perspective.

- **Competency 4: Exercising shared leadership with a view to equity**

Shared leadership requires a non-hierarchical posture, which implies respect for all ideas from the people who put them forward, as well as consideration for the people who put them forward. It means taking points of view into consideration, without necessarily accepting everything.

- **Competency 5: Demonstrating complex thinking skills**

STEM issues require the mobilization of complex thinking skills. These skills are particularly relevant to tackling difficult-to-solve situations associated with women in different STEM fields, especially those that are less than 25% female, including women from all backgrounds.

- **Competency 6: Exercising critical and ethical judgment**

Some realities experienced by women in STEM fields are not always appropriate. Learning to exercise critical and ethical judgment is essential for both men and women, so as not to accept the unacceptable.

- **Competency 7: Engaging in professional development**

Engaging in professional development is important for recognizing unacceptable behaviour and attitudes in yourself (women who tolerate sexist or discriminatory comments or gestures and men who do not respond sufficiently to them) and in others — and for being able to respond to various unacceptable situations.

Competency frameworks for companies and educational institution management and their staff: fostering an organizational culture that facilitates the recruitment, integration and retention of women in STEM

- **Competency 8: Considering the emotional dimension from a professional perspective**

It is essential to ensure that all the pleasant and unpleasant emotions that emerge during disturbing, inappropriate or unacceptable work situations are dealt with professionally.

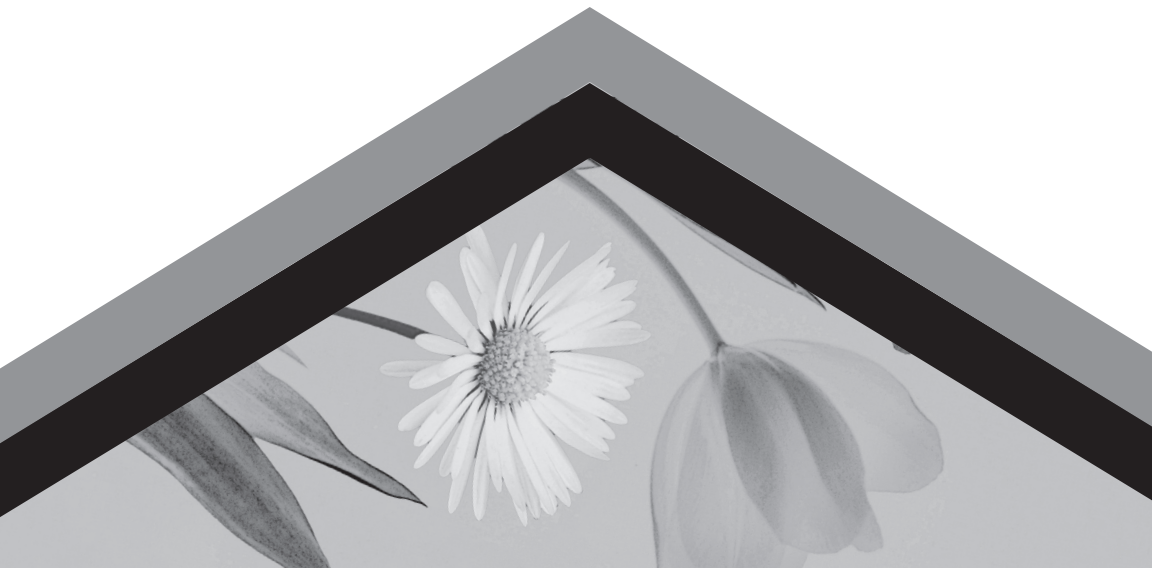
Coresearchers' reflections

Implementing such competency frameworks requires professional gestures that are translated into action, both for those who accompany change and for people who work with those targeted by change. This means that people involved in coaching, training and managing in companies or educational institutions have to demonstrate their commitment to change.

This means that every company and educational institution has questions to ask itself. What is important to change? What are the priorities? How should these changes be presented to staff? What is management prepared to do to implement the change and develop the professional competencies to make it happen?



Chapter 21



To finalize this research project on the recruitment, attraction and retention of women in STEM (science, technology, engineering and mathematics), particularly in fields where they represent less than 25% of the workforce, a practical model for raising awareness and accompanying the implementation of change is proposed. It is associated with the competencies to be developed in the previous chapter.

► 1. A practical model for accompanying professional change (Lafortune et al., 2008b)

A practical model for accompanying professional change is proposed. This model is open, flexible and scalable in the sense that it can be adapted to suit different contexts, both corporate and educational. It can be used to effect change in a general way. However, it is designed here to target changes in behaviours and attitudes, gestures and words that stop conveying stereotypes and prejudices about the realities of women in STEM and that ban all inappropriate, disrespectful and unacceptable gestures and words.

Modelling is the process of representing a real or possible situation to better understand its nature and evolution. Outlined by Legendre (2005), this process can be used to analyze existing systems or design new ones. Associated with significant changes, this model emphasizes innovative approaches. By enabling us to understand the nature of attitudes and practices, the model can also guide their evolution.

Putting such a model into practice requires collaboration (not confrontation) with various stakeholders — individuals, groups, management and executives. This collaborative approach aligns with emerging theory that fosters the development and characterization of an innovative model for the professional accompaniment of professional change in STEM fields, with a strong EDI (equity, diversity and inclusion) perspective.

The practical model proposed is associated with the creation of conditions that encourage individuals and groups to progress in a process of change, in addition to ensuring the sustainable renewal of professional practices. It calls for accompaniment that stimulates reflection and interaction so that change lasts. To ensure change, establishments, organizations and companies can ask themselves questions about the

conditions for its implementation. With this model, certain conditions are linked to accompanying change, but others are associated with reflective-interactive practice, developing professional competencies and exercising leadership.

Before addressing the conditions themselves, it is worth looking at the conceptual background of the conditions for accompanying change.

► 2. Conditions for accompanying change

Accompanying change requires changing professional practices. It has foundations that give it coherence, helping the people concerned to respect the different facets of change. While we know that there will be obligations and rules to respect, working with professional human beings requires flexibility, even if a certain rigour is necessary. Flexibility is the opposite of rigidity, and the balance between flexibility and rigour explains the need for accompaniment.

2.1 Reflective-interactive accompaniment

Reflective-interactive accompaniment is a support measure aimed at developing the competencies of managers or team leaders in their interactions with colleagues. It requires follow-up and continuity. This kind of accompaniment requires the implementation of a certain culture associated with the foundations of change, comprising five components: attitudes, knowledge, strategies, skills and experience, as well as the development and exercising of professional competencies linked to practising accompaniment-centred leadership (see Lafortune and Deaudelin, 2001; Lafortune and Martin, 2004; Lafortune, 2008).

2.2 Professional competencies for directors and managers: attitudinal professional competencies for people affected by change

Adopting a posture aimed at bringing about change requires professional moves and actions that embody professional competencies, both by directors and managers as much by the people targeted by the change. These competencies need to be developed through structured, professional training to avoid the all-too-common notion that leadership development is simply a question of attitude.

2.3 Accompaniment-centred leadership

This follow-up requires the development and practising of accompaniment-centred leadership, which is intended as a process of influencing professional practices towards change. It is exercised and developed through individual and collective reflection in interaction with the staff affected by the change. It is based on structured and rigorous training that still remains flexible.

2.4 Accompaniment approach

This accompaniment and the leadership associated with it leads to a dynamic process that encourages action and leads to change. It implements a set of professional moves and actions that are planned and structured from a perspective of reflection-interaction, according to a targeted intention and based on a partnership with a given environment.

Linked to the conditions for accompanying change, this conceptual context translates into four general conditions, which are then clarified by specific conditions:

1. Setting up reflective-interactive accompaniment;
2. Moving towards reflective-interactive practice;
3. Developing professional competencies;
4. On the road to accompaniment-centred leadership.

1. Setting up a reflective-interactive accompaniment system

Reflective-interactive accompaniment requires staff affected by the change to reflect collectively and develop competencies in interaction with peers or colleagues. This involves:

- Making sure to encourage interaction in the accompaniment process. Questions:
 - In what way does the accompaniment meeting involve interaction-generating actions?

