



Canadian Mining Labour Market Outlook

2017



Canada

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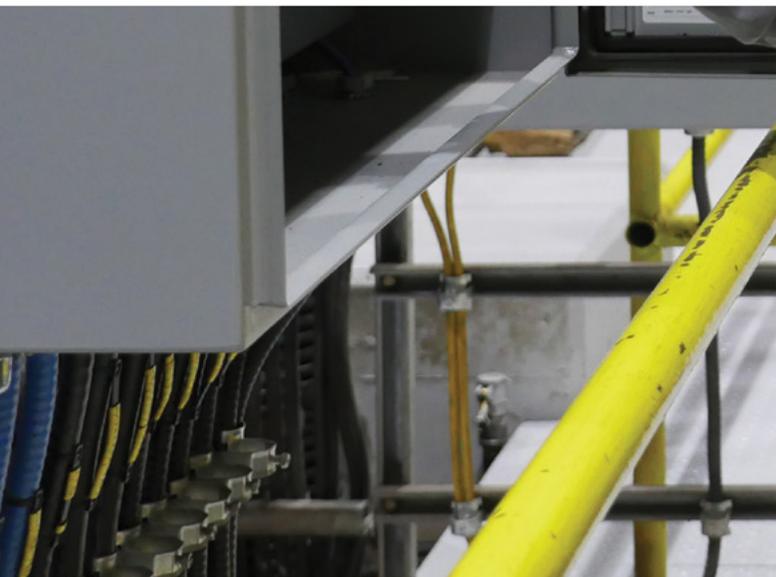
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INTRODUCTION

The Mining Industry Human Resources Council (MiHR) conducts research into Canada's mining labour market with the objective of uncovering the important human resources trends that are relevant

to Canada's mining industry. Each year, MiHR produces a national report that provides analyses and forecasting pertaining to the mining labour market. The 2017 edition of the *Canadian Mining*

Labour Market Outlook builds on this foundation and includes a number of new features:

- ◆ **An adjusted definition of the mining industry to better capture the activities in each mining sub-sector;**
- ◆ **An analysis of the new on-line employer survey data;**
- ◆ **Updated forecasts for 2017, focusing on the demand-side and supply-side factors that shape the mining labour market in Canada; and**
- ◆ **More detailed analysis of the labour market conditions for each mining sub-sector, as well as a deeper discussion on the key labour supply trends in the industry.**

This report is divided into seven sections: Section One provides a brief introduction and report overview; Section Two discusses MiHR's definition of the mining industry and the data sources used in this report, including a description of the data from MiHR's new 2017 Employer Labour Market Information (LMI) Survey; Section Three describes the labour market information (LMI) found in this report and its relevance to various types of mining stakeholders;

Section Four points to key trends in Canada's mining labour market, including a profile of important workforce factors such as age, diversity, unemployment (among others); Section Five discusses the factors related to labour demand in the mining industry and its key sub-sectors, and also provides MiHR's forecasts of employment and occupational structure, including and other related observations;

Section Six examines the factors related to labour supply in the mining industry and its key occupations, including a profile of forecasted entries and exits that will shape the labour supply in the coming years; and Section Seven summarizes the report findings and draws conclusions about the major labour market issues and challenges in the mining industry.



**INFORMATION,
INTELLIGENCE AND
RESOURCES**

Industry definition and key data sources

MiHR's definition of the mining industry groups activities into four main sub-sectors:

- **Exploration:** encompasses activities focused on the discovery of minerals and other commodities in the earth;
- **Extraction & milling:** describes the activities at operating mines across Canada, including both surface and underground mining operations, and includes on-site processing activities;

- **Support services:** includes the activities of organizations providing support services for a wide range of mining activities; usually on a contract or fee basis; and
- **Manufacturing & fabrication:** consists of activities that are directly downstream from extraction & milling, including smelting and refining of ferrous and non-ferrous metals.

The “mining industry” refers to any activity belonging to the set of industry sub-sectors described above. Much of MiHR's analyses

rely on information that is aligned with these defined sub-sectors; as such, MiHR frequently uses sectoral-level data (from Statistics Canada), which is collected and disseminated according to specific North American Industry Classification (NAICS) codes.¹ In addition, National Occupational Classification (NOC) categories are used to describe 70 occupations that are relevant to the mining industry. A full description on the NAICS codes and NOC codes included in this report are found in Appendix A.

WHAT HAS BEEN UPDATED?

Industry definition

MiHR continually reviews its definition of each mining sector (and the corresponding NAICS codes) to ensure that information used is closely aligned with MiHR's definition for the industry. In this 2017 *Canadian Mining Labour Market Outlook* report, MiHR has updated its definition of the industry by making the following key modifications:²

- Expanding the data describing the *extraction & milling* sub-sector to better capture mining activities in the oil sands; and
- Adjusting the *support services* sub-sector data to describe the activities that relate to mining-specific activities, and removing data that is connected to conventional oil and gas extraction.

Key data sources

The forecasts and analyses presented in this report are based on newly available

employment data from the System of National Accounts (SNA) for labour statistics. MiHR has used the SNA data to further enhance our understanding of the labour market outcomes, since it combines employment data from various surveys such as the Labour Force Survey (LFS), the Survey of Employment Payrolls and Hours (SEPH) and National Household Survey (NHS)/ Census data. A list of the main data sources used in MiHR's analyses is provided in Appendix B.

¹Even though each of these sub-sectors is classified by specific NAICS codes (see Appendix A), depending on the specific topic that is being considered, it is not always the case that the analyses are perfectly covered under the preferred NAICS codes. For example, in some cases, it is necessary to use data for NAICS 21 (mining, quarrying and oil & gas extraction) to describe mining related trends in a particular region as the data at the 3–4 digit NAICS level (which would allow exclusion of oil and gas activities) is limited or unavailable.

²A full description on the NAICS codes included in this report and the adjustments made from previous years are found in Appendix A.

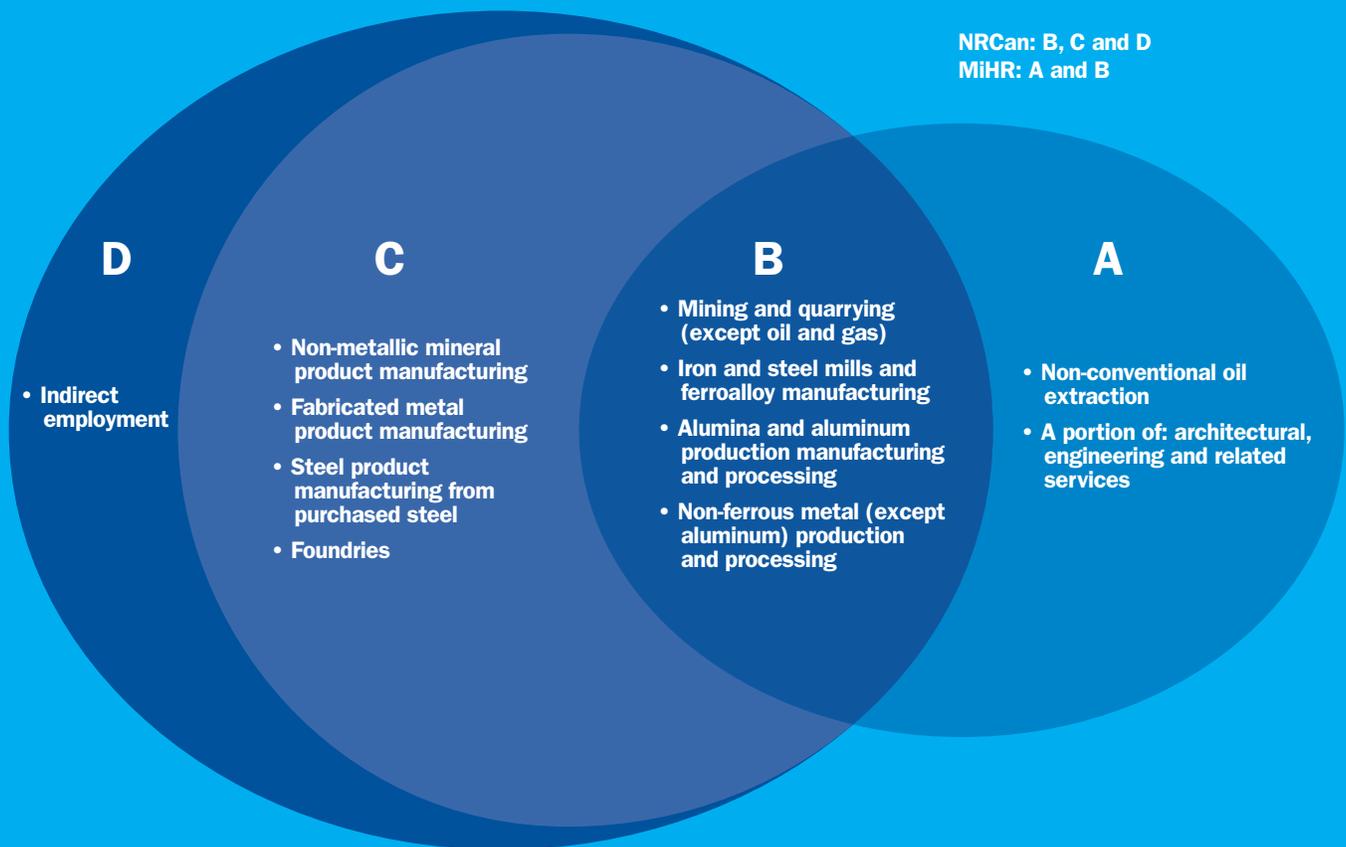
How does MiHR's industry definition compare?

MiHR's definition of the mining industry does not perfectly align with other organizations that produce similar mining-

related employment information. For instance, the Mining Association of Canada (MAC) and Natural Resources Canada (NRCan) both use a definition of the mining industry that is slightly different from

that of MiHR; Figure 1 illustrates the few notable variations in the definitions that NRCan and MiHR have adopted to deliver information for the industry.

Figure 1: Visualizing MiHR's mining industry definitions



Source: Mining Industry Human Resources Council, 2017

Notably, MiHR's estimates of mining industry employment are smaller, given that MiHR's definition does not include certain aspects of downstream manufacturing and indirect employment.

As a result of these variations, NRCan typically reports employment in the mineral sector to be more than 500,000 (direct and indirect), while MiHR regularly reports mining industry employment at around

200,000. The difference is significant when considering how MiHR's employment forecasts compare to a base-level of employment for the industry.

MiHR's 2017 Employer Labour Market Information Survey

MiHR's National Employer Labour Market Information (LMI) Survey is the main source of primary data that is used to profile and gather information and opinions from Canadian mine, mill and smelter operators, as well as contractors who support the mining industry. This survey provides context for the discussion of current and future labour market issues that are unique to the mining industry. It is deployed by MiHR every two years.

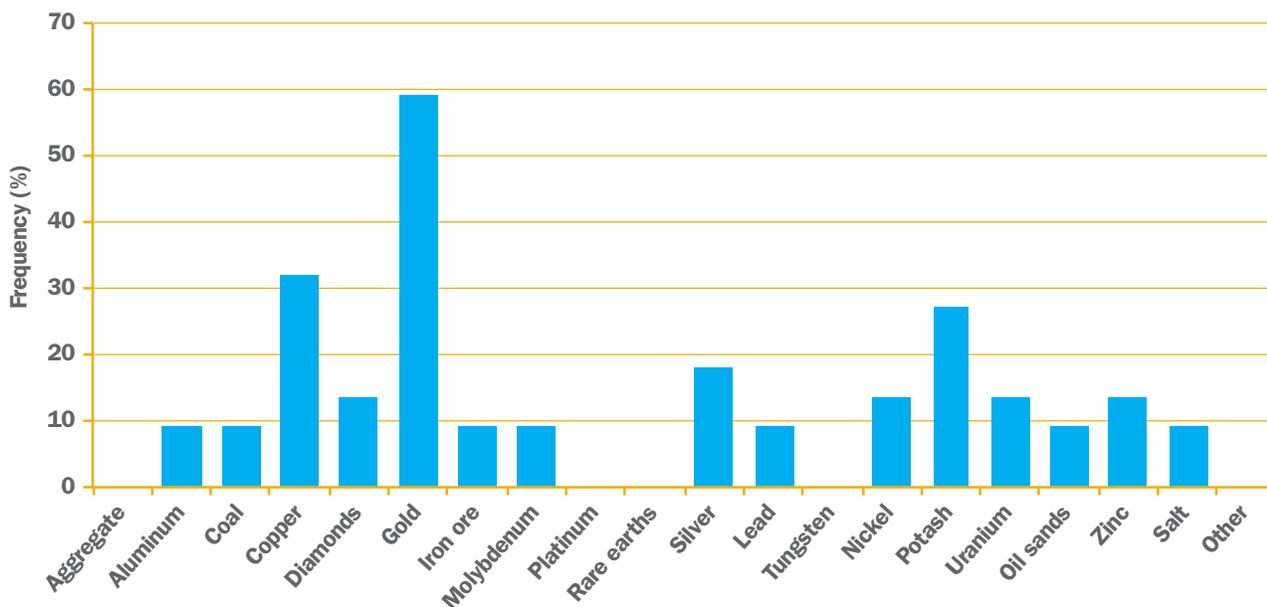
The online survey was distributed to a list of 60 employers, including mine operators, mine contracting firms, and drilling and oil sands companies. The survey consisted of 89 questions and covered matters such as the type of operations;

the number of employees; the number of vacancies and anticipated hiring needs; expectations about retirements; turnover rates; occupations in the highest demand; and the significant trends and challenges facing mining employers in Canada. Survey responses were submitted electronically to MiHR's research team. The findings are presented throughout this report (where appropriate), primarily in "call-out" boxes that supplement and enrich MiHR's labour market analysis.

From the 60 surveys distributed, MiHR received a total of 22 responses, from 19 site operators and 3 contractors. The majority of respondents (82 per cent) reported they operate (or are contracted to) a producing mine, making the sample primarily representative of the *extraction*

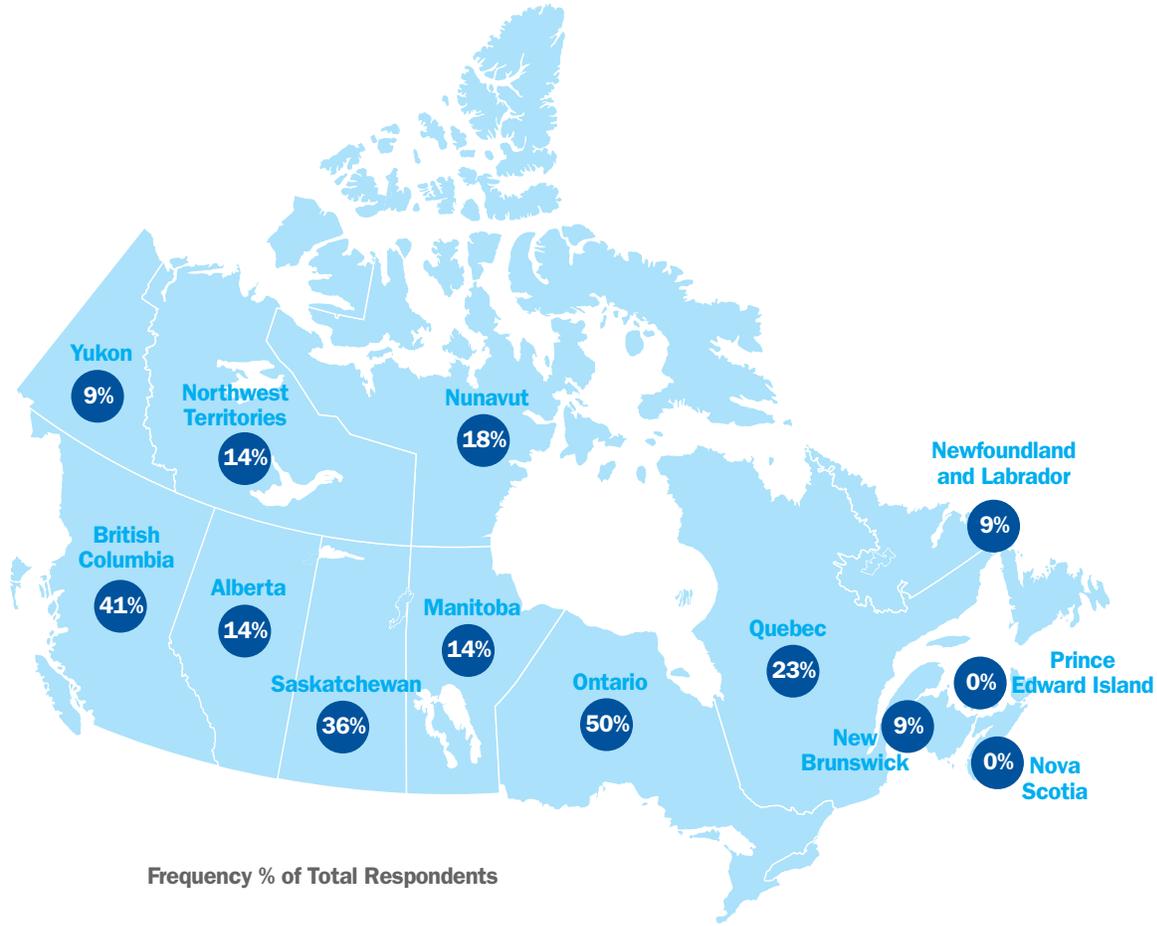
& *milling* and the *support services* sub-sectors. At the same time, several respondents reported an affiliation to other types of mining activities. Among that group with additional affiliations, 68 per cent reported active exploration sites; 58 per cent reported advanced development sites; 32 per cent reported care and maintenance sites; and 32 per cent indicated reclamation sites. As shown in Figures 2 and 3, survey respondents explore for, mine or process 15 different types of commodities, and have operations spanning 11 provinces and territories.

Figure 2: MiHR's 2017 National Employer LMI Survey: On the Canadian-based mining sites that your organization works, which of the following commodities are explored for, mined, or processed? (check all that apply)



Source: Mining Industry Human Resources Council (National Employer LMI Survey), 2017

Figure 3: MiHR's 2017 National Employer LMI Survey: In which of the following provinces and territories do you currently operate? (check all that apply)

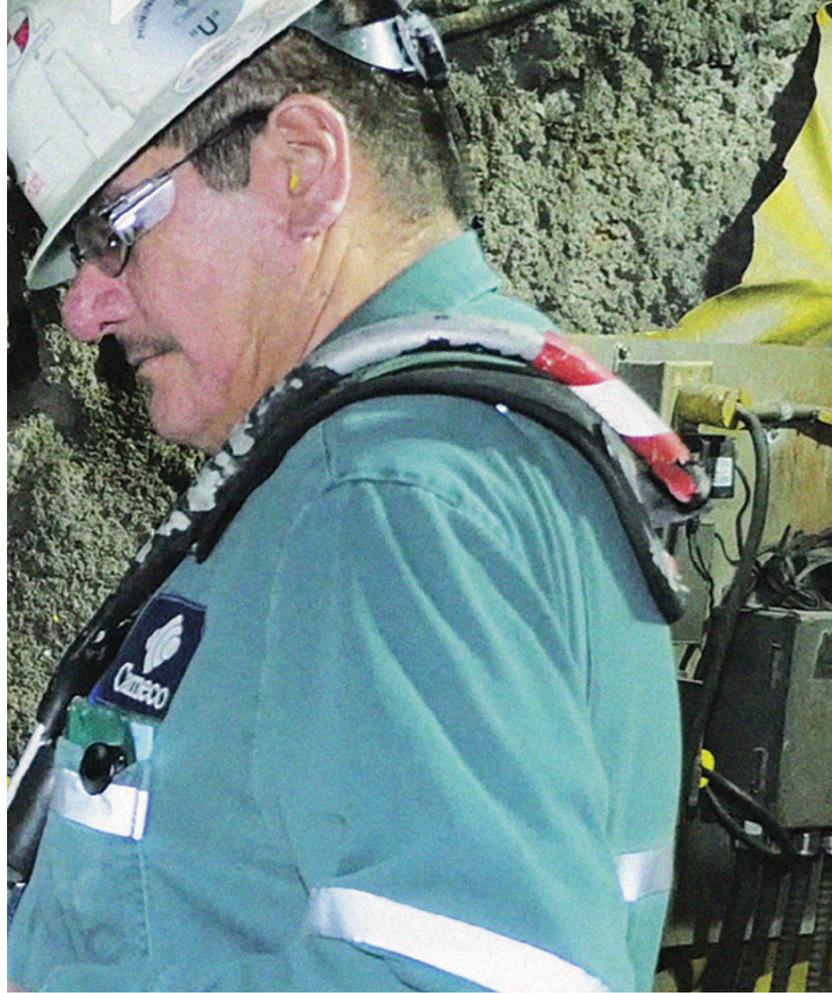


Source: Mining Industry Human Resources Council (National Employer LMI Survey), 2017

Additionally, the survey asked employers to state the number of employees they had working in Canada. In total, respondents reported about 38,700 employees (in both mining operations and in other industries); of this total, about 25,650 employees (or 66 per cent) were reported to be working at Canadian mining sites (including those at corporate or regional head offices,

exploration sites, advanced development projects, producing mines, care and maintenance sites, and reclamation sites). Among those at Canadian mining sites, roughly 96 per cent were full-time employees; 4 per cent were non-permanent employees (e.g., seasonal work); and nearly none of those reported were part-time employees.

Throughout this report, MiHR will provide selected findings from the 2017 National Employer LMI Survey, providing additional depth to the insights drawn from publically available data sources.



WHAT IS LABOUR MARKET INFORMATION (LMI) AND WHAT IS IT USED FOR?

Labour market information (LMI) describes the demand and supply for labour in the economy. LMI also provides a better understanding about the factors and characteristics that influence the demand and supply of labour, which

can in turn, affect the sustainability and competitiveness of the mining industry. Labour demand measures the need of employers for skilled workers in a particular location/region, sector or occupation. Labour supply describes the pool of

workers available to employers that can be influenced by the composition of the supply pool in terms of age, skills, training and location, among other key characteristics.

LMI is used by a number of different decision-makers in a variety of ways:

Governments use LMI as a basis for developing strategic initiatives, setting policies and deciding how best to target spending to support employment and industry success. For example, information about which occupations are in highest demand helps policymakers target spending and resources to ensure a better match between the skills of workers and the needs of industry.

Educators and trainers use LMI to identify the programs and curriculums that will best prepare their graduates for the jobs

available. By describing the demand for specific skills in a particular region of the country, LMI helps local institutions better define the programs and specific curriculums that will help match their graduates with prospective employers.

Employers use LMI to make decisions about which personnel they need to hire, where their recruitment strategies should be targeted, and how to access sustainable sources of skilled workers. Employers may also use LMI to help determine the appropriate mix of labour and capital they require to meet their production targets and to support growth.

Career seekers need information about what types of jobs are available, what skills are required by employers, where jobs are located, and the characteristics of the working environment and of those with whom they will work.

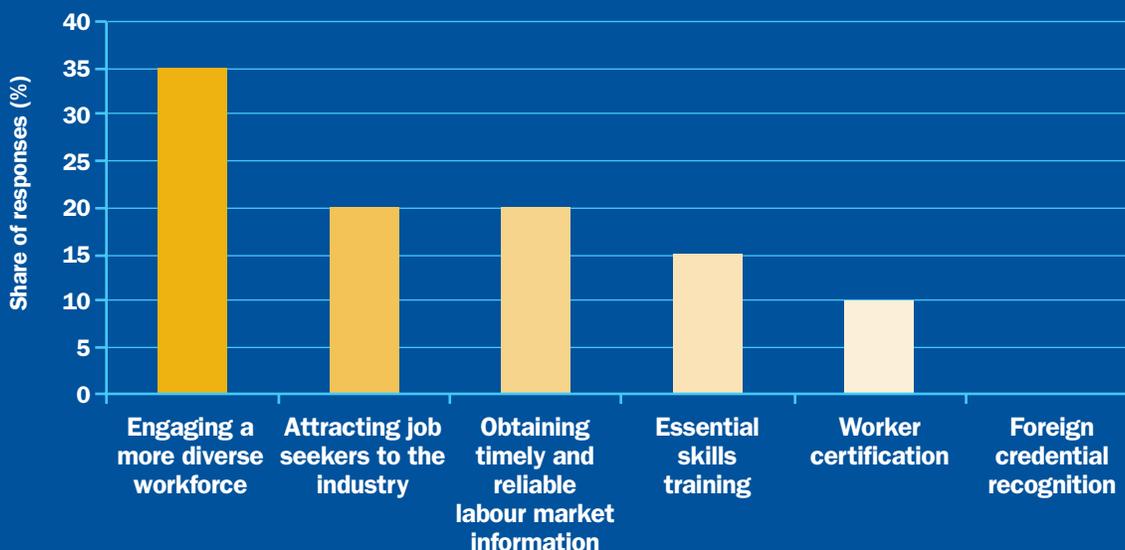
Students, along with their parents, teachers and other influencers, use LMI to decide what to study and where to get the skills they need to access the jobs that are available. They also need LMI that gives them a better understanding of career pathways and progressions from entry-level positions to supervisory and management roles.

