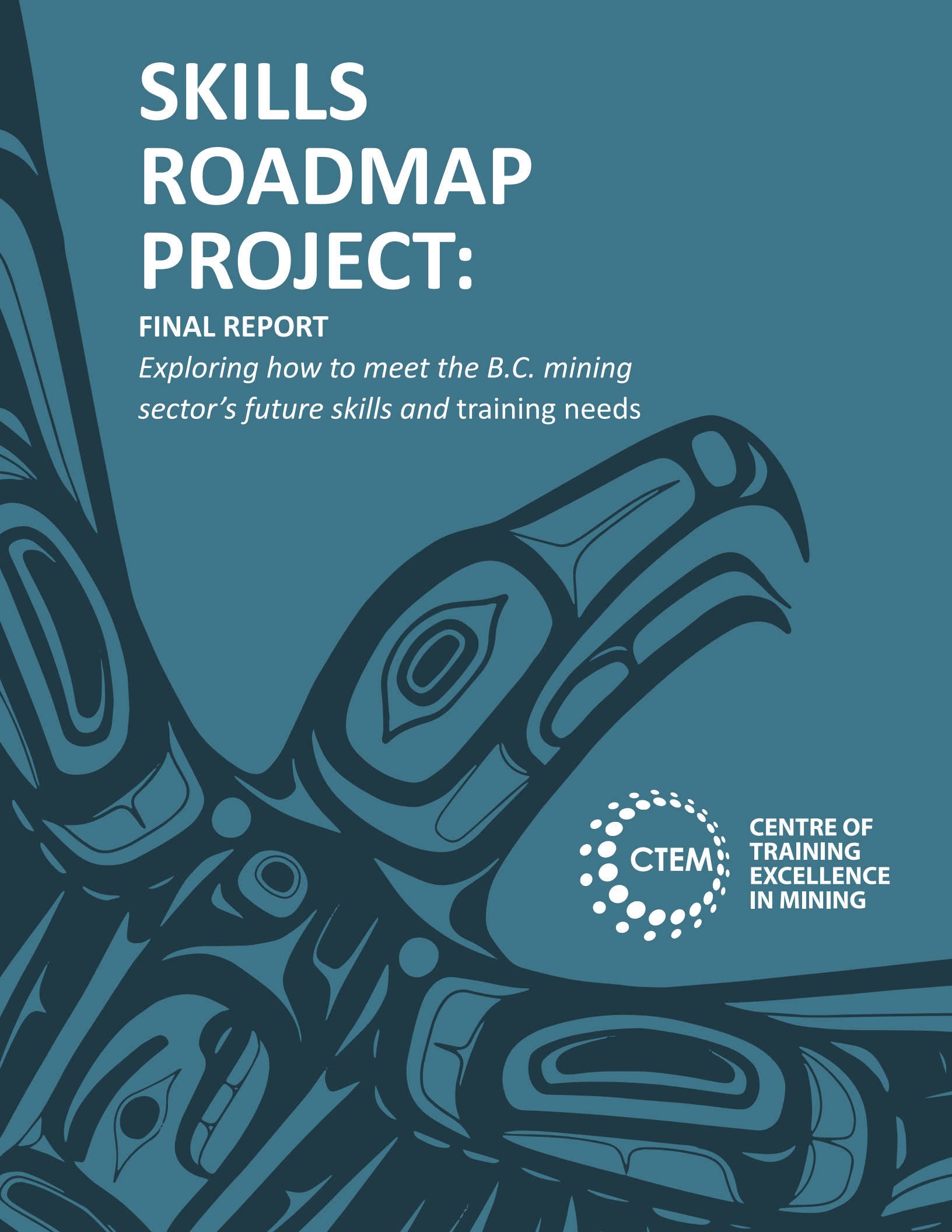
SKILLS ROADMAP PROJECT:

FINAL REPORT

Exploring how to meet the B.C. mining sector's future skills and training needs



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CENTRE OF TRAINING EXCELLENCE IN MINING

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Provided by B.C. Centre of Training Excellence in Mining (CTEM).

The views and opinions expressed in this report are those of its author(s) and not the official policy or position of the Government of British Columbia.

The artwork on the front cover – Eagles Rising – was gifted to CTEM by Dean Heron. Dean is a member of the Wolf clan of the Kaska/Tlingit Nation and is a member of the Skill Roadmap Project Team.

"The Eagle is a visionary. It can see what lies ahead. It represents balance in all things, and is a symbol of leadership. Here it is circling above all; catching the slipstream of knowledge, collaboration and moving forward. Always rising!" ~Dean Heron

For more information on this document please contact CTEM: info@bc-ctem.ca
or visit www.bc-ctem.ca.

Submitted May 2022

Report Provided by B.C. Centre of Training Excellence in Mining (CTEM)

Report written by Two Eyed Seeing Consulting CCC Inc. (TESCI)

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We also thank the mining organizations, for their ongoing support, expertise and guidance, including (but not limited to): the Mining Association of BC (MABC); the Association of Mineral Exploration British Columbia (AMEBC); the Mining Industry Human Resources Council (MiHR); and the many mining and mining related organizations, companies, training providers and institutions, First Nations governments and communities, workforce development providers and experts, who also contributed their knowledge and understanding to this Project.

Funding and support for meetings were generously provided by the Ministry of Advanced Education and Skills Training (AEST), the Province of B.C. and Government of Canada. We thank the ongoing commitment, expertise, and support from Sector Labour Market Partnership staff within the ministry, and the staff within the Ministry of Energy, Mines and Low Carbon Innovation (EMLI).

AEST provides leadership and direction for post-secondary education and skills training across the province to support British Columbians with opportunities to thrive, succeed and reach their full potential. They also promote a collaborative approach that fosters opportunities for our education and skills training partners to contribute to the prosperity of all British Columbians and the resiliency of our post-secondary education and skills training system.

Underlying the work of AEST is the conviction that an inclusive, accessible, responsive, and future focused post-secondary education and skills training system, including the trades, provides pathways for British Columbians into good-paying, high-opportunity jobs and supports the economic recovery of our communities and province.[1]

EMLI is responsible for British Columbia's electricity, alternative energy, oil, natural gas and related infrastructure, and the province's mining and mineral exploration sectors. EMLI facilitates electricity, mining and oil and gas sectors which are globally competitive, environmentally leading, and advance reconciliation with Indigenous peoples, while providing opportunities and quality jobs for British Columbians.

EMLI carries out this work while advancing the CleanBC plan, and commitments to Indigenous reconciliation. In fulfilling its mandate, the Ministry consults and collaborates with other ministries and levels of government, private sector stakeholders, Indigenous people, communities, environmental and industry organizations, and the public.[2]

[1] Ministry of Advanced Education and Skills Training, "2020/21 Annual Service Plan Report." (2021). https://www.bcbudget.gov.bc.ca/Annual_Reports/2020_2021/pdf/ministry/aest.pdf

[2] Ministry of Energy, Mines and Low Carbon Innovation, "2020/21 Annual Service Plan Report." (2021). https://www.bcbudget.gov.bc.ca/Annual_Reports/2020_2021/pdf/ministry/emli.pdf

Executive Summary

The Minister of Energy, Mines and Low Carbon Innovation established the B.C. Mining Jobs Task Force (the Task Force) in February 2018 to review exploration and mining in the province and find ways to strengthen the industry.[3] The Task Force worked with Indigenous groups, the mining industry, and communities to develop recommendations on possible actions the government could take to bring more certainty to the mining sector and create jobs for people now and in the future. It looked at all aspects of mineral exploration and mining in B.C. and its Final Report provided 25 recommendations to the government on measures it could implement to achieve the Task Force's vision of making British Columbians proud of a "growing mining industry that is the backbone of an inclusive, progressive and low carbon economy."[4] In January 2019, the Office of the Premier issued a news release saying the provincial government is "moving forward" with the Task Force's recommendations.[5]

One of the Task Force's recommendations was to collaborate with the Ministry of Advanced Education, Skills & Training (AEST) on the development and implementation of a cohesive roadmap for enhanced mine sector training to meet the mining sector's future skills and labour needs through a collaborative, inclusive, innovative, and geographically focused approach. The recommendation was that the roadmap consists of a forward-looking and responsive training strategy that meets the B.C. mining sector's future need for skills and supply of trained labour.

The project's purpose was to help meet the mining sector's future skills and training needs by developing an evidence-based, cohesive, forward-looking, and responsive strategy for identifying in demand skills and recommendations for enhanced mining sector training. The Skills Roadmap Project was funded by the Province of B.C. and Government of Canada through the Sector Labour Market Partnerships (SLMP) program, which the B.C. Centre of Training Excellence in Mining was tasked to oversee.

The project's key deliverables include the Key Findings Report; Skills, Training and Careers Roadmaps and 19 infographics (Appendix C). These documents formed the foundation for this final report which illustrates the strategic pillars and recommendations for implementation that will support the future skills and training needs of the mining industry.

By creating and maintaining cross-sector partnerships, sharing resources, and not duplicating efforts, the training design and delivery process will continue to improve and further attract job seekers to choose a career in mining. The four strategic pillars developed are Career and Sector Awareness; Talent Acquisition, Retention, and Development; Training Access and Delivery; and Building Capacity and Understanding – Labour Market Intelligence and Research. Please see Section 4.1 for a full list of actionable recommendations categorized.

[3] British Columbia Mining Jobs Task Force, "Mining Jobs Task Force Final Report." (2019). https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/exploration-in-bc/bc-mining-jobs-task-force

[4] Ibid.

[5] Government of British Columbia, "Government acts on Mining Jobs Task Force recommendations." [News Release, 2019]. https://news.gov.bc.ca/releases/2019PREM0006-000099

Contents

1.0 Background

1.1 B.C. Mining Task Force Recommendation

The Ministry of Energy, Mines and Low Carbon Innovation (EMLI) provided the British Columbia Mining Jobs Task Force (the Task Force) report in February 2018 which provided 25 recommendations that focused on how to create and sustain jobs in B.C.'s mining sector. The Task Force worked with First Nation governments, mining industry, and communities to develop recommendations for the province to action bringing more certainty to the mining sector and create good jobs for people today, tomorrow, and beyond.[6] One key recommendation was to collaborate with the Ministry of Advanced Education and Skills Training (AEST) to develop and implement a cohesive roadmap for enhanced mine sector training to meet the mining sector's future skills and labour needs through a collaborative, inclusive, innovative, and geographically focused approach. Additionally, the Task Force had recommendations focused on increasing representation of women and Indigenous peoples in the mining sector.[7]

AEST's Sector Labour Market Partnerships (SLMP) program provided the opportunity for the B.C. Centre of Training Excellence in Mining (CTEM) to bring together diverse perspectives on enhancing training and workforce outcomes within the B.C.'s mining industry.

1.2 About B.C. Centre of Training Excellence in Mining (CTEM)

The B.C. Centre of Training Excellence in Mining (CTEM) is a province-wide virtual hub that facilitates collaborative and innovative training solutions for the mining industry and B.C. communities. Its mission is to connect industry, students, communities, and training providers to meet their respective employment needs by playing a leading role in determining industry skills requirements, facilitating related training, and supporting partners. It was announced by the Ministry of Advanced Education in November 2012 and became operational in May of 2013.

Guided by the values of collaboration, inclusivity, innovation, support, responsiveness, and respect, CTEM works to bring together all parties interested in mining training to:

- foster innovation to improve outcomes;
- build partnerships to create more effective programs;
- enhance the competitiveness of British Columbia's mining sector;
- build awareness of all the training options for careers in mining;
- match students/job seekers and employers; and
- support other appropriate initiatives that will continue to build on a provincial reputation for producing highly skilled workers.

[6] British Columbia Mining Jobs Task Force, "Mining Jobs Task Force Final Report." (2019). https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/exploration-in-bc/bc-mining-jobs-task-force

[7] ibid.

1.3 About the Skills Roadmap Project

The Skills Roadmap Project (the Project) was created to help understand how best to meet the mining sector's future skills and training needs and is a collaboration between representatives from across the B.C. mining industry.

1.3.1 Project Purpose and Objectives

The Project's purpose is to help meet the mining sector's future skills and training needs by developing an evidence-based, cohesive, forward-looking, and responsive strategy for identifying in demand skills and recommendations for enhanced mining sector training.

The Project has two primary objectives:

1. Establish and provide an analysis of labour market information from a literature review, environmental scan, and primary data collection to identify gaps between current skills and training in the B.C. mining sector workforce and the skills and training that will be required to meet the sector's future needs; and
2. Develop skills, career, and training roadmaps (in report and graphic form) to support individuals, communities, post-secondary training providers, and industry that will assist them in adapting to meet the mining sector's future skills and training needs.

1.3.2 Project Governance Committees Overview

A Project Governance Committee (PGC) provided strategic oversight and direction along with seven sub-committees that provided input on the key findings and recommendations. Project committee members represented all B.C. regions, Indigenous communities, service providers, post-secondary institutions, government, employers, and industry partners with an interest in the mining sector. In total, more than 120 people participated in the seven committees:

- Training Providers Sub-Committee
- Golden Triangle Sub-Committee
- Indigenous Sub-Committee
- Women Sub-Committee
- Skills Roadmap Sub-Committee
- Careers Roadmap Sub-Committee
- Training Road Sub-Committee

1.3.3 Key Deliverables

There were eight key deliverables that were achieved over 18 months. The Key Findings Report was developed based on the research gathered from participants on diversity and inclusion; skills and competencies; training; technology and innovation; and environmental, social, and governance values.[8]

[8] B.C. Centre of Training Excellence in Mining, "Skills Roadmap Project, Key Findings Report." (2021). http://ctem.wpengine.com/wp-content/uploads/CTEM-Skills-Roadmap-Project-Key-Findings-Report-2021-FINAL12346.pdf

Three Roadmap Reports were created to address skills, careers, and training.[9] The aim of these reports was to support individuals, communities, post-secondary training providers, and industry to meet the mining sector's future skills and training needs. Each Roadmap Report is inclusive and representative of diverse perspectives and reflects advancements in technology, innovation, and environmental, social and governance (ESG) responsibilities.

The Skills Roadmap Report provides pathways for students and prospective workers interested in the sector and information for industry, government, and training providers. These operational needs extend to requiring workers to be trained in using new technologies and to ensure training providers are given information to meet programming needs based on industry demand. Lastly, it clarifies and informs the discourse on environmental, social and governance requirements for industry (and individual workers) and how this evolving area of work impacts workforce development. It highlights the following:

- Skills gaps that may exist for current workers.
- Guidance for training providers looking to ensure programming aligns with the evolving needs of the sector.
- The key factors for training providers and employers to recognize and remove barriers for a diverse and inclusive workforce.
- Support needed for employers in recruiting workers that meet immediate operational needs

The Careers Roadmap Report provides an overview of jobs available in the B.C. mining sector, both currently and in the future. Specifically providing more focused information on current and future in-demand jobs, in these groupings:

- Technology-related jobs
- Trades-related jobs
- Environment-related jobs
- Community-related jobs
- Management jobs

The Training Roadmap Report looks at training that is available today and outlines what will be needed by the mining sector workforce in the future, including:

- Technological training (e.g., computer and software, information technology operations, and virtual/augmented reality); and,
- Aptitude training (e.g., communication, teamwork, collaboration, problem-solving, and creativity).

Figure 1 - Key Deliverables

[9] B.C. Centre of Training Excellence in Mining, "Skills, Career and Training Roadmap Reports." (2022). www.bc-ctem.ca/projects/

1.3.4 Logic Model

Figure 2 illustrates the logic model for this project.

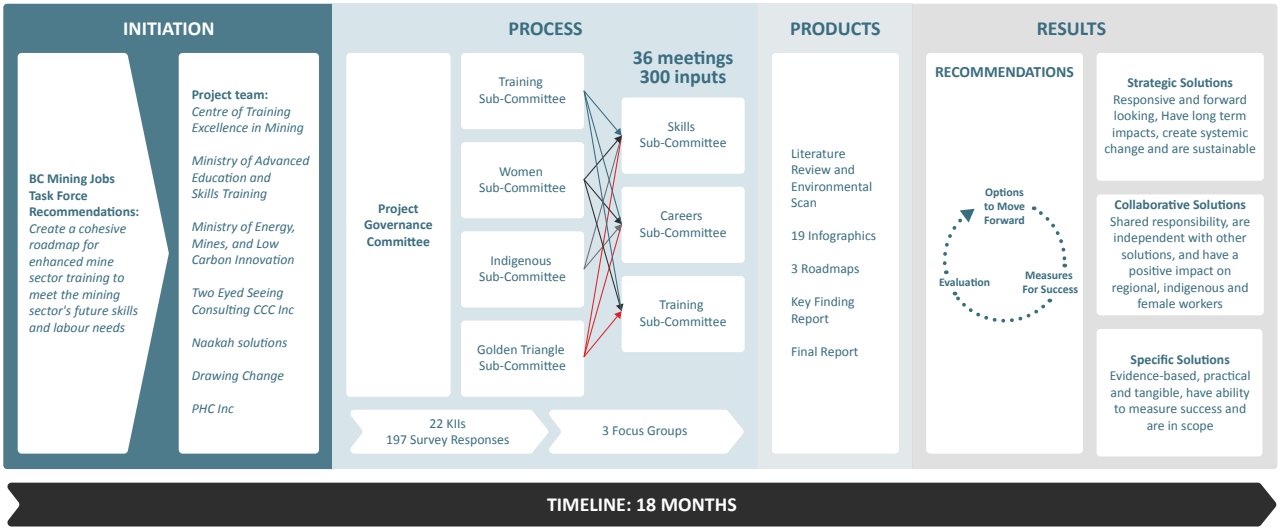

Figure 2 - Skills Roadmap Project Goals, Process and Activities

1.3.5 Methodology

A Participatory Action Research (PAR) Framework was used to conduct the research, which also included an Indigenous Research Methodology approach. The Indigenous Research Methodology is from a Two-Eyed Seeing lens, which is a concept created by a Mi'kmaw Elder, Albert Marshall, "To see from one eye with the strengths of Indigenous ways of knowing, and to see from the other eye with the strengths of Western ways of knowing, and to use both of these eyes together." Figure 3 illustrates the four phases of developing and applying this research methodology and tools, with input and approval from the PGC members.

Figure 3 - Participatory Action Research and Indigenous Research Methodology[10]

[10] Participatory action research with Indigenous methodologies as Two-Eyed Seeing. This model was adapted from the Jacklin and Kinoshameg (2008), *Wikwemikong Community Needs Assessment Research Model* as seen in Pelletier, 2018.