A practical model for accompanying professional change to facilitate the recruitment, integration and retention of women in STEM

- What can encourage questioning, confrontation and sociocognitive conflict?¹
- Providing accompaniment that is in line with what the people affected by the change will have to achieve on their own journey. Questions:
 - How does the accompaniment provided match what the people affected by the change will have to achieve in their workplace?
 - What are the coherences and inconsistencies between the target model and the actions taken?
- Providing accompaniment that ensures continuity and follow-up. Questions:
 - What is planned in the accompaniment process to ensure continuity and follow-up?
 - How do plans ensure that the change will be implemented and that the people affected by it will be able to integrate it?
- Preparing accompaniment meetings that include expectations. Questions:
 - What are the expected responses of those affected by the change?
 - What adjustments and “bereavements” are planned for the accompaniment meeting?
- Integrating hosting and training into accompaniment. Questions:
 - What training elements are planned, to integrate them into the accompaniment process?
 - How will training elements be integrated into the accompaniment process?
 - What is planned for training or self-training in relation to the theoretical and practical content to be covered?

1. Cognitive imbalance — also known as cognitive or sociocognitive conflict — implies that the person in a training or accompaniment situation is confronted with ideas, thoughts and opinions that are quite different from their own. This often leads to questioning, which is not always easy to accept. In this sense, it is a form of imbalance.

- Considering accompaniment as part of ongoing training. Questions:
 - What plans are there to foster a culture of continuous learning?
 - How is the importance of developing a culture of continuous training demonstrated in the accompaniment field?
- Accompanying (cognitive) imbalances that are reassuring (emotional). Questions:
 - What is being done to encourage and accompany cognitive imbalances?
 - What can be done to consider the emotional dimension while creating cognitive imbalances?
- Keeping track of individual and collective reflections. Questions:
 - How do you plan to keep track of the accompaniment/training process and the development of the people affected by the change?
 - How will these traces be used to raise awareness among those affected by the change regarding their professional development and the renewal of their practices?
- Considering the evaluation of the change process. Questions:
 - What do we want to evaluate in the change management-training process (collectively choosing indicators so that they are known and understood)?
 - What are the plans for evaluating certain aspects of the change process, both individually and collectively?
- Integrating professional collaboration into the change management process. Questions:
 - What are the plans to promote professional collaboration?
 - What are the plans to make professional collaboration a priority?

2. Moving towards reflective–interactive practice

This condition means that the accompaniment and training of a change linked to a renewal of practices presupposes a reflective-interactive practice that cannot be imposed. It is gradually put into action. The degree of commitment may vary from one individual to another, from one group to the next.

- Considering reflective-interactive practice as a component of change management. Questions:
 - How can those affected by the change understand that their practices are an integral part of the changes to be implemented?
 - What is being done to recognize when the people affected by the change are ready to reflect on their practices and analyze them collectively?
- Reflecting on your practice and moving towards analysis. Questions:
 - What is being done or planned to encourage reflection on your practice?
 - What is planned to help people move towards analysis of their practice?
- Ensuring action is taken to implement change. Questions:
 - What is being prepared to help you take action?
 - What are the plans to initiate feedback on experiences and the continuation of exchanges beyond the meetings provided for via the accompaniment approach?
- Helping each person to develop their own evolving model of practice. Questions:
 - What characterizes your professional practice? Help each person to identify what characterizes their professional practice.
 - How does making your professional practice model explicitly help you to know yourself professionally?

- Considering modelling (setting yourself as an example) the reflection and analysis of your own practice. Questions:
 - In what way is there coherence between what is required to reflect on and analyze your practice and what is achieved by the management of the company or a work team?
 - What can be done to encourage a commitment to reflecting on and analyzing your professional practice?

3. Developing professional competencies

In the current model, two types of professional competencies are targeted: competencies for company or educational institution directors and managers to accompany change, and attitudinal competencies for the people affected by change (see previous chapter).

- Getting people thinking about the professional competencies they need to develop. Questions:
 - What professional competencies need to be developed, both for managers and for the people affected by the change? Why?
 - What modifications should be made to these competencies as the complexity of implementing the change process is recognized?
 - What activities could be carried out to get people thinking about these competencies?
- Developing the professional competencies of the people in charge of the change process. Questions:
 - How can we measure professional competency development needs in the change process?
 - How can we assess the competencies that people think they have developed but they do not necessarily have?

A practical model for accompanying professional change to facilitate the recruitment, integration and retention of women in STEM

- Demonstrating that there is a pathway to developing professional competencies associated with implementing change. Questions:
 - How do people affected by change demonstrate their willingness to develop professional competencies?
 - How do people affected by change demonstrate their willingness to question, tolerate ambiguity and take risks?

4. Moving towards accompaniment-centred leadership

- Motivating change. Questions:
 - What means are available to encourage people to take action?
 - What action strategies will generate support while respecting the orientations of change?
- Ensuring cohesion, coherence and shared understanding of change. Questions:
 - What activities are planned to discuss the different conceptions of change?
 - What activities are needed to develop a shared understanding of the orientations of change?
- Developing a professional culture associated with change. Questions:
 - What is being done to develop a professional culture associated with the culture of change?
 - What activities/actions should be planned to ensure an acceptable transition to the renewal of the practices of those affected by the change?

- Aiming to establish a partnership between management, managers and staff affected by the change. Questions:
 - How is the partnership to be developed prepared for?
 - What can be changed in the project to allow for adjustments based on proposals from those affected by the change?
- Encouraging the formation of communities of learning and practice, or mixed-gender and women's networks. Questions:
 - How will it be possible to recognize the formation of learning and practice communities (indicators to be developed collaboratively)?
 - If a website is planned, what can it include to help build networks? What is realistic? What will interest the people affected by the change?
- Considering the emotional dimension of change. Questions:
 - How can the emotional dimension of change be considered from a professional perspective?
 - What reactions can be anticipated in relation to the emotional dimension (positive or negative reactions)?
 - What solutions can be envisaged in response to these reactions?

Coresearchers' reflections

In conclusion, it is important to remember that setting certain conditions is essential to optimizing the practical model for implementing professional change, particularly if it concerns values rooted in the people involved or aims to change the culture for recruiting, attracting, integrating and retaining women in STEM (science, technology, engineering and mathematics) fields.

If an organization were to adopt this model and fail to recognize that accompaniment is a long-term and continuous process, it would be unable to expect any lasting impact over time. Although the term "accompaniment" is relatively new in the sense of professional support, it is already overused.



Thus, an environment planning two or three meetings or one-off training days would not be in line with the practical model proposed here. This type of accompaniment presupposes interaction between the people affected by the change. The different roles they play enrich the process, which is established under the aegis of a genuine partnership and participative leadership (see also Lafortune and Deaudelin, 2001; Lafortune and Martin, 2004). Companies benefit from surrounding themselves with experts in change management, especially when it comes to dealing with emotional reactions, resistance, anticipation, collaboration, co-construction and partnership.

The whole part dealing with reflective-interactive practice requires a form of habitual self-reflection and analysis of your own practice – or those of your colleagues. What is more, if these reflections and analyses are carried out on practices that convey prejudices and stereotypes about the realities of women in STEM, competencies are needed to ensure that exchanges take place in a respectful climate, while questioning certain comments or actions. In a company where these habits have not yet been established, how can such reflection and analysis of practices gradually be introduced?



Conclusion

Throughout this research, over a hundred people were interviewed to draw up a portrait of the realities of women working in engineering — mainly in the mining and oil sectors, which are predominantly male-dominated — and to propose strategies and actions to achieve gender diversity in STEM (science, technology, engineering and mathematics) sectors. In addition to the participation of Indigenous women and women from immigrant backgrounds, the originality of the research lies in the fact that the multidisciplinary research team (industrial relations, mathematics education, history, philosophy, engineering, mentorship, human resources management) drew on theoretical perspectives not only from the educational sciences, but also from industrial relations. To move things forward, it also started from the premise that it was necessary to work further upstream to introduce girls to STEM fields from an early age. Furthermore, the team worked from the outset to co-construct interview and analysis grids, which benefited from this contribution of knowledge from diverse disciplines that rarely intersect in research. In fact, the grant obtained from the Commission des partenaires du marché du travail (CPMT) made it possible to integrate two research professionals (a mentorship specialist and an engineer) into the team and to train four doctoral students in empirical research right from the outset. These collaborators were involved in the entire process, from literature review to knowledge

dissemination, grid creation, ethical certification application, analysis and recommendations. Validating the results and proposals with various organizations involved in the advancement of women — including Indigenous women, women from immigrant backgrounds, as well as respondents — enhanced the credibility of our approach.

Some of the proposed strategies and solutions stemmed directly from the words of the people who generously agreed to share their perceptions and experiences as women and men working in the environments under study. Others — particularly those relating to attraction, recruitment, retention and the proposed strategies — resulted from the amalgamation of the complementary knowledge of the coresearchers and collaborators.