MiHR's 2017 National Employer LMI Survey asked employers to evaluate various topics and indicate which are the most valuable to them in helping to overcome key labour

HR challenges. Engaging a more diverse workforce, obtaining timely and reliable labour market information, and attracting

job seekers to the industry were among the more valuable areas of focus indicated by respondents.

Figure 4: MiHR's 2017 National Employer LMI Survey: Which one of these topics would be the most valuable to you?



Source: Mining Industry Human Resources Council (National Employer LMI Survey), 2017



TRENDS IN CANADA'S MINING LABOUR MARKET

The mining industry in Canada has begun to show signs of economic recovery since a steady decline that started in the early 2010s. Yet, throughout this recent period,

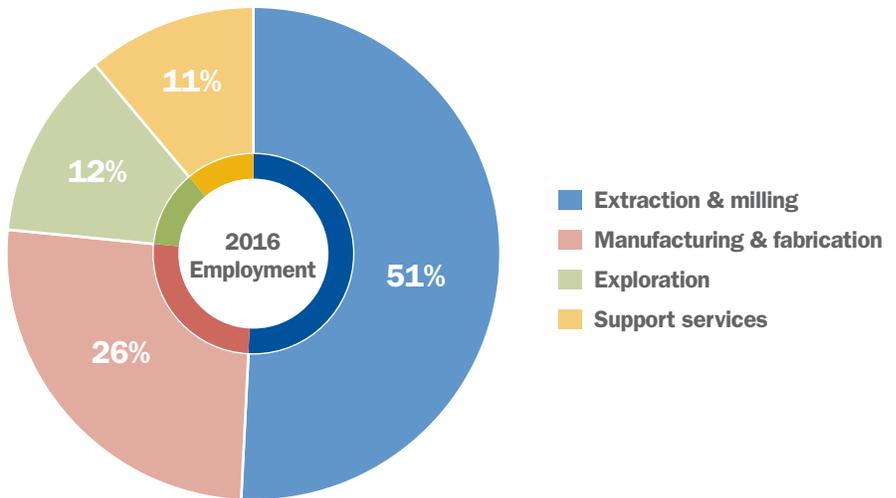
underlying demographic trends have continued to shape the mining labour market in Canada. This section highlights a few of the key trends that promise to

play a significant role in the mining labour market, including a profile of employment, unemployment, age and diversity characteristics.

Industry employment

Canada's mining industry is a strong contributor to economic activity and employment opportunities across the provinces and northern territories. In 2016, employment in the industry was 190,280 workers; as shown in Figure 5, *extraction & milling* was the largest mining sub-sector, with almost 51 per cent of the total mining workforce, followed by *manufacturing & fabrication* (26 per cent), *exploration* (12 per cent) and *support services* (11 per cent).

Figure 5: Share of employment by mining sub-sector (2016)



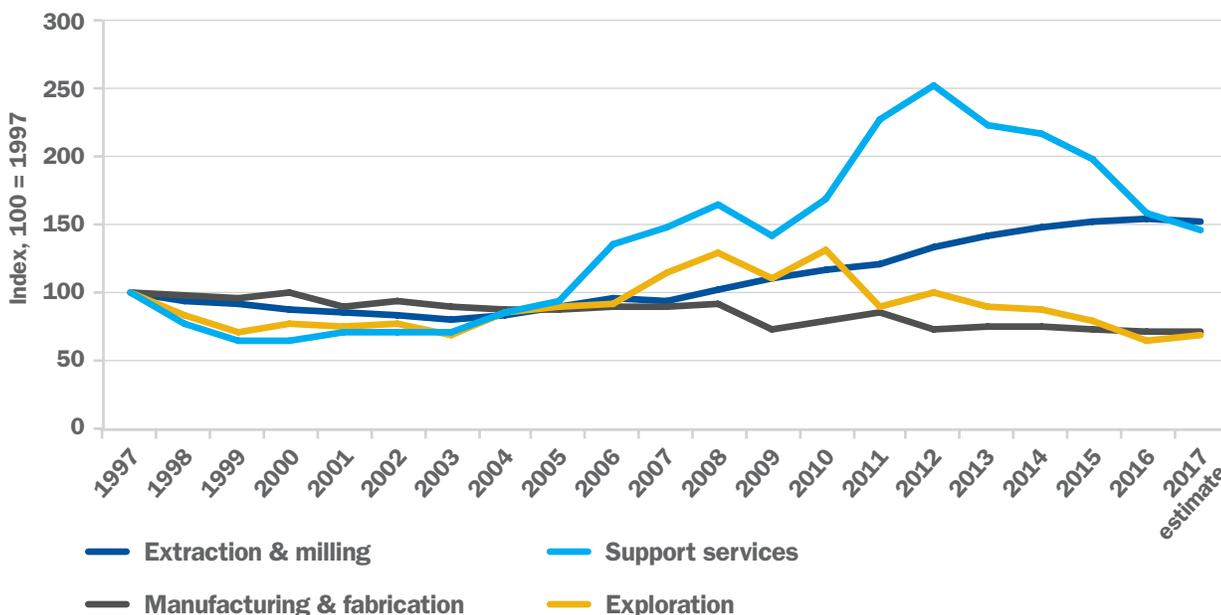
Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2017

The breakdown shown in Figure 5 reveals a shift from MiHR's previous employment figures; notably, the share of *extraction & milling* employment has increased (from 35 per cent in MiHR's 2015 *Canadian Mining Industry Employment, Hiring Requirements*

and Available Talent: 10-year Outlook), whereas the shares of other sub-sectors have each contracted. Notwithstanding the adjustments to MiHR's industry and sectoral definitions (and the switch to SNA employment data), this result echoes the

recent growth patterns for each sub-sector. As Figure 6 reveals, *extraction & milling* is the only sub-sector with consistent employment growth since the start of the 2000s.

Figure 6: Growth indices of employment by mining sub-sector (1997–2017)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2017

Signs of recovery in unemployment

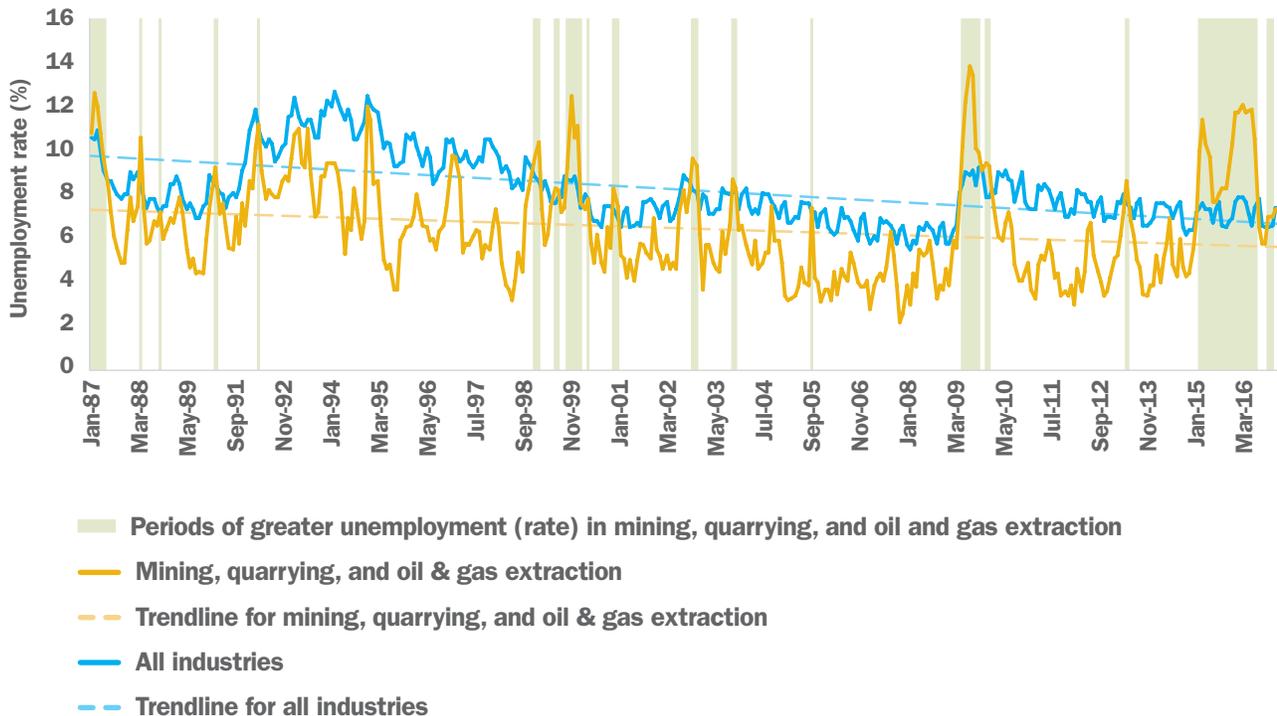
MiHR's 2016 *Canadian Mining Labour Market Outlook* report pointed to the surge in unemployment in the *mining, quarrying and oil & gas extraction* sector. As shown in Figure 7, the sector's higher unemployment rate persisted through 2015 into mid-2016, marking a prolonged downturn in the mining labour market. However, in 2016,

the unemployment rate dropped from roughly 10 per cent in July to about 6 per cent in August; in the first quarter of 2017, the unemployment rate has not exceeded 7 per cent. This recent development is a sign of early recovery for the sector, although a full recovery remains undeveloped at this time.

In general, the unemployment rate in *mining, quarrying and oil & gas extraction*

has been lower than the overall Canadian unemployment rate, as illustrated in Figure 7. The figure also shows the periods where the unemployment rate in the sector surpassed the overall unemployment rate (indicated by green). This outcome has been far less common for the most part; however, as the figure shows, 2015 to mid-2016 saw the most difficult stretch over the past three decades.

Figure 7: Unemployment rate in Canada, all industries and mining, quarrying and oil & gas extraction (January 1987–February 2017)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2017

Higher full-time earnings in mining

In spite of the recent economic downturn, average earnings in the *extraction & milling* sub-sector have stayed relatively robust. For example, MiHR's 2015 *Canadian*

Mining Labour Market Outlook found greater earnings³ for full-time workers in *mining and quarrying (except oil & gas)*, compared to other prominent industries such as construction, manufacturing, forestry and utilities; in 2015, average

weekly earnings (in 2007 dollars) in the sector were roughly \$1,780 – considerably greater than the figure of \$1,180 reported for all industries, according to Statistics Canada's Survey of Employment, Payroll and Hours.

³For full-time salaried employees (excluding benefits, overtime and bonuses)

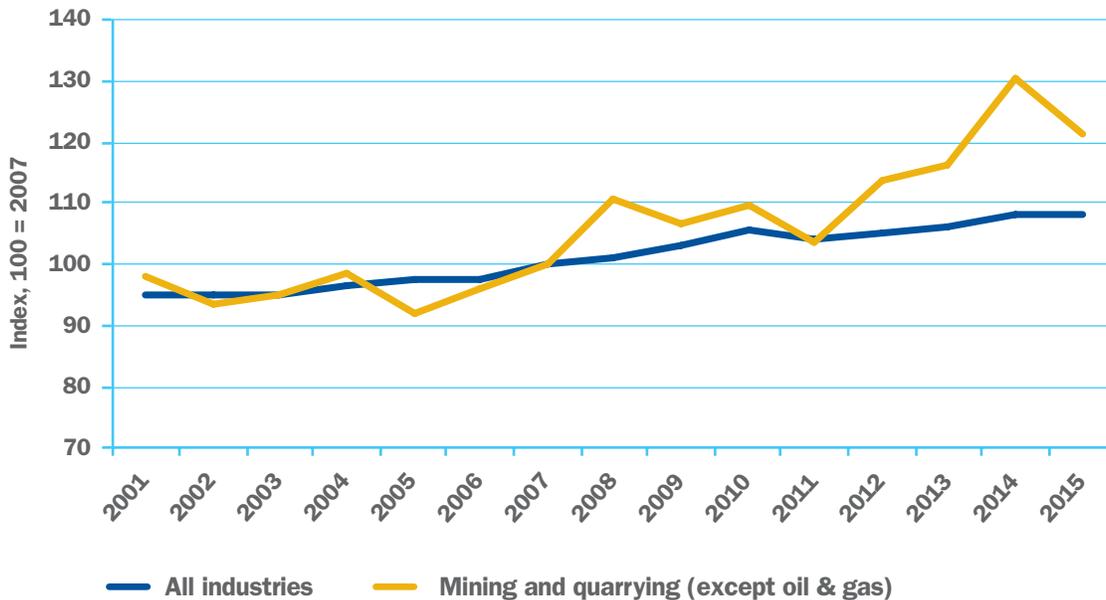
Moreover, earnings growth in the sector has surpassed that of other industries. Figure 8 compares average weekly earnings growth from 2001 to 2015 for full-time workers in (1) *mining and quarrying (except oil & gas)* and (2) all industries. Several factors could be driving earnings growth in the sector, although it

is difficult to make definitive conclusions from Figure 8.

Strong earnings growth is a signal that employers are increasingly willing to pay more to attract the right people. This could be the result of a limited labour supply, which pushes wages higher as

companies compete over fewer prospective candidates. It is also important to note that, since Figure 8 is based on average earnings, employers could still have cut their overall labour costs by adjusting the size of their workforces; the figure shows that earnings among the continuing workforce have remained high.

Figure 8: Growth indices of real average weekly earnings (2007 dollars) for full-time salaried employees, all industries and mining and quarrying (except oil & gas) (2001–2015)



Source: Mining Industry Human Resources Council, Statistics Canada (Survey of Employment, Payroll and Hours), 2017

* Excluding benefits, overtime and bonuses.

An aging population, an aging workforce

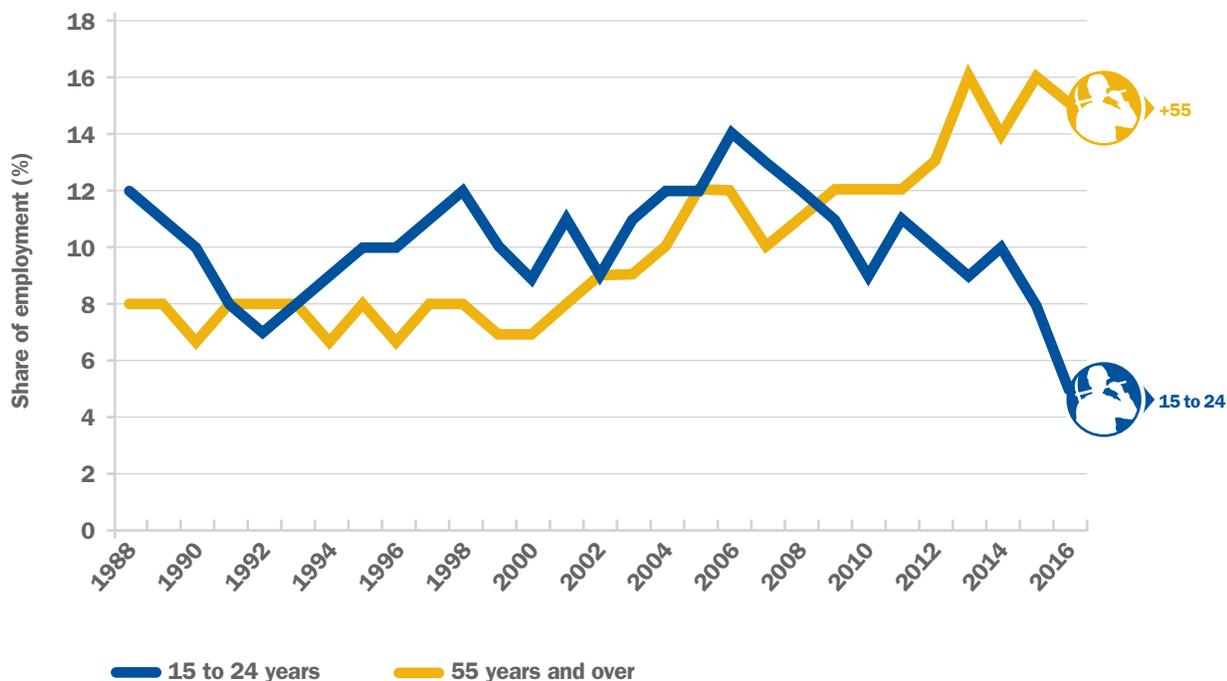
Canada's aging population continues to have a significant impact on the workforce – and by extension, the mining workforce. Over the last decade, the percentage of the population that is 55 years and older has increased from 25 per cent in 2007 to 30 per cent in 2016. A similar shift is revealed in the overall workforce,

particularly as members of the baby-boomer generation have progressed through their working years; over the last decade, the percentage of the labour force that is 55 years and older has increased from 15 per cent in 2007 to 21 per cent in 2016.

These underlying age trends are further echoed in the mining workforce. Figure 9 shows an emerging age gap for workers in

mining, quarrying and oil & gas extraction; since the end of the last decade, the share of older workers (55 years and older) has outpaced that of younger workers (15 to 24 years). Specifically, older workers have surged from 11 per cent in 2007 to 16 per cent in 2016, while younger workers have dropped from 13 per cent to 5 per cent over that same period.

Figure 9: Share of employment in mining, quarrying and oil & gas extraction, by age categories (15–24 years vs. 55 years and over) (1987–2016)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2017

The shift towards an increasingly older workforce presents a major challenge to the industry, especially as future mining development will eventually demand younger generations to take on greater roles and responsibilities. With fewer younger people in the current employment ranks, the future workforce is in a weaker position to transition through the retirement losses associated with an older workforce.

MiHR’s 2015 *Canadian Mining Industry Employment, Hiring Requirements and Available Talent: 10-year Outlook* report showed that the mining labour force was comparatively older than the overall labour force in 2001; a similar comparison of age profiles for 2011 revealed a mining age structure that was increasingly similar to the overall labour force. This convergence was partly due to aging in other industries,

and it suggests that other industries have also begun to experience the impact of an aging labour force. To the extent that other industries will also struggle to find younger workers, the mining industry will need to increase efforts to compete for young and talented people entering the industry.

Women under-represented and in part-time roles

Women continue to be under-represented in the mining labour force. According to MiHR’s *Canadian Mining Labour Market Outlook* report for 2016, based on the last available census in 2011, women accounted for 48 per cent of Canada’s overall labour force, compared to only 17 per cent of mining’s labour force. This proportion appears steady in 2016, with women making up about 19 per cent of the

labour force in *mining, quarrying and oil & gas extraction*, according to the labour force survey.

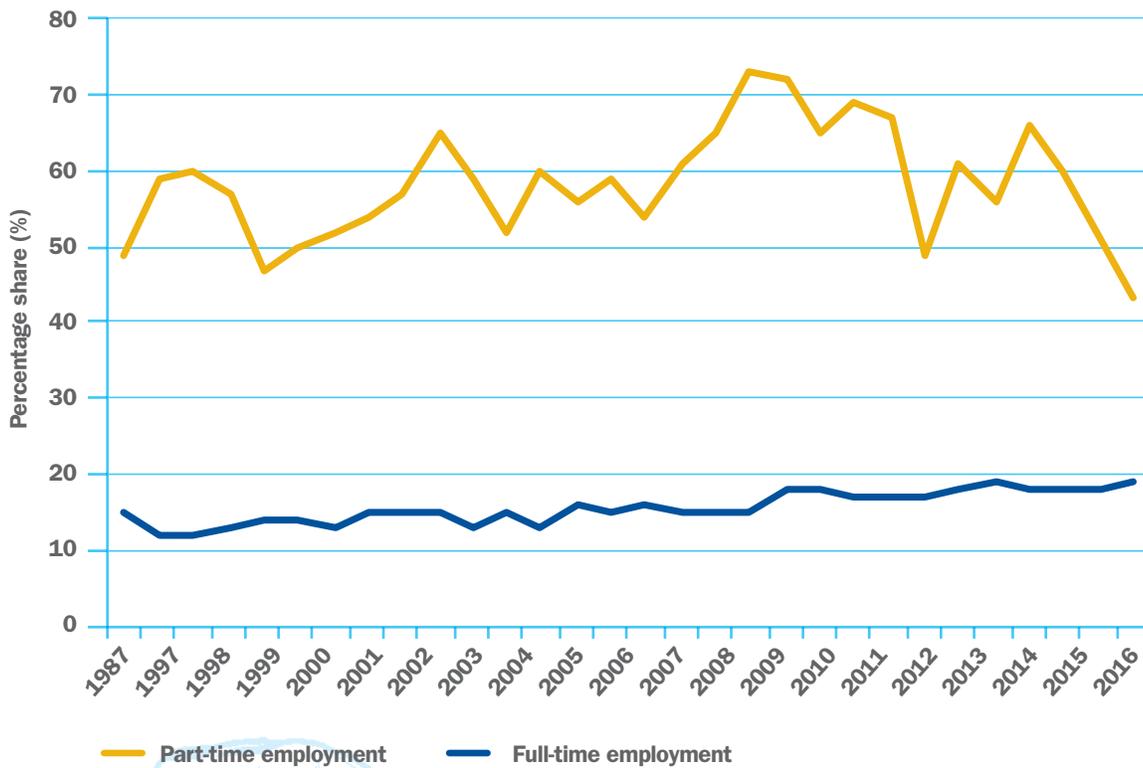
A modest turnout among women is also characteristic of other resource-based industries and occupations. For instance, industries such as *construction* (12 per cent), *forestry and logging* (18 per cent), *fishing, hunting and trapping* (19 per cent) and *agriculture* (30 per cent) each have comparably low percentages of women, according to the labour force survey – suggesting that many of the underlying challenges are not exclusive to the mining industry. Likewise, within certain trades and production occupations, the share of women is small, regardless of whether the focus is on the mining industry or all industries. (See MiHR’s *Canadian Mining Labour Market Outlook* for 2016.)

