CANADIAN MINING LABOUR MARKET

10-YEAR OUTLOOK

2020

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The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Government of Canada.

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A MESSAGE FROM MiHR

Over the course of the last fiscal year, the Mining Industry Human Resources Council (MiHR) Board of Directors undertook an extensive exercise to update the Council's strategic plan. After numerous consultations with stakeholders and several strategic planning sessions, we proudly launched MiHR's new 2019-2024 Strategic Plan in June 2019.

A renewed vision, mission, strategic priorities and values guide MiHR as it continues to lead collaboration across Canada's mining sector to understand labour market trends, identify opportunities, and develop solutions.

Our vision is to build an inclusive, skilled and sustainable Canadian mining workforce that anticipates and adapts to volatility and innovation. The 2020 Canadian Mining Labour Market 10-Year Outlook helps achieve that vision by allowing our sector to better comprehend our current and anticipated labour market challenges. Labour market information provides the necessary intelligence needed by individuals, employers and organizations to make informed decisions. It also provides MiHR the information needed to be the only source of industry driven, made in Canada human resource solutions specific to the minerals and metals sector.

This report provides a brief economic update on the mining industry in Canada, including the latest trends and a 10-year forecast. It also provides an update on Canada's mining labour market, identifying challenges and trends in mining's labour supply, and investigates skills in demand in mining over the past five years.

On behalf of the MiHR Board of Directors, I would like to convey my appreciation to the members of the Labour Market Information Steering Committee, and to the MiHR staff – whose invaluable research and methodology resulted in the important information uncovered throughout this report.

I encourage your comments, questions and feedback on our labour market information program and this national outlook report. Please take a moment to provide input using the survey linked at the end of this report or contact MiHR directly at info@mihr.ca. For more information about the Council, its strategic priorities and programs, please visit www.MiHR.ca.

Sincerely,

Ryan Montpellier

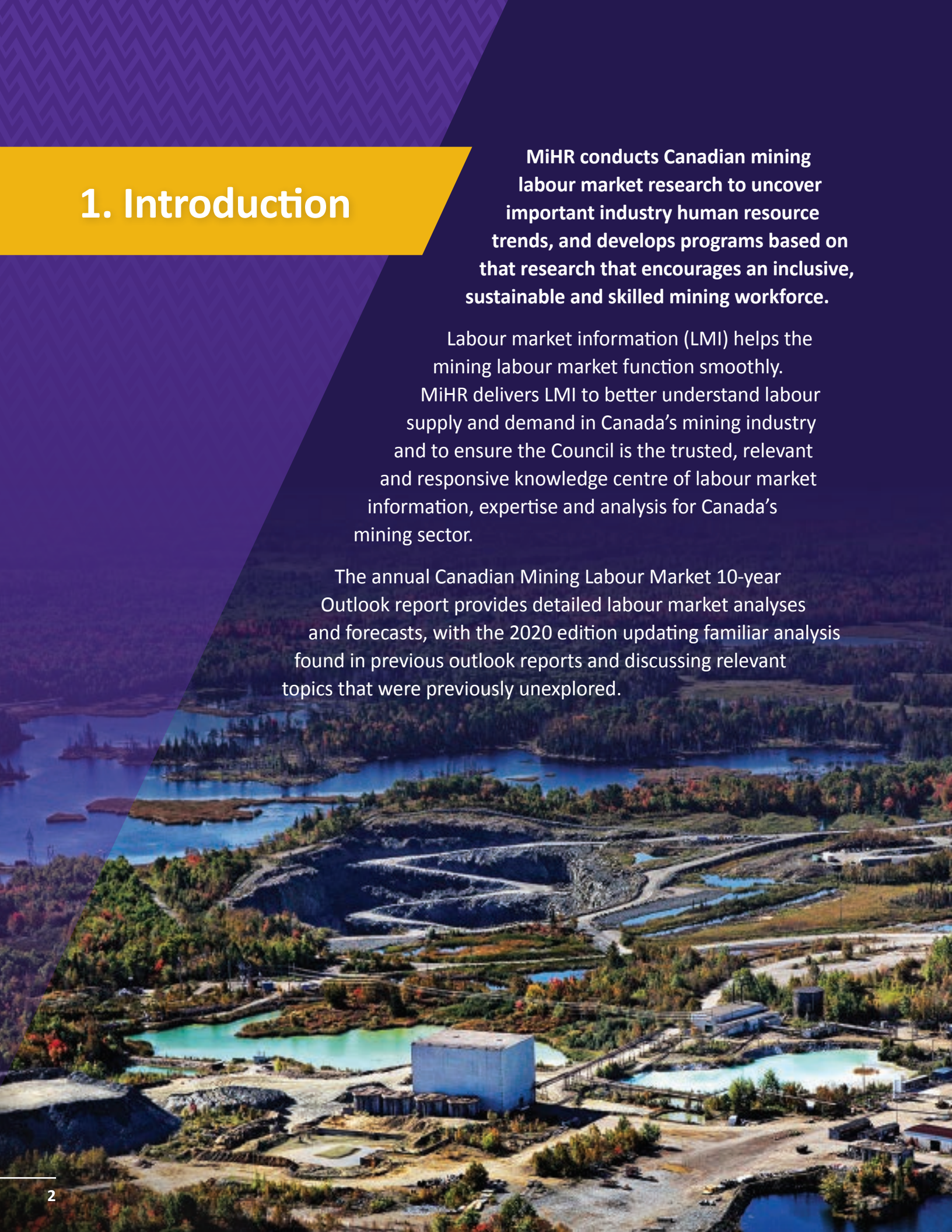
Executive Director, MiHR

1. Introduction

MiHR conducts Canadian mining labour market research to uncover important industry human resource trends, and develops programs based on that research that encourages an inclusive, sustainable and skilled mining workforce.

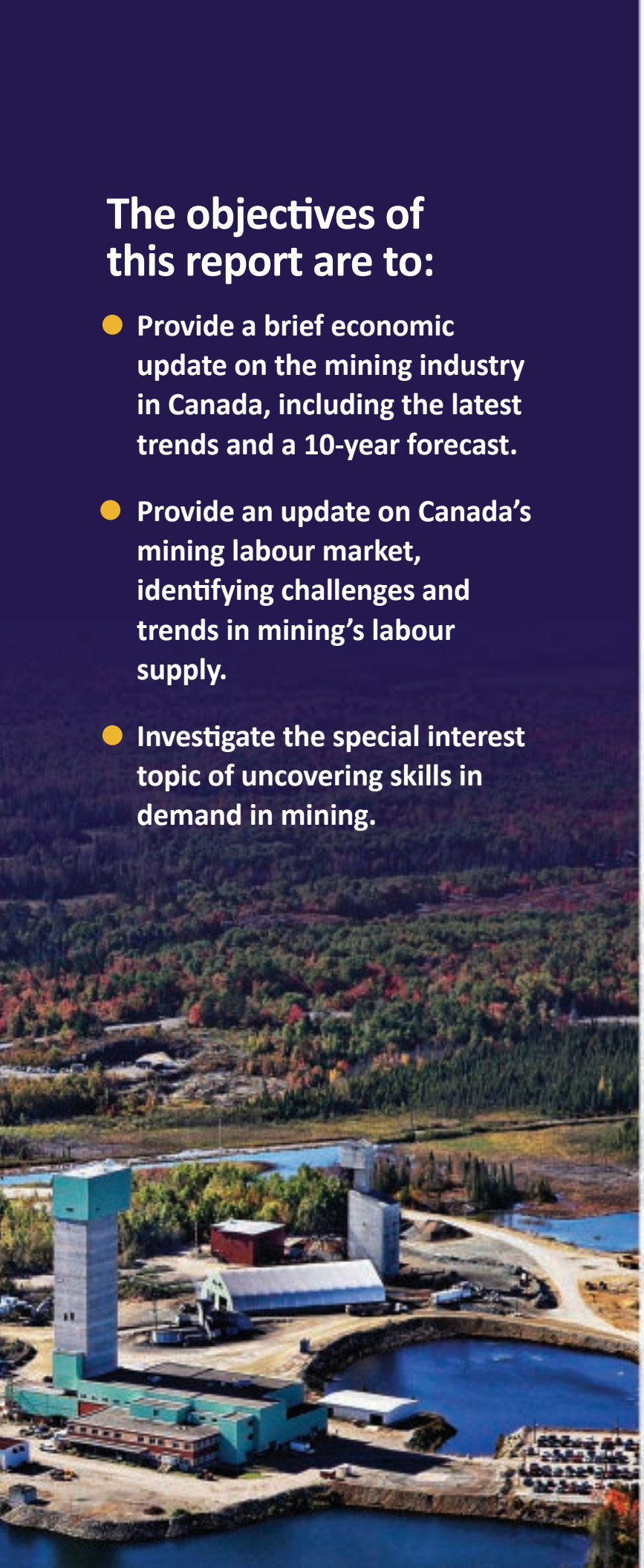
Labour market information (LMI) helps the mining labour market function smoothly. MiHR delivers LMI to better understand labour supply and demand in Canada's mining industry and to ensure the Council is the trusted, relevant and responsive knowledge centre of labour market information, expertise and analysis for Canada's mining sector.

The annual Canadian Mining Labour Market 10-year Outlook report provides detailed labour market analyses and forecasts, with the 2020 edition updating familiar analysis found in previous outlook reports and discussing relevant topics that were previously unexplored.



The objectives of this report are to:

- **Provide a brief economic update on the mining industry in Canada, including the latest trends and a 10-year forecast.**
- **Provide an update on Canada's mining labour market, identifying challenges and trends in mining's labour supply.**
- **Investigate the special interest topic of uncovering skills in demand in mining.**



REPORT OVERVIEW

Section 1 of this report sets the stage for the analysis. It clarifies MiHR's definition of the mining industry in Canada and indicates the key data sources used to provide information on sub-sectors within the industry. Section 2 provides an economic outlook for Canada's mining industry, using key indicators including commodity prices, gross domestic product (GDP) by sub-industry, and investment. Section 3 provides a labour market update that includes a demographic profile of the mining industry's labour force and workforce. Section 4 provides an update on MiHR's forecast for hiring requirements and available talent, covering the years 2020 to 2030. Section 5 focuses on the skills in demand in mining.

EXECUTIVE SUMMARY

Positive Trends Continue

The economic outlook for Canada's mining industry appears to be improving after slowing down significantly from 2012 to 2016. Growing employment and GDP present signs of recovery across some commodities. Yet the slowing down of the global economy and trade tensions between the United States and China may deter continued growth.

- Since 2016, prices for most commodities such as gold, iron ore, copper, zinc and crude oil have grown. The World Bank forecasts continued growth for some commodities; however, prices for most commodities are expected to stabilize.
- Support services, mainly composed of contractors and exploration companies, is often the first sub-sector affected by a mining industry recession, and the last to recover. This sub-sector experienced a substantial loss in real GDP from 2012 to 2016. However, the sub-sector levelled out in 2017 and grew in 2018 – a sign of economic recovery.
- With the exception of primary metal manufacturing, employment in each sub-sector has grown since 2016.

Tight Labour Market

A tight labour market exists when the number of jobs vacancies is high relative to the number of people available to fill them. The mining labour market faces recruitment challenges due to most operational mines being located in remote regions and the limited supply of specialized mining labour such as underground miners.

Low unemployment rates combined with growing mining job vacancies in 2018 indicates a tightening labour market.

- Unemployment rates in mining and quarrying (NAICS 212) are low, averaging 5.2% from March 1987 to April 2019. The unemployment rate in mining and quarrying exceeded the industry's historical unemployment rate in much of 2009 and 2013 to 2016; however, the rate returned to historically low levels (between 2% and 4%) for most of 2017 and 2018.
- In mining and quarrying, the ratio of unemployed to job vacancy is almost equal (1.4 unemployed people per job vacancy in 2018); job vacancies exceeded unemployed in the fourth quarter of 2018.

Opportunities for a Larger, More Diverse Workforce

Attracting talent from various demographic groups can help strengthen the mining labour market; however, the mining industry struggles to engage workers from different demographic groups. Geographical challenges can compound these recruitment issues since certain demographic groups such as youth, visible minorities, and immigrants typically live in larger metropolitan areas while mines are often located in remote areas.

- In 2018, the share of workers ages 15 to 24 was 14% in all industries, but only 8% in mining and quarrying.
- Women make up 48% of the Canadian labour force (2016 census), but they accounted for only 15% of the mining and quarrying labour force in 2018.
- The representation of Indigenous workers is high in mining compared to other industries, at about 7% compared to 4% of Canada's workforce.
- Immigrants represented 13% of the mining industry workforce in 2016 compared to 23% of Canada's workforce.
- In 2016, the representation of visible minorities in the mining industry was 9%, but they accounted for 21% of Canada's workforce.

Ten-Year Labour Market Forecast: Expected Growth in *Extraction and Milling*

The industry may need to hire roughly 79,680 workers over the next decade (2020 to 2030). Sixty percent of hiring requirements are projected to be in extraction and milling, and MiHR expects this sub-sector to face the most significant hiring gap (entrants less hiring requirements) with potentially 4,800 unfilled vacancies.

MiHR expects most job openings in the mining industry over the next 10 years to be in production occupations, yet there may be enough entrants to fill hiring requirements. However, hiring gaps are forecasted for supervisors, coordinators, superintendents and support workers in the industry.

Skills Most Frequently Requested by Mining Industry Employers

MiHR has acquired an innovative data product that amalgamates data from thousands of online job-postings into one intelligible platform. This data can be used to describe keywords for skills that most frequently appear in mining job postings for specific occupations:

- Engineer Occupations – Communication skills; planning; budgeting; and project management.
- Production Occupations – Equipment operation; equipment repair; communication skills; and teamwork/collaboration.
- Trades Occupations – Troubleshooting; communication skills; repair; and welding.

Highlights from MiHR's 2019 Employer Survey

- MiHR's 2019 National Employer LMI Survey asked employers whether they anticipate a change in the size of their workforce over the next 12 months. Forty-six percent of respondents stated they expect their workforce will stay the same size, and 36% anticipated their workforce will expand.
- Employers ranked the importance of various training and development strategies to their organization. Most of the respondents reported that two areas of training are particularly important: (1) increasing opportunities for developing high potential employees, and (2) stronger employee engagement.
- Employers identified the biggest challenges they anticipate in meeting their workforce requirements over the next five years. Most respondents stated their biggest hiring challenges will be finding qualified or skilled workers, and upgrading the skills of supervisors and managers.
- Employers indicated the types of programs their organization have in place to support employee diversity. Eighty-two percent stated they have a program for recruiting diverse candidates. About half of the respondents stated they have a program to develop a "pipeline of diverse leaders".

DEFINITIONS

Industry

MiHR defines the mining industry as inclusive of activities that fall within the following four sub-sectors:

- EXPLORATION: Encompasses activities focused on the discovery of minerals and metals.
- EXTRACTION AND MILLING: Describes the activities at operating mines across Canada, including both surface and underground mining operations, and on-site processing activities.
- SUPPORT SERVICES: Includes the activities of organizations providing support services for a wide range of mining activities, often on a contract or fee basis.[1]
- PRIMARY METAL MANUFACTURING: Consists of activities that are directly downstream from extraction and milling, including smelting and refining of ferrous and non-ferrous metals.

Wherever possible, data and information adhere to MiHR's definition of the mining industry. This includes sector-level data based on the North American Industry Classification System (NAICS) and occupational data according to the National Occupational Classification (NOC) system.

North American Industry Classification System (NAICS)

MiHR has aligned its definition of the industry to a set of NAICS codes (see Appendix A for a detailed description). The NAICS assigns a code number that describes economic and business activity at the industry level. Under NAICS, assignment to a specific industry is based on primary activity, enabling the grouping together of establishments with similar activities. A code with three or more digits denotes a higher level of specificity. In certain instances, however, data based on three and four digit NAICS codes may be limited or unavailable. In such cases, MiHR uses the next best option – the broader, two digit level; for example, NAICS 21 (mining, quarrying, and oil and gas extraction) can be used to describe mining-related trends in Canada.

In particular, the oil and gas extraction sector challenges MiHR's industry definition. MiHR considers non-conventional oil extraction (NAICS 211114) to account for oil sands mining activities. This NAICS code likely includes other activities that are not relevant to mining, such as offshore drilling and shale oil production.[2] MiHR's labour market analysis includes non-conventional oil extraction in order to provide a comprehensive look at the mining industry's labour market.

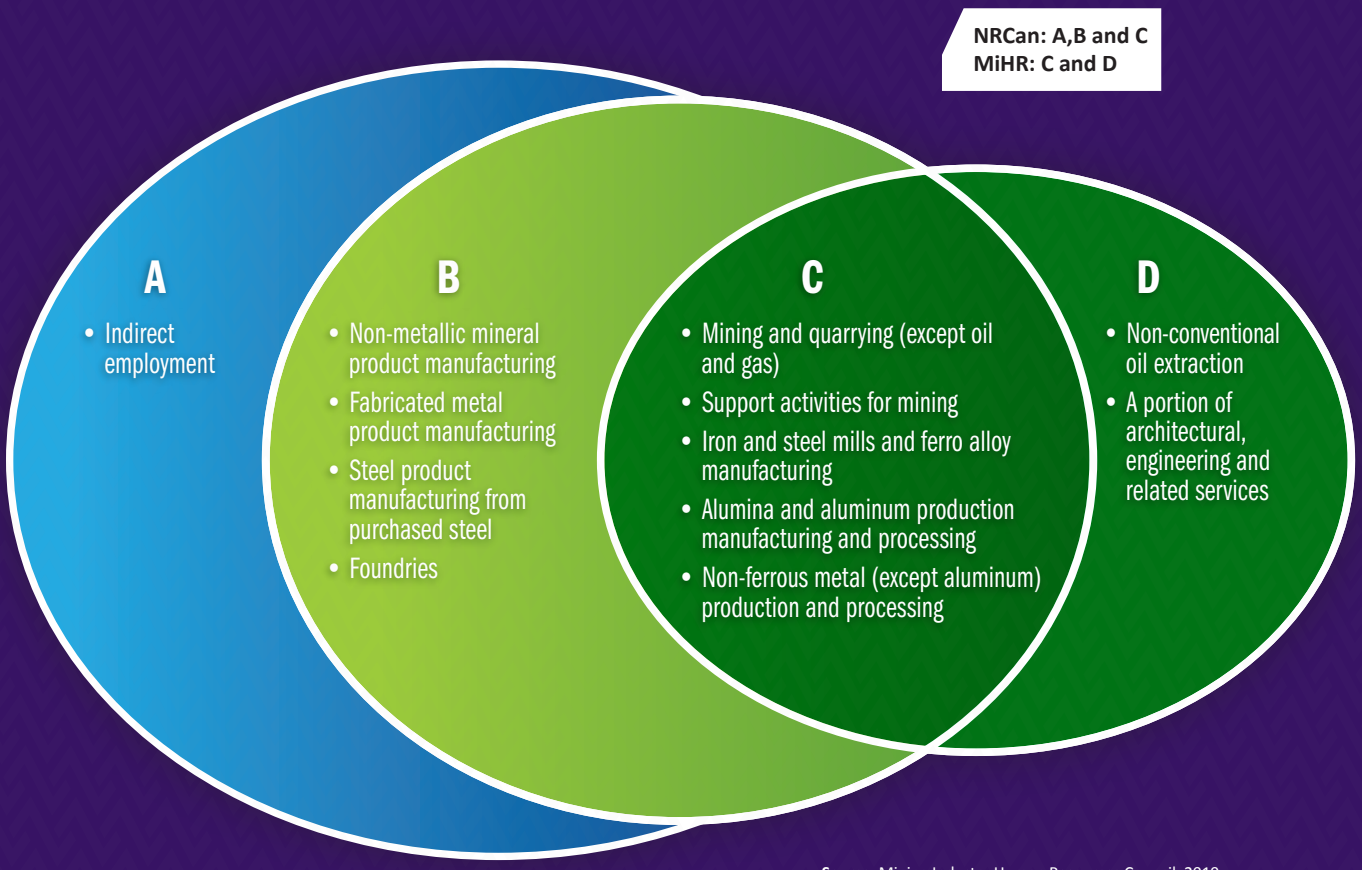
1 Support services are those required for mine construction, extraction, processing and exploration activities.
2 Note: NAICS 211142 was introduced under the 2017 realignment to capture oil sands mining activities. MiHR's definition of oil sands mining is aligned with this NAICS code.

How MiHR's Industry Definition is Different

MiHR's definition of the mining industry does not perfectly align with definitions used by Natural Resources Canada (NRCan), the Mining Association of Canada (MAC), and other organizations that produce labour market and employment information related to mining. In contrast to NRCan, MiHR excludes certain aspects of downstream manufacturing and indirect employment from its definition.

In addition, MiHR selects NAICS that define the phases of mining to capture most of the occupations involved in the mining supply chain. Consequently, MiHR's employment estimates tend to be lower, closer to about 200,000 workers, compared to NRCan's estimate of roughly 630,000 workers (including direct and indirect employment).

FIGURE 1: Comparison of MiHR and NRCan definitions of the mining industry



Source: Mining Industry Human Resources Council, 2019

NATIONAL OCCUPATIONAL CLASSIFICATION SYSTEM (NOC)

Occupational analysis in this report follows the NOC system to report on labour market activity. The NOC system is the nationally accepted taxonomy and organizational framework of occupations in the Canadian labour market. It gathers more than 30,000 occupational titles into 500 unit groups organized according to skill levels and skill types.[3] Statistics Canada uses the NOC system to provide information on labour market and employment outcomes across industries and sub-sectors. Each occupation is assigned a NOC code of one to four digits, and a corresponding occupational title.[4]

From the hundreds of occupations under the NOC system, MiHR has identified and tracked 70 "selected occupations" considered the most relevant to the mining industry (see Appendix A, Table A-1). These range from occupations in production and operations, such as heavy equipment operators, to occupations in professional and physical sciences, such as geologists. As with the NAICS system, data can be limited or unavailable for certain four-digit NOC codes. In such cases, MiHR relies on data for the broader two-digit NOC codes that represent a more inclusive occupational group.

MiHR tracks 70 "selected occupations" which are considered the most relevant to the mining industry.

Each digit in a NOC code conveys specific information. The first digit denotes a broad level of occupational skill type, whereas the second digit indicates a category of skill. The third and fourth digits designate a more specific occupation within the NOC hierarchy. In reports, MiHR presents information aligned to skill level categories defined within the NOC code system,[5] but utilizes its own broad occupational categories to better reflect the mining industry. These broad occupational and skill-level categories are as follows:

Broad Occupational Category

- Trades Occupations
- Production Occupations
- Supervisors, Coordinators and Superintendents
- Support Workers
- Professional and Physical Sciences Occupations
- Technical Occupations
- Human Resources and Financial Occupations

Skill Level Category

- LEVEL A (MANAGEMENT): Occupations usually require university education
- LEVEL A (PROFESSIONALS): Occupations usually require university education
- LEVEL B: Occupations usually require college education or apprenticeship training
- LEVEL C: Occupations usually require secondary school and/or occupation-specific training
- LEVEL D: On-the-job training usually provided for occupations

3 Government of Canada, National Occupation Classification 2016, http://noc.esdc.gc.ca/English/noc/welcome.aspx?ver=16
4 For more information on NOC codes, see the Government of Canada website: http://noc.esdc.gc.ca/English/NOC/Matrix2016.aspx?ver=16
5 For Statistics Canada's classification structure for the NOC skill levels, see: https://www.statcan.gc.ca/eng/subjects/standard/noc/2016/introduction#a6.1

KEY DATA SOURCES

This report uses data from a variety of public and private sources to provide key information on variables of interest including demographic characteristics and economic and behavioural factors. Data sources that were central to this analysis (shown in Appendix B) include:

- Census (Statistics Canada)[6]
- Labour Force Survey (LFS) (Statistics Canada)
- System of National Accounts (SNA) (Statistics Canada)
- Job Vacancy and Wage Survey (JVWS) (Statistics Canada)
- Commodities Price Forecasts (World Bank)
- Conference Board of Canada (CBOC)
- Survey of Mineral Exploration (Natural Resources Canada)
- Map 900A (Natural Resources Canada)
- Labour Market Insights Portal (Burning Glass Technologies)

NATIONAL EMPLOYER LMI SURVEY

MiHR's National Employer LMI Survey[7] is a source of primary data on labour market issues that are unique to Canada's mining industry. Issued biennially, it gathers information and opinions from Canadian mine, mill and smelter operators. The survey covers a range of labour market issues such as the type of mining operation; turnover and anticipated hiring needs; shifts in occupational demand; and recruitment challenges.

MiHR distributed the survey to 25 Canadian mining industry extraction and milling sub-sector employers in 2018, including mine operators, mining contractor firms, and oil sands companies. Eleven employers submitted responses to MiHR, representing operations spanning eight provinces and territories with a combined workforce of 24,836 in Canada – signifying about 18% of workers in extraction and milling.