While challenges around the gender-balanced workplace remain — stemming from factors such as family influence, lack of knowledge of professions and trades related to science, technology, engineering and mathematics (STEM), family-work-life balance (family dimension), the prevalence of stereotypes and prejudices, the absence of networks and role models for women, as well as the existence of a glass ceiling (social dimension), which is still too often justified by a lack of interest on the part of women or by the difficulties inherent in engineering functions (personal or academic dimension) — various strategies and recommendations were proposed to counter them. These include a guide to self-analysis of websites to make them attractive to and inclusive of women, competency frameworks and a practical model. What is more, as it would be simplistic to approach access to employment only from a barriers perspective, we have also included a reflection on inclusive practices. This is one of the important issues “that will require the most collective effort, since coexistence is not self-evident, and the size, management style and policies in place are often specific to the company and sector” (Gagné, 2022).

Although the team’s introductory reflections around their not choosing engineering careers were relevant in the beginning of this endeavour, further pertinent reflection emerged over the course of this research and we share it here to demonstrate the advantages and limitations of our multidisciplinary approach.

► Morgane Vandel¹

While I have no regrets about the choices I've made so far in terms of career path, this project has given me the opportunity to question them, notably by asking myself what my path would have been like if I had chosen a Bac S. Would I have been thrown off by being one of the only girls in my class? Would I have been under more pressure? Would I have been subjected to and overheard sexist remarks from my classmates? From my professors? From my colleagues? What impact would this have had on my personality? Would I have felt isolated? Would I have questioned my career plans? Would I also have taken part in a study about women in fields where they represent less than 20% of the workforce? Would I have given my testimony with the same eloquence as the women we met? All these questions and many more have been on my mind since I first became involved in this project. If there is one word that defines this project for me, it is *encounter*.

Encounter, first, between us, the members of the research team: getting to know each other, working with each other, trusting each other, sharing our analyses and our feelings, feeding off them and cultivating our differences and our assets to progress together in this project. Then, we had an encounter with the participants we interviewed: female engineers, professors and students of all levels. Encountering this otherness, this variety of backgrounds and experiences, obstacles and successes, encountering their points of pride and their doubts. For me, it was also an encounter with a type of research with which I was unfamiliar as a philosophy student: field research. It was an encounter with these methods and practices, a whole apprenticeship that I embarked upon with enthusiasm and certainly some hesitation. Despite the expressions of appreciation at the end of each of our interviews, it is difficult to express to all these women the gratitude they deserve for the time they gave us and the sincerity of their testimonies, which I think have touched every member of our team. Although my theoretical research focuses mainly on literary analysis from a feminist perspective, it was a truly formative experience for me to be able to hear, study and analyze sexist behaviour in the context of such a comprehensive and concrete field study.

1. In the introduction, the coresearchers' comments are listed in alphabetical order. In the conclusion, they are listed in reverse alphabetical order.

► Jennifer Petrela

It's not the first time I'd been struck by the denial mechanism in women who experience microaggressions in the workplace. Many of the female engineers I interviewed began the conversation with a robust attitude: According to them, they had never experienced discrimination, and they had encountered minimal obstacles or none whatsoever. But as the discussion progressed, they came up with stories of blatant injustice. By the end of the interview, I had the impression that their stance had changed 180 degrees. On the one hand, I find this phenomenon impressive. After all, human beings have magnificent survival mechanisms. If these women had recognized the extent of the injustices they were suffering at the time — often with no possibility of remedying the situation, and perhaps even in danger of derision or reprisal if they had dared to report it — would they have been able to carry on with their daily lives without their emotional burden overwhelming them? Denial undoubtedly protected them from a worse fate. That said, their testimonies challenge me more than ever to call for the creation of conditions in which it is possible to recognize and denounce injustice rather than suffer it. What are these conditions? Research confirms them: i) the possibility of sharing your experience, including injustices, without it being denied, minimized or reinterpreted; ii) the presence of other people who have experienced similar injustices to understand that what has been experienced is indeed what happened and that the situation is not due to a failure on your part and iii) a real willingness on the part of decision-makers to rectify injustices.

► Jessie Morin

Curiosity and a little nervousness — these were the two emotions I felt when I first met the members of the project team with whom I would be collaborating for a year, some of whom would also become friends. I was curious to meet women who shared an interest in working on a contemporary issue and a desire to propose solutions aimed at improving the female experience in a predominantly male sphere. I was also nervous, as I came from a research background in history, so the approach used in this project was totally unfamiliar to me. Accustomed to working alone with my archives, researching real people took me out of my comfort zone! However, I was able to bring my personal touch

and expertise to the project, dealing with subjects close to my heart. After our first meeting, it was clear that we all had different professional and personal backgrounds, which led to the originality of the product you're holding in your hands. This research project has taught me a lot about the world of engineering, which was virtually unknown to me until then. However, what I really take away from my experience are the fascinating human encounters I was lucky enough to have with extraordinary women. After each interview, one word came to mind: wow! Sometimes moving and often inspiring, the testimonies of these women in engineering demonstrated the resilience and strength they've shown throughout their careers. Generous and open-minded, these fascinating women shared a passion for their profession and expressed their pride in succeeding as women. Through them emanate a strength and a desire to break down barriers and pave the way for future generations. Beyond scientific research, this project has helped me evolve as a person and as a woman.

► **Louise Lafortune**

In March 2022, when I attended a meeting to find out about the grant opportunities offered by the CPMT (Commission des partenaires du marché du travail), I was immediately motivated to submit a project focusing on women in STEM (science, technology, engineering and mathematics). I had been involved in projects on this subject since the 1980s, with the creation of MOIFEM (international movement for women in mathematics education) in 1986 and AFFESTIM (French-speaking association for women in science, technology, engineering and mathematics) in 2003. That's why I could not pass up such a wonderful opportunity to pursue goals such as understanding the supports and obstacles encountered by women in overwhelmingly male environments and finding solutions, so that society can benefit from the contributions of women to STEM (after the pandemic, this was important) — and asserting a feminist position on the subject. Before beginning, I said to myself: “This project is going to transform me.” I was not mistaken. When I heard the women in the interviews, I thought of what I had experienced 50 years ago as a student — but also in teaching and research — situations I remembered, and others I realized I had experienced myself. My month of March 2023 was challenging, listening to these women working in engineering (around sixty in a single month), hearing them talk about their joys and satisfactions in

working in this field, but also about their obstacles and challenges, the inappropriate and sexist remarks they heard or the sexual gestures they experienced. I often said to myself that maybe it was better that I had not gone into engineering, but there were evenings when I cried, having listened to four or five women on the same day talk about what they had been through. It brought situations to the surface that I had forgotten or buried. I agree with several women who say that to survive in a male-dominated environment, it's necessary to let sexist jokes or even inappropriate gestures slide. Others get into the men's game and make their own jokes. For my part, I also played the role of secretary, both at university for notetaking (students asked me to) and as a professor for transcribing mathematics lecture notes (there were no computers in the 1970s). In the 1980s, I met some colleagues after publishing *Femmes et mathématiques* (1986). They said: "We're not surprised you published this book, because when the guys would make jokes, you wouldn't laugh." I often say that if I had been aware of everything the students (at university) or my colleagues (at CEGEP) were saying or doing, I wouldn't have survived in this world. After two years of commitment to this project, which brought many gains but also setbacks, it was my enthusiasm from the beginning that carried me through to the end. And I still think it's important to carry out research on women who have left their engineering studies or jobs to find out why.

► **Cristina Guzman**

I was the last member of this exciting project. During the six months I was on the team, I broadened my knowledge of women in STEM (science, technology, engineering and mathematics) enormously. I learned about concepts that were not very familiar to me, concepts such as psychological harassment, isolation, being sidelined, imposter syndrome, prejudice, inappropriate gestures and remarks, etc. — concepts that are part of the reality of many women who have dared to enter an environment that's still predominantly male. Listening to several participants, I saw my own difficulties reflected, as a woman in engineering myself, and in a way, a little ironic, you might say, I also felt a little relieved to know that I wasn't the only one to make such an effort to be accepted and find my place in an environment where I wanted to earn a living, feel useful, welcomed and valued. I identified with one of the interviews where one of the women said that the best mentorship was what you could learn from every experience with every

person you met and that you should always look for the bright side and learn. I was also privileged to hear from courageous women who had valuable experiences, achieved their goals and were leaders who made their own way. I also heard from other women who were engineers in their own countries but who had given up their profession, but that does not mean they stopped being as valuable as the others because, from experience, I know the road is not easy, and I don't blame them, but what a waste of talent, I thought! I liked hearing that change, albeit slow, is happening, giving way to a new way of thinking that is taking over from the old school, which has so much trouble with change. It's not just men — some women still don't see their potential and want to continue to let masculine thinking take the helm, whereas what our society needs, in my opinion, is to integrate feminine thinking too. It's not a matter of one eliminating the other. Rather, it's about simply living and letting live, coming together to work together, to coexist in a balanced society. On this team, I have learned that women can work in harmony, help and complement each other, and value what one or the other brings to the table. Are we more emotional? Yes, I think we are! In our daily lives, we make it an integral part of our work, but I don't think it's something to hide. On the contrary, it's something we should accept, channel and value, because our sensitivity is what enables us to think collectively, to understand the position of others and to create environments of harmony and well-being, with motivated people who feel listened to, in a healthy and balanced environment, where communication is paramount and where performance and efficiency are simply byproducts.

