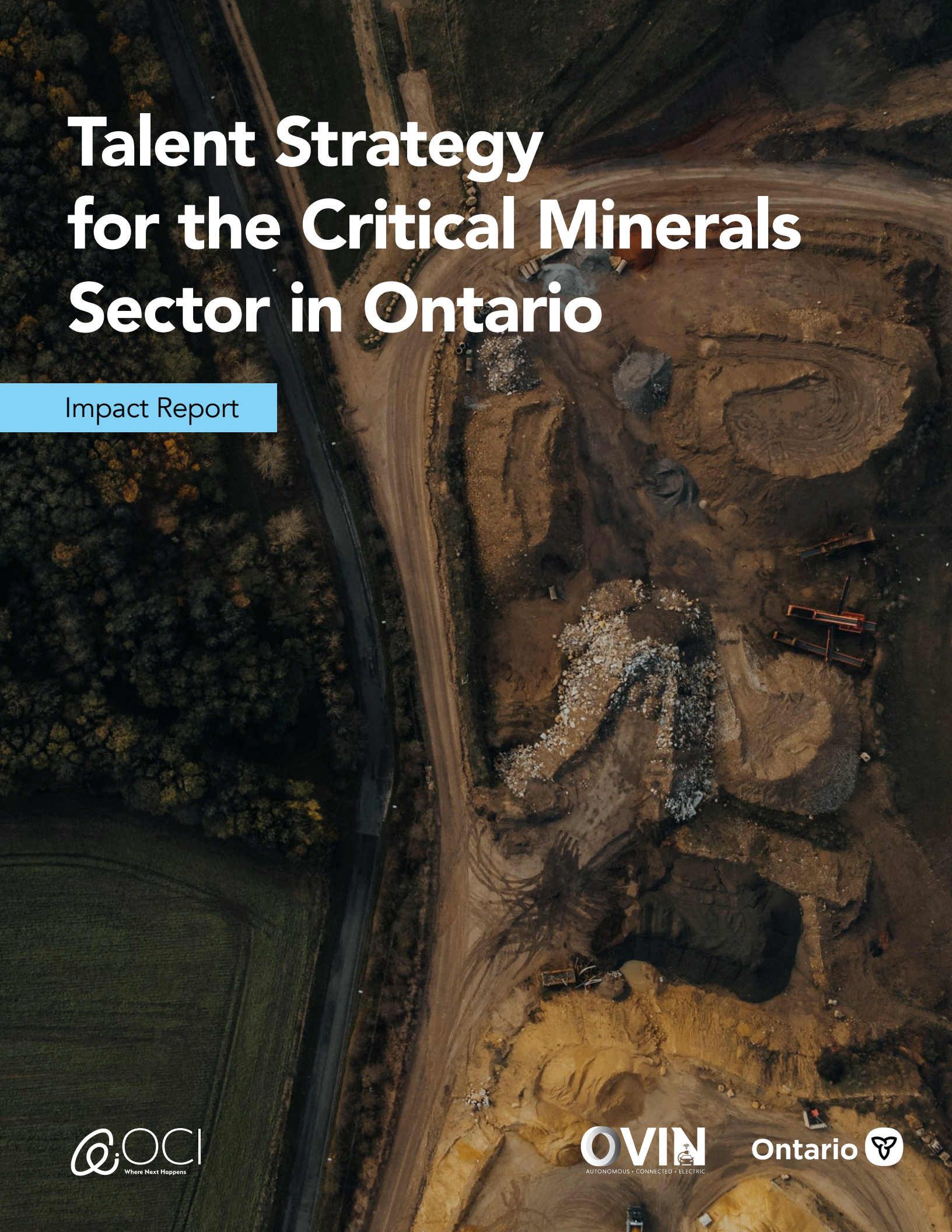

Talent Strategy for the Critical Minerals Sector in Ontario

Impact Report

OCI Where Next Happens

OVIN AUTONOMOUS • CONNECTED • ELECTRIC

Ontario

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Foreword

For over 100 years, Ontario has been a leader in automotive manufacturing, with a renowned history of being one of North America's foremost vehicle production and assembly hubs. As we enter the next century of automotive excellence, our province is committed to leading the charge in building the next generation of vehicles and the innovative technologies that power them.

Today, we are at the forefront of a once-in-a-generation opportunity to lead the global shift to electrification and build an end-to-end electric vehicle supply chain. As Ontario's flagship initiative for the automotive and mobility sector, the Ontario Vehicle Innovation Network (OVIN) is pioneering an all-electric future driven by made-in-Ontario electric vehicles and batteries. Recognizing that the path to this future starts in the North and its wealth of critical minerals, OVIN is responding to the call to reinforce Ontario's position as the global hub for the responsible sourcing of critical minerals and vehicle and battery manufacturing, for generations to come.

The Critical Minerals Talent Strategy provides a roadmap to harnessing Ontario's strengths to build a resilient, end-to-end supply chain, starting with the most pivotal component—its people. Informed by labour market forecasts and key insights from stakeholders, the Talent Strategy outlines a clear path to developing a highly skilled workforce with the ability to lead the exploration and production of the materials that will power the shift to electrification.

This pivotal step towards empowering current and future generations of talent was made possible by the invaluable collaboration with the Ministry of Labour, Immigration, Training and Skills Development; the Ministry of Economic Development, Job Creation and Trade; the Ministry of Northern Development; the Ministry of Indigenous Affairs; and the Ministry of Mines.

As we charge forward to an electric future, the Critical Minerals Talent Strategy will serve as the foundation for engaging talent, advancing training and education programs, promoting meaningful engagement of women and other underrepresented groups in the sector, and establishing long-term trust and partnership with Indigenous communities. Together, these approaches support Ontario's vision of a future-ready workforce primed to lead the automotive and mobility sector globally.

Raed Kadri
Head of the Ontario Vehicle Innovation Network

Acknowledgements

The Critical Minerals Talent Strategy, developed by the Ontario Vehicle Innovation Network (OVIN) in close collaboration with partners across Ontario's critical minerals, automotive, and mobility ecosystem, underscores the province's commitment to innovation. Ontario's vast educational, manufacturing, natural resource, and R&D capabilities are strengthened by its greatest asset: its people and collaborative culture.

OVIN acknowledges the support of the Government of Ontario, particularly the Ministry of Labour, Immigration, Training and Skills Development, the Ministry of Economic Development, Job Creation, and Trade, the Ministry of Northern Development, and the Ministry of Mines, whose insights and guidance were instrumental in crafting this talent strategy amid Ontario's EV transition. Special thanks to the project's key industry stakeholder – the Ontario Mining Association, who contributed valuable feedback and support for elements of the final reports.

We extend sincere gratitude to all other individuals, leaders and organizations who contributed to this project through various stakeholder discussions and interviews. OVIN's holistic approach to the Critical Minerals Talent Strategy mirrors the interconnected nature of the sector's shift to electrification and the substantial investments drawn to Ontario.

Furthermore, we appreciate the insights of community groups, particularly women and Indigenous communities, who will be impacted by sector developments. The collaboration of stakeholders from Northern Ontario's mining industry, post-secondary institutions, non-profit organizations, and community stakeholders has resulted in a strategy that positions Ontario as a global leader in the EV transition.

Key Findings

Ontario's critical minerals sector is expected to grow rapidly in the coming years. As a result, we estimate the industry will need an additional 3,340 workers by 2040. Without strategies to increase the available workforce, there will be an estimated 2,960 job vacancies in the critical minerals sector by 2040, equivalent to a 14 per cent vacancy rate.

Jobs in the critical minerals sector require a variety of technical, digital, and social and emotional skills. Entry level jobs generally require more technical machinery operation and health and safety skills, while engineering and management roles require more communication, leadership, and planning skills.

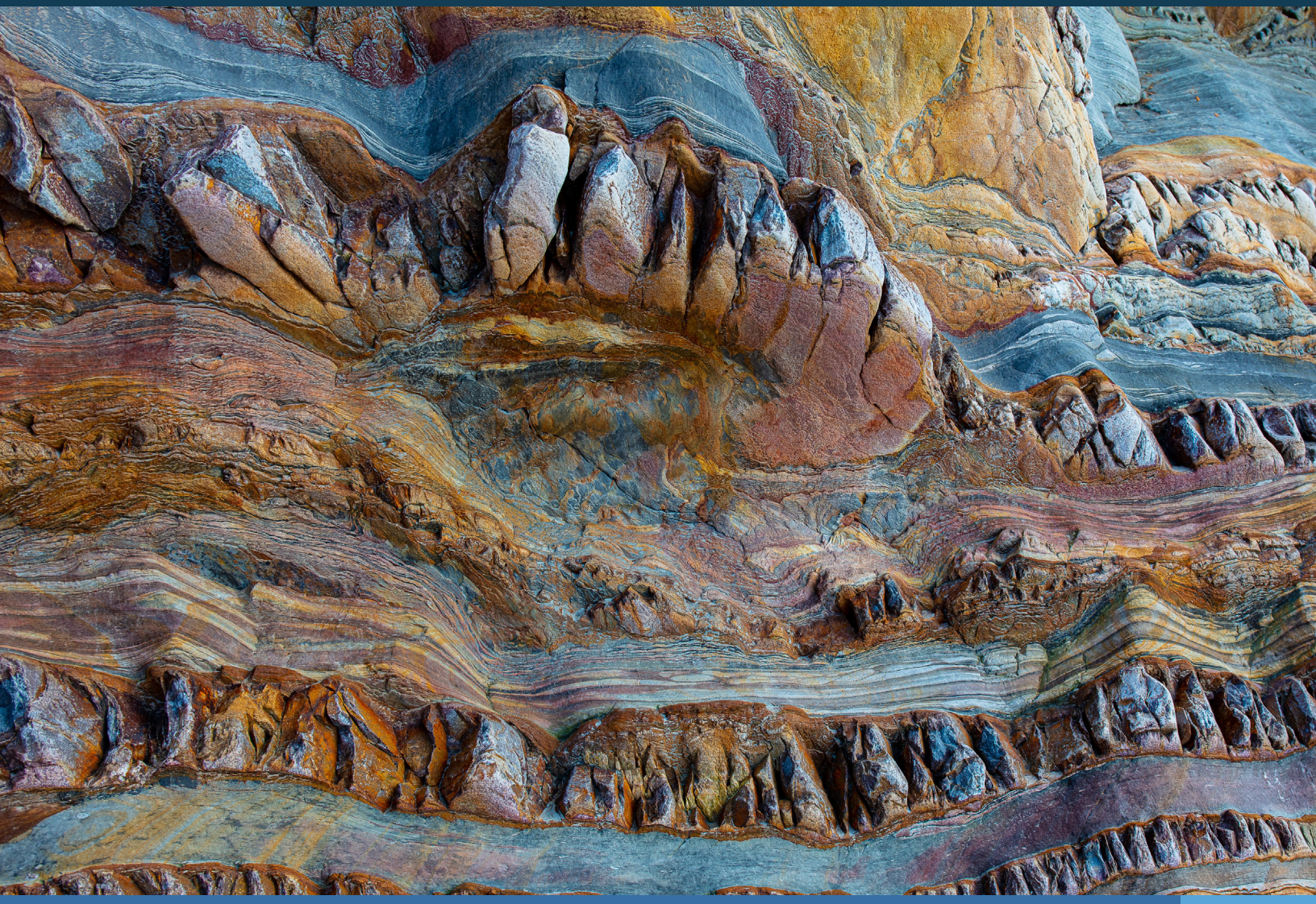
Early engagement with youth and work-integrated learning opportunities in post-secondary institutions are key pathways to increase the talent pool of workers with the appropriate skills for the mining industry.

Reaching underrepresented groups – particularly women and Indigenous communities – can significantly grow the sector's supply of skilled labour over the next two decades. Doing so will require targeted, holistic, and culturally relevant strategies.

The lack of accessible and flexible childcare is a significant barrier preventing women's participation in the mining industry. To increase women's participation, it will be vital for employers to offer parental leave top-up programs, implement and enforce anti-harassment policies, provide equipment and safety gear that is properly sized, and support mentorship programs.

Early and meaningful engagement with Indigenous communities based on treaty relationships is the first step in understanding the training and supports needed to maximize Indigenous participation in the critical minerals sector. Capacity funding, mentorship programs, procurement strategies, and contribution to wrap-around community supports are key, and will require multifaceted approaches, based on each community's unique needs.

Introduction



Ontario finds itself at the forefront of a growing critical minerals sector, driven by rising demand for their use in emerging green technologies like electric vehicle (EV) batteries. Demand for critical minerals like cobalt, lithium, graphite, copper, nickel, and manganese is expected to increase two to six times by 2040[1]. To capitalize on this growth, Ontario will need to further develop and expand its critical minerals value chain capacity, as outlined in the Ontario government's *Critical Minerals Strategy (2022-2027).*[2]

Such a move will drive demand for more employment in the associated mining and manufacturing industries, thus requiring workers in those industries to develop new skills and capabilities and workers from outside those industries to be recruited and trained. The shifting landscape of skills and labour needs within the critical minerals sector is not new but is becoming more important for Ontario's goal of becoming a global player in critical minerals and clean technologies.

The objective of this study is to understand the long-term demand for labour and skills in the critical minerals sector, identify barriers to increasing labour supply especially from underrepresented groups, and suggest strategies for building a talent pipeline for the sector.

While the focus is on the critical minerals sector, especially mining, this project falls within the broader context of Ontario's investment in vehicle electrification and adjacent industry development in clean technology.

For Ontario to capitalize on the expected rise in demand for critical minerals and related clean technologies, a robust talent pipeline is essential. Projections indicate that an additional 3,340 workers will be required for key jobs across mining and manufacturing industries if Ontario realizes its plans to double its critical minerals production by 2040 and expand EV battery manufacturing within the province.[3] These emerging jobs will place greater weight on skills related to machinery operation, equipment monitoring, tool selection, preventative maintenance, and troubleshooting, along with teamwork and leadership skills.

[1] International Energy Agency, "Critical Minerals."
[2] Ontario, "Ontario's Critical Minerals Strategy 2022–2027: Unlocking potential to drive economic recovery and prosperity."
[3] The Conference Board of Canada.

Given the mounting labour needs within the sector, establishing a sufficient talent pipeline for the next two to three decades requires immediate proactive measures. A key source of talent largely untapped by the sector are equity-deserving groups and Indigenous communities. This report focuses on the perspectives of women and Indigenous communities because of the significant potential of their workforce contributions. Indigenous communities also hold considerable importance as an equity-deserving group in the mining industry, given their proximity to mining locations.

Designing specific measures to bring more women into the workforce and to forge better partnerships with Indigenous communities, enhancing their workforce capacity and preparedness, is a critical component in meeting the sector's talent needs over the long-term.

Section 1 of this report will present a long-term forecast for employment and vacancies in both high-demand, high-supply (HDHS) and high-demand, low-supply (HDLS) scenarios, identifying in-demand jobs and skill gaps based on these projections. This section will also examine training and education programs relevant for the in-demand jobs.

Section 2 will examine the key workforce trends affecting the mining industry, drawing on insights gathered from interviews with industry stakeholders.

Section 3 explores the barriers preventing women's participation in the mining industry and provides solutions based on insights from women with experience in the field.

Lastly, section 4 outlines the opportunities, challenges, and essential strategies for meaningful Indigenous participation in the critical minerals sector.

Defining the Critical Minerals Sector

Critical minerals are defined by the Ontario Mining Association as those necessary for key strategic products and applications, like electric vehicles (EVs), and for which there are few viable substitutes.[4] Critical minerals also often have large geopolitical, environmental, or geological risks regarding their availability.[5]

A critical minerals sector in Ontario would encompass the "critical minerals value chain" including resource exploration, mining, processing and refining, basic metal product manufacturing, the manufacturing of high-value end-use products (like EVs and EV batteries), and the recovery and recycling of critical minerals from those products when they reach the end of their useful life.

See Appendix A, Table A.1 for a full list of Ontario's identified critical minerals and their common applications.

[4] Ontario Mining Association, "Critical Minerals Analysis."
[5] Ibid.

Section 1: Forecasting Talent Needs in the Critical Minerals Sector

This section offers estimates of employment and job vacancy projections for Ontario's critical minerals sector across twelve key occupations in mining, six key occupations in manufacturing, and all occupations in recycling.[6] (Refer to Appendix A for the methodology.)

This forecast includes three scenarios:

- a baseline projection with a more limited expansion of Ontario's critical minerals sector and employment growth mostly filled by workers moving from existing jobs.
- a high-demand, high-supply (HDHS) scenario showing strong expansion in the sector and with sufficient labour supply to support it, and
- a high-demand, low-supply (HDLS) scenario showing strong expansion in the sector but with insufficient labour supply resulting in a surge of job vacancies.

The HDHS and HDLS scenarios are estimated by adding positive employment shocks in relevant mining and manufacturing industries, based on the expansion of critical mining activity and EV battery manufacturing in Ontario. Appendix A outlines the forecasting methodology used to estimate these three scenarios.

[6] The mining industry covers NAICS 212, manufacturing covers NAICS 333, 335, and 336, and recycling covers NAICS 5629.

1.1 Employment and Vacancies in the Critical Minerals Sector

If strategies, policies, and economic conditions provide sufficient labour supply to meet the employment needs of the HDHS scenario, there will be 3,340 additional workers employed in Ontario's critical minerals sector compared to the baseline forecast – resulting in almost 22,900 jobs in the sector by 2040, an increase of 145 per cent from 2023 (see Table 1.1).

However, if there is not sufficient labour supply to meet the employment needs (HDLS scenario) there will only be 1,790 more workers employed, leaving 3,570 job vacancies in the sector (Table 1.1). Over 70 per cent of these vacancies will be for jobs in mining and 30 per cent will be in manufacturing. Vacancies in the HDLS scenario will be almost 5 times higher than in the baseline forecast (Chart 1.1).

Even in the HDHS scenario vacancy rates are significantly higher than in the baseline scenario, reflecting the practical challenges of ramping up employment quickly under any circumstance. This is typical behaviour in any high-growth sector because labour supply is driven by slow-moving demographic and educational factors whereas labour demand is driven by expected product market demand, which can shift rapidly. While the HDHS scenario assumes there is an increase in workers entering this sector from adjacent sectors and from unemployment, skills mismatch emerge and lead to increased labour market frictions in the form of vacancies. Therefore, a critical path to address the higher vacancies forecasted is through the training and reskilling of workers new to the sector, increasing enrollments in critical minerals education programs, and attracting people not otherwise in the labour market.

This highlights the importance of developing a talent pipeline focusing on the two of the largest underrepresented groups in the sector – women and Indigenous persons – whose participation in the sector is key to meeting a rapid increase labour demand.

Table 1.1: Employment and Vacancies in the Critical Minerals Sector

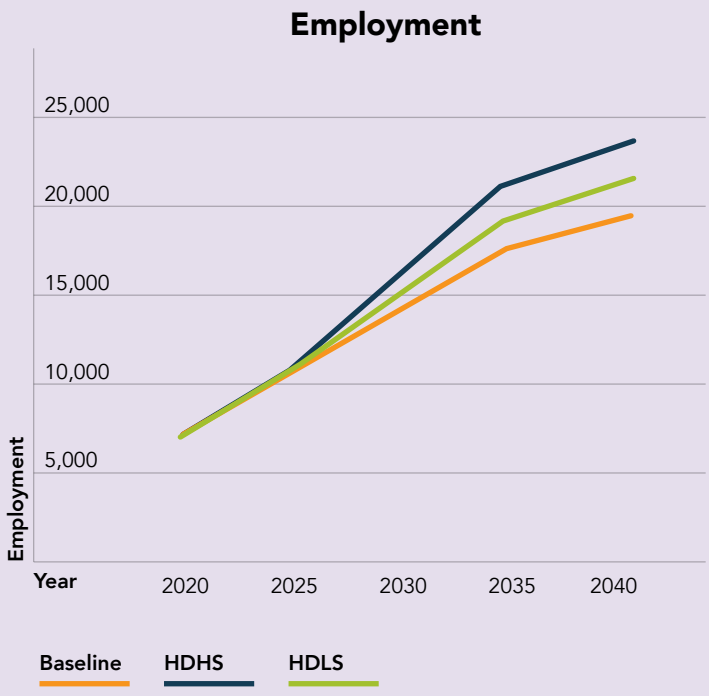
Source:
The Conference Board of Canada.

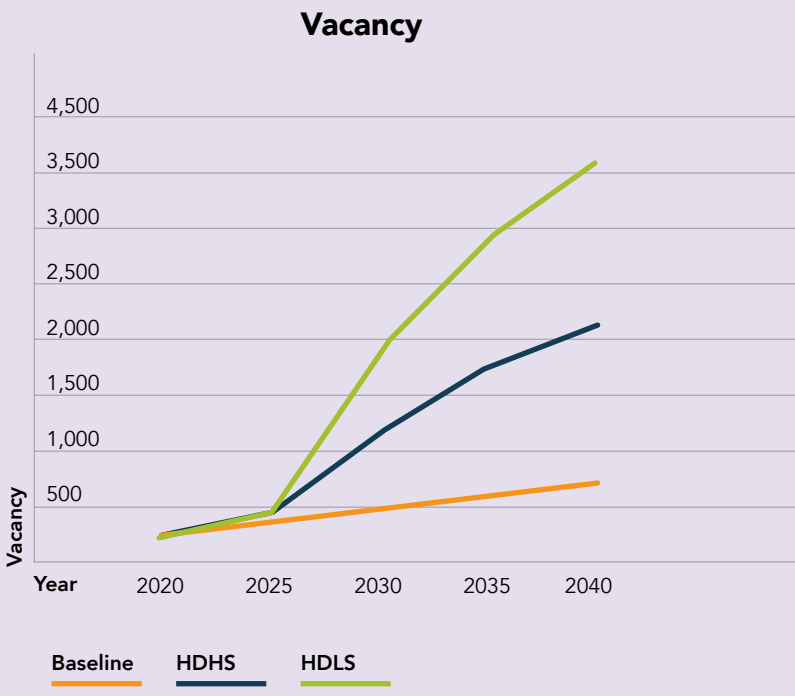
	Baseline	High-demand High-supply (HDHS)	High-demand Low-supply (HDLS)
Employment			
2023	8,709	8,709	8,709
2030	13,794	15,634	15,028
2040	19,551	22,887	21,344
Vacancies			
2023	298	298	298
2030	399	1,193	1,800
2040	614	2,027	2,570

Chart 1.1: Vacancies are 5 times higher in the HDLS scenario compared to the baseline.

(Annual employment and vacancies for jobs in critical minerals sector)

Source:
The Conference Board of Canada.