Survey highlights are presented throughout this report in call-out boxes that supplement specific aspects of MiHR's labour market analysis.

6 The 2016 census marked the reinstatement of the mandatory long-form census that was temporarily dropped in favour of the voluntary National Household Survey for the 2011 census.

7 The 2019 National Employer LMI Survey consists of 53 questions.

2. State of Mining in Canada

Canada is a global mining leader, producing over 60 minerals and metals used in a range of consumer goods, from automobiles and smartphones to medications, plumbing and more. Mining is one of Canada's primary industries, and a strong contributor to economic activity and employment nationwide. In 2018, mining contributed $101 billion to Canada's GDP and accounted for 10% of the value of Canadian exports.[8,9] In the same year, the Canadian mining industry employed 204,500 workers in extraction and milling, support services, primary metal manufacturing, and exploration.[10]

8 Statistics Canada. Table 36-10-0402-01 Gross domestic product (GDP) at basic prices, by industry, provinces and territories (x 1,000,000), https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610040201

9 Statistics Canada. Table 12-10-0094-01 Trade in goods by exporter characteristics, by enterprise employment size and industry (x 1,000), https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1210009401

10 Statistics Canada. Table 36-10-0489-01 Labour statistics consistent with the System of National Accounts (SNA), by job category and industry, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610048901

POSITIVE TRENDS CONTINUE

The mining industry is characteristically volatile and cyclical due to fluctuations in commodity prices stemming from shifting global supply and demand factors. Following a surge in commodity prices between 2009 and 2011, a prolonged downturn lasted beyond the middle of the decade.

Recent trends across a range of indicators, including GDP and investment, suggest a positive shift for Canada's mining industry. Presented here are the most recent data on commodity prices, GDP, and investment. In concert, they present a picture of an industry in slow recovery.

In 2017, prices for most commodities showed signs of recovery and growth.

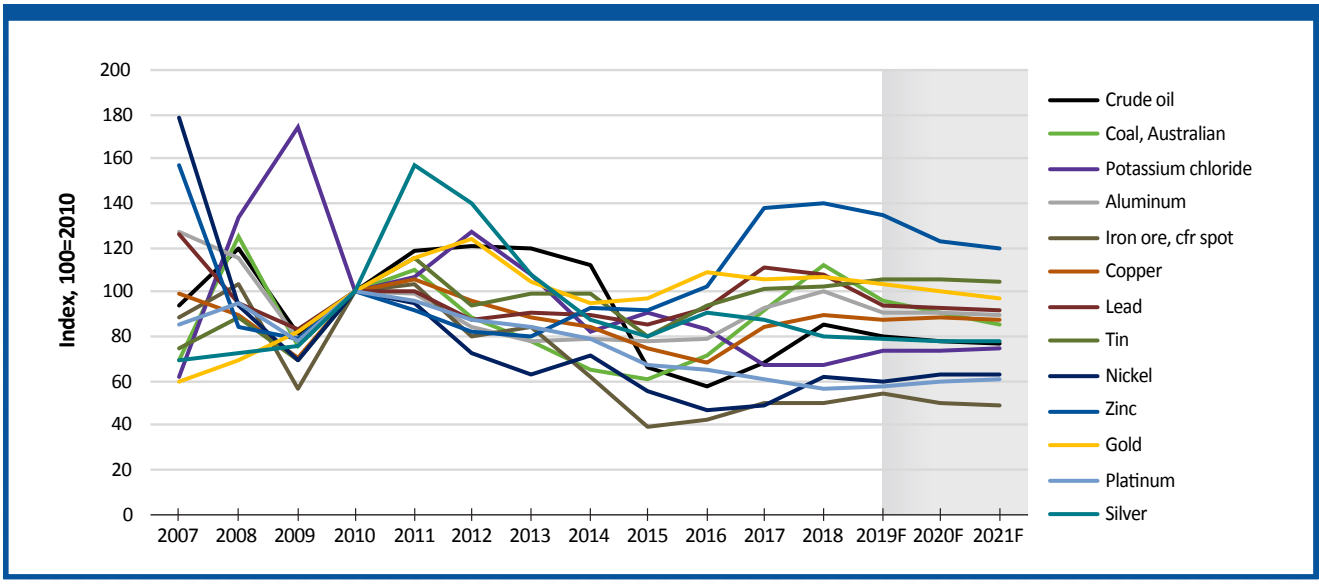
Commodity Prices and Sector Growth

Price increases can trigger investments in mine exploration and development, in turn increasing labour demand. When prices decrease, employers curtail investment in exploration activities and mine development, reducing labour demand.

Following the 2008-2009 recession, Canada's mining industry entered a boom cycle that lasted until about 2012. What followed was an unprecedented cool-down in prices for most commodities, specifically in 2015 and 2016, resulting in industry slowdown.

In 2017, however, prices for most commodities in mining showed signs of recovery and growth. This trend continued into 2018 (Figure 2). However, World Bank price projections for 2019 to 2021 predict a flattening trend for commodities such as crude oil, silver, and copper, and depreciation for gold, coal, and iron ore.

FIGURE 2: Real Prices by Commodity (2007–2021)



Source: Mining Industry Human Resources Council, World Bank (Commodities Price Data), 2019

Two Consecutive Years of Industry Growth

Growth in real GDP in Canada's mining industry occurred in each year of the last three decades, except during the global recession of 2008-2009. In 2010 and 2011, the rate of positive real GDP growth was relatively large, about 15% and 9% respectively, followed by negligible growth in 2012, modest growth of 4% in 2013, and a slowdown with negligible GDP growth in 2016.

In 2017, the industry posted about 6% growth in real GDP, an early indication of a rebound from 2016. The mining industry grew by 5% in 2018, marking two consecutive years of growth since stalling in 2016.

A closer look at real GDP by sub-sector reveals important shifts in industry growth over recent years.

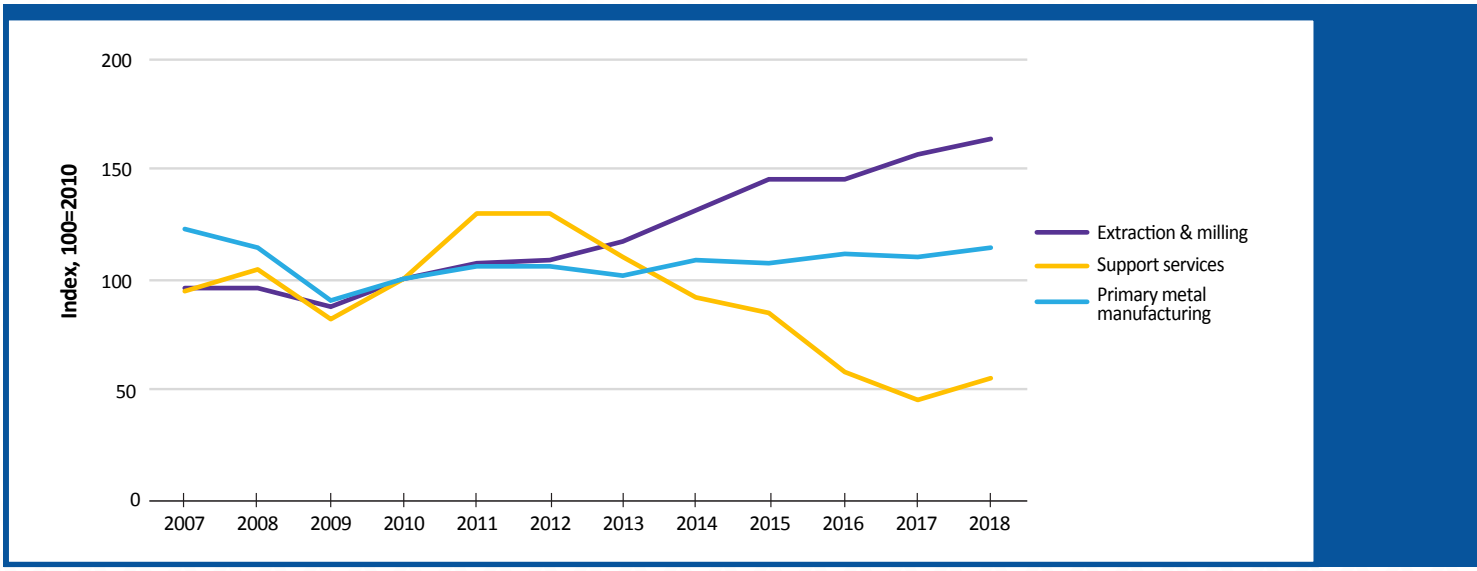
Increase in GDP for Support Services

A closer look at real GDP by sub-sector reveals important shifts in industry growth over recent years. Support services, mainly composed of contractors and exploration companies, is especially sensitive to economic fluctuations. Since contractors and exploration companies receive funding through temporary contracts or venture capital investments, support services is often the first sub-sector affected by a recession and the last to recover. Between 2012 and 2017, support services experienced a substantial loss in real GDP. In 2018, however, growth in real GDP for support services occurred for the first time since 2011, further signalling a recovery in Canada's mining industry (Figure 3).

Consistent GDP Growth in Extraction and Milling

The extraction and milling sub-sector makes up roughly 88% of the mining industry's real GDP. Figure 3 shows that this sub-sector has grown consistently since 2009, outpacing the other mining sub-sectors over the past decade.

FIGURE 3: Mining Real GDP by Sub-sector (Excluding Exploration*) (2007–2018)



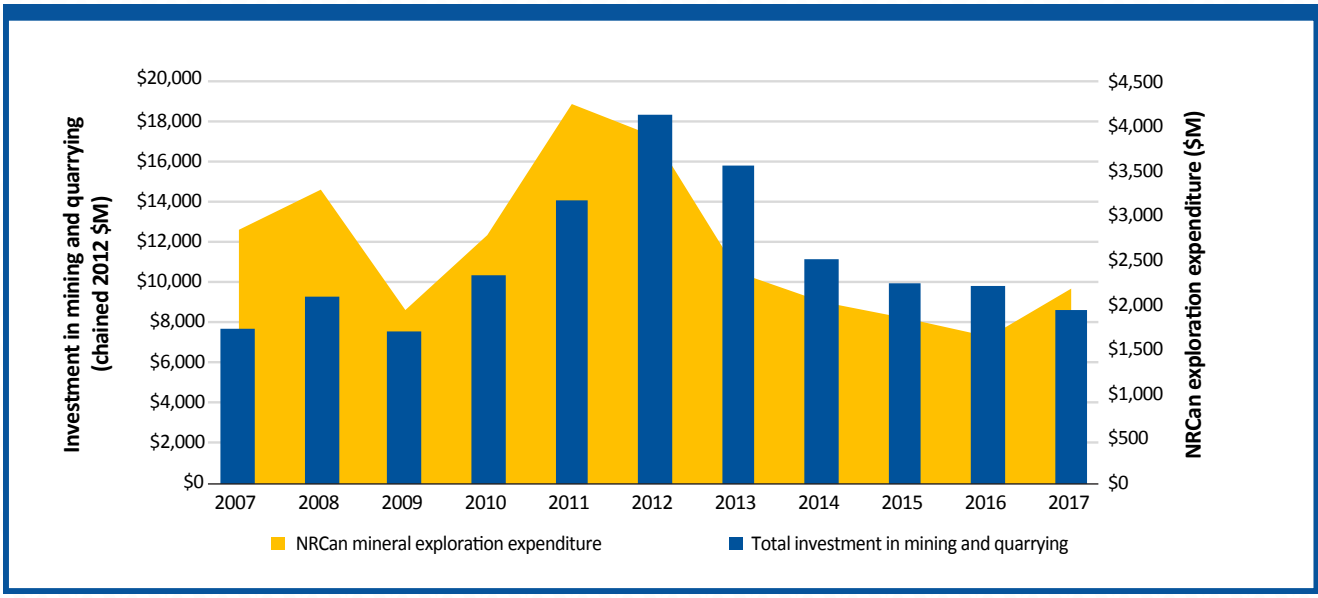
Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2019
**Exploration* is excluded because of limitations in GDP data for this sub-sector

Investment in Exploration Rises Despite Decreased Capital Expenditures

Annual investments in mining and quarrying (NAICS 212) peaked at roughly $18.26 billion in 2012, but fell quickly to relatively normal levels ($11.4 billion) in 2014, steadying at $8.57 billion in 2017. Spending on exploration peaked in 2011 at about $4.23 billion, and subsequently slowed down each year up to 2016 (Figure 4). This slowdown was likely a response to a weakening in commodity prices.

With the rebound of commodity prices that began in 2017, investments in exploration began to increase and continued into 2018, mirroring the continued growth in commodity prices. Spending in the exploration sector provides a leading indicator of industry health as the feasibility of future mining projects is largely determined at this particular stage.

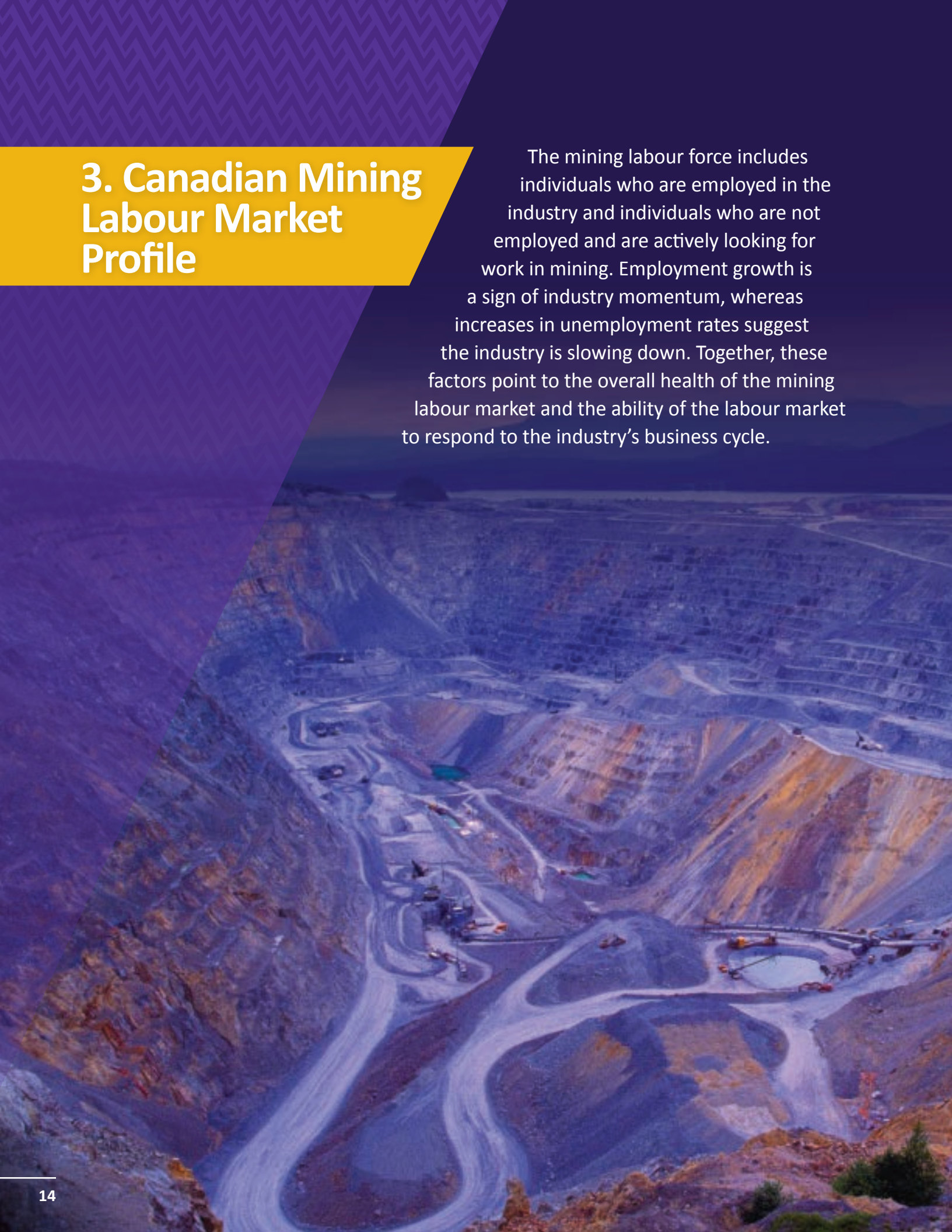
FIGURE 4: Investment in Exploration and in Mining and Quarrying (NAICS 212) (2007–2017)



Source: Mining Industry Human Resources Council, Statistics Canada (Stock and Consumption of Fixed Non-residential Capital) and Natural Resources Canada (Survey of Mineral Exploration), 2019

3. Canadian Mining Labour Market Profile

The mining labour force includes individuals who are employed in the industry and individuals who are not employed and are actively looking for work in mining. Employment growth is a sign of industry momentum, whereas increases in unemployment rates suggest the industry is slowing down. Together, these factors point to the overall health of the mining labour market and the ability of the labour market to respond to the industry's business cycle.



EMPLOYMENT GROWTH

Mining employment growth decreased modestly over the last decade, but with each sub-sector displaying a unique trend (Figure 5). The extraction and milling sub-sector has shown the strongest employment growth since 2010. With the exception of primary metal manufacturing, which has been declining steadily since 2012, employment has grown in each mining sub-sector since 2016.

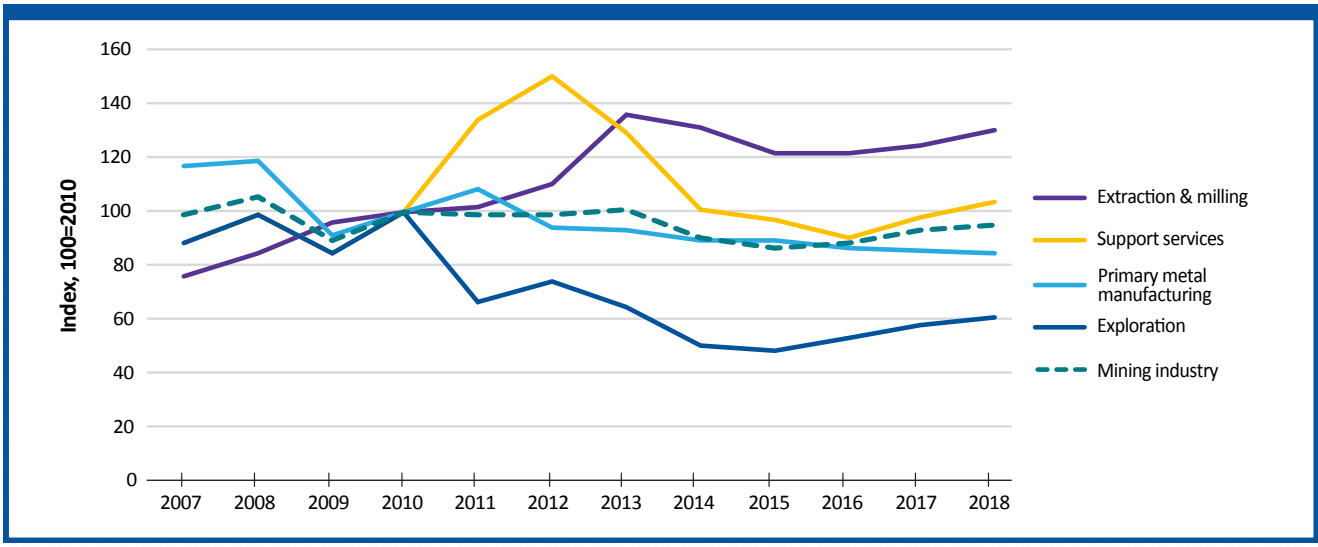
In 2018, the largest share of mining employment was in extraction and milling, at 52%. Primary metal manufacturing had the next largest share at 22%, followed by 15% in exploration and 11% in support services.

Labour Market Insights

MiHR's 2019 National Employer LMI Survey asked employers to estimate the share of workers in their Canadian mining operation that have full-time permanent employment, and the share that have non-permanent jobs. The survey respondents stated that 82% of their workers have full-time permanent employment and 18% have non-permanent employment.

The survey also asked employers to provide the share of unionized employees at their organization. Five out of 11 employers reported they have unionized employees, with an average unionized rate of 47.1%.

FIGURE 5: Employment by Mining Sub-sector (2007–2018)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2019

Strongest Employment Growth in Extraction and Milling

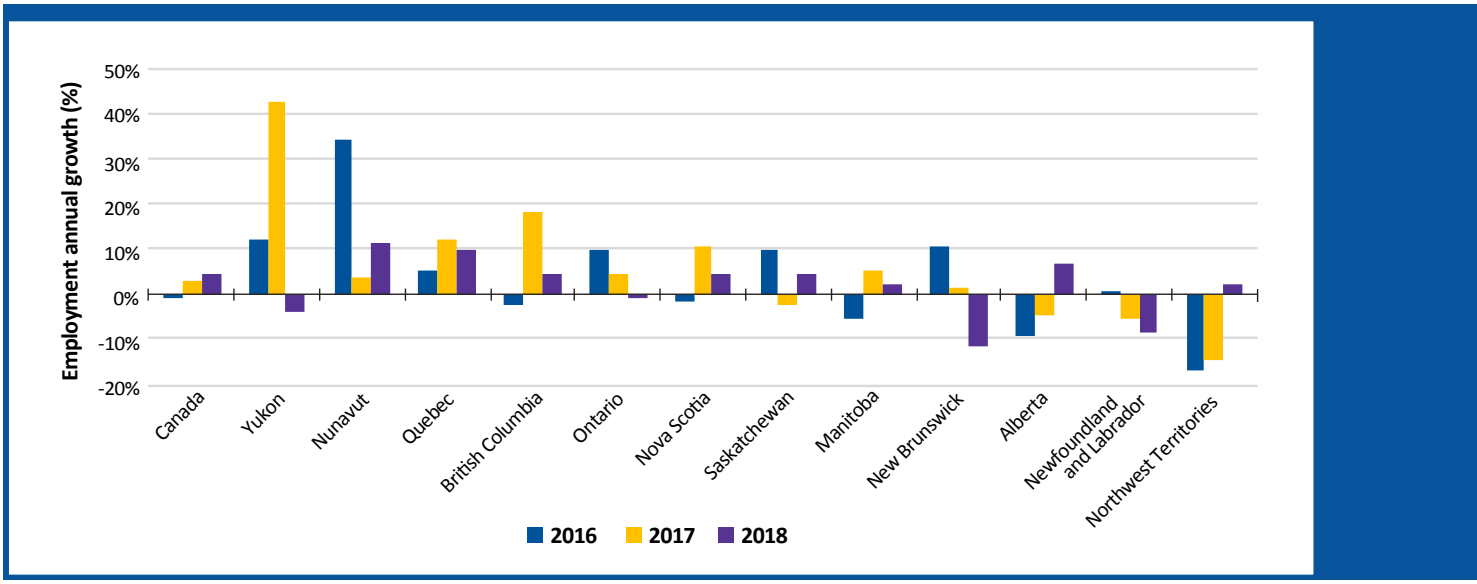
As mentioned, the extraction and milling sub-sector showed the greatest employment growth over the last decade. Figure 6 shows that from 2016 to 2018 the average employment growth in this sub-sector was highest for Yukon (17%), Nunavut (16%), and Quebec (9%). In 2018, employment growth in extraction and milling in both Nunavut and Quebec was about 10%, the highest growth rate for this sub-sector of any province or territory in Canada.

Volatility in Employment

Mining employment is characteristically volatile, making workforce planning and recruitment difficult, contributing to a tight labour market. After an economic downturn, employers often find it challenging to attract workers back to mining when the industry begins to expand. Additionally, potential workers may be overly pessimistic about mining employment opportunities in a downturn, and leave mining before the industry manifests new employment opportunities.