► **Diane Gagné**

Having worked as a petrochemical technician for some fifteen years before becoming a professor of labour relations and public employment policy — and having conducted research for over ten years on systemic discrimination and the challenge of gender balancing the workforce — I wasn't surprised by the slow pace of change. I was, nonetheless, dismayed by certain situations and statements that are still all too prevalent, despite the enactment of various laws and regulations and the advancement of discourse in the public arena. So I keep asking myself the question: What's still holding us back? During this research, I didn't take part in the interviews, as other commitments kept me elsewhere. However, thanks to my network, I was able to contribute to

the recruitment of various people, to the literature review and to the writing of this book, and I'll be the main author of the research report. I derive great satisfaction from this teamwork. I've learned a lot through this research with a team of women from such diverse fields. I was able to deepen my thinking from other perspectives, in particular, to look further upstream, much further upstream. For example, the literature review enabled me to identify how the family and school dimensions contribute to the fact that women can be conditioned from the moment they enter kindergarten to work in fields that are considered more "feminine." The coresearchers' reflections also provided an opportunity to discuss these findings from complementary perspectives (education and sociology of law/industrial relations) and they will be supported at greater length in the research report. My main takeaway from these discussions is this question: Why do they leave their jobs? If I draw on my experience, it's because it's too painful to stay. Given my dialogue with Jennifer, I assume that the reason stems from some form of denial. I'm also really happy to have been able to put together such a great team — chance often yields the best results. The apprenticeships have been rich and varied, and this type of grant really helps to integrate and train young researchers into the profession. Having the chance to be a mentor was a superb experience. Rubbing shoulders with research professionals with such a wealth of experience meant I was challenged on a few occasions, and I was able to question certain practices and gain a better understanding of other facets of mutual aid and job integration, in particular mentorship.

► **Jessica Bélisle**

First of all, I can't hide it: I didn't expect to be so shaken by what came out of the interviews with women in engineering, engineering professors, engineering students, non-engineering students and high school students. Perhaps naively, I didn't think the project would leave so many personal traces. I'm convinced that, even years from now, I'll look back on this chapter of my life and be convinced of the traces it has left on the way I think and act with those closest to me, but also with my colleagues and even strangers in general. On the one hand, the project made me realize that I knew nothing at all about engineering. Quite simply, it wasn't a field I was naturally drawn to. Whether it was the people around me, the guidance counsellors I turned to, my professors or my friends, no one advised me to take an interest in such

a profession. I would never have considered a career in this field. This highlighted the shortcomings of the system in several respects because, on reflection, I think I would probably have found it interesting and rewarding. The engineering profession is both vague and still associated with men. In my opinion, most people who don't work in the field don't really know what an engineer does on a day-to-day basis as part of their job. This makes it harder to break into the field, since the most sought-after profiles are varied, yet don't seem to appeal much to women looking to build a future in engineering.

Plus, when we talk about the engineering profession, we still tend to think of men. Men still seem to be perceived as more credible and better suited to the field. In addition to these aspects of the profession, I think the project has also been an eye-opener. I've always thought of myself as a feminist. However, I think that, without wanting to or even knowing it, I wasn't really that feminist after all, mainly because I didn't have the right arguments. I wasn't aware of all the issues to which women in general — and therefore myself — were exposed daily. It was quite striking and disillusioning to learn about them in a concrete way.

Talking to women who were pioneers in their field — who dared to break down barriers so that others could have an easier path — both shook and touched me. It also made me want to do the same for others and for the generations to come. As the interviews progressed, I was able to see the evolution and different positions regarding the realities experienced by women. Now, I talk about it all the time. I'm proud to be involved, and I'd like everyone to feel concerned about these issues that affect every sphere of life. I believe in a society where differences are seen as advantages, as assets to help us all move forward together towards a better world. Each of us can contribute to the other with our different perceptions of the world. We ask ourselves whether a woman would have the same career knowing what she knows now, aware of everything she had to go through to get there. I hope so! It has also, to some extent, brought out wounds I thought had healed. Comments and disparaging remarks to which I had paid little attention but which, in the end, tainted and dictated some of my decisions and actions in the past. What I'm happiest about in terms of my growth since the start of the project is that I now feel I have arguments to convince skeptics and antifeminists. My aim is for us to learn to live together and for everyone to be seen as an asset to each other, regardless of gender. Focusing on complementarity is an avenue that seems both realistic and fruitful for

future generations. Because, yes, it's still important to change mentalities, and the place of women in traditionally male environments is still far from settled. I believe that education and awareness of EDI issues (equity, diversity and inclusion) are the two most powerful tools we have to give women an equal chance to excel and make their way in the STEM field.

► **Marie-Eva Andriantsara**

Looking back and reflecting on my own experience, this research has enabled me to understand that the representation of women in a traditionally male-dominated job sector plays an important role in attracting women to or retaining them in education and employment in engineering and STEM fields. This research has also enabled me to understand the process by which women from immigrant backgrounds integrate professionally into skilled jobs where women are underrepresented. Also, learning about the professional integration journeys of the women from immigrant backgrounds that I met in this research provides me with motivation for my own journey.

► **Conclusion**

The comments of our coresearchers and collaborators show that this research on women in sectors where they are largely underrepresented has brought out emotions of all kinds, as well as professional and personal learnings. Nevertheless, it is through reading the results of this research that we hope to generate reflections and further research that will lead to the implementation of solutions that will ensure all women feel comfortable choosing any STEM (science, technology, engineering and mathematics) field.

Bibliography

- Adams, A.S., Steiner, A.L. and Wiedinmyer, C. (2016). The Earth Science Women's Network (ESWN): Mentorat communautaire pour les femmes dans le domaine des sciences de l'atmosphère. *Bulletin de la Société météorologique américaine*, 97, 345-354.
- Agocs, C. 2002. Systemic Discrimination in Employment: Mapping the Issue and the Policy Responses. En: Carol Agocs (dir.), *Workplace Equality: International Perspectives on Legislation, Policy and Practice*. The Hague: Kluwer Law International.
- Ainane, S., Bouabid, A. and Sokkary, W.E. (2019). Factors that influence the high percentage of women enrolled in engineering in the UAE and preparing for careers in the oil and gas industry. *Global Journal of Engineering Education*, 21(1), 62-68. <http://www.wiete.com.au/journals/GJEE/Publish/vol21no1/08-Bouabid-A.pdf>
- Allport, G. W. (1979). *The Nature of Prejudice*. Basic Books.
- Anemeje, J. (2014). *Investigating Same-Gender Mentoring Effects on Female Engineers' Job Satisfaction, Satisfaction with Mentor and Job Commitment*. Northcentral University.
- Bakhti, F., Boisseau, A., Hermann, C. et al. (2017). *Les femmes les sciences au-delà des idées reçues*. Association Femmes & Sciences, Association femmes et mathématiques, Association Femmes Ingénieurs. https://prim50.acnormandie.fr/IMG/pdf/livret_femmes_et_sciences_2017-bat.pdf