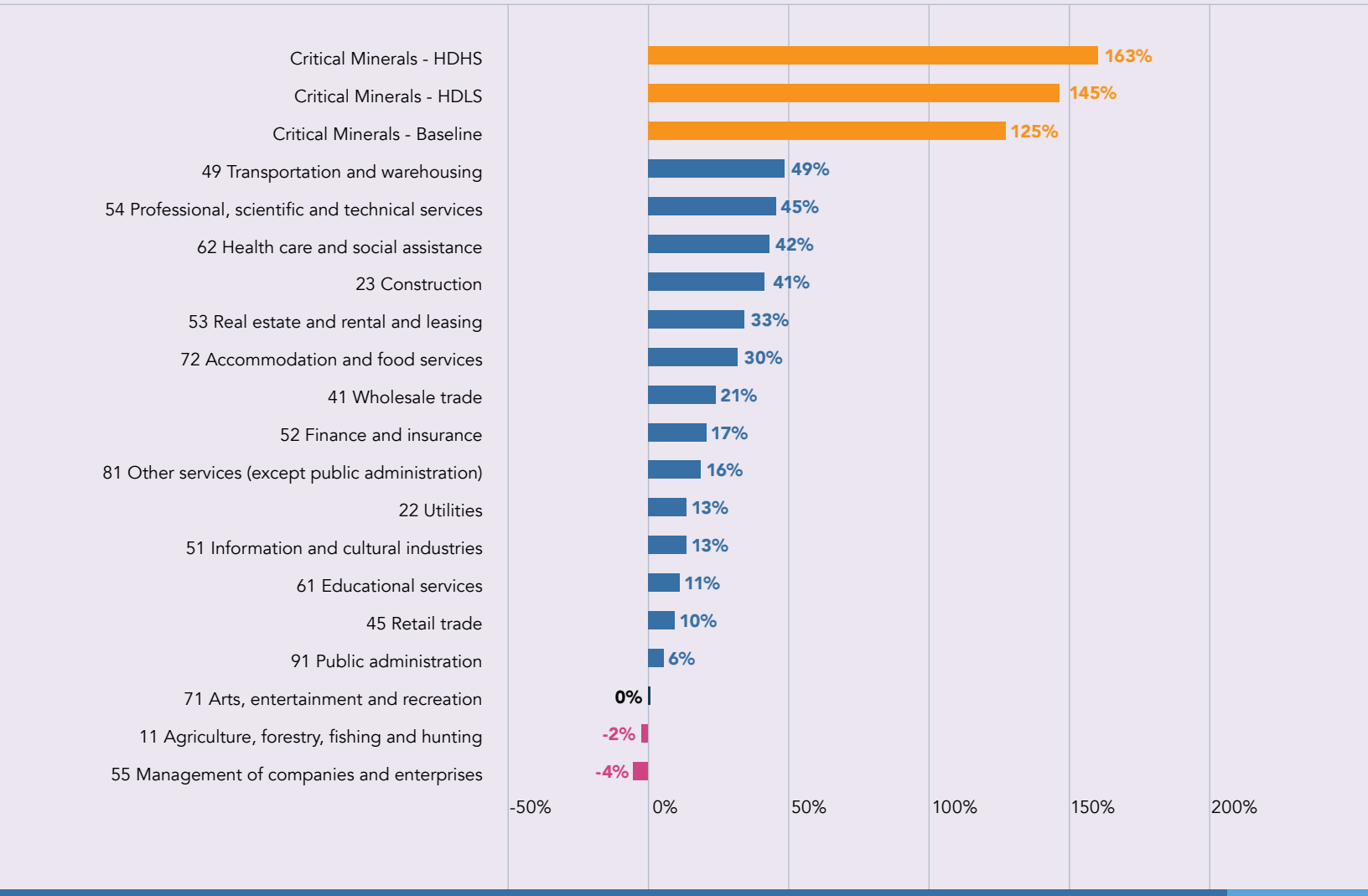
Critical Minerals Sector Employment Outlook Comparison

Employment in the critical minerals sector is forecast to grow faster than all other areas of the Ontario economy (Chart 2.3) though it remains relatively small – accounting for just 0.1 per cent of total employment in the province. Developing the workforce to meet the expected needs in the sector will be key to realizing this growth outlook.

Chart 1.2: Employment growth in the critical minerals sector outpaces all other sectors in Ontario over the next two decades.

Source:
The Conference Board of Canada.

(Per cent change in employment, 2023 – 2040, Ontario)



The expansion of the critical minerals sector is poised to catalyze demand across various industries that supply goods or services to support its operations.

For instance, companies engaged in support activities for mining (NAICS 213) would see increased demand for services such as exploration and drilling. Professional, scientific, and technical services (NAICS 541) would see demand for consulting, engineering, and environmental services tailored to the critical minerals sector.

Manufacturing industries engaged in metal refining and fabrication (NAICS 327, 331, & 332) will experience increased demand for their services, due to the need to produce both metals and equipment for new mines, as well as process the critical minerals themselves.

Computer and electronic product manufacturing (NAICS 334) may experience increased sales of technology and equipment essential for electric vehicle manufacturing.

Truck transportation (NAICS 484) could witness a rise in demand for transportation services to haul raw materials and finished products to and from mining sites and manufacturing plants.

Overall, the growth of the critical minerals sector would create a ripple effect, driving expansion across a variety of industries in Ontario and Canada.

1.2 Job Specific Analysis

Jobs within the critical minerals sector are categorized into five groups – Managers and supervisors, Engineers, Technical jobs, Certified jobs, and Skilled jobs – based on education and experience requirements (see Appendix A, Table A.5 for breakdown). Skilled jobs include mine support workers, machine operators, and electronic assemblers; certified jobs include drillers and blasters, and transport truck drivers; and technical jobs include mineral technicians and industrial mechanics.

Tables 1.2 and 1.3 outline the forecast for employment and vacancies for these five groups, shedding light on how demand for jobs will evolve as the sector grows.

Table: 1.2: Employment in the critical minerals sector by job type

Source:
The Conference Board of Canada.

		Baseline	High-demand High-supply (HDHS)	High-demand Low-supply (HDLS)
Skilled Jobs	2023	560	560	560
	2030	679	918	875
	2040	758	1,095	959
Certified Jobs	2023	2,725	2,725	2,725
	2030	2,534	3,080	2,868
	2040	2,667	3,942	3,327
Technical Jobs	2023	1,839	1,839	1,839
	2030	3,292	3,629	3,595
	2040	4,181	4,750	4,656
Engineers	2023	657	657	657
	2030	1,313	1,550	1,351
	2040	1,704	2,035	1,750
Managers and Supervisors	2023	2,869	2,869	2,869
	2030	5,708	6,190	6,071
	2040	7,545	8,368	7,955

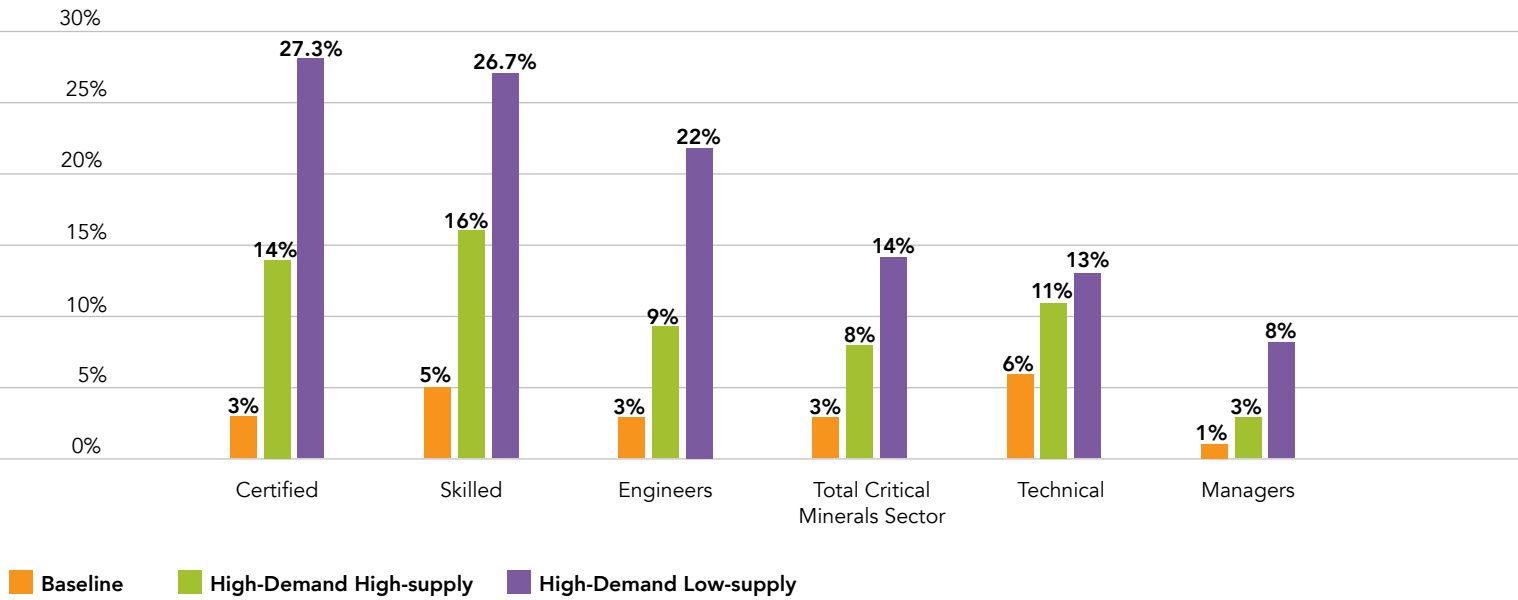
Table: 1.3: Vacancies in the critical minerals sector by job type

Source: The Conference Board of Canada.

		Baseline	High-demand High-supply (HDHS)	High-demand Low-supply (HDLS)
Skilled Jobs	2023	27	27	27
	2030	45	229	272
	2040	40	212	348
Certified Jobs	2023	126	126	126
	2030	70	310	521
	2040	71	634	1,249
Technical Jobs	2023	70	70	70
	2030	181	365	399
	2040	256	612	706
Engineers	2023	28	28	28
	2030	32	117	316
	2040	48	197	483
Managers and Supervisors	2023	45	45	45
	2030	60	162	281
	2040	82	255	667

Chart 1.3: Skilled and certified jobs most at risk of talent supply bottlenecks. (Vacancy rate*, 2040)

Source: The Conference Board of Canada.
*Vacancy rate = vacancies/(vacancies + employment) x 100%



As noted above, vacancy rates are higher in both the HDHS and HDLS scenarios, reflecting the practical challenges of ramping up employment quickly under any circumstance. The higher vacancies under the high-supply scenario captures, in part, the constraints on the future size and structure of Canada's labour supply.

Specifically, the HDHS scenario assumes more workers are attracted to the sector from other, adjacent sectors as compared to the HDLS scenario but does not model changes in the training and educational pipeline nor the potential for an increased working age population in Ontario.

Therefore, improvements to the critical minerals sector talent pipeline is a critical path through which the higher vacancies in the HDHS or HDLS scenarios can be addressed. While there is no "natural" or "optimal" level of vacancies to target, action on the talent pipeline today can help alleviate the potential vacancies forecasted.

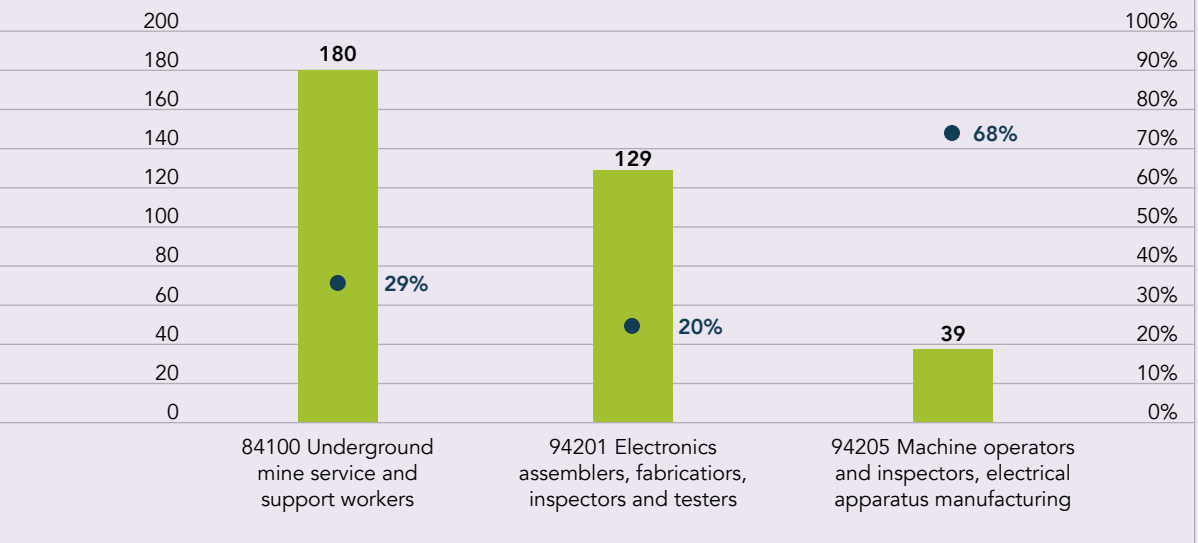
Forecast for Skilled Jobs

In the HDHS scenario, employment in skilled jobs will increase 96 per cent between 2023 and 2040, reaching 1,100. However, without effective strategies to build the required capable workforce (HDLS scenario), almost 350 jobs will go unfilled in 2040, over 8 times higher than the baseline level.

By 2040 in the HDLS scenario, there will be almost 350 vacancies for skilled jobs (Table 1.3). While this accounts for the smallest number of vacancies within the sector, it will have the second highest vacancy rate at 26.6 per cent (Chart 1.3).[7]

A high vacancy rate indicates a larger share of jobs needed will go unfilled, which could significantly hamper production. As a result, vacancies for skilled jobs are concerning despite being fewer than other jobs in the sector. Within skilled jobs, the largest number of vacancies in the HDLS scenario will be for underground mine service and support workers while the highest vacancy rate will be for machine operators and inspectors (Chart 1.4).

Chart 1.4: Machine operators and inspectors will be the hardest to recruit in the future.



(Vacancies [left] and vacancy rate [right] for technical jobs in HDLS scenario, critical minerals sector, Ontario, 2040)

Source:
The Conference Board of Canada.

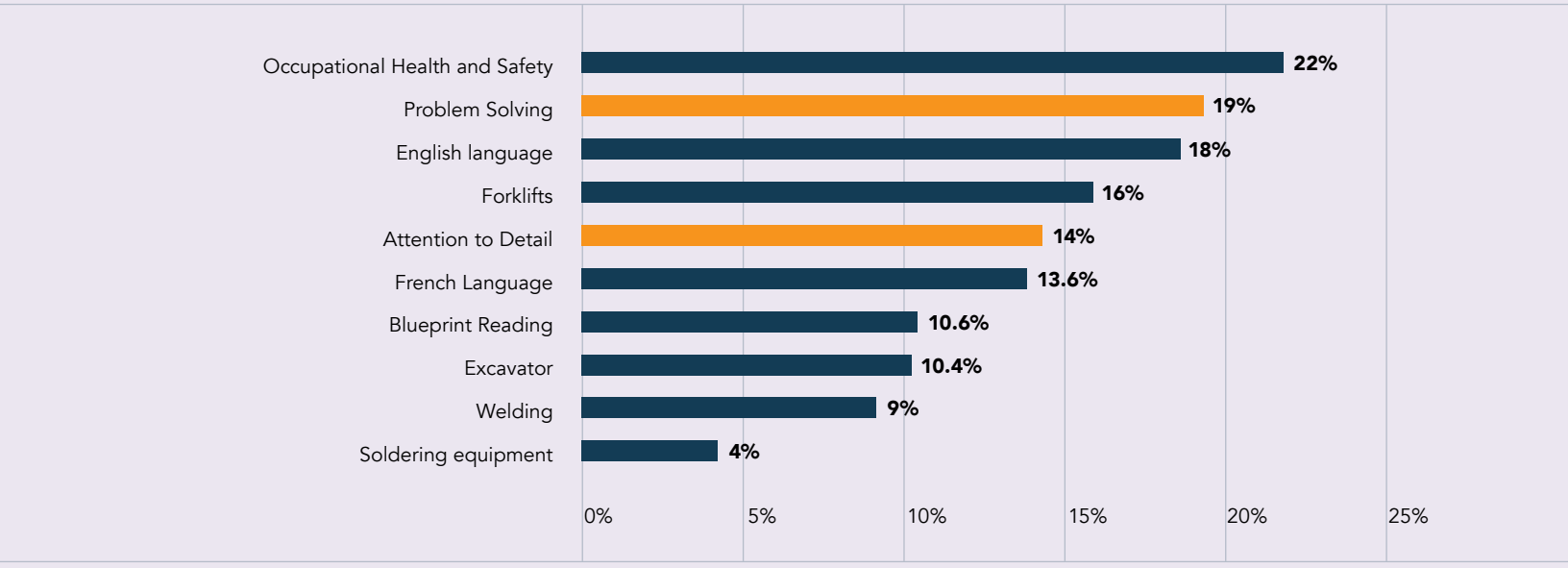
[7] Vacancy rate = vacancies / (vacancies + employment) x 100%

These skilled jobs usually require a secondary school diploma, and/or several weeks of on-the-job training. Essential skills for these jobs include machinery operation and control, equipment monitoring, quality control testing, tool selection, and troubleshooting.[8] Online job postings list a variety of equipment requirements, such as excavators, soldering tools, and forklifts. Consequently, almost 30 per cent of job postings are looking for applicants with related occupational health and safety capabilities (Chart 1.5). In addition to experience with certain tools and equipment, employers are looking for workers who have problem-solving skills, an attention to detail, and meet language requirements in either English or French.

Developing a talent strategy for these jobs should involve engagement with high schools to inform youth about the existence and nature of these careers, and engagement with employers to ensure they can offer adequate on-the-job training for new workers.

Chart 1.5: Skilled jobs primarily require technical skills.

(Share of job postings for top skills* for skilled jobs in the critical minerals sector, n=442)



*Top skills are determined by taking the ten skills with the highest clustering scores. The skills are shown ranked by share of job postings. Refer to Appendix A for methodology.

Source: Vicinity Jobs; The Conference Board of Canada.

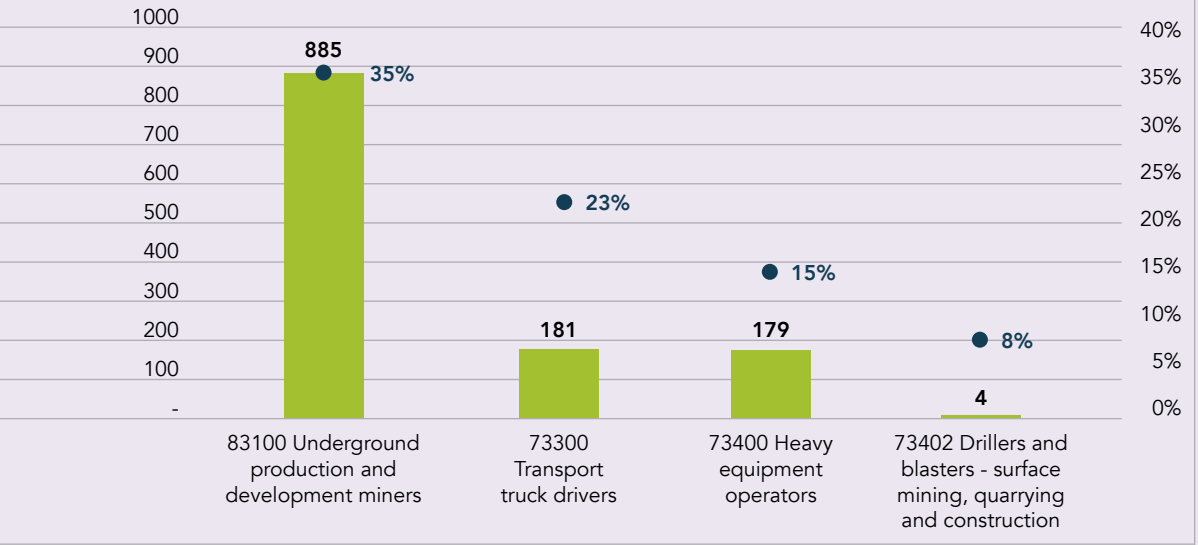
[8] Employment and Social Development Canada, OaSIS.

Forecast for Certified Jobs

In the HDHS scenario, employment in certified jobs will increase 48 per cent between 2023 and 2040, reaching 3,940. However, the HDLS scenario illustrates that without effective workforce development strategies, almost 1,250 certified jobs are projected to remain unfilled by 2040. This is the largest number of expected vacancies within the critical minerals sector. Moreover, with a vacancy rate of 27.3 per cent, certified jobs will face the greatest difficulty in recruitment compared to other positions within the sector.

Within certified jobs, the largest number of vacancies in the HDLS scenario will be for underground production and development miners (Chart 1.6). This job will also have the highest vacancy rate compared to other certified jobs. As such, the talent strategy will need to focus more on these roles.

Chart 1.6: The sector will need more underground production and development miners.



(Vacancies [left] and vacancy rate [right] for technical jobs in HDLS scenario, critical minerals sector, Ontario, 2040)

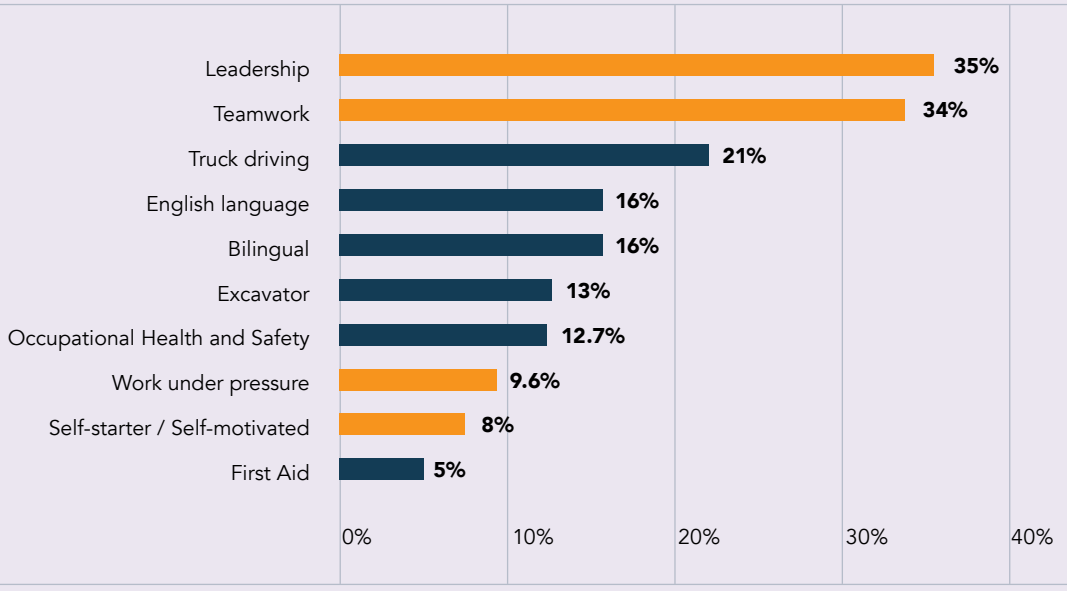
Source:
The Conference Board of Canada.

Certified jobs usually require a college diploma or apprenticeship training of less than two years, or more than six months of on-the-job training and other specific licenses. For example, underground production and development miners often require a blasting license and first-aid certification.[9] Essential skills for these jobs include machinery operation and control, equipment monitoring, tool selection, preventative maintenance, and troubleshooting.

Additionally, employers seek workers with strong teamwork and leadership skills, with these criteria appearing in more than a third of job postings (Chart 1.7). Growing the supply of workers for certified jobs will take targeted education and training programs to develop the necessary skills and licenses.

Chart 1.7: Certified jobs require leadership and teamwork.

(Share of job postings for top skills* for certified jobs in the critical minerals sector, n=1,289)



*Top skills are determined by taking the ten skills with the highest clustering scores. The skills are shown ranked by share of job postings. Refer to Appendix A for methodology.

Source: Vicinity Jobs; The Conference Board of Canada.

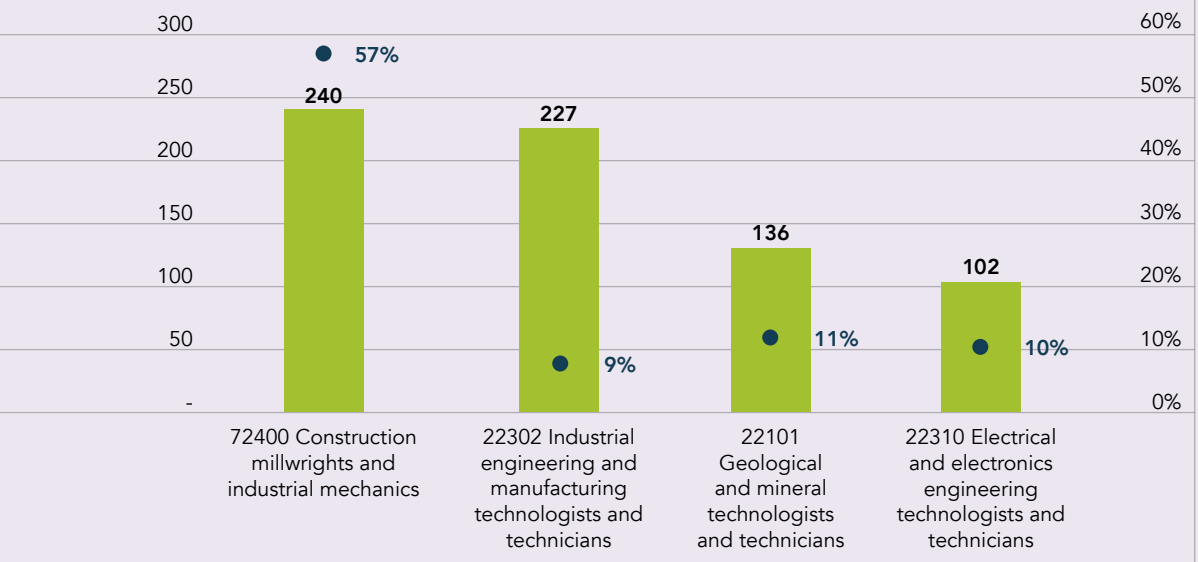
[9] Employment and Social Development Canada, OaSIS.