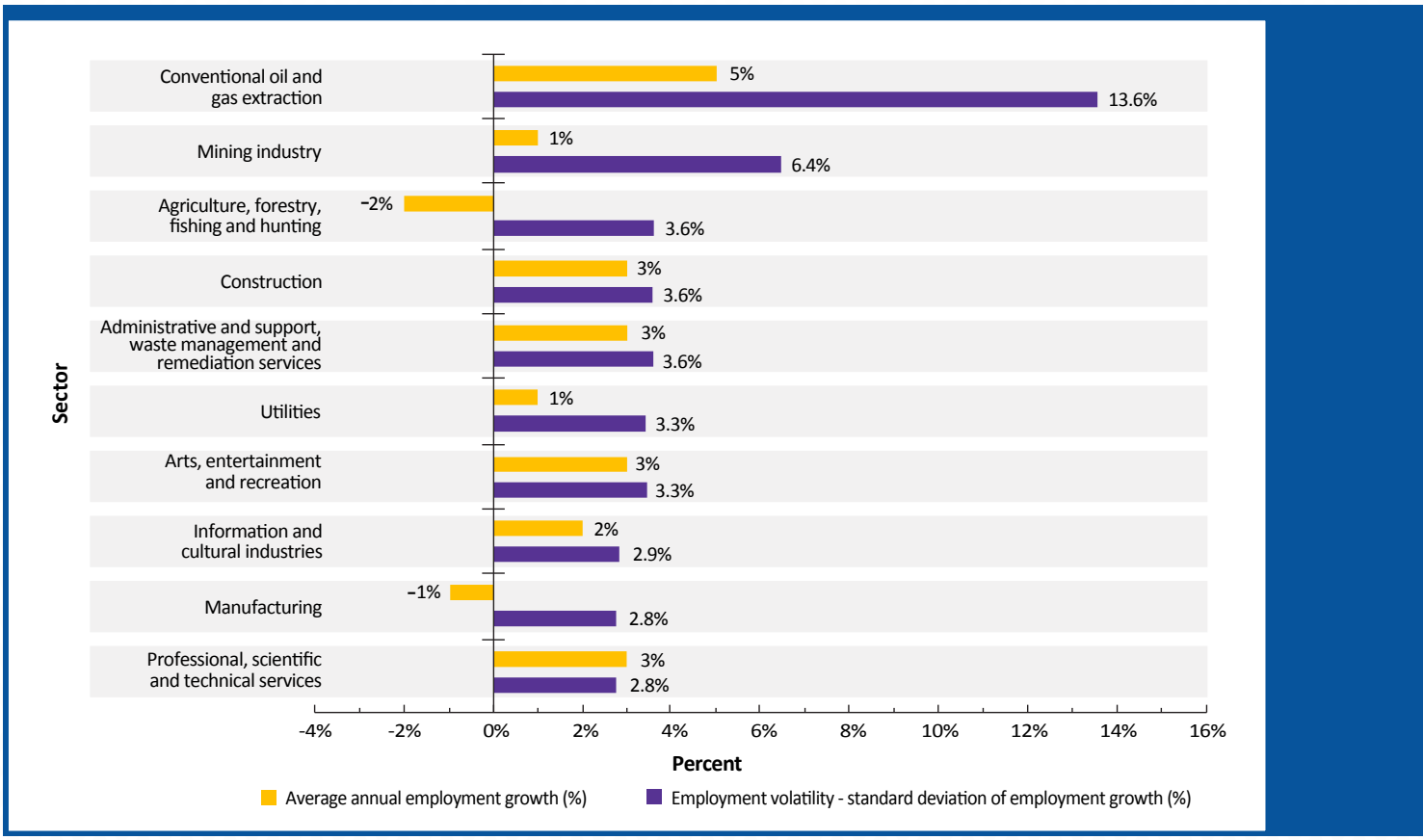
Figure 7 shows mining ranking second among the top 10 industries with the highest employment volatility, and having one of the lowest rates in annual employment growth – averaging 1% over the past two decades. This suggests the demand for mining labour can often outpace the available supply.

FIGURE 6: Employment Growth in Extraction and Milling by Province and Territory (2016, 2017 and 2018)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2019

FIGURE 7: Top 10 Industries with Highest Employment Volatility,[11] Mining Industry versus Other Industries* (1997–2018)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2019
* Other industries are limited to two-digit NAICS.

11 Employment volatility is calculated to be the standard deviation of annual employment growth. Standard deviation of annual employment growth measures the average amount of variation between annual employment growth and the average employment growth.

TIGHTNESS IN THE MINING LABOUR MARKET

A tight labour market exists when the number of available jobs is high relative to the number of people available to fill them. This can result from low unemployment rates, high job vacancy rates, or a combination of both factors. In each case, employers' demand for workers has outpaced supply, likely causing wages to rise and unemployment to fall as employers become more willing to pay for labour.

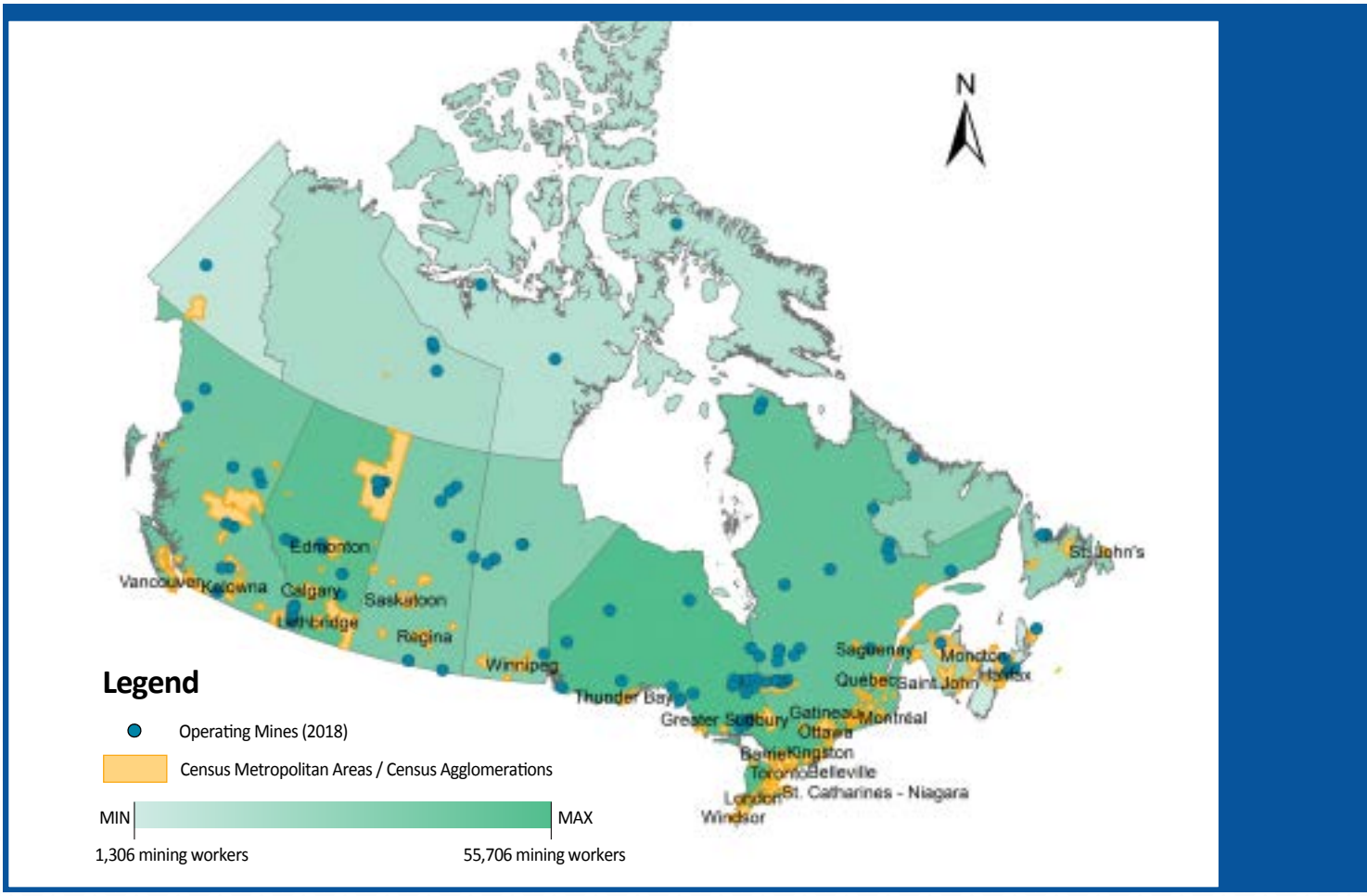
The mining labour market is inherently tight. Figure 8 shows how most operational mines are located in remote regions, contributing to increased recruitment challenges and a shortfall of available workers. As well, the limited supply of specialized labour, such as underground miners and engineers experienced in mining, contributes to labour shortages.

Low unemployment rates and growing employment are evidence of a tightening mining labour market, which in turn limits the labour market's ability to respond immediately to growth in the industry and exacerbates labour market tightness.

Labour Market Insights

MiHR's 2019 National Employer LMI Survey asked employers to provide the current number of vacant positions associated with their Canadian mining sites, including vacancies at exploration sites, advanced development projects, producing mines, care and maintenance sites, reclamation sites, and corporate offices. There were 1,820 reported vacancies.

FIGURE 8: Mining Industry Workforce and Operational Mines across Canada



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts) and Natural Resources Canada (Map 900A), 2019

Unemployment Rates Remain at Low Levels

Unemployment rates in mining and quarrying (NAICS 212) are typically low, averaging 5.2% from March 1987 to April 2019, but reaching as low as 2% in most years. The median unemployment rate in mining and quarrying has been 4% since January 2007, an indication that the industry habitually faces a tight labour market.

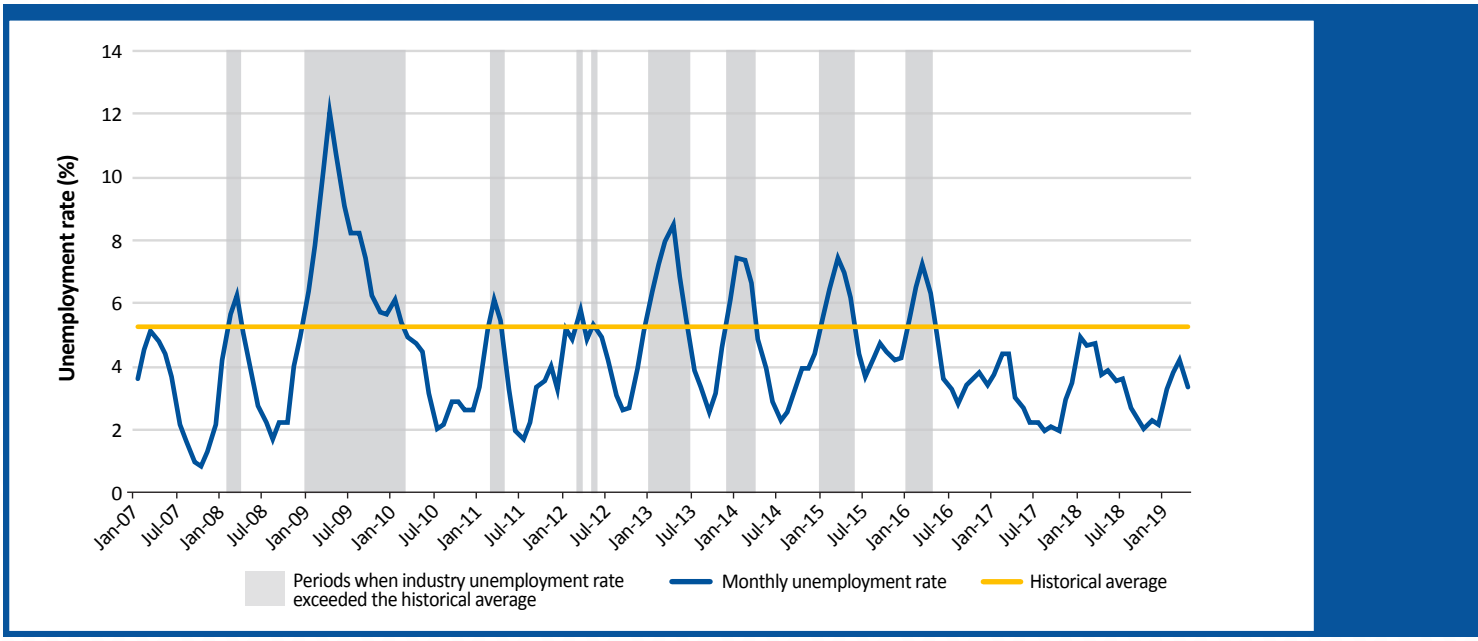
On the other hand, unemployment in the industry can be volatile. Figure 9 illustrates the specific periods over the last decade when the unemployment rate in mining and quarrying exceeded the historical unemployment rate. Notable years with prolonged periods of high unemployment rates in the industry were 2009 and 2013 to 2016. The rate returned to historically low levels between 2% and 4% for most of 2017 and 2018. This trend is a further sign that the mining industry has been in slow recovery.[12]

Mining Currently Faces a Tight Labour Market

The ratio of unemployed to job vacancies is one measure of labour market tightness. It compares the number of people actively looking for work with the number of openings available. Thus, in the tightest markets, there are fewer unemployed people for every vacancy.

In mining and quarrying, the ratio of unemployed to job vacancy is almost equal (1.4 employed to 1 vacancy in 2018) – significantly lower than the ratio for industries, such as construction (4.8 to 1), that compete for many of the same skilled workers (Figure 10). Since the mining industry cannot fill all of its job vacancies by hiring every unemployed person in the industry, many of mining's job vacancies will remain unfilled unless more job seekers enter the industry.[13]

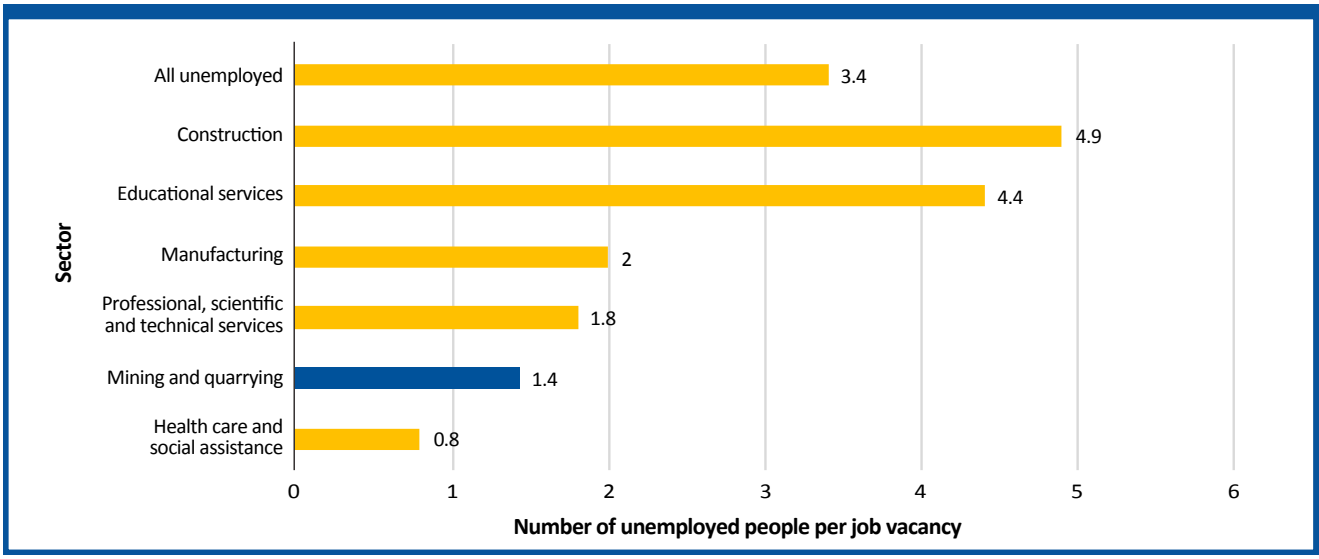
FIGURE 9: Unemployment Rates in Mining and Quarrying (NAICS 212) (January 2007–April 2019)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2019

12 Such low unemployment rates can make it increasingly difficult to recruit for new positions.
13 Note: All labour markets at any particular time have a positive number of unemployed people. This phenomenon is known as "natural" unemployment.

FIGURE 10: Number of Unemployed per Job Vacancy, Mining and Quarrying* and Other Industries (2018)



Source: Mining Industry Human Resources Council, Statistics Canada (Job Vacancy and Wage Survey), 2019
* Calculated from using data from Statistics Canada's Labour Force Survey and Job Vacancy and Wage Survey, 2019 (See Figure 11)

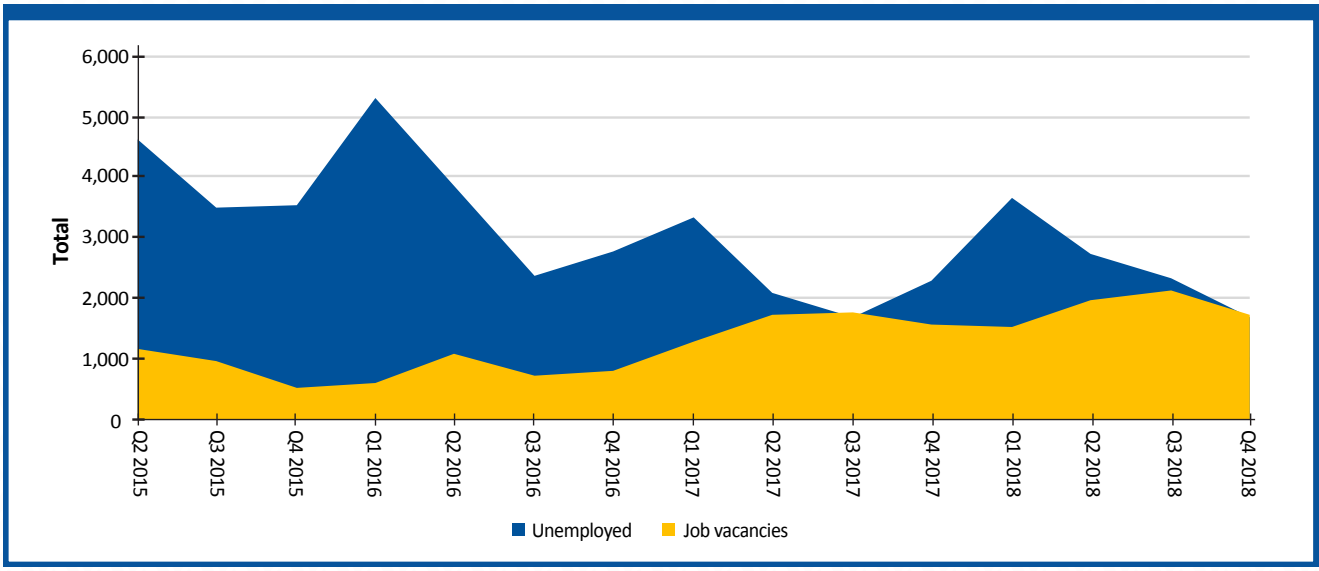
The Mining Labour Market is Getting Tighter

In mining, unemployment usually decreases as job vacancies increase – creating significant hiring pressures when the industry expands. In the third quarter of 2017, the number of job vacancies (1,760) exceeded the number of unemployed (1,700) in extraction and milling. Similarly, Figure 11 shows in the fourth quarter of 2018 there were 20 more job vacancies in this sub-sector than there were unemployed people to fill them.

In contrast, there were over 3,000 more unemployed than job vacancies in Q2 of 2015, and over 4,000 more unemployed than job vacancies in Q1 2016.

Although the mining labour market can appear slack during an economic downturn, it is more common for the industry to face a tight labour market. This is because the industry usually has very low unemployment rates, which typically translates to dramatically fewer unemployed people relative to job vacancies (as shown in Figure 9 in conjunction with Figure 11).

FIGURE 11: Job Vacancies and Unemployment in Mining and Quarrying (NAICS 212) (Q2 2015 to Q4 2018)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey, Job Vacancy and Wage Survey), 2019

OPPORTUNITIES FOR A LARGER, MORE DIVERSE WORKFORCE

The ability to attract talent from various demographic groups can help any industry mitigate labour supply challenges. However, the mining industry struggles to engage workers from different demographic groups such as youth, women and immigrants. The scarce supply of diverse labour in mining results in a limited labour pool; out of necessity, mining employers may resort to hiring underqualified candidates during an economic expansion in order to fill vacancies, which can increase training costs and decrease productivity. Mining employers are missing opportunities to hire qualified candidates because the industry is not tapping into Canada's large and growing supply of diverse labour.

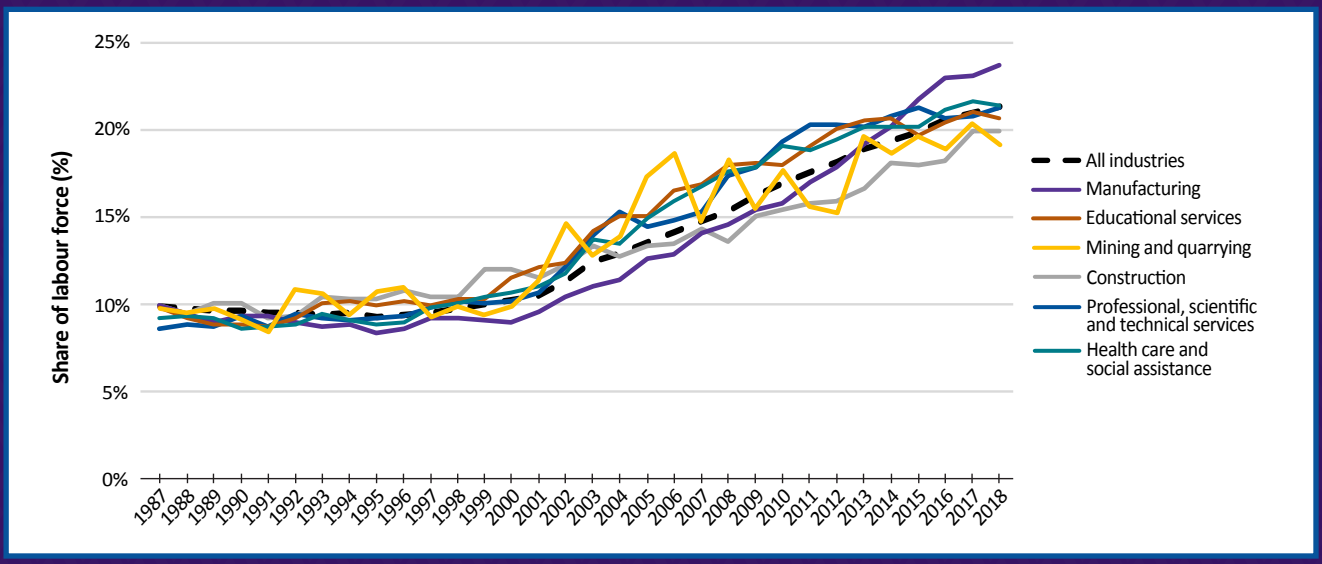
The analysis presented below focuses on the presence of youth, women, Indigenous people, immigrants, and visible minorities in the mining industry, highlighting the demographic groups that the industry could draw upon to build a more robust and diverse labour supply.

An Aging Workforce

Canada's workforce is aging as the baby boomer generation nears or enters retirement age.[14] Most of the Western world is experiencing this phenomenon and many industries could face a significant gap in labour because the share of young people entering the labour market is not sufficient to offset the share of older people retiring.[15]

Figure 12 shows Canada's share of the overall labour force aged 55 years and over doubled from 1998 to 2018, increasing from 10% to 21%. The mining industry has also seen a comparable increase, with the share of 55-year-olds and older in the mining and quarrying labour force increasing from 10% to 19% over the same period.

FIGURE 12: Share of Labour Force Ages 55 and Over, Mining and Quarrying and Other Industries (1987–2018)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2019

14 Statistics Canada, Census in Brief, https://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-311-x/98-311-x2011003_2-eng.cfm

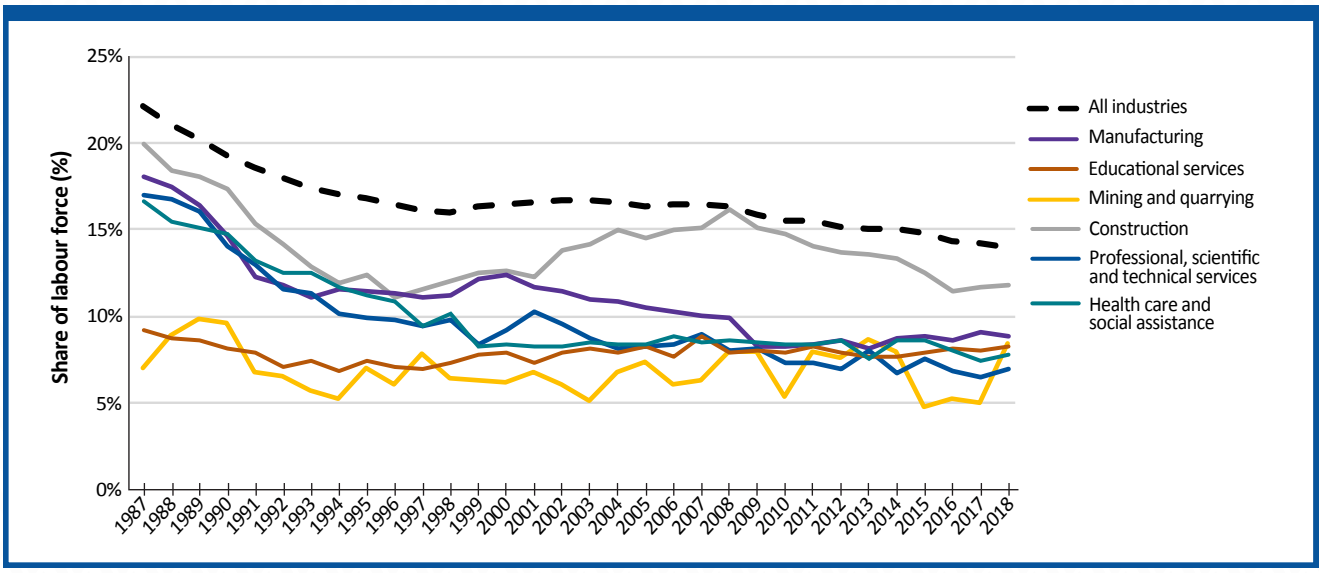
15 Statistics Canada reports that an increasing share of older people continue to work after they turn 65. See: Andrew Fields, Sharanjit Uppal and Sébastien LaRochelle-Côté, "The impact of aging on labour market participation rates," *The Daily* (June 14, 2017), Statistics Canada, https://www150.statcan.gc.ca/n1/pub/75-006-x/2017001/article/14826-eng.htm

Youth Participation is Low

In 2018, 14% of youth ages 15 to 24 were in the Canadian labour force. In contrast, only 8% were in mining and quarrying (Figure 13). Although the mining labour force has aged (see Figure 12), the share of young people in the industry's labour force has remained about the same since 1987. In fact, for all industries in 1987, the share of the labour force ages 15 to 24 was 22%, whereas the share in mining and quarrying was much lower, at 7%.