- Banchefsky, S. Westfall, J., Park, B. and Judd, C.M. But You Don't Look Like A Scientist!: Women Scientists with Feminine Appearance are Deemed Less Likely to be Scientists. *Sex Roles*, 75(3-4), 95-109.
- Barraud-Didier V., Guerrero, S. and Igalens, J., (2003). L'effet des pratiques de gestion des ressources humaines sur la performance des entreprises: le cas des pratiques de mobilisation. *Revue de Gestion des Ressources Humaines*, 47, 2-13.
- Belletête, V., Pelletier-Nolet, J., Brodeur, J. and Langelier, È. (2020). *Statistiques sur les inscriptions des femmes en sciences et en génie au collégial et à l'université au Québec entre 2005 et 2019*. cfsg.espaceweb. usherbrooke.ca/rapport-statistique/
- Bilge, S. (2009). Théorisations féministes de l'intersectionnalité. *Diogène*, 225, 70-88. <https://www.cairn.info/revue-diogene-2009-1-page-70.htm>
- Bouchard, P., St-Amant, J. and Tondreau, J. (1997). Stéréotypes sexuels, pratiques sociales et rapport différencié à l'école secondaire. *Recherches sociographiques*, 38(2), 279-302.
- Brière, S. et al. (2016). *Les femmes dans les métiers et professions traditionnellement masculins: une réalité teintée de stéréotypes de genre nécessitant une analyse critique, systémique, comparative et multidisciplinaire*. https://frq.gouv.qc.ca/app/uploads/2021/05/pc_cm_s.briere_rapport_femmes-metiers-hommes.pdf
- Brière, S. (dir.). (2019). *Les femmes dans des professions traditionnellement masculines*. Presses de l'Université Laval.
- Brodeur, J., Crozet, N., Belletête, V., Pelletier-Nolet, J., Langelier, E., Brière, S., and Deschênes, C. (2023). *L'expérience des stages coopératifs en sciences et en génie: le point de vue des étudiantes, le regard des conseillères et des conseillers de stage*. Chaire pour les femmes en sciences et en génie.
- Brodeur, J., Pelletier-Nolet, J., Belletête, V., Crozet, N., Lessard, G. and Langelier, E. (2020). *Collaborer pour une meilleure mixité en génie à l'université: Pratiques de recrutement, de rétention et d'aide à la réussite pour les étudiantes au Québec, exploration de la littérature et recommandations*. Chaire pour les femmes en sciences et en génie.
- Burjek, A. and Rafter, M.V. (2017). *The Awesome Influence of Women in HR*. Workforce. <https://workforce.com/news/awesome-influence-women-hr>
- Chicha, M.-T. and Charest, È. (2013). *Le Québec et les programmes d'accès à l'égalité: Un rendez-vous manqué? Analyse critique de l'évolution des programmes d'accès à l'égalité depuis 1985*. Centre d'études ethniques des universités montréalaises. <https://papyrus.bib.umontreal.ca/xmlui/bitstream/handle/1866/23564/PAE%20Chicha%20et%20Charest%2030%20avril%202013.pdf?sequence=1>
- Chicha-Pontbriand, M.-T. (1989). *Discrimination systémique: Fondement et méthodologie des programmes d'accès à l'égalité en emploi*. Les Éditions Yvon Blais.

Bibliography

- CIAFT. (2017). *Guide des bonnes pratiques de l'industrie minière pour favoriser l'intégration des travailleuses*. https://ciaft.wpcomstaging.com/wp-content/uploads/2017/01/ciaft_guide_bonnespratiquesintc3a9grationfemmes_fc3a9v-2017.pdf
- Coefficiente. (2019). *Mémoire sur la place des femmes. Industries de la chimie, de la pétrochimie, du raffinage et du gaz*.
- Coleman, M. (2020). Women leaders in the workplace: perceptions of career barriers, facilitators and change. *Irish Educational Studies*, 39(2), 233-253.
- Commission de développement des ressources humaines des Premières Nations du Québec. (2019). *Trousse à outils. Les femmes autochtones dans les métiers non traditionnels*. https://5d896bb782c34f89-8058aaeb370a0f17.filesusr.com/ugd/4f7b76_2292604c216a47bb8dc957aef9207571.pdf
- COPAS Editors. (2021). *Women in the Oil and Gas Industry | COPAS |*. Rubrique « Blog ». <https://copas.org/women-in-the-oil-and-gas-industry/>
- Corbeil, C. et al. (1983). *L'Intervention féministe. L'alternative des femmes au sexisme en thérapie*. Éditions A. St-Martin.
- Corbeil, C. and Marchand, I. (2010). *L'intervention féministe d'hier à aujourd'hui Portrait d'une pratique sociale diversifiée*. Les Éditions du remue-ménage.
- Corbin, J., and Strauss, A.L. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology*, 13(1), 3-21.
- Crenshaw, K. (1989). Demarginalizing the Intersection of Race and Sex: Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. *University of Chicago Legal Forum*, 1, 139-168.
- Dennehy, T. C., and Dasgupta, N. (2017). Female peer mentors early in college increase women's positive academic experiences and retention in engineering. *Proceedings of the National Academy of Sciences*, 114(23), 5964-5969.
- De Paoli, A. and Ellemers, P. *Écoutez Pamela Ellemers du Groupe De Beers évoquer certaines des possibilités qui lui ont été offertes au cours de sa carrière*. https://www.ey.com/fr_ca/mining-metals/leading-women-in-mining/pamela-ellemer
- Deschênes, C., Belletête, V., Langelier, E., Gauthier, C. A., Tanguay, D. and Brière, S. (2019). Les professeures en sciences et en génie: rareté, sacrifices et compétition. In S. Brière (dir.), *Les femmes dans des professions traditionnellement masculines* (p. 33-49). Presses de l'Université Laval.
- Deschênes, É. (2022). *L'insertion sociale et professionnelle des travailleurs autochtones. Des pistes claires pour contribuer concrètement et efficacement*. Éditions JFD.
- Deshaies, M-H. and Druelle, A. (2007). *Penser l'économie autrement – thème: Femmes et économie*. https://relais-femmes.qc.ca/wp-content/uploads/2023/04/Femmes_economie.pdf
- Deslauriers, J-P. (1991). *Recherche qualitative. Guide pratique*. McGraw-Hill.
- Detournay, R.H. (2021) Le concept d'emergent-fit dans les approches méthodologiques inductives. *Enjeux et société*, 8(1), 36-61.

- Diamond, K.K. and Stebleton, M.J. (2019). The Science Identity Experiences of Undergraduate, Foreign-Born Immigrant Women in STEM at U.S. Institutions. *Journal of Women and Gender in Higher Education*, 12(2), 143-165.
- Dumont-Lagacé, É. (2021) Les pionnières perpétuelles. *Siggi. Le magazine de sociologie*, 2. <https://revuelespritlibre.org/les-pionnieres-perpetuelles>
- EcoTec Consultants. (2020) *Retombées économiques de l'industrie minière au Québec en 2020*. AMQ. https://amq-inc.com/wp-content/uploads/2023/02/retombees-fr-2020_vf.pdf
- Elez, V., Imbeau, E., Tao, Y., et al. (2022). *À la hauteur: Résultats canadiens de l'étude du PISA 2022 de l'OCDE. Le rendement des jeunes de 15 ans du Canada en mathématiques, en lecture et en sciences*. https://www.cmec.ca/Publications/Lists/Publications/Attachments/438/PISA-2022_Canadian_Report_FR.pdf
- Enseigner l'égalité. *Stéréotypes de genre au secondaire*. <https://enseignerlegalite.com/secondaire/stereotypes-de-genre-au-secondaire/>
- Eugène, F. (2019). Femmes en recherche au Québec: où en sommes-nous? *Magazine Acfas*. <https://www.acfas.ca/publications/magazine/2019/02/femmes-recherche-au-quebec>
- Forbes. (2019). *Why Are Fewer Women Employed In The Oil And Gas Industry Than Men?* <https://www.forbes.com/sites/quora/2019/03/08/why-are-fewer-women-employed-in-the-oil-and-gas-industry-than-men/?sh=5847d9606033>
- Fortin, M. F. (2010). *Fondements et étapes du processus de recherche*. Chenelière éducation.
- Gagné, D. (2014). *Le devoir syndical de représentation sous l'angle de la charte des droits et libertés de la personne: Le cas des clauses orphelin*. Tesis de doctorado. Universidad de Montreal.
- Gagné, D. (2017). La difficile mixité en emploi: un point de vue québécois. In M. Polge, C. Fourcade, C. Debray et A. Paradas, *et coll., Femmes dans l'Entreprise: État des lieux et Enjeux*. Éditions EMS.
- Gagné, D. (2019). Femmes opérateur 30 ans ont passés: quelles distances parcourues: Le cas du secteur de la pétrochimie, du raffinage et du Gaz au Québec. *Gestion 2000*, 36, 79-111.
- Gagné, D. (2021). La responsabilité sociale de l'entreprise ou la responsabilité sociétale de l'organisation: quel rôle pour le mouvement syndical québécois?. Dans Y. Sadik et P. Koleva. *RSE et développement durable: Regards croisés Sud-Nord* (p. 233-262). Les publications de l'ISSM.
- Gagné, D. (2022). L'illusion de l'égalité: conception polymorphique de l'action syndicale québécoise, entre discours et actions. En: C. Kuptsch and É. Charest, *Le futur de la diversité* (p. 225-242). Presses de l'Université du Québec.