Forecast for Technical Jobs

In the HDHS scenario, employment in technical jobs will increase 158 per cent between 2023 and 2040, reaching 4,750. These technical positions will constitute the second-largest share of employment, making up 21 per cent of the critical minerals sector's workforce. However, the HDLS scenario shows over 700 vacancies projected for technical jobs—more than three times higher than the baseline level.

Within technical jobs, over a third of vacancies (240) will be for construction millwrights and industrial mechanics. They will also have the highest vacancy rate compared to other technical jobs, suggesting these jobs will be the more difficult to recruit in the future (Chart 1.8).

Chart 1.8: Construction millwrights and industrial mechanics will be the hardest to recruit in the future.



(Vacancies [left] and vacancy rate [right] for technical jobs in HDLS scenario, critical minerals sector, Ontario, 2040)

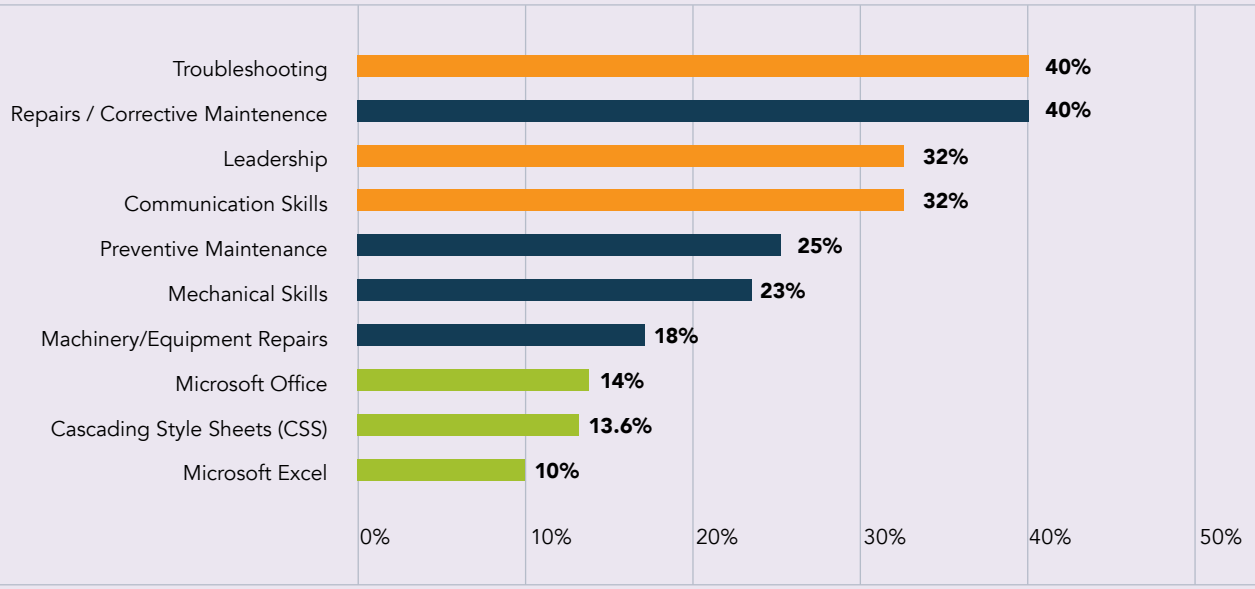
Source:
The Conference Board of Canada.

Technical jobs usually require a college diploma or apprenticeship training of two or more years. To become an industrial mechanic millwright specifically, it generally takes a four year apprenticeship, consisting of 7,280 hours of on-the-job work experience and 720 hours of in-school training[10]. Essential skills for technical jobs include troubleshooting, numeracy, machinery operation and control, tool selection, quality control testing, and preventative maintenance[11]. In addition, employers seek workers with strong communication and leadership skills, with these criteria appearing in more than 30 per cent of job postings (Chart 1.9).

A proactive talent strategy for these jobs will involve attracting workers by building awareness of these careers in the sector, and partnering with colleges and industry employers, to ensure suitable education, training, and apprenticeship programs are in place, especially for construction millwrights and industrial mechanics.

Chart 1.9: Technical jobs require a combination of technical, digital, and soft skills.

(Share of job postings for top skills* for technical jobs in the critical minerals sector, n=1,184)



*Top skills are determined by taking the ten skills with the highest clustering scores. The skills are shown ranked by share of job postings. Refer to Appendix A for methodology.

Source: Vicinity Jobs; The Conference Board of Canada.

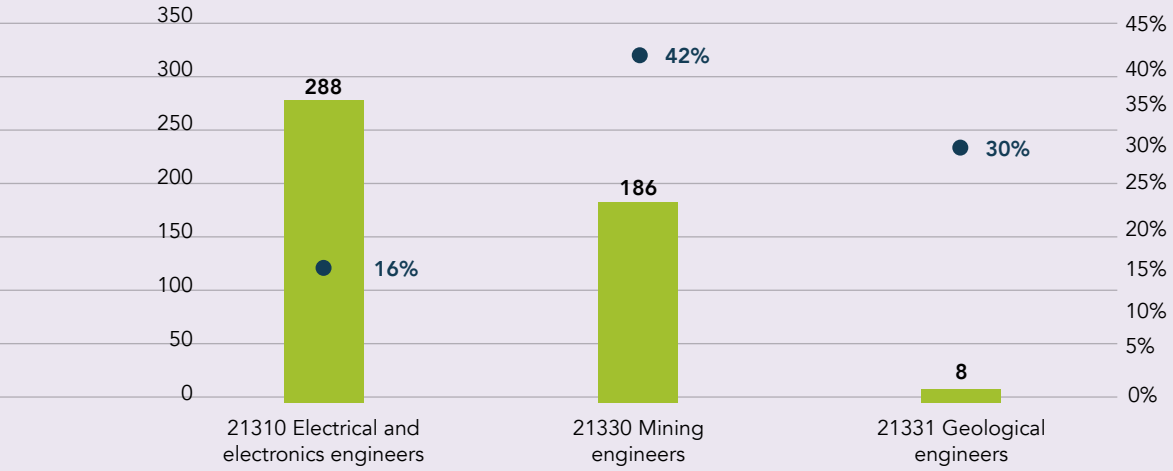
[10] Skilled Trades Ontario, "Industrial Mechanic Millwright."
[11] Employment and Social Development Canada, OaSIS.

Forecast for Engineers

In the HDHS scenario, employment in these engineering jobs will increase 210 per cent between 2023 and 2040, reaching 2,035. However, the HDLS scenario shows over 480 jobs at risk of remaining vacant by 2040, 10 times higher than the baseline forecast, and equivalent to a 23 per cent vacancy rate.

While the largest number of vacancies in the HDLS scenario will be for electrical and electronics engineers, mining and geological engineers will have the highest vacancy rates (Chart 1.10).

Chart 1.10: Mining and geological engineers have the highest vacancy rates.



Vacancy Rate (right)

Vacancies (left)

(Vacancies [left] and vacancy rate [right] for technical jobs in HDLS scenario, critical minerals sector, Ontario, 2040)

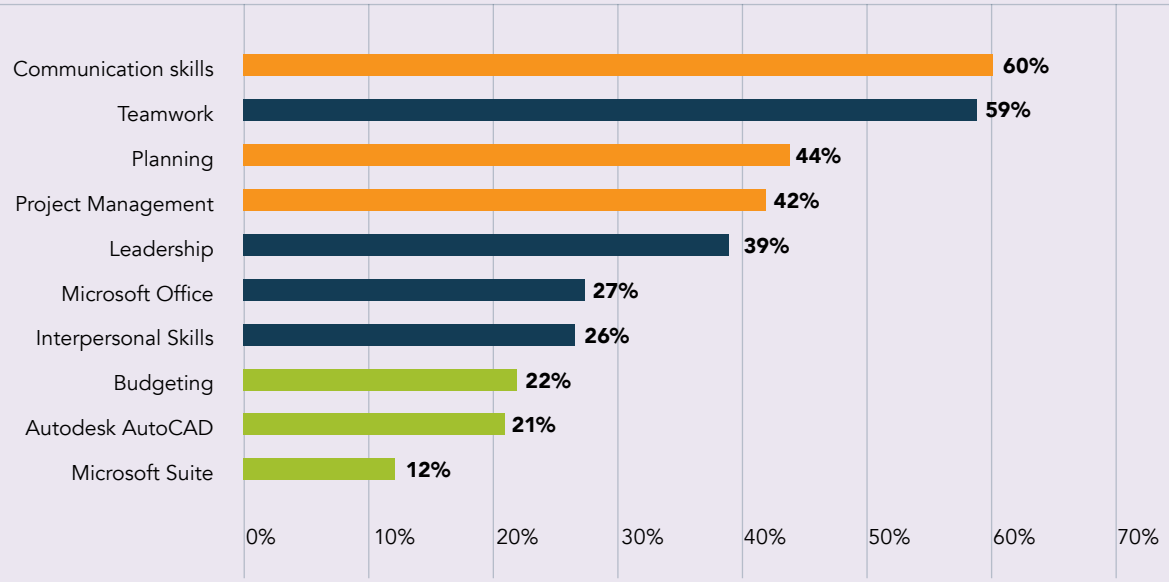
Source:
The Conference Board of Canada.

Engineering jobs usually require a university degree and significant hands-on-learning opportunities, so they are equipped for jobs in the field. Essential skills needed for engineers in the critical minerals sector include critical thinking, decision making, numeracy, preventative maintenance, product design, and reading comprehension.[12]

Beyond these prerequisites, job posting analysis shows employers seek engineers who possess communication, teamwork, leadership, project management, and interpersonal skills (Chart 1.11).

Chart 1.11: Engineers require communication, teamwork, and planning skills.

(Share of job postings for top skills* for engineers in the critical minerals sector, n=505)



*Top skills are determined by taking the ten skills with the highest clustering scores. The skills are shown ranked by share of job postings. Refer to Appendix A for methodology.

Source: Vicinity Jobs; The Conference Board of Canada.

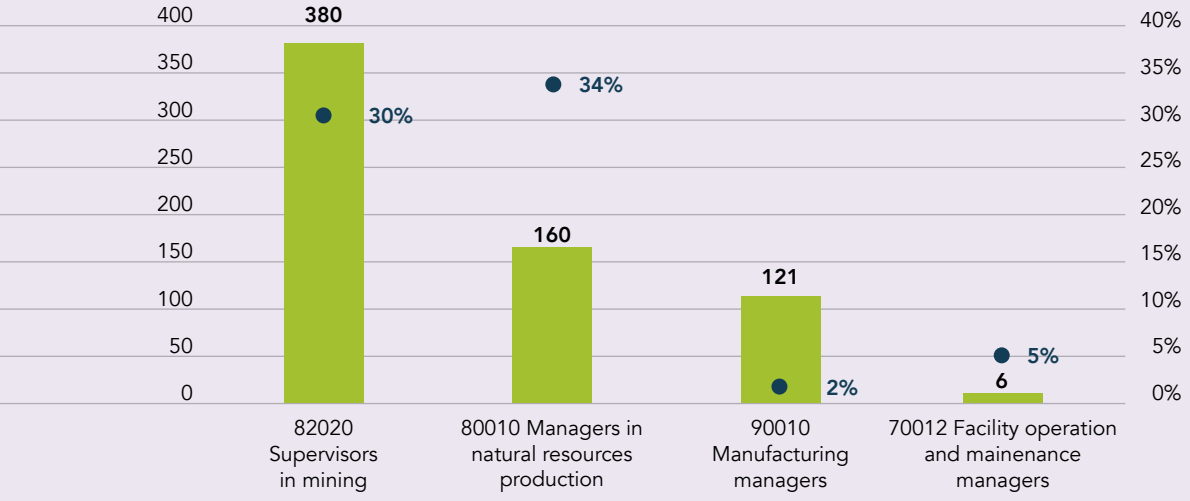
[12] Employment and Social Development Canada, OaSIS.

Forecast for Managers and Supervisors

In the HDHS scenario, employment in managerial jobs will increase 192 per cent between 2023 and 2024, reaching 8,370. This accounts for the largest share of employment in the critical minerals sector at 37 per cent. However, 670 jobs are at risk of remaining vacant by 2040 in the HDLS scenario, over 8 times the baseline level. The largest number of vacancies will be for supervisors in mining (Chart 1.12).

However, managers in natural resources production will have the highest vacancy rate, suggesting a larger share of these roles will go unfilled.

Chart 1.12: Supervisors in mining account for the most vacancies.



(Vacancies [left] and vacancy rate [right] for technical jobs in HDLS scenario, critical minerals sector, Ontario, 2040)

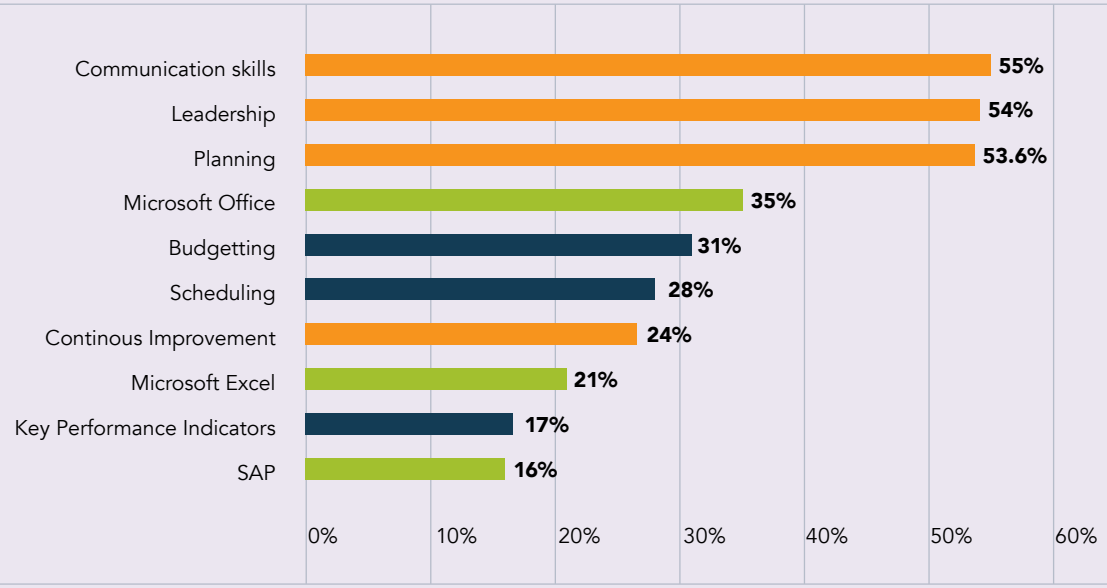
Source:
The Conference Board of Canada.

Managers, though they generally require some college or university education in a relevant field, also require significant internal training due to the need for on-the-job supervisory or management experience. Essential skills for these managerial occupations include management of material resources, time management, management of financial resources, management of personnel resources, monitoring, and negotiating.[13] Beyond these prerequisites, employers are looking for effective communication, leadership, and planning skills with over 50 per cent of job postings listing these prerequisites (Chart 1.13).

Building a talent pipeline for supervisors and managers will involve building awareness for both current and potential employees about the pathways to management positions while also helping employers train and promote workers within their organization.

Chart 1.13: Managers require a combination of technical, digital, and soft skills.

(Share of job postings for top skills*)



*Top skills are determined by taking the ten skills with the highest clustering scores. The skills are shown ranked by share of job postings. Refer to Appendix A for methodology.

Source: Vicinity Jobs; The Conference Board of Canada.

[13] Employment and Social Development Canada, OaSIS.

Job Postings in Adjacent Industry

The jobs discussed in the sections above are not only needed within the critical minerals sector but also in other industries, as indicated by the job posting data in Chart 1.14. Certain sectors, such as professional, scientific, and technical services (NAICS 541), will play an important role in supporting the expansion of the critical minerals sector.

Professional, scientific, and technical services account for the largest share of job postings for key occupations outside the critical minerals sector. In particular, 86 per cent of postings for geological engineers, 41 per cent for electrical engineers, 30 per cent of mining engineers, and 30 per cent of underground production and development miners are in professional, scientific and technical services. This industry includes engineering, scientific research, and environmental consulting services, many of which are involved in the critical minerals sector.

Chart 1.14: Many other industries are looking for jobs also needed in the critical minerals sector.

(Share of job postings by industry for each occupation group*, Canada, 2023.)

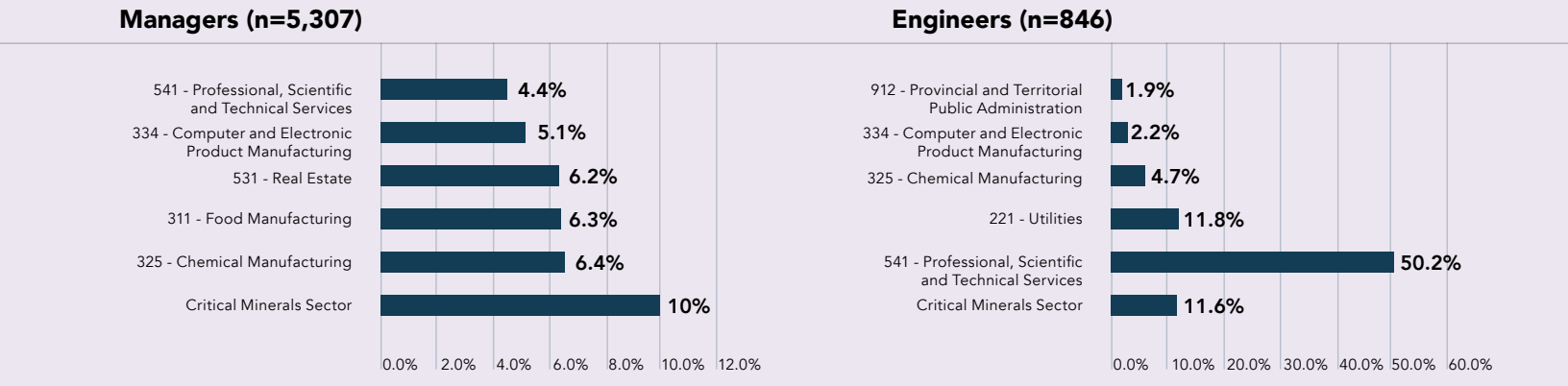
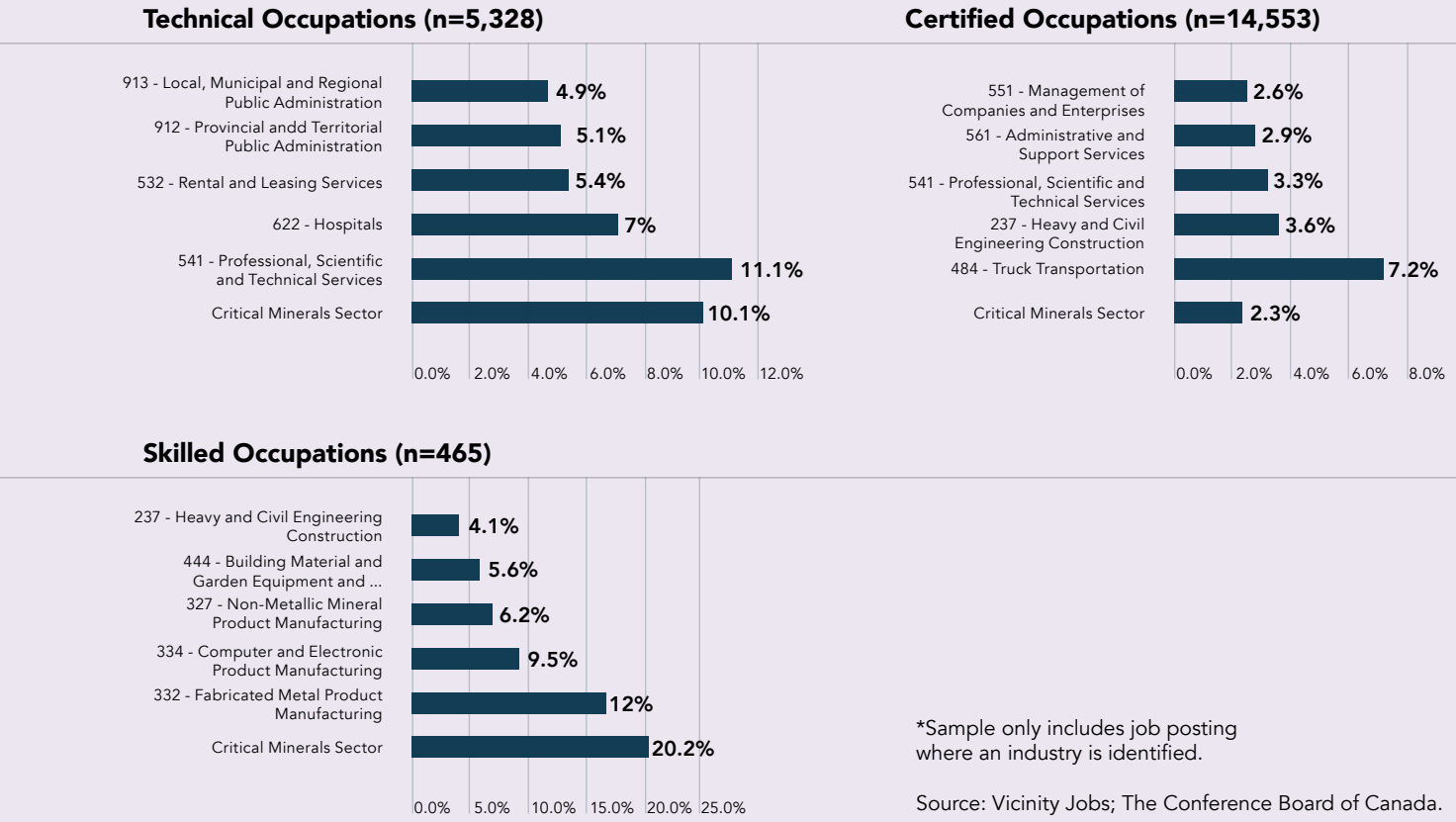


Chart 1.14: Many other industries are looking for jobs also needed in the critical minerals sector.

(Share of job postings by industry for each occupation group*, Canada, 2023.)



*Sample only includes job posting where an industry is identified.

Source: Vicinity Jobs; The Conference Board of Canada.

1.3 Training and Education Programs

Table 1.4 provides a selection of training and education programs geared towards jobs in the critical minerals sector.

Table 1.4: Essential skills and point of acquisition for jobs in the critical minerals sector.

Job Category	Essential Skills (per ESDC OaSIS database)*	Where are the skills acquired?	Examples of relevant education and training programs
Skilled Jobs	machinery operation and control, equipment monitoring, quality control testing, tool selection, and troubleshooting	secondary school diploma, and/or several weeks of on-the-job training	Common Core Surface Miner Training Online at Ontario Stone, Sand, & Gravel Association Essential Skills Training from the Mining Industry Human Resource Council Mining Common Core Training at NORCAT Occupational Health And Safety Essentials at Conestoga College Surface Miner Common Core Program at Canadian Safety Group Inc.
Certified Jobs	machinery operation and control, equipment monitoring, tool selection, preventative maintenance, and troubleshooting	college diploma or apprenticeship training of less than two years, or more than six months of on-the-job training and other specific licenses	Common Core Training at NORCAT Drilling and Blasting Training at Fleming College Heavy Construction Equipment Operation at Conestoga College Heavy Equipment Operator at Fleming College Transportation Training Centre at Humber College
Technical Jobs	troubleshooting, numeracy, machinery operation and control, tool selection, quality control testing, and preventative maintenance	college diploma or apprenticeship training of two or more years	Earth Resource Technician at Fleming College Electrical Engineering Technician at Fanshawe College Electric Drive Vehicle Technician at St. Clair College Mineral Exploration Techniques at Northern College Mining Engineering Technician at Northern College Mining Engineering Technology at Cambrian College Manufacturing Engineering Technician at Algonquin College Mechanical Engineering Technician - Industrial (Millwright) at St. Clair College
Engineers	critical thinking, decision making, numeracy, preventative maintenance, product design, and reading comprehension	university degree	Automotive Engineering at Ontario Tech University Mineral Engineering at University of Toronto Mining Engineering at Laurentian University Mining Engineering at Queen's University Geological Engineering at Waterloo University
Managers and Supervisors	management of material resources, time management, management of financial resources, management of personnel resources, monitoring, and negotiating	college or university education in a relevant field, and significant on-the-job experience	Professional Management Certificate at Ontario Tech University Management Essentials at Georgian College Schulich-Lassonde Certificate In Project Management For Engineers Generic First Line Supervisor Common Core at Northern College Global Metals and Minerals Management Diploma at the Schulich School of Business

For more information on education and training programs available see OVIN's 2023 report: **A Spotlight on Skills, Talent & Workforce Development: Critical Minerals for Electrification.**

* Essential skills based on results from the HDLS scenario and the Occupational and Skills Information System (OaSIS).