Data was gathered through conducting primary and secondary research that was validated by the PGC and subcommittee participants. Primary research included surveys, key informant interviews and focus groups. Secondary research included a literature review and environmental scan of published literature, policy, current initiatives, and research studies.

1.4 Project Successes, Challenges and Key Lessons

Throughout this Project, there were several successes to celebrate, challenges that were overcome and key lessons learned. Highlights include bringing together the many diverse perspectives from various areas of the mining industry, a high response rate to surveys (197), and a keen interest by participants for collaborating on regional skills strategies and training projects.

1.4.1 Successes

Due to the COVID-19 pandemic, the Project successfully utilized technology to gather information to create pathways for workers to obtain the necessary skills and training required to enter and remain employed in B.C.'s mining industry. With over 120 subject matter experts providing input, a wide range of perspectives and experiences contributed to the forward-looking strategies.

In May 2021, Tk'emlups te Secwépemc (previously known as Kamloops Indian Band) announced there were 215 unmarked graves nearby the Residential School in the community. To help committee members process this information, the Project Planning team reaffirmed their commitment to Cultural Awareness and Safety: "To support the space for healing and reconciliation, one of the Indigenous committee members provided a prayer to create a safe and respectful space for conversations." Following the meetings, additional resources were provided to committee participants for reference, which provided information about the history of residential schools and the intergenerational trauma that continues to impact Indigenous Peoples to this day.

CTEM recognized that under-represented groups currently face barriers and micro inequities that are often not discussed. As a result, CTEM completed a sub-project, "Recognizing Barriers and Challenges Women Face" that captured recommendations for creating meaningful employment and retention strategies (Appendix A).

1.4.2 Challenges

The challenges throughout this Project include research limitations, determining how to create a safe space to help committee members process the confirmation of the unmarked graves at residential schools, adjusting timelines for contending with the COVID-19 pandemic, and having a well-rounded understanding of the technological advancements that impact the current and future skills and training needs and requirements.

Research limitations included the inability to guarantee survey responses were an accurate representation of the mining sector makeup, a lack of universal definitions for Skills, Competencies, Golden Triangle, and the B.C. Mining industry. Through the course of the project, it was also identified that gaps in regional workforce data and demographic data limited our understanding of the workforce and training realities of each region and how it responds to shifts in mining activity. As an industry bound by geographical

constraints, a lack of timely regional data makes it particularly challenging to determine mining workforce and training outcomes and needs.

There was a lack of literature to thoroughly evaluate the impacts of environmental, social, and governance (ESG) issues on the training and workforce needs of the mining sector, specifically, how ESG continues to evolve the specific skills, competencies, and the training needs of the sector.[11] Increased expectations around ESG requirements influence not only expectations for employers, but also the skills and responsibilities of individual employees. Additionally, there is a lack of information on mining supplier workforce needs and downstream workforce impacts that develop over the mining life cycle.

Some committee members were directly or indirectly impacted by the natural disasters that occurred during the summer of 2021, which resulted in varying degrees of participation. The wildfires, floods, landslides, and states of emergency affected the availability of committee members dealing with personal situations.

With over 120 careers in the mining sector, it was challenging to summarize the skills and training required for workers to enter or remain employed in this industry. To address this, careers were categorized into environmental, community, trades, and technology and input was gathered on the skills required based on ESG, technical, aptitude, and transferable skills. Furthermore, the impacts of new and emerging technologies were considered along with expanding and evolving legislation. More information on the range of careers in mining is in Appendix B.

Intersectionality is a term used in the Equity, Diversity and Inclusion (EDI) space which is often not well understood by the mining industry and training institutions which created challenges during the project. An example of intersectionality is when an Indigenous woman can face multiple barriers within a workplace such as racism, sexual harassment, or discrimination based on their sexuality, gender, or ethnicity. As this Project ends, it is clear there needs to be more inclusive research to fully understand intersectionality and the compounded impacts that under-represented groups face in the mining industry and what resources are needed to support industry in working with these groups. Under-represented groups include individuals living with a disability along with self-identifying LGBTQ+2S.

Regional needs vary according to the stage of the mining life cycle in remote, rural, and urban areas of the province. There is a significant need for localized solutions to support the skills and training development for remote and urban workers that aligns with small to large scale operations. More importantly, delivering training to prepare future workers as employment demands increase throughout the mining life cycle.

These challenges present an opportunity for B.C.'s mining industry to lead the way by implementing the forward-looking strategies outlined in this report.

[11] The term Environmental, Social, Governance (ESG) refers to three central factors in measuring the sustainability and societal impact of a company or business.

1.4.3 Key Lessons

The key lessons learned throughout this Project include ensuring multiple industry partner perspectives are provided to truly understand the challenges and the opportunities; the need to categorize the skills and training needs of the mining life cycle; and understanding how current and emerging technology impacts skills and training.

The mining life cycle is defined as exploration, development, extraction, production, decommissioning, and reclamation and involves over 120 occupations. Through committee discussions, it became clear that grouping common activities and/or job types together, would be helpful to clarify the pathway for new workers to enter B.C.'s mining industry understand the future skills needed. As a result, Roadmap Reports were grouped according to technology related skills and careers, trades related skills and careers, and environmental, social and governance skills, which translated into environmental, community and management careers.

Technology, advances in innovation and automation, as well as expanded legislative and environmental, social and governance priorities impacting the sector are increasing the time it takes to upskill current workers. It is important that the many perspectives and partners are involved in training development and implementation to ensure the training meets both employer and workforce needs. For the current workforce, these changes also create pressure to develop their skills to remain current with new technology and innovation, but this cannot be achieved without the support of their employer.

The mining industry continues to implement Equity, Diversity and Inclusion strategies, however, during the Project it was observed that the effectiveness of these strategies was sometimes lacking. Specifically, the inherent biases in spoken words, graphics, images and written content were noted. To help address this, Committee members worked to provide a clear understanding of the importance of language and graphics used to reflect under-represented groups and incorporated this into all infographics.

1.5 Definitions

Clear and consistent definitions were established for the purpose of primary data collection and generating the Roadmap Reports.

- **Aptitude** - the innate or acquired capacity for something, including developed knowledge, learned, or acquired abilities (skills), talents, or attitudes necessary to perform a task.
- **British Columbia** – a geographical boundary that defines the Province of British Columbia as the most westerly province of Canada.
- **B.C. Mining Industry** – organizations or individuals that work on some aspect of the mining life cycle within B.C., including exploration, extraction, and processing of minerals and metals; closure; and reclamation of mining lands; and organizations or individuals which support these activities through consultation or other service offerings.
- **B.C. Mining Community** – all communities in B.C. are considered B.C. mining communities – as the B.C. mining industry impacts and connects with communities in all spaces and places within the province.

- **Competencies** – an important skill that is needed to do a job.
- **Diversity and Inclusion** – industry and community practices, initiatives, and policies that support the engagement, development, and retention of a diverse and inclusive B.C. mining workforce.
- **Emerging Jobs** - those identified in research as new activities/roles required in the sector to meet industry demands.
- **Essential Skills -** those skills that people need for work, learning, and life. They provide the foundation for learning all other skills.
- **Environmental, Social, and Governance** – the three central factors in measuring the sustainability and societal impact of an organization. Corporate values that are measured and reported by publicly traded companies.
- **Golden Triangle** – a geographical area located in the northwestern part of British Columbia that is rich in gold and other minerals - it is within the North Coast and Nechako region of British Columbia near the areas of Stewart and Dease Lake. The Golden Triangle region is predominantly located within Tahltan Territory and Nisga'a Traditional Territory (the Nass Area). The Gitanyow Lax'yip, Gitxsan Laxyip, Metlakatla, Tlingit and Kaska Traditional Territories have also been identified as Territories that may be impacted as a result of exploration and mining activity in the Golden Triangle.
- **Skills** – an ability to do an activity or job well, achieved through practice.
- **Technology-Related Technical Skills** - are technical skills required to perform tasks associated with new technological advancements or innovation.
- **Technical Skills -** abilities that allow a person to perform technological or physical tasks.
- **Training** – the activity of learning or teaching the skills and knowledge needed for a particular job or activity.
- **Transferable Skills -** (aka "portable" skills) are the abilities a person can transfer from one job to another.

2.0 B.C.'s Mining Industry Overview

B.C.'s mining industry continues to respond to global market conditions by implementing innovative solutions including automating production which is changing the skills and training requirements of the workforce. The B.C. Mining Innovation Roadmap states that the mining sector is well positioned to becoming a recognized world leader in mining as one of the largest clusters of exploration and mining companies in Canada.[12]

The B.C. mining sector directly employs over 30,000 workers and thousands more through indirect employment,[13] and contributes to the economy of local communities throughout B.C. due to the expenditures of mine suppliers and mine employees living there.[14]

[12] Mining Association of BC (MABC), "BC Mining Innovation Roadmap" (2021). https://www.mining.bc.ca/sites/default/files/MABC_BC_Mining_Innovation_Roadmap_FINAL.pdf

[13] Ministry of Energy, Mines and Low Carbon Innovation, "Featured Topics." (2022). https://www2.gov.bc.ca/gov/content/governments/organizational-structure/ministries-organizations/ministries/energy-mines-and-petroleum-resources

[14] ibid

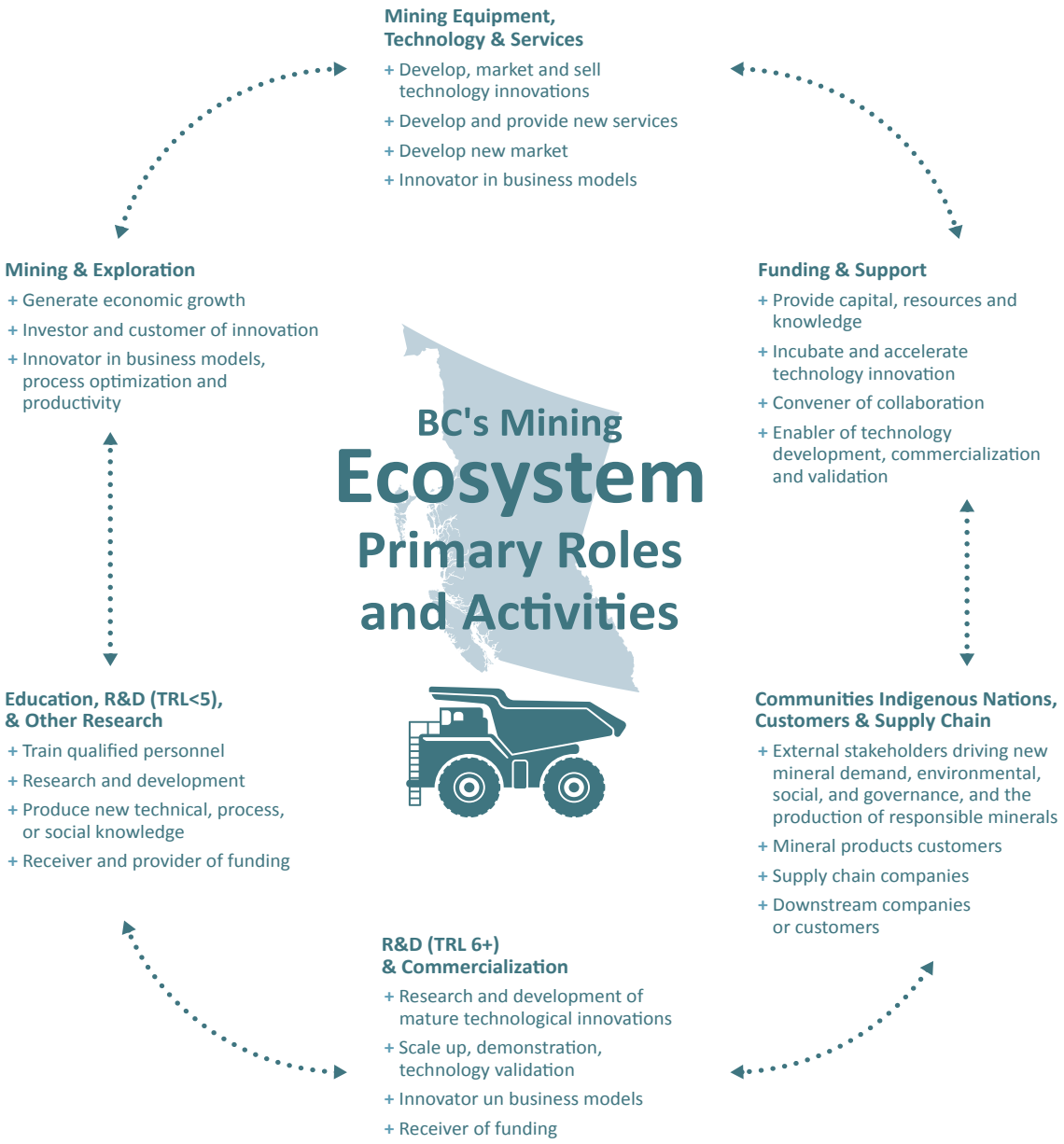

Figure 4 – B.C.'s Mining Ecosystem[15]

B.C.'s mining industry is valued at $12.6 billion from mining rare and precious metals including copper, gold, silver, zinc, molybdenum, coal, aggregate, and industrial minerals. In 2021, there were 10 active metal mines and seven active coal mines, 30 industrial mineral mines, 378 (16 % increase from 2020)[16] active exploration projects, and over 1,000 aggregate operations.[17]

[15] Mining Association of BC (MABC), "BC Mining Innovation Roadmap." (2021). https://www.mining.bc.ca/sites/default/files/MABC_BC_Mining_Innovation_Roadmap_FINAL.pdf

[16] EY Canada, "BC exploration thriving in the post-pandemic economic recovery." (2022). https://www.ey.com/en_ca/mining-metals/bc-exploration-survey-report-2021

[17] Ministry of Energy, Mines and Low Carbon Innovation, "Provincial Overview of Exploration and Mining in British Columbia, 2021." (2022). https://cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/InformationCircular/BCGS_IC2022-01.pdf

According to the International Institute for Sustainable Development, *"Rapid advances in technology innovation, including automation, digitization and electrification, are fundamentally changing how the mining sector operates"*.[18] Automation and robotics are identified as having the most impact in B.C., followed by data analytics and the incorporation of electrical and battery-operated vehicles; however, new computer software, artificial intelligence, and the use of drones, virtual and augmented reality, and sensors are all impacting required skills.[19]

The shift in the global investing community towards 'net-zero' is pushing industries to reduce their carbon footprint. One such movement is the electrification of vehicles and operations which require substantial amounts of critical minerals, many of which are found in British Columbia. The CleanBC: Roadmap to 2030[20] was developed to counter climate change and provide new social and physical infrastructure to strengthen communities and promote economic development across the province. The report highlights the emerging jobs and skills that will support the decarbonization of industries.

The 'StrongerBC Economic Plan, A plan for today and a vision for tomorrow', has applicable initiatives on training for the future skills and Environmental and Social Responsibility (ESG) focus including to:

- Foster B.C.'s innovation eco-system through a Future Ready: Skills for the Jobs of Tomorrow plan to develop and attract new talent;
- Strengthening B.C.'s mining sector through the B.C. Mining Jobs Task Force to ensure environmental and regulatory excellence in mining, and the sustainable exploration for minerals needed in the new economy; and
- Drive the expansion of B.C.'s tech, clean energy and life sciences sectors, while adding value to traditional industries like mining and forestry, innovation is a key contributor to new jobs and growth throughout B.C.'s economy. Innovation improves our productivity, increases wages, boosts investments, and increases exports.[21]

The mining industry is at the forefront of advancing reconciliation with Indigenous peoples. The sector is also a key employer of Indigenous peoples in rural and remote communities, and benefit agreements and revenue sharing with First Nations provide revenue streams to advance community priorities. The mining sector has been a leader, and continues to find ways to improve, in developing and implementing collaborative decision-making and including Indigenous communities in compliance monitoring and verification.[22]

[18] International Institute for Sustainable Development (IISD), "How Can Technology in Mining Protect the Environment?." (2019). https://www.iisd.org/articles/how-can-technology-mining-protect-environment

[19] B.C. Centre of Training Excellence in Mining, "Skills Roadmap Project, Key Findings Report." (2021). http://ctem.wpengine.com/wp-content/uploads/CTEM-Skills-Roadmap-Project-Key-Findings-Report-2021-FINAL12346.pdf

[20] Government of British Columbia, "CleanBC Roadmap to 2030." (2021). https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf

[21] Government of British Columbia, "B.C.'s Economic Plan: A plan for today, a vision for tomorrow." (2022). https://news.gov.bc.ca/files/StrongerBC_Economic_Plan_2022.pdf

[22] BC Mining Jobs Taskforce, "Mining Jobs Taskforce Final Report." (2018). https://www2.gov.bc.ca/assets/gov/business/natural-resource-industries/mineral-exploration-and-mining/memp_10535_task_force_report_final-rev.pdf

2.1 Strengths, Weaknesses, Opportunities, Threats (SWOT) Analysis

The Mining Association of BC (MABC) conducted an extensive Strengths, Weaknesses, Opportunities, and Threats (SWOT) in their B.C. Mining Innovation Roadmap Report[23], released in 2020. This report and the shared experiences of Project committee participants on past training programs challenges, characteristics of successful training programs, and vision for future skill development were used to create a SWOT analysis specific to this Project.

The SWOT analysis established a realistic snapshot of where the industry stands today and how to best inform future innovation in the B.C. mining industry. The SWOT analysis, illustrated in Appendix C, identifies the B.C. mining industry's ability to meet its own current and future workforce demands, by addressing opportunities listed in the SWOT analysis (e.g., "Improve education and professional development to include innovation").

2.2 Current Landscape – Discovery

2.2.1 Growing demand for environmental, social and governance focus

Environmental, Social, and Governance (ESG) are the three central factors in measuring the sustainability and societal impact of an organization. ESG priorities and guidelines aim to help a mining company navigate and balance the benefits to planet, people, and profit successfully. Although different ESG frameworks prioritize different metrics and criteria to screen potential risks and opportunities for investments and evaluate a firm's overall commitment to ESG (which does pose a challenge for industry to navigate), the following themes are important across most of the dominant global frameworks currently in use:

- Environmental factors look at energy use, mine waste, pollution, natural resource conservation, carbon footprint, hazardous substances, and mine closure.
- Social criteria examine how a company manages relationships with employees, communities, suppliers, and customers; upholds human rights; uses land; deals with resettlement; and addresses the needs of vulnerable people.
- Governance relates to a company's leadership, executive pay, audits, legal compliance, internal controls, and shareholder rights.[24]

These evolving ESG priorities are shaping the skills required by workers across the mining sector, but it is important to recognize that while companies are trying to integrate these skills within the workforce, the training landscape for ESG is still in the formative stage. Project participants expressed the need to develop a coordinated approach to environmental stewardship, community outreach, diversity initiatives, and reclamation and linking these to strategies to measurable outcomes to move ESG priorities further forward.