Bibliography

- Gagné, D. (2024). Pourquoi déconstruire le mythe de l'égalité en emploi? In L. Lafortune, V. Páez Pérez, Guillot, M-C. Calcerrada, M. Clisson, M. Gongora, L. Sorin, Yaquelin Cruz, N. Páez Concepción, E. and Medina, R. (dir.), *Perspectives sociopédagogiques pour l'équité des femmes Cuba-Québec: Réflexions collectives vers des changements* (p. 315-319). Éditions JFD.
- Gagné, D. et Bellemare, K. (2021). *Projet jeunesse malgache compétente au travail (JMCT) volet égalité femmes et hommes*. Affaires mondiales Canada.
- Gagné, D. et Lafortune, L. and collaborators. (2024). *Situation des femmes en ingénierie dans des secteurs où elles sont largement sous-représentées: rapport de recherche*. Éditions JFD.
- Galbreath, D. (2011). Are there gender-related influences on corporate sustainability? A study of women on boards of directors. *Journal of Management & Organization*, 17(1), 17-38.
- Gervais, M. and Lafortune, L. (dir.). (2024). *La coconstruction en recherche partenariale: perspectives féministes*. Éditions JFD.
- Gian, C. (2013). The Role of Women in the Oil Industry. *Journal of Social Sciences*, 9, 94-100.
- Glaser, B. y Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Sociology Press.
- Gouvernement du Canada. (2017). *Reconnaître et éliminer les préjugés et les micro-agressions en milieu de travail*. <https://www.cspc-efpc.gc.ca/events/microaggression/index-fra.aspx>
- Gouvernement du Québec. (2024). *Ingénieurs miniers / ingénieures minières*. <https://www.quebec.ca/emploi/informer-metier-profession/explorer-metiers-professions/21330-ingenieurs-miniers-ingenieures-minières>
- Green, M. (2004). Safe space et représentation substantive: le cas des délégations aux droits des femmes et à l'égalité des chances. *Raisons politiques*, 3(15), 97-110.
- Guéricolas, P. (2022). *Femmes en génie: par ici le guide!* <https://www.oiq.qc.ca/publication/femmes-en-genie-par-ici-le-guide/>
- Guilhaumou, J. (2012). L'agentivité, un concept opératoire dans les études de genre. *Rives méditerranéennes*, 41, 25-34.
- Haegel, A. (2022). Outil 10. L'égalité de traitement entre les femmes et les hommes. En: A. Haegel, *La boîte à outils des Ressources Humaines* (p. 30-33). Dunod.
- Ingénieurs Canada. (2022). *Rapport de 2022 sur les effectifs de la profession à l'échelle nationale*. <https://engineerscanada.ca/fr/rapports/rapport-national-denquete-sur-les-effectifs/rapport-de-2022-sur-les-effectifs-de-la-profession-a-lechelle-nationale>
- Jackson, T. (2002). *International HRM a cross-cultural approach*. Sage Publications.

- Jiménez C., M. D. and Rodríguez A. O. (2017). *Análisis de la situación de la mujer en el sector STEM. Comparativa España-Países Bajos*. Universidad politécnica de Cartagena. <https://repositorio.upct.es/xmlui/bitstream/handle/10317/7443/tfg-jim-ana.pdf?sequence=1&isAllowed=y>
- Kaplan, L. (2022). *Examining key demographics of Canadian oil and gas workers: Canadas oil and gas workforce is becoming increasingly diverse with significant opportunities for women, immigrants and Indigenous people*. Canadian Energy Center. <https://www.canadianenergycentre.ca/examining-key-demographics-of-canadian-oil-and-gas-workers/>
- Kemp, S. J. (2012). Constructivist criteria for organising and designing educational research: How might an educational research inquiry be judged from a constructivist perspective? *Constructivist Foundations*, 8(1), 118-125.
- KPMG. (2015). *KPMG Women's Leadership Study. Moving Women Forward into Leadership Roles*. <https://assets.kpmg.com/content/dam/kpmg/ph/pdf/ThoughtLeadershipPublications/KPMGWomensLeadershipStudy.pdf>
- KPMG BLOG. (2019). *Gender equality drives growth in chemicals*. <https://kpmg.com/xx/en/blogs/home/posts/2019/03/gender-equality-drives-growth-in-chemicals.html>
- Lafortune, L. (1992). *Dimension affective en mathématiques*. MODULO Éditeur.
- Lafortune, L. (1992 a). *Élaboration, implantation et évaluation d'implantation à l'ordre collégial d'un plan d'interventions andragogiques et didactiques portant sur la dimension affective en mathématiques*. Tesis de doctorado, Universidad de Quebec en Trois-Rivieres.
- Lafortune, L. (2006). *Accompagner l'évaluation des apprentissages dans l'école québécoise. Aide à l'apprentissage et reconnaissance des compétences. Fascicule 3: Exercice et développement du jugement professionnel. Accompagnement-Recherche-formation (PARF)*. https://oraprdnt.uqtr.quebec.ca/pls/public/docs/GSC510/F1616991042_fasc3jug_prof_21fe8.pdf
- Lafortune, L. (2015). *L'accompagnement et l'évaluation de la réflexivité en santé: des applications en éducation et en formation*. Presses de l'Université du Québec.
- Lafortune, L. (2024b). Une approche sociopédagogique intersectionnelle sensible à l'EDI (équité, diversité, inclusion). In L. Lafortune, V. Páez Pérez, Guillot, M-C. Calcerrada, M. Clisson, M. Gongora, L. Sorin, Yaquelin Cruz, N. Páez Concepción, E. and Medina, R. (dir.), *Perspectives sociopédagogiques pour l'équité des femmes Cuba-Québec: Réflexions collectives vers des changements* (p. 148-150) Éditions JFD.
- Lafortune, L. et collaboradoras (2008). *Compétences professionnelles pour l'accompagnement d'un changement*. Presses de l'Université du Québec.
- Lafortune, L. and collaborators (2008b). *Un modèle d'accompagnement professionnel d'un changement*. Pour un leadership novateur. Presses de l'Université du Québec.

Bibliography

- Lafortune, L. and collaborators (2012). *Des stratégies réflexives-interactives pour le développement de compétences*. La formation en éducation et en santé. Presses de l'Université du Québec.
- Lafortune, L. and collaborators. (2015). *Accompagnement-formation d'une pratique réflexive-interactive féministe: le cas de Relais-Femmes*. Presses de l'Université du Québec.
- Lafortune, L. and collaborators (2024a). *Une approche d'équité sociopédagogique sensible à L'EDI (équité, diversité, inclusion) pour intéresser les filles et les garçons à s'orienter en STIM (sciences, technologies, ingénierie, mathématiques)*. Éditions JFD.
- Lafortune, L. and Deaudelin, C. (2001). *Accompagnement socioconstructiviste. Pour s'approprier une réforme en éducation*. Presses de l'Université du Québec.
- Lafortune, L., Groleau, A., Deschênes, C, et al. (2022). *Manifeste à propos des femmes en STIM: 50 textes positifs et percutants*. JFD Éditions.
- Lafortune, L. and Martin, D. (2004). L'accompagnement: processus de coconstruction et culture pédagogique. Dans M. L'Hostie et L.-P. Boucher (dir.), *L'accompagnement en éducation. Un soutien au renouvellement des pratiques* (p. 47-62). Presses de l'Université du Québec.
- Lafortune, L. and Pons, F. (2004). Le rôle de l'anxiété dans la métacognition: une réflexion vers des actions. Dans L. Lafortune, P.-A. Doudin, F. Pons et D. Hancock (dir.), *Les émotions à l'école* (p. 145-169). Presses de l'Université du Québec.
- Lafortune, L. and Solar, C. (dir.). (2003). *Femmes et maths, sciences et technos*. Presses de l'Université du Québec.
- Lafortune, L., Páez Pérez, V., Guillot, M-C., Calcerrada, M., Clisson, M., Gongora, L., Sorin, Yaquelin Cruz, N., Páez Concepción, E. and Medina, R. (dir.) (2024). *Perspectives sociopédagogiques pour l'équité des femmes Cuba-Québec: Réflexions collectives vers des changements*. Éditions JFD
- Leaper, C. and Friedman, C.K. (2007). The socialization of gender. Dans: J. E. Grusec and P. D. Hastings. *Handbook of Socialization: Theory and Research*, (p.561-587). Guilford Press.
- Le Boterf, G. (2001). *Construire les compétences individuelles et collectives*. Éditions d'Organisation.
- Legendre, R. (2005). *Dictionnaire actuel de l'éducation (3^e éd)*. Éditions Guérin.
- Masson, D. (2015). Enjeux et défis d'une politique féministe intersectionnelle – L'expérience d'Action des femmes handicapées (Montréal). *L'Homme & la Société*, 198, 171-194. <https://doi.org/10.3917/lhs.198.0171>