Source: The Conference Board of Canada.

Section 2: Workforce Trends

2.1 Identifying Key Workforce Trends

To understand workforce trends in the critical minerals sector, semi-structured interviews were conducted by the Conference Board of Canada with twenty diverse stakeholders from the mining industry, as well as relevant government and post-secondary institutions (see Appendix B).

These dialogues revealed three key workforce trends: automation and digitalization; greener practices and processes; and diversity, equity, and inclusion (DEI) practices.

"In this green clean future, there is an opportunity for the mining industry to play a pivotal role in supplying the world with the minerals and metals it needs."

~ Stakeholder, Mining Association

Automation and Digitalization

As the mining industry progresses over the next few decades, automation and digitalization will change the workforce landscape. Several stakeholders highlighted how certain technical skills, traditionally associated with the mining industry, are becoming increasingly automated, driving up the demand for digital skills required to oversee such automation processes and semi-automated equipment.

Stakeholders shared that it is essential for the Ontario mining industry to have "understanding of emerging technologies and solutions coming out of the global mining and innovation industries with the goal of creating pathways for these emerging technologies to be visible and accessible to the Canadian mining industry."

Stakeholders also emphasized the need for future-focused digital skills such as knowledge and innovation relating to artificial intelligence, machine learning, and quantum technologies. Building a workforce equipped with these future-focused digital skills will improve productivity and innovation in the Ontario mining industry.

Greener Practices and Processes

The mining industry is undergoing a transformation towards greener processes and practices, requiring a shift in workforce skills. Industry stakeholders have highlighted the importance of green skills, which encompass the knowledge, abilities, values, and attitudes required to develop and sustain a resource-efficient society. These skills are seen as essential in supporting the mining industry's adoption of clean technologies. Moreover, industry stakeholders see a greater need for social and emotional skills (SES), such as problem-solving, relationship-building, and communication, which are essential for navigating the complexities of sustainable mining practices.

Green skills and SES are viewed as instrumental in dispelling negative stereotypes about the industry's environmental impact and in fostering collaborative relationships with Northern communities, employment agencies, and education institutions to attract new talent to the sector.

[14] Igogo et al. "Integrating clean energy in mining operations: opportunities, challenges, and enabling approaches."

While job postings may not explicitly mention 'green skills', stakeholders have identified them as essential for the industry's future growth. Skills related to clean energy technologies and environmental policy, for instance, are expected to be increasingly important. Stakeholders have also emphasized the need for skills related to the expansion of electric vehicle supply chains, reflecting the industry's growing focus on sustainability and the transition to cleaner transportation technologies.

Overall, the integration of green skills into the critical minerals sector workforce is an important component of building more sustainable practices over the next two decades.

DEI Practices

Stakeholders recognized a growing demand for the skills necessary to further the adoption of diversity, equity, and inclusion (DEI) practices within the sector. These skills encompass the knowledge, abilities, values, and attitudes necessary to combat stereotypes, foster cultural awareness, address biases, and mitigate microaggressions. The sector will need to recruit from underrepresented populations, such as women, youth, immigrants, Indigenous peoples, and individuals with disabilities, in order to expand their workforce.

To do so, it is essential for the sector to enhance its capacity to adopt DEI practices and apply DEI principles consistently throughout workplaces and training programs. Thus, DEI knowledge and abilities are crucial for the sector's future success in promoting inclusivity and fostering a supportive and respectful work environment. Moreover, the incorporation of DEI practices signals the sector's social commitment to diversity, highlighting its dedication to building an inclusive and equitable workforce.

2.2 Building the Future Workforce

To address these future workforce trends and build a critical minerals sector talent strategy, stakeholders identified six key strategies:

- **increase industry awareness in youth,**
- **diversify training and development pathways,**
- **increase hands-on and experiential learning opportunities,**
- **increase awareness, access, and information on training program, and**
- **reach underrepresented groups and increase DEI awareness.**

Increase Industry Awareness in Youth

Early exposure through education is crucial for increasing awareness of job opportunities in the mining industry and promoting the industry's role in sustainability from a young age[15]. Through tailored curricula, both students and educators gain valuable insights into the intricacies of the mining industry, fostering a deeper understanding of its significance and potential. Mining industry stakeholders recommend introducing students to mining in elementary school and expanding exposure during high school. This helps students select courses aligned with pathways into mining-related higher education and training programs.

Industry stakeholders identified the need to effectively counter negative stereotypes of the mining sector through bridging the public perception gap. Media campaigns and materials aimed at audiences such as youth and underrepresented groups can play a crucial role in spotlighting the critical minerals sector, particularly within the context of clean technologies. These initiatives raise awareness of the mining industry's role in advancing clean technologies (like EVs) and building a sustainable future.

"There's no TV show or popular culture that makes mining cool. We have Suits for law, we have Grey's Anatomy [for medicine], we have Billions for banking. We don't have anything that's cool for the mining industry."

~ Stakeholder, Private Industry

[15] Mining Industry Human Resource Council, "From Classroom to Mine Site: A Review of Canada's Postsecondary Education Pipeline for the Mining Sector."

Diversify Training and Development Pathways

Nearly all stakeholders spoke of the need for diverse training pathways for entry into the mining industry. This involves having pathways for both entry-level positions, catering to students transitioning from high school or entering the workforce for the first time, and pathways for individuals seeking skilled employment through post-secondary training.

Several stakeholders highlighted the need for entry-level training programs for populations that are under-represented in the workforce such as youth, immigrants, Indigenous peoples, and persons with disabilities. Wage subsidies were noted as a successful strategy for increasing the number of companies employing students and entry-level workers, providing opportunities to under-represented groups to "gain a foothold into the sector" and obtain the necessary skills or work experience for employment after graduation.

Online and hybrid programs (programs that are mostly online but include in-person field work experiences) create opportunities for students who face barriers to full-time, in-person programs. This includes international students and women with family responsibilities, enabling them to pursue education while accommodating their specific circumstances. While online and hybrid programs help to diversify the skilled talent pool entering the mining sector, they do come with challenges relating to less time in field work. Hybrid training programs that provide sufficient hands-on learning opportunities will be key to ensuring students are equipped for jobs in the field.

"My mining students are across 17 time zones… the online program is great, because it's created a huge reach around the world."

~ Stakeholder, Education and Training

Increase Hands-on and Experiential Learning

Increasing experiential learning opportunities or 'work-integrated learning' for students enrolled in mining programs provides prospective employees with hands-on experience, which ultimately increases their interest and retention in the mining sector. Building stronger collaborations between post-secondary institutions, training organizations, and mining equipment suppliers will increase work-integrated learning opportunities for students and other job seekers.

Increase Awareness, Access, and Information on Training Programs

Many respondents identified gaps in current training offerings and a lack of centralized information about programs that allow direct entry into skilled work such as apprenticeships, certification and diploma courses, and degree programs. Several stakeholders stated that this lack of centralized information disproportionately impacted individuals from regional and rural areas who are often required to relocate for opportunities.

The Mining Industry Human Resource Council found that post-secondary mining programs are small and shrinking, despite rising demand.[16] Some industry stakeholders mentioned that there are not enough schools offering mining programs, and long waitlists and high costs for certain trades programs make it hard to increase skilled talent in the mining industry.

"The penalty [of online programs] is that you don't have as much time on site… I'd like to see even more on-site hands-on type training… [such as] adding another week or two to the field school."

~ Stakeholder, Education and Training

[16] Mining Industry Human Resource Council, "From Classroom to Mine Site: A Review of Canada's Postsecondary Education Pipeline for the Mining Sector."

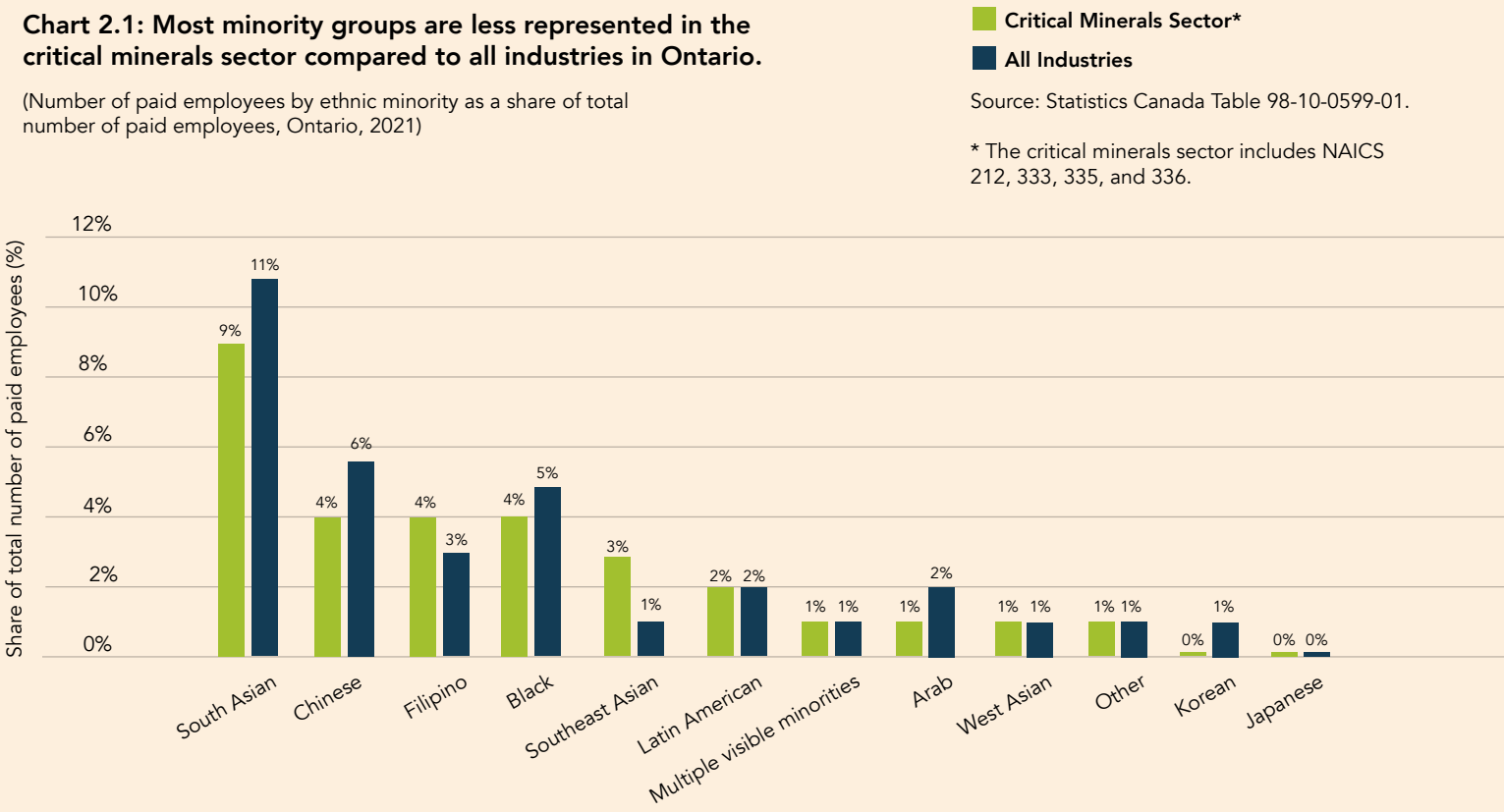
Engage Underrepresented Groups

Reducing barriers to entry and promoting inclusivity are paramount to increasing the participation of underrepresented groups in the critical minerals sector, which will ultimately benefit the sector. A 2020 study of over 1,000 large companies found those in the top quartile for racial diversity are 36 per cent more likely to outperform financially compared to those in the bottom quartile.[17] Similarly, businesses with gender-diverse leadership had a 25 per cent higher likelihood of outperforming their least-diverse counterparts.[18]

Just 30 per cent of paid employees in the critical minerals sector are people of colour, slightly less than the 33 per cent across all industries in Ontario,[19] and the sector lags the broader economy in terms of its employment shares across all minority groups except for South Asians and Filipinos (Chart 2.1).

Chart 2.1: Most minority groups are less represented in the critical minerals sector compared to all industries in Ontario.

(Number of paid employees by ethnic minority as a share of total number of paid employees, Ontario, 2021)



Source: Statistics Canada Table 98-10-0599-01.

* The critical minerals sector includes NAICS 212, 333, 335, and 336.

[17] McKinsey & Company, "Diversity wins: How inclusion matters."
[18] Ibid.
[19] Statistics Canada, "Table 98-10-0599-01 Employment income statistics by industry groups, visible minority, highest level of education, work activity during the reference year, age and gender: Canada, provinces and territories." The critical minerals sector includes NAICS 212, 333, 335, and 336. Note we use the term" people of colour" throughout instead of "visible minority" as it represents current best practice.

Research by McKinsey & Company found that certain minority groups were twice as likely to view a positive impact on environmental, social, and governance (ESG) factors as a motivation to join the mining industry, compared to non-minority groups.[20] This highlights the different desires and needs a more diverse workforce has compared to the sector's traditional workforce.

Targeted outreach and mentorship programs are two ways to recruit underrepresented groups and reduce barriers. Several stakeholders highlighted the need to focus on immigrants and international students with the skills, backgrounds, and interests directly relevant to the mining industry. Streamlining credential evaluation processes, minimizing costs associated with accreditation, and reducing wait times for qualification recognition can enhance the accessibility of the mining industry for skilled immigrants and international students, enriching the industry with diverse perspectives and expertise.

Adapting training programs to meet the needs of a diverse student population is crucial for boosting recruitment of underrepresented groups. Culturally responsive pedagogy is an approach to teaching in higher education that considers students' cultural backgrounds and norms, recognizes how they may differ from the traditional mining sector worker, and validates diverse experiences through appropriate and meaningful teaching materials and strategies.[21]

Further ways to enhance program responsiveness, include offering financial incentives like tuition reduction and scholarships and flexible formats such as part-time, online, and hybrid courses, ensuring accessibility for learners with diverse backgrounds, schedules, and commitments.

"I think we also have to look at… new immigrants to Canada and I don't think that we do a good job at all in attracting them to the mining industry."

~ Stakeholder, Private Industry

[20] McKinsey & Company, "Increasing diversity in mining: Three years on."
[21] Ragoonaden and Mueller, "Culturally Responsive Pedagogy: Indigenizing Curriculum".

Reporting Underrepresented Groups

Ultimately, there is limited research on the labour market outcomes of underrepresented groups. Data on people of colour and gender minorities (2SLGBTQ+) is missing from most standard labour market data in Canada making it difficult to measure and track these underrepresented groups, especially at the industry-province level.[22] Additionally, companies tend to have limited reporting on indicators related to ethnic diversity, and even less reporting on gender minorities.[23] Improving reporting and data measurement is a beneficial first step for the critical minerals sector to address the participation of equity deserving groups.

Increase DEI Awareness

Increasing DEI awareness will be key in fostering a more inclusive workplace where underrepresented employees want to stay. This includes providing training for employers and managers on supporting a diverse workforce, encompassing Indigenous peoples, newcomers, women, visible minorities, and persons with disabilities. Additionally, fostering flexible and understanding workplaces through initiatives like flexible work hours and remote work options contributes to accommodating diverse needs and circumstances.

Implementing robust workplace policies pertaining to discrimination, harassment, leave entitlement, accommodations, and performance management further ensures a supportive environment for all employees. Moreover, striving for representation of diversity across all levels of employment, from entry-level positions to senior leadership roles, promotes inclusivity and equitable opportunities for career advancement within the mining industry.

[23] Kincaid & Smith, "Diversity and inclusion in mining: An analysis of indicators used in sustainability reporting."

Section 3: Challenges and Strategies to Increase Women's Participation

Women's participation in the mining and manufacturing industry has changed very little over the past two decades. They currently (2023) represent a mere 14 per cent of the workforce in mining and 25 per cent in manufacturing in Ontario, compared to their 47 per cent representation across all industries.[24] The critical minerals sector remains a male-dominated one, with systemic challenges that complicate women's entry, retention, and advancement.

In our exploration of women's experiences in the mining industry, we interviewed 17 women of different backgrounds who are employed within Northern Ontario's mining industry (Appendix B). These dialogues revealed four major challenges that prevent women's participation in the industry: challenges navigating work-life balance; discrimination in the workplace; unrepresentative leadership; and lack of awareness and exposure for women. Interview participants have also recommended approaches to address these challenges.

Chart 3 summarizes the expected timeline for these strategies to positively impact the talent pipeline for the mining sector assuming they are implemented in the next 1 to 5 years.

[24] Mining includes mining, quarrying, and oil and gas extraction (NAICS 21, 2100) and manufacturing includes manufacturing durable goods (NAICS 321, 327, 331-339). Statistics Canada, "Table 14-10-0023-01 Labour force characteristics by industry, annual (x 1,000)".

Chart 3.1: Strategy timeline to increase women participation in the critical minerals sector.

Short-term (1-5 years)

- Implement DEI training.
- Update workplace policies to support flexible work arragements and accommodations.
- Offer parental leave policies and top-ups programs.
- Review hiring practices to eliminate bias or discrimination, and prioritize hiring women.
- Ensure workplaces have approriate facilites and equipment for women.

Medium-term (5-10 years)

- Ensure quality childcare facilities near worksites.
- Provide leadership training and mentorship programs for women.
- Review salaries to ensure women and men are being paid equally.
- Monitor representation, evolve policies or strategies accordingly.
- Review workplace policies and procedures, ensure DEI principals are followed.

Long-term (5-10 years)

- Promote networking and outreach amoung women in the sector.
- Review salaries to ensure women and men are being paid equally.
- Monitor representaion, evolve policies or strategies accordingly.
- Review workplace policies and procedures, ensure DEI principals are followed.

Source: The Conference Board of Canada.

3.1 Challenges Navigating Work-Life Balance

Mining and its adjacent industries frequently operate in remote areas and the nature of many roles entail shift work that often conflicts with responsibilities for childcare, family care, and other household duties that typically fall on women. For women, the sector's demanding work conditions and hours, coupled with a lack of quality and reliable daycare are daunting barriers to working in the sector.

Several participants highlighted the lack of maternity and parental leave as a considerable barrier to entering or continuing within the industry. Extensive maternity/parental leave top-up programs in other industries make those industries more attractive options and further deter women from staying in the mining industry. Parental leave policies and return to work provisions are imperative to fostering a supportive work environment for women.

"...by the nature of mining, which means that it's remote...women often leave it when it gets to that age of family, because the mining sector hasn't yet worked out how to access this part of the workforce because women end up choosing family first."

~ Woman in the Mining Industry

Offering Workplace Flexibility and Accessible Childcare

Workplace flexibility to effectively balance work and family responsibilities would significantly enhance women's participation and retention in the mining industry. This can include flexible work arrangements, such as remote work and part-time options, as well as flexible working hours. Participants also highlighted that those accommodations need to be formalized in workplace policies, to ensure that they are protected and supported as workplace rights.

Most participants identified lack of childcare as a major barrier to women entering or staying in the mining industry. They emphasized the importance of having high-quality, reliable childcare facilities, located on-site or nearby mine locations, aligning with the flexible/extended work hours and offering fair compensation to staff. This is essential for women to be able to fully contribute at work. Moreover, accessible childcare would also benefit men with young children in dual-working-parent families, thereby supporting overall sector retention.

"Workplaces need to support and have policies on workplace flexibility, it would allow more participation. Formalize that. I think in a lot of cases it's very informal and it's between an employee and their manager. And if that manager changes, then they may not be able to continue doing their job."

~ Woman in the Mining Industry

3.2 Discrimination in the Workplace

Women report facing more discrimination in the mining sector compared to other industries and fields of work.[25] Every woman interviewed shared experiences of encountering discrimination in the workplace, from both supervisors and peers. These instances included derogatory remarks, actions that undermined their abilities and careers, and preferential treatment for male counterparts. Every participant offered examples of how these discriminatory experiences made it difficult to stay in the mining industry and be successful at work. Many women also shared experiences of unsafe situations where they encountered sexual harassment and assault from male peers.

Enduring discrimination has created an environment where many women feel they have no choice but to leave the industry entirely. This not only affects those who leave but also discourages other women from considering careers in the industry. Many participants shared stories of colleagues who left their jobs because of discrimination.

"...working in the industry and attending meetings and visiting companies, the immediate reaction was always, "I'll take milk in my coffee." Things like that. Those were the comments I would get. "Oh, whose secretary are you?" That type of stuff, even though I'm there running the meeting."

~ Woman in the Mining Industry

"I've had to push men off of me physically, I've had to have them pulled off of me, I've had people banging on my hotel room door, I've had all of it. And unfortunately, it's part of the game."

~ Woman in the Mining Industry

[25] McKinsey & Company, "Why women are leaving the mining industry and what mining companies can do about it."

Updating Workplace Policies and DEI Training

Anti-bullying and anti-harassment policies are needed to prevent the harassment and discrimination women face in the industry and safeguard their well-being. While implementing anti-bullying and harassment policies would provide immediate benefits, changing workplace culture takes time as companies work on enforcing these policies and holding employees and managers accountable to following them. Additional DEI training for both managers and employees would be needed to change the workplace culture.

Providing DEI training to leadership, managers, supervisors, and peers will help build inclusive workplaces. Such training equips individuals with the knowledge and skills to effectively navigate diversity, address instances of bias and discrimination, and cultivate workplaces that are supportive for women. Management and human resource (HR) professionals need to be equipped to provide guidance, assistance, and reasonable accommodations for all workers, ensuring that women receive the support they need to succeed in the critical minerals sector.

Lack of Resources and Accommodations for Women

Women in the mining industry face the reality of working in environments designed without due consideration of provisions for women's safety and well-being. This includes equipment and safety gear ill-suited for women's physiology and sizes, and the absence of appropriate facilities on mine or field sites such as bathrooms and designated spaces for specific needs of women. These shortcomings not only compromise the safety of women working in the mining industry, but also contribute to an environment that is unwelcoming and inhospitable.

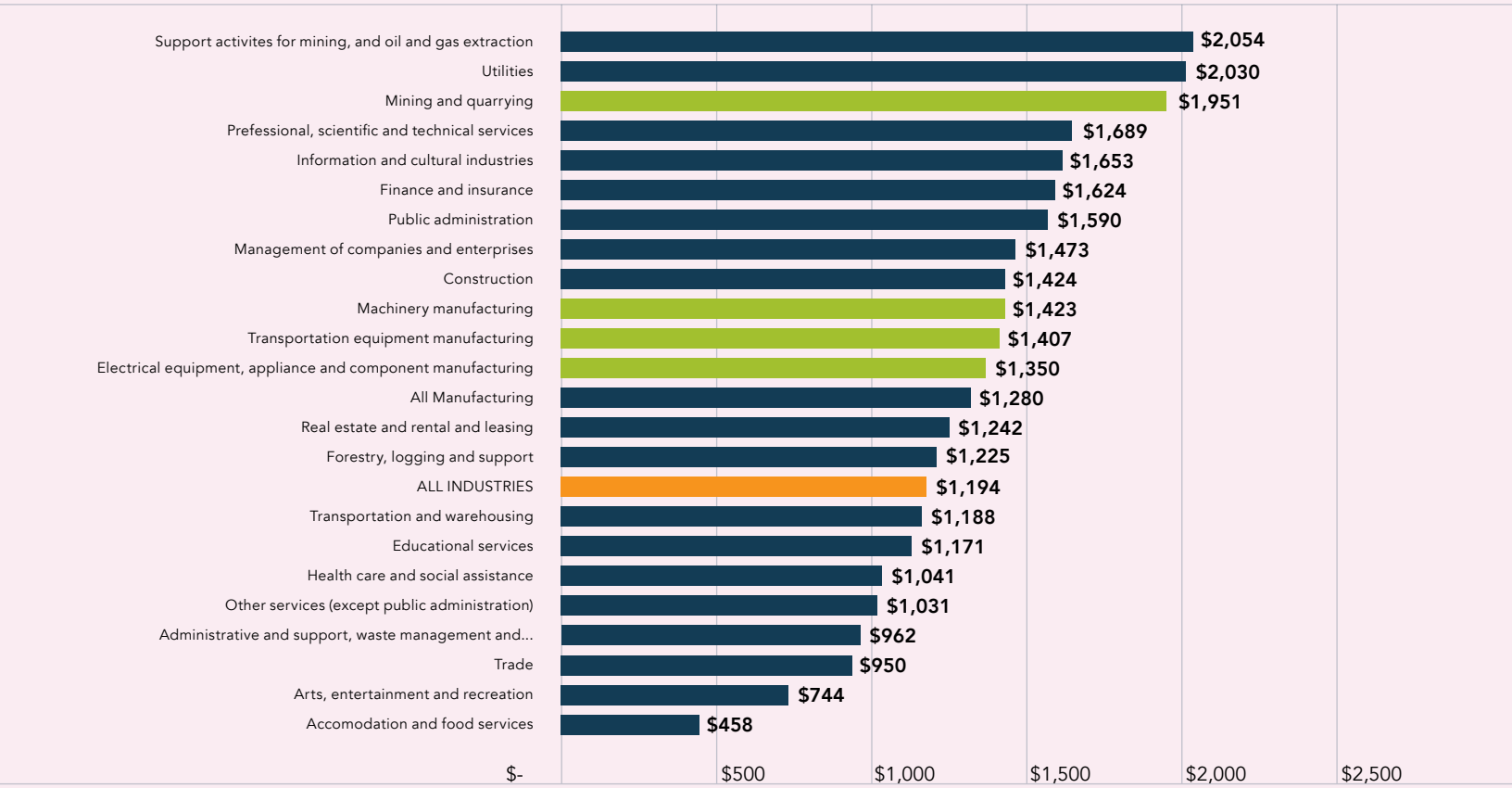
Attractive Wages

A significant pull factor for workers considering entering the critical minerals sector is the high wages the sector offers (Chart 3.2). This is particularly true for women, who are overrepresented in sectors that offer the lower average wages.[26] One third of the women participants interviewed identified high wages as a reason for entering, staying, or recommending the sector to other women.