As ESG priorities evolve and grow, new and existing workers in the environmental sciences will need increased training in expanded environmental regulatory requirements, as well as increased understanding and training in cultural diversity, Indigenous principles of environmental stewardship, and the ability to integrate this knowledge.

[23] Mining Association of BC (MABC), "BC Mining Innovation Roadmap." (2021). https://www.mining.bc.ca/sites/default/files/MABC_BC_Mining_Innovation_Roadmap_FINAL.pdf

[24] Investopedia, "What is Environmental, Social and Governance (ESG) Investing?." (2021). https://www.investopedia.com/terms/e/environmental-social-and-governance-esg-criteria.asp

New and expanded ESG requirements are increasing the engagement, consultation, and collaboration occurring with local and Indigenous communities throughout the life cycle of a mining project, which will increase the demand for occupations that carry out this important work. Key skills at the site level of these occupations include:

- Effective communications
- Community collaboration skills
- Ability to work with diverse perspectives and peoples
- Understanding and adhering to government regulations
- Sound environmental stewardship to eliminate negative impacts on other land users
- Environmental understanding, policy development, technical skills (science and computer)

2.2.2 Higher than average retirement rates combined with challenges attracting young workers (19-24)

In the 2016 report, *Preparing for the Future: Mining Labour Market Outlook for British Columbia 2016-2026,* it was anticipated that 13,705 individuals would need to be hired to meet the mining sector labour market demand by 2026, with almost half of those openings coming from people who are retiring.[25]

To prepare and retain these new entrants, workers will need to be equipped with the skills to be successful. Despite this, project key informants indicated that skilled trades continue to face challenges with employer supported apprenticeships and recognized Red Seal training. This is particularly felt by smaller organizations who incur training costs and are heavily impacted by the reduced productivity of those doing the training, only to have concerns around losing newly trained or certified employees to a larger employer.

2.2.3 Challenges in accessing technical skills and filling workforce shortages

The technical focus groups carried out during this project highlighted a number of challenges in accessing technical skills and filling workforce shortages. These include:

- Attracting technical talent to the mining industry, and to rural and remote communities.
- Intense competition for skilled trades and technical skills that can work in multiple industries.
- Adapting mining jobs to technical workers needs; flexibility in scheduling, work from home or remote options, childcare and training supports.[26]

The Mining Association of Canada (MAC) established the Towards Sustainable Mining™ (TSM) initiative in 2004 that supports mining companies in managing key environmental and social risks. TSM is

[25] Mining Industry Human Resources Council (MiHR), "Preparing for the Future: Mining Labour Market Outlook for British Columbia 2016-2026." (2016). https://www.workbc.ca/getmedia/f7c01e3e-ea59-416b-90aa-2725ebb9c250/mining_labour-market-outlook-report-for-bc_feb-2017.pdf.aspx

[26] B.C. Centre of Training Excellence in Mining, "Skills Roadmap Project: Focus Groups with Mine Managers, Leaders in Exploration, and Human Resources groups." (2022).

a globally recognized program that is mandatory for all MAC members' to commit to responsible mining. The standard provides mining companies, communities, and additional partners clarity on ESG initiatives. (e.g. community outreach, tailings management, and biodiversity).[27]

As part of the enhanced consultation on technical skills and careers, *the B.C. Mining Innovation Roadmap* was referenced to provide focus group participants further context on innovation and technological developments that will impact the sector and the skill needs it will create.[28] It was acknowledged that competition for skilled technical labour will remain high as many sectors grapple with the integration of new technology and innovations within their processes and operations. In order to address the increased demands for technical skills, both an upskilling of the current workforce, and a path to attract new workers that reflects diversity within B.C. will be needed in order for the mining workforce to remain nimble and able to acquire the skills needed to implement these new technologies.

Additionally, MiHR's report on the *Changing Nature of Work* found that occupations have differing vulnerabilities to technological change, and that production occupations are most vulnerable as technologies such as automation are adopted. This research also noted the increased need for technical skills, particularly computer programming and systems analysis, and the importance of balancing technical skills with soft skills including leadership, collaboration, and communication to guide the change management and implementation of new technology and innovation within the sector.[29]

2.2.4 Barriers that impact acquiring and utilizing skills

Research identified a series of historical legacies and systemic barriers that have disproportionately affected the inclusion of women, Indigenous peoples and people living in rural and remote communities in the mining sector.[30] Systemic barriers include, "situations, policies and/or practices, which results in some people receiving unequal access or being excluded from benefits and opportunities."[31] These barriers may impact the ability to acquire a skill, prevent people from being hired and therefore utilizing their skills, or both.

2.2.5 Golden Triangle

Following the recommendations coming out of the *Mining Jobs Task Force Report*, this project focused on mining operations in the Golden Triangle, to further explore and understand the regional opportunities and barriers to workforce participation by women, Indigenous peoples and those individuals living in rural and remote communities.[32]

[27] The Mining Association of Canada (MAC), "The Total Sustainable Mining Initiative." (2004). https://mining.ca/towards-sustainable-mining/

[28] Mining Association of BC (MABC), "BC Mining Innovation Roadmap." (2021). https://www.mining.bc.ca/sites/default/files/MABC_BC_Mining_Innovation_Roadmap_FINAL.pdf

[29] Mining Industry Human Resources Council (MiHR), "Changing Nature of Work" (2020). https://mihr.ca/wp-content/uploads/2020/05/MIHR_Innovation_Report_EN_WEB.pdf

[30] B.C. Centre of Training Excellence in Mining, "Skills Roadmap Project: Environmental Scan and Literature Review", pg.25-30. (2021).

[31] B.C. Centre of Training Excellence in Mining, "Skills Roadmap Project: Research Methodology and Tools." (2021).

[32] Mining Association of BC (MABC), "BC Mining Innovation Roadmap." (2021). https://www.mining.bc.ca/sites/default/files/MABC_BC_Mining_Innovation_Roadmap_FINAL.pdf

The Golden Triangle, as shown in Figure 5, is a geographical area within the North Coast and Nechako regions of B.C. that is rich in gold and other minerals. The Golden Triangle is predominantly located within Tahltan Territory and Nisga'a Traditional Territory (the Nass Area). The Gitanyow Lax'yip, Gitxsan Laxyip, Metlakatla, Tlingit and Kaska Traditional Territories have also been identified as Territories that may be impacted by exploration and mining activity in this region.

Figure 5 - Map of Golden Triangle - B.C. Regional Mining Alliance

The Golden Triangle had experienced challenging times due to lack of investment interest, partially attributed to its remote nature and lack of infrastructure. This has changed significantly in recent years with the completion of the Northwest Transmission Line which follows Highway 37, shifts in metal prices and newly discovered deposits. As of 2021, "exploration expenditures [for the Northwest Region] were estimated at $365.9 million and exploration drilling was estimated at 662,200 m."[33] This represents significant activity within the area and highlights the Golden Triangle's growing importance as the current centre of provincial exploration activities.

Figure 6 illustrates the Golden Triangle's provincial significance when looking at the ratio of exploration expenditure; in 2021, the Provincial Overview of Exploration and Mining in British Columbia Report

[33] Ministry of Energy, Mines and Low Carbon Innovation, "Provincial Overview of Exploration and Mining in British Columbia, 2021." (2022). http://cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/InformationCircular/BCGS_IC2022-01.pdf

indicates that the expenditure within the Northwest of B.C. represented more than 50% of the total provincial expenditure on exploration. With renewed interest in exploration, advanced development, and existing and upcoming mining operations, the Golden Triangle is now a significant region of focus for the mining sector internationally. The B.C. Regional Mining Alliance (BCRMA) is a regional partnership between Indigenous groups, industry, and provincial government representatives and seeks to promote GoldenTriangle opportunities internationally, engage with the investment community and demonstrate how partnerships among Indigenous and mining and exploration companies can lead to responsible resource development.

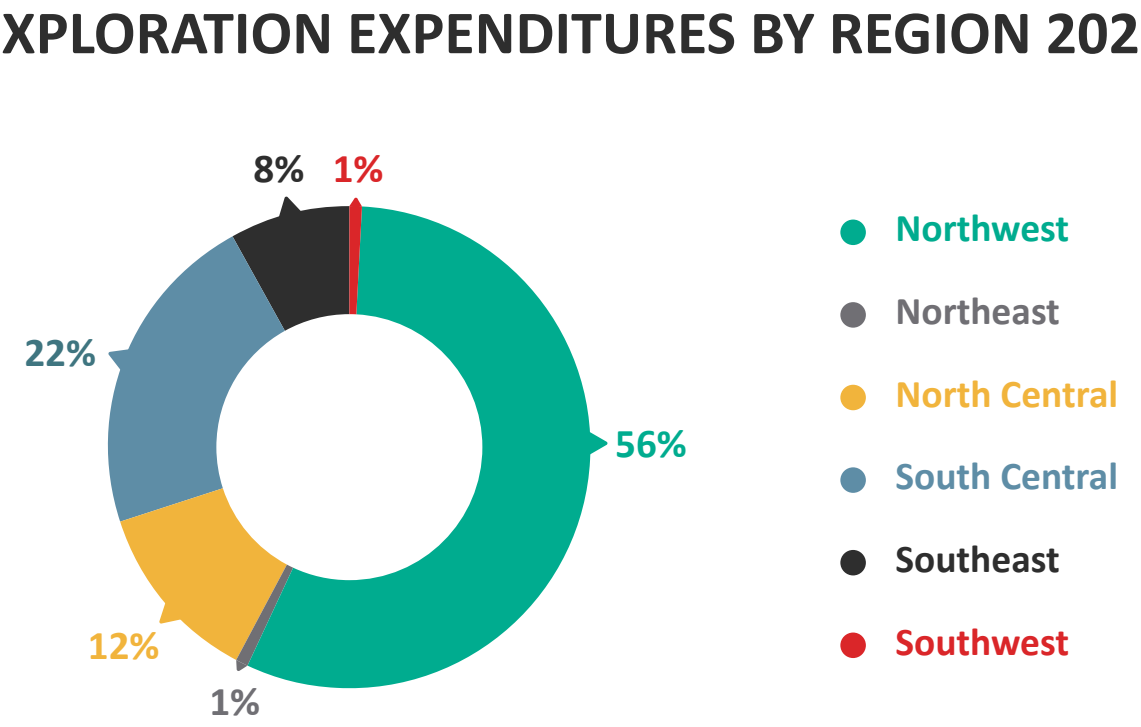

Figure 6 - Northwest Share of B.C. Exploration 2021[34]

2.3 Building Partnerships with the Mining Industry

Project participants recognized that a solution to meeting the mining sector's current and future workforce needs will rely on partnership and industry collaboration; training cannot be successful if employers are not informing what is required to meet the needs of the industry and new workers cannot be successful if they enter a workforce that is not inclusive and understanding of their needs, with opportunities to grow their career.

The sector is well positioned for success and the story it can tell careers seekers; according to B.*C.'s Mining Innovation Roadmap*, B.C.'s mining has a reputation as one of the most environmentally aware and safest mining sectors in the world. B.C. is also the first province in Canada to develop its own legislation to implement its commitment to the principles contained within the *United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)* and has a strong technology and clean energy sector and is the

[34] Ministry of Energy, Mines and Low Carbon Innovation, "Provincial Overview of Exploration and Mining in British Columbia, 2021." (2022). http://cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/InformationCircular/BCGS_IC2022-01.pdf

home of the Digital Technology Supercluster, a non-profit focussed on accelerating clean growth through world-leading digital innovation. These factors all create an environment poised and ready to continue driving the sector into the future - integrating and incorporating advancements in technology - as well as increased activities relating to expanding environmental, social and governance priorities.

The project has identified the incredible number of participants in B.C.'s mining ecosystem, and their commitment to the success of the industry. A considerable amount of work has already been done by mining organizations and partners to explore, understand and meet the needs of the sector; leveraging these existing resources and continuing to build partnerships will support the momentum already established and build on the collective work of the many contributors to this project.

2.3.1 Limitations and Gaps

Despite the many opportunities in the mining industry, the expectations of governments (provincial, federal, and Indigenous) and the future workforce requires changes to be made to the way that mines operate, and these changes may require a shift in workplace culture that is understood by all employees at every level of leadership. Challenges shared by participants included:

- Mine permits terms can limit confidence of investors, creating instability for the mine, the employees, and any partners.
- The need to align First Nations needs with corporate values and not be limited by expectations provided by investors and financial institutions.
- Lack of research prior to providing training to determine skills already possessed, technical knowledge and abilities, or the occupations required at local mines.
- Textbook only learning that provides good theoretical knowledge but does not provide the practical experience required by mining companies.
- Low appetite for training that requires extensive travel or for students to stay away from home.
- Instructors using old course materials or course materials not relevant/specific to B.C. and local circumstances.
- Lack of industry participation in training programs including as instructors and a lack of industry support to host field trips.
- Training for the sake of training, with no targeted employment following a course, or without identifying a career path.
- Timelines for training that need to be carefully balanced so as not to be too close or too far away from employment opportunities.
- The need to provide on-the-job training and providing hands-on learning without job shadowing, mentorship, or other supports which takes time away from production goals.
- A one-size-fits-all approach to learning, without the recognition that some people learn in different ways to others.
- Lack of accreditation (e.g., certificates) that students can add to resumes to increase their chance of employment.
- Training on specific software, only to have the software change or become irrelevant.
- A lack of mining career awareness until after high school graduation.
- Prerequisites that create barriers or challenges for potential students.
- Lack of training facilities or equipment.

2.3.2 Opportunities

British Columbia has an incredible opportunity to tell its story and build a positive perception of the mining industry. To ensure workers are successful entering and remaining in the industry:

- Training programs could be designed collaboratively between training providers, educational institutions, industry, and communities to meet the needs of all partners.
- Frequent updates to training (e.g., micro-credentials, essential skills, critical thinking, progressive thinking, etc.) or ongoing career planning would reinforce continual, lifelong learning and allow people to progress in the industry.
- Undertake succession planning with learners to provide them with career aspirations.
- Learning should be encouraged at all levels of the mining industry and be part of the company culture.
- Blended learning in the digital environment and practical methodology.
- Teaching learners to learn so they may adapt in the future.
- Training and education programs (e.g. certifications) being valued and recognised by mining companies and/or employers.
- Established partnerships between industry and educational institutions.
- Work with industry to prepare people for employment before jobs are available, rather than reacting to fill positions.
- Support reconciliation through inclusivity, creating awareness, respect and upholding cultural safety at all levels of industry.
- Essential skills and other practical foundational skills in place and removing barriers and assisting people at critical decision points in their lives to understand their natural potential.
- Form a better understanding of people's skills and work with those people to move them into new positions when desired instead of just creating career plans for workers with seniority.
- Work with employees to develop competencies and shared values.
- Recognize the transferable skills of workers coming from other industries or transferring from different companies.

3.0 Synthesizing the Feedback

3.1 Current Skills in Demand

Within mining specifically, global mining organizations reported the following skills to be in high demand:[35]

- Technology use, monitoring, and control
- Analytical thinking and innovation
- Complex problem-solving
- Systems analysis and evaluation
- Reasoning, problem-solving and ideation
- Troubleshooting and user experience
- Creativity, originality, and initiative
- Active learning and learning strategies
- Emotional intelligence
- Quality control and safety awareness
- Instruction, mentoring and teaching
- Technology, design, and programming

[35] World Economic Forum, "The Future of Jobs Report 2020." (2020). https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf

In 2019, the Mining Industry Human Resources Council (MiHR) analyzed the top technical skills required in the mining sector.[36] The word "technical" is defined as the way something works or describes something in specific words related to a field of work or study. Technical skills are sets of abilities or knowledge used to perform practical tasks. The following technical skills are in demand in B.C. mining:

- Ability to learn, adapt to new knowledge
- Hand eye coordination, quick reaction time
- Computer and software skills
- Data-based decision making
- Communication skills
- Ability to "think outside the box"
- Programming and coding
- Mine modelling, interpretation
- Systems development
- Electronics and maintenance
- Mechanics and advanced engineering
- IT operations
- Systems integration
- Virtual reality, artificial reality
- Data mining, data analytics, statistics, data interpretation
- Problem solving/troubleshooting skills
- Ability to work in diverse groups
- Lifelong learning
- Teamwork/collaboration
- Mathematics and statistical analysis skills
- Leadership skills
- Science, technology, engineering and math (STEM) basic skills
- Research and product development
- Reading, writing and creative skills

Innovation and technology are requiring workers to be flexible, creative, collaborative, and problem-solving. The abilities to think critically, adapt and communicate effectively will be key to success in an evolving work environment; and lifelong learning to keep skills current will be essential to the success of the mining sector worker, regardless of their technical skills.

3.2 Future Skills in Demand

When looking towards the future of mining, digitalization, automation and ESG requirements will continue to unfold and evolve, requiring continuous refinement of associated skills to carry out these important tasks across the workforce. Current workers will need upskilling to keep up with changes to technology and legislative requirements, while students and new workers will need access to training that is in keeping with the pace of change in these occupational demands. With a 70% completion rate, the 197 survey respondents ranked these skills in order of priority:

1. Cultural awareness, human rights and anti-racism, reconciliation
2. Judgement and decision making
3. Critical thinking
4. Complex problem-solving
5. Resilience, stress tolerance and flexibility
6. Digital literacy
7. Active listening and conflict resolution
8. Data analysis
9. Leadership and social influence

[36] Mining Industry Human Resources Council (MiHR), "Canadian Mining Labour Market Outlook 2020." (2019). https://mihr.ca/wp-content/uploads/2020/03/MIHR_National_Report_web2.pdf

3.3 Technology

The World Economic Forum released *The Future of Jobs Report 2020* outlining key findings and predictions on the changing nature of work. This report estimated that by 2025, 85 million jobs globally will be displaced by a shift in the division of labour between human and machines, while 97 million new roles may also emerge.[37]

Consistent with the World Economic Forum research, the Project's findings indicate that technology and innovation will have the most impact on the future of mining and due to the current increasing digitalization and automation within the mining sector,[38] these skills are already increasing in demand. It is reported that 84% of employers are set to rapidly digitalize working processes, including significant expansion of remote work.[39]

To prepare for this, B.C.'s mining industry needs to determine how to attract talent and forecast workforce demand in in these occupations and identify the labour pool available to meet the workforce demand. Areas of innovation and technology include:

1. Automation and robotics
2. Data and analytics
3. Electric and battery-operated vehicles
4. Social Innovation
5. Computer and software
6. Artificial intelligence
7. Drones
8. Virtual and augmented reality
9. Use of sensors
10. Internet/Wi-Fi

Automation, robotics, data analytics and electric and battery-operated vehicles were indicated by research participants as the technologies that will most impact the future of the B.C. mining sector. The importance of these technologies and their adoption within were further validated by the participants within the technical focus groups sessions.