Recruitment of young workers can help the industry deal with its aging workforce. In addition, younger workers can make it easier for the industry to introduce new technologies in mining operations and in turn, the use of new technologies in mining can attract a younger workforce to the industry.

FIGURE 13: Share of Labour Force Ages 15 to 24, Mining and Quarrying and Other Industries (1987–2018)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2019

Future Talent

The 2019 National Employer LMI Survey asked employers for their views on whether Canadian high schools and post-secondary institutions are responding to the needs of Canada's mining industry.

- About one-third stated they view high schools as responsive.
- Half stated they view post-secondary institutions as responsive.

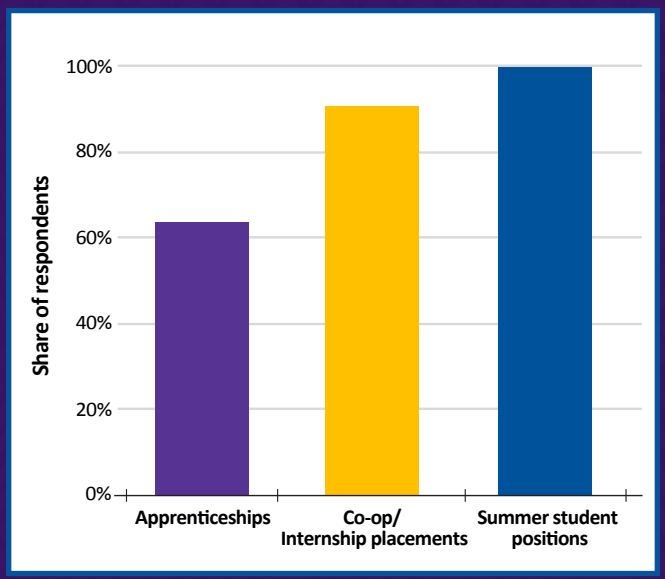
The survey also asked employers whether their recruitment and hiring practices include apprenticeships, co-op/internship placements, and summer employment for students.

- All respondents stated their organization provides summer employment for students (Figure 14).
- About two-thirds reported having apprenticeship programs.
- Ninety-one percent reported using co-op/internship placements.[16]

The survey also asked employers whether a wage subsidy program would help to increase the number of co-op/internship placements at their organization.

- Fifty-five percent indicated a wage subsidy would help increase the number of co-op/internship placements.

FIGURE 14: MiHR's 2019 National Employer LMI Survey: "As part of your organization's recruitment and hiring practices, do you use the following?"



Source: Mining Industry Human Resources Council (2019 National Employer LMI Survey)

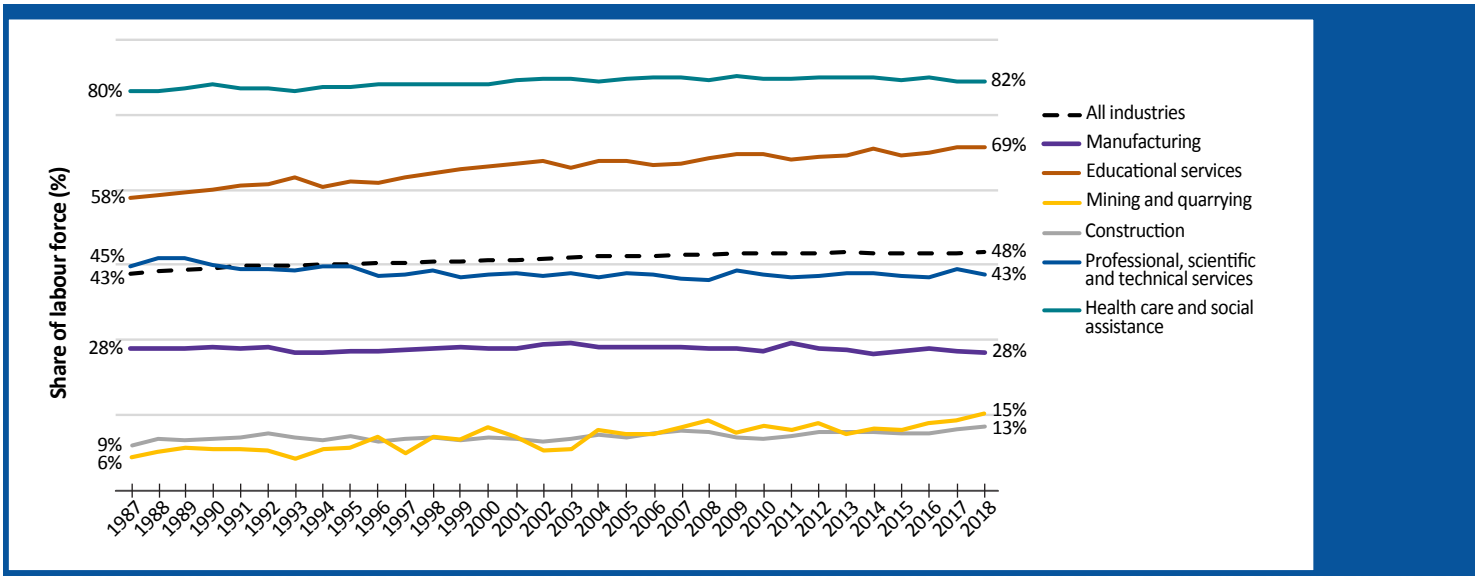
16 In total, employers had 864 co-op/internship placements in 2018 compared to 583 in 2017.

Women Remain Underrepresented

Although women currently represent 48% of Canada's labour force, their representation in the mining industry remains much lower, at 15% in mining and quarrying (Figure 15). Over the past two decades, the share of women in mining and quarrying increased from 6% in 1987 to 15% in 2018 – a significant improvement. Moreover, women are better represented in mining and quarrying than in other industries, such as construction, which draw from similar labour pools (e.g., trades occupations and production occupations).

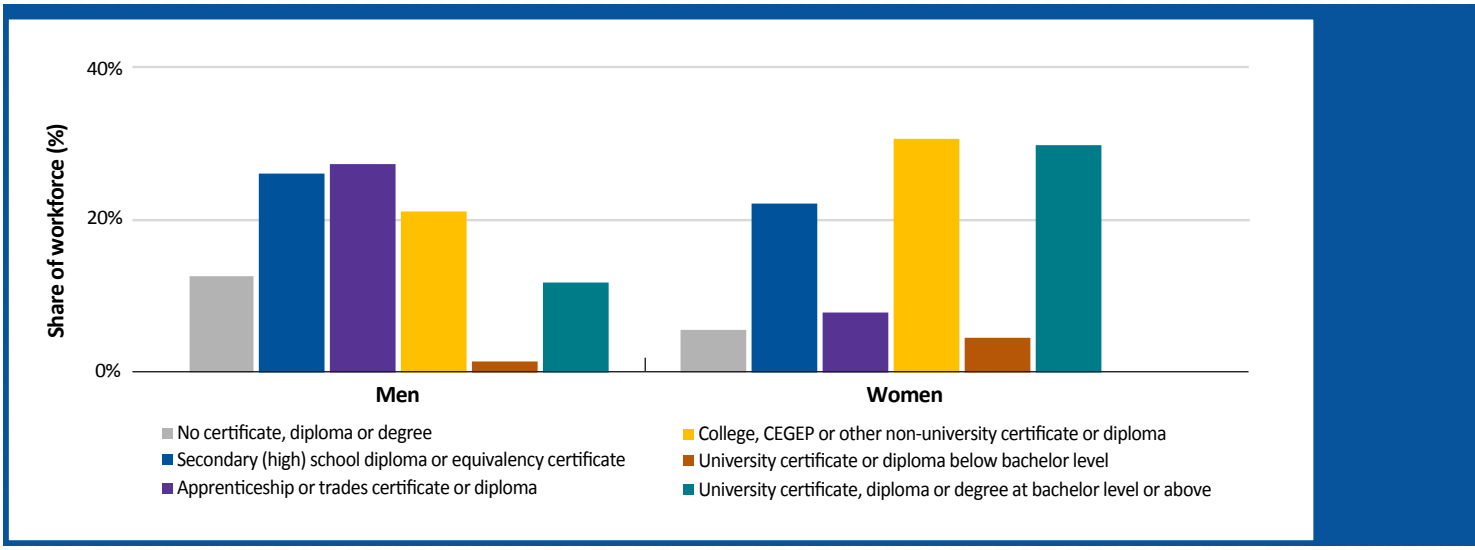
In Canada, this demographic group has had low representation in industries such as construction, manufacturing, and mining and quarrying despite their presence in the overall labour force. More women in mining can increase the industry's access to Canada's available talent.

FIGURE 15: Representation of Women in the Labour Force, Mining and Quarrying and Other Industries (1987–2018)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2019

FIGURE 16: Educational Profile of Mining and Quarrying Workforce by Sex (2016)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2019

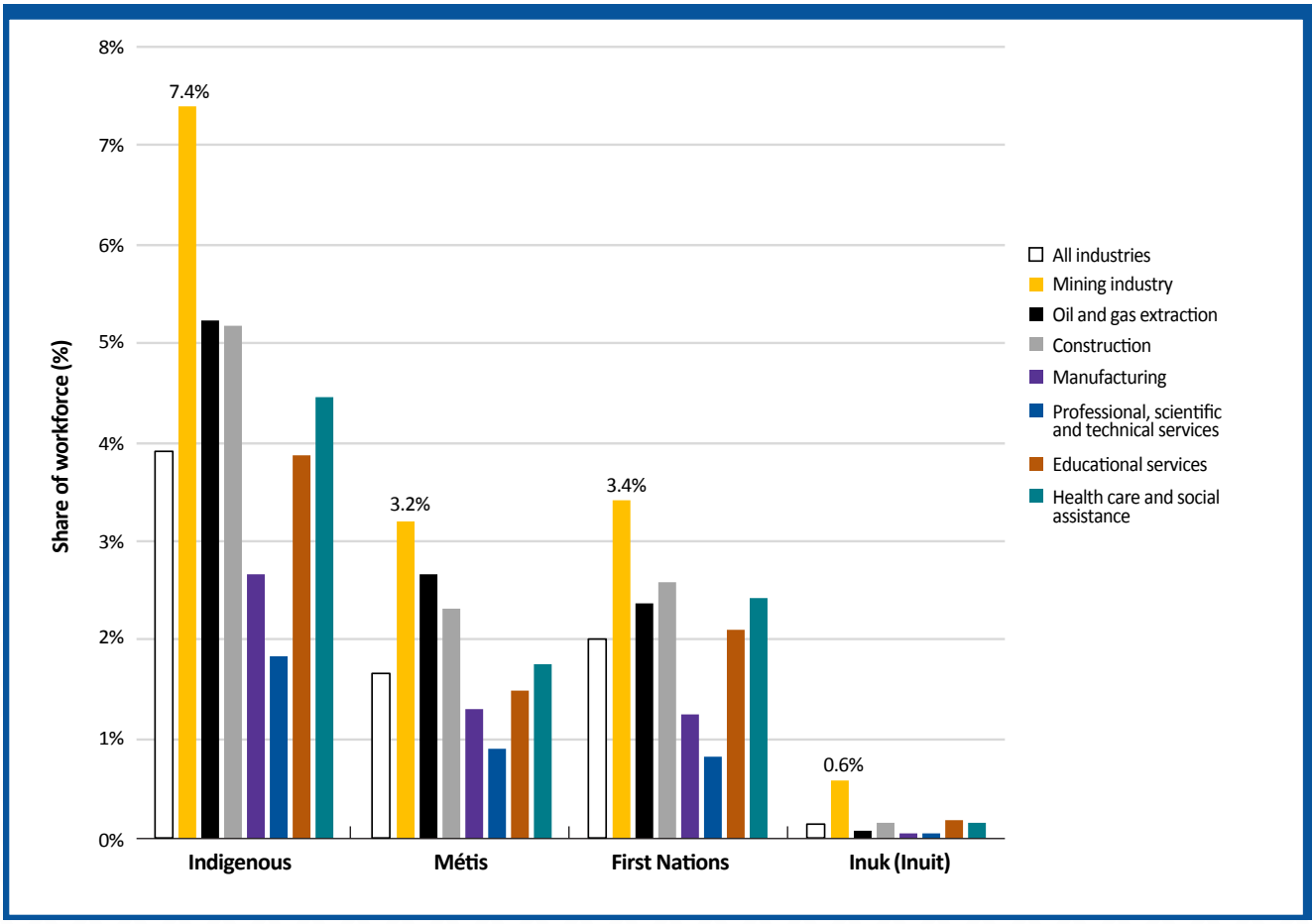
Reliance on Indigenous Employment

The Indigenous population in Canada comprises First Nations, Métis and Inuit – and their participation in the mining industry's labour force is highly valued. In 2016, these groups represented 5% of the total population, an increase from about 4% in 2006 and 3% in 1996.[17] As the Indigenous population increased, so did their representation in the mining workforce – increasing from 4% in 2006 to 7% in 2016.[18]

Indigenous people are one of the most important labour supply groups for the mining industry because mining operations are often located near Indigenous communities. Thus, the success of a mining project often depends on the community's level of interest and participation in the mine's labour force.

Canada's mining workforce has the highest representation of Indigenous workers (7%) compared to other Canadian industries (Figure 17).[19] Industries with the next highest representation of Indigenous people are oil and gas extraction (5%) and construction (5%). It is critical that mining employers continue to improve their relationships with Indigenous people and ensure that Indigenous communities can benefit from employment opportunities in nearby mining operations.

FIGURE 17: Representation of Indigenous People in the Workforce, Mining Industry and Other Industries (2016)



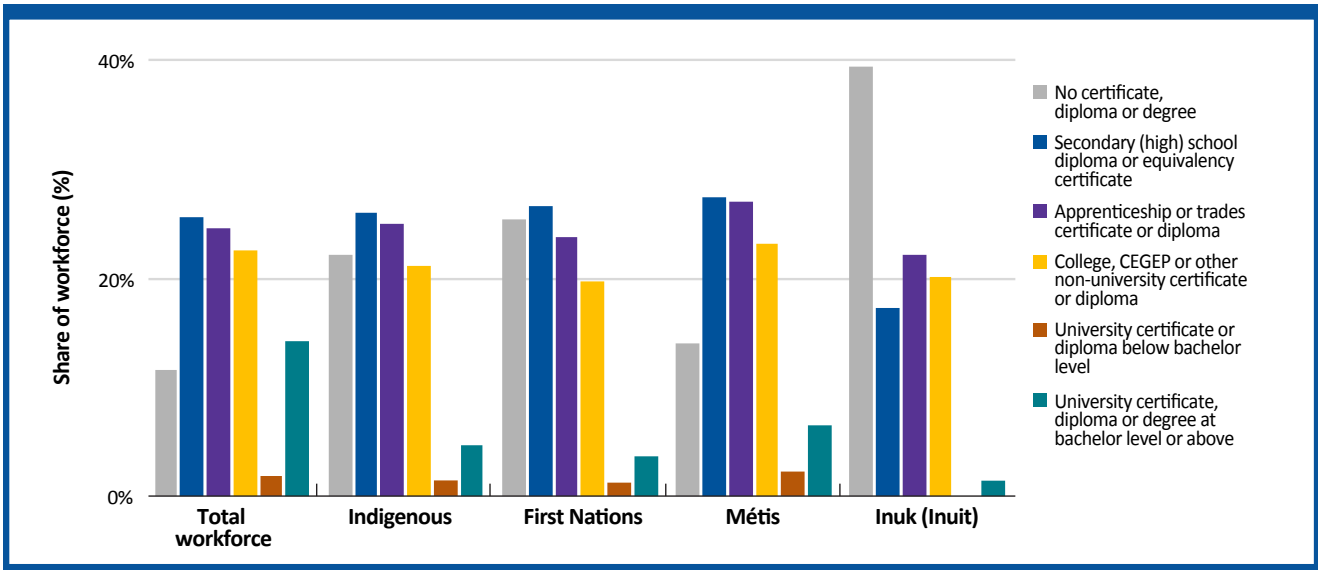
Source: Mining Industry Human Resources Council, Statistics Canada (2016 Census), 2019

17 Statistics Canada, "Aboriginal peoples in Canada: Key results from the 2016 Census," *The Daily* (Oct. 25, 2017), https://www150.statcan.gc.ca/n1/daily-quotidien/171025/dq171025a-eng.htm

18 See MiHR, *Canadian Mining Labour Outlook 2019*

19 Note that at the three-digit NAICS mining and quarrying (NAICS 212) has the third highest representation of Indigenous workers (12%). The three-digit NAICS with higher representation of Indigenous workers were Aboriginal public administration (NAICS 914) at 88% and fishing, hunting and trapping (NAICS 114) at 16%.

FIGURE 18: Educational Profile of Mining and Quarrying Workforce by Indigenous Identity (2016)



Source: Mining Industry Human Resources Council, Statistics Canada (2016 Census), 2019

Immigrants and Visible Minorities are a Large and Growing Source of Potential Labour

Immigrants and visible minorities have become a substantial source of labour in Canada. Census data from 2016 demonstrate that immigrants and visible minorities each make up one-fifth of the country's total population. Of the visible minority population,[20] three in 10 were born in Canada. Statistics Canada projects that the immigrant share of Canada's population could reach between 25% and 30% by 2036 and Canada's visible minority population to be even higher, between 31% and 38%.[21] Despite the significance of these rates, Canada's mining industry has been unable to adequately recruit immigrant and visible minority workers.

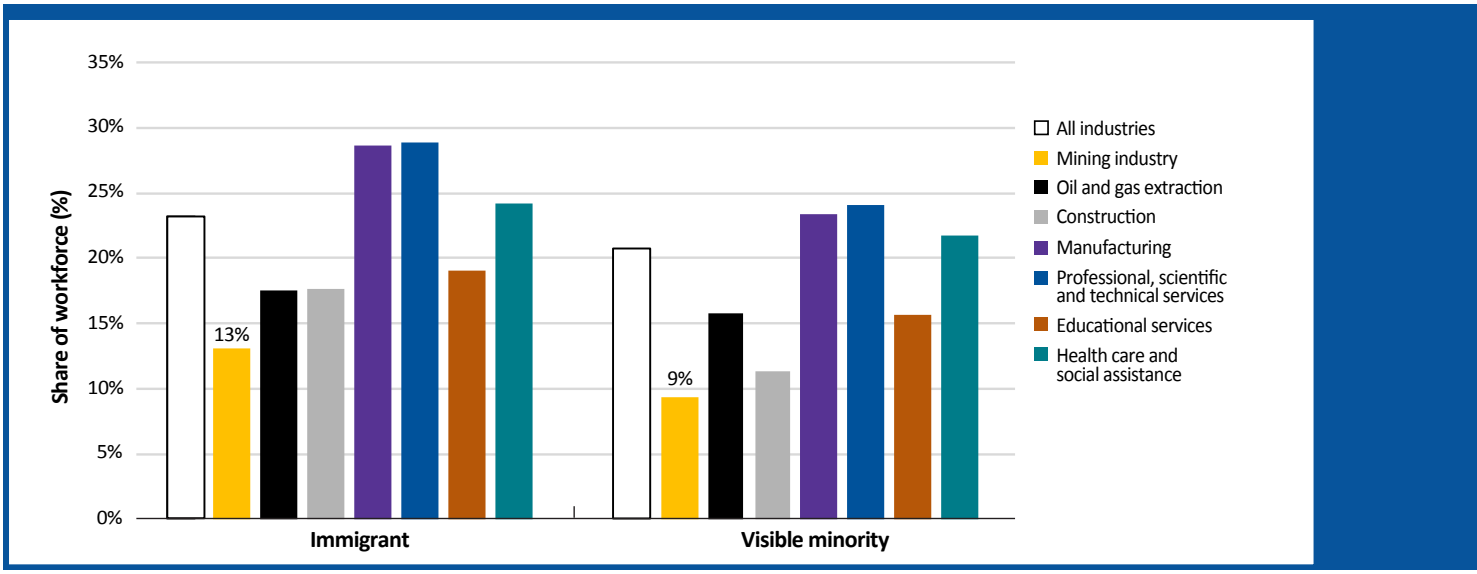
The representation of both immigrants and visible minorities in the mining industry workforce in 2016 was the lowest among industries shown in Figure 19, at 13% and 9% respectively. The representation of immigrants and visible minorities in Canada's workforce, 23% and 21% respectively, far exceeded that in the mining industry. Likewise, industries that share a similar labour pool (e.g., oil and gas extraction and construction) had a higher representation of immigrants and visible minorities than the mining industry.

There are geographical challenges that the mining industry faces in recruiting immigrants and visible minorities. Most immigrants and visible minorities in Canada live in larger metropolitan areas while mine operations are predominantly located in remote areas. As a result, employers are often challenged to find those willing to travel long distances on a regular basis or relocate to secure employment. Canada's mining industry can bolster its labour supply by improving its recruitment of immigrants and visible minorities.

Immigrants and visible minorities each make up one-fifth of the country's workforce.

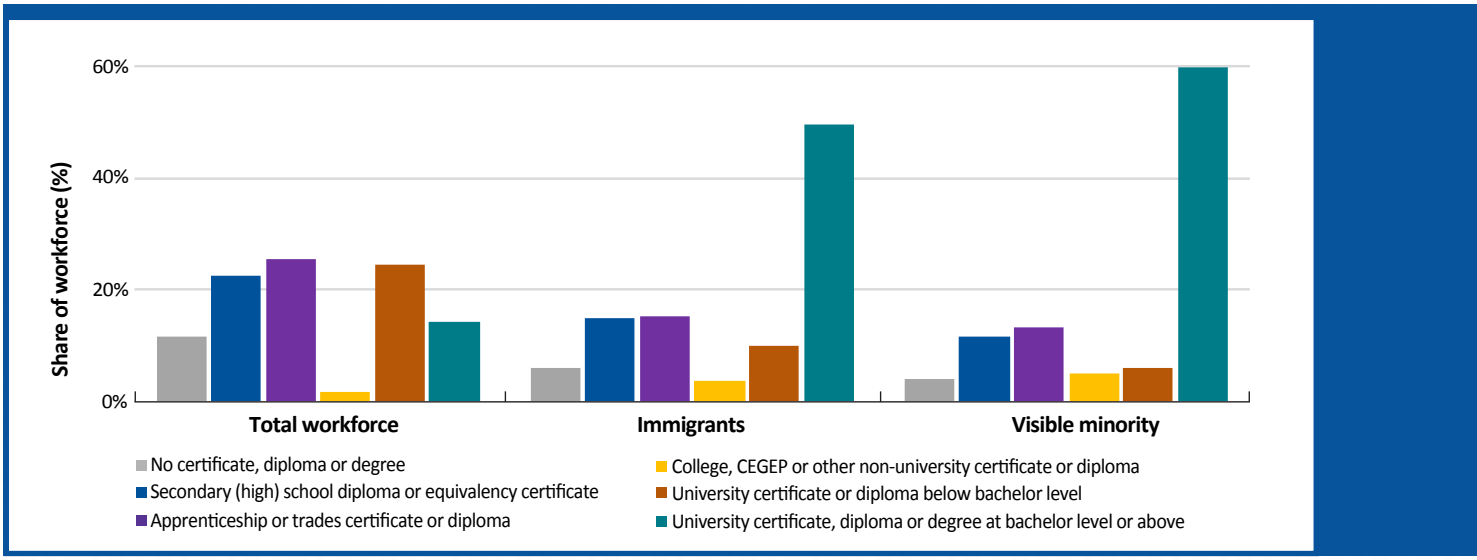
20 The *Employment Equity Act* defines visible minorities as "persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour."
21 Statistics Canada, "Immigration and ethnocultural diversity: Key results from the 2016 Census," *The Daily* (Oct. 25, 2017), https://www150.statcan.gc.ca/n1/daily-quotidien/171025/dq171025b-eng.htm

FIGURE 19: Representation of Immigrants and Visible Minorities in the Workforce, Mining Industry and All Industries (2016)



Source: Mining Industry Human Resources Council, Statistics Canada (2016 Census), 2019

FIGURE 20: Educational Profile of Mining and Quarrying Workforce, Immigrants and Visible Minorities (2016)



Source: Mining Industry Human Resources Council, Statistics Canada (2016 Census), 2019

Diversity

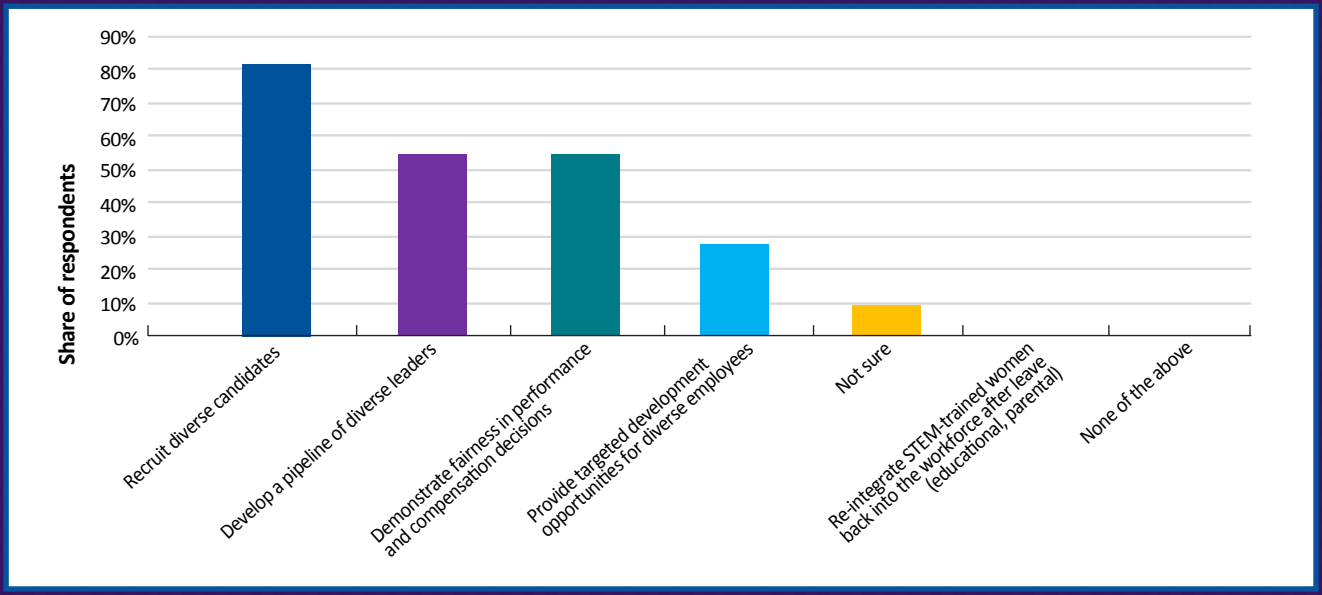
The 2019 National Employer LMI Survey asked employers to indicate the types of programs their organization has in place to support employee diversity.