One quarter of women participants also shared that they had experienced wage discrimination in comparison to male colleagues, which they attributed to women being less likely to negotiate salary during the hiring process than male peers. Wage gaps due to women's reluctance to negotiate salary are not unique to the critical minerals sector.[27] Several women participants shared that their companies have created job classifications and bi-annual salary review processes to mitigate gender wage disparities.

Chart 3.2: Wages in the critical minerals sector are higher than average.

(Average weekly earnings for all employees [including overtime], 2022 current dollars, Ontario)



[26] Schirle & Sogaolu, "A work in progress: Measuring wage gaps for women and minorities in the Canadian labour market."
[27] Recalde & Vesterlund, "Gender differences in negotiation and policy for improvement"

Industries in the critical minerals sector

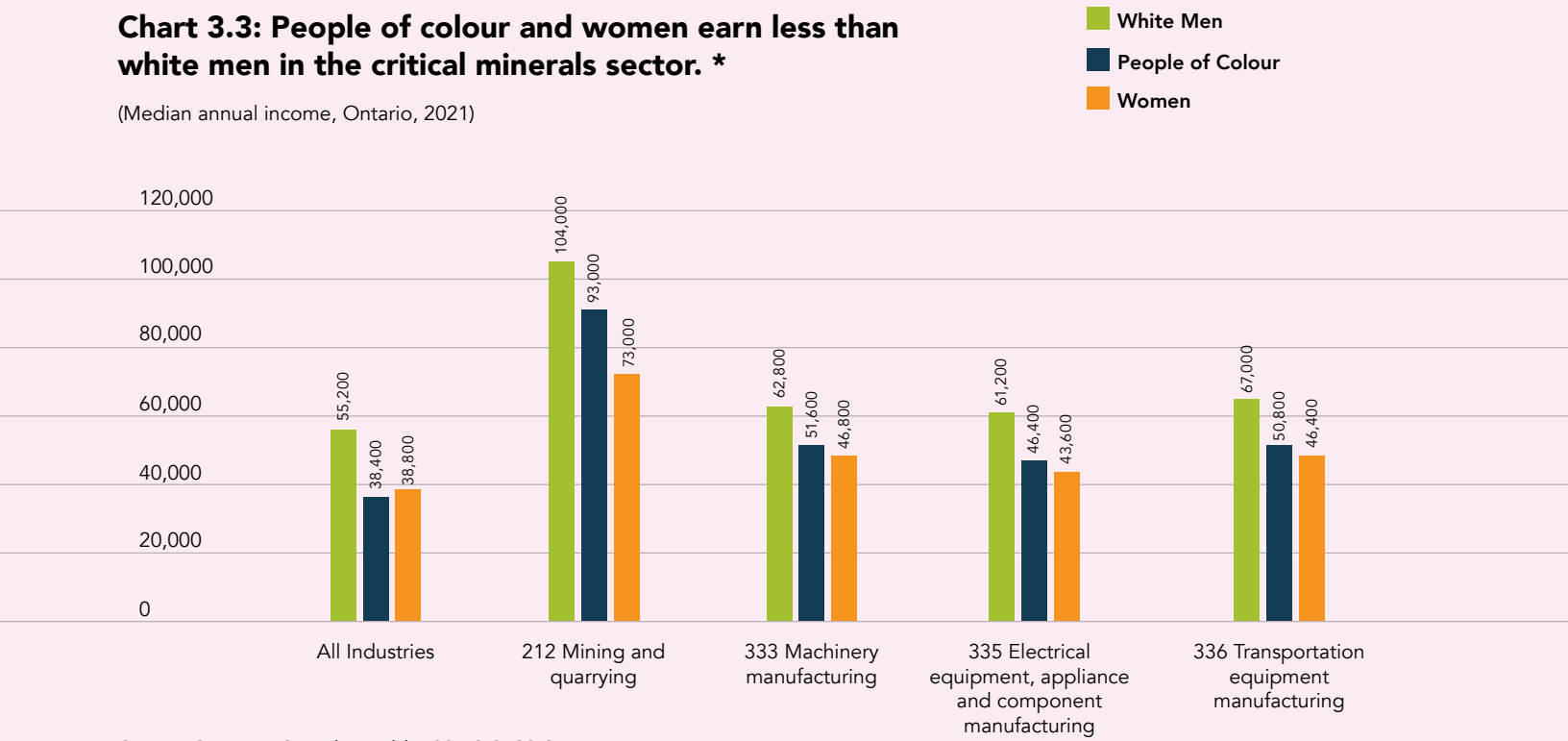
Source: Statistics Canada, "Table: 14-10-0204-01"

Although wages for women and people of colour are comparatively higher within industries in the critical minerals sectors than across all industries in Ontario, they still lag behind those of white men (Chart 3.3).

This discrepancy can be attributed to various factors, such as the nature of their roles, educational and skill levels, work experience, discrimination, and limited negotiation opportunities.[28] Implementing policies and programs that help people of colour and women enter higher-paying positions within the sector will be crucial in narrowing this wage gap.

Chart 3.3: People of colour and women earn less than white men in the critical minerals sector. *

(Median annual income, Ontario, 2021)



Source: Statistics Canada, "Table: 98-10-0599-01"

* In Statistics Canada's terminology, people of colour are categorized as 'visible minorities,' while those who are not part of these groups are classified simply as 'not a visible minority,' commonly understood as white.

[28] Schirle & Sogaolu, "A work in progress: Measuring wage gaps for women and minorities in the Canadian labour market."

3.3 Unrepresentative Leadership

Only 19 per cent of women hold senior management positions in the mining and oil and gas industry (the second-lowest industry in the province for female representation) and 27 per cent in the manufacturing industry, both well below the 37 per cent level seen across all industries in Ontario.[29]

This absence of visible female figures in leadership roles makes it challenging for women to picture themselves working in the critical minerals sector and aspiring to top leadership positions. Additionally, participants highlighted that a lack of women in leadership positions also perpetuated a workplace culture where women's voices and perspectives are rarely asked for and even more rarely considered.

"...a big reason why women don't enter the mining sector is because they don't see themselves represented in enough of the roles, whether it be site-based, or senior, or CEO, or board."

~ Woman in the Mining Industry

[29] Statistics Canada, "Table: 33-10-0660-01: Average percentage of women and men in management positions, first quarter of 2023."

Inclusive Hiring Practices

To attract and retain women in the critical minerals sector, especially in senior leadership positions, there must be a concerted push for inclusive hiring practices that address discrimination and bias in the hiring process. While some organizations may adopt quotas for interviewing or hiring women to meet diversity metrics, true inclusivity requires a deeper commitment to a balanced workforce across all levels, and not just for entry level positions. This entails creating an environment where women are valued, respected, and empowered to thrive, rather than simply patronized as a way of meeting numerical targets.

Mentorship and Networking

Nearly all participants highlighted the pivotal role of mentorship throughout their careers in the mining industry. They emphasized the value of mentorship, both formal and informal, in providing opportunities for women's career advancement and sector retention. Many women interviewed expressed that the gender of their mentor was not a determining factor; rather, they sought reliability and trustworthiness in their mentors and a good fit in terms of role and industry. Proactively creating and offering mentorship opportunities for women seeking to enter or remain in the field can significantly enhance attraction and retention.[30]

Throughout Northern Ontario, there are nonprofit associations and advocacy groups developing opportunities for women to build supportive networks and find mentorships within the industry.[31] Many participants advocate for expanding these programs or creating more opportunities for women to network with peers in the mining industry. They believe this could attract more women by offering access to good job prospects and supportive networks.

"You cannot let companies provide you with a weak plan of hiring women at the bottom. In that way, they achieve critical mass, but women are at the bottom so they don't have a voice. They don't have a say. They don't have the power to make change. You have to hire women at the upper level - that's where representation really matters."

~ Woman in the Mining Industry

[30] McKinsey & Company, "Why women are leaving the mining industry and what mining companies can do about it."
[31] Mining Matters: Resources/Links

3.4 Lack of Awareness and Exposure for Women

Women have limited awareness of careers in the mining industry, especially if they lack personal connections to the industry. The Ontario Mining Association (OMA) found only 26 per cent of women surveyed were familiar with the mining industry, contrasting starkly with healthcare (72 per cent) and banking and financial services (62 per cent).[32]

Widespread negative stereotypes about the mining industry, including perceptions of it being dirty, dangerous, and primarily manual labour, compound the issue by further deterring women from exploring opportunities within the field.

"Women don't see themselves in [the mining industry]. So whether that's a perception of it being a dirty industry or difficult environment with respect to bullying, et cetera, women haven't found it attractive.

~ Woman participant from Private Sector Leadership

Early Exposure in School

High school and post-secondary students, educators, and career development professionals were identified by most participants as important audiences for industry awareness outreach. Educators and career development professionals need accessible and engaging materials that highlight entry points, career paths, and salary potential within the industry. Exposing students to career opportunities at a young age is shown to improve the likelihood of students pursuing those careers in the future.[33] The mining industry should partner with educators and career development professionals to provide insights on the variety of opportunities available and show examples of women thriving in the industry. These actions can help dispel misconceptions and empower more girls and women to pursue careers in mining.

[32] Ontario Mining Association (OMA), "OMA-OLMP Labour Market Assessment."
[33] Emembolu et al, "Using action research to design and evaluate sustained and inclusive engagement to improve children's knowledge and perception of STEM careers."

Section 4: Opportunities, Challenges, and Strategies for Indigenous Participation

We conducted eleven interviews with representatives of First Nations and Indigenous groups in Ontario to better understand the opportunities, challenges, and essential strategies for meaningful Indigenous participation in the critical minerals sector. Throughout our discussions, Indigenous representatives underscored the multifaceted approach required to ensure Indigenous communities not only participate in but thrive within the critical minerals sector.

This approach involves integrating Indigenous interests and perspectives across the value chain, enhancing training and education, strengthening community readiness for engagement, navigating social and environmental risks in mining development, and rethinking Treaty-based relationships in critical mineral development. These strategies, if implemented soon, will have short-and long-term impacts on Indigenous participation in the sector as outlined in Chart 4.

Chart 4.1: Strategy timeline to increase Indigenous participation in the critical minerals sector.

Short-term (1-5 years)

- Early engagement on all proposed projects; targeted awareness campaigns highlighting opportunities for individuals and businessess
- Support for community capacity building and training programs, including immediate needs such as housing, transportation, childcare and training subsidies
- Unbundling contracts and upholding Indigenous procurement targets

Medium-term (5-10 years)

- Support role-model and mentorship programs for both individuals and businesses
- Ongoing capacity support for businesses and increasing involvement as businesses grow
- Funding and implementing wrap-around supports for community such as policing and community safety, health, recreation, and cultural programs

Long-term (5-10 years)

- Ongoing mentorship and role-model programs
- Ongoing support for individuals and businesses
- Ensuring Indigenous-led montioring and remediation of sites when the life-cycle of a mine is complete.

Source: The Conference Board of Canada.

4.1 Integrating Indigenous Interests and Perspectives Across the Value Chain

The exploration and extraction of critical minerals present a unique opportunity for Indigenous communities to engage in the entire value chain. This section highlights the key findings from our discussions with community members and stakeholders, outlining the prospects for employment, business development, and the necessary supports for successful integration.

Employment Opportunities at Every Stage

Respondents identified a broad-spectrum of employment opportunities for Indigenous individuals including roles in management, human resources, finance, environmental science, geology, and hydrogeology, alongside traditional on-site jobs. Properly conducted engagement and thoughtful involvement of Indigenous communities could lead to increased participation of their members in planning, engineering, mapping, exploration, drilling, and operational phases of mining projects.

While entry-level jobs such as equipment operators and labourers are typically available, there is a strong desire of Indigenous people to be involved in every stage of the mining sequence, including processing roles. This aspiration underscores the need for targeted training and education in science, technology, engineering, and math (STEM) to prepare for such positions.

For ongoing monitoring, Indigenous Guardian programs are seen as vital because "Indigenous Guardians help Indigenous Nations honour the responsibility to care for lands and waters. They serve as the 'eyes and ears' on traditional territories."[34] One example of a successful Guardian program is the Coastal Guardian Watchmen, a regional collaboration between several North Pacific coast First Nations that ensures the sustainable management of resources and enforces rules and regulations based on their traditional and contemporary laws.[35] These Guardian roles leverage the connection Indigenous people have with their land, ensuring responsible and respectful project execution.

Challenges and Supports

As we explore ways to increase Indigenous participation across the diverse range of employment opportunities, it is important to also consider the challenges that come with achieving these goals. These include the need for comprehensive training programs, that account for the specific challenges faced by each community – addressing practical barriers such as remoteness, childcare and housing and fostering a conducive environment for Indigenous participation. For example: some communities are remote and may require reliable internet access or transportation to training programs; other communities may have a population near a training institution and good internet access but may instead have housing or childcare barriers that prevent them from taking a training program that is needed.

Practical barriers to Indigenous community participation including inadequate transportation, housing, and childcare. Respondents emphasize the necessity of "wraparound supports" within community employment strategies to ensure the widest possible involvement.

[34] Indigenous Leadership Initiatives, "Guardians."
[35] Coastal Guardian Watchmen, "About Coastal Guardian Watchmen."

There is a need for role models and targeted awareness campaigns to showcase all the different careers available in the critical minerals value chain. Approaching communities and/or regional representative organizations at the beginning of the project is crucial for fostering community trust and involvement and will lead to the most successful methods of communicating with each community.

Respondents indicated that racism and gender-based discrimination remain challenges within the industry. Proposals to tackle these issues include the introduction of Indigenous liaison roles and programs to provide culturally relevant support and advice from Elders.

Indigenous Businesses in the Value Chain

Indigenous businesses also stand to benefit from opportunities within the critical minerals value chain. Strong opportunities for Indigenous participation include Geographic Information Systems (GIS) mapping, environmental and geological consulting, transportation, storage, site preparation, laundry and industrial cleaning, labour camp and supply chain services, equipment servicing, and all forms of construction and maintenance. Businesses that provide professional services such as management consulting, accounting, environmental monitoring, and site remediation were also seen as important prospects. It is critical to raise awareness of these opportunities, while implementing strategies to overcome challenges linked to capacity, experience, and access to capital.

Respondents highlighted the importance of the existence of Indigenous procurement strategies and suggested the unbundling contracts to allow smaller businesses to compete with larger, more established non-Indigenous businesses. Ongoing support in the form of mentorship programs to navigate the industry's complexities was noted as a valuable part of growth and development.

4.2 Enhancing Training and Education

Barriers to Education and Training

The Need for Alternative Education Models

For many in northern communities, it is a significant challenge to obtain a conventional Ontario Secondary School Diploma. There is a call for a shift in perspective towards education within these communities, emphasizing the inclusion of traditional, cultural, and linguistic elements of Indigenous peoples in the educational system. This approach acknowledges the diverse learning styles and backgrounds of students, advocating for education that resonates with their heritage and experiences.

Overcoming Financial Barriers to Training

The cost of training programs can be cost-prohibitive for many individuals, creating a barrier to entry into the mining sector. As an example, the current cost of NORCAT's basic Underground Hard Rock Miner Common Core course is over $10,000 for tuition, which can present a barrier for individuals without access to the necessary financial resources.[36] This is compounded by the expenses of transportation and accommodation and does not account for any lost income while the individual is undergoing training.

These financial obstacles are further compounded by the fact that entry-level positions in mining, while necessary, may offer little job security and are physically demanding, leading to high turnover and burnout rates. The need for training that leads to higher-level positions, such as trades, mineral advisors, environmental scientists, surveyors, and engineers, is evident.

[36] NORCAT, "Training Catalogue"

Proposed Solutions to Enhance Training Accessibility

Partnerships with Educational Institutions

It is necessary to create partnerships with educational and training institutions to deliver training programs that are more accessible to remote and northern communities are necessary. One such example is the Mining Essentials Program delivered by Anishinabek Employment and Training Services (AETS).[37] The curriculum was developed collaboratively by the Mining Industry Human Resources Council and Indigenous advisors.[38] Other partnerships can be arranged with Ontario-based post-secondary institutions, ensuring the programs centre the unique needs and priorities of each community.

Incorporating Mentorship and Hands-On Learning

Adopting mentorship programs and a hands-on, person-to-person approach to training could better accommodate the learning approaches of Indigenous communities. This bridge the gap between traditional educational formats and the practical needs of learners, making training more engaging and effective.

Providing Training Subsidies and Supports

These subsidies could encourage more individuals to purse training opportunities by addressing their immediate financial concerns like bills and living expenses, with a long-term view of their career prospects.

Creating a Pathway to Employment

Our interviewees highlighted the concept of a "pathway to employment" as an effective strategy, wherein training programs are directly linked to guaranteed job placements upon completion. This approach ensures that participants have a clear transition from education to employment, reducing the uncertainty that often accompanies post-training job searches.

[37] Anishinabek Employment and Training Services, "Mining Essentials."
[38] Northern Ontario Business," Aboriginal mining training program provides skill, confidence".

Government Support for Training Initiatives

The role of provincial and federal governments in supporting training initiatives was underscored as vital. Government funding and support are necessary to sustain training programs, particularly for programs developed in partnership with Indigenous organizations and the private sector. This collaborative approach can alleviate the financial burden on industry and avoid the possibility that companies decide to not allocate resources to such an undertaking. .

Addressing the challenges related to education and training within Indigenous communities requires a multifaceted approach that includes financial support, innovative learning models, and strong partnerships among communities, industry, and government. By implementing these solutions, we can move towards a more inclusive and effective training framework that prepares Indigenous individuals for meaningful careers in the critical minerals sector, ensuring their participation not just as employees but as leaders and innovators in the industry.

Success Story

One representative of a First Nations economic development organization shared their region's strategy for working with the mining sector to create employment, skills development, and other benefits:

"We worked in partnership with the mine to develop an Indigenous Economic Development Fund. We were able to increase that initial intake of skills in the community prior to the mine showing up on site...before we even got to construction, we were already working with the mine. And we were doing skills development, underground hard rock mining common core, heavy equipment operator training, all to increase the skill in that area. So that when they did open, we were going to be able to maximize our opportunity to get our people those employment opportunities. Each mine has an initial agreement, it's broken down into a variety of levels under our IBA [Impact Benefit Agreements]. The first level is the communities that are directly affected... They've actually really flown with this. They've gone ahead and they've really looked to bring up those skills and employ those individuals from these particular communities. And what we see is now the highest amount of members in that first run of Indigenous people.

This mine, it sits on the edge of one of a huge waterway, which is where their water comes from ... So we put a lot of work in to ensure that a lot of safety was going to be put into place. And of course the community members in that area are going to directly benefit economically from this mine opening on their land. We're now around five or six years in to operation and we're seeing a lot of success with this mine.

4.3 Strengthening Community Capacity and Readiness for Engagement

This section explores the challenges communities face in building the necessary capacity to forge productive relationships with industry partners and outlines potential pathways to address these issues.

Challenges to Building Capacity

Limited Resources and Competing Priorities

Indigenous governments often find themselves stretched thin, juggling multiple competing priorities with limited resources and staffing. Communities interviewed expressed that this challenge hampers their ability to engage in meaningful negotiations with industry and government partners, who usually have more resources at their disposal and set tight timelines for responses.

Social Challenges and Infrastructure Barriers

Some communities may be grappling with severe social challenges, such as drug abuse, suicide, housing shortages, and poverty. The remoteness of many communities exacerbates these issues, with young people having to leave for education and facing unemployment upon return. Additionally, infrastructure challenges such as limited internet access and the high cost of transportation and living in northern or remote areas impact housing availability and overall community wellbeing.

Some communities are described as being in a "state of emergency," with significant mental health, addiction, and suicide issues. There is also the persistent issue of access to clean drinking water.[39] However, some communities are not faced with these urgent situations and are more prepared to engage. Recognizing the unique situations and strengths of each community is the first step towards addressing both profound challenges as well as opportunities.

[39] Reports of the Auditor General of Canada, "Report 3—Access to Safe Drinking Water in First Nations Communities—Indigenous Services Canada."

Addressing Community Health and Readiness

Community Healing Initiatives

It is imperative to improve community health through community-lead initiatives before meaningful engagement in economic activities can occur. These include addressing basic needs like hunger and providing resources and facilities for community activities. A focus on individual and collective healing is seen as a prerequisite for developing a capable and ready workforce.

Transitioning Towards Solutions

Understanding the multifaceted nature of capacity-building and addressing both the immediate social challenges and the long-term goal of economic engagement requires a holistic approach. Through targeted initiatives, resource allocation, and a focus on healing, Indigenous communities can enhance their capacity to engage meaningfully with industry and government partners, paving the way for sustainable development and prosperity.

4.4 Navigating Social and Environmental Risks in Mining Development

The development of the mining sector brings social and environmental risks that can disproportionately affect Indigenous communities. This section explores the complexities of these risks and outlines strategies for mitigating their impacts. The focus is on understanding how social dynamics and environmental concerns intersect with the goals of sustainable development and cultural preservation.

Social Risks and Mitigation Strategies

Social Risks

It was noted that the expansion of mining activities and influx of cash into communities may introduce several social risks, including increased substance abuse and associated patterns of stress and violence. These challenges underscore the need for comprehensive mitigation strategies that address the root causes and provide supportive measures, such as drug and alcohol treatment programs. There are also concerns surrounding community safety, trafficking, and Missing and Murdered Indigenous Women and Girls (MMIWG) related to an increased temporary labour force and mining camps. Community safety and policing programs are an important part of these mitigation strategies.

Industry-community partnerships can decrease the social risks by fostering a sense of mutual responsibility between project proponents, employees, and community members. Additionally, social supports such as community drug and alcohol programs, financial literacy programs, and community resilience initiatives can further reduce social risks.

Combatting Racism and Gender-based Discrimination

The presence of racism and gender-based discrimination within the mining industry was raised as a significant concern. Employing more women and gender-diverse individuals would inherently foster feelings of security and belonging at the workplace. Establishing cultural supports such as an Indigenous ombudsperson that can help with workplace issues and programs involving cultural teachings and access to Elders for guidance and spiritual/ceremonial activities can also help foster more inclusive and respectful workplace environments.

Supporting Community-Level Services

The expansion of mining operations can strain existing services such as housing, schools and childcare, policing and emergency response, and basic infrastructure, such as roads, sewage systems, and electrical grids, when there is a sudden increase in a formerly small population. Adequate financial support for programs based on what the community identifies as their immediate and long-term goals within this framework are essential to ensure the community's well-being and resilience against the pressures of development. This can include housing, childcare, transportation and training subsidies, increased policing or community safety programs, drug and alcohol treatment programs, and recreational facilities and programming for youth.