It is important to note that the need to adopt new technology is highly dependent on the individual mine; there is no one list or guideline of technologies that companies should implement. Those companies who embrace the management and cultural changes central to technology advancements and are well prepared with the skills, mindset and processes required to implement new technologies, will be able minimise any negative impact to business operations.[40]

The use of autonomous vehicles, remote operating centres, automated drilling, and tunnel boring systems are expanding the skill sets required by workers. In the Mine Manager, Exploration, and Human Resources focus groups, technical skills were presented, and participants selected the skills they perceived would have the most impact on the future of mining in B.C.:

[37] World Economic Forum, "The Future of Jobs Report, 2020." (2020). https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf

[38] B.C. Centre of Training Excellence in Mining, "Skills Roadmap Project, Key Findings Report." (2021). http://ctem.wpengine.com/wp-content/uploads/CTEM-Skills-Roadmap-Project-Key-Findings-Report-2021-FINAL12346.pdf

[39] World Economic Forum, "The Future of Jobs Report, 2020." (2020). https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf

[40] McKinsey & Company, "Behind the Mining Productivity Upswing; Technology-enabled transformation." (2018). https://www.mckinsey.com/industries/metals-and-mining/our-insightsbehind-the-mining-productivity-upswing-technology-enabled-transformation

- Computer and software skills; digital literacy
- Programming and coding
- Technology use, monitoring and control
- Systems development
- IT operations
- Systems integration
- Systems analysis and evaluation
- Virtual reality, artificial reality
- Mine modelling, interpretation
- Data mining, data analytics, statistics, data interpretation
- Research and product development
- Technology, design, and programming
- Instruction, mentoring and teaching (of technology-related skills)

Systems integration, analytical thinking and innovation, systems analysis and evaluation and data mining and analysis were highlighted by the focus group participants as collectively most important to the future mining sector. Precision machining, virtual reality and computer numerical control machining were perceived by the focus group participants as equally less important to the future of skills needs of the sector.

In order to support industry in adapting and capitalizing on these technical shifts, industry needs to address the current disconnect between industry and education. Collaboration and coordination between partners through work-integrated learning opportunities is one potential solution in that it provides both the opportunity for mines to test new technology and simultaneously develop future workers' technical skills in an applied setting.

3.4 Skilled Trades

Skilled trades are occupations that require a particular applied skill, knowledge, or ability. Most often, this is obtained at a college, technical school or through specialized training. The Industry Training Authority (ITA) manages more than 100 trades in B.C., including many that are in demand in the mining sector, during all phases of the mine life cycle (exploration, extraction, processing, closure, and reclamation).

Trades-related jobs found in the mining sector include (but are not limited to):[41]

- Carpenter
- Construction Craft Worker
- Construction Millwright
- Electrician
- Industrial Mechanic (Millwright)
- Instrumentation and Control Technician
- Heavy-Duty Equipment Technician
- Heavy Equipment Operator
- Machinist
- Steamfitter/Pipefitter
- Truck and Transport Mechanic
- Welder

Competition for these occupations is high due to due to the demand for them in other sectors, and an aging workforce, where more workers are leaving than the number of new and transitioning workers entering the workforce. Continuing to provide information, access and an opportunity to explore the skilled trades will continue to be an important part of ensuring there are sufficient numbers of workers to fill these needs within the sector.

[41] BCJobs.ca, "Careers in the Mining Industry." *(2013).* https://www.bcjobs.ca/blog/careers-in-the-mining-industry/

3.5 Environmental, Social, and Governance

Rising and evolving ESG perspectives will require mining sector innovation and a high-skilled workforce to implement the innovations. As a result, complex problem-solving will become more important, as will resiliency and the ability to adapt to change. Other ESG relevant skills identified in the Project are:

- Effective communications
- Community collaboration skills
- Ability to work with diverse perspectives and peoples
- Understanding and adhering to government regulations
- Sound environmental stewardship to eliminate negative impacts on other land users
- Environmental understanding, policy development, technical skills (science and computer)

Although integrating ESG is still within the formative stage, it is becoming increasingly clear that ESG expectations and performance will not only require additional skills relating to community consultation and engagement, but will also require more technical skills, scientific skills, as well as engineering and even corporate skills as companies work to meet new standards.

The absence of literature on the subject has subject matter experts placing emphasis on the need to develop a coordinated approach to environmental stewardship, community outreach, diversity initiatives, and reclamation; and linking these to strategies and outcomes.

The 2020 *Mines Amendment Act* alters how mining workers engage with mine regulators, acquire permits, and ensure compliance. The professional requirements of geoscientists and engineers is requiring their greater understanding of governance structures and managing ethical responsibilities.[42]

3.6 In-Demand and Emerging Careers

The range of careers in mining is vast; there are more than 120 different jobs in the mining sector,[43] across the five phases of the mining life cycle that cover many areas of expertise; science, trades, technology, environment, community, administrative and executive:

1. Exploration, sand, gravel, and aggregate
2. Mine site design and planning
3. Construction
4. Production/active mine
5. Closure

As the mining sector deals with rapidly shifting technology and innovation that are driving changes in occupations (both in mining operations and corporate environments), identifying, and predicting occupations and skills required to operate these new technologies and further drive innovation is very challenging. Relying on literature and subject matter expertise about new technology demands and associated skill sets are helping to create understanding about the careers needed.

[42] Ibid.

[43] Mining Industry Human Resources Council (MiHR), "The Changing Nature of Work: Innovation, Automation and Canada's Mining Workforce." (2020). https://mihr.ca/wp-content/uploads/2020/05/MIHR_Innovation_Report_EN_WEB.pdf

Jobs central to mining activities will continue to be in demand, while new and exciting roles in technology, trades, environmental, community and management occupations will emerge and expand.

The majority of the upcoming expected job openings in B.C. are primarily in the northern and interior regions of the province, with the highest demand being in the following occupations across the five phases of the mine life cycle:

- Heavy Equipment Operators
- Geoscientists and Oceanographers
- Truck Drivers
- Drillers
- Underground Productions and Development Miners
- Supervisors, Mining, and Quarrying
- Land Surveyors
- Heavy-Duty Mechanics
- Chemical Technicians
- Drafting Technicians
- Mining Engineers
- Geological Engineers
- Metallurgical and Materials Engineers
- Mechanical Engineers
- Civil Engineers

In addition to the occupations above, MiHR research indicates the continuing high demand for Geologists.[44]

3.6.1 Technological Careers

According to a study by the Workforce Information Council, the high-tech sector can be defined as industries having high concentrations of workers in science, technology, engineering, and mathematics (STEM) occupations.

Mining in B.C. will experience a period of time where in-demand skills of today and the future will intersect. It will become increasingly important to identify and distinguish between those that will continue in demand, and those that are emerging in demand.

Industry will need to look at developing strategies that attract and retain new talent and technology workers to the industry, and how best to gear on the job training to meet the changing skills needs in the current workforce.

The World Economic Forum also states the following jobs are emerging in demand due to the increasing digitization and automation and other technology and innovation shifts in the mining sector:[45]

- AI and Machine Learning Specialists
- Data Analysts and Scientists
- Process Automation Specialists
- Robotics Engineers
- Software and Application Developers
- Digital Transformation Specialists
- Remote Sensing Scientists & Technologists
- Management Analysts
- Internet of Things Specialists
- Big Data Specialists

[44] Mining Industry Human Resources Council (MiHR), "Preparing for the Future: Mining Labour Market Outlook for British Columbia 2016-2026." (2016). https://www.workbc.ca/getmedia/f7c01e3e-ea59-416b-90aa-2725ebb9c250/mining_labour-market-outlook-report-for-bc_feb-2017.pdf.aspx

[45] World Economic Forum, "The Future of Jobs Report." (2020). http://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf.

As part of the technical focus group sessions, participants were asked to consider the emerging technical occupations in mining highlighted within previous research work and reflect on the question "*Which of these emerging jobs identified in research are you seeing in the B.C. Mining Sector?*"

The most commonly emerging jobs selected by participants were Data Analysts and Specialists, Software and Applications Developers, Instrumentation and Control Technicians, and Process Automation Specialists. Conversely, Mechatronics Engineers, Internet of Things Specialists, Network Analysts and Management Analysts were not as commonly recognized.

Six careers were then prioritized for introductory career profiles: Data Analysts, Energy Conservation Technicians, Process Automation Specialists, Remote Sensing Scientists and Technologists, Robotics Engineers and Instrumentation and Controls Technicians.

3.6.2 Skilled Trades Careers

Skilled trades are occupations that require a particular manual/applied skill, knowledge or ability which is most often obtained at a college, technical school or through specialized training. Trades continue to be in high demand across sectors, including mining. As in other sectors, the skilled trades workforce is aging, with more workers leaving than entering. Yet trades continue to provide a good source of well-paid work that is also adapting to new technologies and innovation. The top trades in the mining sector (as defined by number of apprenticeships) are:[46]

1. Heavy Duty Equipment Technician
2. Industrial Mechanic (Millwright)
3. Industrial Electrician
4. Parts Person
5. Truck and Transport Mechanic
6. Welder
7. Construction Electrician
8. Carpenter
9. Machinist
10. Power Line Technician
11. Steamfitter/Pipefitter

B.C. mining subject matter experts in this Project reinforced the consistent demand for the skilled trades in mining; there is an ongoing need for Red Seal Trades and the technical and operational skills required for equipment operation and underground mining and exploration.

In addition to these current trades careers, a key emerging career was identified through the course of this Project; Electrical Battery Technician. More information on this career is in Appendix D.

3.6.3 Environmental and Community Careers

The growing body of work around Environmental, Social, and Governance (ESG) priorities and regulations is shaping the skills and careers required in mining. ESG criteria are the three central factors in measuring the sustainability and societal impact of an organization. ESG brings together these themes in a comprehensive framework that can help a mining company navigate and balance the benefits to the planet, people, and profit successfully.

[46] Data from Mining Association of BC (MABC), Association for Mineral Exploration (AME), and Sand, Gravel, and Aggregate Association in February 2020.

Increasing regulations on the environmental and social impacts of resource projects places new skills and occupational requirements on the mining industry. The individuals that possess the skills, knowledge, and aptitude to navigate complex regulatory environments and effectively engage with the public and Indigenous communities within consultation and assessment processes will be in demand in the sector.

According to Marsh & McLennan's Advantage Insights research, ESG can be used as a workforce strategy to recruit and retain top talent as Millennials and Gen Z make up the majority of the global workforce. Their recent study looked at the link between ESG performance and workforce sentiment and found that employers with highly satisfied employees scored higher on ESG performance.[47]

Environmental Jobs: Environmental jobs continue to be a sub-set of mining occupations that are essential, and as the mining industry sees an increase in ESG priorities and their further integration into daily operations, they will continue to play a significant role in mining. These jobs are shaped by technological and ESG advances, require a broad understanding of the natural environment, technology, governance structures, and ethical responsibilities. Three high demand environmental jobs were highlighted through the work of this Project, Geologists, Environmental Monitors, and Water Quality Monitor/Technologist/ Engineers, and one emerging environmental career: Land Management and Compliance.

Community Jobs: These careers are also expanding as engagement and consultation with local and Indigenous communities is becoming increasingly important in ensuring mining operations are established and operate consistently with local values. People in these roles will be drawn to meeting and talking with local communities to understand potential impacts and benefits to mining operations in the region. The career of Community Liaison Officer was viewed as essential by Project participants.

Management Jobs: Managers of the future need to have innovative approaches to both technology integration as well as engagement and partnership development. These jobs will include skills to engage with Indigenous communities; to develop and utilize technical skills (e.g. leadership, engagement, diversity, inclusion, and collaboration); and incorporate skills in cultural awareness/cultural agility. Careers highlighted by this Project include Engineers (including Engineering Managers) and the emerging role of Community Cultural Directors.

3.7 The Evolution of Training and Skills Recognition

A new education and training system is emerging to accommodate the technological changes to the industry that is flexible and works with individual learners. This includes courses outside of the formal classroom setting, with flexible start dates and programming that works at the pace of the learner. Shorter-term training is particularly helpful to those already working in the industry as they learn new skills to keep pace with the changes in technology.

Mixed approaches to training delivery, incorporating both theory and applied learning opportunities, are proving successful, as are training programs that are responsive to learners and the variety of individual

[47] Marsh & McLennan, "ESG as a Workforce Strategy." (2020). https://www.mmc.com/esg-interactive.html

learning styles. Providing training at home, supported by the community, and removing barriers improve the success of those living in rural and remote communities. New credential recognition and certification will be needed to complement the changing landscape.

Despite these advances, the B.C. mining landscape and changing workforce requirements are evolving faster than technology or training curriculum can keep pace with. In 2021, the Mining Industry Human Resources Council reported the findings of their 2020 Employer Survey. When asked about the comparative importance of their corporate training and development strategies, most of the survey respondents agreed that certification, and recognition of employee skills were very important (75%). Respondents also stated that access to standardized training, and/or curriculum (64%), alignment with national occupational standards (55%), training for new technology and innovation (55%), and competency-based performance measurements strategies (50%) were very important.[48]

Only 39% of respondents agreed that post-secondary institutions are adequately preparing students for careers in the mining industry, and 13% agreed that high schools were doing the same. Conversely, 67% of respondents agreed that high school was not sufficiently preparing students for mining, while only 46% said the same of post-secondary education.

Employers will benefit from identifying new skills requirements early and supporting training provider/ employer partnerships to encourage effective job placement, as well as on-the-job training, mentorship, micro-credentialing, and other upskilling opportunities while workers stay employed.

New technologies such as simulations, augmented reality and virtual reality can help individuals to develop confidence and competencies in cost-effective ways for employers. Industry will need the active engagement of organizations that understand their business needs and that foster connections with education and training providers with innovative answers on how to apply new learning technologies efficiently. Greater collaboration between employers and education and training providers to integrate learning into work, and work into learning will increase the sector's ability to support its learners.[49]

3.7.1 Current Workers

Current workers require ongoing training to remain competitive as the industry evolves their technology advancements in automation and other innovations. A commitment to lifelong learning will be essential, as will the importance of employers and training providers making space for workers to learn new skills while working.

Providing a variety of flexible training options will help current workers integrate learnings into their work-life while providing valuable integration opportunities for their new skills. Flexible training options include:

[48] Mining Industry Human Resources Council (MiHR), "Mining Year in Review; National Outlook 2020." (2021). https://mihr.ca/wp-content/uploads/2021/03/MIHR-National-Outlook-LMI-Report-2021-E-web.pdf

[49] Employment and Social Development Canada: Future Skills Advisory Council, "Canada - A Learning Nation." (2020). https://www.canada.ca/en/employment-social-development/programs/future-skills/report-learning-nation.html

- Combining or offering training both virtually and/or in-person
- Use new technology like virtual and augmented reality, simulations
- Work-integrated learning
- Prior learning assessment recognition (PLAR)
- Assessment of on-the-job learning
- Micro-credentials
- Certification supported by industry

3.7.2 Students and Potential New Workers

Similarly, those looking to enter the mining workforce will benefit from training that incorporates new technologies and growing environmental, social and governance priorities in the sector. The use of new technology and innovation that mining is so rapidly integrating - such as virtual and augmented reality, equipment simulations - will provide great value to learners, through a blend of online and in-person training.

Industry and training provider collaborations continue to be a critical component to increasing the success of transitioning new workers from the learning environment over to the workplace. These collaborations can ease barriers –such as investment to help cover the high cost of technology - that may be a factor in training and workplace integration of new skills requirements. Added mentorship and on-the-job training opportunities will further strengthen this transition and support new workers in further developing their skills.

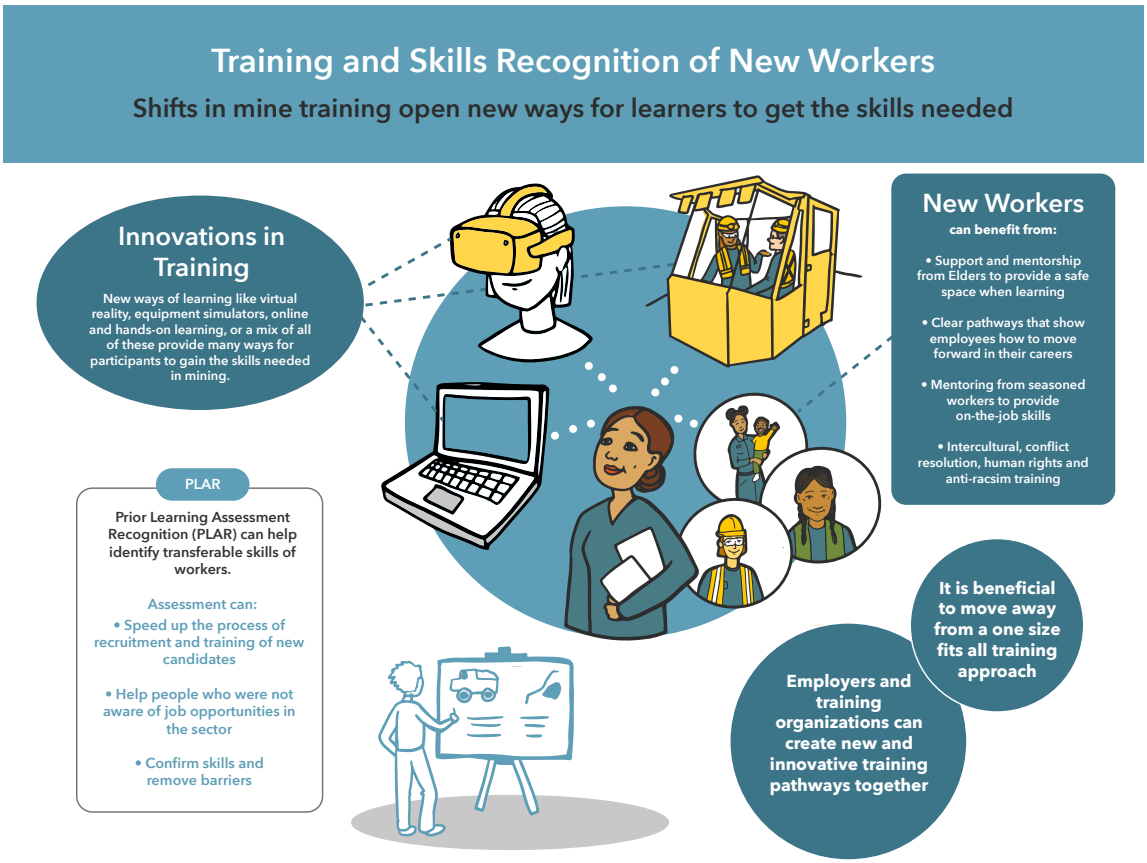

Figure 7 - Training and Skills Recognition of New Workers

3.7.3 Evolving Training Programs and Materials to Meet Current Industry Needs

As skills evolve to meet the various technical, technological, environment, social and governance requirements of the sector, training will become a critical component of ensuring all workers have the tools to carry out new functions effectively.