- McCormick, H. (2016). *The Real Effects of Unconscious Bias in the Workplace*. <https://teammates.atriumhealth.org/-/media/human-resources/documents/new-teams/unc-white-paper-the-real-effects-of-unconscious-bias-in-the-workplace-final.pdf>
- McGrath, K. and Marinelli, M. (2012). *Female workforce participation in the Australian oil and gas industry a global comparison*. https://www.researchgate.net/publication/281445238_Female_workforce_participation_in_the_Australian_oil_and_gas_industry_a_global_comparison_a_global_comparison
- McKinsey & Company. (2019). *Women Matter: Les femmes et le travail au Canada: d'aujourd'hui à demain*. <https://www.mckinsey.com/-/media/mckinsey/featured%20insights/gender%20equality/the%20present%20and%20future%20of%20women%20at%20work%20in%20canada/20190602-women-matter-2019-vf.pdf>
- MEQ. (2001). *Programme de formation de l'école québécoise. Ministère de l'Éducation du Québec*. <https://www.education.gouv.qc.ca/enseignants/pfef>
- Mentorat Québec. (2021). *Le mentorat au féminin: Meilleures pratiques (3/3)*. <https://mentoratquebec.org/le-mentorat-au-feminin-trois-reponses-pour-les-mentees-3-3/>
- Meynaud, H. Y., Fortino, S. and Calderón, J.A. (2009). La mixité au service de la performance économique: réflexions pour penser la résistance: Introduction. *Cahiers du Genre*, 2(47), 15-33. <https://www.cairn.info/revue-cahiers-du-genre-2009-2-page-15.htm>
- Mickey, E. (2019). *STEM Faculty Networks and Gender: A Meta-Analysis*. Women in Engineering ProActive Network. https://assets-global.websitefiles.com/60ceadbbd1b31b75588b6cd7/616b43870d9694321e309b86_Mickey-ARC-VVS-Final-Report-Updated.pdf
- Ministère du Travail, de l'Emploi et de la Solidarité sociale. (2023). *C-26 - Code des professions*. <https://www.legisquebec.gouv.qc.ca/fr/document/lc/c-26>
- Ministère du Travail, de l'Emploi et de la Solidarité sociale. (2023). *I-9 - Loi sur les ingénieurs*. <https://www.legisquebec.gouv.qc.ca/fr/document/lc/I-9/>
- Organisation for Economic Co-operation and Development (OECD/OCDE) (2017). *The Pursuit of Gender Equality: An Uphill Battle*. OECD Publishing.
- Ordre des Ingénieurs du Québec. (2022). *Femmes en génie Guide de l'employeur pour un milieu de travail plus diversifié, inclusif et équitable*. https://www.oiq.qc.ca/wp-content/uploads/documents/Communications/femmes_en_genie_guide_employeur.pdf
- Ordre des ingénieurs du Québec. (2024). *Guide de pratique professionnelle*. <https://gpp.oiq.qc.ca/Start.htm?t=Accueil.htm>
- Pailé, P. (1994). Pour une méthodologie de la complexité en éducation: le cas d'une recherche-action-formation. *Canadian Journal of Education/Revue canadienne de l'éducation*, 19(3), 215-230.

Bibliography

- Paillé, P. and Mucchielli, A. (2012). *L'analyse qualitative en sciences humaines et sociales*, 3^e édition. Armand Colin.
- Parker, R., Pelletier, J. and Croft, E. (2019). *La diversité des genres en SG. Un résumé de la situation des femmes en sciences et en génie*. Chaire pour les femmes en sciences et en génie. https://www.ulaval.ca/sites/default/files/EDI/Diversite_des_genres.pdf
- Pelissero, M. (2022). *Why Aren't More Women in Industrial Chemical Professions?* <https://ecolink.com/info/why-arent-more-women-in-industrial-chemical>
- Petrela, J. (2021). *Le mentorat et les micro-agressions*. <https://mentoratquebec.org/le-mentorat-et-les-micro-agressions-le-traitement/>
- Piraud-Rouet, C. (2017). *Les Pédagogies alternatives pour les nuls*. FIRST.
- Proulx, J. (2019). Recherches qualitatives et validités scientifiques. *Recherches qualitatives*, 38(1), 53-70.
- Roy, N. (2018) Portrait des Québécoises Édition 2018. CSF. https://csf.gouv.qc.ca/wpcontent/uploads/Portrait_portrait_quebecoises.pdf
- Savoie-Zajc, L. (1989). Cadres conceptuels et évolution des modèles de changement planifié en éducation. *Revue des sciences de l'éducation*, 15(1), 123-138.
- Serbin, L.A., Zerkowicz, P., Doyle, A-B., Gold, D. and Wheaton, B. (1990). The socialization of sex-differentiated skills and academic performance: A mediational model. *Sex Roles*, 23, 613-628.
- Shirt, E., Kim, C. and Coady, L. (2022). *Women in Energy Transformation: Series Summary Paper Why are Canadian women vital to the coming energy transformation?* www.pembina.org/pub/women-energy-transformation-series-summary-paper
- Stratchan, R. et al. (2018). *Women in Engineering: Addressing the Gender Gap, Exploring Trust and our Unconscious Bias*. IEEE. <https://ieeexplore.ieee.org/document/8363497>
- Tajfel, H. and Turner, J-C. (1979). An Integrative Theory of Intergroup Conflict. Dans W. G. Austin and S. Worchel (Eds.), *The Social Psychology of Intergroup Relations* (p.33-37). Brooks/Cole.
- Tremblay, M. and Wils, T. (2005). La mobilisation des ressources humaines: une stratégie de rassemblement des énergies de chacun pour le bien de tous. *Gestion*, 30(2), 37.
- UQTR. (2022). *Engagements institutionnels*. https://oraprdnt.uqtr.quebec.ca/pls/public/gscw031?owa_no_site=1138&owa_no_fiche=19
- Vachon-L'Heureux, P. and Guénette, L. (2006). *Avoir bon genre à l'écrit. Guide de rédaction épiciène*. Publications du Québec.
- Vidal, C. (2015). *Nos cerveaux, tous pareils, tous différents!* Laboratoire de l'Égalité. Éditions Belin.
- Vieira do Nascimento, D., Mutize, T. and Roser Chinchilla, J.F. (2021). *Mujeres en la educación superior: ¿la ventaja femenina ha puesto fin a las desigualdades de género?* <http://creativecommons.org/licenses/by-sa/3.0/igo/>

What are the Realities of Women in Engineering in Quebec?

- Williams, C. L. (1992). The glass escalator: Hidden advantages for men in the “female” professions. *Social Problems*, 39, 253-67.
- Williams, C., L. (2018). The gendered discourse of work-family balance in the oil and gas industry. *Social Currents*, 5(2), 120-139.
- Williams, C. L. (2021). *Gaslighted: How the oil and gas industry shortchanges women scientists*. University of California Press.
- Williams, C. L., Kilanski, K. and Muller, C. (2014). Corporate Diversity Programs and Gender Inequality in the Oil and Gas Industry. *Work and Occupations*, 41(4), 440-476.
- Yanosek, K., Abamson, D. and Ahmad, S. (2019). How women can help fill the oil and gas industry’s talent gap. *McKinsey & Company*. <https://www.mckinsey.com/industries/oil-and-gas/our-insights/how-women-can-help-fill-the-oil-and-gas-industrys-talent-gap>

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1. <https://www.erudit.org/en/journals/enjeux/2021-v8-n2-enjeux06134/1078497ar/abstract/>

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Appendix 1: General Interview Protocol

► 1. Introduction to interviewing

Brief presentation of the project. People have already received explanations in the confidentiality agreement to be signed.

Topics covered during the interview:¹

- The joys of engineering work
- Difficulties in this field as a woman
- Perception of EDI (equity, diversity and inclusion)
- Self-perceptions as a woman in engineering
- Women's contributions to engineering
- Possible solutions to help increase the number of women in engineering in fields where they represent less than 20-25% of the workforce
- Interview length, maximum 1 h 15 m.

1. In the interview protocol, there were a few special features for the interviews conducted with specialists in human resources, women from immigrant backgrounds and Indigenous people. Other particularities were part of the interviews with men in engineering, for example, giving their opinions on scenarios based on research results.

- Please note that the interview will be recorded for research purposes only.
- Note that people can withdraw when they wish.
- The participants and the research team signed a confidentiality agreement.