While the share of women in the mining industry has remained modest, women who are in the industry are more likely to work on a part-time basis. As Figure 10 illustrates, women frequently account for more than half of the part-time

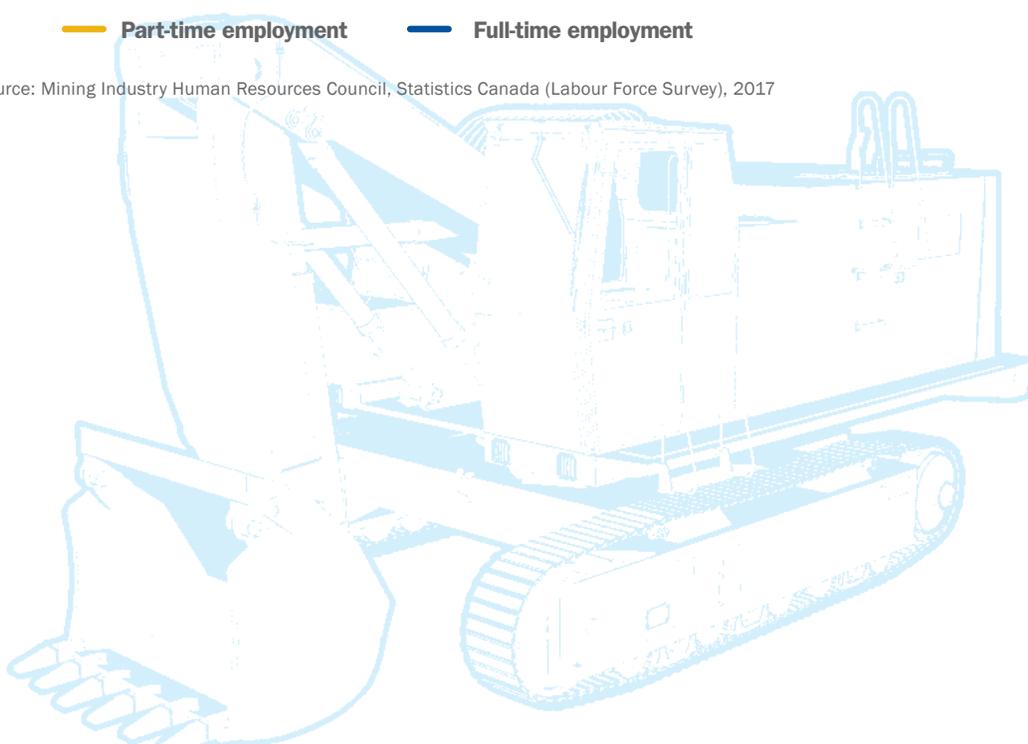
workforce in *mining, quarrying and oil & gas extraction* (averaging 59 per cent from 2007 to 2016) – significantly higher than women’s share of full-time employment (averaging 18 per cent). This difference points to a significant disparity

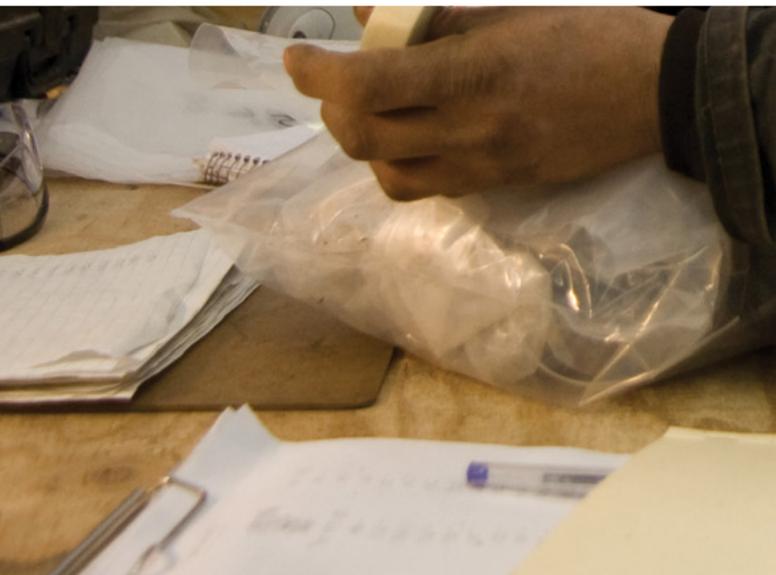
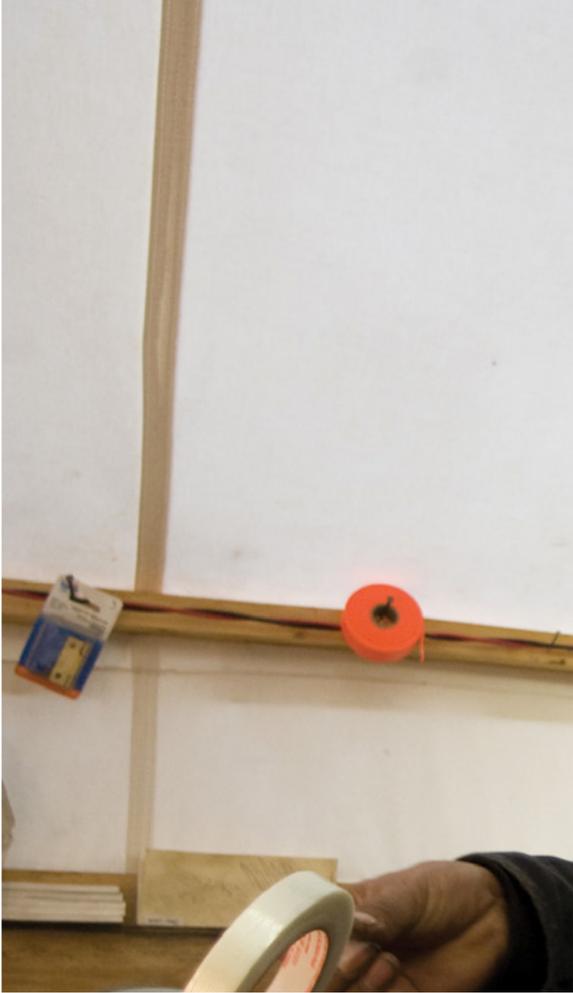
in labour market outcomes for women in the industry, and although the gap has narrowed slightly over the last three decades, it is noteworthy that women are still far less likely to work on a full-time basis.

Figure 10: Share of women in part-time and full-time employment, in mining, quarrying and oil & gas extraction (1987–2016)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2017





THE DEMAND FOR LABOUR IN MINING

The demand for labour in the mining industry is subject to global economic conditions that affect the demand for mined commodities. Many of these economic factors are, to a large extent, beyond the control of Canadian mining sector employers. Yet, they have a strong impact on the business environment for mining sector growth, development, production levels and, ultimately, on the need for workers. Furthermore, many of

these external factors fluctuate widely over time due to economic cycles, creating the volatility that characterizes the mining industry.

On the other hand, Canadian mining companies do possess a degree of control over decisions relating to how they use different factors of production (i.e., labour and capital) and their relative intensities at individual operations.

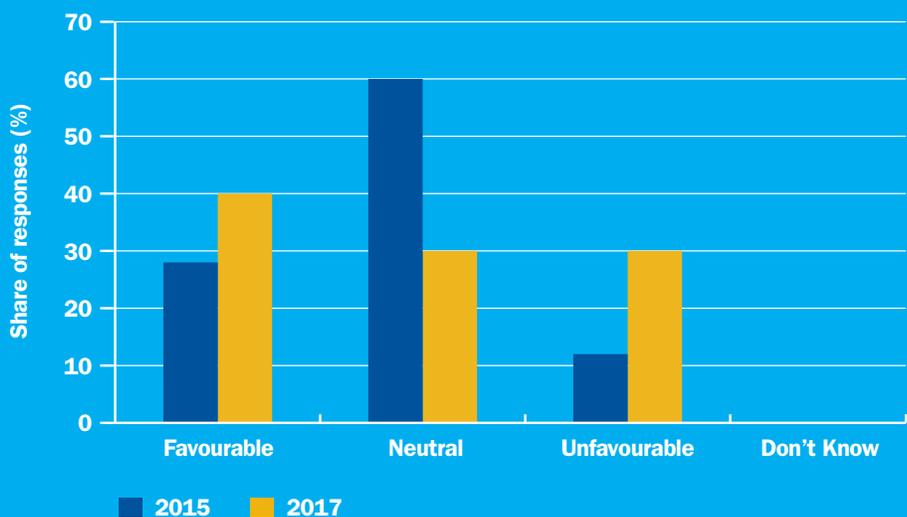
This section provides an overview of the key external and internal factors that shape the demand for labour in Canada's mining industry. It also presents MiHR's forecasts of employment in the four main mining sectors outlined in Section Two. These forecasts estimate the potential levels of employment over the next decade, based on expectations for various factors, under three different economic scenarios.

40% favourable

LMI Survey about the current business conditions for their operations in Canada

In 2015, MiHR's National Employer LMI Survey asked respondents about the current business conditions for their operations in Canada; this question was revisited in the 2017 survey. Compared to 2015, respondents were relatively split about their current business conditions in 2017, with an increased percentage reporting that business conditions were both favourable (40 per cent) and unfavourable (30 per cent), compared to the share that reported conditions as neutral (which fell to 30 per cent).

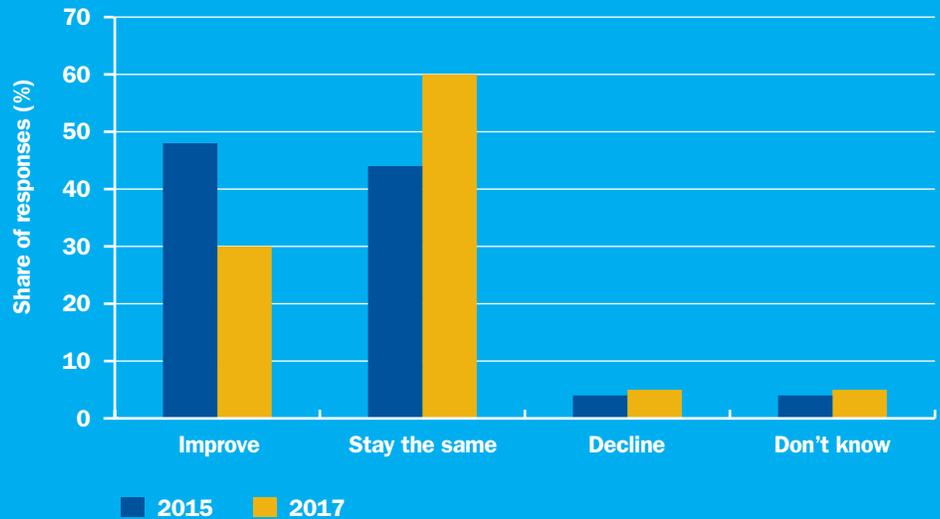
Figure 11: MiHR's 2017 National Employer LMI Survey: Currently, business conditions for your Canadian based-sites are generally?



Source: Mining Industry Human Resources Council (National Employer LMI Survey), 2017

MiHR's 2017 National Employer LMI Survey also asked employers about their expectations regarding future business conditions for their Canadian-based operations in the next 12 months. Respondents were less optimistic about their future business conditions; 30 per cent stated that business conditions will improve in the next 12 months, compared to 48 per cent in 2015. Sixty per cent of the respondents expect business conditions to stay the same in the next 12 months, an increase from 44 per cent in 2015.

Figure 12: MiHR's 2017 National Employer LMI Survey: Over the next 12 months, business conditions for your Canadian-based site(s) are expected to?



Source: Mining Industry Human Resources Council (National Employer LMI Survey), 2017

External influencers of mining labour demand

For a mining employer, the need for workers is contingent on external economic factors that influence the demand for mining products/services and impact the feasibility of certain mining activities. For instance, the demand for mined commodities depends on global markets, and tracking these developments is important to understanding how the demand for labour in the Canadian mining industry may change over time. Thus, a change in global economic conditions, especially in major export markets – such as the United States, the United Kingdom, and East Asia (China, Japan, Hong Kong, and South Korea) – has a significant

impact on the demand for labour in the mining industry in Canada. Price effects and other factors that affect labour demand are explored below.

Prices of commodities mined

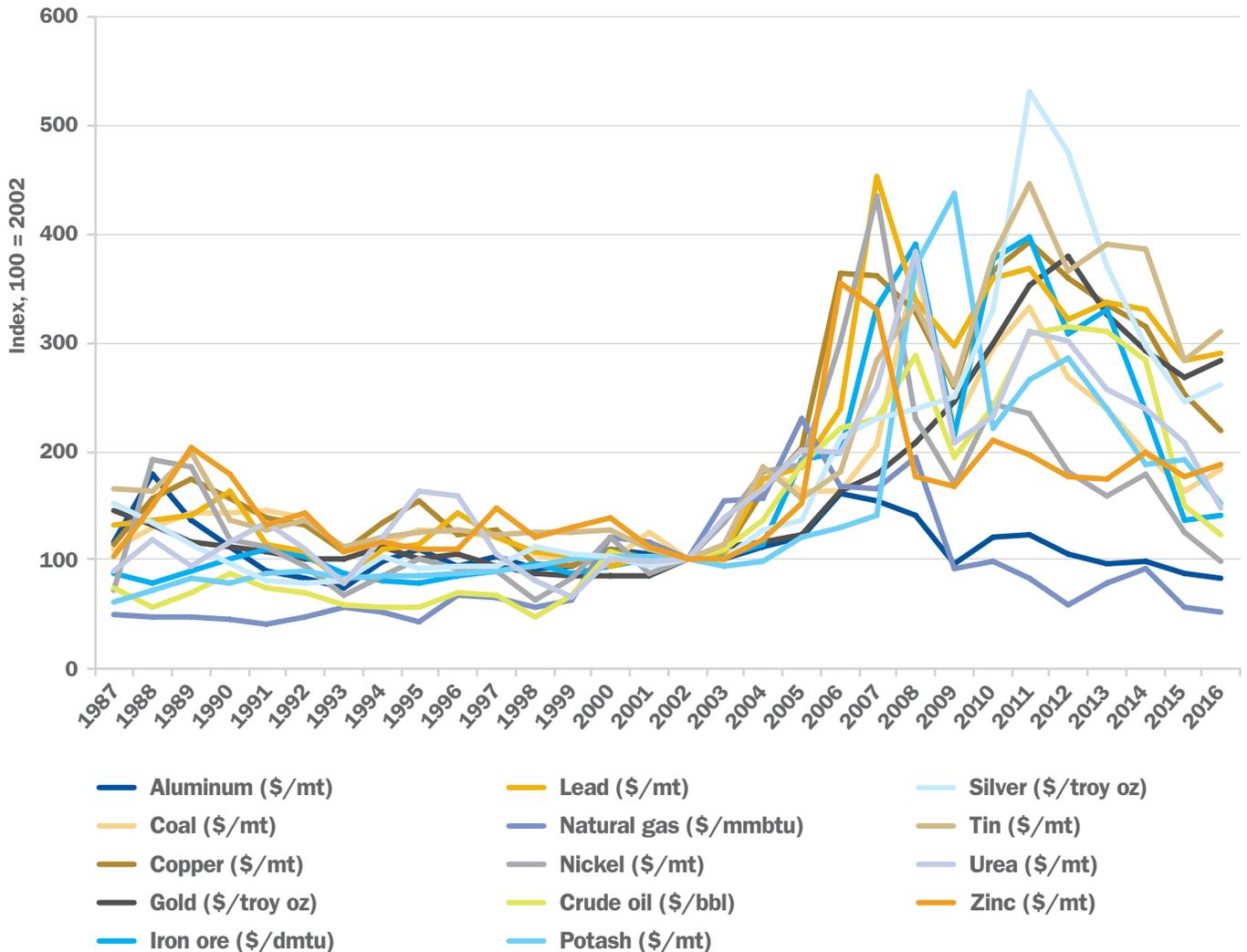
Prices have a significant impact on the viability of Canadian mining operations. An increase in price generally translates to greater profits for mining companies and can act as a catalyst, spurring mine development, boosting production levels and increasing labour demand.

Figure 13 shows the historical price indices for a number of mined commodities from 1987 to 2016. Since the last decade, several commodity prices have shifted upward to historical levels, only to slump

after the turn of the 2010 decade. Many of these price movements reflect a surge (and then cooling) in demand and economic growth from key global markets (especially Asia). Recently, certain prices have begun to show minor signs of recovery heading into 2017.

Given that Canadian mining companies are mostly price takers in the international market, employers have had to manage through the cycles depicted in Figure 13. This naturally puts employers in a reactionary position to commodity price movements, and they frequently respond to price movements either by ramping up or curtailing their production and labour demand accordingly.

Figure 13: Commodity price indices for various mined commodities (1987–2016)



Source: Mining Industry Human Resources Council, World Bank, 2017

Access to infrastructure

The ability to access certain infrastructure (e.g., roads, housing, amenities, etc.) is another major consideration for mining development and labour demand. To the extent that mining projects have no control over their location, there is uncertainty about the availability of adequate infrastructure. For example, the existence of a public road or highway can have a significant impact on the cost and

feasibility of a project and, by extension, on the hiring decisions made by a potential mining operator – including the need to utilize a fly-in fly-out rotation for employees.

Capital markets

Mining activities require significant financial investment. Therefore, mining enterprises, big and small, often turn to investors in capital markets to finance and advance their mining development

projects. However, finding a willing investor is not a simple process, and the prevailing mood of investors is critical for numerous projects that depend on funding from external sources. Exploration projects are especially sensitive to investor behaviour, which is further tied to the specific commodity that is being explored. In the last several years, capital markets have cooled in conjunction with slumping commodity prices. This cooling has

created significant hurdles for exploration companies, which have collectively reduced their spending during this same period. According to Natural Resources Canada, exploration expenditures fell by 54 per cent from 2012 (roughly \$3.9 million) to 2015 (roughly \$1.8 million).

Other factors

A variety of other external factors affect the business climate for mining operations in Canada. Two examples are exchange rates and interest rates.

As Canada's mining industry depends on exports to other countries, the prevailing exchange rate can have consequences for mining transactions involving foreign currencies. The Canada-US dollar exchange rate has fallen significantly over the past couple of years and while this movement is considered favourable to exporting sectors of the economy, including the mining industry, it is still not evident that mining operations will significantly alter their production capacity or levels of employment in response to short-term movements in the exchange rate.

Interest rates can make it more or less expensive to borrow money. For a mining enterprise looking to finance its activities, an adjustment to the interest rate can affect the feasibility of certain projects and subsequently, the demand for labour.

Currently, interest rates are exceptionally low by historical standards. The low interest rates coincide with a slower economy, which has, in turn, initiated a reduced cost of borrowing.

Overall, there are countless factors that positively and negatively influence the demand for labour in Canada's mining industry; mining companies must take many of these as given, before they make key decisions on whether to proceed with mining activities or determine how much labour and capital they will need to satisfy production targets. Some of these factors are also discussed in Appendix C, outlining how certain economic factors are considered in MiHR's employment forecasting system.

Internal influencers of mining labour demand

Although labour demand is contingent on numerous external economic factors, industry employers exercise control over decisions that affect the quantity and types of workers they need in their operations. Internal considerations such as the factors of production used and the optimal combination of workers, machines and technology can define the specific skill sets of the workers that are required.

Factors of production

The factors of production describe the combination of inputs and resources – such as labour and capital (machines and equipment) – that are used during production processes. An individual mining operation determines their optimal mix of labour and capital from among a variety of combinations. The labour component represents only one part of a wider production process that involves a greater assembly of inputs (which can include labour, machines, equipment, technologies, etc.).

For instance, MiHR's 2015 report, *Canadian Mining Industry Employment, Hiring Requirements and Available Talent: 10-year Outlook*, found that the ratio of capital dollars used in extraction activities (e.g., machines, equipment and buildings, etc.) per worker has escalated since 2000, and because the size of the workforce did not show a corresponding increase, the additional capital dollars indicate that operations have invested in larger-scale and more sophisticated equipment. Technological shifts can affect labour demand as well as the set of skills and experience required for the workers employed in the industry.



Labour productivity

Labour productivity is defined as the value of output that is produced for every input of labour – commonly measured as gross domestic product per hour of work. Given that the mining industry is naturally capital intensive, changes to the factors of production can have a great impact on labour productivity, including the following:

the skills and composition of the workforce; the arrival of new technologies; and/or additional capital in the form of larger-scale machines and equipment.

In the short run (generally fewer than five years), firms mainly affect their labour productivity by adjusting the level of labour employed in production; meanwhile, other factors of production – such as the kinds

of major equipment in use – are relatively fixed in the short term. In the long run, however, firms have the flexibility to adjust all factors of production, including the types of machines, techniques and processes that they choose to invest in.

Several other major factors that affect productivity are listed in Table 1 below.

Table 1: Various factors that impact labour productivity

Factors	Description
Capital to Employment	A firm can choose to increase or decrease their capital stock. Generally, a rise in the capital-labour ratio increases labour productivity.
Labour Composition	Building a more skilled and experienced workforce improves labour productivity. Mining companies may also consider changing the occupational mix of their workforce, in order to improve overall labour productivity.
Proven Reserves and Ore Feasibility	Proven reserves where ore is easily extracted from the earth allow for higher labour productivity. Investment in exploration activities allows firms to improve the quality and quantity of their proven reserves.
Technology and Adoption Rate	Introducing new technologies in production is a major way for firms to improve labour productivity. New technologies are either sustaining technologies (i.e., those leaving the production process largely unchanged) or disruptive technologies (i.e., introducing a new technology that eventually replaces one or several current technologies, thus significantly changing the production process). Sustaining technologies have a higher rate of adoption by industry than disruptive technologies.

Source: Mining Industry Human Resources Council, 2017

Challenges with measuring labour productivity in the mining industry

Labour productivity changes can be challenging to analyze or attribute to a specific cause(s). Underlying each observation are several complex and indistinct factors that may be difficult to quantify. For instance, experience, learning, new innovation or the passing of knowledge create efficiencies that boost labour productivity; yet, each is tough to measure in isolation.

Labour productivity in the mining industry also presents additional challenges; in a given short-term period, labour productivity is mostly driven by economic cycles, and less by momentous gains in technology and systemic efficiencies. Figure 14 compares the two key variables used to measure labour productivity – (1) the value of output (real GDP) and (2) the number of hours worked. Specifically, the figure shows how these factors have changed annually in the mining and quarrying (except oil & gas)

sector from 1998 to 2015. In a given year, labour productivity increases when output grows faster than hours worked; as such, the shaded areas in Figure 14 indicate periods of positive labour productivity growth. Note that these periods are shown to be impermanent and cyclical in the short term.

Figure 14: Annual percentage changes in factors of labour productivity (real GDP and hours worked), mining and quarrying (except oil & gas) (1998–2015)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey and Canadian System of National Economic Accounts), 2017

There are additional complications related to analyzing labour productivity for the mining industry; since ore deposits become increasingly difficult to extract over time, it is problematic to compare volumes of ore production across time periods in order to gauge changes in labour productivity. Lastly, labour productivity in the industry has benefitted from periodic waves of innovation; yet, events that are unprecedented can be difficult to predict. For example, the arrival of driverless haul trucks would undoubtedly change the size, skills and productivity of the mining workforce. However, the timing and rate that this technology will be fully

adopted by mining companies remains somewhat indefinite.

For the reasons highlighted above, labour productivity in the mining industry should also be evaluated with a long-term focus. As such, MiHR has begun to broaden its focus on this topic, especially as it relates to Canada’s future mining labour market.

Employment forecast in Canada’s mining sub-sectors

As described in Section Two, MiHR’s analysis focuses on four distinct mining sub-sectors: *extraction & milling, support*

services, fabrication & manufacturing and exploration. This section provides MiHR’s employment forecast and analysis for each of these sub-sectors, pointing to their unique characteristics in relationship to their occupational structure and other factors.

Forecasting industry employment

At the centre of MiHR’s labour market analysis is a forecast of employment in the industry over a ten-year horizon. Specifically, MiHR uses an econometric model to project total employment and changes in employment over the coming

decade. MiHR’s employment forecasting model takes into account the historical movements of relevant explanatory variables that are associated with the size of the workforce, and their observed effect on employment in the industry. Future changes in employment over the next decade are then estimated using various leading forecasts and intelligence for key explanatory variables.

The employment forecasts are generated using three alternative economic scenarios. These three scenarios are developed to capture the underlying volatility in the economy and to show how different outcomes for the explanatory variables could change expectations about the future level of employment in the industry. The baseline scenario uses the current trends and forecasts for prices and other input variables from organizations such as the World Bank. The contractionary and expansionary scenarios are constructed by adjusting the underlying

forecasts to account for higher and lower future values for these variables.

Extraction & milling

This sub-sector primarily describes activities at operating mines in Canada, including both surface and underground mining operations. This includes removing ore from the ground, as well as the primary processing (crushing, separation, etc.) that occurs in on-site mills. This sub-sector covers all types of commodities that are extracted, including extraction activities associated with oil sands mining. Mining operations can range in size, and are frequently among the larger employers – with an average workforce of more than 500 people on an individual mine site.