- Eighty-two percent stated they have a program for recruiting diverse candidates.
- About half stated they have a program to develop a "pipeline of diverse leaders."

The survey asked employers to indicate the focus of their diversity awareness training programs.

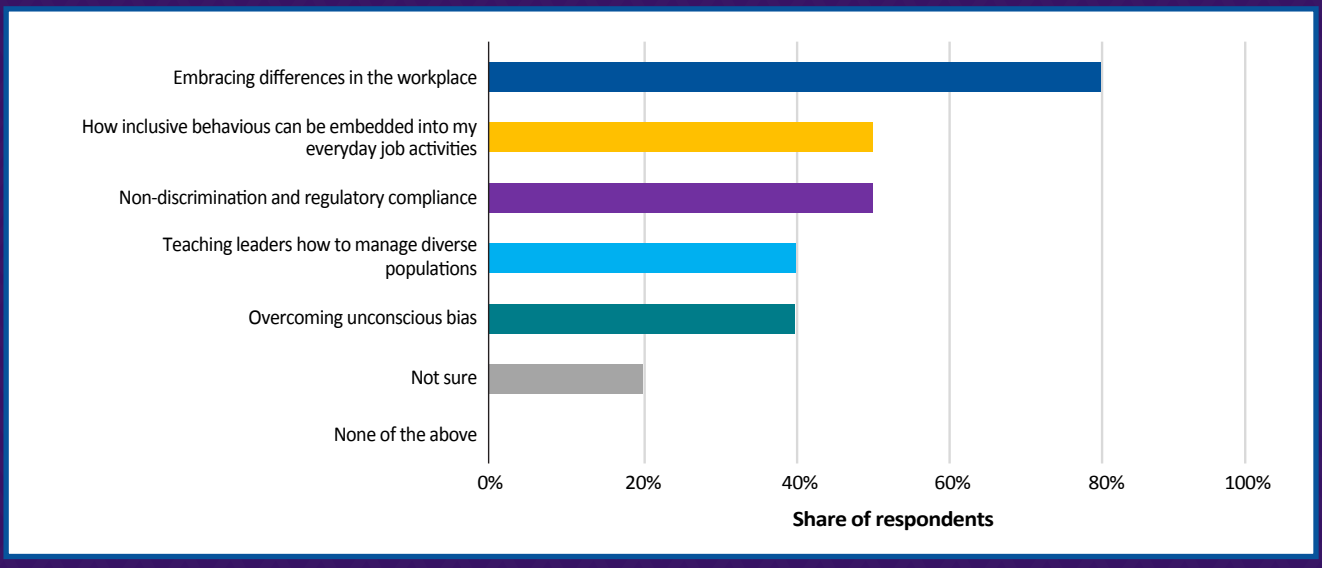
- Eighty percent stated their training program focuses on "embracing differences in the workplace."

FIGURE 21: MiHR's 2019 National Employer LMI Survey: "My organization has programs in place to…"



Source: Mining Industry Human Resources Council (2019 National Employer LMI Survey)

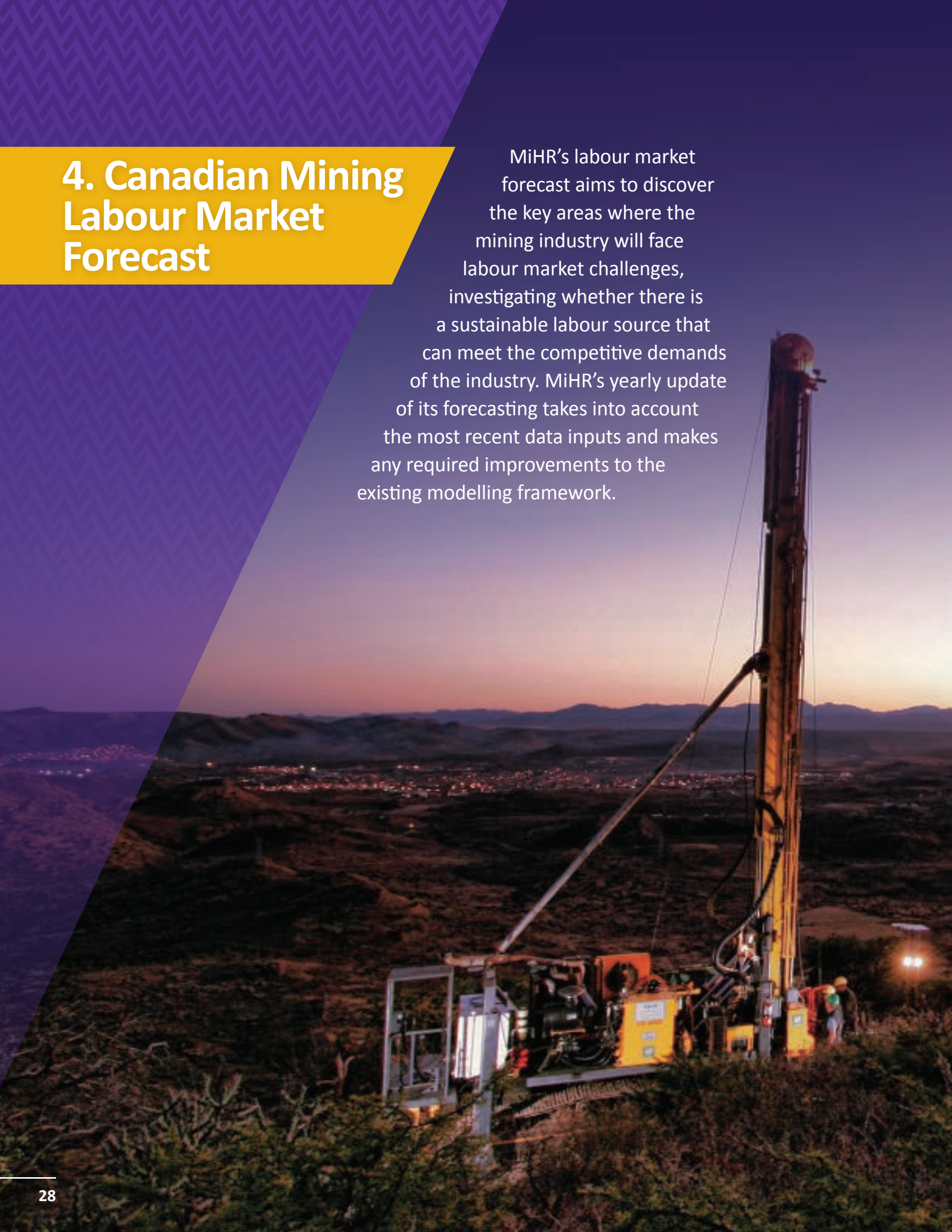
FIGURE 22: MiHR's 2019 National Employer LMI Survey: "My organization offers training programs that focus on …"



Source: Mining Industry Human Resources Council (2019 National Employer LMI Survey)

4. Canadian Mining Labour Market Forecast

MiHR's labour market forecast aims to discover the key areas where the mining industry will face labour market challenges, investigating whether there is a sustainable labour source that can meet the competitive demands of the industry. MiHR's yearly update of its forecasting takes into account the most recent data inputs and makes any required improvements to the existing modelling framework.



MiHR's forecasting centers on three main research questions:

1. **What will be the mining industry's labour demand in the future?**

   MiHR's forecast of industry employment provides an estimate of the demand for labour in the mining industry (i.e., the optimal employment level) over the next decade (2020–2030).

2. **What workforce adjustments will be required to achieve the optimal level of industry employment?**

   The industry's employment level is sustained by ongoing recruitment efforts. MiHR's forecast of hiring requirements estimates the cumulative workforce adjustments that will be necessary to maintain the optimal level of employment over the next decade. This forecast considers the factors that drive recruitment decisions, namely: (1) the need to expand or contract due to changes in economic conditions, and (2) the need to replace workers who have exited the industry.

3. **How difficult will it be to meet the required workforce adjustments?**

   The industry's ability to meet its hiring requirements will depend on whether there is a sufficient number of new workers entering mining-related occupations. A healthy labour market will draw enough entrants to offset future hiring needs. MiHR's forecast of the available talent is an estimate of the number of entrants by broad occupational categories.

FUTURE DEMAND FOR MINING LABOUR

Central to MiHR's analysis of the mining labour market is a forecast of industry employment over a 10-year horizon. MiHR uses an econometric model to project changes in employment over the forecast period. This model takes into account the movements of relevant explanatory variables, such as mineral prices and exports, and observes their effects on employment. Future changes in employment over the next decade are then estimated using various leading forecasts and intelligence as key explanatory variables.

Three Employment Scenarios

MiHR uses three economic scenarios – contractionary, expansionary and baseline – to generate employment forecasts. These three scenarios capture the industry's underlying volatility relative to changes in the economy, and the potential impact of these changes on employment levels for the forecast period. Each forecast scenario represents the net workforce adjustment that will be required to meet the net change in employment.

MiHR's baseline scenario is the primary forecast and uses various data sources, including the World Bank, Conference Board of Canada and Statistics Canada, to inform current trends and forecasts for prices and other input variables.[22]

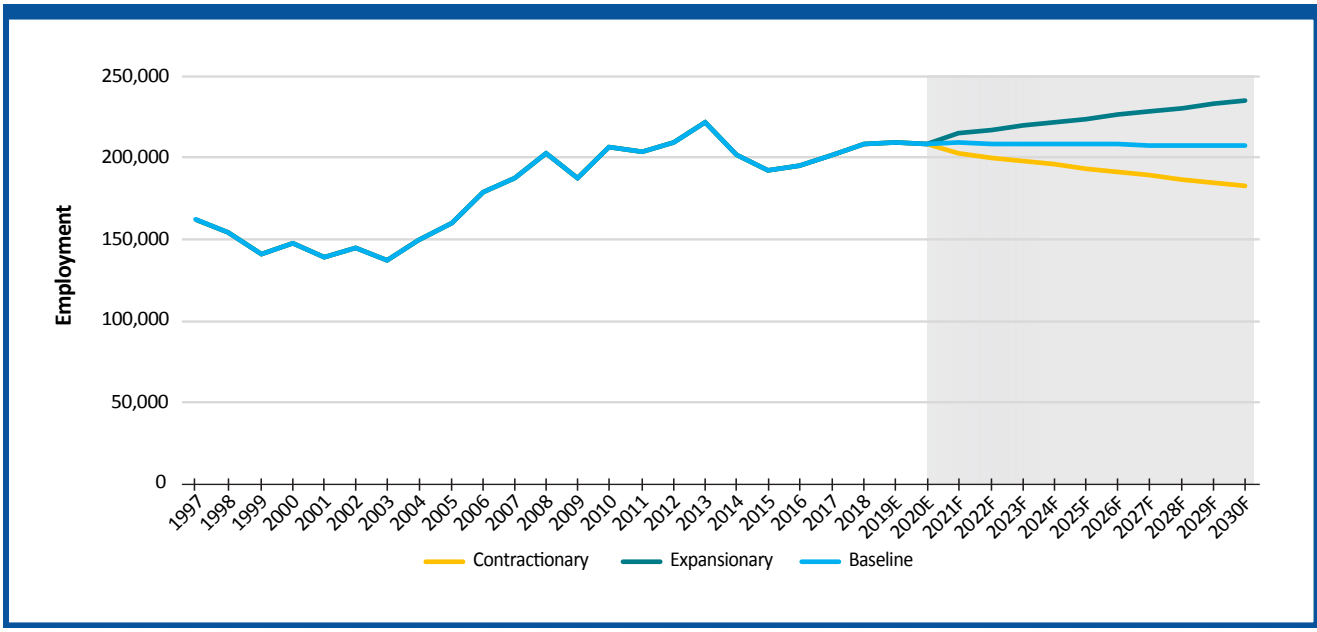
Mining Employment Outlook

Figure 23 illustrates the overall mining industry employment outlook for the three economic scenarios. The overall outlook is the summation of historical and forecasted employment of the mining sub-sectors. We expect the mining industry will need to employ about 208,680 workers in 2020, a slight contraction in employment of roughly 0.3% from 2019. Under the baseline scenario, total employment in the mining industry is projected to decrease very slightly over the next decade with employment falling to approximately 207,270 workers in 2030.

If the industry follows the expansionary scenario, employment in the mining industry is projected to increase to 235,020 workers by 2030. However, under a contractionary scenario, employment in the mining industry is projected to decrease to 182,730 workers by 2030.

22 MiHR selects a 10% confidence interval in baseline forecast results to estimate contractionary and expansionary scenarios.

FIGURE 23: Historical and Forecasted Employment in the Mining Industry (1997–2030)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts, 2016 Census), 2019

More on the Indicators Used in the Forecast

MiHR forecasts employment for each mining sub-sector using leading macroeconomic indicators for the mining industry, such as prices of base and precious metals, and imports and exports of crude metals and minerals in Canada.

This forecast, however, does not take into account the impact that new technologies will have on future employment, such as widespread adoption of autonomous trucks. Instead, the forecast assumes that the capital and occupational mix currently utilized in mining will remain the same in the next 10 years.[23]

Accordingly, our forecast represents the change in mining industry labour demand over the next 10 years resulting from macroeconomic events that alter the industry's overall production level.

Adjustments to MiHR's Forecasting Model

MiHR continually adjusts the forecasting model to ensure integrity, applicability and relevance of the analysis. In this year's forecast, readers may note that MiHR has made modifications to the econometric model used to forecast mining industry employment. These changes increased the accuracy of the forecast and provides a better estimate of the effects that changes in the economy have on mining employment. As a result, forecasts for the next decade have been updated.

23 MiHR's study, *The Changing Nature of Work in Mining: Impact on the Canadian Mining Workforce*, investigates the impact that new technologies will have on the mining workforce. The analysis integrates several lines of inquiry including an empirical analysis of occupations at-risk due to automation.

Cumulative Net Change in Employment by Mining Sub-Sector

Over 2020 to 2030, employment in extraction and milling will likely increase at a steady rate. However, we expect employment to decline significantly in primary metal manufacturing and modestly in support services and exploration (Figure 26).

Employment in the primary metal manufacturing sub-sector has been declining steadily in the past decade, from 62,805 employees in 2008 to 44,855 in 2018 – representing a net loss of 17,950 or 30% over the 10-year period.

MiHR forecasts that employment in this sub-sector will continue to decline gradually over the next decade, because of depressed commodity price forecasts and growing exports of Canadian raw minerals and metals. Employment is expected to decrease by 10% from 2020 to 2030, adding up to about 4,400 fewer jobs in the sub-sector over 10 years.

Labour Market Insights

MiHR's 2019 National Employer LMI Survey asked employers whether they anticipate a change in the size of their workforce over the next 12 months.

- Forty-six percent stated they expect their workforce will stay the same size.
- Thirty-six percent stated they anticipate their workforce will expand.

Innovation

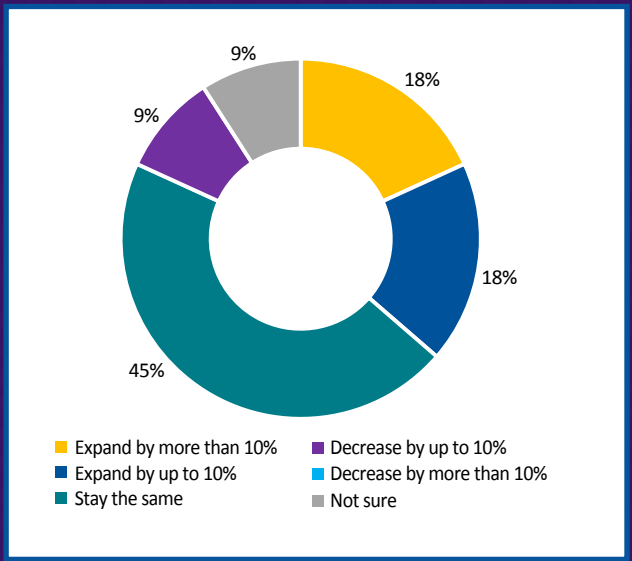
The 2019 National Employer LMI Survey asked employers whether their organization is considering the integration of "new innovative technologies" into their operations.

- Fifty-five percent stated they have already started integrating new innovative technologies.
- Twenty-seven percent stated they are planning to adopt new innovative technologies within five years.

The survey also asked employers whether the adoption of new technologies will impact the size of Canada's mining workforce.

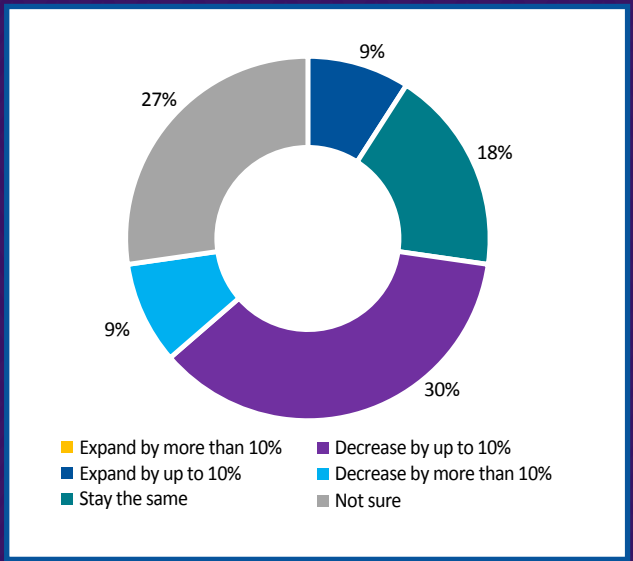
- Forty-six percent stated the adoption of new technologies will reduce the workforce.
- Twenty-seven percent indicated they are "not sure" how new technologies will affect the size of the workforce.

FIGURE 24: MiHR's 2019 National Employer LMI Survey: "Over the next 12 months do you anticipate your workforce will ..."



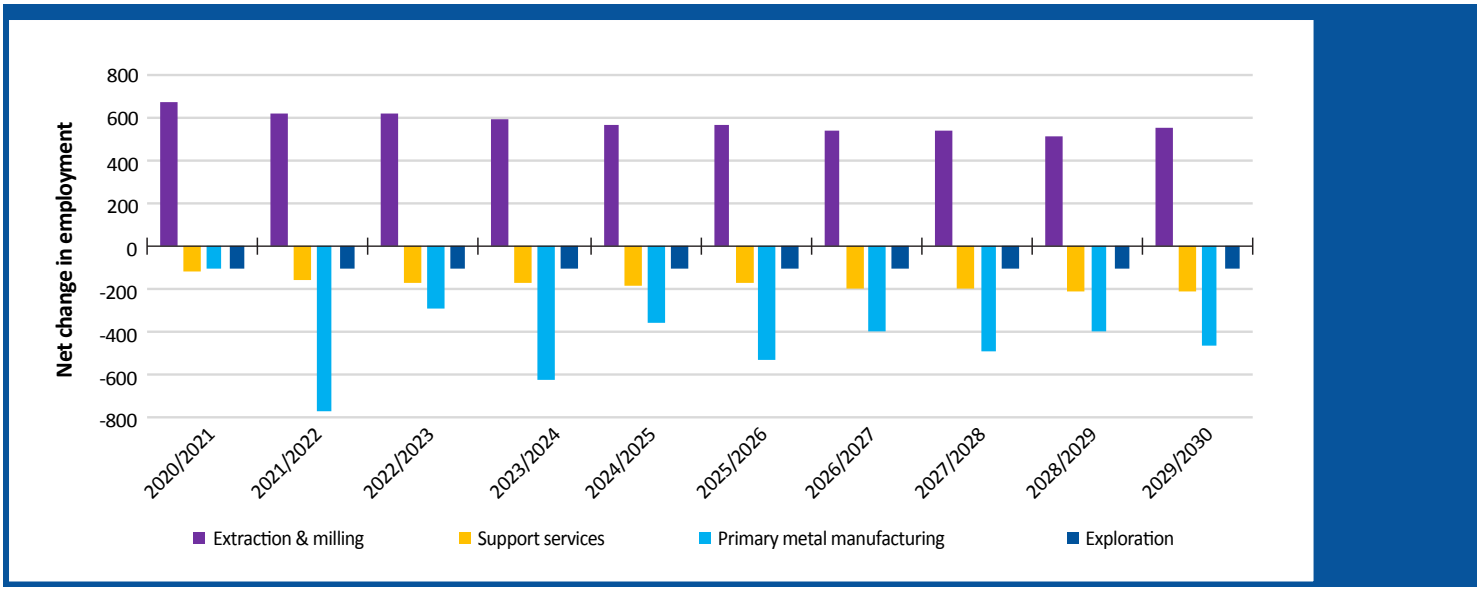
Source: Mining Industry Human Resources Council (2019 National Employer LMI Survey)

FIGURE 25: MiHR's 2019 National Employer LMI Survey: "What impact do you think the adoption of new technologies will have on the size of the Canadian mining industry's workforce?"



Source: Mining Industry Human Resources Council (2019 National Employer LMI Survey)

FIGURE 26: Annual Net Change in Mining Employment by Sub-sector, Baseline Scenario (2020–2030)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts, 2016 Census), 2019

Cumulative Net Change in Employment by Mining Occupation

Table 1 shows the forecasted net change in mining employment for each broad occupational category. Under the baseline scenario, overall employment in the industry is expected to contract by 1% (a loss of 1,410 workers) over the forecast period. Under the expansionary scenario, the industry's overall employment is expected to grow by 13% (an additional 26,330 workers). The contractionary scenario projects a 12% decline in employment (a loss of 25,940 workers).

Over the next decade, most of the demand is expected to be for workers in production occupations. The industry will need to employ 330 more people in this occupational category under the baseline scenario, and 6,410 more people under the expansionary scenario.