Environmental Risks and Indigenous Perspectives

The Importance of Land and Culture

Indigenous cultures have a deep, intrinsic connection to the land, which is considered vital for future generations. The most frequently raised concern by respondents is the environmental impact of mining and processing activities, emphasizing the need for sustainable practices that do not compromise the land's integrity.

Community representatives expressed concerns about contamination and the long-term impacts of mining projects, highlighting the importance of making decisions that consider the next seven generations. The goal of this philosophy is to ensure that land remains usable and that the natural environment, including lakes and rivers, is protected for future use.

Advocating for Nation-to-Nation Engagement

The concept of nation-to-nation engagement – that recognizes the original treaty relationship of two equal and autonomous nations – is critical in addressing environmental and social risks.[40] Indigenous communities emphasize their role as long-term stewards of the land, advocating for involvement in all stages of mining development to ensure that practices align with their values and the sustainable use of natural resources.

Addressing social and environmental risks in Indigenous territories from mining developments requires a multifaceted approach that respects cultural values promotes community well-being and prioritizes environmental sustainability. Targeted mitigation and nation-to-nation partnerships aim to balance economic growth with land and water preservation for present and future generations, ensuring that Indigenous communities remain active participants in decision-making processes and beneficiaries of their resources.

As one First Nation leader framed the fundamental issue of engagement:

"We've been here for thousands of years. These mines might be in operation for 25 years, 30 years, 50 years. They are in fact just short-term visitors on our land. Our people will be here hopefully for generations after this mine is gone. We have to be involved in the early stages and we have to be involved in the production stages. We have to be involved in the pulling the mineral out stages. We have to be involved in the getting the land back to normal stages… We talk about the seven generations thing lots in Native country and that's a real thing."

[40] Mainville, Sara. "Nation to Nation and why it matters."

4.5 Rethinking the Treaty-based Relationship in Critical Minerals Development

There are 128 First Nations in Ontario as well as a substantial Métis population represented by the Métis Nation of Ontario. This diversity of nations encompasses a range of opinions and Indigenous policy perspectives on the risks and opportunities of mining and Ontario's evolving critical minerals sector. While some nations are opposed to any form of mining development on their lands, others aspire to be involved in responsible mining that respects their historic treaties and inherent rights to self-govern.

The development of the critical minerals sector offers a unique opportunity to revisit and reinforce the treaty-based relationship between Indigenous Nations, governments, and the mining industry. This section delves into the challenges and opportunities within this evolving dynamic, emphasizing early engagement, long-term partnerships, and the sharing of opportunities and risks.

The following section summarizes perspectives shared by a cross-section of Indigenous leaders and senior managers, representing Indigenous communities and organizations that currently participate, or have an interest in participating, in Ontario's critical minerals sector. (See also the appendix titled Engagements with Indigenous Communities Methodology).

The Need for Early and Ongoing Engagement

The traditional method of engaging Indigenous communities—posting notices after project conceptualization—is increasingly seen as inadequate and disrespectful. Indigenous Nations, possessing constitutionally protected rights and legal claims to their territories, demand involvement from the earliest stages of project planning. This alternative approach fosters long-term, mutually-beneficial relationships rather than transient, transactional interactions.[41]

Several participants involved in active projects noted that a significant barrier to sustaining good working relationships is a high turnover among government and industry representatives. This instability can undermine the trust and continuity essential for meaningful partnership, highlighting the need for strategies to ensure long-term engagement.

Reimagining Treaty Commitments

Respondents emphasize the importance of returning to the principles of treaty relationships, urging both government and industry to honour these agreements through meaningful action – now also framed and guided by the United Nations Declaration on the Rights of Indigenous Peoples Act. This includes ensuring that progress continues in the area of meaningful consultation, a concern exacerbated by the global nature of the mining industry and its impact on Indigenous territories.

Communities are looking for involvement that transcends the traditional models of Memoranda of Understanding (MOUs) or short-term, unskilled job creation. They aspire to co-ownership, equity, and the development of Indigenous businesses within the critical minerals value chain, seeking creative agreements that allow for environmental risk compensation and sustainable community reinvestment.[42]

[41] Westropp and DeCoste, "Finding the Win-Win in Major Project Agreements: Lessons From Indigenous Groups and Industry Proponents."
[42] Belliveau, "Indigenous Ownership: Best Practices for Major Project Success."

Innovative Agreements and Sustainable Development

Innovative agreements made between First Nations and industry, such as unique Impact Benefit Agreements (IBAs) and Resource Revenue Sharing Agreements (RRS agreements), can provide communities with direct revenue sources and significant economic benefits.[43] RRS agreements are agreements between government and an Indigenous community regarding the sharing of public revenues generated from natural resource extraction or use, and may include royalties, mineral taxes, and rents.[44] IBAs can deal with economic benefits but also contain socio-economic and environmental clauses such as community capacity-building, respecting traditions, and responsible Indigenous-led stewardship practices to mitigate the ecological impacts of mining development.[45] The demand for new and innovative arrangements reflects a desire for sustainable business practices that withstand the volatility of global markets and frequent changes in mine ownership.

» Considering the Full Lifecycle of Mining Operations

Indigenous perspectives on responsible mining and development often incorporate a long-term view, prioritizing the wellbeing of future generations. This approach demands a comprehensive consideration of a mine's lifecycle, from development through to closure and land rehabilitation, ensuring decisions are made with the next seven generations in mind.

[43] Fiser and Pendakur, "Options And Opportunities: Resource Revenue Sharing Between The Crown And Indigenous Groups In Canada."
[44] Coates, Ken S., "Sharing the Wealth: How Resource Revenue Agreements Can Honour Treaties, Improve Communities, and Facilitate Canadian Development.".
[45] Indigenous Leadership Institute. "Impact Benefit Agreements."

Addressing Information and Resource Gaps

Enhancing Communication and Cultural Awareness

The variance in Indigenous communities and Indigenous representative organizations receiving sufficient information from government and industry partners points to a need for improved communication strategies. Direct engagement and investment in cultural awareness are essential for bridging these gaps.

Empowering Communities Through Resource Allocation

The disparity in resources between Indigenous communities and project proponents often can leave Indigenous representatives without sufficient legal and expert technical counsel during project negotiations.[46] It was suggested that both levels of government and industry work together to allocate resources to communities for hiring experts and additional staff, thereby leveling the playing field and ensuring that Indigenous voices are heard and respected in the development process.

[46] Westropp and DeCoste, "Finding the Win-Win in Major Project Agreements: Lessons From Indigenous Groups and Industry Proponents."

Conclusion

Ontario's critical minerals sector is growing rapidly, driven by the expansion of critical minerals mining and the transition to manufacturing EVs. To support this growth, the sector will need up to 3,340 more workers for jobs in the sector by 2040. These jobs range from heavy equipment operators to electrical technicians to mining engineers. Without proactive measures taken in the near-term, an estimated 2,960 jobs will remain vacant by 2040, severely limiting the sector's growth and productivity performance.

Building a robust critical minerals sector and value chain relies on a multi-pronged talent strategy to build up an appropriately skilled workforce over the next two decades.

This strategy must involve attracting new talent to the sector through early engagement; ensuring appropriate training and educational programs are in place; increasing participation from women; and partnering with Indigenous communities.

The critical minerals sector faces many barriers that prevent individuals from seeking careers in the sector, with the foremost being a lack of awareness and negative stereotypes that discourage potential workers. Additionally, there are complexities and costs associated with undergoing the training and education necessary for a career in mining. Working collaboratively with the K-12 and post-secondary education systems to create clear, coherent, and attractive pathways into the mining industry will be an essential first step. Moreover, creating public awareness campaigns and responsive media materials that educate the public on the essential relationship between mining and new and emerging clean technologies is also imperative for attracting new talent to the sector over the next decade.

Increasing the participation of women in the critical minerals sector is an important strategy for addressing the risk of sector-wide talent shortages. However, to attract and retain women in the sector, employers and workplaces will need to implement stronger policies and procedures that hold employers and workplaces accountable for safe and respectful workplaces that value diversity.

The sector will benefit from workplaces that support the work/life balance of their employees by creating strong parental leave policies with salary top-ups, increased flexibility with work hours and location, and on-site or closely located childcare to support women staying in the workforce after having children. Additionally, hiring and promoting women into leadership positions is important to make workplaces more reflective of women's participation in the sector. To do this, transparent and fair promotion and advancement policies are needed to mitigate any bias that prevent the deserved advancement of women.

[1] International Energy Agency, "Critical Minerals."
[2] Ontario, "Ontario's Critical Minerals Strategy 2022–2027: Unlocking potential to drive economic recovery and prosperity."

The opportunities for Indigenous partnership in the critical minerals sector extend beyond employment in entry-level mining jobs to encompass a broad spectrum of roles and responsibilities along the value chain. To ensure meaningful engagement with Indigenous communities, the sector needs a strategy that respects Indigenous rights and leverages their unique perspectives and stewardship of the land.

Early and appropriate engagement with Indigenous communities based on the Treaty relationship is the first step in understanding what training and supports are needed to maximize individuals' and businesses' participation in the critical minerals sector. Capacity-building, mentorship programs, procurement strategies, and contribution to wraparound community supports are key, and will require multifaceted approaches, depending on each community's unique needs.

Further and deeper discussions with Indigenous stakeholders and community representatives will help pave the way for a more inclusive, sustainable, and equitable critical minerals development landscape, where Indigenous communities are recognized as key contributors and beneficiaries in the sector.

Appendix A

Critical Minerals Sector Definition

Table A.1: Ontario's Critical Minerals List

Mineral	Common Uses
Antimony	Metal products and fire-retardant material
Barite	Weighting agent, drilling fluids and X-ray shielding
Beryllium	Aerospace, industrial and medical technologies
Bismuth	Pharmaceuticals and metallurgy
Cesium	Atomic clocks and drilling fluids
Chromite	Stainless steel and alloys
Cobalt	Rechargeable batteries and superalloys
Copper	Electronics, plumbing, and antimicrobial applications
Fluorspar	Chemical, cement, steel, and glass production
Gallium	LEDs and integrated circuits
Germanium	Fibre optics
Graphite	Lubricants, batteries, and fuel cells
Indium	Fusible alloys, solders, electronics, LCD, and thin-film application
Lithium	Rechargeable lithium-ion batteries, lubricant, glass, and ceramics
Magnesium	Manufacturing, agricultural, and industrial applications
Manganese	Steelmaking and batteries
Molybdenum	High-temperature superalloys
Nickel	Stainless steel and rechargeable batteries
Niobium	Electrolytic capacitors and high-tech alloys
Phosphate	Fertilizer
Platinum Group Elements (PGEs)	Catalysts, catalytic converters, and alloys
Rare Earth Elements (REEs)	Electronics, catalysts, and magnets
Scandium	Aerospace alloys and fuel cells
Selenium	Rubber compounding, steel alloying, and selenium rectifiers
Tantalum	Alloys and electrical capacitors
Tellurium	Photovoltaic solar cells and high-tech alloys
Tin	Alloys, coatings, and construction material
Titanium	Aerospace alloys
Tungsten	Abrasives, alloys, and electronics
Uranium	Nuclear fuel and life-saving medical isotopes
Vanadium	Aerospace alloys and redox-flow batteries
Zinc	Anti-corrosion agent in batteries and alloys
Zirconium	Fibre-optics, ceramics, and abrasives

Source: Ontario's Critical Minerals Strategy: 2022-2027.

Table A.2: Defining Jobs in the Critical Minerals Sector

Key Sectors (NAICS)	Key Occupations (NOCs)
Mining 212 Mining and quarrying (except oil and gas)	• 21330 Mining engineers • 21331 Geological engineers • 22101 Geological and mineral technologists and technicians • 70012 Facility operation and maintenance managers • 72400 Construction millwrights and industrial mechanics • 73300 Transport truck drivers • 73400 Heavy equipment operators • 73402 Drillers and blasters - surface mining, quarrying and construction. • 80010 Managers in natural resources production and fishing • 82020 Supervisors, mining and quarrying • 83100 Underground production and development miners • 84100 Underground mine service and support workers
Manufacturing 333 Machinery manufacturing 335 Electrical equipment, appliance, and component manufacturing 336 Transportation equipment manufacturing	• 21310 Electrical and electronics engineers • 22302 Industrial engineering and manufacturing technologists and technicians • 22310 Electrical and electronics engineering technologists and technicians • 90010 Manufacturing managers • 94201 Electronics assemblers, fabricators, inspectors and testers • 94205 Machine operators and inspectors, electrical apparatus manufacturing
Recycling 5629 Remediation and other waste management services	• All occupations

Source: The Conference Board of Canada

Labour Forecast Methodology

The forecast of employment and vacancies was created using The Conference Board of Canada's proprietary Model of Occupations, Skills, and Technology (MOST). The MOST is a unique tool that generates detailed employment and vacancy projections at the occupation, industry, and provincial level based on historical data from Statistics Canada and output and employment forecasts produced by The Conference Board of Canada.[47]

For this project, the MOST was customized to show three scenarios:

- **Baseline:** a baseline forecast using The Conference Board of Canada's forecasts with no additional growth added to the critical minerals sector.

- **HDHS Scenario:** a high-demand, high-supply scenario showing strong expansion with sufficient labour supply to support it.

- **HDLS Scenario:** a high-demand, low-supply scenario showing strong expansion but with insufficient labour supply resulting in a surge of job vacancies.

The high labour demand for both the HDHS and HDLS scenarios was generated by adding positive output and employment shocks in relevant mining and manufacturing industries.

[47] Conference Board of Canada, "The Labour Market of Tomorrow: Projections From the Model of Occupations, Skills, and Technology (MOST)."

Mining Industry Shocks

In both the HDHS and HDLS scenarios, critical mining output is forecasted to expand by 2.3 times by 2040. These projections align with existing research from Canada's Energy Regulator (CER), suggesting that the demand for critical minerals for clean technologies is expected to increase by two- to six- times by 2040. The growth in critical mineral mining activity from 2023 to 2040 will cause total mining activity in Ontario to increase by 73 per cent – well above the 34 per cent increase in the baseline forecast. This results in an additional 4,700 workers needed across all occupations in metal ore mining (NAICS 2122) and non-metallic mineral mining and quarrying (NAICS 2123).

Table A.3 presents the Conference Board of Canada's (CBoC's) baseline forecast, the added growth, and the total growth of the critical mineral mining industry in per cent terms throughout the forecast period.

Table A.3: Forecasted Critical Mineral Mining Industry Growth in Ontario

(per cent change at annual rates)

Year	Baseline Forecast	Scenario Growth	Total Growth
2023	0.2%	4.5%	**4.8%**
2024	2.3%	2.4%	**4.8%**
2025	2.3%	3.1%	**5.5%**
2026	3.9%	4.5%	**8.4%**
2027	0.8%	5.2%	**6.1%**
2028	3.0%	5.9%	**8.9%**
2029	0.3%	8.4%	**8.7%**
2030	1.6%	8.9%	**10.5%**
2031	-0.3%	7.9%	**7.6%**
2032	0.7%	6.5%	**7.2%**
2033	2.0%	5.0%	**7.0%**
2034	3.1%	4.1%	**7.2%**
2035	2.1%	3.7%	**5.9%**
2036	1.2%	3.5%	**4.8%**
2037	1.5%	3.3%	**4.8%**
2038	1.1%	3.1%	**4.2%**
2039	1.6%	2.8%	**4.4%**
2040	2.1%	2.4%	**4.5%**

Source:
The Conference Board of Canada.

Manufacturing Industry Shocks

The boost in manufacturing employment comes directly boosting the sectors' employment levels based on information regarding upcoming EV battery plants and their employment needs. While manufacturing will see new employment growth from new EV battery production facilities, but we assume other employment is drawn away from existing manufacturing of combustion engine vehicles and put into the production of EVs. Current employees working in combustion engine-vehicle manufacturing will be reskilled/retrained to manufacture EVs.

The two new EV battery plants coming to Ontario are NextStar in Windsor and PowerCo (Volkswagen) in St. Thomas. Together these plants will employ 5,500 workers at full production by 2030. Based on the occupation mix seen in such plants we assume 4,500 of these 5,500 jobs will be net new – meaning there will need to be 4,500 new workers in sector drawn from the existing labour pool (i.e., workers in adjacent industries and people who would otherwise be unemployed). This additional employment falls under NAICS 3359 (other electrical equipment and component manufacturing).

As the global and North American EV sector grows, more EV battery manufacturing investment may come to Ontario. However, without additional information on this, we limit our forecast to including known EV battery manufacturing coming to the province.

If more EV battery manufacturing comes to Ontario, it will put further pressure on the labour market, resulting is even more vacancies than in our forecast.

[49] Ontario, "Volkswagen's New Electric Vehicle Battery Plant Will Create Thousands of New Jobs." Nextstar Energy, "$5B Windsor battery plant the largest private sector investment in Ontario history."

Baseline Scenario

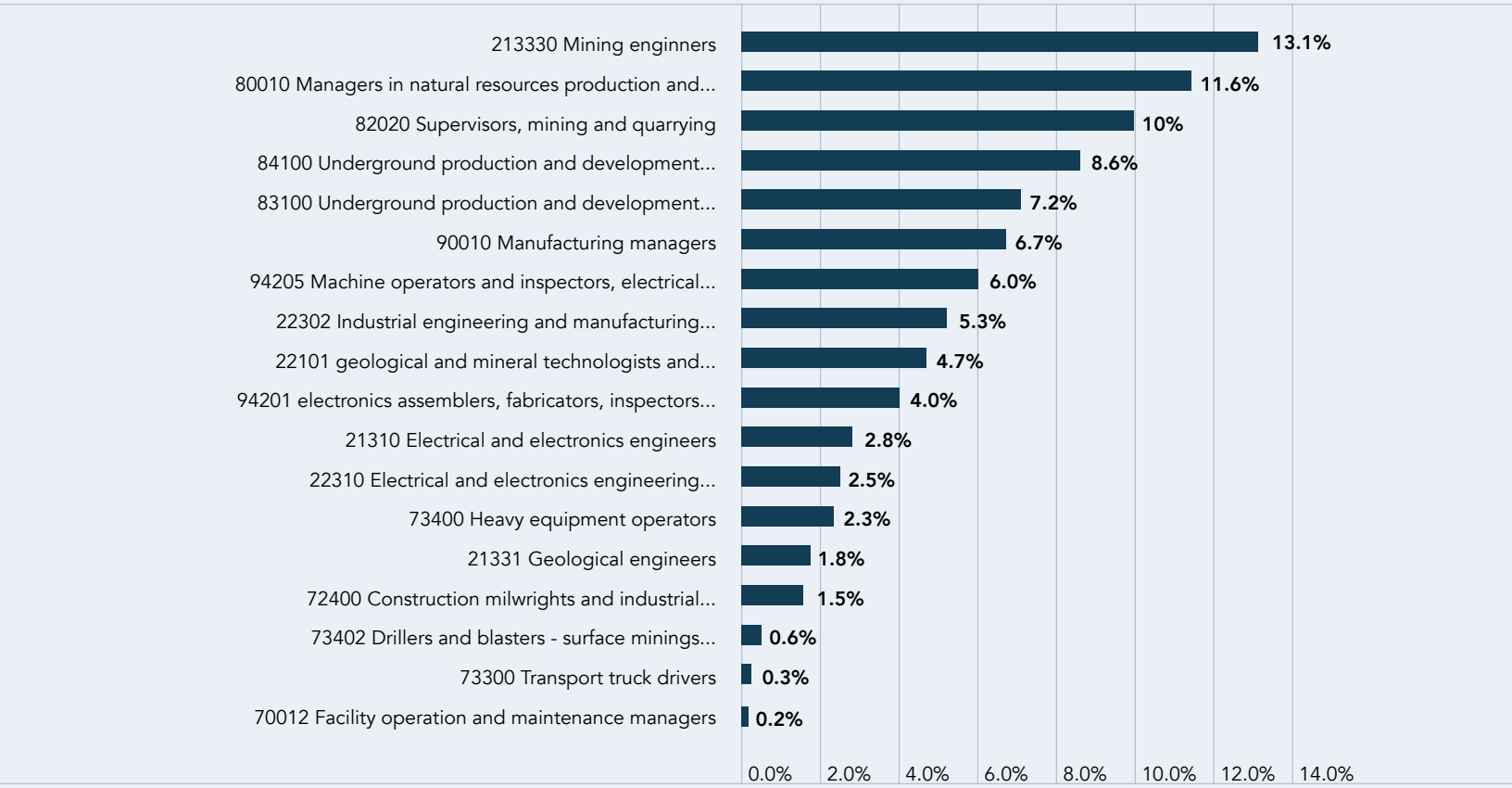
The baseline forecast of employment and vacancies is derived from The Conference Board of Canada's (CBoC's) Model of Occupations, Skills, and Technology (MOST). Employment projections are constructed as using the Census of Population and the Conference Board's national and provincial forecasts, as well as information on occupational and industry trends, and information on automation vulnerability. Vacancy projections are constructed by matching skills and job preferences between job openings and job seekers.

Job openings include expansion demand and replacement demand based on mortality, retirements, interprovincial migration, emigration, and turnover. Job seekers include immigrants, school leavers, temporary foreign workers, turnover, and interprovincial migration. Job openings and job seekers components use data sources such as the CBoC's employment and population projections, Vicinity Jobs, and Statistics Canada's 2021 Census of Population and Job Vacancy and Wage Survey.

Chart A.1: Retirement rate by occupation in the critical minerals sector.

Source: The Conference Board of Canada

Number of workers expected to retire between 2024 and 2040 as a share of current 2023 employment)



Creating the HDHS and HDLS Scenarios

In the HDHS scenario, wherever possible, we assume workers first come from the unemployed for each occupation. However, this has practical limits since it would be impossible to have zero unemployment. We assume a maximum of 75 per cent of unemployed workers from the baseline forecast will become employed each year. The additional labour supply then comes from a combination of employed and unemployed people in other occupations and/or in other sectors, and from those not participating in the labour force.[50] Ultimately, in the HDHS scenario, we assume there is sufficient labour supply to meet the additional annual labour demand.

The HDLS scenario has the same increase to labour demand as the HDHS, however the assumptions for labour supply changes. We assume it is more difficult for the sector to attract new workers and as a result, only a maximum of 50 per cent of unemployed workers from the baseline forecast will become employed each year, and beyond this, no other labour supply is available. As a result, employment will be lower, and vacancies will be higher in the HDLS scenario.

Table: A.4: Unemployment rate in the critical minerals sector by job type.
Source: The Conference Board of Canada.

		Baseline	High-demand High-supply	High-demand Low-supply
Skilled Jobs	2023	6.2%	6.2%	6.2%
	2040	6.4%	2.4%	3.5%
Certified Jobs	2023	6.0%	6.0%	6.0%
	2040	6.1%	1.4%	2.9%
Technical Jobs	2023	1.6%	1.6%	1.6%
	2040	1.7%	0.8%	1.0%
Engineers	2023	0.4%	0.4%	0.4%
	2040	0.4%	0.2%	0.3%
Managers and Supervisors	2023	2.3%	2.3%	2.3%
	2040	2.4%	1.5%	1.8%
Total Critical Minerals Sector	2023	3.3%	3.3%	3.3%
	2040	3.4%	1.7%	2.2%

[50] There is a slight (~1,300) increase in the labour force in the HDHS scenario, due to people entering the workforce who were previously not in the labour force.

Measuring Jobs in the Critical Minerals Sector

Jobs in the critical minerals sector encompass twelve key occupations in mining (NAICS 212), six key occupations in manufacturing (NAICS 333, 335, 336), and all occupations in recycling (NAICS 5629) (see Appendix A, Table A.2). However, because these jobs may also be found in firms not directly involved in the critical minerals sector, we estimate the proportion of these jobs that are with critical mineral employers.

The portion of jobs in critical minerals mining is based on the share of critical mineral mining gross domestics product (GDP) of a share of total mining GDP in Ontario. This share is around 40 per cent for 2023. We also explored job posting data, which indicated around 24 per cent of mining jobs were in the critical minerals sector. However since this was based on a search for critical minerals listed in the job posting, it will miss job postings in the critical minerals sector that do not explicitly mention a critical mineral. As such, 24 per cent would be lower than the actual share.