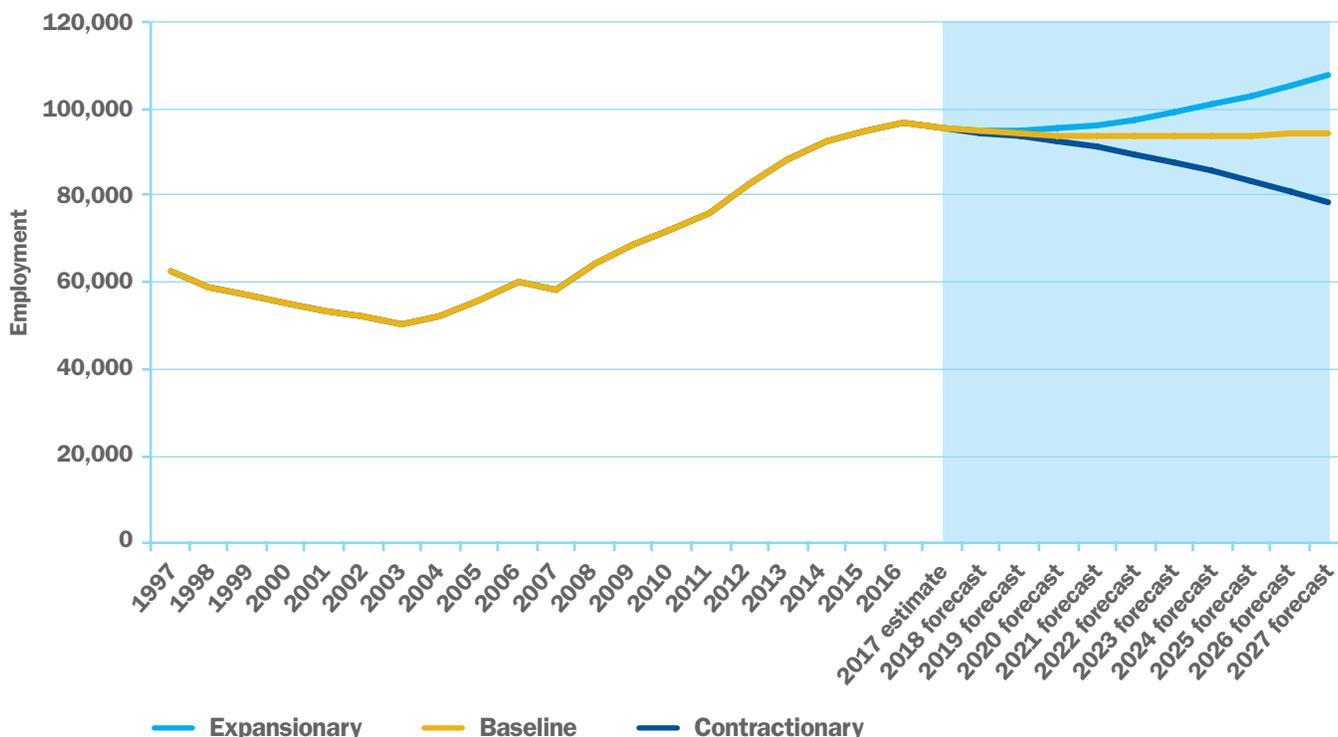
Employment forecast for the extraction & milling sub-sector

Figure 15 shows MiHR’s employment forecast for the *extraction & milling* sub-sector. The figure provides historical

employment for the period between 1997 and 2016. In 2017, employment in *extraction & milling* is estimated to be about 95,300 workers, a modest decrease of roughly 1.4 per cent from 2016.

Employment in the sub-sector is forecasted from 2018 to 2027, under the three scenarios. Under the baseline scenario, employment is anticipated to decrease by roughly 1,060 workers (or by 1 per cent) by 2027. Under the expansionary scenario, employment is expected to grow by 12,510 workers (or by 13 per cent), whereas the contractionary scenario projects a reduction of 16,770 workers over the forecast period (or by 18 per cent). Each scenario reflects a likely range of employment outcomes for the sub-sector – from a modest change (or status quo) under the baseline scenario, to a 13 per cent expansion, or an 18 per cent contraction over the forecast period.

Figure 15: Historical and forecasted employment in the extraction & milling sub-sector (1997–2027)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2017

Occupational structure in the extraction & milling sub-sector

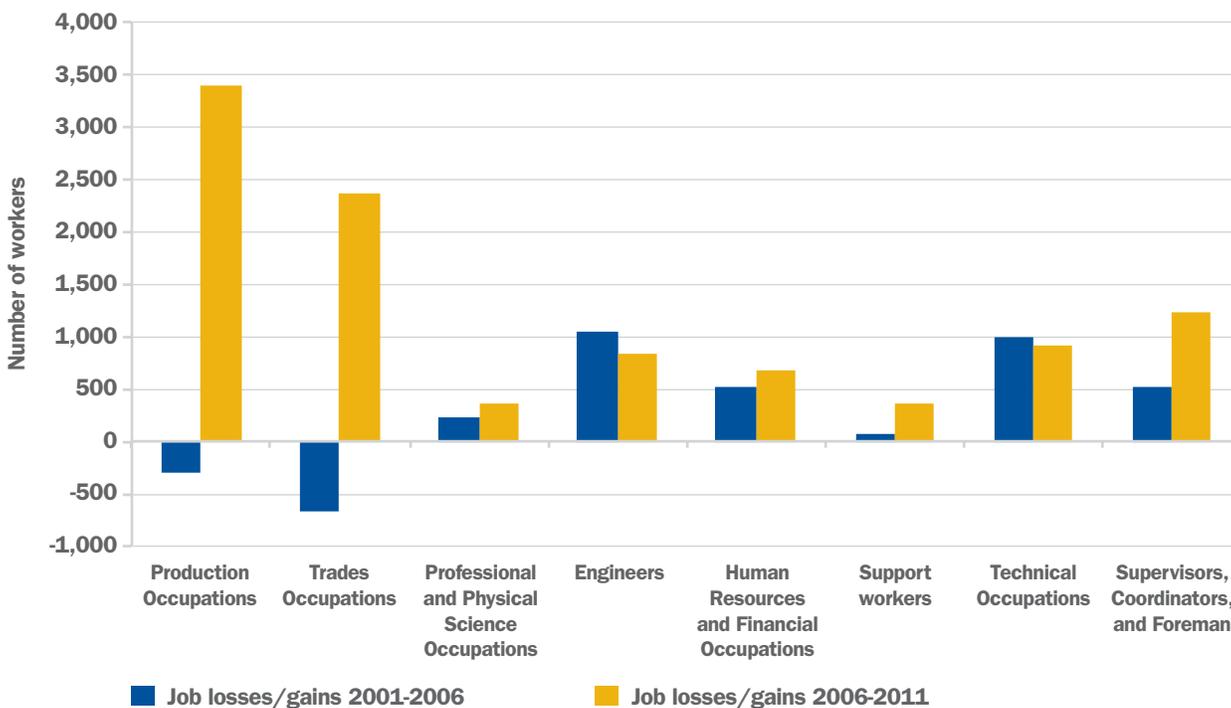
Within the *extraction & milling* sub-sector, the profile of occupations has gradually changed over the past three census periods (2001, 2006 and 2011). Trades and production occupations together make up the largest share among the occupational categories, although this share has steadily drifted downward, from 60 per cent in 2001 to 53 per cent in 2011. In the latter census period, this translates to roughly 11 workers in trades and production occupations for every 10 workers in other occupational categories – down from 15 for every 10

in the previous census period. This trend could be a sign that extraction employers are gradually placing emphasis on other occupational areas, or even outsourcing trades and production activities to external contractors.⁴ Concurrently, other occupational categories, such as *engineers and technical occupations*, have slightly increased.

Currently, the true significance of these subtle changes is difficult to conclude, but MiHR continues to monitor and evaluate the occupational trends in each sub-sector, in order to determine whether they are indeed significant and likely to continue in the future.

Fluctuations in the economy can affect certain occupations differently. As such, the occupational composition of an organization usually varies with economic cycles. For a primary production industry such as mining, a period of prosperity may lead employers to hire more *production occupations* versus other categories. Figure 16 shows the employment gains and losses for the various occupational groups in the *extraction & milling* sub-sector over three census periods. The left column shows the gains or losses between 2001 and 2006, whereas the right column shows the gains or losses between 2006 and 2011.

Figure 16: Employment gains and losses in the extraction & milling sub-sector, by broad occupational group (2001–2006 versus 2006–2011)



Source: Mining Industry Human Resources Council, Statistics Canada (2001 Census, 2006 Census and 2011 NHS/Census), 2017

Notably, employment in *trades and production occupations* dropped between 2001 and 2006, and rebounded between 2006 and 2011. This is seemingly counterintuitive, since the former period

is marked with economic growth and increased output in the sub-sector. However, as shown in the next section (see Figure 18), employment in *trades and production occupations* increased in the

support services sub-sector during the same period. This suggests that mining development during the early half of the 2000s entered a growth phase, coinciding with an upward shift in prices (often

⁴A discussion on the use of contractors is further provided in the following section in this report on the support services sub-sector.

referred to as the super-cycle). During the construction phase, mine developers depend more on contracted firms to build the mines, and when these properties started production in the latter part of the decade, employment in these occupations shifted to the *extraction & milling* sub-sector, as it became more established and properties moved in to full production.

Support services

The *support services* sub-sector includes the activities of organizations providing support services for the mining industry. Given that these organizations are typically not the primary owner/operators of a project, their services are usually purchased on a contract or fee-for-service basis. This sub-sector includes all forms of support services, including those required for mine construction, extraction, processing and exploration activities. As

such, the *support services* sub-sector covers a wide range of organizational types and sizes.

Employment forecast for the support services sub-sector

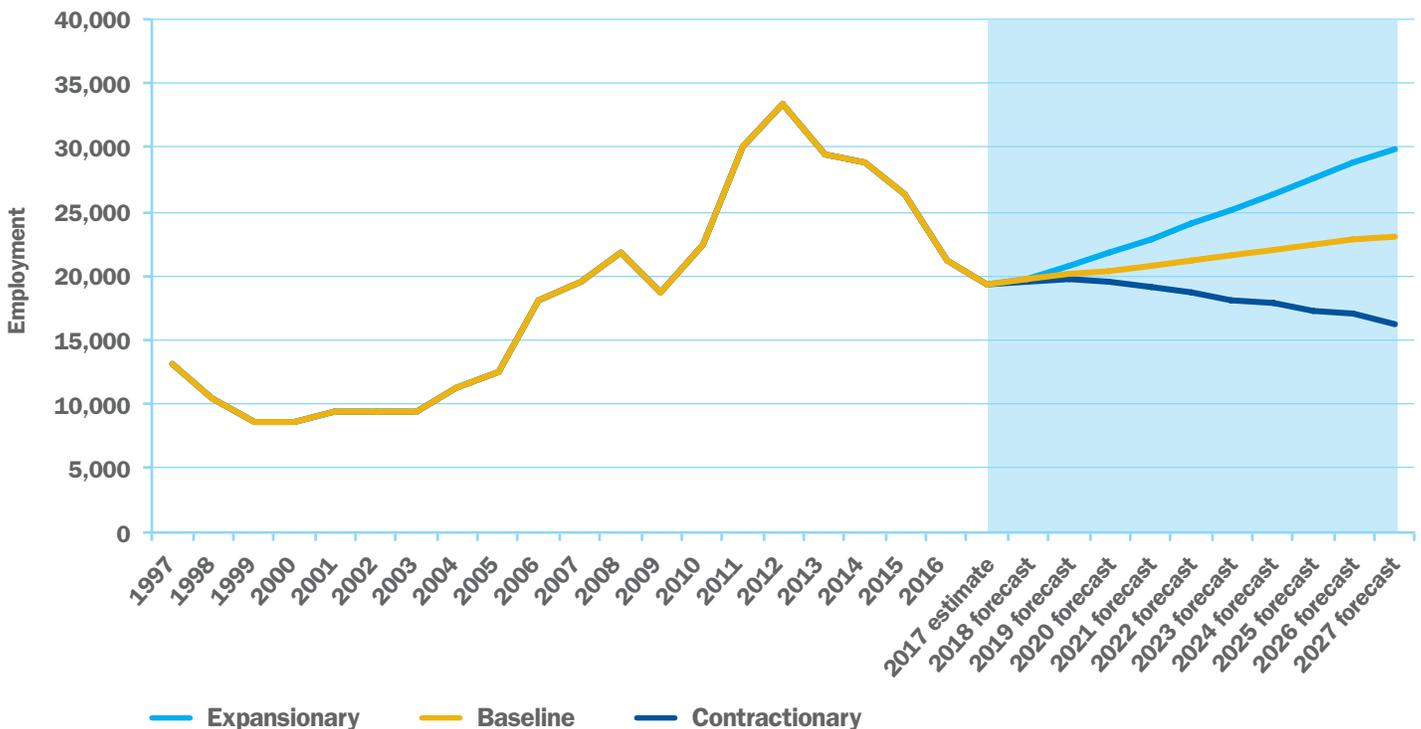
Figure 17 shows MiHR’s employment forecast for the *support services* sub-sector. The figure shows historical employment between 1997 and 2016, the estimated employment for 2017, and the three scenarios of forecasted employment from 2018 to 2027. In 2017, employment in the sub-sector is estimated at 19,400 workers, a decrease of about 8 per cent from 2016.

Over the forecast period, employment in the sub-sector is expected to gain roughly 3,720 workers (or 5 per cent) under the baseline scenario; the forecast further anticipates an increase of about 10,540 workers (or 19 per cent) under the

expansionary scenario, and a decrease of about 3,090 workers (or 16 per cent) under the contractionary scenario.

As Figure 17 illustrates, the support services sub-sector is prone to relative large fluctuations in levels of employment. This is likely an indication of the sub-sector’s sensitivity to short-term economic changes, especially considering that support service companies are mainly represented by external contractors. This sub-sector is comprised of businesses that may play a temporary role during an individual phase of mining development, such as construction. Furthermore, mine operators may view external contractors as a comparatively easier way to temporarily increase or decrease their workforce in response to economic cycles (when compared to laying off direct company employees).

Figure 17: Historical and forecasted employment in the support services sub-sector (1997–2027)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2017

Occupational structure in the support services sub-sector

The occupational profile in the *support services* sub-sector has also shifted over the past three census periods (2001, 2006 and 2011). In contrast to the *extraction & milling* sub-sector, the share of *trades and production occupations* in the *support services* sub-sector has increased from about 20 per cent in 2001 to about 25 per cent in 2011. This translates to roughly one in four workers in *trades and production occupations* in 2011 – up from one in five

in 2001. This may suggest that the *support services* sub-sector is increasingly engaged in trades and production occupations within their broad portfolio of activities (which include several activities that support other sub-sectors as well).

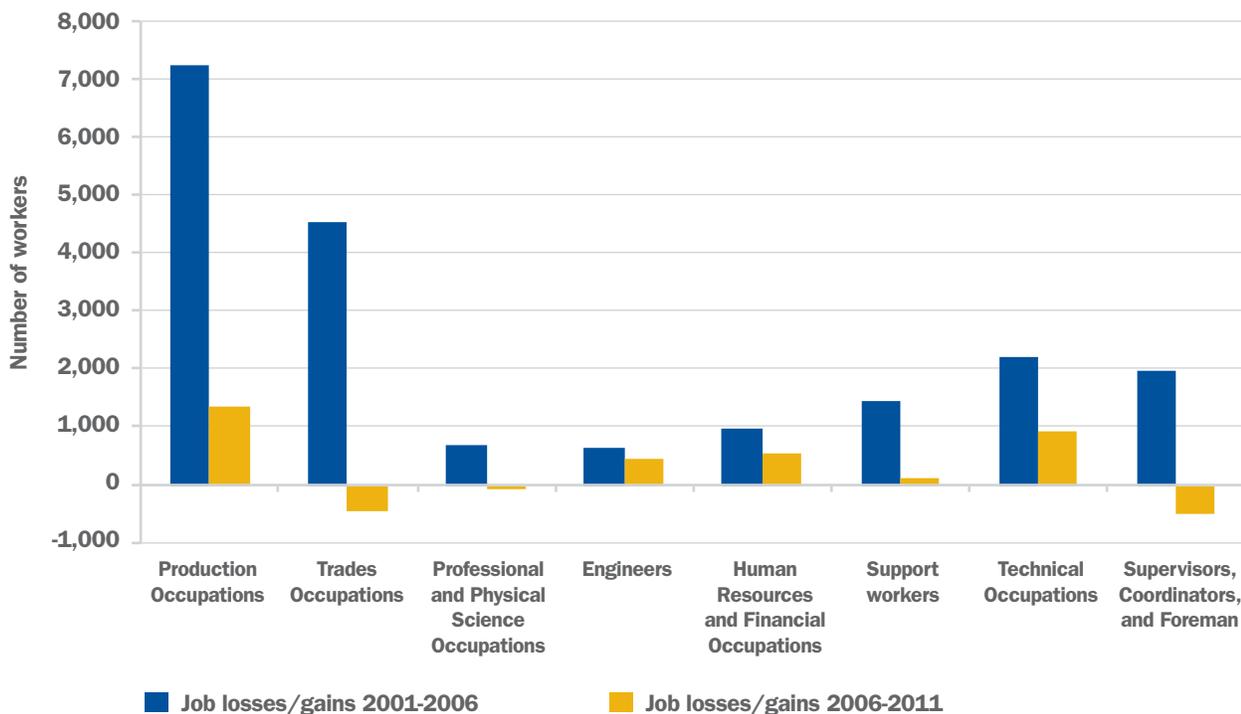
Figure 18 shows the employment gains and losses for the various occupational groups in the *support services* sub-sector over the three census periods. The left column shows the gains or losses between 2001 and 2006, whereas the right column

shows the gains or losses between 2006 and 2011.

Employment in *trades and production occupations* in the *support services* sub-sector increased between 2001 and 2006, and then increased by a smaller amount between 2006 and 2011. As noted, this trend is reversed for these same occupations in *extraction & milling* over the same time period.

MiHR’s 2017 National Employer LMI Survey asked employers if they hire external contractors. All respondents indicated that they hire external contractors; on average, respondents further reported that externally contracted employees represented about 20 per cent of their on-site workforce.

Figure 18: Employment gains and losses in the support services sub-sector, by broad occupational group (2001–2006 versus 2006–2011)



Source: Mining Industry Human Resources Council, Statistics Canada (2001 Census, 2006 Census and 2011 NHS/Census), 2017

Manufacturing & fabrication

The *manufacturing & fabrication* sub-sector consists of activities that are directly downstream from *extraction & milling*, including smelting iron ore, aluminum production and smelting, refining, rolling, drawing, extruding, and alloying other non-ferrous metals; each of these activities adds value to mined products by transforming commodities from a raw, unprocessed state to a product that is ready for use or for further refinement processing.

Employment forecast for the manufacturing & fabrication sub-sector

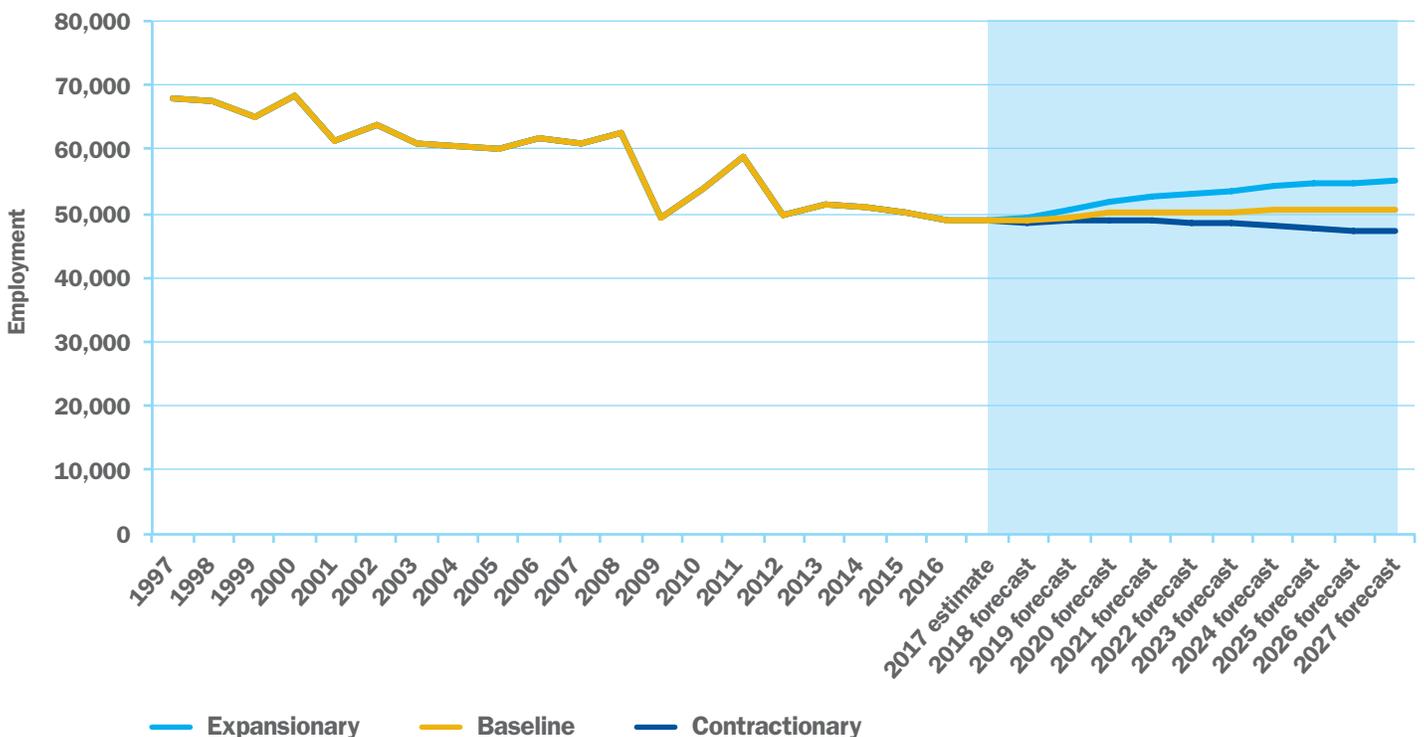
Figure 19 provides MiHR's employment forecast for the manufacturing &

fabrication sub-sector. The figure shows historical employment between 1997 and 2016, the estimated employment for 2017, and the three scenarios of forecasted employment from 2018 to 2027. In 2017, employment in the sub-sector is estimated at 49,180 workers, a negligible decrease from 2016.

Over the forecast period, employment in the sub-sector is expected to gain roughly 1,380 workers (or 3 per cent) under the baseline scenario; the forecast further anticipates an increase of about 5,850 workers (or 12 per cent) under the expansionary scenario, and a decrease of about 1,960 workers (or 4 per cent) under the contractionary scenario.

As shown in Figure 19, employment in the *manufacturing & fabrication* sub-sector has gradually declined over the last two decades (by roughly 28 per cent from 1997 to 2016). Given that extraction employment has risen over the same period, this observation could be a sign that the industry is reducing the amount of these activities taking place in Canada, at least those that are most labour-intensive. Technological advancements in smelting and refining are also relevant to the decay observed in Figure 19. As a result, the forecast for employment in the sub-sector is somewhat stationary, and relatively less sensitive to economic expansions and contractions that affect the overall mining industry.

Figure 19: Historical and forecasted employment in the manufacturing & fabrication sub-sector (1997–2027)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2017

Occupational structure in the manufacturing & fabrication sub-sector

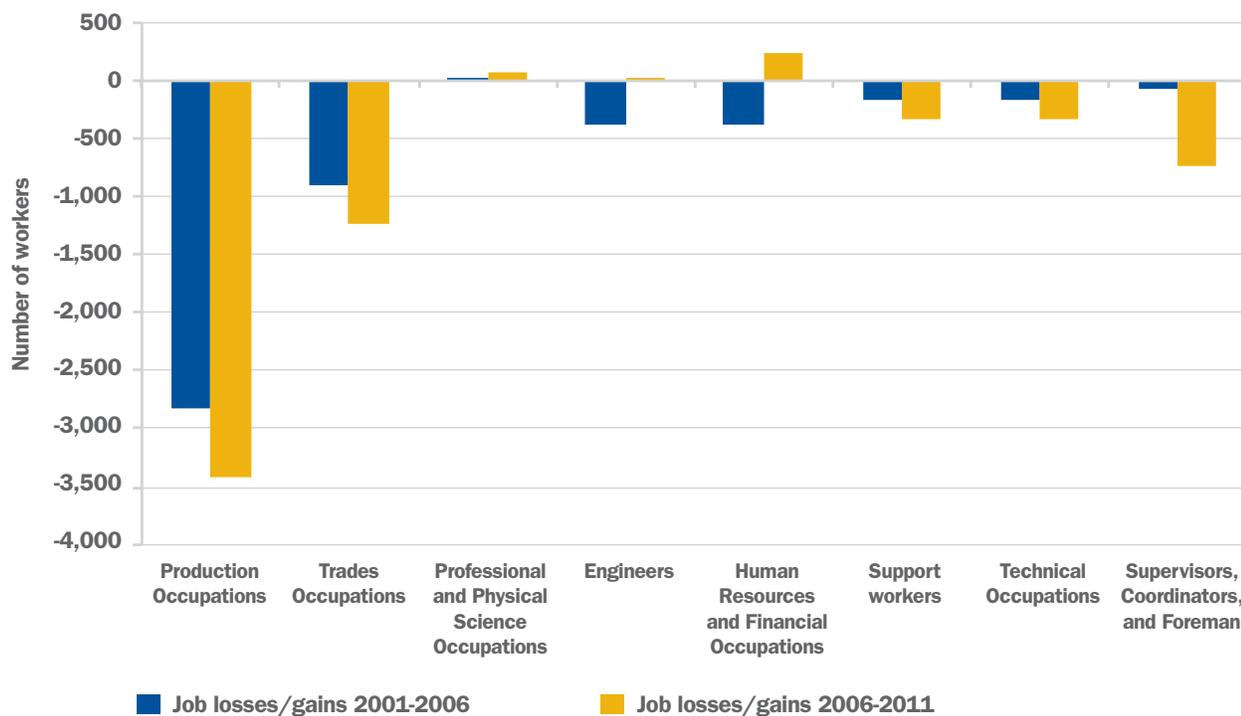
The steady decline in employment in the *manufacturing & fabrication* sub-sector is echoed in changes to the occupational structure of the workforce over time.