The majority of current training focuses on technological advancement and the introduction of socially conscious values, e.g., environmental, social, and governance training. In addition to these, many workers will retire and need to be replaced with people who understand and are trained with foundational mining skills, albeit with additional skills in response to technological advances.

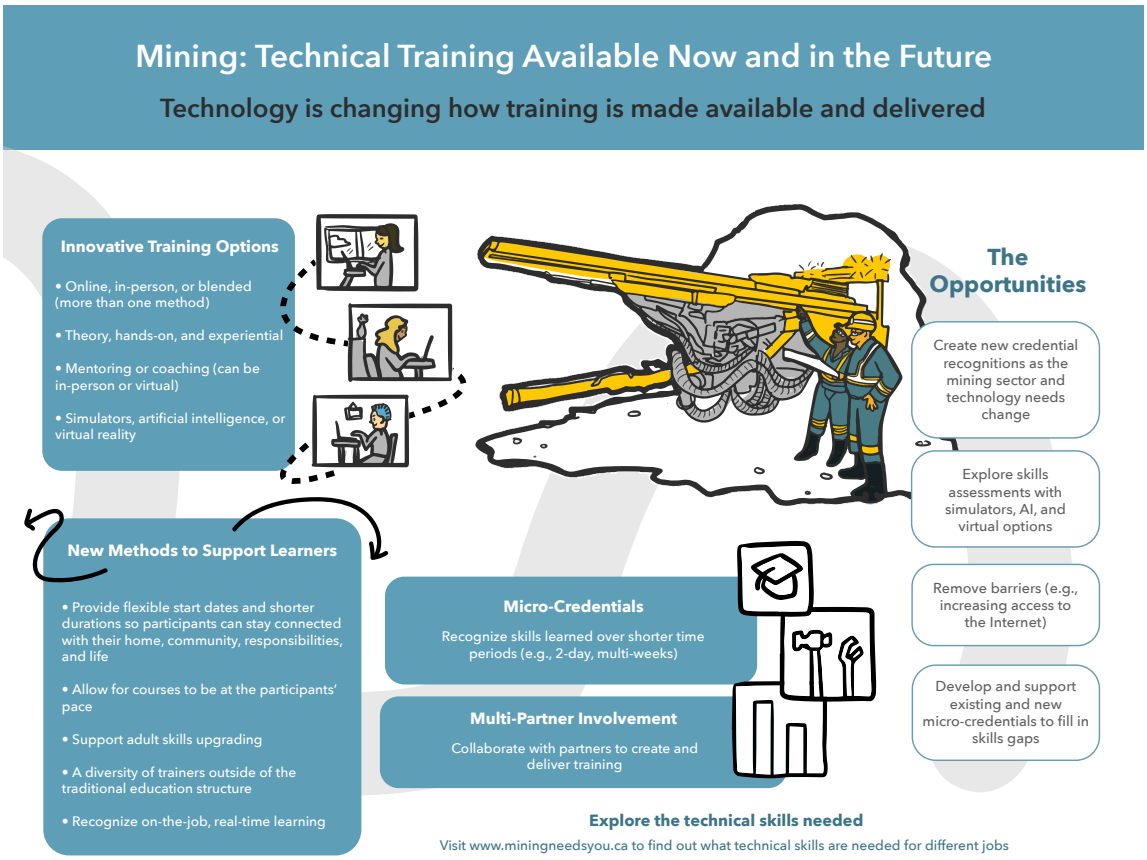

Figure 8 – Technical Training Available Now and in the Future

Overall, and across occupations, findings from this project indicates the following types of training are needed in the mining workforce:[50]

- Training for technology
- Cultural awareness and cultural safety training, reconciliation, human rights, and anti-racism
- Essential skills training (e.g. reading, numeracy, writing, digital technology)
- Leadership training
- Unconscious bias training

[50] B.C. Centre of Training Excellence in Mining, "Skills Roadmap Project, Key Findings Report." (2021). http://ctem.wpengine.com/wp-content/uploads/CTEM-Skills-Roadmap-Project-Key-Findings-Report-2021-FINAL12346.pdf

- Communications training (ex. active listening and conflict resolution)
- Driver's license training
- Equipment training
- Health and safety training
- Diversity and inclusion training
- Cultural mentorship
- Bystander or allyship training

When asked to prioritize training needed most in the sector, trainer survey respondents prioritized:

1. Training for technology.
2. Cultural awareness and cultural safety training, reconciliation, human rights, and anti-racism.
3. Essential skills training (e.g. reading, numeracy, writing, digital technology).

Training will not only change due to technological advances, but also its delivery through new or improved technology. It is notable that the COVID-19 pandemic dramatically increased the interest in online learning and this way of training and has now become a widely accepted platform.

3.7.4 Aptitude Training

"Aptitude is the innate or acquired capacity for something. Aptitudes can range from developed knowledge, learned, or acquired abilities (otherwise known as skills), talents, or attitudes necessary to perform a task. In essence, aptitudes are traits that help us accomplish tasks. Some aptitudes can be taught and developed, like knowledge, skills, or attitudes, but some aptitudes are not teachable, such as talents."[51]

Figure 9 - Aptitude Training Available Now and in the Future

[51] APL nextED, "Aptitudes, Talents and Skills: Same Difference?." (2020). https://aplnexted.com/aptitudes-talents-and-skills/

Aptitude training, therefore, refers to those skills that can be learned or developed. Skills can either refer to hard skills like programming, hardware design, and carpentry, or soft skills like negotiating, people management, and social skills.

The following aptitudes will be required generally and across the range of mining sector jobs, in addition to the specific technical skills required by each career.

- Communication skills
- Teamwork/collaboration
- Problem solving ability
- Creativity

3.7.5 Recognizing Transferable Skills

Assessments can be an important tool in determining which skills and abilities someone has, as well as understanding which skills may need to be developed. Many of the skills identified as crucial to the current and future mining worker, such as critical thinking, creativity, flexibility, out-of-the-box thinking and problem-solving skills, effective communication, collaboration, cultural awareness/cultural safety, and essential skills (e.g., reading, numeracy, writing, digital technology), can be acquired through other work and through life experiences.

Figure 10 - Transferable Skills are Valuable for B.C. Mining Careers

Understanding and assessing people's transferable skills will be critical to understanding an individual's training needs and can reduce time in retraining or preparing people for work in the mining sector.

Assessment also provides an opportunity to connect with individuals who may be disconnected from job opportunities in the sector and faster candidate processing during recruitment and strategic training in support of candidate's skill sets.[52]

Ensuring these tools are assessed for cultural safety and the absence of biases can be a useful way to ensure resources to not present additional barriers for underrepresented groups.

3.7.6 Micro-Credentialing

Micro-credentials are rapid training programs offered by colleges, universities and Indigenous institutes that can help workers get the skills employers require and provide a solution to changing workforce training needs. Colleges, universities, and Indigenous institutes and training providers are piloting frameworks to recognize these credentials, along with traditional education pathways.[53]

Research indicates that providing a variety of training options will help current workers integrate these new learnings into their work-life and provide valuable integration of these new skills.

3.7.7 Tying Training to Meaningful Employment Opportunities

Education and training systems are changing alongside the technological changes to the industry that is flexible and works with individual learners. Tying these training programs to employers – where both trainers and employers support learners to acquire and apply new skills - enables workers to be supported as they train on new technologies and prepare for new and shifting skills requirements at the mine. One notable example of this is the Mining Essentials training from the Mining Industry Human Resource Council, where trainees complete a work readiness program with the aim of then being hired by the mine partner hosting their training.

3.7.8 Opportunities for Enhanced Collaboration on Technical Skills and Careers in Mining

Additional comments on the opportunities for enhanced collaboration on technical skills and careers in mining were provided by the focus group participants. These included:

- Significant opportunity for greater coordination between industry, education, and community to support the technical skills shifts.

[52] Northern Lights College & Mining Industry Human Resources Council (MiHR), "Employer Guide for Hiring New Canadians and Immigrants Occupation: Underground Miner. " (2014). https://iecbc.ca/files/1%20Toolkit%20-%20Employer%20Guide%20-%20Underground%20Miner%20V5%20FINAL.pdf

[53] Government of British Columbia, "Micro-Credentials a gateway to support B.C. workers." (2021). https://news.gov.bc.ca/releases/2021AEST0060-001869#:~:text=Micro%2Dcredentials%20recognize%20stand%2Dalone,for%20employment%20or%20learning%20purposes.

- How to execute on this collaboration - work-integrated learning opportunities including greater support for apprenticeships, support for EIT/New Grad programs are a potential solution in that they provide both the opportunity for mines to test new technology – and simultaneously develop future workers technical skills in an applied setting.
- More visibility on successful reclamation, safety and environmental and community partnerships and technology.
- Work with K-12 schools to generate interest in mining, to let them know the extensive technology use and excitement of working in the mining industry and continue the collaboration with post-secondary institutions.
- Technical scholarships for local students including adult learners.

3.7.9 Recognizing and Mitigating Barriers

Recognizing and removing barriers is essential to increasing diversity and inclusion, providing great value to the broadening work within the sector, but also in providing a tangible and practical solution to both current and anticipated labour shortages. This will be critical for mining in B.C. to attract and retain the talent to meet the future needs of the sector.

Some barriers are faced particularly by one group of people, while other barriers are common to women, Indigenous peoples and those living in rural and remote communities. More needs to be understood about how these barriers intersect with one another, for instance, the barriers and solutions required for a worker who identifies as female, Indigenous, and living in a rural and remote community.

Research conducted for the Literature Review and Environmental Scan indicates the historical legacy of women being excluded from some mine sites (women were not permitted to work underground in mines until 1979)[54] that continues to impact the underrepresentation of women in mining. Despite making up 48% of the B.C. workforce, women only account for 19% of the provincial mining workforce.[55]
In 2011, the Association for Mineral Exploration (AMEBC), Mining Association of BC (MABC) and Aggregate Producers Association of British Columbia (APABC) released a report that found the key drivers for women in operational roles to stay in the industry were compensation and benefits, and the proximity of the job to their home. Conversely, the drivers to exit the sector included the challenge of balancing work and home; concern for the environment and sustainability; and challenges around inclusive workplace cultures.[56]

Some important work is happening in this space already, as evidenced by the Mining Industry Human Resources Council, Women in Mining Canada, Women in Mining British Columbia, and more can be done to support inclusion of women in the mining workforce.

For Indigenous peoples, the legacy and inter-generational impacts of colonialism and the residential school system continue to have an impact on learning outcomes and subsequent workforce participation.

[54] The Globe and Mail, "Mining for Women." (2020). https://www.theglobeandmail.com/report-on-business/mining-for-women/article4419151/

[55] Mining Industry Human Resources Council (MiHR), "Preparing for the Future: Mining Labour Market Outlook for British Columbia 2016-2026." (2016). https://www.workbc.ca/getmedia/f7c01e3e-ea59-416b-90aa-2725ebb9c250/mining_labour-market-outlook-report-for-bc_feb-2017.pdf.aspx

[56] APABC, AMEBC, MABC, "Women – an Unmined Resource. A Report on Female Participation Within B.C.'s Mineral Exploration and Mining Industry." (2011). https://internationalwim.org/wp-content/uploads/2020/06/Women-AnUnminedResource.AReporton-FemaleParticipationwithinBCsMineralExplorationandMiningIndustry.pdf

Relative to the overall Indigenous population in Canada, representation is high with seven percent of the mining workforce self-identifying as Indigenous.[57] However, in many rural and remote communities where mining occurs, Indigenous peoples make up a considerably larger percentage of the local population (e.g. in the Nechako and North Coast economic regions, Indigenous peoples make up 30.1 percent and 62.81 percent of the total population respectively).[58] This provides greater opportunity for increased Indigenous participation in these mining activities, and further enhances the opportunity for greater diversity and inclusion as well as environmental, social and governance implementation in the sector.

Through the Project key informant interviews, surveys, and committee discussions, it has become evident that both women and Indigenous peoples are prone to experiencing these distinct barriers to training and career access in mining:

- Lack of career awareness
- Lack of opportunity or inequity in career advancement opportunities
- Lack of diversity within leadership, resulting in fewer role models and mentors, networks
- Problematic workplace and training culture – unconscious bias, microaggressions
- Location and remoteness

Survey respondents and key informants interviewed from rural and remote communities also cited the disparity between training and infrastructure accessibility in northern communities compared to urban centres as a distinct barrier to workforce participation. One example provided was students entering post-secondary with courses from high school may not have equal access to prerequisites. For example, high school physics is commonly required to enter an engineering program, but many high schools in northern British Columbia do not offer Physics 12.

According to members of the Project Skills Sub-Committee, the barriers most impacting skills development (in order of ranking) are:[59]

1. Training access and education gaps
2. Location and remoteness
3. Lack of diversity within leadership resulting in fewer role models and mentors, networks tied with lack of career awareness
4. Community infrastructure inequities
5. Social, health, and economic factors

[57] Mining Industry Human Resources Council (MiHR). "Canadian Mining Labour Market Outlook 2020." (2019). https://mihr.ca/wp-content/uploads/2020/03/MIHR_National_Report_web2.pdf

[58] British Columbia Assembly of First Nations, "First Nations in BC." (2022). https://www.bcafn.ca/first-nations-bc/nechako and https://www.bcafn.ca/first-nations-bc/north-coast.

[59] B.C. Centre of Training Excellence in Mining, "Skills Roadmap Report" (2022). https://bc-ctem.ca/wp-content/uploads/CTEM_SKILLS-Roadmap_March-2022.pdf

Figure 12 - Solutions for More Diversity in Mining

3.8 Success Factors Needed to Overcome Challenges and Barriers

Overcoming challenges and barriers includes increasing awareness of new corporate values, increasing diversity and inclusion in the workplace, improving access to training, and remaining flexible to the requirements of workers and partners. Examples to improve training delivery could include:

- Ensure activities related to expanded ESG priorities are everyone's responsibility, not just a top-down initiative.
- Are relevant for local opportunities and ensure they cover a range of skills that are required now and in the future.
- Provide a mixture of classroom time with hands-on learning (including mine visits) to put theory learned in the classroom into practice.
- Provide a core set of skills that can be supplemented with micro-credentials to enable specialization and/or skills advancement.
- Include components of essential skills and soft skills and ensure that training is transferable between employers.
- Are adaptable and flexible and can be easily reconfigured as industry develops.
- Align mentors with students to lead hands-on training, to further encourage continued learning during practical components, and keep the student motivated and engaged.
- Incorporate practical examples of the B.C. mining industry through field trips, guest speakers from companies (e.g. active mine workers) and mining-based organizations.

- Have a wide range of instructors with different experiences, as well as knowledge and experience in the mining industry and can provide real examples of working in a mine.
- Come to the community where the students live, rather than requiring students to travel.
- Are flexible in class size, especially in smaller communities.
- Are presented to and approved by Indigenous and corporate leadership.
- Add to the training and skills acquired by participants, and not repeating previous training.
- Provide learners support to enter the industry e.g. interview skills, resume preparation.

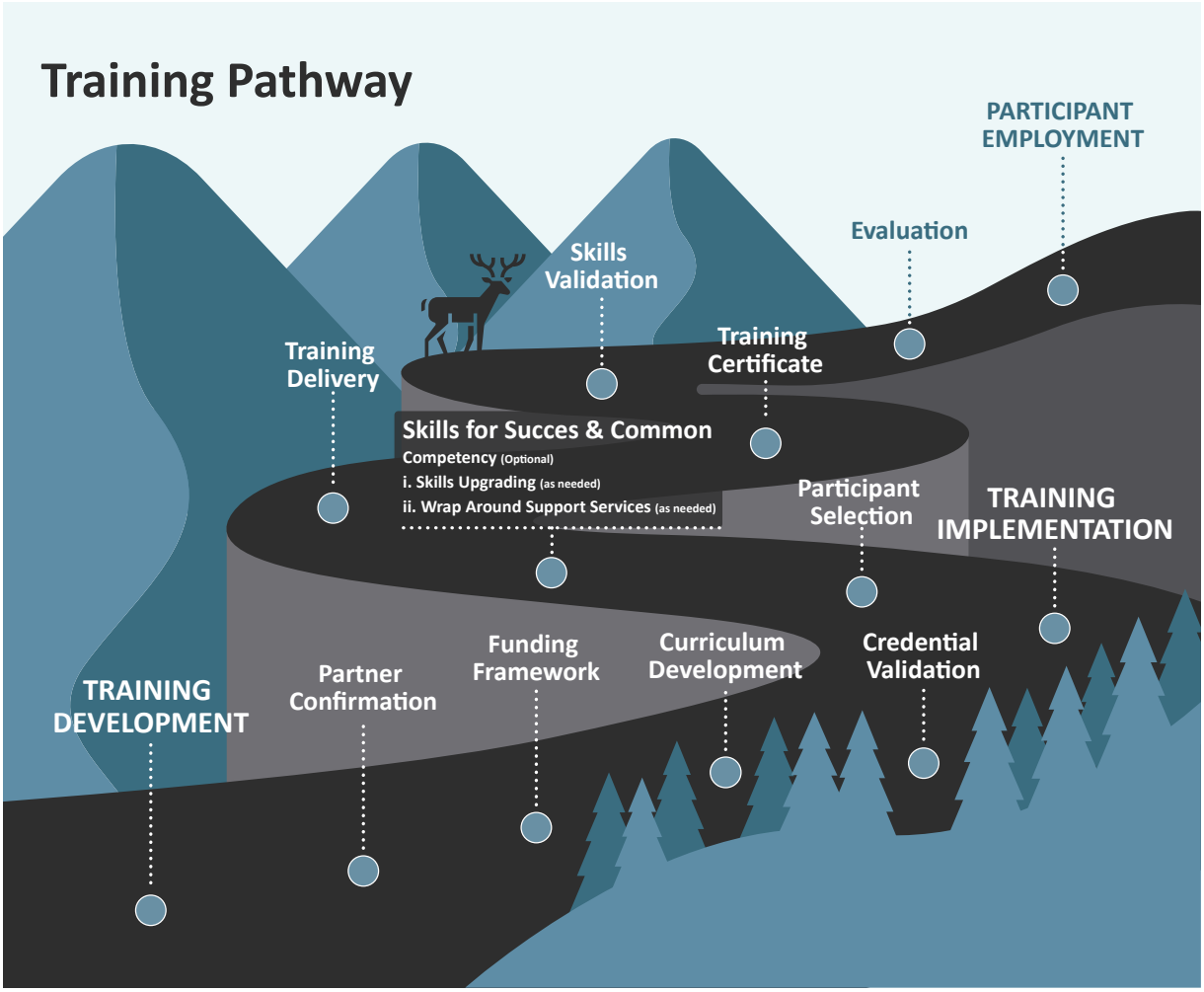

Figure 11 - Training Pathway

Figure 11 provides an overview of key elements to consider and include when developing successful training pathways for new and current workers. It can be applied to short-term training as well as longer programs.