TABLE 1: Forecast Scenarios of Cumulative Net Change in Mining Employment by Broad Occupational Category (2020–2030)[24]

	Total Employed (2020)	Net Change in Employment (2020-2030)		
		Contractionary	Baseline	Expansionary
Human Resources and Financial Occupations	6,680	-730	50	930
Professional and Physical Sciences Occupations	17,770	-2,720	-140	2,870
Supervisors, Coordinators, and Superintendents	14,190	-1,530	90	1,910
Support Workers	9,160	-1,220	-100	1,160
Technical Occupations	13,630	-2,030	-170	2,000
Trades Occupations	22,980	-2,560	-100	2,630
Production Occupations	50,300	-5,130	330	6,410
Other Occupations[25]	73,970	-10,020	-1,370	8,420
All Occupations	**208,680**	**-25,940**	**-1,410**	**26,330**

Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts, 2016 Census), 2019

24 Forecast results have changed significantly from last year's report because of minor changes in the forecasting model and significant changes in forecasted prices. In addition, these numbers do not take into account the adoption of new technologies in mining that can change the industry's occupational mix.

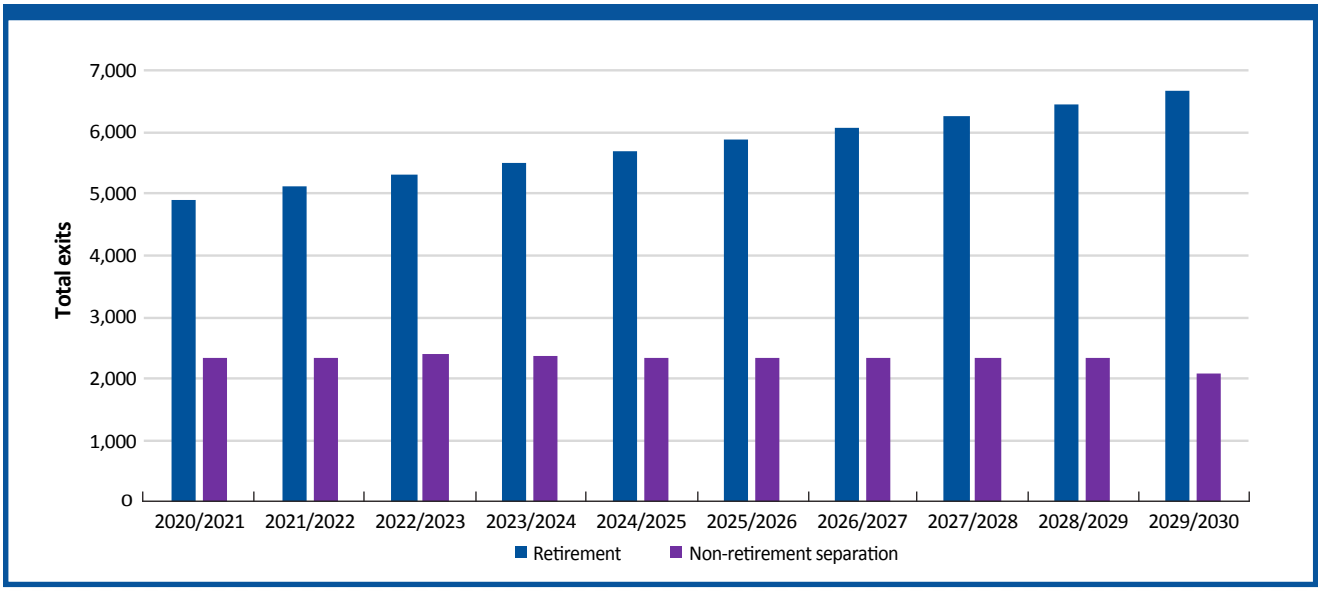
25 *Other Occupations* refers to a group of 4-digit NOC code occupations that are not exclusive to mining operations (e.g., registered nurses, light duty cleaners, security guards) and are not targeted in MiHR's analysis. Nonetheless, the mining industry has employees working in these occupations.

Retirements and Other Industry Exits

Employee exits are a common ongoing occurrence for all industries. Workers exit the mining labour force for various reasons, and MiHR's forecasting captures two main categories: (1) retirements and (2) non-retirement separations.[26]

Under the baseline scenario, retirements (4,890) will be more than twice that of non-retirement separations (2,340) in 2020-2021 (Figure 27). Retirements are expected to increase as the decade progresses, and reach roughly 6,660 in 2029-2030. Over the same period, non-retirement exits are predicted to remain relatively stable at a smaller share (2,080).

FIGURE 27: Forecast of Annual Workforce Exits from Mining Industry, Baseline Scenario (2020–2030)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts, 2016 Census), 2019

Labour Market Insights

The 2019 National Employer LMI Survey asked employers to indicate the number of turnovers at their company over the last 12 months and to rank the three main reasons for employees leaving their organization.

- There were 2,935 turnovers[27] over the last 12 months.
- Voluntary departure (personal reasons other than retirement) ranked as the primary reason for employee turnover.
- Non-voluntary turnover (lay-offs and terminations) ranked as the second main reason.
- Retirement ranked third.

Hiring Requirements

Employee exits create additional hiring pressures for employers looking to replace exiting workers, especially if the workers are leaving with valuable skills, training and industry experience. MiHR's forecast of hiring requirements gauges the effort required by the mining industry to attain the forecasted employment level (see Figure 23).

Table 2 displays the industry-wide hiring requirements for the forecast period of 2020 to 2030 for each of the three economic scenarios described earlier in this report. The projected 10-year cumulative hiring requirements are an estimated 79,680 new hires under the baseline scenario; 113,130 new hires under the expansionary scenario; and 49,880 new workers under the contractionary scenario. The majority of required new hires over the forecast period will go toward the replacement of industry exits.

26 Non-retirement separations refer to exits for reasons other than retirement, such as moving to another industry, moving out of the country, or dropping out of the labour force altogether.

27 This represents a turnover rate of about 12%.

TABLE 2: Cumulative Hiring Requirements by Forecast Scenario (2020–2030)

	Net Change in Employment	Replacement Requirements		Cumulative Hiring Requirements
		Retirement	Non-Retirement	
Contractionary	-25,940	54,020	21,800	49,880
Baseline	-1,410	57,830	23,260	79,680
Expansionary	26,330	61,960	24,840	113,130

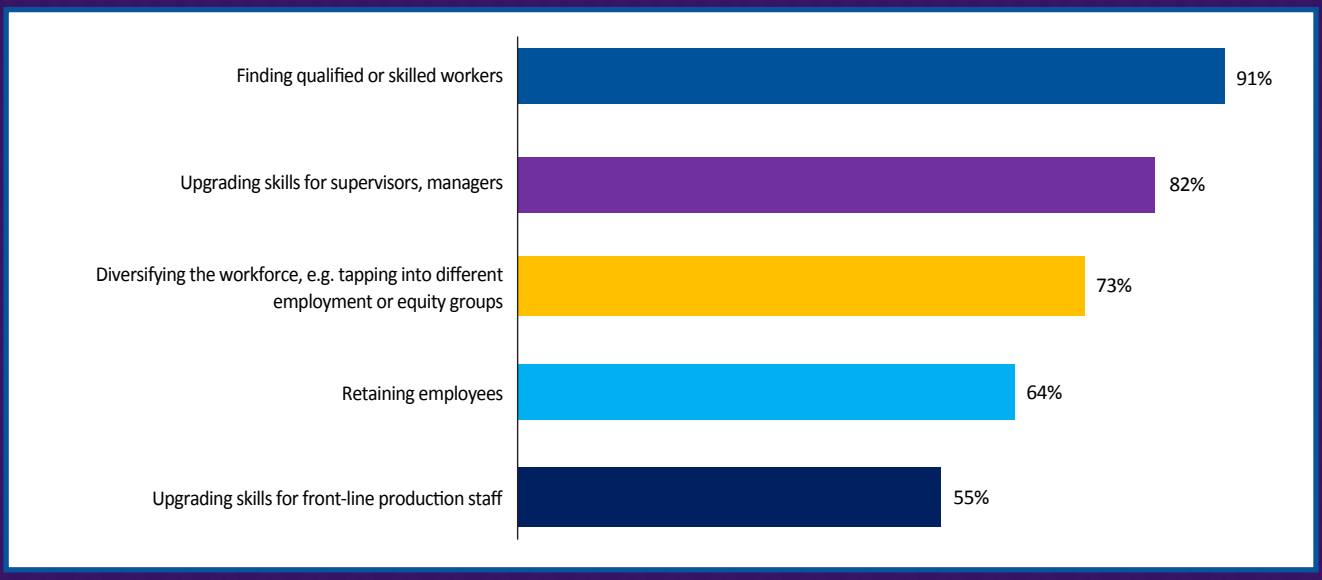
Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts, 2016 Census), 2019

Recruitment Challenges

The 2019 National Employer LMI Survey asked employers to identify the biggest challenges they anticipate in meeting their workforce requirements over the next five years.

- Ninety-one percent stated one of their biggest hiring challenges will be finding qualified or skilled workers.
- Eighty-two percent stated upgrading the skills of supervisors and managers will be one of their biggest challenges.
- Seventy-three percent cited significant challenges in attracting a more diversified workforce, 64% stated retaining employees, and 55% stated upgrading the skills of front-line production staff.

FIGURE 28: MiHR's 2019 National Employer LMI Survey: "Over the next five years, in your view, what do you anticipate to be your biggest challenge(s) in ensuring you have the workers you need to meet your business goals?"



Source: Mining Industry Human Resources Council (2019 National Employer LMI Survey)

FUTURE LABOUR SUPPLY AND HIRING CHALLENGES

The industry's capacity to secure reliable labour can vary by occupation. Various factors such as occupational training requirements and the timing of hiring can affect the level of effort and resources required to meet an occupation's imminent hiring needs. For example, it takes a considerable amount of time to improve the labour supply of mining engineers because prospective mining engineers require a four-year undergraduate degree and a professional engineering certificate; however, prospective mine labourers do not require specialized training and skills and thus the supply of their labour is more easily increased.

Entrants to mining-related occupations are essential to the industry's labour supply and its capacity to meet forecasted hiring requirements. A disruption that contributes to a shortfall of new entrants, such as declining enrollment in mining engineering programs,[28] points to potential risks for mining operations. A thin labour supply can derail projects, drive up the cost of finding workers, and ultimately undermine an operation's ability to remain competitive.

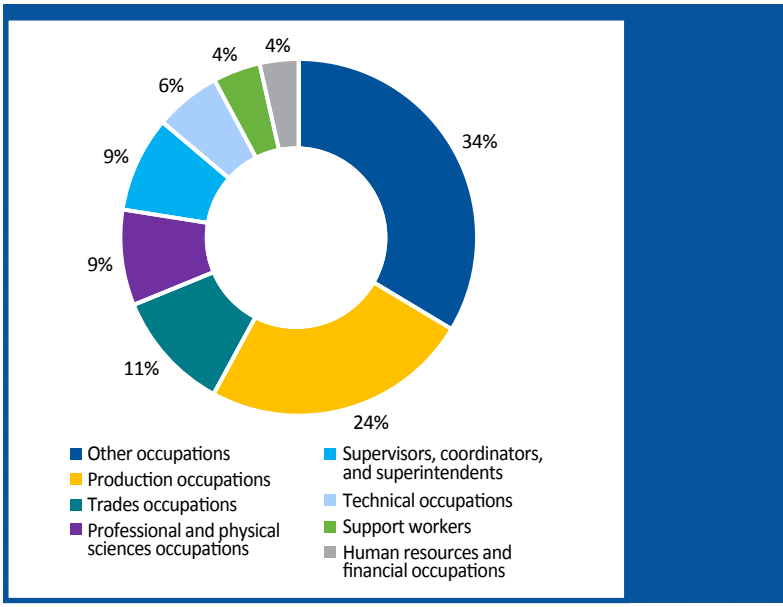
Mining Labour Supply Outlook

MiHR's forecast of available talent investigates whether new entrants to mining-related occupations can adequately offset future hiring needs. The forecast model captures new entrants from various entry points including school-to-work transitions, immigration, industry migration, and returning to the labour force after a temporary leave, among others.

For each of MiHR's broad occupational categories, the model first projects the total new entrants that all industries will compete for, and then predicts the proportion that the mining industry will successfully attract over the forecast period. This proportion varies among broad occupational categories, depending on how specific a broad occupational category is to the mining industry, and is based on historical patterns, taking into account other industries drawing from the same occupational pool. The model does not make any assumptions about future developments, such as the introduction of new training programs or changes to immigration policies.

Figure 29 depicts MiHR's 10-year forecast of new entrants to the mining industry by broad occupational categories. The 2020 to 2030 forecast predicts that about one-third (34%) of new entrants will likely be in other occupations. About one-quarter (24%) of new entrants will likely be in production occupations; 11% of new entrants are expected to be in trades occupations; and 9% of new entrants will likely be in the occupational category supervisors, coordinators, and superintendents.

FIGURE 29: Share of New Entrants to Mining by Broad Occupational Category (2020–2030)



Source: Mining Industry Human Resources Council, 2019

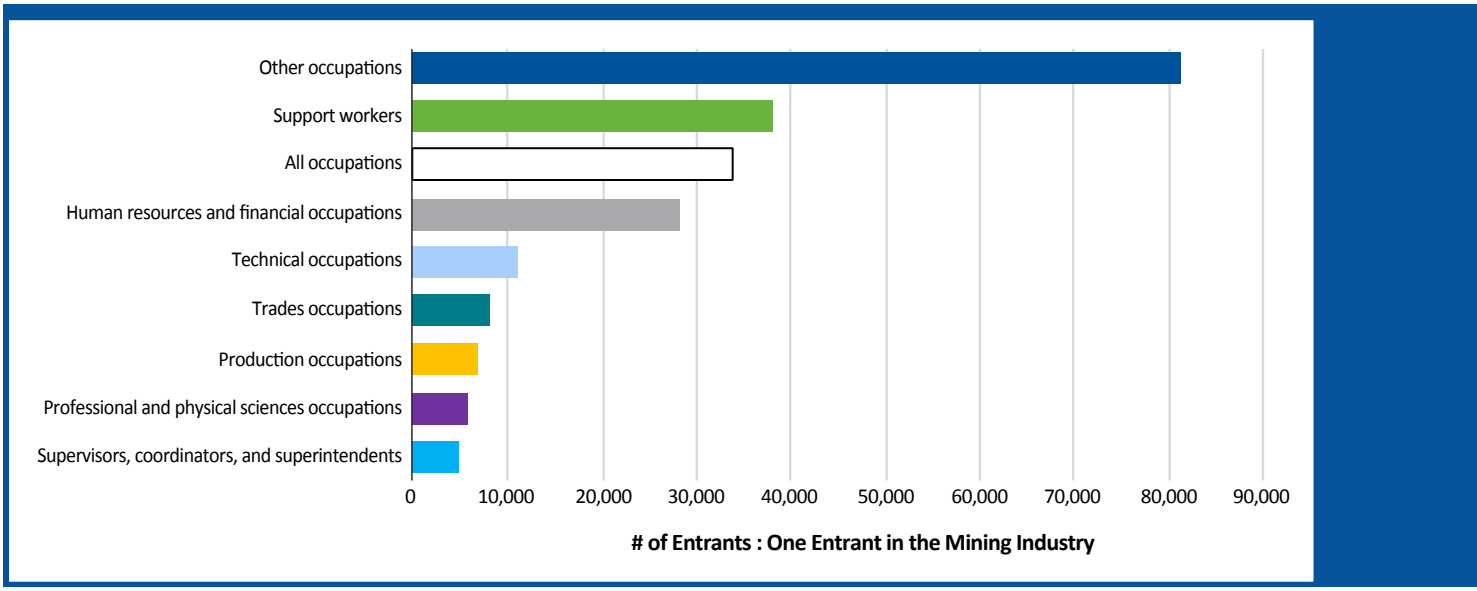
Sharing Talent with Other Industries

The mining industry competes with other industries for the same pool of talent.[29] Not all workers who pursue a mining-related occupation will actually enter the mining industry. For example, heavy equipment mechanics can also find work in the construction industry. As such, the industry's ability to attract talent can vary from one occupation to another.

MiHR gauges the mining industry's capacity to attract new entrants by estimating the talent "sharing ratio" for each broad occupational category. This ratio is expressed as the number of entrants across all industries that are required to attract one entrant to the mining industry. For instance, a sharing ratio of 10,000:1 means that for every 10,000 entrants across all industries, one entrant is likely to enter the mining industry.[30]

28 See MiHR, *Canadian Mining Labour Outlook 2019*
29 This pool refers to the 70 mining-related occupations considered in this report.
30 A sizable sharing ratio is less favorable for mining stakeholders looking to develop talent specific to the industry. Occupational development could prove inefficient and competition from other industries could erode the pool of new entrants.

FIGURE 30: Sharing Ratio of New Entrants with Other Industries by Broad Occupational Category (2016)



Source: Mining Industry Human Resources Council, 2019

The category other occupations has the highest sharing ratio (81,000:1) of new entrants (Figure 30), which is not surprising as this category comprises a diverse group of occupations that are also popular in other industries (e.g., accountants, office support workers, customer service representatives, cleaners). The category support workers has the second highest sharing ratio of new entrants (38,000:1). For the mining industry, successful recruitment of workers in occupations with a high sharing ratio will be challenging, requiring mining employers to compete with many employers across different industries, adding to hiring challenges.

The mining industry competes with other industries for the same pool of talent.

LABOUR MARKET PROJECTIONS AND HIRING GAPS

Central to MiHR's mining industry forecast is the hiring gap analysis, which is a result of the labour market projections and the forecasted labour demand and supply stated earlier in this section.

MiHR's hiring gap analysis takes into account two main factors that contribute to workforce adjustments in the mining industry: *net change in employment* and *exits*. The term *net change in employment* represents the difference between gross job gains and gross job losses within a specific time period. The term *exits* references workers who have left the industry through retirement, out-migration, or other avenues. A hiring gap exists when the industry's hiring needs meet or exceed the number of new entrants over the forecast period, indicating that the industry is likely to face a tight labour market if labour supply does not adapt to accommodate workforce adjustments.

As mentioned in Section 3, the mining industry regularly faces a tight labour market. The goal of MiHR's hiring gap analysis is to inform mining stakeholders of sub-sectors and occupations in the industry that are most at risk of facing a tight labour market.

Hiring Gaps

Table 3 consolidates the forecasted hiring requirements and available talent for mining sub-sectors under the baseline scenario. Over the forecast period, the extraction and milling sub-sector is the only sub-sector expected to face significant hiring gaps. The labour market may be tight for support services and exploration as the projected number of entrants is just enough to meet the hiring requirements for these sub-sectors. MiHR forecasts a slack labour market for primary metal manufacturing, which may result in higher unemployment and displaced workers competing for jobs in other sub-sectors and industries.

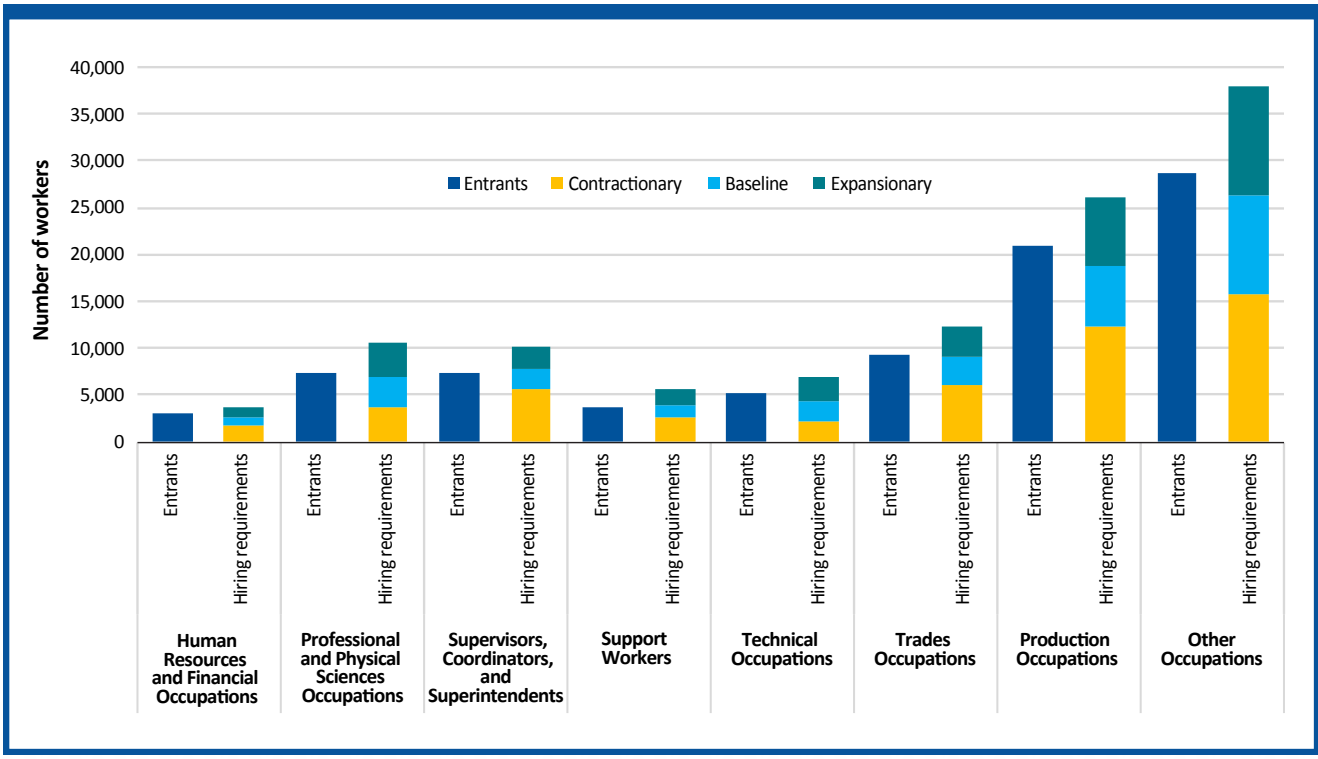
For broad occupational categories, a large gap between required new hires and cumulative new entrants indicates a greater risk of labour shortages. Projected hiring gaps are largest for two of the broad occupational categories: (1) supervisors, coordinators, and superintendents; and (2) support workers (Figure 31). In combination, these two occupational categories represent a gap of 610 workers in the next decade under a baseline scenario (Table 4). However, the extraction and milling sub-sector is projected to face hiring gaps in all broad occupational categories, with the largest talent shortages being a gap of 830 in trades occupations and 1,630 in other occupations.

TABLE 3: Forecasted Hiring Gaps in the Mining Industry by Sub-sector, Baseline Scenario (2020–2030)

	Extraction and Milling	Support Services	Primary Metal Manufacturing	Exploration	Mining Industry
Net Change in Employment	5,770	-1,770	-4,410	-1,010	-1,410
Exits	42,930	11,050	16,460	10,660	81,100
Total Hiring Requirements	48,700	9,280	12,050	9,650	79,690
Entrants	43,900	10,940	19,910	10,910	85,650
Hiring Gaps	**-4,800**	**1,660**	**7,860**	**1,260**	**5,960**

Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts, 2016 Census), 2019

FIGURE 31: Cumulative New Entrants versus Hiring Requirements by Broad Occupational Category (2020–2030)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts, 2016 Census), 2019

TABLE 4: Forecasted Hiring Gaps in the Mining Industry by Broad Occupational Category, Baseline Scenario (2020–2030)

	Hiring Gaps				
	Extraction and Milling	Support Services	Primary Metal Manufacturing	Exploration	Mining Industry
All Occupations	**-4,800**	**1,660**	**7,860**	**1,260**	**5,960**
Human Resources and Financial Occupations	0	100	210	60	370
Professional and Physical Sciences Occupations	-250	90	320	430	580
Supervisors, Coordinators, and Superintendents	-760	40	400	10	-310
Support Workers	-460	0	200	-40	-300
Technical Occupations	-80	110	420	360	810
Trades Occupations	-830	120	1,060	10	360
Production Occupations	-790	370	2,350	30	1,960
Other Occupations	-1,630	830	2,900	400	2,490

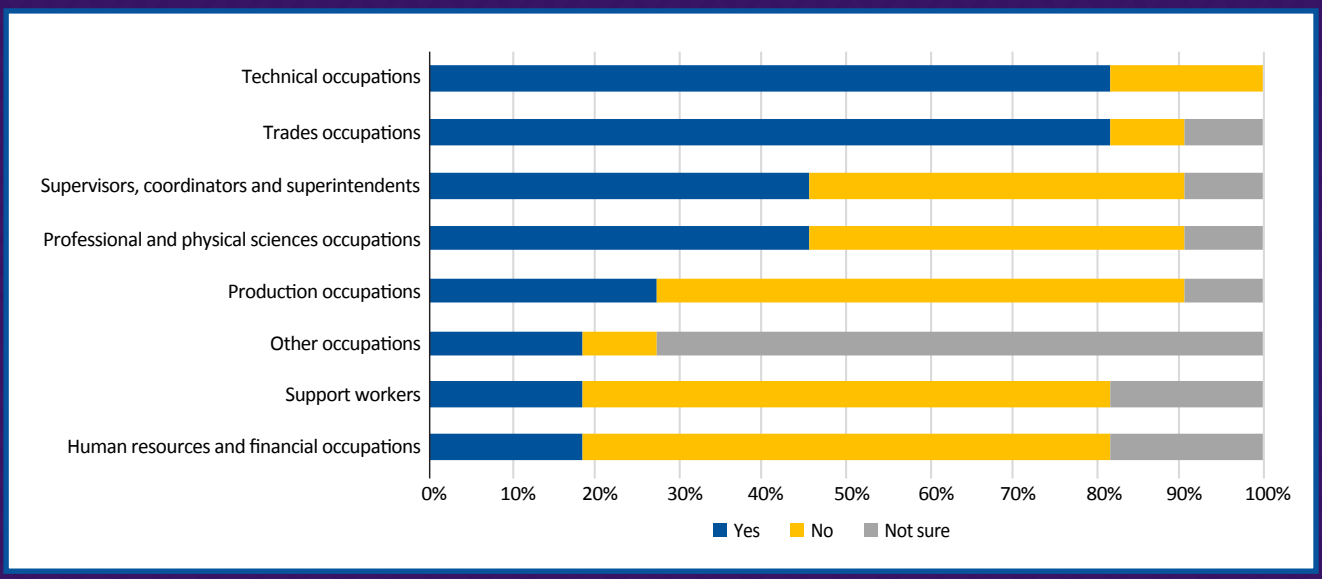
Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts, 2016 Census), 2019

Recruitment Challenges

The 2019 National Employer LMI Survey asked employers whether they had difficulty finding workers in specific occupational groups over the last 12 months.