Figure 20 shows job gains and losses for

the various occupational groups in the *manufacturing & fabrication* sub-sector over the last three census periods (2001, 2006 and 2011). The left column shows the gains or losses between 2001 and 2006, whereas the right column shows the gains or losses between 2006 and 2011.

Over both inter-census periods, the majority of occupational categories suffered job losses, most notably in the *trades and production occupations*. As such, these occupations have been the most strongly affected by the drop in the sub-sector's employment level.

Figure 20: Employment gains and losses in the manufacturing & fabrication sub-sector, by broad occupational group (2001–2006 versus 2006–2011)



Source: Mining Industry Human Resources Council, Statistics Canada (2001 Census, 2006 Census and 2011 NHS/Census), 2017

Exploration

The exploration sub-sector encompasses activities focused on the discovery of minerals and other commodities in the earth. Exploration projects can be as basic as a one-day walk with no equipment or as robust as a multi-month-long program with drills and a camp setting; a typical project's workforce can range from one to a couple of dozen employees.

Exploration can be classified in a number of ways, generally green-field or brown-field,⁵ and exploration activities can range from small-scale to advanced exploration, to near-mine expansion exploration. An exploration company is typically categorized as either a junior or senior exploration company.⁶ The sub-sector also supports a wide range of occupations from drillers to labourers to geoscientists and other professional scientists. The

multifaceted characteristics of *exploration* make it a particularly challenging sub-sector to analyse. Given the large depth and range of the sub-sector, in 2017, MiHR (in partnership with the Prospectors & Developers Association of Canada) has commissioned an exploration survey to improve on the available LMI on the *exploration* sub-sector and its unique labour force challenges.

⁵Brown-field exploration refers to looking for deposits adjacent to an existing mine, whereas green-field exploration refers to searching unexplored areas for mineral deposits.

⁶Natural Resources Canada describes a "junior" exploration company as "small, flexible, and specialized in higher-risk, early-stage exploration activities" and which "usually has no operating revenue and relies on equity financing." The activities of these smaller enterprises represent much of the green-field exploration that takes place in a particular region.

Employment forecast for the exploration sub-sector

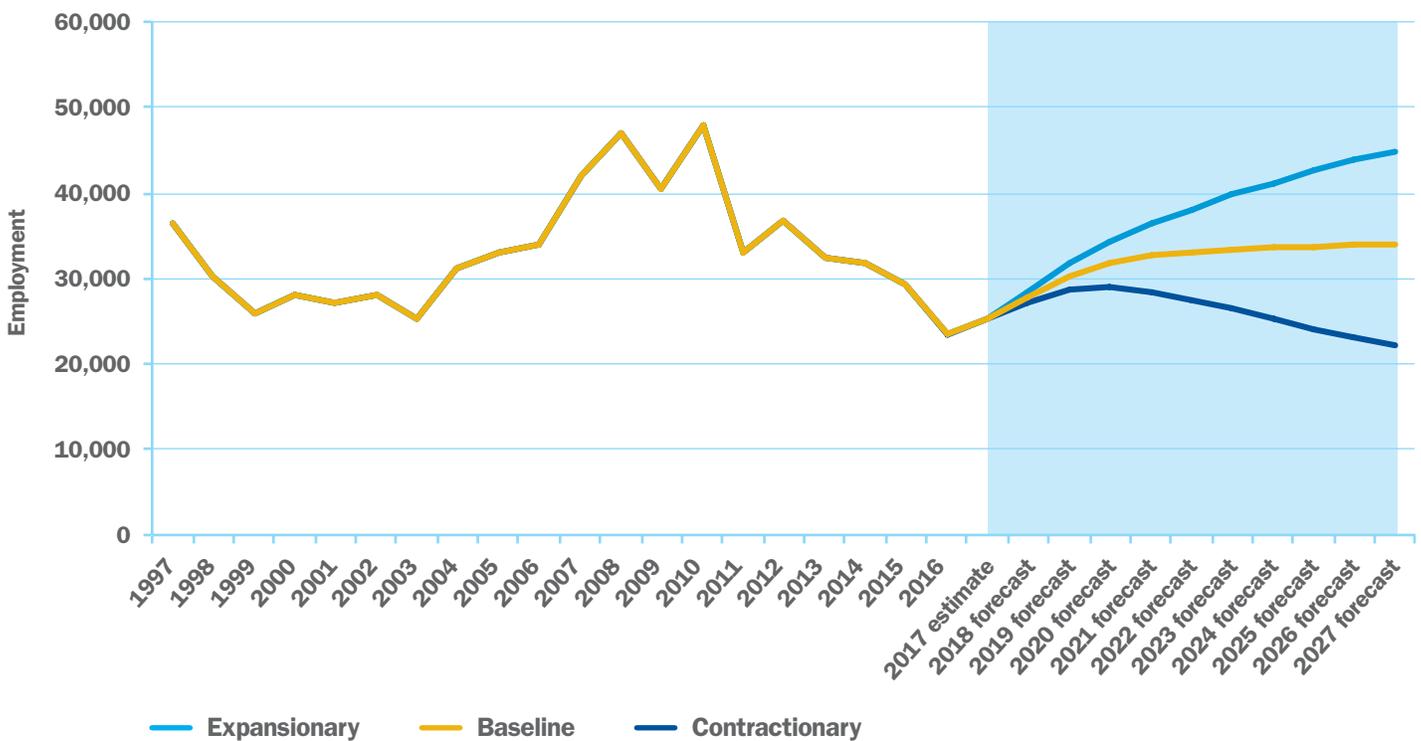
Figure 21 provides MiHR’s employment forecast for the *exploration* sub-sector. The figure shows historical employment between 1997 and 2016, the estimated employment for 2017, and the three

scenarios of forecasted employment from 2018 to 2027. In 2017, employment in the sub-sector is estimated at 25,180 workers, an increase of about 7 per cent from 2016.

Over the forecast period, employment in the sub-sector is expected to gain

roughly 8,740 workers (or 35 per cent) under the baseline scenario; the forecast further anticipates an increase of about 19,620 workers (or 78 per cent) under the expansionary scenario, and a decrease of about 3,100 workers (or 12 per cent) under the contractionary scenario.

Figure 21: Historical and forecasted employment in the exploration sub-sector (1997–2027)



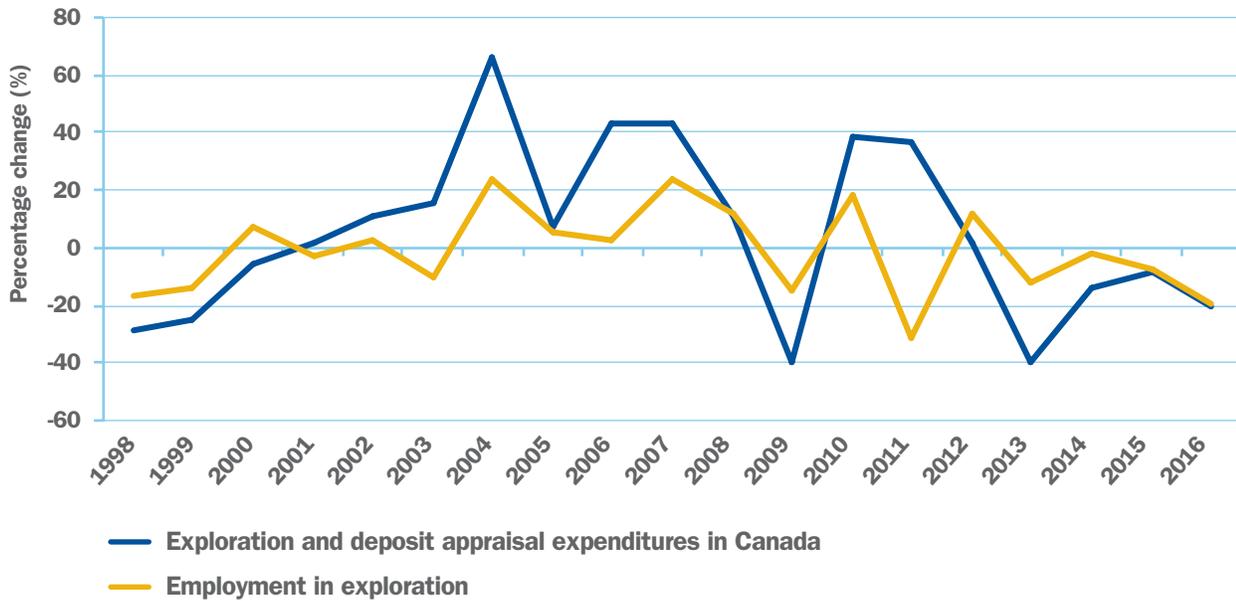
Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2017

In Figure 21, employment in the *exploration* sub-sector is shown to be particularly sensitive to economic expansions and contractions. Many exploration activities are financed through capital markets and speculative investment; therefore, signals of weaker commodity prices reduce confidence among investors and suppress the venture capital that is available to finance exploration efforts. From 2010 until 2016, employment in exploration

contracted to its lowest level over the last two decades, largely due to a significant slump in commodity prices over that period. Employment in the sub-sector is expected to recover in the short-term under all three scenarios; in the long term, however, the sub-sector is still connected to market conditions and uncertainty, and by 2027, the employment scenarios range from levels similar to 2010 to slightly below those observed in 2016.

The uncertainty of securing venture capital is echoed by exploration spending and ultimately employment. Figure 22 draws parallels between spending and employment in *exploration*, highlighting the particular challenge for the sub-sector to maintain a sustainable workforce through economic fluctuations over time.

Figure 22: Changes in spending and employment in the exploration sub-sector (1998–2016)



Source: Mining Industry Human Resources Council, Natural Resources Canada, Statistics Canada (System of National Accounts), 2017

Summary of employment in Canada's mining sub-sectors

Together, the *extraction & milling, support services, manufacturing & fabrication* and *exploration* sub-sectors collectively describe the mining industry as defined by MiHR. Figure 23 provides the overall

employment outlook (historical and forecasted), based on the sub-sectoral employment figures shown throughout this section. The figure also provides the three forecast scenarios for mining industry employment. Each of these represents a cumulative workforce adjustment over

the forecast period that will be needed to match the ever-changing demand for workers – commonly referred to as “net change in employment” in previous MiHR reports. A summary of net change in employment is given in Table 2.

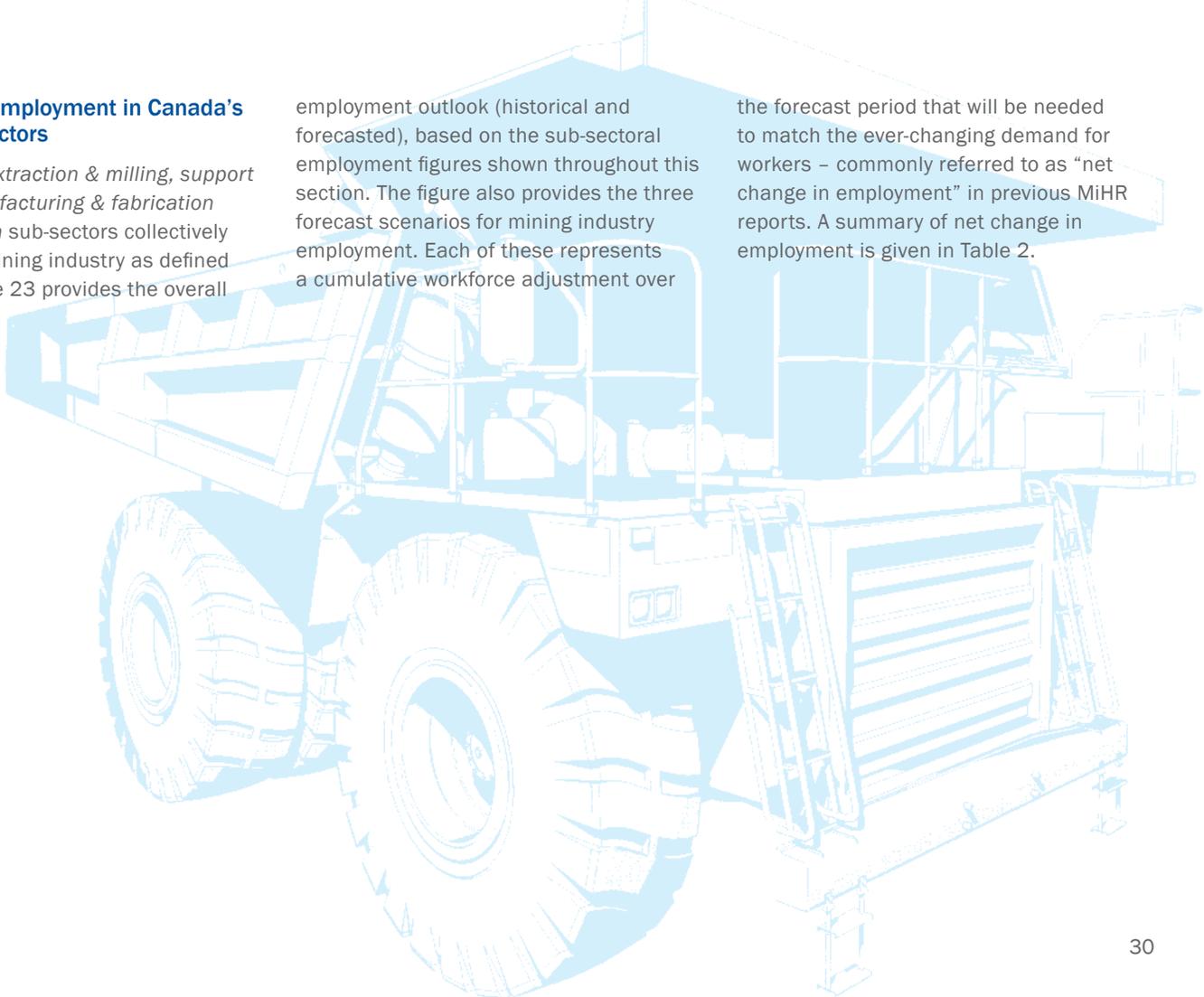


Figure 23: Historical and forecasted employment in the mining industry (all sub-sectors) (1997–2027)



Source: Mining Industry Human Resources Council, Statistics Canada (System of National Accounts), 2017

Table 2: Forecasted net change in employment in the mining industry by sub-sector (2018–2027)

	Contractionary	Baseline	Expansionary
Extraction & milling	-16,770	-1,060	12,510
Support services	-3,090	3,720	10,540
Manufacturing & fabrication	-1,970	1,380	5,850
Exploration	-3,110	8,740	19,620
Total	-24,940	12,780	48,520

Source: Mining Industry Human Resources Council, 2017

Note that the gap between the scenarios in Table 2 has widened, compared to previous MiHR forecasts for net change in employment. This outcome is mainly caused by (1) the shift to SNA employment data and (2) the adjustment to the industry definition. Both of these changes

have revealed a greater variation in the historical employment data that better represents the progression of each mining sub-sector (as shown in Figures 15, 17, 19, and 21). At the same time, additional variation and the recently observed super-cycle movement has broadened the

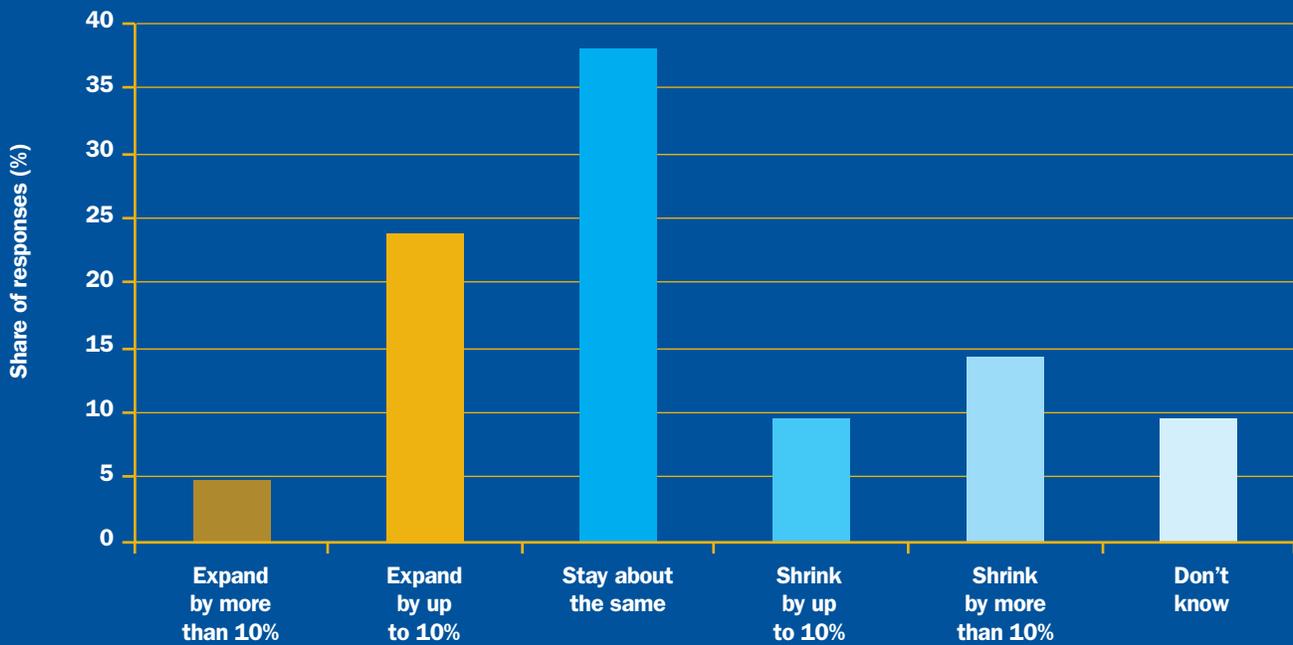
distance between the contractionary and expansionary scenarios. To the extent that wider super-cycle fluctuations represent a new standard for the industry, the scenarios presented in Table 2 account for the uncertainty that characterizes the industry.

MiHR's 2017 National Employer LMI Survey asked employers to anticipate whether the size of their workforce will expand, shrink, or stay the same in the next 12 months. The largest percentage of respondents, 38 percent, stated that they expect their workforce will stay the same. At the same time, 24 percent of respondents stated that their workforce will expand (by up to 10 percent) and 14 per cent of respondents expect their workforce will shrink (by more than 10 percent). The distribution of these responses, shown in Figure 24, is reasonably consistent with the MiHR's overall employment forecast under the baseline scenario (see Figure 23); though respondents were not asked to anticipate their employment needs past 12 months.



Out of the reported vacancies, the vast majority were permanent, full-time positions

Figure 24: MiHR's 2017 National Employer LMI Survey: Thinking of the current number of employees, in the next 12 months do you anticipate your work force will...



Source: Mining Industry Human Resources Council (National Employer LMI Survey), 2017

MiHR's 2017 National Employer LMI Survey also asked employers to provide their current number of vacant positions at their Canadian mining operations. The average response was roughly 28 vacancies per respondent; out of the reported vacancies, the vast majority (87 per cent) were permanent, full-time positions, while about 13 per cent were non-permanent positions;

virtually none of the reported vacancies were part-time positions.

Based on this information for vacancies, it is possible to calculate the vacancy rate of respondents – defined as the percentage of total labour demand (employees plus vacancies) that is represented by vacancies. Subsequently, the vacancy rate is estimated at about 2 per cent from the

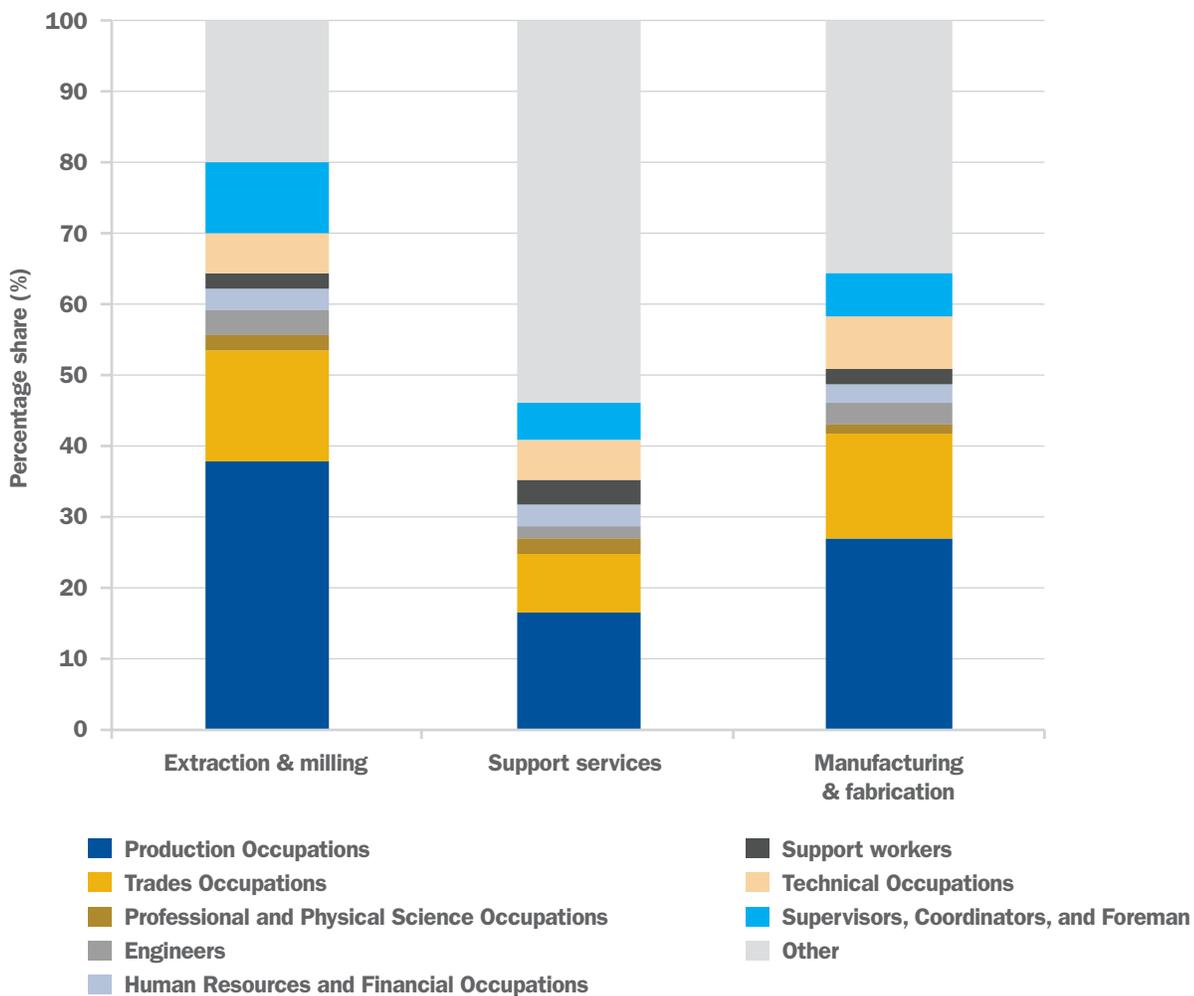
sample of responses. This estimate is comparable to the vacancy rates provided by Statistics Canada's Job Vacancy and Wage Survey (JVWS), which since the start of 2015, have ranged between 0.7 and 2 per cent for *mining and quarrying (except oil & gas extraction)* and 0.9 and 2 per cent for *support activities for mining, and oil & gas extraction*.