4.0 Strategic Framework

The strategic framework, actionable recommendations and implementation plan was designed after evaluating the input gathered from committee participants. The evaluation criteria used to assess over 300 ideas was based on the following questions:

- Is the recommendation responsive and forward-looking?
- Are there long-term impacts to B.C.'s mining sector?
- Does the recommendation create systemic change and is it sustainable?
- For collaborative recommendations, do they have shared responsibility, are interdependent on other recommendations and have a positive impact on regional, Indigenous, and female workers?
- Are the recommendations evidence-based, practical, tangible, measurable and in-scope?

The Strategic framework is structured on four strategic pillars that include Career and Sector Awareness; Talent Acquisition, Retention and Development; Training Access and Delivery; and Building Capacity and Understanding – Labour Market Intelligence and Research.

4.1 Actionable Recommendations

The actionable recommendations are categorized into short-term (0-2 years); medium-term (2-5 years); and long-term (5 to 10 years) timeframes along with identified resources and measures of success. The actionable recommendations were then further analyzed to create a plan that guides the implementation of these recommendations.

CTEM's partners will be approached to either lead or support the implementation of the actionable recommendations. Including but not limited to:

- B.C. Mining Associations
- Mining Employers and Industry Partners
- Post-Secondary Institutions
- Local and Regional School Districts
- First Nation Career Development Partners
- Women Organizations

Strategic Pillar: Career and Sector Awareness

Vision for the future:

- *Mining industry awareness is expansive (BC urban and rural communities) and is started at an early age*
- *Mining career and training opportunities are well understood by community, teachers, training and service providers and influencers*
- *Mining careers and training opportunities are recognized as inclusive, aligned with ESG values, and innovative*

Short-Term Recommendations	Medium-Term Recommendations	Long-Term Recommendations	Measuring Success
• Identify and consolidate current and past BC career and industry awareness resources and determine gaps in current campaigns with a focus on engaging diverse groups in remote, rural, and urban communities • Identify supports required to increase mine tour access with a focus to mitigate barriers for rural school visits • Connect with Colleges, BC Teachers Federa-tion, and public and FNs school boards to de-termine how best to support the sharing of career awareness/mining awareness mate-rials and resources • Expand promoting and facilitating educa-tors/teachers and students to attend provin-cial and regional conferences • Invest in expanding or reinvigorating existing programs (e.g. ITA (trades samplers), BC Women in Trades, Below BC, MineralsEd, EduMine, BC Industry Training Authority's trade sampler programs, UBC Geering Up)	• Implement and facilitate mine tours (virtual or in-person) for community and students • Deepen and create new partnerships with schools to increase teacher and student awareness of mining • Collaborate with K-12 school systems to enhance mining in the curriculum (create understanding of a resource-based economy) leveraging digital tools and resources • Develop new scholarships and online repository of current scholarships for mining and exploration training and skills development	• Based on the gap analysis, develop new BC mining career and training resources that are universally accessible and reflective of the different regional needs and opportunities, making sure to utilize research collected through capacity building efforts • Develop career awareness resources that connect and attract workers from other sectors • Develop comprehensive and inclusive BC mining and career exploration awareness strategy and communications plan • Create a speakers' library to be a resource for educators/trainers and community groups (network of diverse industry speakers). Opportunity for knowledge transfer from transitioning/ retiring workers engaging as speakers • Develop and update curriculum and resources to strengthen connection of mining to everyday life – math skills, chemistry, physics	• Regular surveying for improved perceptions of BC mining industry and employment opportunities by communities/learners / mining workforce • numbers of K-12 teachers using mining and exploration focused curriculum modules in classroom • Number of engagements with online career awareness resources, distribution of career resources • Number of mine tours and number of individuals accessing tours • Number of engagements with online career awareness resources, distribution of career resources

Strategic Pillar: Talent Acquisition, Retention and Development

Vision for the future:

- *The BC mining industry is inclusive, embodies a culture of continuous learning, and employee voices participate in developing strategies for ac-tion*
- *Skills development is linked with career/employment opportunities and is intertwined in BC mining workers career development while being re-sponsive to individual career paths*

Short-Term Recommendations	Medium-Term Recommendations	Long-Term Recommendations	Measuring Success
• Develop resources to support employers to integrate policy initiatives with on-the-ground work culture and practices • Develop materials that explain mining career pathway that focus on skills capacity development and career progression identifying transferable skills and new skilling • Develop communication strategy and materials to reach workers who have been displaced from other sectors/ careers as a result of Covid-19 • Enhance Mining Association of Canada's Towards Sustainable Mining (TSM) metrics to include more than training hours • Add HR specific content in conferences to raise awareness of barriers and to share successes • Invest in expanding mentoring programs and networking groups (e.g. Association for Mineral Exploration British Columbia mentorship program, Young Mining Professionals Mining Network, Women in Mining BC Mentorship program)	• Develop flexible training options and workplace supports for current employees with a focus on small and medium sized companies (e.g. childcare, flexible scheduling) • Foster formal and informal Champions, Mentors and "you can get there" role models • Advocate to provide greater tax incentives (e.g. flowthrough shares expanded) to be used for training and outreach • Create resources that highlight technology careers in mining and the role mining will play in creating a low carbon future to attract young, high-tech talent into the sector • Expand Mining Industry Human Resources Council's skills recognition program to recognize more jobs and to be implemented at all sites • Identify and disseminate cultural needs and practices for the retention of Indigenous employees	• Leverage collaboration to implement EDI training across the sector to shift workplace cultures to be more inclusive • Create an external body that establishes standards and accreditation for training and trainers • Develop and deliver train for mentors (including peer mentors) for successful knowledge transfer, and inclusion. Ensure outreach to wider audiences • Facilitate internal conversations between HR and Project Management/ Operations teams to integrate policy initiatives with on-the-ground work culture and practices	• Tracking of removal of identified barriers for equity-seeking groups (e.g. women, Indigenous workers) through annual industry surveying • Tracking improvements towards a representative workforce (targets match regional representation) • Tracking of mining company's hiring, retention rates, and promotions of underrepresented groups

Strategic Pillar: Training Access and Delivery

Vision for the future:

- *BC mine training is innovative, linked to employment outcomes, and responsive to shifts in skill and labour market demands*
- *Recognizing we walk different paths, BC mine training delivery is flexible, accessible, and adaptable to individual learners needs*
- *The BC mining industry works together to advance sector training and skills development that leads to meaningful learning and employment outcomes*

Short-Term Recommendations	Medium-Term Recommendations	Long-Term Recommendations	Measuring Success
• Map current Industry training offerings and skills and training gaps • Identify network of service providers/ en-trepreneurs to connect with mentorship and training opportunities • Expand assessments and recognitions of transferable skills of new and current work-ers • Increase internet connectivity in rural and remote communities • Reduce driver's license barriers by working with Work with Insurance Corporation of British Columbia (ICBC) and partners (e.g. vehicles, instructors, and testers) • Support policy/ advocacy for enhancing skills and training and accessibility (e.g. employ-ment insurance (EI) access for skills upgrad-ing, funding for micro-skilling) • Work with post-secondary institutions and their Indigenous communities to incorporate speakers and Elders	• Supporting the removal of systemic training and skills development barriers • Establish childcare/caregiving supports for learners and workers • Develop and deliver pilot to cross-train workers (e.g. common competencies) • Provide training for Trainers on mentorship, cultural agility/awareness, bystander training and EDI (equity, diversity, and inclusion), and online delivery • Expand Equity Diversity and Inclusion (EDI) resources for trainers • Create local networks (rural and remote communities) to develop trainer pool using local entrepreneurs and professionals • Support blended delivery mechanisms w/core and optional curriculum • Develop micro-credentialling for emerging skill needs	• Develop and pilot portable education tools and resources (such as online education apps, simulation pro-grams) and raise awareness about existing resources (e.g., core library) • Conduct training and skills fo-rums/ symposias to share collective experiences and address challenges and opportunities - supporting em-ployers and training providers to better understand and create strat-egies to overcome systemic (and sometimes compounded) barriers in training and skills development • Develop and deliver training to train local and diverse trainers • Develop Industry program to repur-pose or reuse equipment (laptops and cell phones) to increase connec-tivity for learners • Focus on transferable skills to help movement of workforce between mines and between sectors (given their short lifecycles)	• Tracking demographics in mine training and skills development programs – (e.g. gender diversity, Indigenous representation) • Tracking money and time dedicated to training current employees • Report on dollar amount and number of applications for mining and exploration related scholarships

Strategic Pillar: Training Access and Delivery (continued)

Short-Term Recommendations	Medium-Term Recommendations	Long-Term Recommendations	Measuring Success
• Invest in expanding EDI training programs (e.g. Mining Industry Human Resources Council's cultural training and the B.C. Indus-try Training Authority's 'Be More Than a By-stander' training) • Develop resources to ensure training curricu-lum and guides are aligned with leading Equi-ty, Diversity and Inclusion (EDI); Environmen-tal, Social, Governance (ESG) and innovation practices • Support training of 'Assessors' to recognize on-the-job skills development	• Create trainer support networks; con-nect trainer networks with tech re-sources • Evaluate and test potential pilots of Port-able Education systems or units for re-mote and rural learners and communi-ties • Expand across province skills assess-ments for current workers		

Strategic Pillar: Building Capacity and Understanding - Labour Market Intelligence and Research

Vision for the future:

- *Labour Market Information is timely, accessible, and reflective of regional labour market realities*
- *Mine training and skills development programing contributes to and is responsive to Labour Market Intelligence and Knowledge*

Short-Term Recommendations	Medium-Term Recommendations	Long-Term Recommendations	Measuring Success
• Collectively determine key identifiers related to monitoring current and emerging labour market needs (e.g. overcoming barriers) and produce baseline metrics • Develop capacity to track Equity, Diversity, and Inclusion (EDI) stats within mine training pro-graming and organizations • Collect greater data on programs that have made a positive difference in Equity Diversity and Inclu-sion (EDI) of the workforce and training • Conduct research to identify mine training barri-ers experienced by 2SLGBTQIA+ community and disabled workers • Create a plan/tool to support mine operators to recognize and apply new understanding from project findings	• Increase understanding/ measuring of worker needs – regular check-ins/ evaluation; is the sector improving workforce needs? • Develop Community of Practice to collect information, share resources, develop community, identify and disseminate strategies, support policy and advocacy development, and support sector and cross-sector collaboration • Bring Indigenous and non-Indigenous service providers, educators, cultural educators, elders, high schools, and industry (including current and past mine operators and contractors) and communities together and into the conversation	• Assess intended and unintended consequences of mining in community • Expand current diversity research to include intersectionality and the impact on mine training and skills outcomes along with acquisition and retention • Expand national inventory of skills in mining to include additional jobs and expand, enhance, or link skills databases to recognize transferable skills and skills progression	• Tracking mine skills and training program participation in the province • Tracking qualitative improvements over time (from workers) • Number of engaged individuals and organizations in Community of Practice • Number of engagements with Community of Practice • Number of collaborations and partnerships developed

4.2 Supporting and Mobilizing Existing Resources (Other Relevant Projects)

Throughout this Project, it has become apparent that there is already great work happening to meet B.C.'s current and future mining sector's workforce needs. Leveraging and supporting these existing resources, therefore, is a significant opportunity to maximizing the industry's effectiveness in attracting, training, and retaining the workers it needs. This list is not exhaustive, but is a good indication of opportunities to work with existing resources, organizations, and programs:

When building career and sector awareness:

- Utilizing existing gatherings such as the Association of Mineral Exploration's (AME) annual conference - Round Up.
- Work with partners and their programing, including Industry Training Authority of B.C. (trade samplers); B.C. Women in Trades; Mine Suppliers Association; Geoscience B.C.
- Leveraging and amplify existing programs like BELOW B.C.; Minerals Ed; EduMine; UBC outreach camps (Gearing Up); School District 73's Heavy Metal Rocks program; School District 57's Career Technical Centre; Smithers Exploration Group and Kamloops Exploration Group outreach programs; and previous collaborations such as Tumbler Ridge's Conuma Challenge.

Relating to acquiring, retaining, and developing talent:

- Collaborating with the Mining Industry Human Resources Council (MiHR); AME Mentorship Program; Young Mining Professionals Mining Network; Women in Mining BC (WIMBC) Mentorship Program; Prospectors & Developers Association of Canada (PDAC), Mining Association of Canada (MAC) and Women in Mining (WIM) Canada; B.C. Regional Mining Alliance (BCRMA); ITABC's Mining Sector Advisory; Skeena Resources Tahltan Mentorship Program; TRICORP WESTT (Workplace Essential Skills Trades Training); and, Dease Lake Annual Boot Camp.

Relating to accessing and delivering training:

- Industry websites often hold a list of resources that can be used to innovate training programs. For example, the Mining Industry Human Resources Council website provides several training programs: gender equity in mining, Indigenous awareness training, and green jobs overview, among others.
- Collaborate with and participate in training development with the Industry Training Authority of B.C.

Opportunities for collaboration and cross-sector partnerships:

- Existing innovation and other networks – MABC, AME, B.C. Centre of Training Excellence in Mining (CTEM), Engineers and Geoscientists BC.
- Increase collaboration with other relevant organizations outside of mining (ITABC, BBC WITT, etc.)

Building capacity and understanding through labour market intelligence and research:

- Support and expand models like "On Track," which is the Tahltan First Nation's job board and community database on employment and skills.
- Working with researchers like UBC's Mineral Deposit Research Unit to increase understanding and solve sector challenges.
- Look to other jurisdictions and industries to find promising practices, such as Anaconda mining in New Zealand and Agnico (re. micro-learning).

4.3 Requirements for Successful Plan Implementation

To ensure successful implementation of the plan and sustainable change, the project identified the barriers to the plan that in order to be removed may require a shift in mindsets; changes to policies; the time involved in creating the shift; as well as how much funding/resourcing may be required.

Interestingly, community infrastructure inequities were the barrier identified most clearly as requiring a mindset shift. This was followed closely by lack of career awareness; lack of diversity within leadership; and problematic workplace and training culture. Barriers identified as requiring less of a shift in mindset included: lack of opportunity or inequity in career advancement opportunities; location, remoteness, and transportation; training access and education gaps; and social, health and economic factors.

Committee members identified lack of opportunity or inequity in career advancement opportunities; and lack of diversity within leadership as barriers requiring policies within individual workplaces. Training access and education gaps, and social, health and economic factors were identified as policies required by education and training providers to support the reduction of these barriers. Finally, shifts in/creation of government policy to reduce community infrastructure inequities was identified as having the potential to impact the reduction of this barrier. Problematic workplace and training culture; and location, remoteness and transportation were identified as barriers where policy changes would be less effective. A lack of career awareness was identified as the barrier least likely to be impacted by changes in policy.

Some barriers, such as lack of opportunity or inequity in career advancement opportunities and lack of diversity within leadership clearly do not require a great deal of financial resourcing, whereas mitigating the location, remoteness and transportation issues; community infrastructure inequities; training access and education gaps and social and economic factors require considerably more investment. Lack of career awareness and problematic workplace and training cultures were identified as those barriers with median financial requirements to address.

5.0 Next Steps

For B.C.'s mining sector to continuously adapt to changing legislation, global market fluctuations, declining new workforce entrants while upskilling the current workforce requires commitment by all industry partners. These steps provide a pathway in continuing to move the mining sector forward:

1. Sharing knowledge gained from the Skills Roadmap Final Report with CTEM partners.
2. Working collaboratively with industry partners to develop their training roadmaps and career pathways that meet their specific workforce needs.
3. Recognizing regional barriers and working with partners to remove barriers to jobs.
4. Moving forward the actionable recommendations.
5. Create localized solutions to meet labour needs and challenges.

6.0 Conclusion

The extensive input from over 120 participants in meetings and nearly 200 survey respondents enabled a deeper look at barriers to employment provided solutions and recommendations, as well as identifying the skills needed to work and remain successful in the B.C. mining industry. CTEM recognizes and is grateful for the extensive input and support from representatives from across the province to be able to produce a comprehensive report.

B.C.'s mining sector continues to seeking ways to improve on being the top choice employer for people choosing a career in mining, however, this report reinforces the need to remove systemic barriers to create a safe space for all, and the need to create lasting partnerships between all industry members. By pooling our resources and not duplicating efforts we can attract and retain the talent needed to keep the industry sustainable and ready to capitalize on current and future technological change.

Appendix A – 'Recognizing Barriers and Challenges Women Face' Project

CTEM recognized that under-represented groups face obvious barriers and micro inequities that are often not discussed. And that lack of discussion prevents the ability to share experiences or tools that have helped people work through the situation. This lack of sharing prevents others from learning; and can also allow for the experience to remain locked in place with the feeling of no resolution.