Overall, the share of mining jobs in the critical minerals sector starts at 40 per cent in 2023 and slightly declines to 38 per cent by 2040 in the baseline but grows to 50 per cent in the HDHS and HDLS scenarios.[51]

The manufacturing industry includes machinery manufacturing (NAICS 333), electrical equipment manufacturing (NAICS 335), and transportation equipment manufacturing (NAICS 336). The critical mineral share for each of these sub-industries required different assumptions. Machinery manufacturing includes manufacturing mining and metalworking machinery which are inputs into the mining industry. As such, we applied the same share as the mining industry, 40 per cent in 2023. We assume 20 per cent of electrical equipment manufacturing is in critical minerals mining in 2023. Since EV battery manufacturing falls under this industry, the share increases to 40 per cent by 2040 in the HDHS and HDLS scenarios, due to the increased production of battery manufacturing. The share of transportation equipment manufacturing jobs included in the critical minerals sector begins at 10 per cent in 2023 but grows to 80 per cent by 2035 due to the rapid expansion of electric vehicle manufacturing in Ontario. Overall, the share of manufacturing jobs in the critical minerals sector starts at 19 per cent in 2023 and grows to 61 per cent by 2040 in the baseline and 63 per cent in the HDHS and HDLS scenarios.

[51] The share of mining jobs in the critical mineral sector slightly declines in the baseline scenario because the output of non-critical minerals is growing faster than the output of critical minerals. This is not the case in the HDHS and HDLS scenarios.

The share of recycling jobs in the critical minerals sector starts around 2 per cent but grows to 70 per cent by 2040 due to the increase in battery recycling that comes from increased production of electric vehicles.

Overall, the share of jobs in the critical minerals sector starts at 25 per cent and grows to 53 per cent in the baseline scenario and 58 per cent in the HDHS and HDLS scenarios (Table A.5).

Table A.5: Share of Jobs in the Critical Minerals Sector

(Jobs in the critical minerals sector as a share of total jobs in mining, manufacturing, and recycling).		Mining	Manufacturing	Recycling	Total
Baseline	2023	40%	19%	2%	25%
	2040	38%	61%	71%	53%
HDHS & HDLS scenarios	2023	40%	19%	2%	25%
	2040	50%	63%	71%	58%

[51] The share of mining jobs in the critical mineral sector slightly declines in the baseline scenario because the output of non-critical minerals is growing faster than the output of critical minerals. This is not the case in the HDHS and HDLS scenarios.

Table A.6: Jobs Groupings

Group	List of Included Occupations (NOCs)
Managers and Supervisors	• 90010 - Manufacturing managers* • 70012 - Facility operation and maintenance managers • 80010 - Managers in natural resources production and fishing • 82020 - Supervisors in mining and quarrying
Engineers (Occupations usually require a university degree)	• 21310 - Electrical and electronics engineers • 21330 - Mining engineers • 21331 - Geological engineers
Technical Occupations (Occupations usually require a college diploma or apprenticeship training of two or more years; or supervisory occupations)	• 22101 - Geological and mineral technologists and technicians • 22302 - Industrial engineering and manufacturing technologists and technicians • 22310 - Electrical and electronics engineering technologists and technicians • 72400 - Construction millwrights and industrial mechanics
Certified Occupations (Occupations usually require a college diploma or apprenticeship training of less than two years; or more than six months of on-the-job training)	• 73400 - Heavy equipment operators • 73300 - Transport truck drivers • 73402 - Drillers and blasters - surface mining, quarrying and construction • 83100 - Underground production and development miners
Skilled Occupations (Occupations usually require a secondary school diploma; or several weeks of on-the-job training)	• 22101 - Geological and mineral technologists and technicians • 22302 - Industrial engineering and manufacturing technologists and technicians • 22310 - Electrical and electronics engineering technologists and technicians • 72400 - Construction millwrights and industrial mechanics

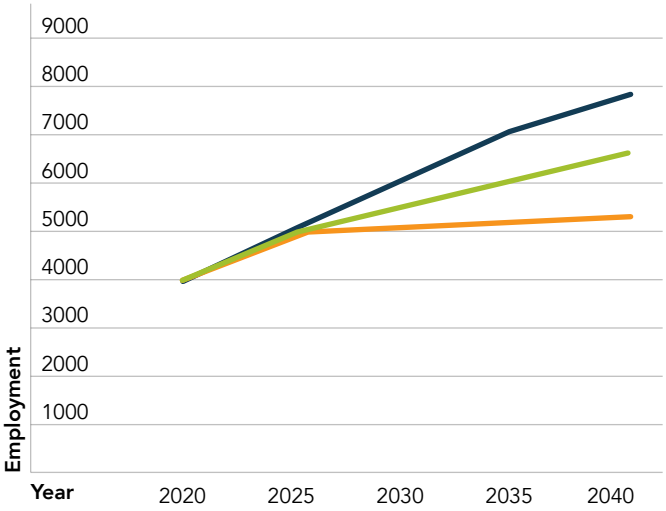
Source: The Conference Board of Canada.

Additional Forecast Charts

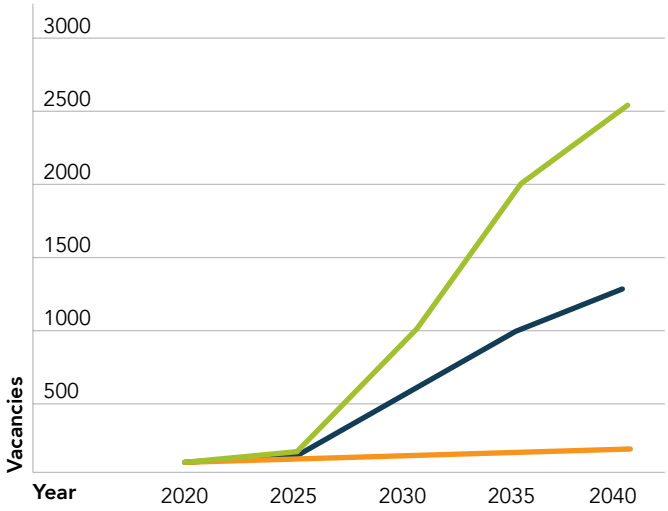
Chart A.2: Annual employment and vacancies for jobs in the critical minerals sector

Baseline HDHS HDLS

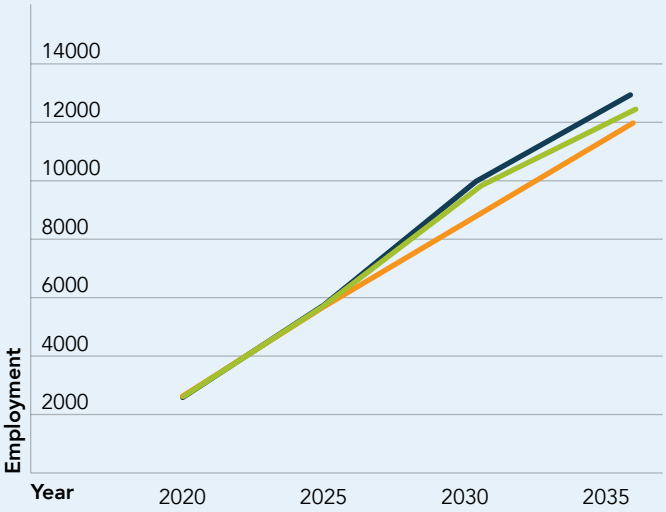
Employment in Mining Jobs



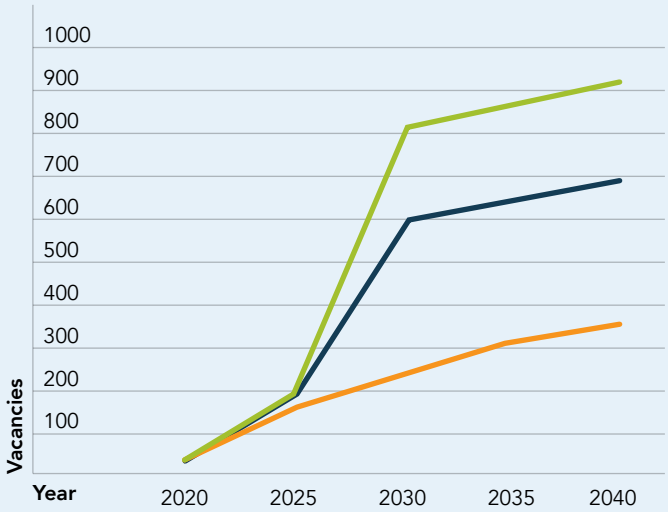
Vacancies in Mining Jobs



Employment in Manufacturing Jobs



Vacancies in Manufacturing Jobs



Source: The Conference Board of Canada.

Chart A.2: Annual employment and vacancies for jobs in the critical minerals sector

Source: The Conference Board of Canada.

Chart A.3: Annual employment and vacancies for skilled jobs

Source: The Conference Board of Canada.

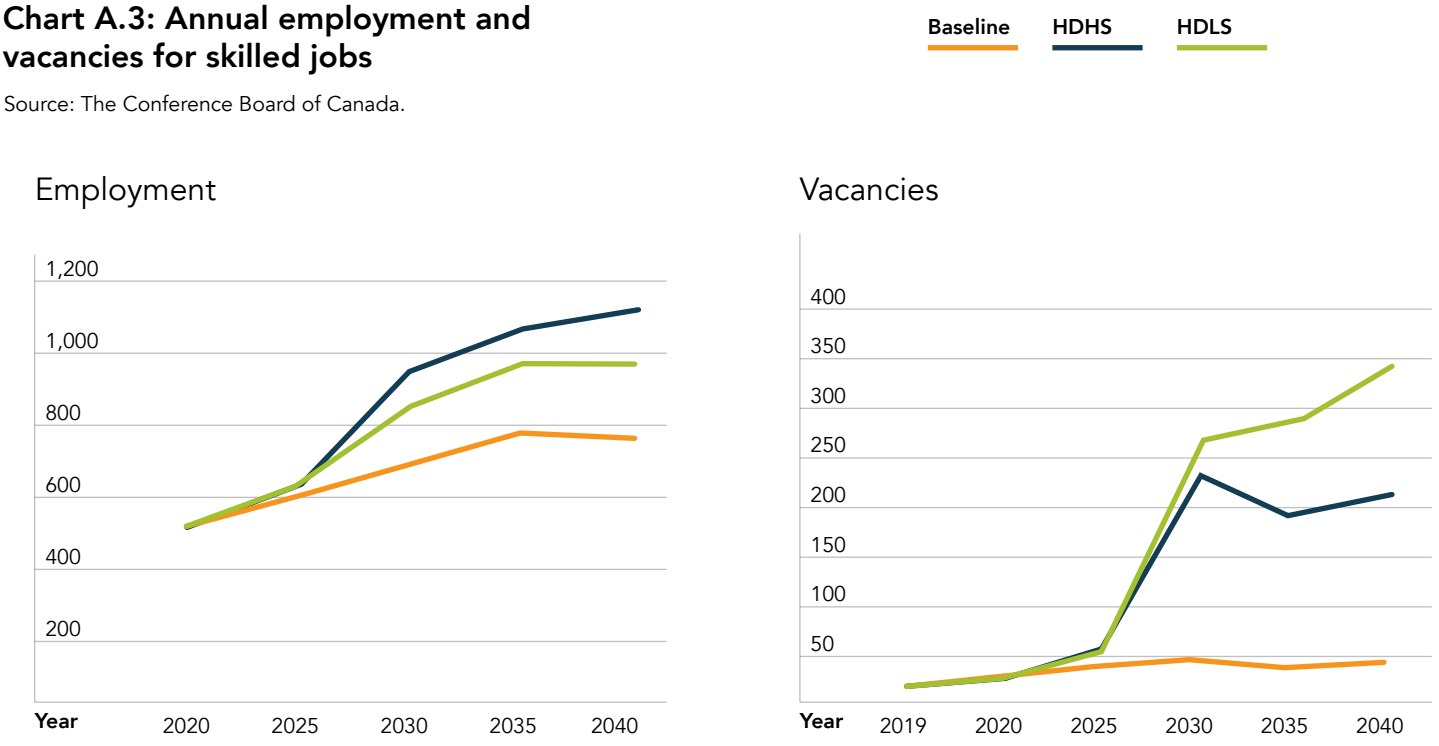


Chart A.4: Annual employment and vacancies for certified jobs

Source: The Conference Board of Canada.

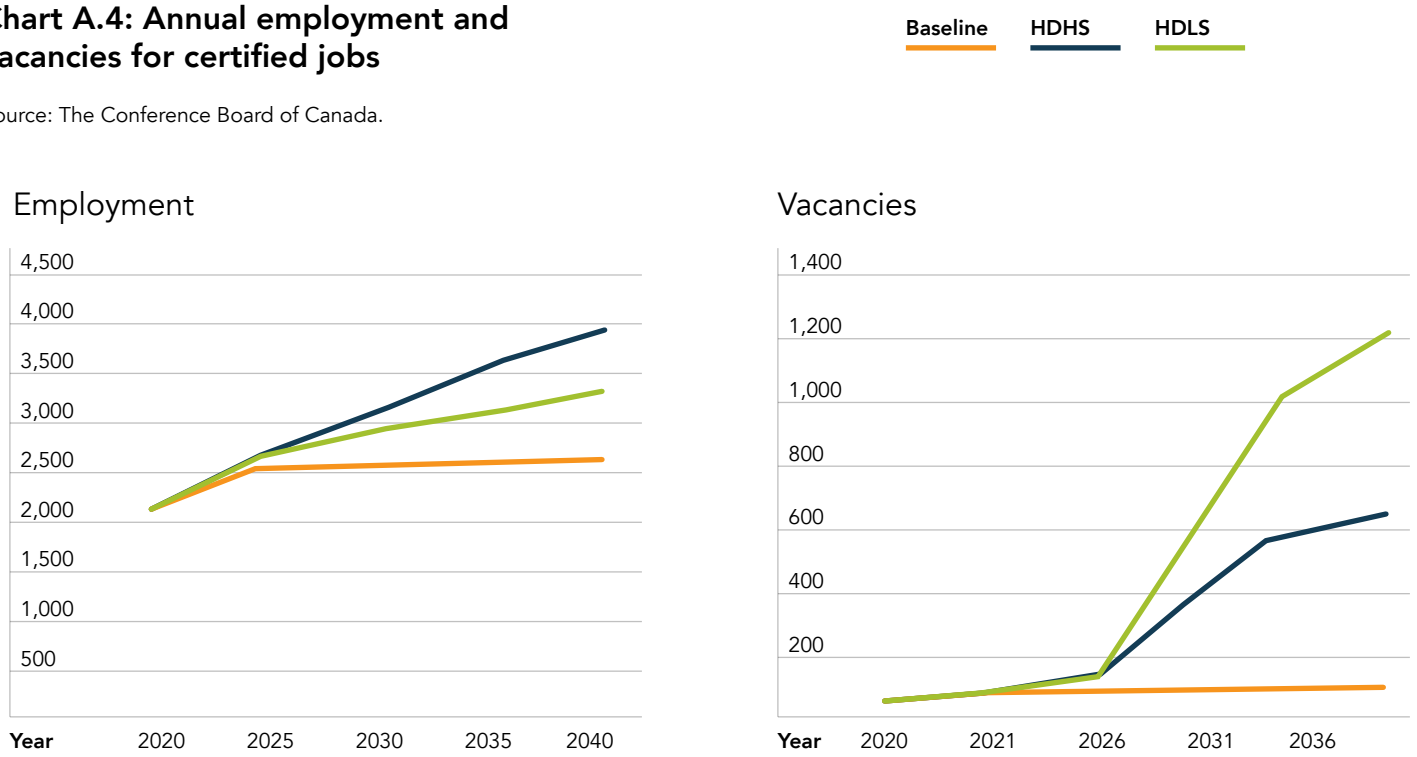


Chart A.5: Annual employment and vacancies for technical jobs

Source: The Conference Board of Canada.

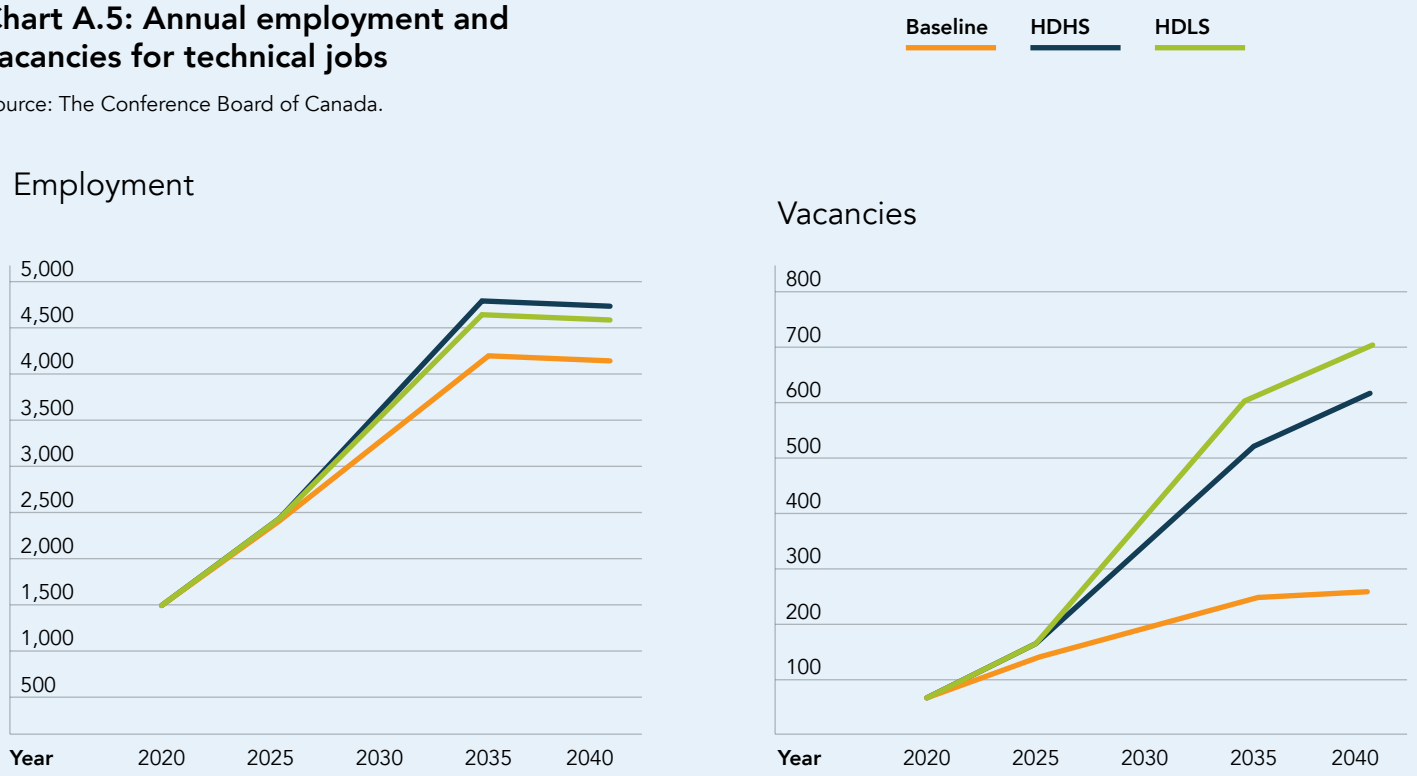


Chart A.6: Annual employment and vacancies for engineers

Source: The Conference Board of Canada.

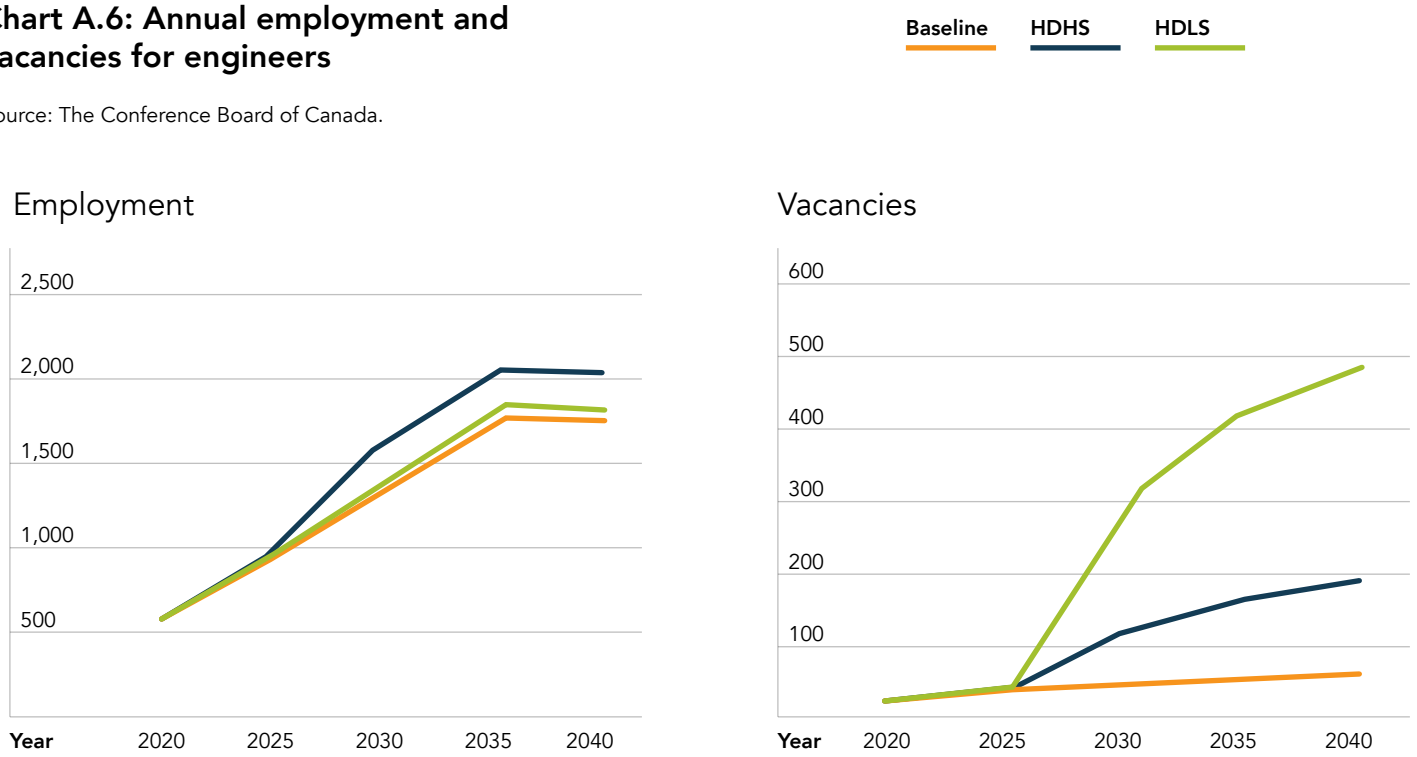
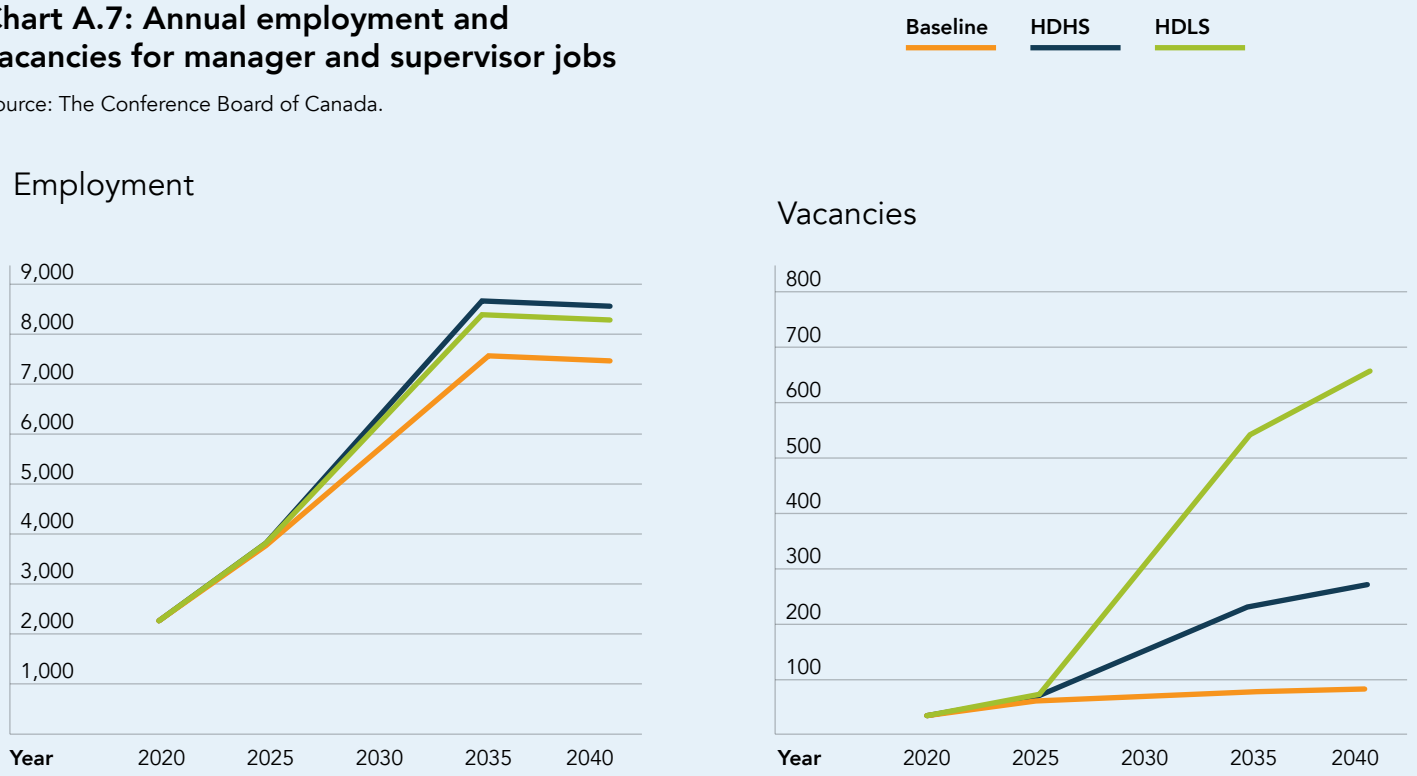


Chart A.7: Annual employment and vacancies for manager and supervisor jobs

Source: The Conference Board of Canada.