This section has pointed to the distinct occupational changes within each mining sub-sector (except for the *exploration* sub-sector) over the last three census periods. Figure 25 complements this discussion by comparing the occupational profile of each sub-sector in the latest census

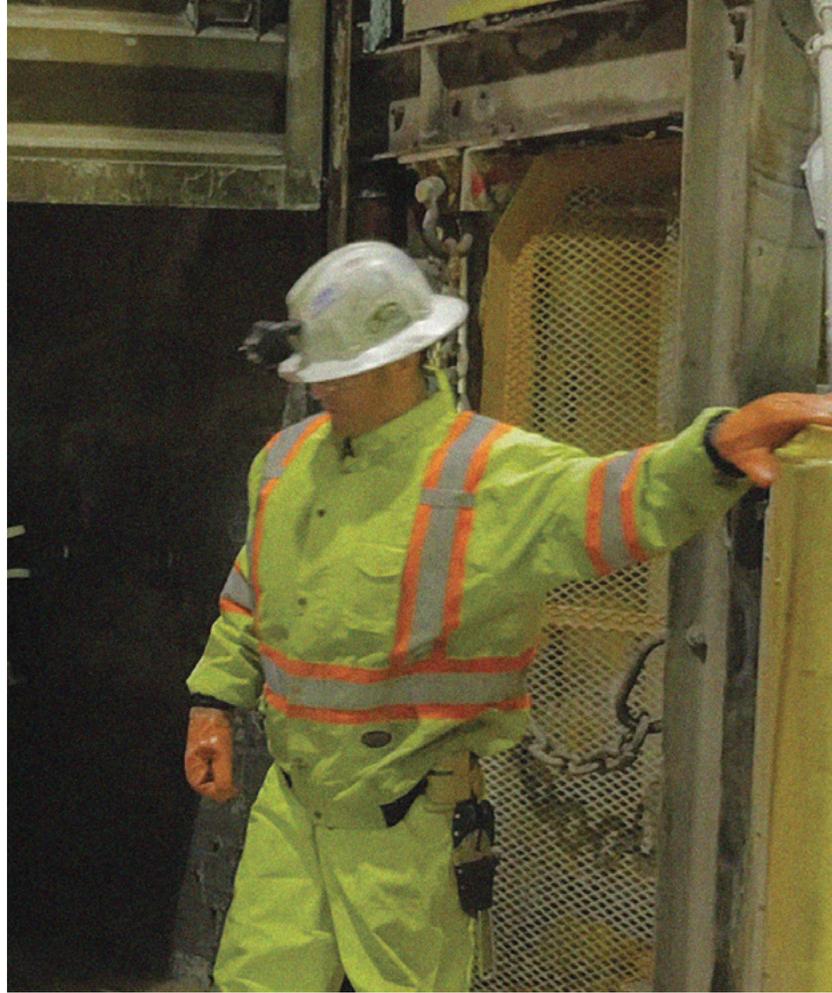
period (2011). As shown by the figure, each sub-sector supports a unique mix of occupation categories. Generally, *trades and production occupations* make up the largest proportion of the mining workforce. The significance of these profiles is that they provide context for each sub-sector's

particular occupational trends and sensitivities. For example, a contraction or expansion in the *extraction & milling* sub-sector will have a relatively weighty effect on the demand for production workers as they represent nearly 40 per cent of the occupations in the sub-sector.

Figure 25: Occupational structure by sub-sector (2011)



Source: Mining Industry Human Resources Council, Statistics Canada (2011 NHS/Census), 2017
 * Note that the occupational structure for the exploration sub-sector is not included, due to limitation with currently available occupational data for the sub-sector.



THE SUPPLY OF LABOUR FOR CANADA'S MINING INDUSTRY

In contrast to labour demand – which describes the labour inputs that employers are willing to buy from workers – labour supply describes the labour inputs that people are willing to offer to employers. As such, the Canadian mining industry's labour supply depends on the collective

actions and decisions of individuals, including the fundamental choice of whether or not they want to participate in the labour market at all.

This section explores the labour market outcomes of Canadians with a particular

focus on the sectors and occupations that are relevant to Canada's mining industry. The discussion highlights the types of occupations people have gravitated toward and how various groups have entered and exited the mining labour market over time.

Outcomes in the labour market

A central part of labour supply analysis is looking at how people participate in the labour force. The labour force is formally defined as those who are either employed or unemployed (looking for work). For a particular individual, participation in the labour force is not a given. According to Statistics Canada, the labour force participation rate, or the share of the working-age population that is participating in the labour force, averaged about 67 per cent from 2005 to 2015.

A person's participation in the labour force can depend on a variety of factors and motivations. While these may well vary from person to person, there are certain characteristics that collectively shape participation and thus, the aggregate supply of labour that is available. For example, labour force participation among 25- to 29- year-olds is likely greater than that of 65- to 69- year-olds, all other things being equal. Aside from age composition, other factors that can influence labour force participation include prevailing wages, population size, and demographic

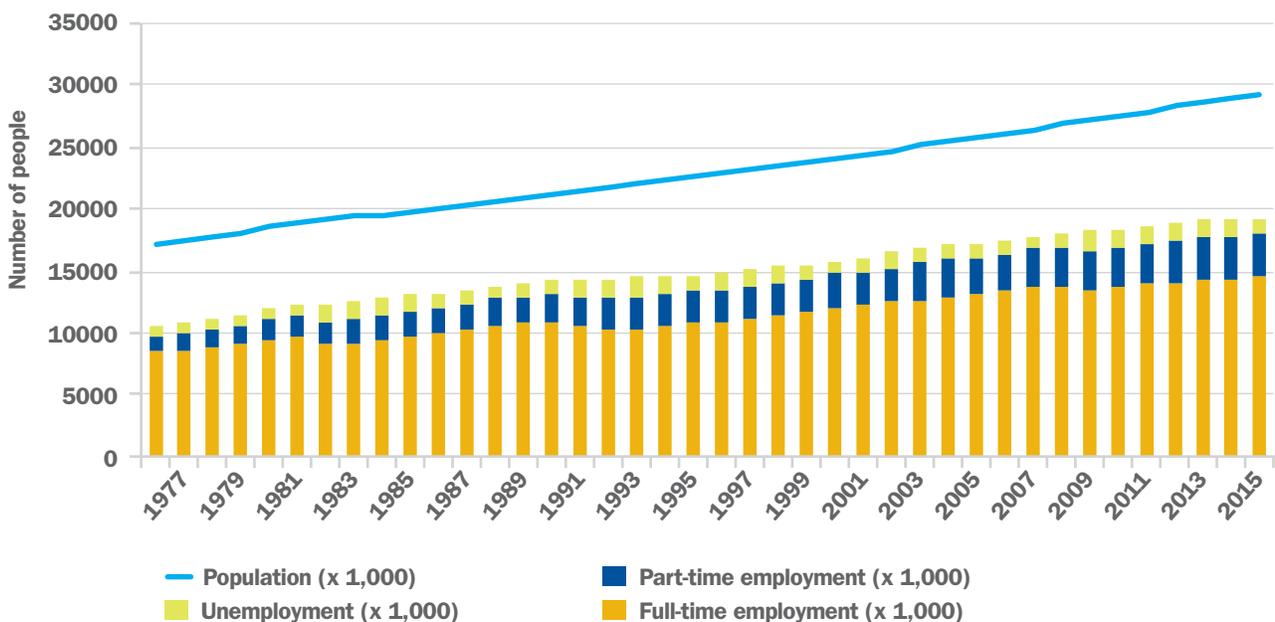
characteristics such as education and mobility, among others. Together, these factors determine the relative ease with which an industry is able to access a sustainable source of labour.

The mining industry, in particular, possesses certain characteristics that regularly challenge its ability to secure a robust labour supply pipeline; for example, given that mining activities are often (and unavoidably) located far from population centres and amenities, mining employers frequently turn to other regions to supplement their labour needs. Also, economic fluctuations create uncertainty, undermining the industry's ability to retain attachment to its supply of labour. Both of these factors have a significant impact on the numbers of people willing to participate in the mining labour force. In response to these realities, industry employers have adapted to ensure their labour supply pipeline remains sufficient (e.g., flying in workers, delaying layoffs, increased wages, etc.), but these measures are costly and threaten the industry's overall competitiveness and sustainability.

Labour market outcomes in all industries

Figure 26 charts the labour market outcomes of Canadians from 1976 to 2015. Over this time period, the working-age population has increased steadily (at a compound annual growth rate of about 1.4 per cent). The growth observed in each year reflects the addition of new immigrants, as well as those who have reached the work-eligible age. By comparison, the growth of the labour force has roughly paralleled that of the working-age population (at about 1.6 per cent in compound annual growth). This increase represents the addition of new labour force participants, which includes a percentage of the new immigrants, those who have reached the work-eligible age and non-participants who have subsequently entered the labour force (e.g., graduates transitioning from school to the labour force). Figure 26 also shows how full-time and part-time employment, and unemployment in the labour force progressed over time.

Figure 26: Labour market outcomes in Canada, all industries (1976–2015)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2017

These trends provide a broader context for the supply of labour that is available to all industries in Canada, including the mining industry. The size of the Canadian labour force has increased by approximately 2.0 million people from 2005 to 2015; given that this increase is for all industries and all occupations, the central questions explored in this section are:

- Which types of industries and occupations have people entered into? That is, which types of industries and occupations have been the biggest winners and losers over this time period?
- What are the sources of new entrants to the labour force? And what are their characteristics (age, education, occupations, for example)?

- Finally, what implications do these trends have for Canada’s mining industry and its access to a sustainable labour supply?

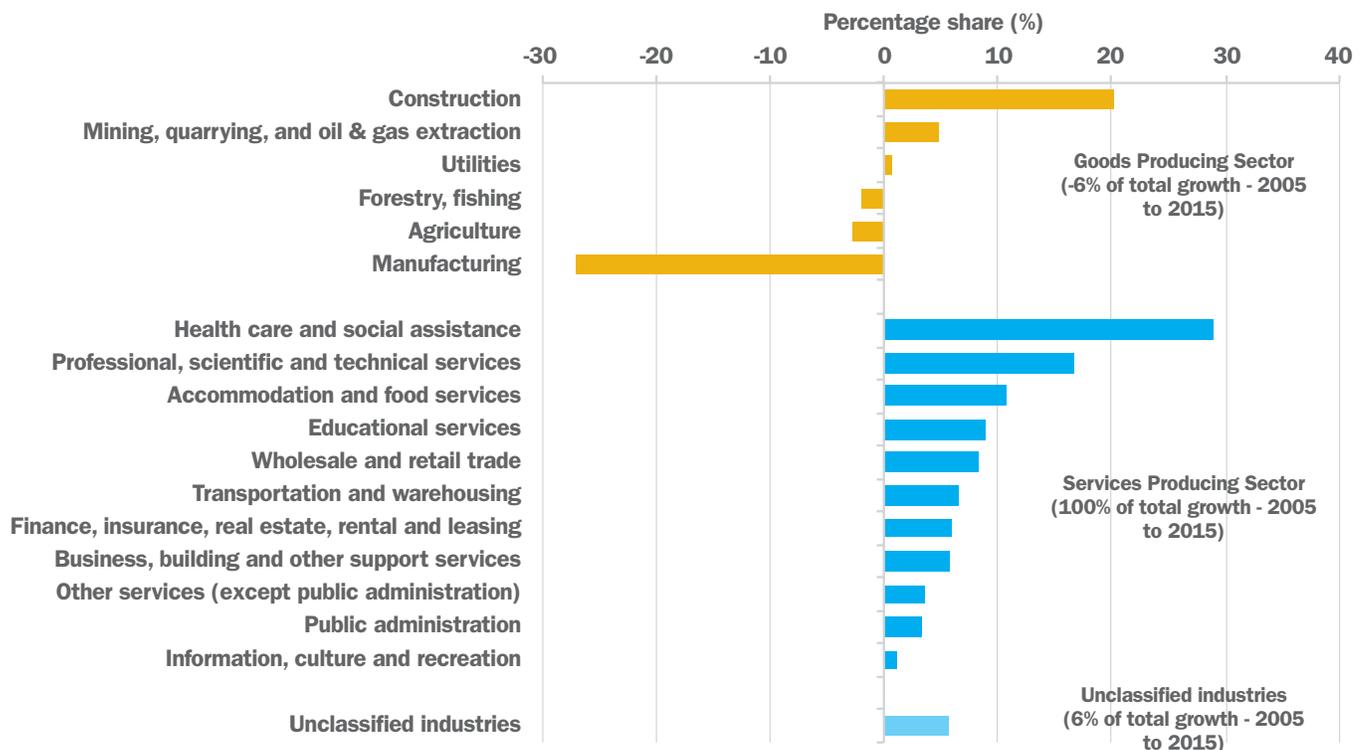
Since the mining industry draws from the same labour pool as other industries, its ability to compete for a finite source of new labour depends on the pull that certain occupations and industries have on individuals entering the labour force, and on the mining industry’s capability to adapt to these forces.

Labour force winners and losers by sector

Figure 27 highlights the extent that various sectors are represented within the overall labour force expansion that was observed from 2005 to 2015. As shown in the figure,

virtually all of the increase is attributed to the services-producing sector, whereas the labour force in the goods-producing sector actually contracted as a whole over the same period.⁷ Within the goods-producing sector, gains in *Construction* have been offset by losses in *Manufacturing*. In contrast, all of the services-producing sub-sectors have expanded their respective labour forces. Although mining industry activities extend to a broad range of the illustrated sectors, the industry is intrinsically part of the goods-producing sector. Thus, the recent pull toward the services-producing sector is potentially problematic for mining employers that draw from the goods-producing labour force.

Figure 27: Share of labour force expansion by sector (2005–2015)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2017

⁷The net result of these changes (along with a minimal growth in unclassified industries) produces the overall increase of 2.0 million people cited above.

Labour market outcomes in extraction and milling

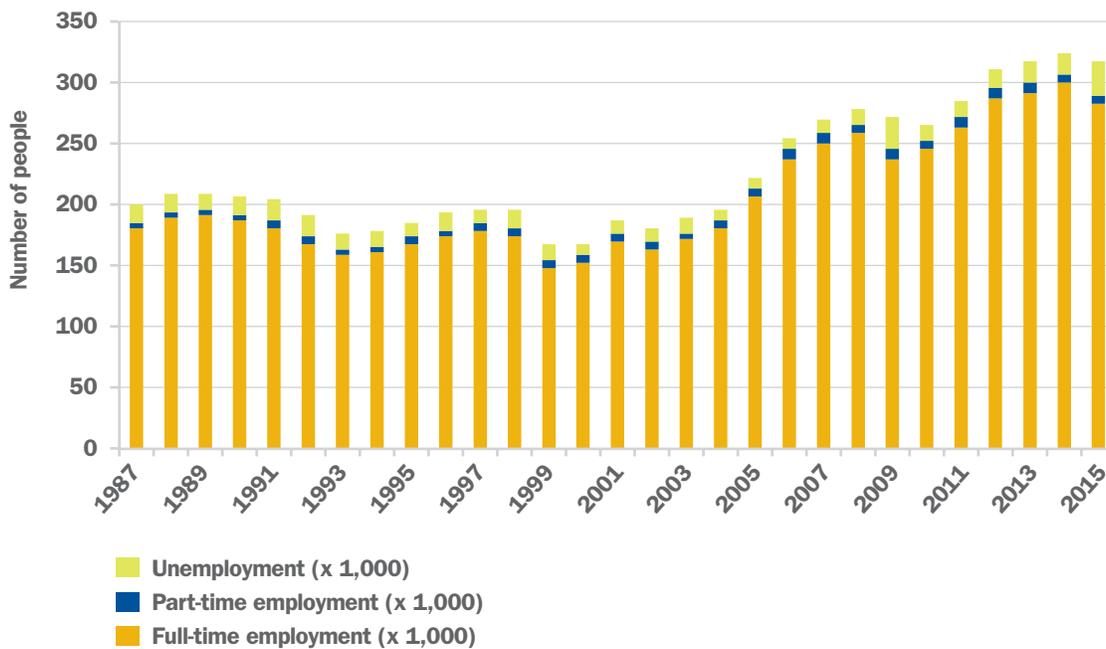
Again, the mining industry is not confined to any one of the sectors displayed in Figure 27. However, among the sectors, *mining, quarrying and oil & gas extraction* has the most identifiable association with the mining industry, specifically with *extraction & milling* activities. This sector is shown to have captured a modest 4.8 per cent of the overall labour force expansion

reported in Figure 27, which translates to 96,000 additional participants from 2005 to 2015.⁸

Figure 28 shows how labour force outcomes have evolved in *mining, quarrying and oil & gas extraction* from 1987 to 2015. Over this time, the labour force has grown by about 1.7 per cent in compound annual growth, and since 2005, this growth has accelerated to 2.3 per cent.

Similar to the overall labour force, the expansion observed for *mining, quarrying and oil & gas extraction* represents the net addition of new labour force participants – which includes new immigrants, those who have reached the work-eligible age, and non-participants who have subsequently entered the labour force. Unlike the overall labour force, these increases may also represent the addition of participants who have moved to mining from other industries.

Figure 28: Labour market outcomes in Canada, mining, quarrying and oil & gas extraction (1987–2015)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2017

Table 3 compares different categories within the labour force for mining, quarrying and oil & gas extraction from 2005 to 2015; over this time span, the size of the labour force increased by 96,000 people (from 222,000 in 2005 to 318,000 in 2015). The breakdown of this increase reveals a few distinctions when compared to the overall labour force.

First, even with growth in the overall labour force, the share of part-time employment in

mining, quarrying and oil & gas extraction has remained relatively minimal at roughly 3 per cent. In contrast, the share of part-time employment in the overall labour force was in the range of 17–18 per cent.

Second, compared to the overall labour force, a greater portion of the labour force increase observed in *mining, quarrying and oil & gas extraction* has come from a rise in unemployment. Specifically, unemployment

has increased from 4 per cent in 2005 to 9 per cent in 2015, or about 20 per cent of the sector's labour force growth. This result is mainly due to the recent economic downturn that has affected mining activities in the last few years. This rise in unemployment has primarily come at the expense of full-time jobs, given that part-time employment is low within the mining sector.

⁸Calculated as 4.8 per cent multiplied by 2.0 million in labour force expansion = 96,000 in labour force expansion in *mining, quarrying and oil & gas extraction* from 2005 to 2015.

Table 3: Change in labour market outcomes in Canada, mining, quarrying and oil & gas extraction (2005 vs. 2015)

	2005		2015		Difference	
	(000's)	%	(000's)	%	(000's)	%
Labour force	222	100%	317.9	100%	95.9	100%
Employment	213.3	96%	289.9	91%	76.6	80%
Full-time Employment	207	93%	281.7	89%	74.7	78%
Part-time Employment	6.2	3%	8.2	3%	2	2%
Unemployment	8.7	4%	28	9%	19.3	20%

Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2017

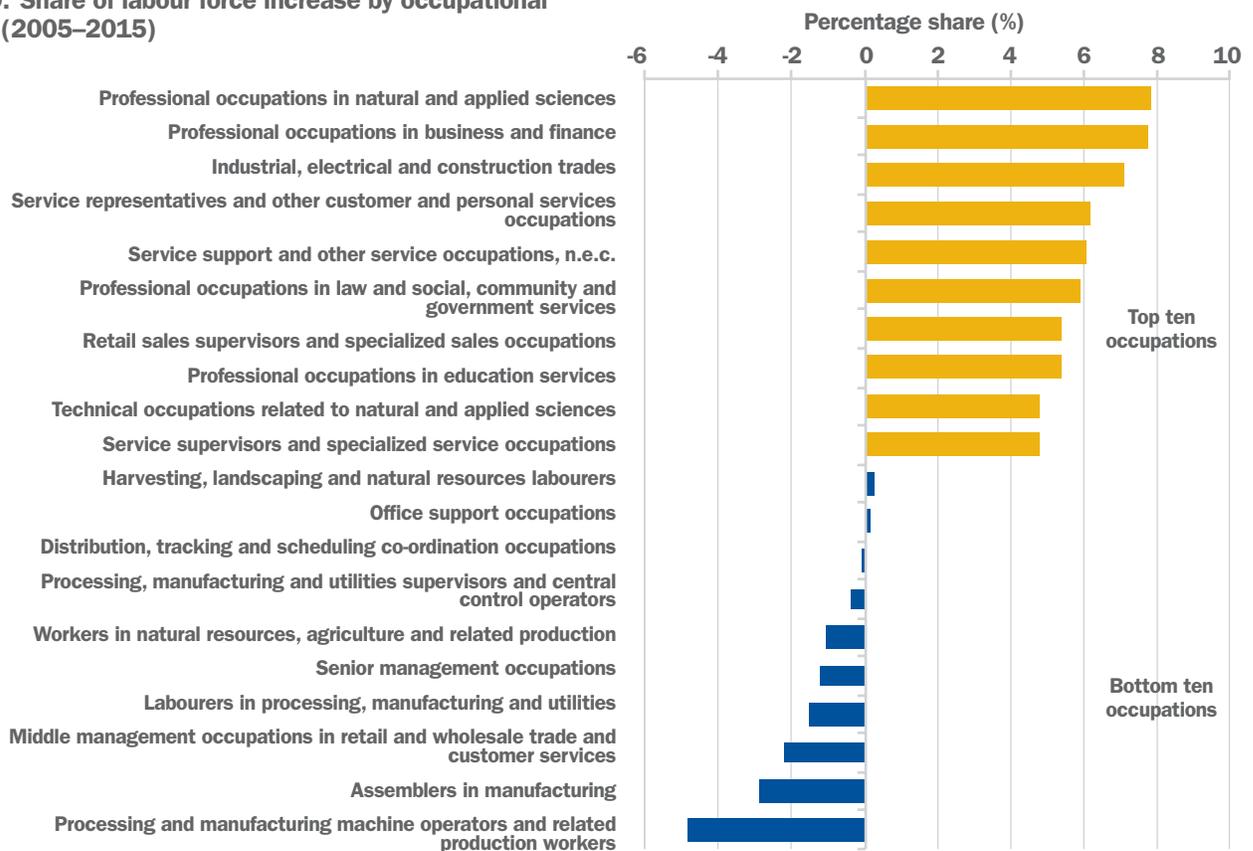
Labour force winners and losers by occupational category

Figure 29 shows the extent that certain occupational categories have contributed to the overall labour force increase from 2005 to 2015. *Professional occupations* (both in natural and applied sciences, and business and finance) are included among the categories with the largest share of

growth; conversely manufacturing-related occupations (*assemblers in manufacturing, and processing and manufacturing machine operators and related production workers*) are among those for which employment has contracted, echoing the decline in *manufacturing & fabrication* activities observed in Section Four of this report.

The mining industry draws from a number of the occupational categories shown in Figure 29, including from both the top and bottom ranks of labour force growth. Thus, the industry’s ability to secure an adequate labour pool is also dependent on the types of occupations it utilizes, and whether they are among the growing segments of the labour force.

Figure 29: Share of labour force increase by occupational category (2005–2015)



Source: Mining Industry Human Resources Council, Statistics Canada (Labour Force Survey), 2017

Observing how the labour force has evolved over time provides a foundation to better understand the trends in labour supply that may affect the mining industry's access to talent in the future. Behind these trends are the actions of individuals who, in a given time period, have entered, exited or remained in a particular industry or occupational labour force.