Through consultation with the Project Team, CTEM established a stand-alone, mini project, titled 'Recognizing Barriers and Challenges Women Face'. This project captured individual career experiences and tools or supports that were or could have been helpful. The purpose of the project was to recognize barriers and challenges women face during their careers and the potential recommendations that could impact meaningful employment and retention. The two primary objectives were:

1. Collect lived experiences of women who experienced a barrier or challenge that impacted meaningful employment or retention in a confidential manner; and to,
2. Identify opportunities for the individual, the company, or the industry to respond to or mitigate the barrier or challenges.

Inclusion, Diversity, and Equity hold different meanings for different people. This project looked at why these matter in the B.C. mining industry, along with some of the barriers that exist to real and lasting change. Some might suggest there exists an inability or unwillingness by business leaders to recognize that inclusion problems exist in their organizations. Others might point to organizations wanting to change but lack the awareness on how to make a genuine commitment to walking systemic bias out the door. For many organizations they may view change as simply a matter of creating policies that address barriers - assuming this resolves the challenge - and moving on to the next task.

What is often missed is the opportunity to have meaningful conversation around what real and lasting change looks like and how best to meet the needs of a diverse workforce. Rather, organizations may review policies around diversity and inclusion once a year but miss the opportunity to have it live as a cultural value within their organization.

Organizations and leaders may not be aware how deeply rooted discrimination against marginalized groups is, or that it is regularly (consciously or unconsciously) expressed in the words we use. Understanding the big picture broadens the level of awareness needed by leaders to tackle everyday challenges, improve the lives of workers, and, ultimately, to enhance corporate value operationally, financially, and culturally.

Participants in this mini-project were from the CTEM Skills Roadmap Project Women's Sub-Committee. They comprised individuals who are currently affiliated with the B.C. mining industry, including employers, workers, contractors, vendors, and project management consultants. All were female participants, who ranged in age from 25-60 plus years of age. Participants represented a broad range of roles in the mining sector, such as: Engineers, Geologists, Trades, Project Management, Finance, Leaders. They represented

a wide range of aspects in the mining sector, which included exploration, development, mining, trades, suppliers, project management, and consultants. The majority were in their mid to late career (over 10 years' experience) and pulled from previous and recent experiences. A smaller subset were within the early part of their career (under 10 years).

In both one-to-one interviews and group discussions there were several common themes to support opportunities to mitigate or resolve barriers. Participants agreed that diversity and inclusion is everyone's responsibility at all levels. Encouraging frequent and open discussion around what barriers exist is helpful in taking away some of the discomfort in discussing these issues, and to affect real and lasting change. Having it be a part of the work conversation like other operational goals is a way to take away some of the fear around having these discussions. It is also important to allow for mistakes while people are learning and to use these mistakes not as a way to create blame and further division, but as lessons learned to enable growth and change. For many who have not experienced some of these barriers, it is important for them to hear the perspectives from those who have.

Common themes identified:

- Diversity and inclusion practices are critical to ensuring the mining sector's success in attracting and retaining the workforce of the future.
- Diversity and inclusion training and education is needed at all levels.
- Encouraging a culture of openness; including frequent discussions that allow for learning; and allowing the making of mistakes and sharing experiences; are key values to having diversity and inclusion live in the workplace.
- Organizations need to implement smaller, more frequent culture pulse surveys.
- Inclusion and diversity start at the top with diverse boards and executive teams that model desirable behaviour and impact decision making.
- Creating shared understanding and encouraging different perspectives is everyone's responsibility.
- Inclusion and diversity practices allow for new ways of thinking and doing things.
- Inclusion and diversity programs and practices need to be built into all aspects of business, as well as into human resources policies.
- Providing mentoring and coaching opportunities is critical for advancement.

Key Takeaways:

- Employers need to make sure employees have a clear understanding of career pathing within their company and what is needed to be successful and advance.
- Industry boards and executive teams that reflect that diversity is a priority.
- Unconscious bias training for employees, especially those involved in hiring, can be an effective tool for attracting and retaining diverse talent.
- Organizations and industry social media and outward facing marketing materials should reflect that diversity and inclusion are a priority.
- Having inclusion and diversity as part of organizations strategic goals and actions and accountability tied to roles for successful outcomes are key.

- Reaching out to future workforce at the high school level and participating in career development pathways to promote mining as an exciting career may bring young workers to the industry.

During this project participants identified that they witnessed similar barriers for other underrepresented groups. Other factors to consider include age, ethnicity, sexual orientation, mental health, and neurodiversity (used to describe people with autism, dyslexia, ADHD, and other neurological conditions). Having a more diverse leadership team communicates to employees that diversity is valued and there is a path to leadership for everyone.

Appendix B – Careers in Mining

Career Field	Occupation	NOC Code	Job Title
Human Resources and Financial Occupations	Management	0013	Senior managers - financial, communications and other business services
		0111	Financial managers
		0112	Human resources managers
	Professionals in business and finance	1111	Financial auditors and accountants
		1112	Financial and investment analysts
		1121	Human resource professionals
	Administration and Finance Supervisors	1223	Human resources and recruitment officers
	Finance, insurance, and business administration	1311	Accounting technicians and bookkeepers
	Office Support	1431	Accounting and related clerks
Production Occupations	Maintenance and Equipment Operation	7371	Crane operators
		7372	Drillers and blasters- surface mining, quarrying and construction
	Other installers, repairers, and servicers	7452	Material handlers
	Transport and heavy equipment operation	7511	Transport truck drivers
		7521	Heavy equipment operators (except crane)
	Trades helpers and labourers	7611	Construction trades helpers and labourers
		7612	Other trades helpers and labourers
	Supervisors and technical in natural resources	8231	Underground production and development miners
	Workers	8411	Underground mine service and support workers
	Harvesting, landscaping and natural resources labourers	8614	Mine labourers
	Processing, manufacturing, and utilities supervisors	9231	Central control and process operators, mineral and metal processing
		9241	Power engineers and power systems operators
		9243	Water and waste treatment plant operators

	Processing, manufacturing, and utilities operators	9411	Machine operators, mineral and metal processing
		9412	Foundry workers
		9416	Metalworking and forging machine operators
		9417	Machining tool operators
		9418	Other metal products machine operators
		9423	Rubber processing machine operators and related workers
	Labourers	9611	Labourers in mineral and metal processing
		9612	Labourers in metal fabrication
		9619	Other labourers in processing, manufacturing, and utilities
Professional and Physical Sciences Occupations	Professionals in natural and applied sciences	2112	Chemists
		2113	Geoscientists and oceanographers
		2115	Other professional occupations in physical sciences
		2121	Biologist and related scientists
		2131	Civil engineers
		2132	Mechanical engineers
		2133	Electrical and electronics engineers
		2134	Chemical engineers
		2141	Industrial and manufacturing engineers
		2142	Metallurgical and materials engineers
		2143	Mining engineers
		2144	Geological engineers
		2145	Petroleum engineers
		2147	Computer engineers (except software engineers and designers)
		2148	Other professional engineers, n.e.c.
		2152	Landscape architects
		2153	Urban and land use planners
		2173	Software engineers and designers
		2174	Computer programmers and interactive media developers
	Technical related to natural and applied sciences	2271	Air pilots, flight engineers and flying instructors
		2274	Engineer officers, water transport
	Professionals in law and social, community and government services	4161	Natural and applied science policy researchers, consultants, and program officers

Supervisors, Coordinators, and Forepersons	Management	0016	Senior managers - construction, transportation, production, and utilities
		0113	Purchasing managers
		0211	Engineering managers
		0711	Construction managers
		0714	Facility operation and maintenance managers
		0811	Managers in natural resources production and fishing
		0911	Manufacturing managers
		0912	Utilities managers
	Administrative and finance supervisors	1215	Supervisors, supply chain, tracking and scheduling coordination
	Technical	2264	Construction inspectors
	Industrial, electrical and construction	7201	Contractors and supervisors, machining, metal forming, shaping, and erecting trades and related occupations
		7203	Contractors and supervisors, pipefitting trades
		7204	Contractors and supervisors, carpentry trades
		7205	Contractors and supervisors, other construction trades, installers, repairers, and servicers
	Maintenance and equipment operation	7301	Contractors and supervisors, mechanic trades
		7302	Contractors and supervisors, heavy equipment operator crews
	Supervisors and technical in natural resources	8221	Supervisors, mining, and quarrying
	Processing, manufacturing, and utilities supervisors	9211	Supervisors, mineral and metal processing
		9212	Supervisors, petroleum, gas and chemical processing and utilities

Support Workers	Administrative and Finance Supervisors	1221	Administrative officers
		1225	Purchasing agents and officers
		1241	Administrative assistants
	Office Support	1411	General office support workers
		1452	Correspondence, publication, and regulatory clerks
	Distribution, tracking and scheduling co-ordination	1521	Shippers and receivers
		1523	Production logistics coordinators
		1524	Purchasing and inventory control workers
		1525	Dispatchers
		1526	Transportation route and crew schedulers
	Technical related to natural and applied sciences	2234	Construction estimators
		2261	Non-destructive testers and inspection technicians
		2262	Engineering inspectors and regulatory officers
		2263	Inspectors in public and environmental health and occupational health and safety
	Paraprofessionals in legal, social, community and education services	4212	Social and community service workers
	Service supervisors	6322	Cooks
	Service representatives	6521	Travel counsellors
		6541	Security guards and related security service occupations
	Service support	6733	Janitors, caretakers and building superintendents
	Processing, manufacturing, and utilities operators	9415	Inspectors and testers, mineral and metal processing
Technical Occupations	Professionals in natural and applied sciences	2154	Land surveyors
		2171	Information systems analysts and consultants
	Technical related to natural and applied sciences	2211	Chemical technologists and technicians
		2212	Geological and mineral technologists and technicians
		2221	Biological technologists and technicians
		2223	Forestry technologists and technicians
		2231	Civil engineering technologists and technicians
		2232	Mechanical engineering technologists and technicians
		2233	Industrial engineering and manufacturing technologists and technicians
		2241	Electrical and electronics engineering technologists and technicians

		2243	Industrial instrument technicians and mechanics
		2253	Drafting technologists and technicians
		2254	Land survey technologists and technicians
		2255	Technical occupations in geomatics and meteorology
		2281	Computer network technicians
	Retail sales supervisors	6221	Technical sales specialists- wholesale trade
Trades Occupations	Industrial, electrical and construction	7231	Machinists and machining and tool inspectors
		7235	Structural metal and platework fabricators and fitters
		7236	Ironworkers
		7237	Welders and related machine operators
		7241	Electricians
		7242	Industrial electricians
		7251	Plumbers
		7252	Steamfitter, pipefitter, and sprinkler system installer
		7271	Carpenters
	Maintenance and equipment operation	7311	Construction millwrights and industrial mechanics
		7312	Heavy-duty equipment mechanics
		7321	Automotive service technicians, truck and bus mechanics and mechanical repairers

Appendix C – SWOT Analysis

SWOT Analysis

B.C. mining sector's ability to meet its current and future workforce needs

Strengths

Family supporting careers are available in the mining industry

B.C. is an attractive place to live and work

B.C. has world class universities and research institutes focused on mining

Mining in B.C. has a long history of applied trainers

Strong technology and clean-tech sectors to support innovation in mining

Mining sector is actively working to improve equity, diversity and inclusion

Training providers are experienced in the mining industry

B.C. has a varied and diverse mining and exploration landscape

Willingness within the sector to collaborate on workforce solutions

Commitment to ongoing and strong safety culture and performance in the B.C. mining industry

Industry has an ongoing commitment to advancing reconciliation with Indigenous communities and businesses

Weaknesses

Scale up, adoption and integration of innovation is slow

Overall mining career awareness is low (in urban areas, amongst youth, with primary educators, etc.)

Challenging reputation for younger workers interested in sustainability; messaging around how mining will help advance a low carbon future is not clear nor widely understood.

Insufficient investment on training for new technologies and application of new tech

Limited ability to attract and retain workers with technology skills (competition is high and access is low)

Innovation and technology adoption for junior miners is difficult

Small businesses may not have in-house Human Resources professionals

Lack of consistent and accredited training

Lack of flexibility in training delivery (virtual, in-community, duration, cost)

Ability to diversify the workforce is impacted by barriers (lack of transportation, cultural support, childcare, other)

Current training does not consistently include future skills requirements

Opportunities

Meaningful long-term employment is available in the sector

Shift to low carbon global economy, and demand for critical minerals, is an opportunity to expand the sector and attract workers interested in sustainable movements and new technology

Provincial responsible mining priorities

Career planning can lead to laddering up and lifelong careers

Aligning training w/employment opportunities; adapting as industry evolves

Technology advances mean theory training can be provided anywhere; provincial commitment to improved connectivity will support availability in remote areas

Teaching life skills can provide a well-rounded, successful worker

Hands-on training at a diversity of local worksites is possible and necessary

Training mentors to support new workers can improve onboarding and retention

Under-utilized but available local workforces exist

Commitment to equity, diversity and inclusion promotes development of safe learning and working environments for all

Environment is primed for collaboration

Can tailor training to supply in-demand jobs

Demand for innovation is strong

Opportunity to leverage B.C.'s strong technology base (clean tech sector), incubators, accelerators (Digital Technology Supercluster), and research institutes

Exporting mining solutions to adjacent sectors & industries

Being a region of sustainable mining expertise

Improve education and professional development to include innovation

Fostering collaborations to create closer connections with training providers, workers and employers

Threats

Skills gap with new technologies being integrated into the sector

Talent attraction and retention

Aging workforce in the sector; not enough new entrants to meet demand

Infrastructure gap – connectivity in remote areas and transportation

Lack of childcare and family support infrastructure

Ongoing evolution of technology and innovation makes it challenging to predict workforce needs and align training to meet future demand

Transferable skills from other industries or other mines are unrecognized

Small class sizes can prevent training from occurring in remote areas

Need safe, current and/or accessible training facilities

Prerequisites for training provide barriers

Training materials are often out of date due to changes, innovation, and evolving requirements in the sector

Inconsistent connections between industry and training providers

Lack of local trainers in rural and more remote communities

Current lack of diversity in the mining sector impacting ability to attract a more diverse workforce

Historical legacies of exclusion from underrepresented groups (women, Indigenous peoples, etc.) in both training institutions and mining workplaces