Job Posting Analysis

Clustering Score Methodology

To determine the most in-demand skills and unique skills, online job posting data was analyzed using Vicinity Job's proprietary "skills clustering methodology". The methodology measures the frequency and uniqueness of a skill for a given occupation compared to other occupations in a given industry.

The purpose of conducting clustering analysis is to determine the skill requirements that are unique to jobs that have certain defined characteristics / meet certain criteria. That characteristic or criteria defines the clustering core. A clustering core can be built around one of the following:

- An occupation, in which case we would be looking for the skill requirements that are unique to that occupation.

- An industry, in which case we would be looking for the skill requirements that are unique to jobs in that industry.

When considering skill requirements, uniqueness is rarely absolute. Even if a skill is prevalent among job postings within a certain cluster core, it might also be needed for some positions outside of that core, and not necessary for every job within it. Thus, a skill is hardly ever completely unique to a specific clustering core. We gauge the extent of a skill's uniqueness in a particular clustering core by calculating a clustering score tailored to that skill requirement within the context of the cluster.

The clustering score is calculated as a combination of two factors:

- The frequency with which the skill appears within job postings of the cluster core: If the posting appears in a larger share of the job postings within a cluster, this increases the coefficient.

- The frequency with which the skill appears within job postings outside of the cluster core: If the posting appears in a larger share of the job postings outside of the cluster as well, this decreases the coefficient (indicating that the skill is less unique to the cluster).

At the extremes, a clustering score value of 100 would mean that the skill appears in every posting of the cluster core and in none of the postings outside of the cluster core. A clustering score of 0 indicates that the frequency with which the skill appears in the cluster is no different than the frequency with which it appears outside of it (meaning that the skill is not part of the cluster).

Job postings were included in the cluster core based on the following criteria:

Postings for 12 key occupations (Table A.2) in mining if:

Canadian job postings for these occupations will be included if the job title or employer name includes “mine” or “mining”, or the employer is associated with industries:

- 212 - Mining (except Oil and Gas), or
- 213 - Support Activities for Mining and Oil and Gas Extraction

Postings for 6 occupations (Table A.2) in manufacturing if:

Canadian job postings for these occupations will be included for known EV producers who are associated with industries:

- 333 - Machinery Manufacturing or
- 335 - Electrical Equipment, Appliance and Component Manufacturing
- 336 - Transportation equipment manufacturing

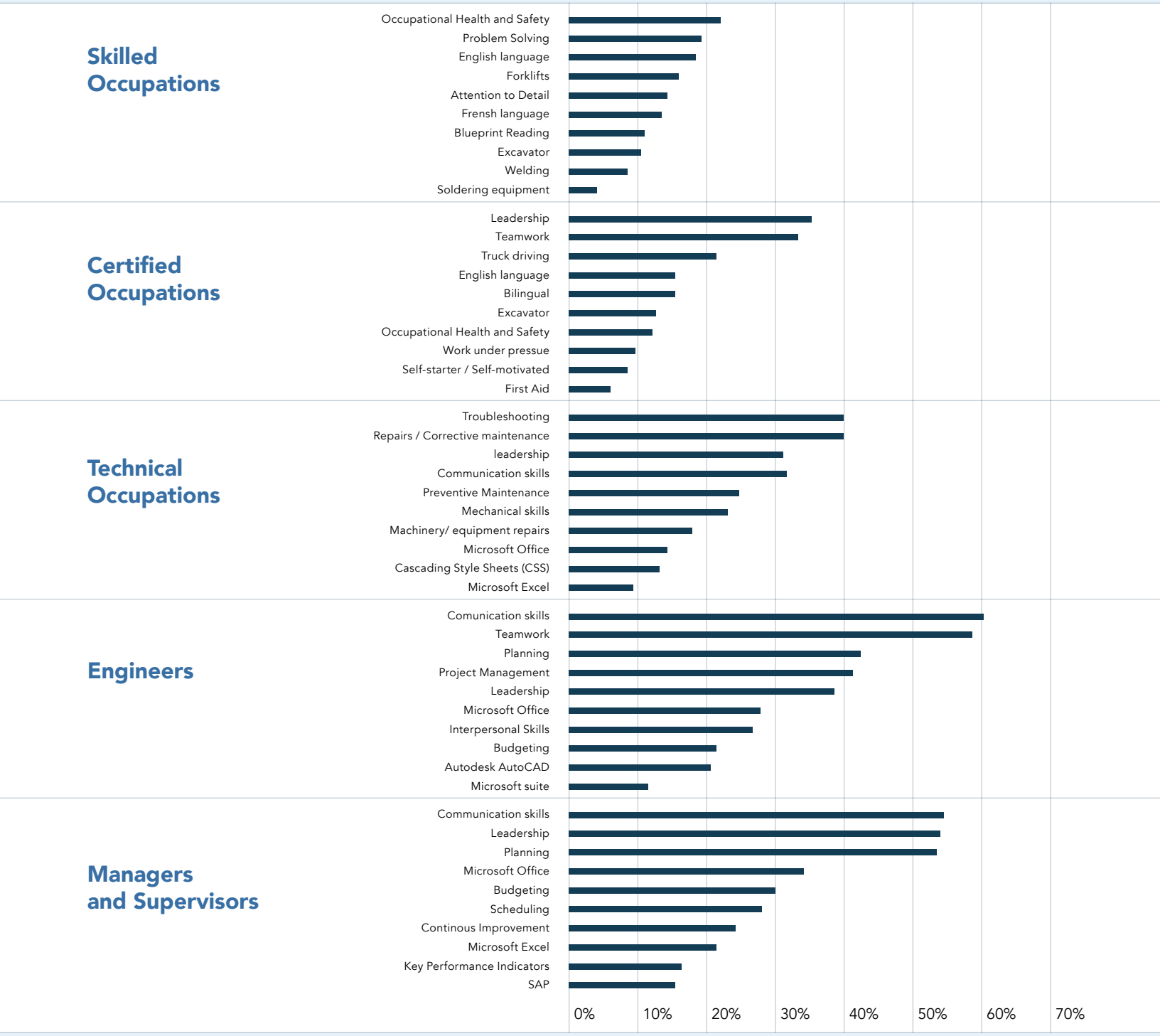
Table A.7: Number of Job Postings by NOC between June 2021 and June 2023.

Skilled Occupations	84100 - Underground mine service and support workers	223
	94201 - Electronics assemblers, fabricators, inspectors and testers	102
	94205 - Machine operators and inspectors, electrical apparatus manufacturing	117
	Total	**442**
Certified Occupations	73300 - Transport truck drivers	225
	73400 - Heavy equipment operators	513
	73402 - Drillers and blasters - surface mining, quarrying and construction	179
	83100 - Underground production and development miners	372
	Total	**1289**
Technical Occupations	22101 - Geological and mineral technologists and technicians	243
	22302 - Industrial engineering and manufacturing technologists and technicians	182
	22310 - Electrical and electronics engineering technologists and technicians	290
	72400 - Construction millwrights and industrial mechanics	469
	Total	**1184**
Engineers	21330 - Mining engineers	151
	21310 - Electrical and electronics engineers	168
	21331 - Geological engineers	186
	Total	505
Managers and Supervisors	90010 - Manufacturing managers	**498**
	70012 - Facility operation and maintenance managers	204
	80010 - Managers in natural resources production and fishing	122
	82020 - Supervisors, mining and quarrying	243
	Total	**1067**

Source: Vicinity Jobs

Chart A.8: The critical mineral sector requires a variety of skill sets.

(Top Skills for Each Occupation Group*)



Source: Vicinity Jobs; The Conference Borad of Canada.
*Top skills are determined by taking the ten skills with the highest clustering scores.
The skills are shown ranked by share of job postings.

New Job Titles

While our labour analysis focuses on jobs that fall under the 18 defined occupations within the NOC system, Vicinity Jobs analysis reveals five frequently mentioned critical mining job titles that do not align with any established NOC occupation title (Table 2).

Table A.8: Job titles not classified under NOC system.

Job title	Number of job postings*
Mine Technician	279
Plant Operator	94
Mine Operator	84
Mine Maintenance Supervisor / Superintendent / Lead	80
Mobile Maintenance Supervisor / Superintendent / Coordinator / Planner	74

Source: Vicinity Jobs

* Estimated number of job postings within the mining industry referencing this job title over a 2-year period - July 2021 to June 2023 for NAICS 212 and 213.

Key Mining Employers

Vicinity Jobs analysis identifies these top ten employers based on their number of postings (Table 4). Together these employers account for 57 per cent of employers in the mining industry (NAICS 212 and 213).

Source: Vicinity Jobs

* Estimated number of job postings within the mining industry referencing this job title over a 2-year period - July 2021 to June 2023.

Table A.9: Top Mining Employers in Ontario

Job title	Number of ON Postings *	Share of known employers	Industry
Vale Canada Limited	753	16%	Mining - Core
Real Time Measurements Inc.	294	6%	Supporting Industry
Alamos Gold Inc.	280	6%	Mining - Core
Horizon North Logistics Inc.	234	5%	Supporting Industry
New Gold Inc.	219	5%	Mining - Core
Kinross Gold Corporation	214	5%	Mining - Core
Canadian Royalties Inc.	191	4%	Mining - Core
Amex Exploration Inc.	176	4%	Mining - Core
IAMGOLD	161	3%	Mining - Core
Lake Shore Gold Corp.	138	3%	Mining - Core
TOTAL	**2660**	**57%**	

Appendix B

Stakeholder and Women Interview Methodology

The interview guides were designed to a) understand the skills demands and gaps relating to the critical minerals sector, with a focus on the future needs of the sector, and b) identify barriers and opportunities for entry and retention, as well as representation of traditionally underrepresented groups within sector. The interview guides underwent the Research Ethics Review process.
All interviewees were guaranteed confidentiality.

We sought 30 total interviews (n=15 women, n=15 stakeholders). The final demographic breakdown of participants can be found in Appendix B. The interviews with women were distributed across two broad role types:

- **Front-line roles:** includes science and engineering roles, labourers and operators, technicians, and skilled trades.

- **Management and support roles:** includes financial and investment analysts, business management, advertising, marketing, public relations, project managers, health and safety professionals, DEI specialists, and management roles.

The interviews with women were also distributed across cultural background and age.

We interviewed four stakeholder groups:

- **Education:** participants working in post-secondary institutions in Ontario, adult learning, or skills development
- **Advocacy/professional group:** professional associations with members whose mission is to promote and advance the field of mining and minerals through policy, networking, and capacity-building.
- **Private companies/employers:** private/for-profit enterprises who employ a large number of geologists, miners, and earth scientists to work in the critical minerals sector in Ontario.
- **Government:** participants working in the Ontario government (e.g., Ministry of Northern Development)

The interviews with stakeholders were also distributed across gender, cultural background, and age. The final breakdown of participants and subpopulations can be found in Table B.1 – B.7.

To build the recruitment list, we conducted an internet search (i.e., via LinkedIn) for women and working in the sector. We developed a list of industry associations, councils, and post-secondary institutions that offered mining-related training programs. We also used snowball sampling to recruit both stakeholders and women.

Recruitment emails were sent to potential interviewees over three months (November 2023 to January 2024). Of the 104 women approached, 17 accepted invitations to be interviewed. The response rate was 16 per cent. Of the 131 stakeholders approached, 20 accepted invitations to be interviewed. The response rate was 15 per cent.

Thirty-seven interviews were conducted from November 6th 2023, to January 12th 2024. With one exception, interviews were conducted virtually, using MS teams. One interview was conducted via telephone due to technological difficulties at the time of the interview. All interviews lasted approximately one hour. Interviews were recorded and transcribed by a third-party, CCS. CCS has signed a Non-Disclosure Agreement. CCS transcribed a total 608 minutes of Women interviews and 553 minutes of Stakeholders interviews resulting in a total of 1161 minutes/19.35 hours of interviews.

Table B.1: Women participants by age

Age	Target	Actual
Under 25 years old	3-4	1
25-35 years old	3-4	4
36-45 years old	3-4	3
46-55 years old	3-4	6
Over 55 years old	3-4	2
Prefer not to say		1
Total	**15-20**	**17**

Table B.2: Women participants by role

Role	Target	Actual
Front-line roles	7-8	5
Management and support roles	7-8	12
Total	**15-20**	**17**

Table B.3: Women participants by cultural background

Cultural Background	Target	Actual
African	1-2	0
European	1-2	10
East Asian	1-2	0
South Asian	1-2	1
Southeast Asian	1-2	1
First Nations or Indigenous	1-2	2
Hispanic or Latinx	1-2	2
Middle Eastern	1-2	0
Prefer not to say		1
Total	**15-20**	**17**

Table B.4: Stakeholder participants by industry

Age	Target	Actual
Education	3-4	6
Advocacy/professional group	3-4	5
Government	3-4	3
Private companies/employers	3-4	5
Other		1
Total	**15**	**20**

Table B.5: Stakeholder participants by age

Age	Target	Actual
Under 25 years old	3-4	1
25-35 years old	3-4	5
36-45 years old	3-4	2
46-55 years old	3-4	6
Over 55 years old	3-4	6
Total	**15-20**	**20**

Table B.6: Stakeholder participants by gender

Gender	Target	Actual
Man	7-8	10
Woman	7-8	10
Total	**15**	**20**

Table B.7: Stakeholder participants by cultural background

Cultural Background	Target	Actual
African	1-2	0
European	1-2	10
East Asian	1-2	0
South Asian	1-2	1
Southeast Asian	1-2	1
First Nations or Indigenous	1-2	2
Hispanic or Latinx	1-2	2
Middle Eastern	1-2	0
Prefer not to say		1
Total	**15-20**	**17**

Engagements with Indigenous Communities Methodology

This section outlines the methodology employed to interview Indigenous groups and communities. The purpose of this research was to identify capacity-building initiatives that can empower First Nation communities and Métis in Ontario to participate fully in the critical minerals value chain. We also sought to understand participants' perspectives on the broader risks and opportunities for Indigenous communities if critical minerals projects were developed in their region.

Interview Guide

An interview guide was designed to facilitate our interviews with representatives of Indigenous groups and communities. A draft guide was shared with the client and subsequently submitted for ethics review. The guide included an introduction, an overview of participants' rights and a request for verbal consent. This was followed by a context setting discussion, and lines of questioning based on the following themes: exploration of opportunities, identification of barriers, capacity building initiatives, evaluation of risks, and addressing other considerations.

Introduction and Purpose

The introduction provided a succinct overview of the research objectives, emphasizing the focus on skills development opportunities within the critical mineral value chain, including mining, processing, and recycling. Specifically, the goal was to understand what Indigenous communities need in Northern Ontario to participate fully in these sectors.

Reminder of Rights and Consent

Prior to initiating the interview, interviewees were reminded of their rights regarding confidentiality and informed consent. Assurance was provided regarding the anonymization and confidential treatment of all collected data. Permission for recording was sought solely for note-taking purposes, with strict protocols in place for its restricted use.

Context Setting

A brief segment aimed at gathering background information about the interviewee's organization and their role therein. This served as foundational knowledge for understanding the interviewee's perspective within the broader context of critical minerals sectors.

Exploration of Opportunities

Structured questions were employed to explore employment and business opportunities within critical minerals sector both for individuals and Indigenous-owned businesses. Probing prompts sought insights into the evolving nature of these opportunities over time and the potential role of Indigenous-led organizations.

Identification of Barriers

Interview questions delved into the barriers faced by individuals and Indigenous businesses in accessing opportunities within the critical minerals value chain. Follow-up inquiries aimed to understand the role of governments, industry, and broader infrastructure issues in mitigating these barriers.

Capacity-Building Initiatives

Focused questions sought perspectives on education, training, and resource needs to enhance local capacity for participating in critical minerals opportunities. Specific attention was given to short-term and long-term initiatives, as well as resources required by Indigenous-owned businesses.

Evaluation of Risks

Interview questions probed into perceived risks associated with critical minerals developments and sought recommendations for risk management strategies. Consideration was given to ensuring alignment with Indigenous and treaty rights and enhancing community engagement and decision-making processes.

Addressing Other Considerations

The interview guide concluded with an invitation for interviewees to share any additional insights or considerations not covered during the interview. This open-ended prompt allowed for the exploration of diverse perspectives on relevant topics such as resource revenue sharing agreements and government programming impacting Indigenous communities.

Purposive Sampling and Outreach

The research team built an initial purposive sampling frame and recruitment list based on the identification of Indigenous groups and communities that were already participating in the critical minerals value chain or likely to be affected by future critical minerals sector projects. This activity was informed by our understanding of geography, the history of mining projects in Ontario, and our planning discussions with technical experts from Ontario's Ministry of Northern Development and Mines, and the Chiefs of Ontario. The recruitment list was further expanded to include Indigenous organizations and educational institutes that were involved in relevant training, human resources, mining, economic development, lands management and finance. A total 119 Indigenous communities and organizations were identified for outreach.

Recruitment emails were sent to potential interviewees over three months (November 2023 to January 2024). Of the 119 potential interviewees approached, 13 accepted invitations to be interviewed. Two interviewees confirmed interest but were unable to make time for the research. The resulting response rate was therefore 9.2 per cent. Based on the feedback we received during the outreach process, this low response rate is partially attributable to the subject matter of the project being a sensitive and political issue for many respondents. For some, issues pertaining to Indigenous lands and economic rights need to be negotiated on a Nation-to-Nation basis between First Nations and the provincial government. Other explanations include a lack of available time and capacity among potential interviewees.

Interview Process

We pursued 13 total interviews and were able to conduct 11. Interview participants were distributed across two broad role types:

Senior executives of First Nations governments that were representing Chief and Council and/or responsible for economic development, lands management or education and training portfolios relevant to the critical minerals sector;

Senior executives of Indigenous organizations – such as Tribal Councils, Training Service providers, etc. – that manage education and training services, economic development and lands management issues relevant to the critical minerals sector.

The interviews were based on the role that each participant occupied, and therefore data was not specifically collected about the individual's age or gender identity.

In one instance, a scoping meeting was arranged with a prominent Indigenous political organization to address their reservations regarding the research's purpose and objectives. Concerns were raised about potential misinterpretation of participation as consultation on matters requiring Nation-to-Nation engagement under Treaty relationships. Additionally, representatives expressed apprehensions regarding the funding source, given that the client, OVIN, was established by the Ontario provincial government, raising concerns about conflicting interests. However, after clarifying that the research primarily focused on employment within critical mineral development and assuring the organization of the Conference Board of Canada's commitment to impartiality and complete anonymity through the removal of identifying information, the meeting successfully led to an interview with a knowledgeable informant. This individual possessed extensive personal and professional experience in mining, employment, and community-level training, enriching the research with valuable insights.

Ultimately, eleven interviews were conducted between November 15, 2023 and January 16, 2024. Interviews were conducted virtually, using MS teams. All interviews lasted approximately 45 minutes, with one lasting over an hour. Interviews were subsequently transcribed by a third-party service provider, CCS under a Non-Disclosure Agreement. In total CCS transcribed 7.3 hours of interviews.

Research Ethics and Data Protection

The Conference Board of Canada upholds a strict standard of research ethics and data protection. The qualitative research component of this project is governed by our research ethics policy which ensures:

- our research projects adhere to the highest standards of ethical practice
- our practices foster integrity, credibility, and accountability in research involving human participation
- and that we are well positioned to build public confidence in our work

For research that requires ethical review, the Conference Board of Canada retains Veritas, an independent REB, to provide ethics review services for projects involving human participants. The Veritas Institutional Review Board (IRB) assessed this project and granted unconditional approval.

Prior to initiating interviews, participants were reminded of their rights regarding confidentiality and informed consent. Assurance was provided regarding the anonymization and confidential treatment of all collected data. Permission for recording was sought solely for note-taking purposes, with strict protocols in place for its restricted use and protection.

All data is maintained according to the confidentiality and security promised to the study participants. All responses collected during the project are stored with high security on a Conference Board of Canada server, ensuring that access is strictly limited to individuals directly involved in the project. To further protect the privacy of participants, all identifying details have been meticulously omitted from the final analysis.

OCAP Statement

The project's Indigenous engagement process was carefully designed to align with the principles of Ownership, Control, Access, and Possession (OCAP), which are of paramount importance when conducting research that involves Indigenous communities in Canada. Below is an overview of how the project's methodology and practices adhere to these principles:

Ownership and Control: By informing Chiefs of Ontario, the Métis Nation of Ontario, and First Nations Political Territorial Organizations about the project before proceeding, we are recognizing the inherent right of Indigenous groups to own and control information that pertains to them. This upfront communication respects the principles of Ownership and Control by acknowledging that any data or knowledge generated belongs to the communities it represents.

Control: Sharing our interview guide and questions with participants ahead of time and allowing them the opportunity to discuss the research and any concerns prior to participating exemplifies the principle of Control. This approach ensures that Indigenous communities have significant input and influence over the research process, including the nature of questions asked and the topics discussed. Furthermore, seeking explicit permission to record and use the interviews for project purposes reinforces their control over how their information is used.

Access: Ensuring that research participants can request their interview recordings and transcripts, as well as review the Conference Board's analysis before the final client report is finalized, aligns with the principle of Access. This ensures participants have full access to the information collected from them and can see how their input is being utilized in the research findings.

Possession: The secure storage of all data on Conference Board of Canada servers, with access limited to the research team, addresses the principle of Possession. By maintaining strict control over who can access the data and reminding participants of their rights to withdraw from the research and request the deletion of their interview data, the project demonstrates a commitment to respecting the communities' rights to possess and protect their own information.

Reminding participants of their rights to withdraw from the research and withdraw their interview data at any time, further emphasizes respect for their autonomy and control over their participation and the information they share.

These measures, taken together, demonstrate our commitment to conducting the research in a manner that respects and upholds the OCAP principles, ensuring that the research is not only compliant with ethical standards but also respectful of the rights and sovereignty of the Indigenous communities involved.

Disclaimer

This report was commissioned by the Ontario Centre of Innovation (OCI) through a Request for Proposals titled "Ontario Centre of Innovation – OVIN Skills, Talent & Workforce Development: Critical Minerals Talent Strategy" dated May 2, 2023, and has been prepared by the Conference Board of Canada. This report, along with the accompanying policy insights paper, is intended to support the Ontario Vehicle Innovation Network (OVIN) in the development of a long-term talent strategy for Ontario's critical minerals sector.

This report contains general information only, and by means of this communication, OCI is not rendering professional advice or services. Accordingly, readers are cautioned not to place undue reliance on this report and to perform their due diligence, investigations, and analysis before making any decision, relying on the report, or taking any action that may affect readers' finances or business. Neither OCI nor the Conference Board of Canada shall be liable or responsible for any loss or damage arising directly or indirectly in connection with any person relying on this report.

No representations, warranties, or undertakings (express or implied) are given as to the accuracy or completeness of the information in this report. Any mentions of, or specific advice regarding groups of people based on race, ethnicity, and/or gender are not intended to fully capture the breadth of opinions, and the diversity of the needs of individuals within those groups. We do not claim to represent any specific group of people.

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