MiHR examines the mining industry's labour supply through the lens of entries and exits. One common analogy used to describe labour supply, exits and entries is to visualize a bathtub: the water in the tub represents the current supply of labour; the drain represents those who are exiting, whereas the faucet represents those who are entering the labour supply. Over a particular time period, what effect will the drain and the faucet have on the level of water in the tub? MiHR uses forecasts of exits and entries in order to evaluate the above question for the mining labour supply. However, rather than just one faucet and one drain, the labour supply bathtub includes several faucets and drains representing the various points of entry (and exit) into (and out of) the industry's labour supply.

The remainder of this section offers an analysis of exits and entries in the mining industry. Specifically, this includes a review of the methods that MiHR uses to forecast and analyze exits and entries, as well as a description of the primary sources of exits

and entries. The objective of this analysis is to profile those who are entering and exiting the mining labour supply, which could inform and help the mining industry to plan strategies aimed at optimizing its available labour supply.

Exits

Exits describe the segment of the mining labour force that, in a given time period, elects to withdraw from Canada's mining labour force for a variety of potential reasons. Retirement is a prime example of exiting the labour force, given that when a person retires, they are no longer available for employment in the industry; consequently, retirement reduces the size of the labour force. A participant can decide to exit the Canadian mining industry's labour force for reasons other than retirement. MiHR refers to this scenario as non-retirement separation. In this report, MiHR considers the following sources for non-retirement separation:

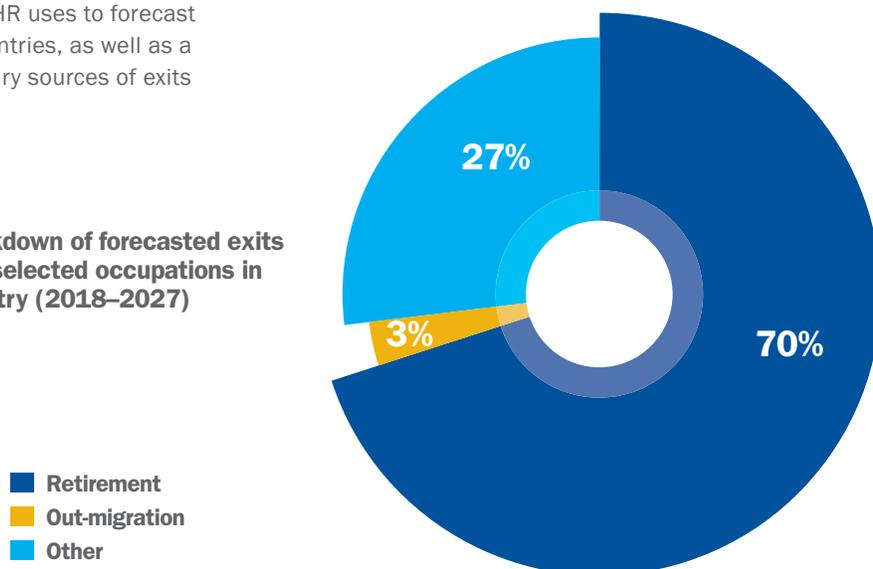
- 1 A worker or potential worker that decides to work or look for work in another industry;
- 2 A potential worker that becomes discouraged in looking for work; and
- 3 A worker or potential worker that moves out of the country.

MiHR utilizes two forecasting models to evaluate the exits that affect Canada's mining industry. First, MiHR's model for available talent is used to develop projections for out-migration and other non-retirement separation. This model includes a forecast of labour force exits; specifically for 70 mining-related occupations of interest (see Appendix A for a complete list). Note that this model is also used more extensively to forecast entries for the mining industry and is therefore described in more detail later in this section. Second, MiHR's model of retirement projects the occurrence of retirement exits in the mining labour force. Together, these models are used to gauge and profile exits for Canada's mining industry.

Source of Exits

Figure 30 compares the main sources of exits from Canada's mining industry labour force. The estimates show that, over the next decade, the majority of exits are expected to come from retirees (at 70 per cent), followed by other exits (27 per cent) and out-migration (3 per cent). The significance of this breakdown is especially felt by the mining industry, as those who are preparing to retire have substantial experience and expertise.

Figure 30: Breakdown of forecasted exits by category, for selected occupations in the mining industry (2018–2027)



Source: Mining Industry Human Resources Council, 2017

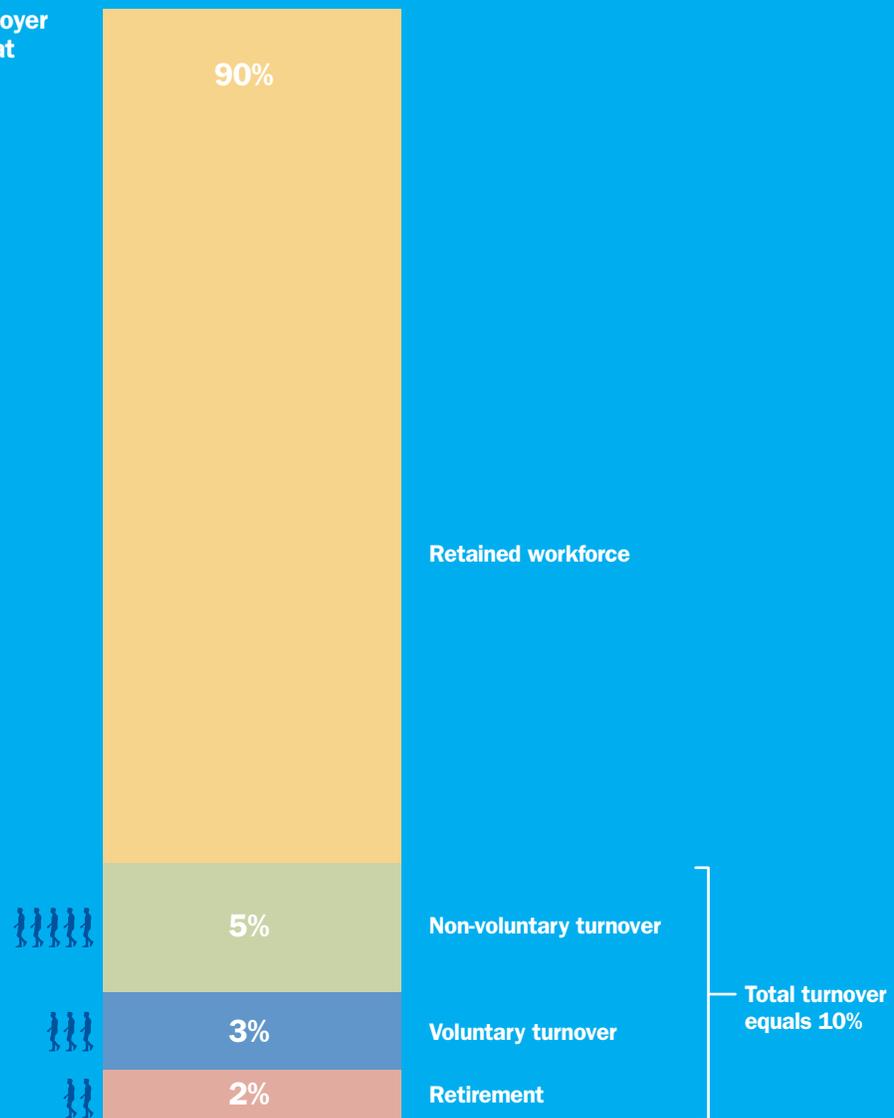
MiHR's 2017 National Employer LMI Survey asked employers to report the turnover at their company. Figure 31 shows the average of responses for various categories of turnover, including retirement, voluntary (people who left for reasons other than retirement) and non-voluntary (layoffs or terminations). The average turnover among survey respondents is calculated at 10 per cent, with the largest segment coming from lay-offs/terminations (5 per cent), followed

by voluntary (non-retirement) turnover (3 per cent) and retirement (2 per cent). In other terms, lay-off/terminations represent about 50 per cent of the overall turnover, while voluntary turnover and retirement represent 30 per cent and 20 per cent respectively.

While the employer survey data seems to contradict the information in Figure 30, it is important to note that Figure 30 focuses

on the Canadian mining industry as a whole, and therefore, does not include movements of workers from one mine site to another, whereas from the perspective of an individual mining employer, this type of turnover still represents a reduction of its on-site workforce, and generates a vacancy or hiring requirement.

Figure 31: MiHR's 2017 National Employer LMI Survey: In the last 12 months, what was the turnover at your company?*



Source: Mining Industry Human Resources Council (National Employer Labour Market Survey), 2017

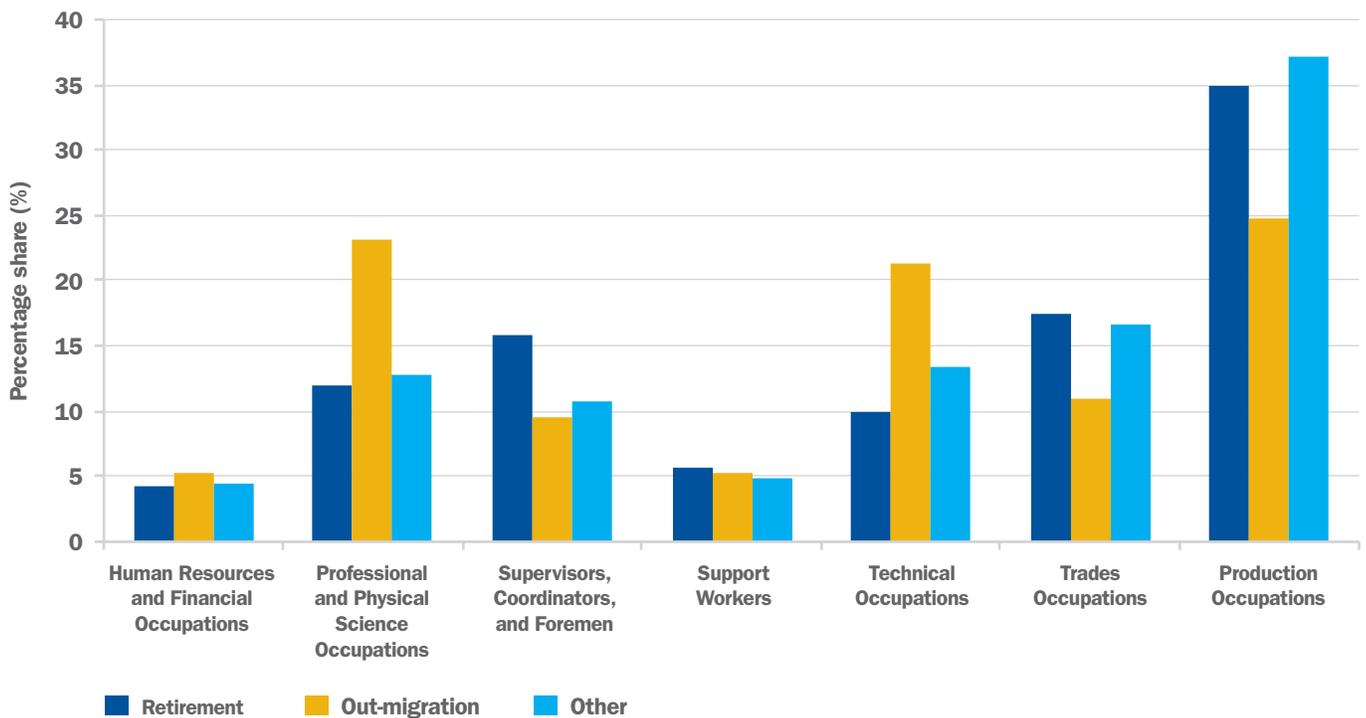
*Turnover rates were calculated using headcount data given by survey respondents for the number of employees who left their organization over the last year and the total organizational employment.

On an occupational basis, a majority of the exits (35 per cent) is expected to be from *production occupations* followed by 17 per cent from the *trades occupations* and 14 per cent from the *supervisor, coordinators and foremen occupations*.

Figure 32 illustrates how these occupational groups are likely to exit the labour force over the next 10 years. Interestingly, the occupations most likely to exit due to out-migration are the *professional and physical science occupations* and the *technical*

occupations. Compared to other types of exits, the figure also shows a noticeably greater share of retirement for the *supervisors, coordinators, and foremen occupations, production occupations, and trades occupations*.

Figure 32: Breakdown of forecasted exits by occupational group, for selected occupations in all industries and the mining industry (2018–2027)



Source: Mining Industry Human Resources Council, 2017

Respondents indicated that about **70%** of retirees were under the age of 65

Identifying these trends in labour force exits from the Canadian mining industry gives a better idea of the worker replacement and hiring challenges that the industry faces.

Retirement

MiHR estimates the expected retirement rate for each year in the forecast period.

MiHR uses a retirement model that examines the average “working-life expectancy” among the mining labour force. In estimating the retirement rates, the retirement model considers age, educational attainment and labour force participation in the previous year.

Over the next decade, retirement rates for the mining industry are expected to

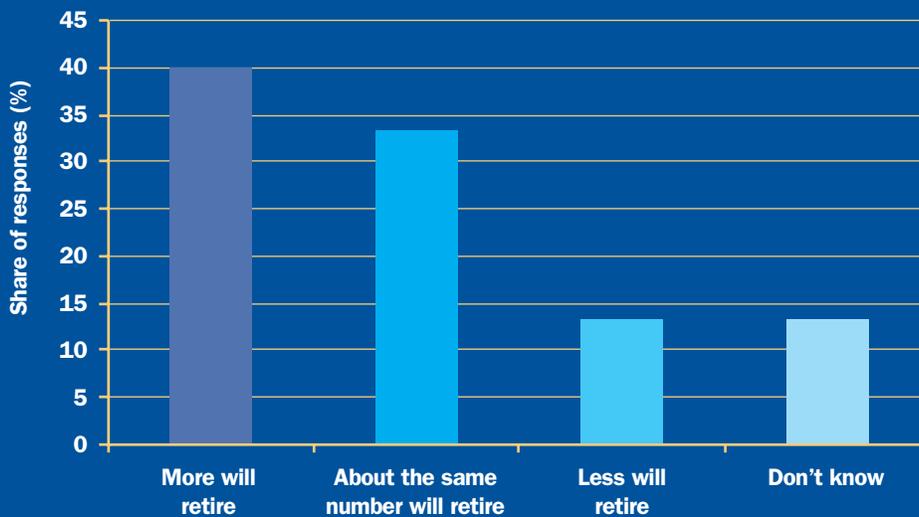
outpace the average for all industries; in 2017, MiHR expects the industry’s retirement rate to grow from about 2.0 per cent in 2017 to about 2.9 per cent in 2027; the rate for all industries is expected to grow from about 2.0 per cent to about 2.6 per cent over that same period.

MiHR’s 2017 National Employer LMI Survey asked employers if they expect more, less or about the same number of employees to retire over the next 12 months. About 40 per cent of respondents stated that they expect more of their workforce will

retire, while 33 per cent anticipate about the same number of retirements over the next 12 months. Survey respondents reported an average retirement rate of approximately 2 per cent for 2016 (Figure 31). This result is consistent with MiHR’s

forecasted retirement rate for the mining industry, which was estimated at 2 per cent in 2017. Respondents also indicated that about 70 per cent of retirees were under the age of 65.

Figure 33: MiHR’s 2017 National Employer LMI Survey: Compared to the last 12 months, do you expect more, less or about the same number of your employees will retire over the next 12 months?



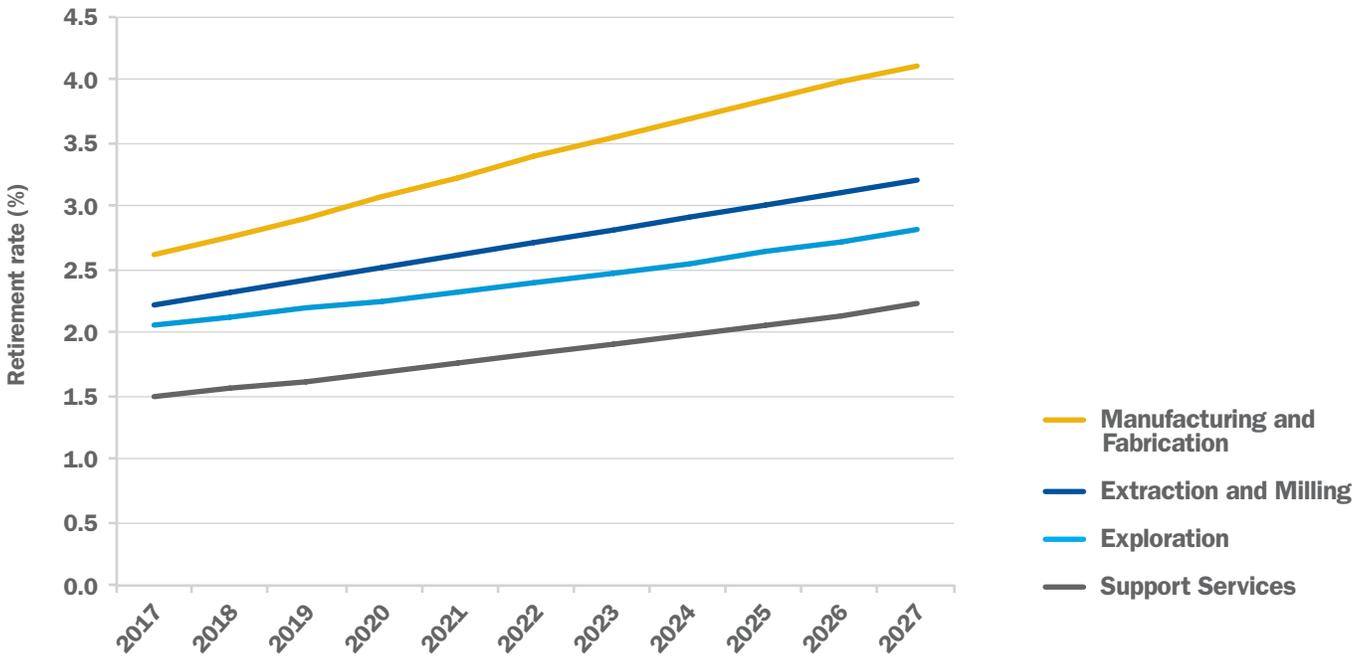
Source: Mining Industry Human Resources Council (National Employer Labour Market Survey), 2017

Figure 34 shows the retirement rates for each sub-sector in the mining industry. The highest expected retirement rates are in *manufacturing & fabrication*, followed by *extraction & milling*, *exploration*, and *support services*. The workforce in the *manufacturing & fabrication* and *extraction*

& *milling* sub-sectors are among the oldest, with roughly 58 per cent and 47 per cent respectively over the age of 44 years. MiHR estimates that, in the next decade, retirement rates in *manufacturing & fabrication* will rise from about 2.6 per

cent in 2017 to about 4.1 per cent in 2027 – an indication that the aging labour force and compensating for a growing number of retirees will become an increasingly difficult challenge for the sub-sector in the coming years.

Figure 34: Forecasted retirement rates by mining sub-sector (2017–2018)



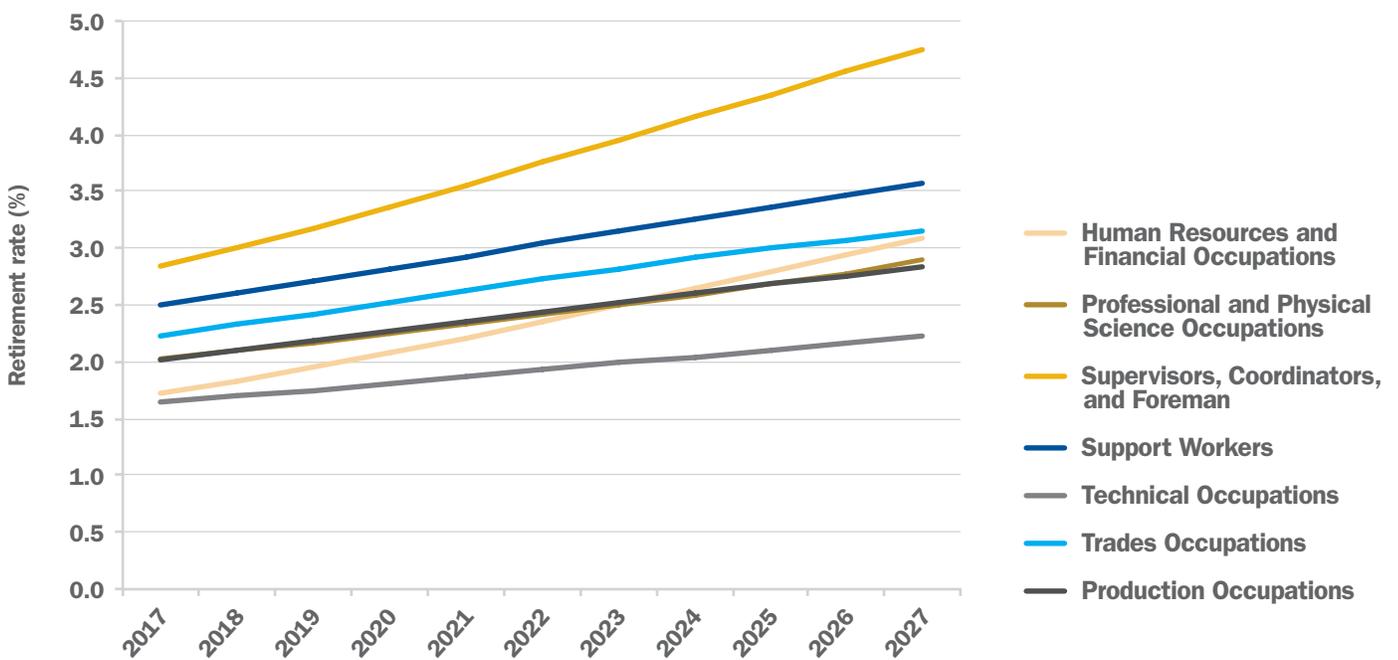
Source: Mining Industry Human Resources Council, 2017

MiHR also estimates retirement rates for the various occupational groups in the mining industry, as shown in Figure 35.

Supervisors, coordinators, and foremen display the highest retirement rates over the next 10 years. For this group,

it is anticipated that in a decade, the retirement rate will move from 2.8 per cent in 2017 to 4.8 per cent in 2027.

Figure 35: Forecasted retirement rates by broad occupational group (2017–2018)



Source: Mining Industry Human Resources Council, 2017

Entries

At any given time, labour supply includes a segment of new entrants –referring to those who were not in the labour supply during the previous period. MiHR’s available talent model provides a forecast of the new entrants into the mining labour market; specifically for 70 mining-related occupations of interest (see Appendix A for a complete list).⁹

The model first projects, for each occupation, the new entrants that the mining industry is expected to draw from, and then predicts the proportion that the mining industry will successfully attract in a given year.¹⁰ The share that the mining industry is predicted to attract is based on historical patterns, compared to all other industries drawing from that same occupation pool. The model does not make any assumptions about future

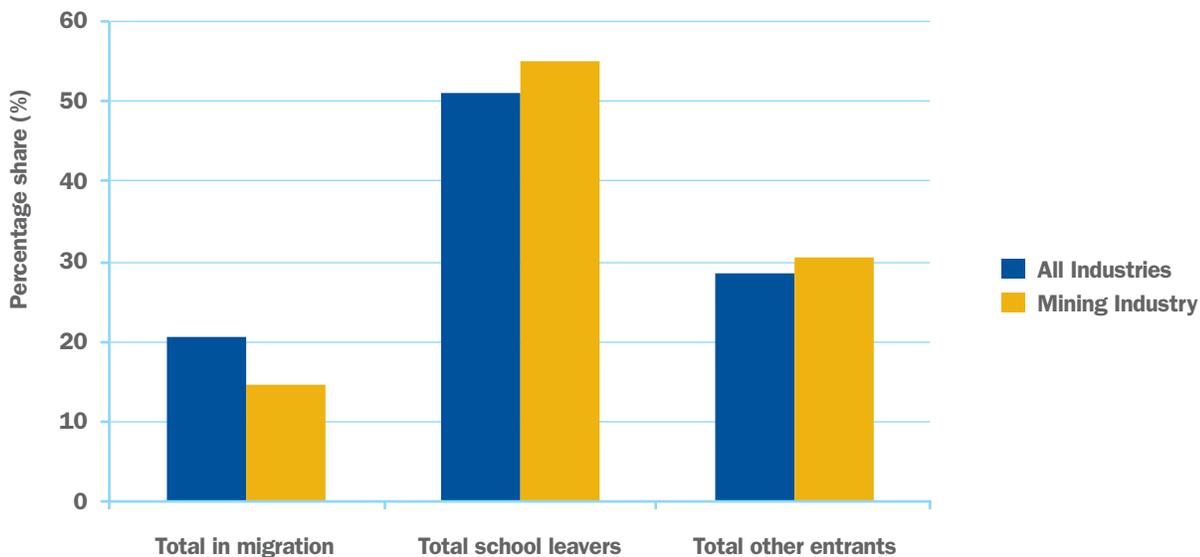
developments, such as the introduction of new training programs or changes to immigration policies.