- Over 80% stated their organization experienced difficulties in recruiting workers for jobs in trades occupations and technical occupations.
- About 45% found it difficult to recruit workers for jobs in professional and physical sciences occupations, and supervisors, coordinators and foremen occupations.

FIGURE 32: MiHR's 2019 National Employer LMI Survey: "For each of these occupational groups, please indicate if your organization has experienced any hiring difficulties over the past 12 months."



Source: Mining Industry Human Resources Council (2019 National Employer LMI Survey)

5. Skills and Qualifications in Mining

Work skills are the competencies needed to perform job-related tasks. For the purposes of this section of the analysis, work skills are analysed through the lens of skill-related keywords from online job postings, categorized as fundamental baseline skills and specialized skills. Fundamental skills describe the skills consistently requested in job ads across many industries and occupations. Communication skills, collaboration, problem solving, and computer literacy are examples of fundamental skills that employers may look for in a job candidate. Specialized skills are industry-specific and occupation-specific skills such as forklift operation, project management and welding.

Analyzing Work Skill Requirements

MiHR has acquired data on thousands of online job postings that describe the specific occupations, fundamental skills, and specialized skills that mining employers currently demand. The data are a report on the number of times certain keywords appear in online job postings. Online job posting data are delivered in real time and can be filtered by industry, experience level, occupation, region and skill category to create an in-depth analysis of labour demand in Canada's mining industry.

This section provides a unique window on the types of skills that are in high demand in the mining industry. Mining stakeholders can now identify the skills that employers across the mining industry most commonly request and use this information as a skills benchmark for individuals looking to enter the industry. For example, someone looking for a job in mining can use this analysis to identify skills they already have and skills they need to gain to be better qualified for the job. Individual employers also may use this analysis to understand how their skills requirements differ from the skills that most employers in the industry request.

Understanding "skills" in this section

Since the data on skills are retrieved from online job postings, the analysis does not rank or even reveal the skills that are essential for employment in a certain occupation. Rather, the data on skills are purely a reflection of what employers are requesting. For example, an employer may assume that a particular set of skills is understood to be a given (e.g., math skills for a geological engineer) and thus understates the skills; in another instance, an employer may ask for skills that are not necessary or essential for the job, but will differentiate candidates.

Furthermore, the analysis reports keywords quoted in job postings that relate to a group of skills, but it does not interpret the keywords (e.g., communication skills) retrieved from the data. That being the case, we ask readers to apply their own context and interpretation of these keywords for skills.

Globalisation, demographic shifts, rapid advancements in new technologies, and other pressures alter the skills that largely define a worker's occupation. As a result, a gap between these evolving demands and the supply of certain skills can exist across occupations.[31, 32] This section of the report aims to provide a better representation of the skills that mining employers are looking for in certain occupations, so that job seekers, training developers, education institutions, and others can better align their endeavours with industry requests.

The analysis focuses on three main occupational groups in the mining industry: (1) engineer occupations, (2) production occupations, and (3) trades occupations.[33] For each occupational group, it presents a breakdown and ranking of the most frequently cited fundamental and specialized skills over the past five years. The occupations that constitute these three occupational groups are shown in Appendix A, Table A-2.

The data on skills are purely a reflection of what employers are requesting.

31 John P. Martin (2018), *Skills for the 21st century: Findings and policy lessons from the OECD Survey of Adult Skills*, OECD Education Working Paper No. 166, page 9, http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=EDU/WKP(2018)2&docLanguage=En

32 Brookfield Institute for Innovation + Entrepreneurship (March 2018), *Understanding the Talent Gap: Lessons + Opportunities for Canada. A Discussion Paper*, https://brookfieldinstitute.ca/wp-content/uploads/BrookfieldInstitute_Understanding-the-Talent-Gap-1.pdf

33 *Trades occupations and production occupations* are both broad occupational categories. Engineer occupations are mostly contained under the broad occupational category Professional and Physical Sciences Occupations, but comprise all 4-digit NOCs tracked by MiHR that are associated with engineering (e.g., 0211 Engineering Managers, 2145 Petroleum engineers).

The Changing Nature of Work

Findings from MiHR's research initiative, *The Changing Nature of Work in Mining: Impact on the Canadian Mining Workforce*, show mixed responses from interviewees when asked which workplace skills in mining will change as a result of technological adoption and innovation. Many respondents pointed to the need to recruit technologically savvy, data-driven individuals who can understand, interpret and analyze data. Other respondents pointed to the need for well-rounded individuals who can work on teams, show leadership and communicate effectively. Either way, the respondents noted that the adoption of new technologies and innovations in mining will cause a fundamental shift in the skills required in the industry.

SKILLS FOR ENGINEER OCCUPATIONS IN MINING

Engineers play an integral role in mining as they are required to help design, plan and manage mine construction, operations, maintenance and closure. They are knowledgeable about different facets of engineering (e.g., mining, geological, civil, industrial, mechanical) and are skilled in project management. Moreover, employers increasingly need engineers who are skilled in research and written and oral communication.

Fundamental Skills

The most frequently cited fundamental skills in online job postings for engineer occupations in mining and quarrying from 2013 to 2018 were (1) communication skills, (2) planning, and (3) problem solving (Figure 34). In 2018, the most frequently cited fundamental skill was communication skills, which has held since 2013.

Employee Training and Development

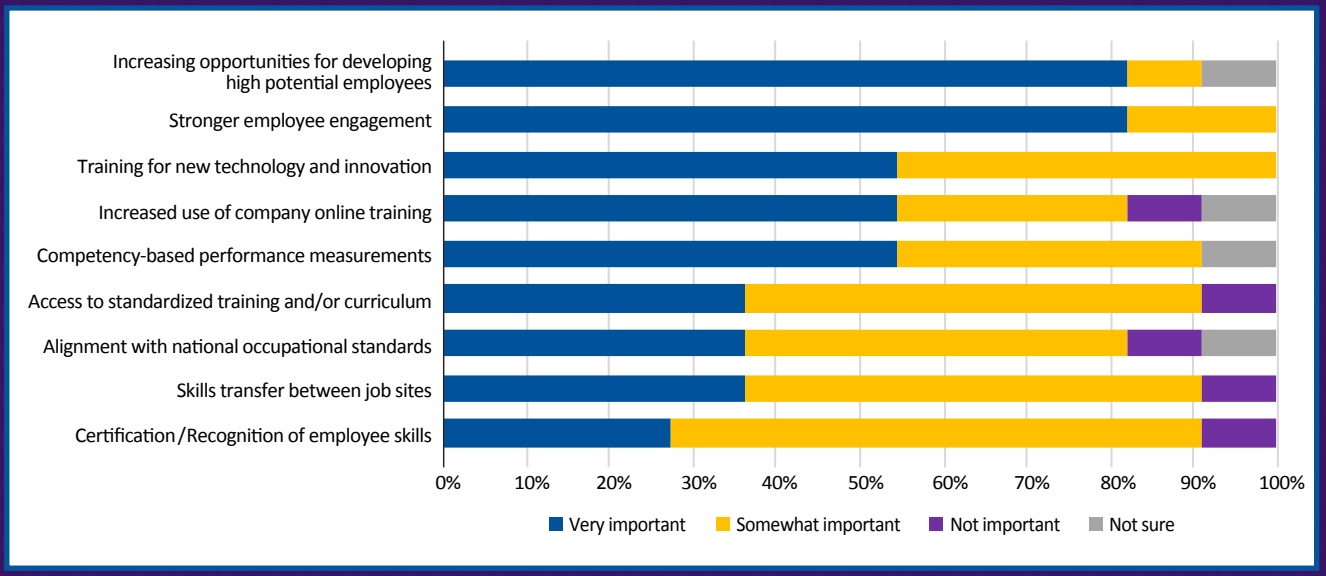
The 2019 National Employer LMI Survey asked employers whether their company's training budget per employee was increasing, decreasing, or staying about the same as in previous years.

- Seventy-three percent reported their current training budget as higher than in previous years.

The survey also asked employers to rank the importance of various training and development strategies.

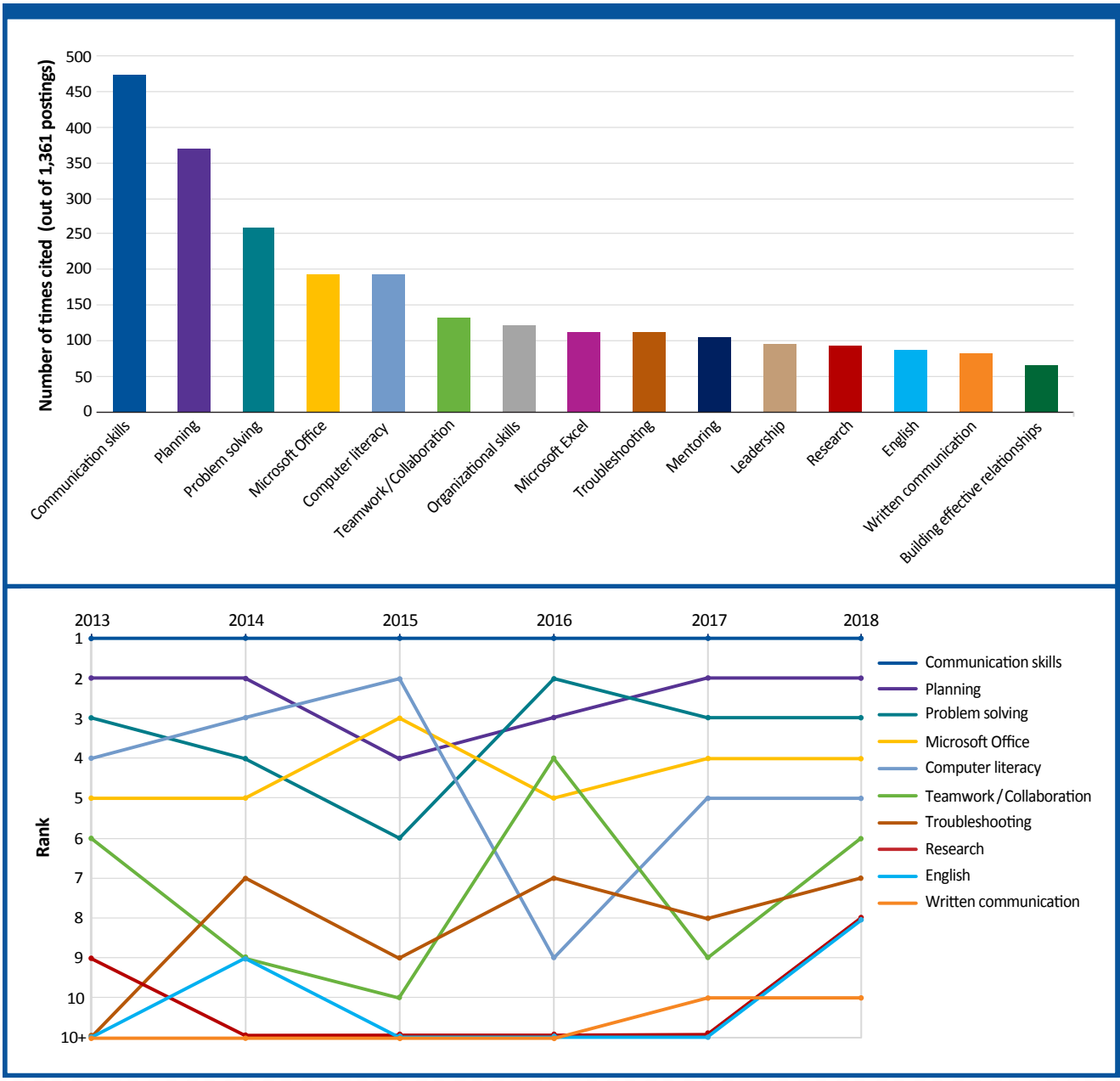
- Most stated two areas of training are particularly important: (1) increasing opportunities for developing high potential employees, and (2) stronger employee engagement.

FIGURE 33: MiHR's 2019 National Employer LMI Survey: "How important are the following to your organizations training and development strategy?"



Source: Mining Industry Human Resources Council (2019 National Employer LMI Survey)

FIGURE 34: Most Frequently Cited Fundamental Skills* in Online Job Postings Related to Engineer Occupations in Mining and Quarrying (2013–2018)



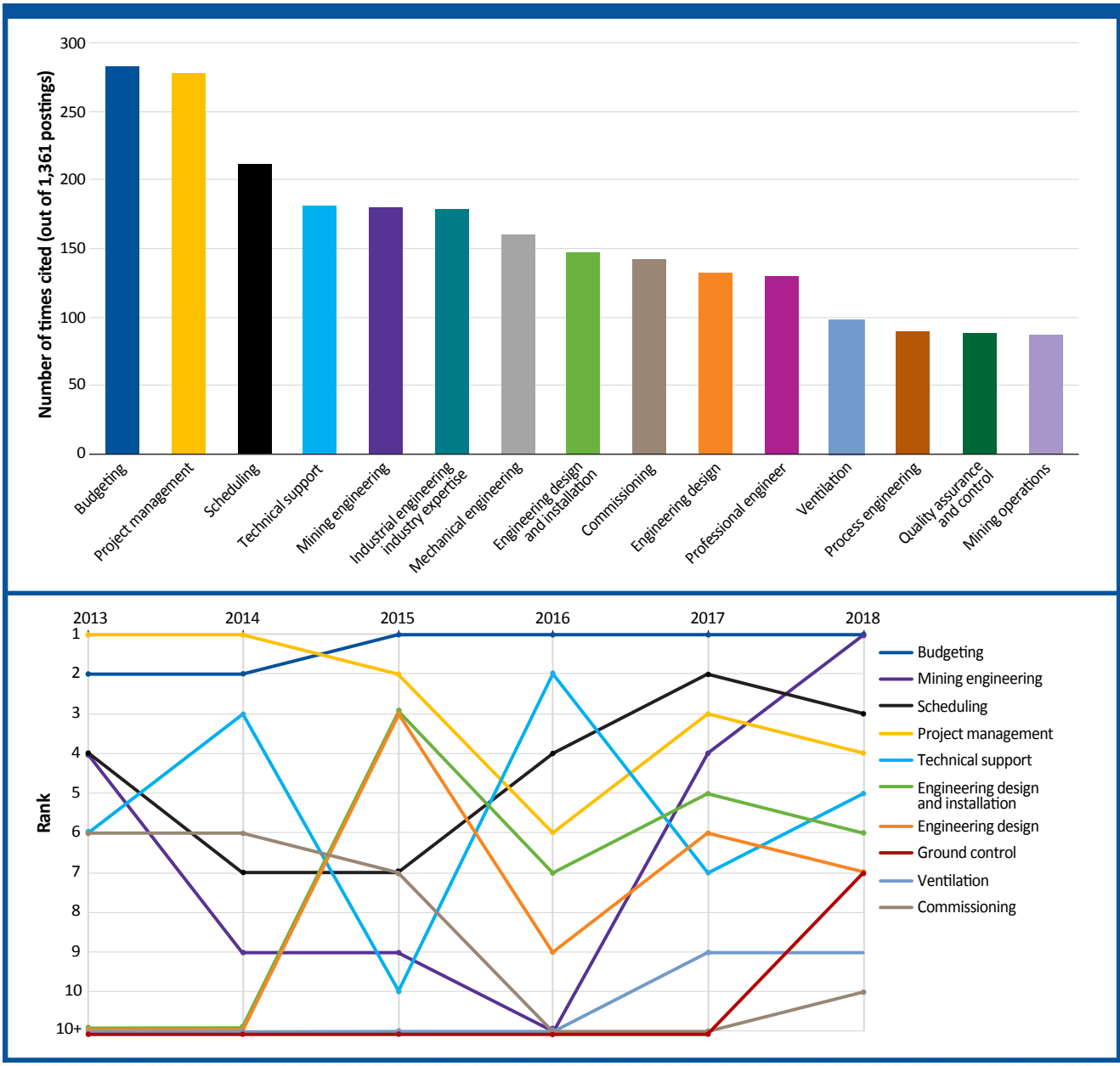
Source: Mining Industry Human Resources Council, Burning Glass Technologies, 2019

* Fundamental skills in this figure are keywords that appear in online job postings. See: *Understanding skills in this section*, page 41.

Specialized Skills

From 2013 to 2018, the most frequently cited specialized skills in online job postings for engineer occupations in mining and quarrying were (1) budgeting, (2) project management, and (3) scheduling. In 2018, the most frequently cited specialized skills for this occupational group were budgeting and mining engineering (Figure 35). Budgeting has been the most frequently cited skill since 2015 and was the second highest in the two previous years. In contrast, mining engineering has only recently surged as a specialized skill commonly requested by employers.

FIGURE 35: Most Frequently Cited Specialized Skills* in Online Job Postings Related to Engineer Occupations in Mining and Quarrying (2013–2018)



Source: Mining Industry Human Resources Council, Burning Glass Technologies, 2019

* Specialized skills in this figure are keywords that appear in online job postings. See: *Understanding "skills" in this section*, page 41.

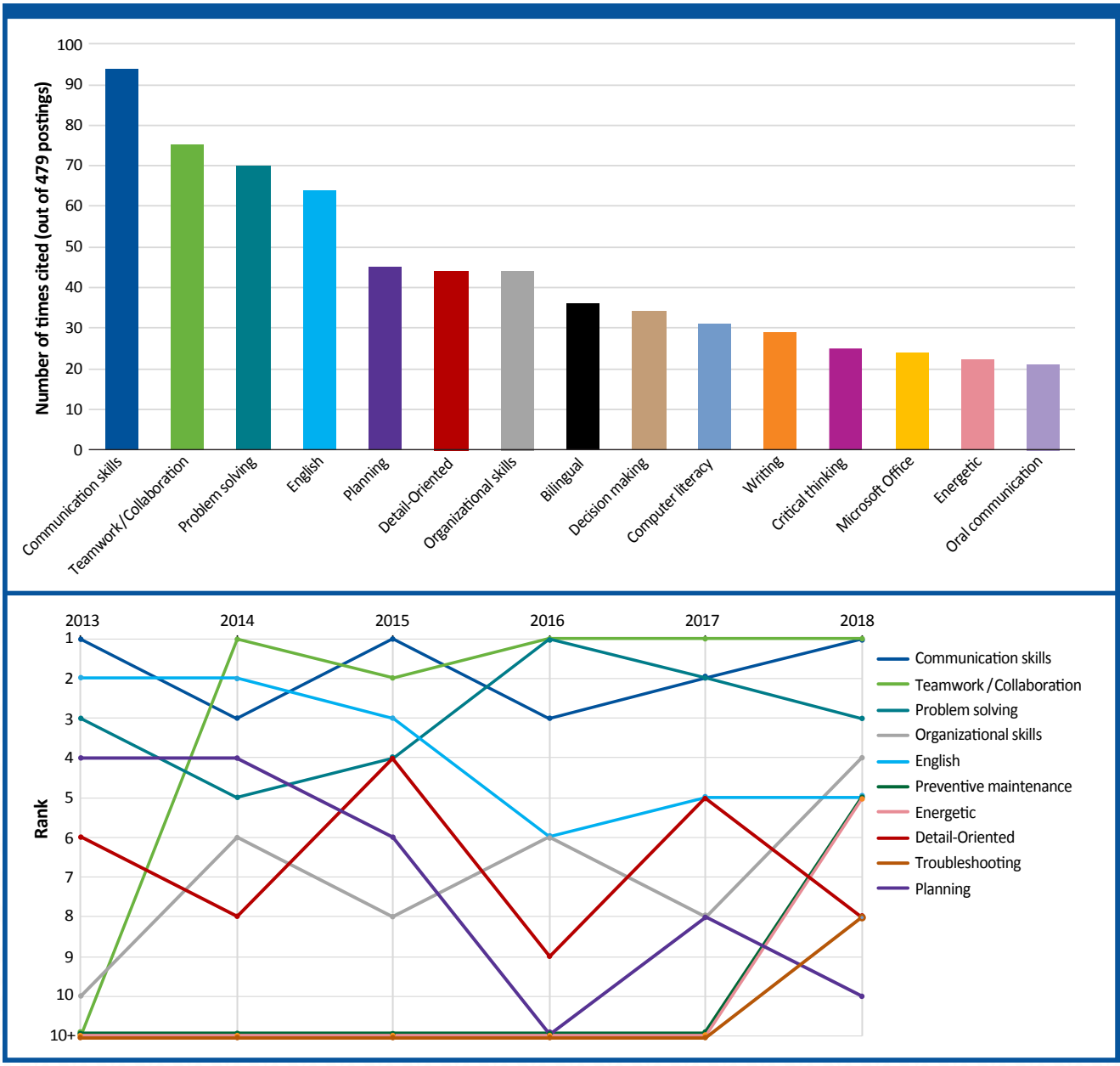
SKILLS FOR PRODUCTION OCCUPATIONS

Production occupations in mining are largely responsible for the physical extraction of the raw materials, so workers in these occupations need to be skilled in the operation of different types of heavy equipment. Employers are looking for candidates who are problem solvers, capable of adapting to new technologies and have computer literacy skills, and are able to repair equipment on the fly. Additionally, employers need people who can communicate effectively and work collaboratively on teams.

Fundamental Skills

From 2013 to 2018, the most frequently cited fundamental skills in online job postings related to production occupations in mining and quarrying were (1) communication skills, (2) teamwork/collaboration, and (3) problem solving (Figure 36). Interestingly, planning was the fourth most-cited fundamental skill win 2013, but gradually fell over the years to the tenth most-cited fundamental skill in 2018.