Appendix D – Infographics

Skills Infographics

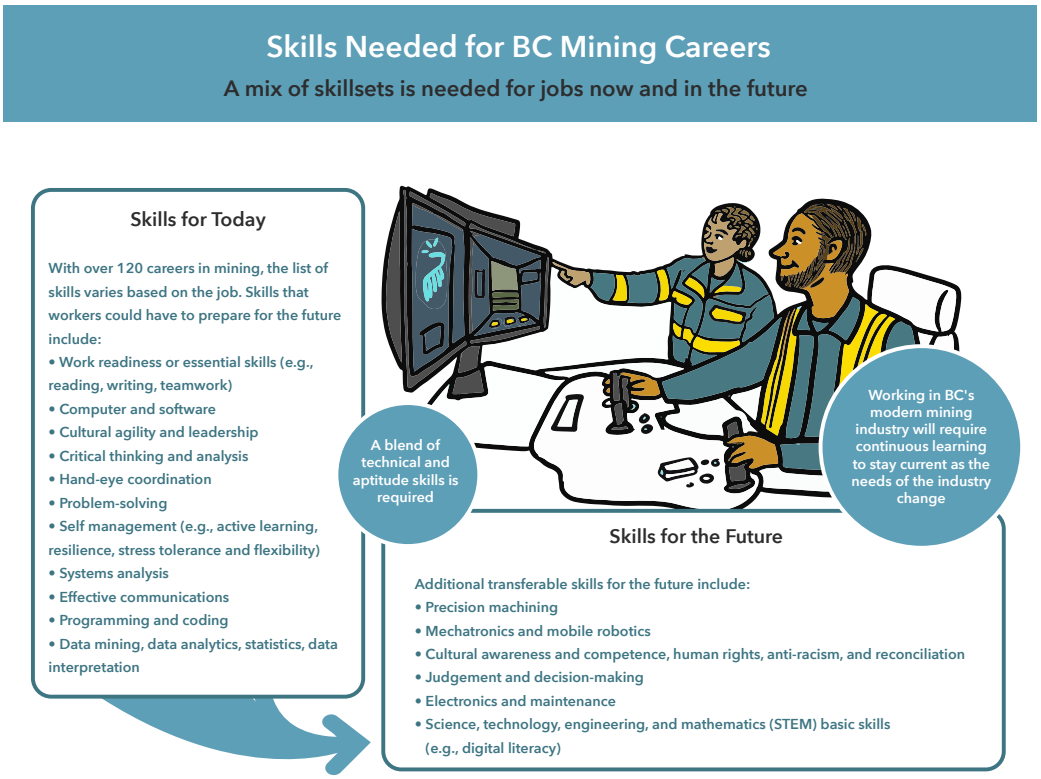

Figure 13 - Skills Needed for B.C. Mining Careers

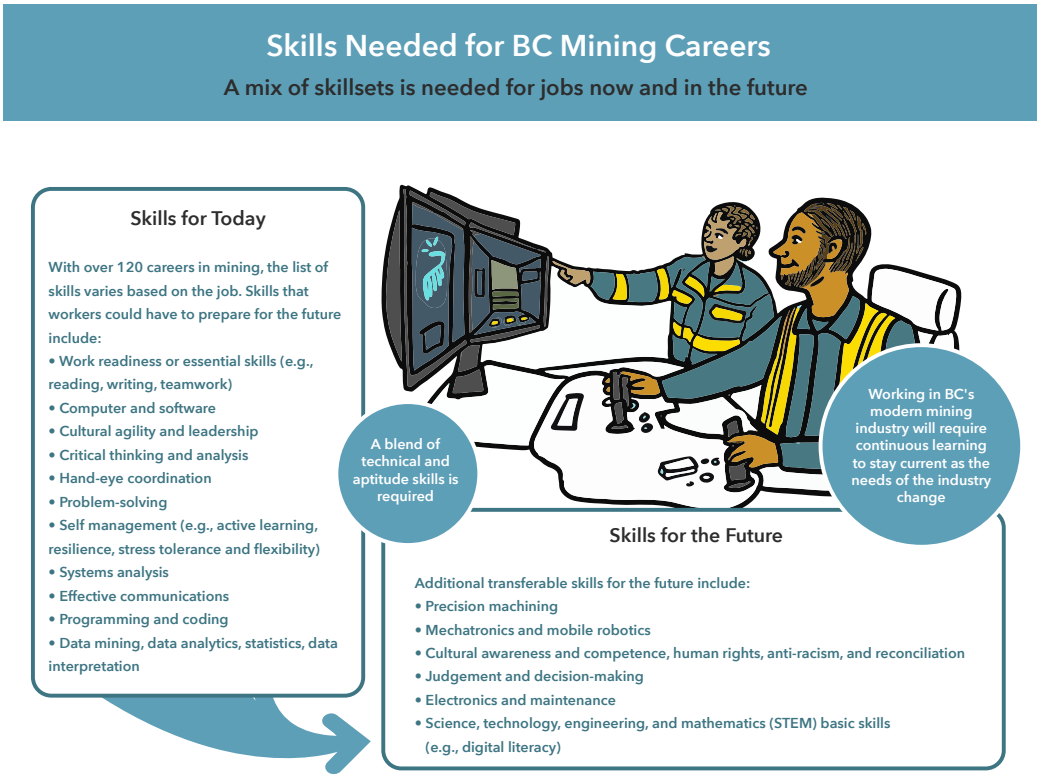

Figure 14 - Training and Skills Recognition of Current Employment

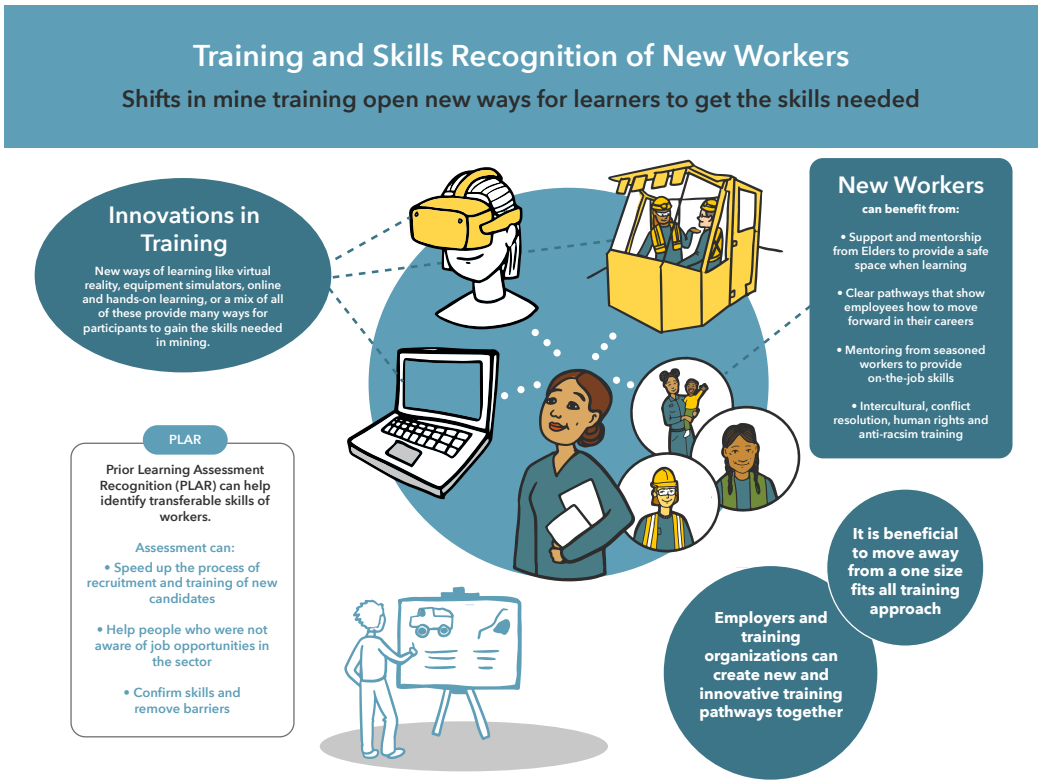

Figure 15 - Training and Skills Recognition of New Workers

Figure 16 – Solutions for Increasing Diversity in Mining

Training Infographics

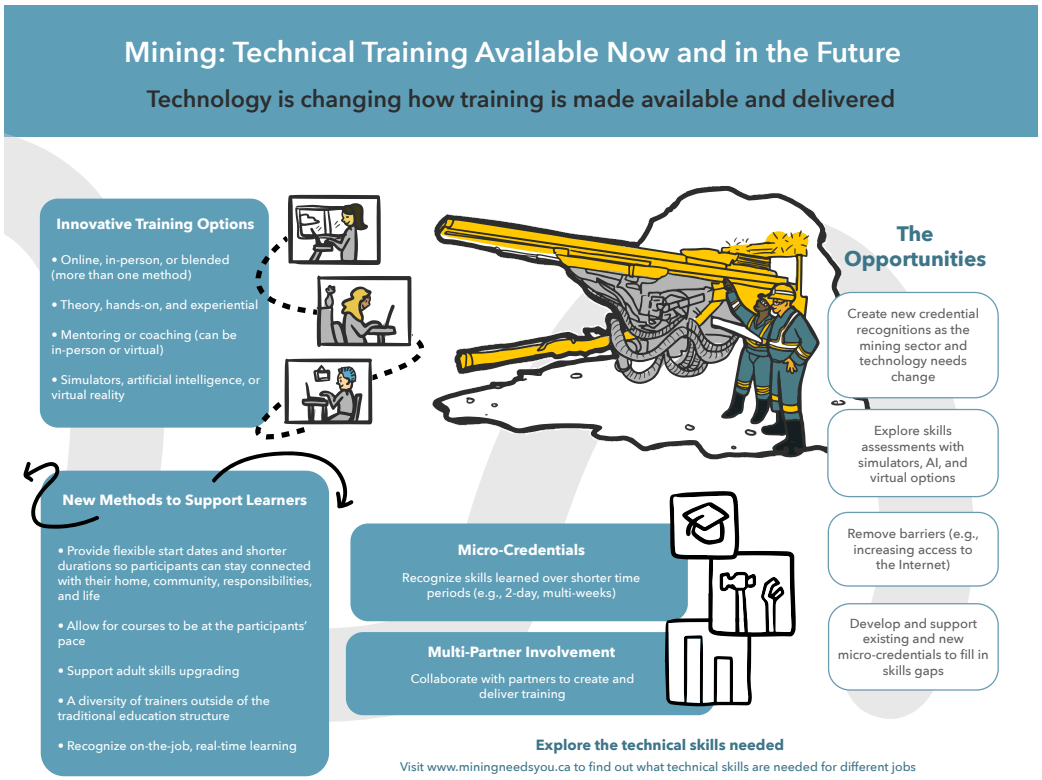

Figure 17 – Mining: Technical Training Available Now and in the Future

Figure 18 – Mining: Aptitude Training Available Now and in the Future

Career Infographics

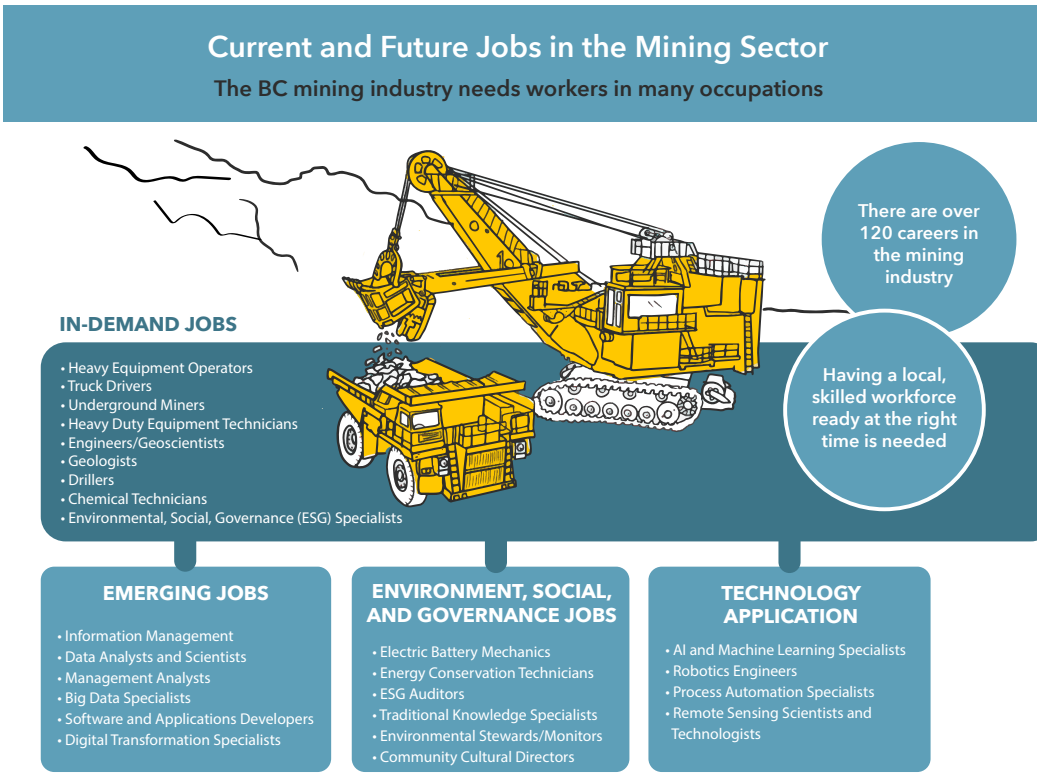

Figure 19 – Current and Future Jobs in the Mining Sector

Emerging Career - Data Analyst

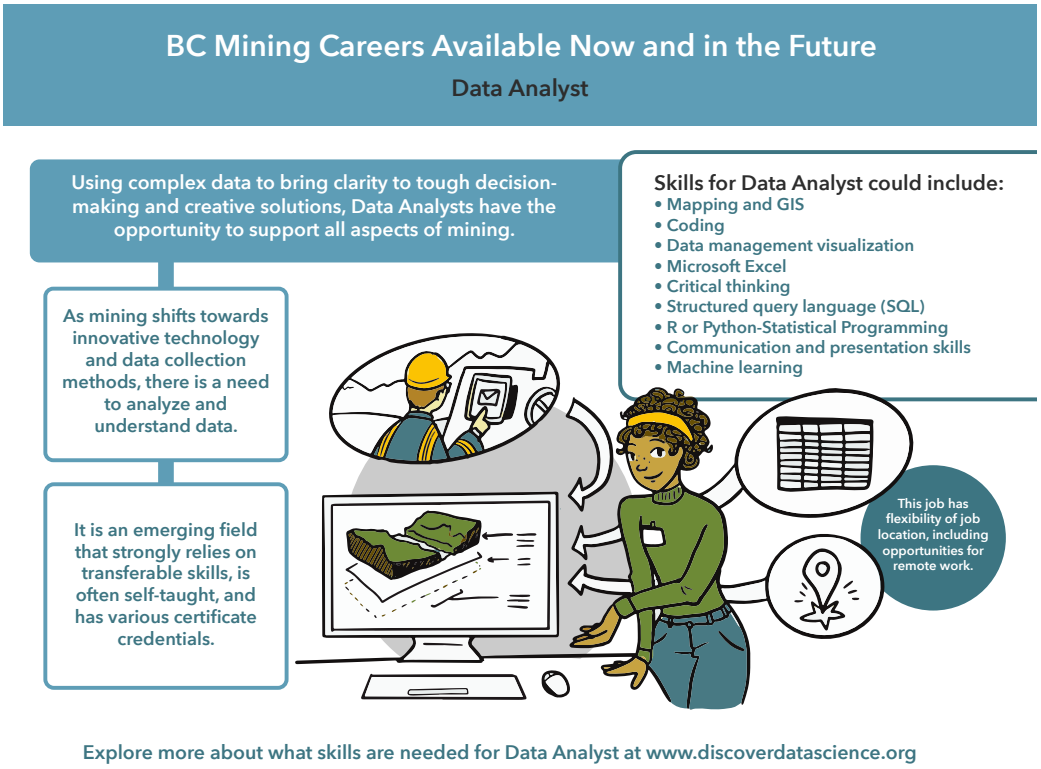

Figure 20 - B.C. Mining Careers Available Now and in the Future – Data Analyst

Emerging Career - Energy Conservation Technician/Manager

Figure 21 - B.C. Mining Careers Available Now and in the Future – Energy Conservation Technician/Manager

Other Career Profiles – Jobs of the Future

Figure 22 - Technical B.C. Mining Careers Available Now and in the Future

In-Demand Career - Heavy Duty Equipment Technician

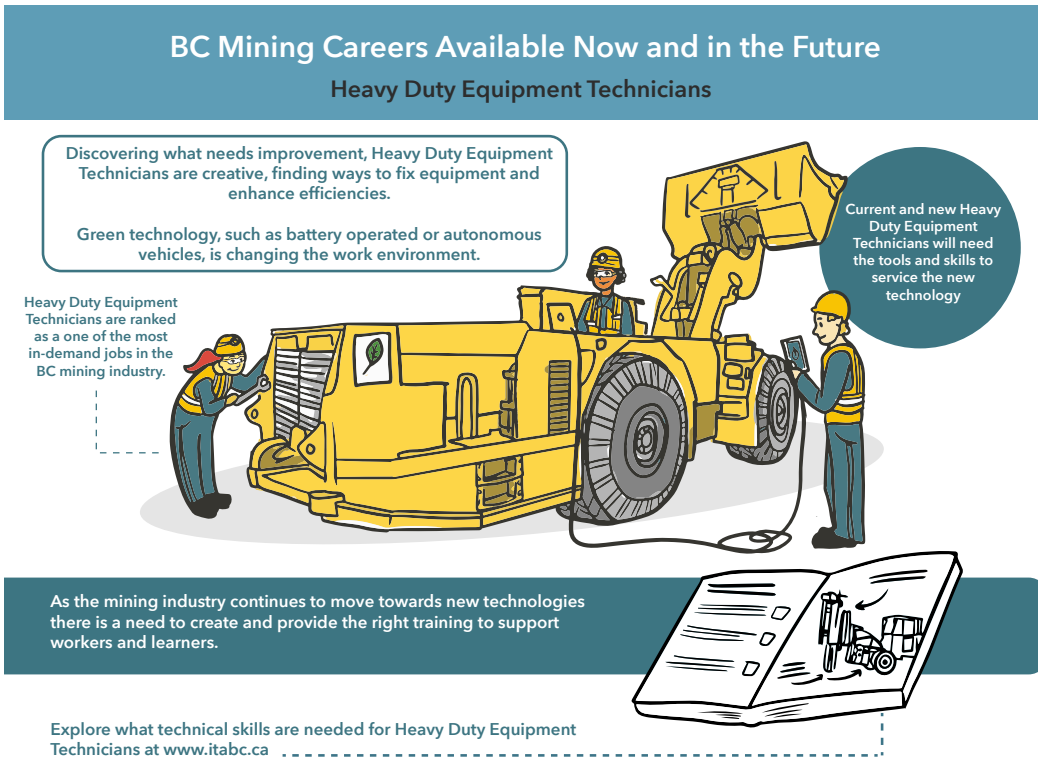

Figure 23 - B.C. Mining Careers Available Now and in the Future – Heavy Duty Equipment Technicians

In-Demand Career - Geologist

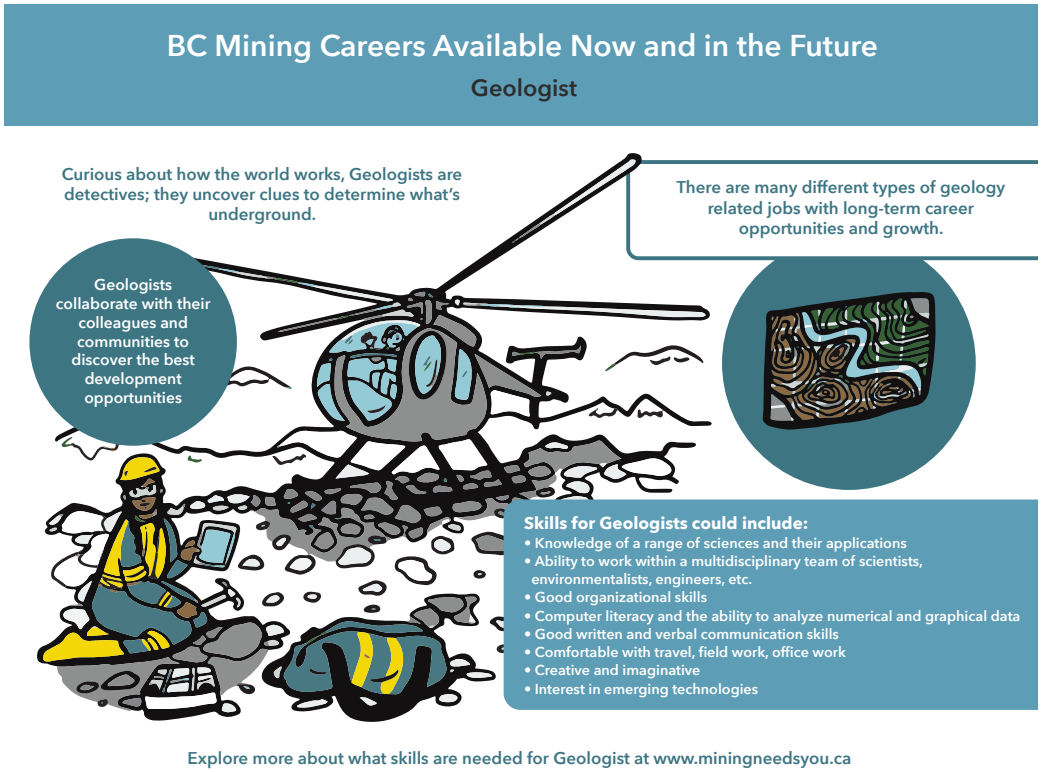

Figure 24 - B.C. Mining Careers Available Now and in the Future – Geologist

In-Demand Career – Environmental Monitor

Figure 25 - B.C. Mining Careers Available Now and in the Future – Environmental Monitor

In-Demand Careers – Water Quality Monitor/Technologist/Engineer

Figure 26 - B.C. Mining Careers Available Now and in the Future – Water Quality Monitor/Technologist/Engineer

Emerging Career – Land Management and Compliance

Figure 27 - B.C. Mining Careers Available Now and in the Future – Land Management and Compliance

In-Demand Career - Community Liaison Officer

Figure 28 - B.C. Mining Careers Available Now and in the Future – Community Liaison Officer

In-Demand Career – Engineers

Figure 29 - B.C. Mining Careers Available Now and in the Future – Engineer

Emerging Career - Community Cultural Director

Figure 30 - B.C. Mining Careers Available Now and in the Future – Community Cultural Director