► 2. Beginning of the interview

Each person introduces themselves, talking about their specialty, studies, current job and previous employment, if relevant.

On a scale of 1 to 10, with 1 being dissatisfied and 10 being completely satisfied, each person interviewed rated their satisfaction with their career, providing a few explanations.

Those who agreed provided the age range they were in.

Interview questions based on different themes: *The questions are adjusted in the moment according to the degree of experience of the women we meet and their responses.*

► 3. Motivation, stimulation, satisfaction, inspiration²

What we are looking for here is what made the interviewees choose the field of engineering and, more specifically, the specialty they chose (name it). And why they chose to work for a particular company (name it). There may have been one or more triggering events, but what makes these women stay? What stimulates them and brings them great satisfaction?

1. What motivated your choice to study and work in the engineering field, in the specialty (name it)?

Sub-questions

2. What inspired you?
3. What motivates you to continue your work?
4. What do you get out of it?

2. The themes are presented as if they were being discussed with women in engineering.

See during the interview when it would be appropriate to ask the question that follows:

5. What would you say to young girls hesitating to choose engineering in your field?

► **4. Supports, advantages, positive aspects, passions**

The aim is to get people talking about the support these women have received both before entering engineering and in order to stay there.

This first question could also be asked at the end.

1. What do you love about your work?

The first question could be this second question, depending on the answers in the other theme.

2. What facilitated your entry into the profession?
3. What supports have helped you integrate into your work team?
4. What strategies were used to facilitate your integration into this industry (or company)?
5. If you have ever thought about leaving your job, what led you there? Why did you stay?

► **5. Barriers, obstacles, difficulties, apprehensions**

The aim here is to point out the difficulties and obstacles encountered, what slowed down their career, and what made people think of changing careers. It is also a good idea to get them to talk about colleagues, overheard conversations or perceived gestures addressed to them or to other women.

1. What difficulties have you encountered: a) in your studies, b) in your job search, and c) in your work? What do you think is related to your realities as a woman?

Getting others to talk

2. What difficulties do you think your female colleagues have faced or are facing now? How do they differ from yours?

Back to women in engineering. This could be asked after the first question.

3. What actions or comments have shocked you during your career? To yourself, to others, to female colleagues in engineering?
4. How did you respond when hurtful words were spoken to you? Or when you heard something you should not have?

► 6. Perception of society, family, friends and colleagues

The aim here is to get ideas about how society, family, friends and colleagues perceive women in engineering and how these people perceive what women in engineering are like.

1. What was your family's reaction to your career choice? How did your friends react? What effect did it have on you?
2. How do you think your colleagues perceive you? How does this show up?

The first question may have answered that.

3. How do you think your family perceives you, and how does this show up?
4. What do your friends say about your work? How do your friends perceive your work?
5. What is the reaction of your environment or society when you present yourself as a woman in engineering?

Towards a more general question

6. How do you think society views women in engineering?

► 7. Self-perceptions

The aim is to get these women in engineering to talk about how they see themselves and their career choices.

How do you see yourself as a woman in engineering? What would be the 3 or 4 traits you would attribute to yourself?

► 8. Strategies, solutions, improvements, mentorship

The aim is to collect strategies or solutions that have already been used with these women, as well as proposals they might suggest. Mentorship is explored as a possible strategy. This series of questions can be adjusted according to responses to the second theme of what has helped these women. Depending on the solutions they come up with, it would be a good idea to explore them in greater depth rather than sticking to general ideas.

1. What strategies have helped you integrate into your job?
2. What helps you stay in the profession?

Exploring solutions for others

3. What would help girls in high school or CEGEP to choose engineering? To choose engineering in the same field as you?

Question specifically about mentorship

4. What do you think of mentorship, of people who could help you get into the profession? How do you see yourself as a mentor? If you were asked to be a mentor, how would you respond?

► 9. Perception of EDI

Depending on what is said in the interview, it may be possible to include a question about current EDI perspectives (equity, diversity and inclusion).

1. EDI (equity, diversity and inclusion) is a hot topic these days. Universities are adopting action plans to promote EDI. How do you see this opening to equity, diversity and inclusion?
2. What would you suggest to achieve greater equity, diversity and inclusion in your field?

► 10. Conclusion, openness, future³

Questions for the future

1. How do you see your future in engineering?
2. How do you perceive the evolution of engineering for women in your field of work?
3. If you have anything to add, we would be delighted to hear from you.
4. Thank you very much for your participation in this research.
5. Would you like to receive research results?
6. Would you like to give your opinion on a first version of the results, a first version of the practical model we are going to develop?

This means taking part in the results validation process.

7. Finally, would you like your name to appear in the acknowledgements?

3. These questions could not always be asked, given the time available for the interview.

Appendix 2: Evaluation/Self-assessment questionnaire for Corporate Websites

A. REPRESENTATION OF WOMEN ON THE CORPORATE WEBSITE

Criterion 1: Representation of women in the website's iconography

- Women are present in photos;
- Women appear in images in all sections of the website, not just in categories assigned to them;
- Women appear in all categories — not limited to career, culture, community or environment;
- Women are not only shown in a static portrait format, but also in action, i.e., in motion;
- Women are not only presented in “employee” mode, they are also depicted in “supervisor” mode;
- Women are presented with other colleagues or as part of a team, they are not isolated;

What are the Realities of Women in Engineering in Quebec?

<ul style="list-style-type: none"> • Photos feature women of all ages • In videos, women are present and have the same right to speak as men. 					
Not really: 0	Very few: 1	A little: 2	Enough: 3	Often: 4	Very often: 5
Where does the company stand on each of the above points?					
Comments: What can be done to improve the site?					

Criterion 2: Integration of women in website text and video					
<ul style="list-style-type: none"> • Job listings are gender neutral; • The way the jobs are presented is stimulating for both women and men; • The site mentions the initiatives taken by the company to integrate and retain women; • Women participate as much as men in testimonials on work experience 					
Not really: 0	Very few: 1	A little: 2	Enough: 3	Often: 4	Very often: 5
Where does the company stand on each of the above points?					
Comments: What can be done to improve the site?					

B. INTEGRATION OF INDIGENOUS COMMUNITIES AND DIVERSITY					
Criterion 3: Integration of Indigenous people					
<ul style="list-style-type: none"> • Photos show Indigenous people (men and women) in a proportion that allows their presence to be perceived; • Indigenous people appear in images in all sections of the website, rather than in specific categories such as culture, community and environment; • Indigenous people are seen in action; • Indigenous people are in action with other coworkers, not in isolation; • In videos, the presence of Indigenous people is visible and they are given talk time; • The website mentions the company's programs for the integration and retention of Indigenous people; • There are testimonials from Indigenous people working at the company. 					
Not really: 0	Very few: 1	A little: 2	Enough: 3	Often: 4	Very often: 5
Where does the company stand on each of the above points?					
Comments: What can be done to improve the site?					

What are the Realities of Women in Engineering in Quebec?

Criterion 4: Representation of diversity in website iconography					
<ul style="list-style-type: none"> • People from diverse backgrounds are present in photos; • People from diverse backgrounds appear in images in all sections of the website, not in specific categories, for example, in a “career” section; • People from diverse backgrounds are seen in action; • People from diverse backgrounds are presented alongside other colleagues, not in isolation; • In videos, people from diverse backgrounds are present and are given talk time. 					
Not really: 0	Very few: 1	A little: 2	Enough: 3	Often: 4	Very often: 5
Where does the company stand on each of the above points?					
Comments: What can be done to improve the site?					

Criterion 5: Integration of diversity in texts and videos					
<ul style="list-style-type: none"> • The website mentions the programs put in place by the company for the integration and retention of people from diverse backgrounds; • There are testimonials from people working at the company from diverse backgrounds. 					
Not really: 0	Very few: 1	A little: 2	Enough: 3	Often: 4	Very often: 5
Where does the company stand on each of the above points?					
Comments: What can be done to improve the site?					

C. COUNTERING STEREOTYPES AND PREJUDICE					
Criterion 6: Reflections on ways to counter stereotypes and prejudice					
<ul style="list-style-type: none"> • Measures taken by the company in relation to parenthood are expressed by men and women (videos, testimonials, etc.); • Both men and women are equally represented on all pages of the website; • Indigenous representation is non-stereotypical and unprejudiced; • Representation of immigrants and visible minorities is non-stereotypical and unprejudiced. 					
Not really: 0	Very few: 1	A little: 2	Enough: 3	Often: 4	Very often: 5
Where does the company stand on each of the above points?					
Comments: What can be done to improve the site?					

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is manufactured using renewable energy - Biogas
and processed chlorine free.



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