FIGURE 36: Most Frequently Cited Fundamental Skills* in Online Job Postings Related to Production Occupations in Mining and Quarrying (2013–2018)



Source: Mining Industry Human Resources Council, Burning Glass Technologies, 2019

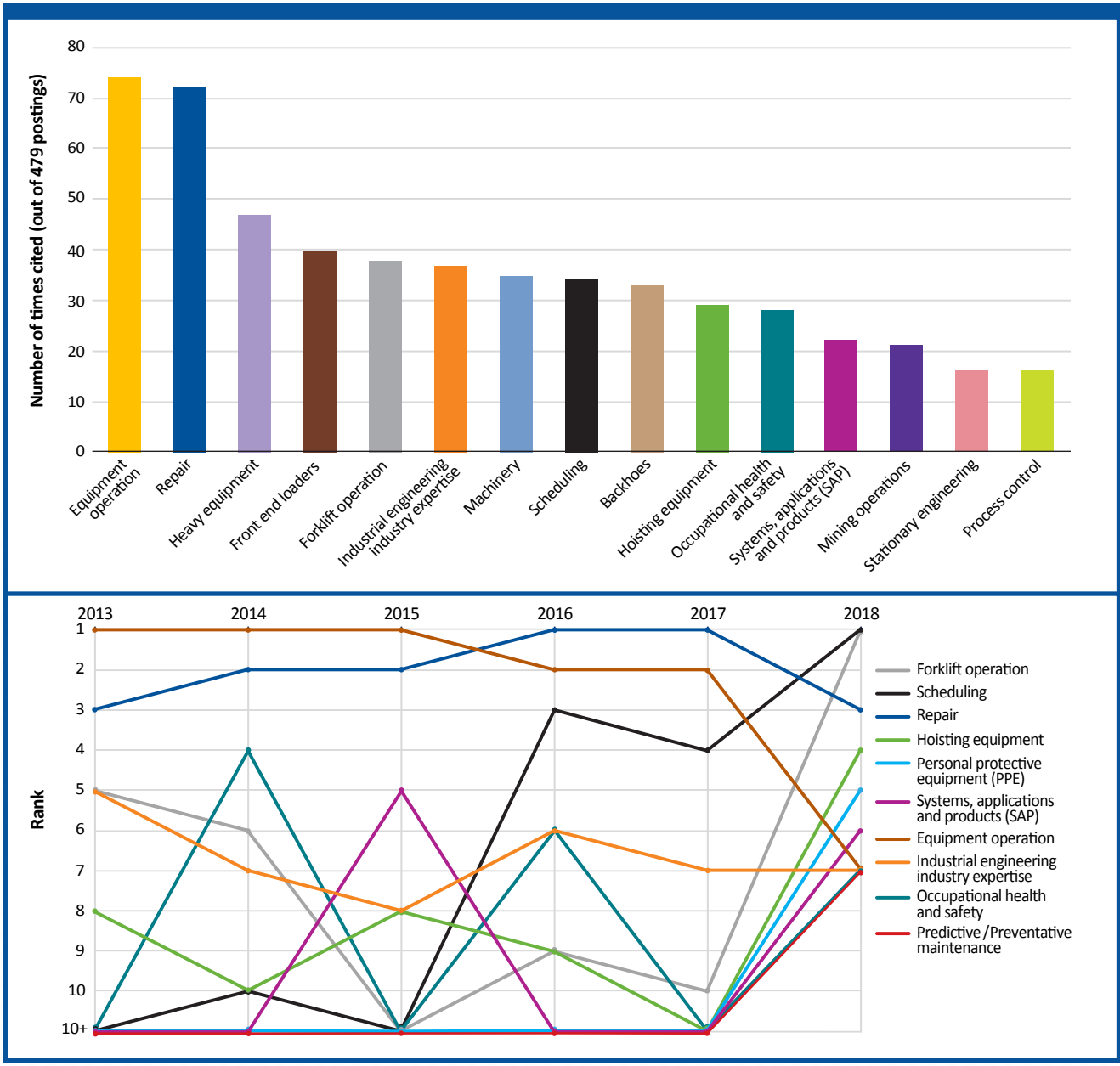
* Fundamental skills in this figure are keywords that appear in online job postings. See: *Understanding "skills" in this section*, page 41.

Specialized Skills

From 2013 to 2018, the most frequently cited specialized skills in online job postings related to production occupations in mining and quarrying were (1) equipment operation, (2) repair, and (3) heavy equipment. Additionally, the most frequently cited specialized skills in 2018 were scheduling and forklift operation. However, repair and equipment operation were the two most frequently cited specialized skills from 2013 to 2017 (Figure 37).

Scheduling and forklift operation were the two most frequently cited skills in 2018.

FIGURE 37: Most Frequently Cited Specialized Skills* in Online Job Postings Related to Production Occupations in Mining and Quarrying (2013–2018)



Source: Mining Industry Human Resources Council, Burning Glass Technologies, 2019

* Specialized skills in this figure are keywords that appear in online job postings. See: *Understanding "skills" in this section*, page 41.

NORCAT Simulation Training Centre

The NORCAT simulation training centre features a user-friendly training simulator where operators can sit in the driver's seat to gain experience working in a realistic, non-destructive environment. The simulators can be used to train workers on eight different pieces of equipment.

A simulated cab with all the instruments and controls that would be available on actual mining equipment is mounted on a motion platform surrounded by a 360-degree panoramic, high-resolution projection display with surround sound audio.

Engines, braking systems, drilling heads, hydraulics, and other sub-systems have been mathematically modelled to the manufacturer's specification in order to provide accurate feedback to the trainer and user. Situational analysis, operator vigilance and procedural knowledge are consistently tested throughout the training process. This ensures that operators who successfully complete the training are skilled, safe, and productive.

The two trainers at NORCAT were both lifelong miners before they moved into their current roles in simulation training. They have a combined 104 years of mining experience and are well versed in all aspects of operating equipment in open pit and underground mining environments.

FIGURE 38: NORCAT Simulator

Photo courtesy of NORCAT

The simulators can be used to train workers on eight different pieces of equipment.

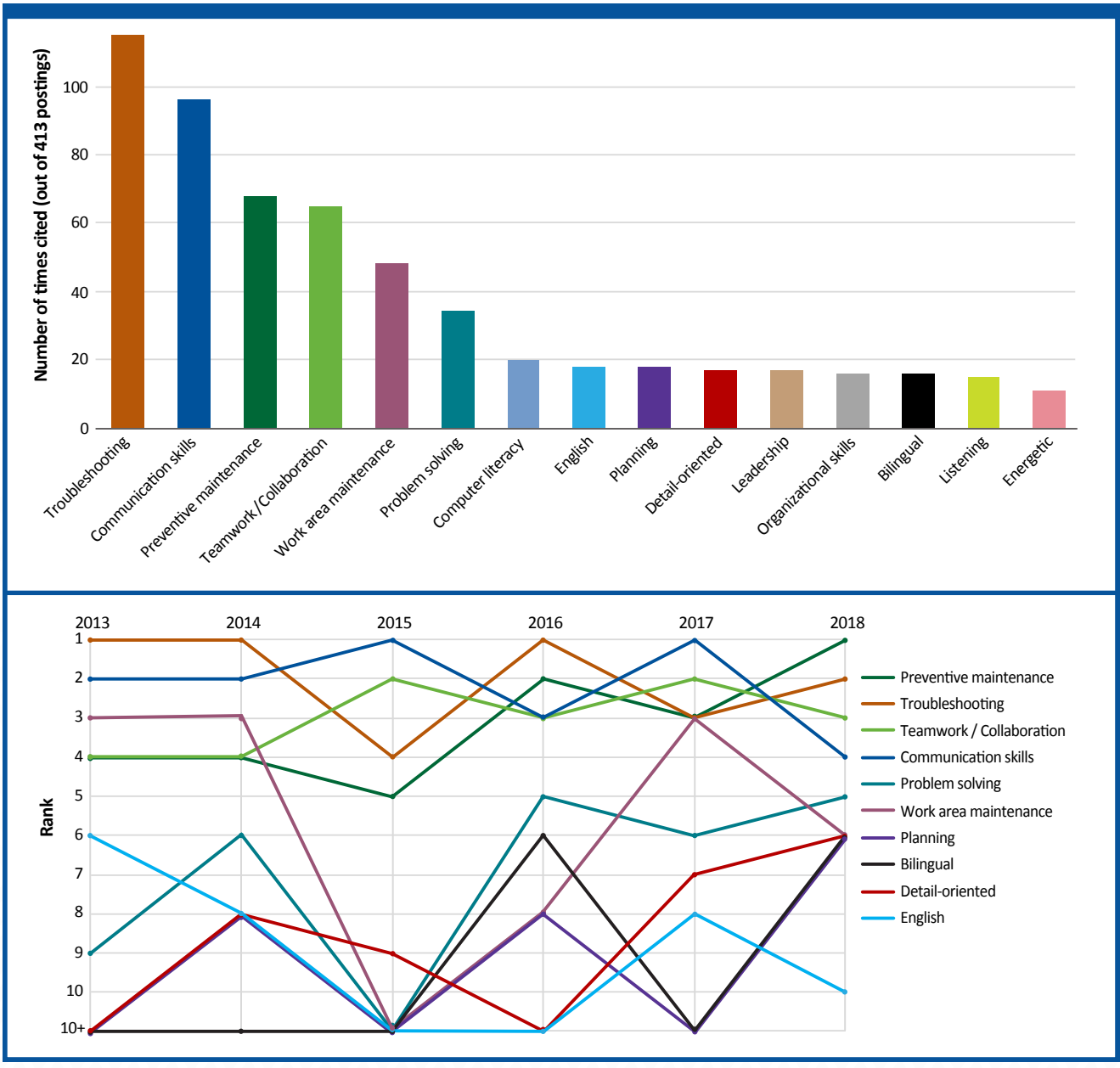
SKILLS FOR TRADES OCCUPATIONS

Being knowledgeable about the different types, uses, operation, and repair of mining equipment is essential to successful employment in mining trades occupations. Furthermore, employers want people who are proactive, organized, value preventative maintenance, and can troubleshoot issues with machinery and equipment.

Fundamental Skills

From 2013 to 2018, the most frequently cited fundamental skills in online job postings related to trades occupations in mining and quarrying were (1) troubleshooting, (2) communication skills, and (3) preventative maintenance. Additionally, the most cited fundamental skill in 2018 was preventative maintenance, and this skill has risen in importance over the past few years after being the fifth most frequently cited fundamental skill in 2015 (Figure 39).

FIGURE 39: Most Frequently Cited Fundamental Skills* in Online Job Postings Related to Trades Occupations in Mining and Quarrying (2013–2018)



Source: Mining Industry Human Resources Council, Burning Glass Technologies, 2019

* Fundamental skills in this figure are keywords that appear in online job postings. See: *Understanding "skills" in this section*, page 41.

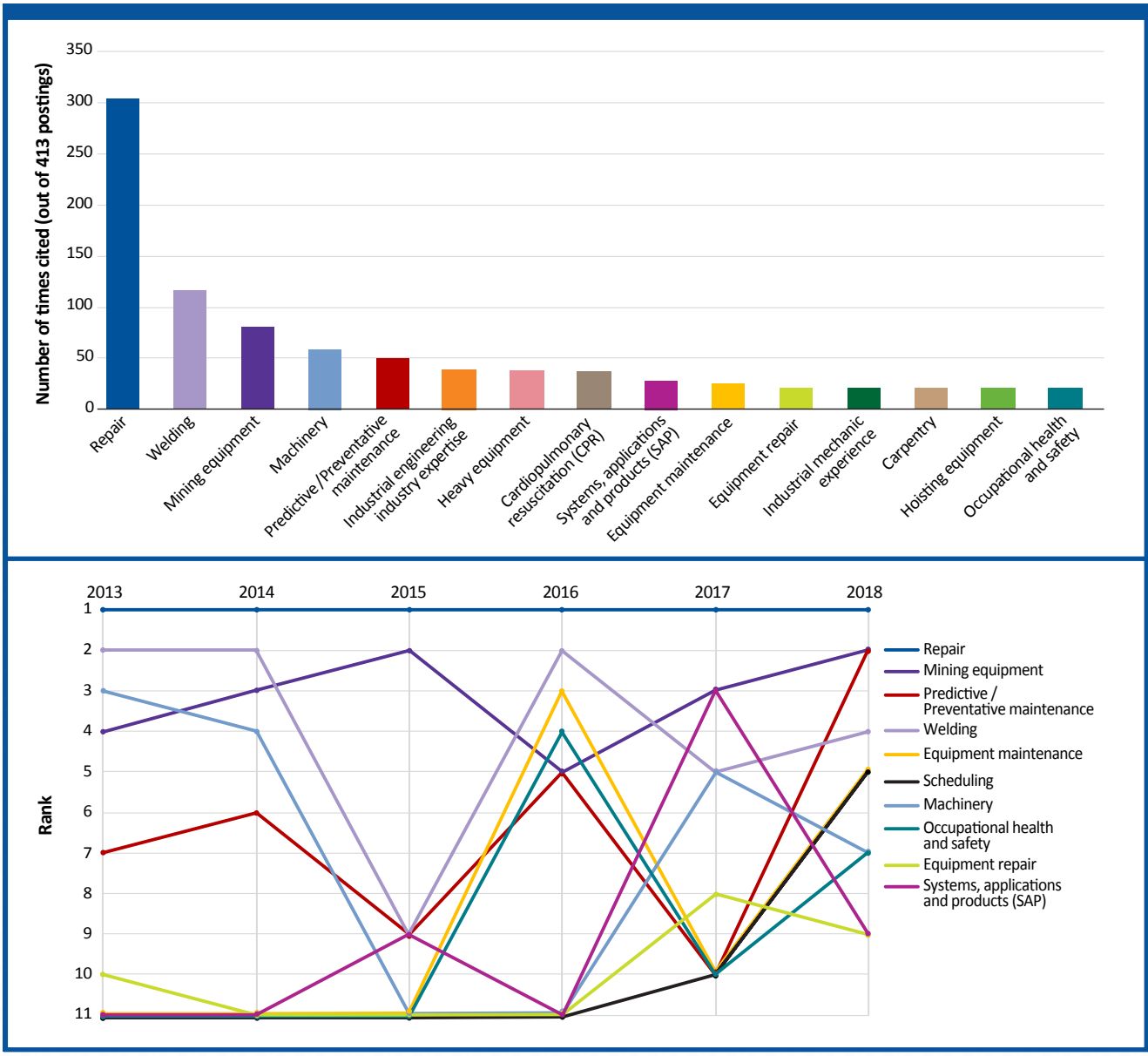
Specialized Skills

From 2013 to 2018, the most frequently cited specialized skills in online job postings related to trades occupations in mining and quarrying were (1) repair, (2) welding, and (3) mining equipment. Additionally, the most frequently cited specialized skill in 2018 was repair, which has held since 2013 (Figure 40).

Innovation's Effect on Equipment Maintenance

Many participants in MiHR's recent innovation research noted a change in the nature of maintenance work due to more complex control centers and automation, and that "continuous maintenance" will become an increasingly important component of mining operations. This will require recruiting digitally skilled and adaptable workers, or retraining existing workers. Instead of performing only mechanical repairs to equipment, workers will also have to maintain technologically sophisticated systems associated with the machines. Real-time information generated by the equipment can make it easier to troubleshoot problems, but requires a mechanic who can read and interpret data.

FIGURE 40: Most Frequently Cited Specialized Skills* in Online Job Postings Related to Trades Occupations in Mining and Quarrying (2013–2018)



Source: Mining Industry Human Resources Council, Burning Glass Technologies, 2019

* Specialized skills in this figure are keywords that appear in online job postings. See: *Understanding "skills" in this section*, page 41.

Final Thoughts

The most significant challenge facing Canada's mining industry is ensuring that the supply of labour is sufficient to meet demand throughout industry downturns and upswings.

Given that the industry is largely a price-taker in the international marketplace, growth cycles are mainly an outcome spurred on by external economic factors. These factors exert a strong influence on the industry's need for workers and cause significant changes in an employer's need to recruit and retain workers.

On the other hand, all mining stakeholders – employers, government, educators, and associations, among others – have a vested interest in managing the supply of labour, especially in the longer term. MiHR's key program areas will continue to focus on improving mining industry labour supply. Each area is designed to strengthen the industry's labour supply by creating opportunities for job seekers to match their skills with the needs of mining employers and for improving employers' ability to find and validate skilled job seekers in high demand occupations.

Other strategic efforts can also retain the talents of the existing and incoming labour supply for the industry, and increase participation among those not in the mining industry. Given the technical skills required to use advanced technologies, it is likely that the industry will need to draw more talent from other industries such as the informational technology industry. Collaborative programs aimed at increasing inclusion and diversity, mentorship from one generation to the next, and efficient collaboration between educators and employers are examples of efforts to enhance the supply of workers. Each of these efforts also aim to strengthen the labour supply's attachment to the mining industry, resulting in a robust pipeline of workers that is suited to withstand shifts in economic cycles and employer needs.

WHAT CAN MiHR'S LMI DO FOR YOU?

MiHR's research, analysis and forecasting strengthens understanding of mining labour market supply and demand. Custom LMI supplements research or workforce planning initiatives by providing analysis and forecasts that help identify organizational human resource trends. Regional level information identifies trends requiring internal and collaborative strategies to address.

Enhance your research and workforce planning initiatives through MiHR LMI, intelligence and regional insight. Contact us at research@mihr.ca

WE WANT TO HEAR FROM YOU!

If you have any feedback on this report, or suggestions for the 2021 report, **please fill out this survey**.

We look forward to hearing from you.

Sincerely,

The MiHR Team

Appendix A

INDUSTRY CLASSIFICATION

NAICS codes are used by statistical agencies throughout North America to describe economic and business activity at the industry level. The system features a production-oriented framework whereby assignment to a specific industry is based on primary activity, enabling the grouping together of establishments with similar activities. MiHR uses the following NAICS codes to define the mining industry:

Extraction and Milling

- **NAICS 2121 (Coal mining):** This industry group comprises establishments primarily engaged in mining bituminous coal, anthracite, and lignite by underground mining, as well as auger mining, strip mining, culm bank mining, and other surface mining.
- **NAICS 2122 (Metal ore mining):** This industry group comprises establishments primarily engaged in mining metallic minerals (ores). Also included are establishments engaged in ore dressing and beneficiating operations, whether performed at mills operated in conjunction with the mines served, or at mills, such as custom mills, operated separately.
- **NAICS 2123 (Non-metallic mineral mining and quarrying):** This industry group comprises establishments primarily engaged in mining or quarrying non-metallic minerals except coal. Primary preparation plants, such as those engaged in crushing, grinding and washing, are included.
- **NAICS 211114 (Non-conventional oil extraction):**[34] This industry group comprises establishments primarily engaged in producing crude oil from surface shales or tar sands, or from reservoirs in which the hydrocarbons are semisolids and conventional production methods are not possible.

Support Services

- **NAICS 21311B (Support activities for mining):** This industry group comprises establishments primarily engaged in providing support services, on a contract or fee basis, required for the mining and quarrying of minerals. Establishments engaged in the exploration for minerals are included. Exploration includes traditional prospecting methods such as taking ore samples and making geological observations at prospective sites. Note that this NAICS code combines NAICS codes 213117 (Contract drilling (except oil and gas)) and 213119 (Other support activities for mining).

Primary Metal Manufacturing

- **NAICS 3311 (Iron and steel mills and ferro-alloy manufacturing):** This industry group comprises establishments primarily engaged in smelting iron ore and steel scrap to produce pig iron in molten or solid form.
- **NAICS 3313 (Alumina and aluminum production and processing):** This industry group comprises establishments primarily engaged in extracting alumina.
- **NAICS 3314 (Non-ferrous metal (except aluminum) production and processing):** This industry group comprises establishments primarily engaged in smelting, refining, rolling, drawing, extruding and alloying non-ferrous metal (except aluminum).

Exploration

- **NAICS 5413 (Architectural, engineering and related services):** This industry group comprises establishments primarily engaged in providing architectural, engineering and related services, such as structure design, drafting, building inspection, landscape design, surveying and mapping, laboratory and on-site testing, and interior, industrial, graphic and other specialized design services. Note that only a portion of this NAICS code relates to geosciences, surveying and mapping, and assay laboratories. This NAICS code was included because many of these professionals are involved in mineral exploration activities but identify under NAICS 5413 instead of NAICS 211 or NAICS 213 (e.g. geoscientists and oceanographers).

34 Excluded in all analyses in this report except for forecasting (Section 4).

OCCUPATION CLASSIFICATION

Listed below are the 70 NOC codes MiHR uses to define the occupations considered important to Canada's mining industry. The occupation titles listed are those used in the Statistics Canada system.

TABLE A-1: List of National Occupational Classification (NOC) Codes

NOC Code	Title
Production Occupations	
8231	Underground production and development miners
7511	Transport truck drivers
7521	Heavy equipment operators (except crane)
8614	Mine labourers
7452	Material handlers
7611	Construction trades helpers and labourers
8411	Underground mine service and support workers
9411	Machine operators, mineral and metal processing
9231	Central control and process operators, mineral and metal processing
9611	Labourers in mineral and metal processing
7372	Drillers and blasters - Surface mining, quarrying and construction
7612	Other trades helpers and labourers
7371	Crane operators
9241	Power engineers and power systems operators
Trades Occupations	
7312	Heavy-duty equipment mechanics
7271	Carpenters
7251	Plumbers
7252	Steamfitters, pipefitters and sprinkler system installers
7311	Construction millwrights and industrial mechanics
7242	Industrial electricians
7237	Welders and related machine operators
Professional and Physical Sciences Occupations	
2132	Mechanical engineers
2133	Electrical and electronics engineers
2113	Geoscientists and oceanographers
2143	Mining engineers
2121	Biologists and related scientists
2131	Civil engineers
2148	Other professional engineers, n.e.c.
2144	Geological engineers
2134	Chemical engineers
2142	Metallurgical and materials engineers
2141	Industrial and manufacturing engineers

NOC Code	Title
2115	Other professional occupations in physical sciences
2112	Chemists
Human Resources and Financial Occupations	
1111	Financial auditors and accountants
0112	Human resources managers
1112	Financial and investment analysts
0111	Financial managers
1121	Human resources professionals
Support Workers	
2263	Inspectors in public and environmental health and occupational health and safety
1241	Administrative assistants
2261	Non-destructive testers and inspection technicians
6322	Cooks
1411	General office support workers
1525	Dispatchers
1523	Production logistics coordinators
9415	Inspectors and testers, mineral and metal processing
2262	Engineering inspectors and regulatory officers
1526	Transportation route and crew schedulers
2234	Construction estimators
Technical Occupations	
2253	Drafting technologists and technicians
2231	Civil engineering technologists and technicians
2212	Geological and mineral technologists and technicians
2241	Electrical and electronics engineering technologists and technicians
2154	Land surveyors
2243	Industrial instrument technicians and mechanics
2211	Chemical technologists and technicians
2254	Land survey technologists and technicians
2232	Mechanical engineering technologists and technicians
2171	Information systems analysts and consultants
2233	Industrial engineering and manufacturing technologists and technicians
2255	Technical occupations in geomatics and meteorology
2221	Biological technologists and technicians
Supervisors, Coordinators, and Foremen	
8221	Supervisors, mining and quarrying
0811	Managers in natural resources production and fishing
0711	Construction managers
7203	Contractors and supervisors, pipefitting trades
0211	Engineering managers
9211	Supervisors, mineral and metal processing
7301	Contractors and supervisors, mechanic trades

TABLE A-2: NOC Codes for Occupational Groups in Skills Analysis (Section 5)

NOC Code	Title	Share of online job postings in occupational group
Production Occupations		**100%**
8231	Underground production and development miners	23%
7521	Heavy equipment operators (except crane)	23%
7452	Material handlers	15%
7611	Construction trades helpers and labourers	11%
9241	Power engineers and power systems operators	8%
7511	Transport truck drivers	6%
7371	Crane operators	5%
7612	Other trades helpers and labourers	4%
8411	Underground mine service and support workers	3%
7372	Drillers and blasters - Surface mining, quarrying and construction	1%
Trades Occupations		**100%**
7312	Heavy-duty equipment mechanics	47%
7311	Construction millwrights and industrial mechanics	28%
7237	Welders and related machine operators	16%
7271	Carpenters	5%
7251	Plumbers	2%
7252	Steamfitters, pipefitters and sprinkler system installers	1%
Engineer Occupations		**100%**
2131	Civil engineers	21%
2132	Mechanical engineers	14%
2143	Mining engineers	13%
0211	Engineering managers	12%
2133	Electrical and electronics engineers	11%
2142	Metallurgical and materials engineers	8%
2148	Other professional engineers, n.e.c.	6%
2141	Industrial and manufacturing engineers	6%
2147	Computer engineers	4%
2134	Chemical engineers	4%

Appendix B

LIST OF MAIN DATA SOURCES

TABLE B-1: List of Main Data Sources Used in MiHR's Analyses

Data	Description
MiHR's Custom Cross-Tabulation (NHS/Census)	MiHR purchased this from Statistics Canada's National Household Survey (NHS)/Census for 2006, 2011 and 2016. It is aligned with MiHR's definition of the mining industry and covers a selected set of NAICS and NOC codes. It is used to describe the demographic characteristics of the mining labour force, as well as in the forecasting exercise.
MiHR's Custom Cross-Tabulation (LFS)	MiHR purchases this from Statistics Canada's Labour Force Survey (LFS) on an ongoing basis. It is aligned with MiHR's definition of the mining industry and covers a selected set of NAICS codes. It is used to describe the demographic characteristics of the mining labour force, as well as in the forecasting exercise.
Statistics Canada (LFS)	MiHR's research often turns to publically available LFS data for information regarding labour force trends in a particular region (e.g., unemployment and part-time employment, among other characteristics of the labour force). These are often reported for broader NAICS codes than MiHR's custom cross-tabulation (for example, they provide data for NAICS 21 instead of the three-digit NAICS 212).
Other Statistics Canada Products	MiHR often also relies on other public information from Statistics Canada: Among these are the System of National Accounts, Canadian Business Patterns, Survey of Employment Payroll and Hours, and the Job Vacancy and Wages Survey.
NRCan	Natural Resources Canada (NRCan) provides information on several mining-related topics including exploration spending and the value and type of minerals that are produced in Canada. NRCan also has a list of mining projects by type (e.g., producing mines, exploration and advanced development projects by region).
Industry Canada	Industry Canada provides useful information on mineral exports, exporting regions and other industry-specific variables.
World Bank	MiHR commonly uses the historical and forecasted mineral prices as a key input in its forecasting model. The World Bank updates its outlook for several commodities on a quarterly basis.
Burning Glass Technologies	Burning Glass Technologies' innovative data product amalgamates data from thousands of online job-postings into one intelligible platform. Burning Glass generates the data by calculating the number of times certain keywords appear in online job postings, using web crawling technology to describe the specific occupations, fundamental skills, and specialized skills that are currently demanded by employers.

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