The available talent forecast considers three primary sources of new entrants, including:

1. School-to-work transition (or “school leavers”)
 - High school diploma or lower
 - Trade, college or some university (below bachelor level)
 - University degree
2. Migration
 - Interprovincial
 - International
3. Other potential entrants, such as those returning to the labour force after a temporary leave

Figure 36 shows the breakdown of these three main sources of new entrants as forecasted by MiHR’s available talent model. The graph shows how these sources compare for selected occupations for all industries and for the mining industry. In general, school leavers represent the largest share of forecasted new entrants, followed by other potential entrants, and immigrant entrants. Notably, the share of immigrants in the mining industry (14 per cent) is relatively less than that for all industries (21 per cent), suggesting that immigrants tend to gravitate towards other industries at a greater rate than the mining industry.¹¹

Figure 36: Breakdown of forecasted entrants by category, for selected occupations in all industries and the mining industry (2018–2027)



Source: Mining Industry Human Resources Council, 2017

⁹A detailed description of the model and its assumptions can also be found in Appendix C.

¹⁰This proportion varies among occupations depending on how specific an occupation is to the mining industry.

¹¹In 2016, MiHR produced a report: *Strengthening Mining’s Talent Alloy: Exploring Immigrant Inclusion*, which pointed to certain barriers for immigrants in the mining industry. Among these barriers: (1) low awareness of opportunities and industry careers; (2) lack of recognition of skills, credentials and experience; (3) complications of the immigration process on hiring; (4) and language and communication barriers, etc.

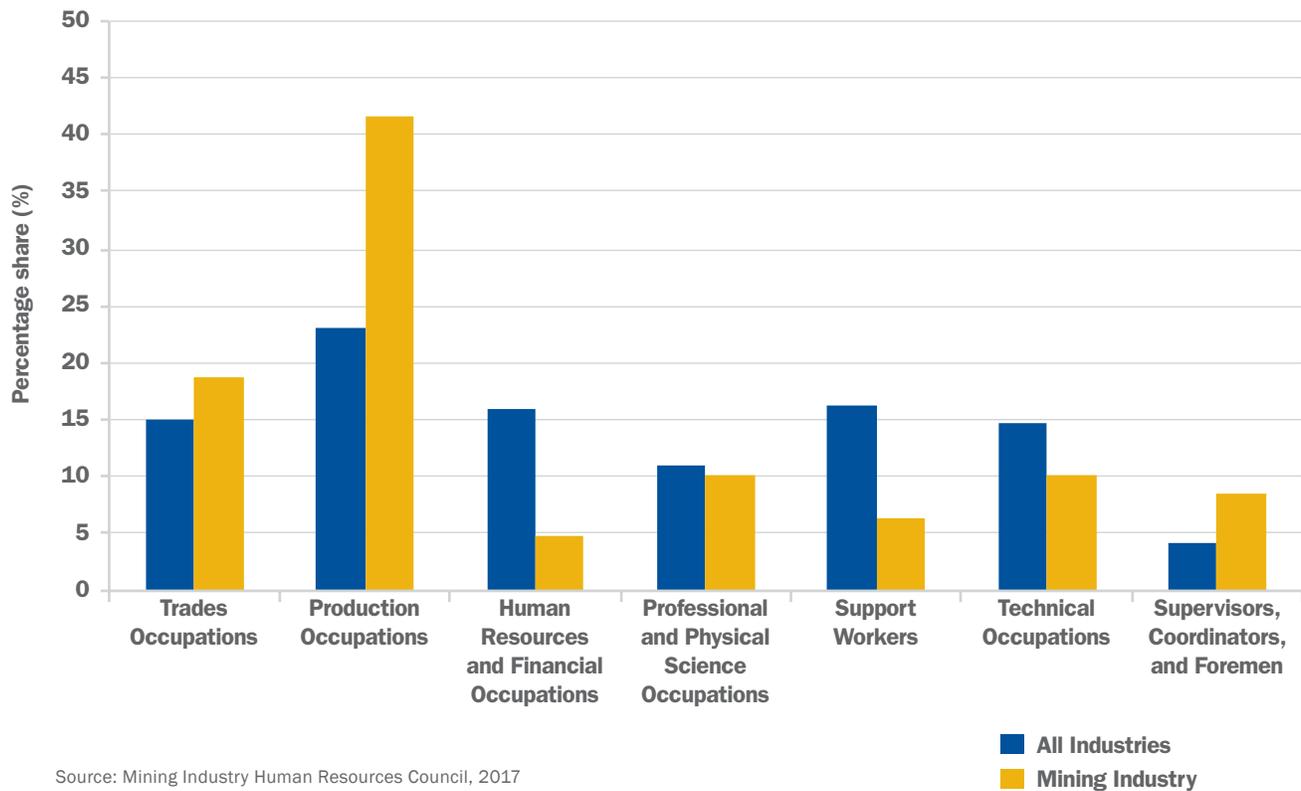
Figure 37 highlights the breakdown of forecasted entrants across various occupational categories, contrasting all industries with the mining industry. Notably, the mining industry is expected to draw a significantly greater share of entrants into *production occupations* compared to other industries.

Traditionally, the mining industry has tended to rely on *production occupations* in their operations, and those seeking

employment in these occupations have, in turn, been attracted to employment in the mining industry. Moreover, this occupational group exemplifies one of the key human resources challenges facing the mining industry, particularly the challenge of recognizing the skills of production workers in these occupations, which have not conventionally been recognized as designated trades or certified occupations, unlike those in the *trades occupations* categories. Workers in the *production*

occupations have traditionally had to re-train in their occupations each time they move to a different employer, especially if that employer is in a new province or territory. MiHR’s Canadian Mining Certification Program (CMCP) provides a national framework to help address these labour supply challenges for miners (both underground and surface), diamond drillers and minerals processing operators.¹²

Figure 37: Forecasted entrants by occupational group, for selected occupations in all industries and the mining industry (2018–2027)



Source: Mining Industry Human Resources Council, 2017

School leavers

The term “school leavers” refers to entrants who are transitioning out of school and into the labour force. As Figure 36 illustrates, this category represents a major source of new entrants for the

occupations considered in this report, both in all industries and in the mining industry. As a component of the available talent forecast, school-leaver estimates are calculated for three broad levels of education: (1) high school diploma or

lower; (2) trade, college or other post-secondary education below the bachelor’s degree level; and (3) university degree.

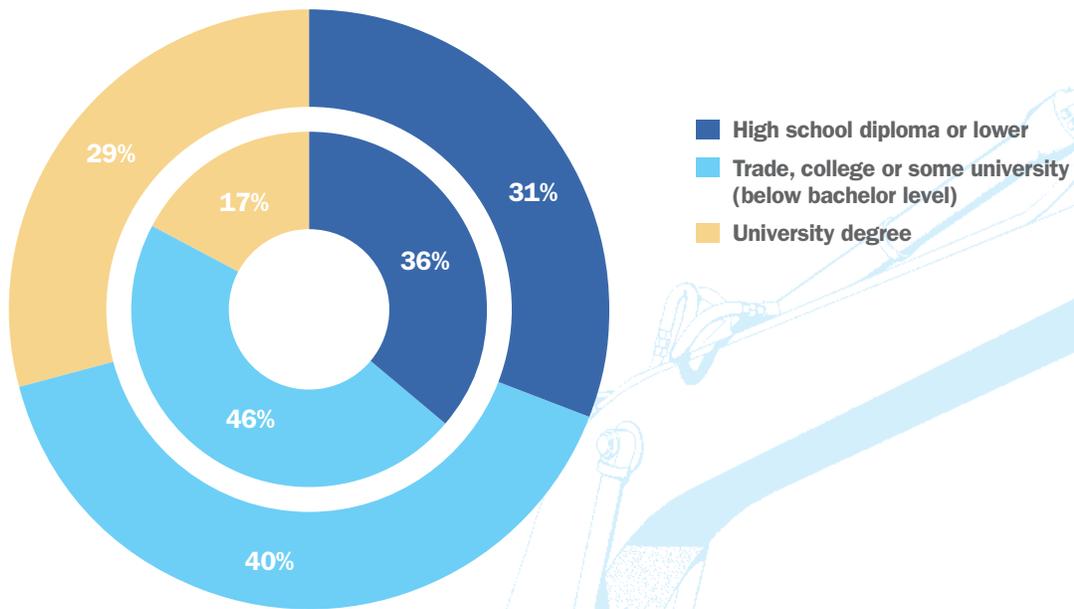
¹²Certification for Frontline Supervisors, Industry Trainers and Hoist Operators is currently being piloted.

A comparison of these educational categories is shown in Figure 38, which profiles school leavers for all industries (outer ring), and the mining industry (inner ring), based on MiHR's available talent forecast for selected occupations. Among the educational categories, the mining industry is anticipated to draw fewer university graduates (about 17 per cent) in favor of trades/ college and high school graduates (about 46 per cent and 36 per

cent, respectively). This is in contrast to all industries, which highlights a greater emphasis on university graduates expected to enter the selected occupations. This result is mostly a reflection of historical performance, but it also represents a potential challenge, especially if the educational requirements of mining evolve towards advanced education in the future, as suggested in MiHR's 2016 *Canadian Mining Labour Market Outlook*.

In particular, while MiHR's previous hiring requirements forecasts have risen by 7 per cent from 2011 to 2016, the strongest increases have come from university graduates (a 29 per cent increase) and those with an apprenticeship or trades certificate (a 15 per cent increase).

Figure 38: Breakdown of school leavers by category, for selected occupations in all industries (outer ring) and the mining industry (inner ring) (2018–2027)



Source: Mining Industry Human Resources Council, 2017

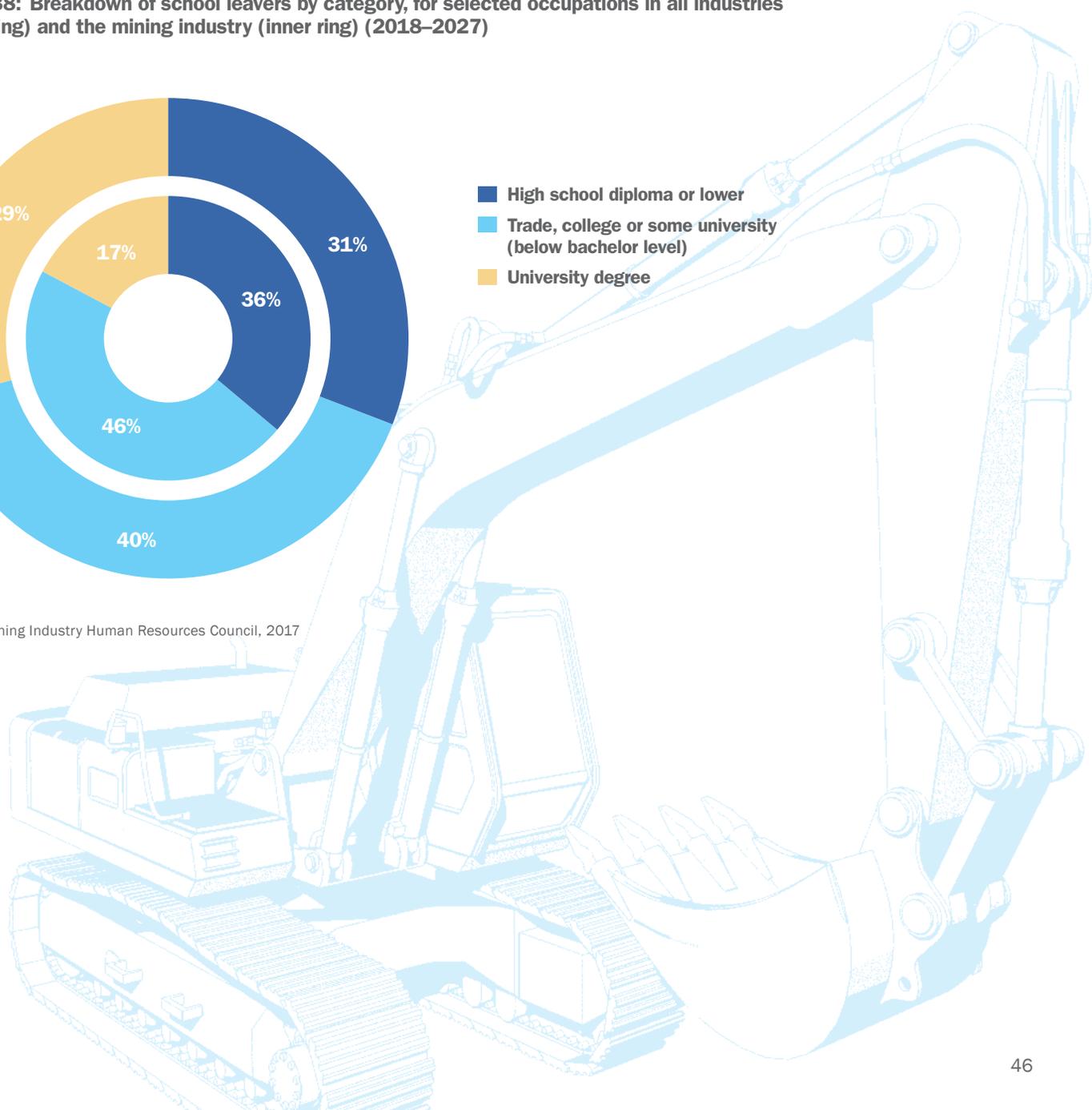
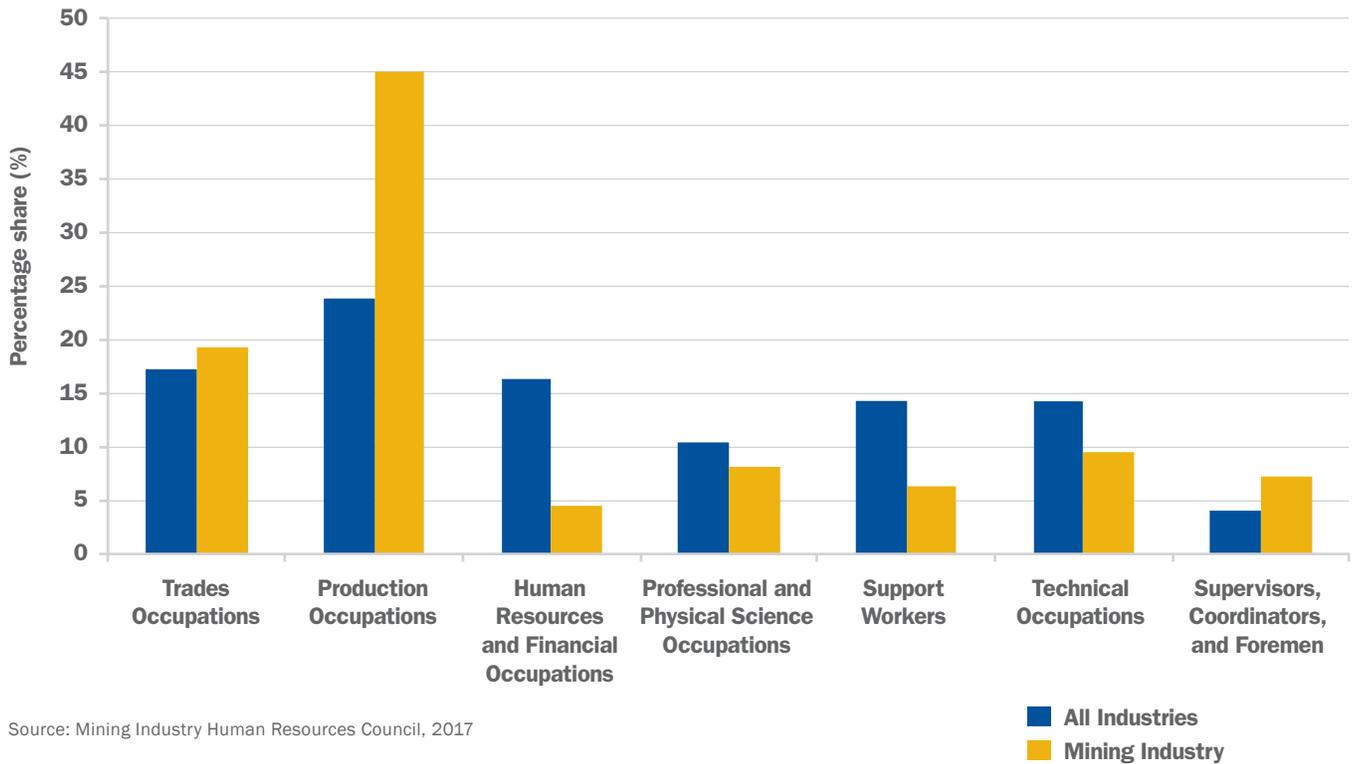


Figure 39 compares forecasted school leavers across various occupational categories both for all industries and the mining industry. Over the next decade, the mining industry is anticipated to draw a significantly greater share of school leavers

into *production occupations* (about 45 per cent) compared to other industries (about 24 per cent). This result is largely driven by entrants from high school, as well as from trades, college or some university; of the high school entrants expected to

enter the mining industry (not shown in Figure 39), the majority (roughly 70 per cent) are expected to enter into *production occupations*.

Figure 39: School leavers by occupational group, for selected occupations in all industries and the mining industry (2018–2027)



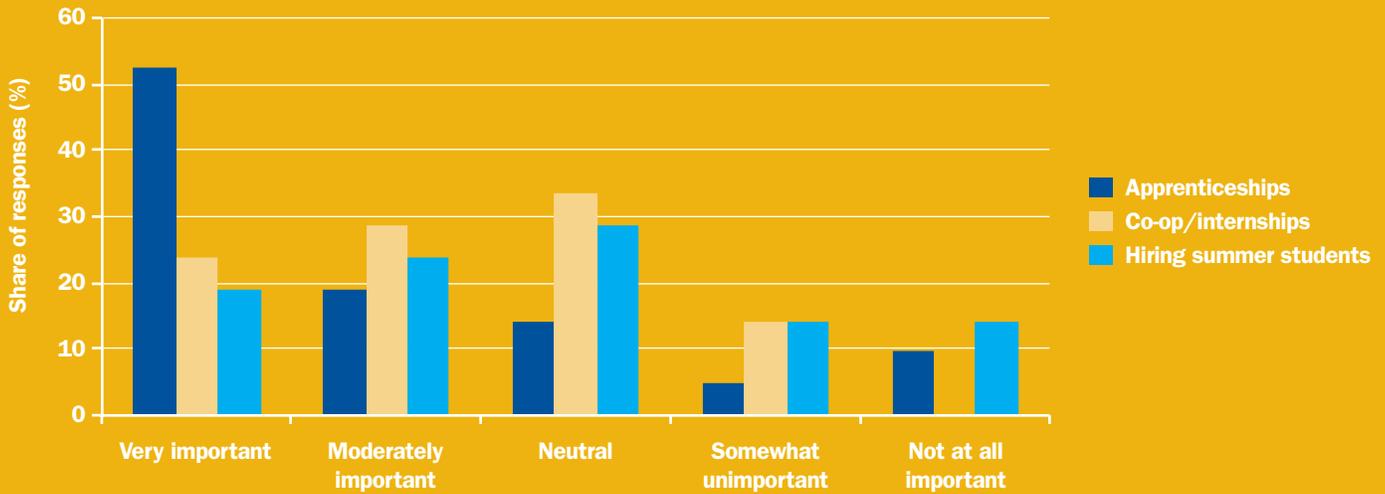
The number of survey respondents that feel post-secondary institutions are responsive to mining industry needs.

MiHR's 2017 National Employer LMI Survey asked survey respondents if they feel Canadian post-secondary institutes are responsive to the needs of the mining industry; the majority of respondents agreed – with 5 per cent and 75 per cent indicating that they strongly agree or somewhat agree, respectively, that post-secondary institutions are responsive to mining industry needs.

Respondents were also asked about the importance of certain programs in helping their company identify and hire employees. About 80 per cent of respondents reported that they utilize apprenticeship, co-ops/ internship, and summer placement programs as part of their organizations' hiring practices. Co-op or internship

placements fill, on average, 2 per cent of organization-wide employment, or about 36 placements per employer. At the same time, as Figure 40 shows, respondents strongly pointed to apprenticeships as an important program to help their company identify and hire employees.

Figure 40: MiHR's 2017 National Employer LMI Survey: How important are the following programs in helping your company identify and hire employees?



Source: Mining Industry Human Resources Council (National Employer Labour Market Survey), 2017

Migration

A key source of entrants, migration (or specifically in-migration) refers to labour force entrants from other geographical jurisdictions. From the perspective of all of Canada, this exclusively refers to new immigrants from other countries. However, for an individual province, in-migrants come from other provinces as well. As a component of the available talent forecast, estimates for migration are calculated for (1) Interprovincial migrants; and (2) International migrants (i.e. immigrants).

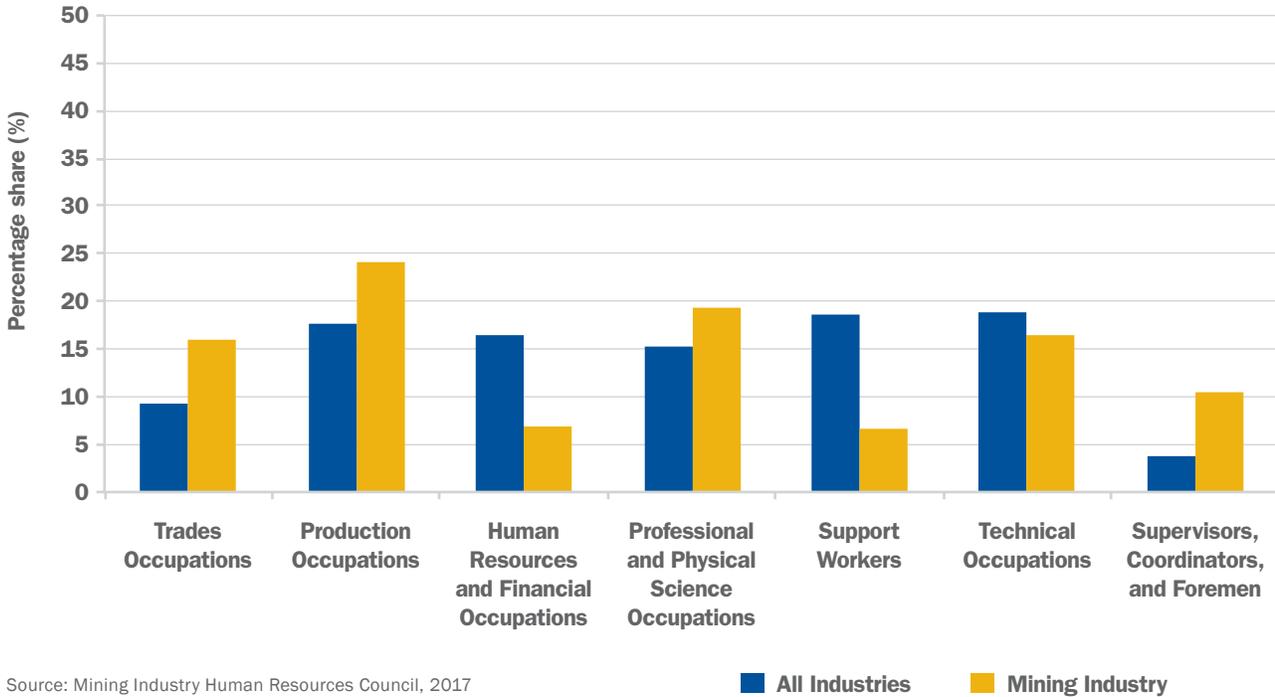
Migration forecasts are based on observed migration patterns in Canada and the provinces/territories, which are used to predict how people will flow into certain occupations and jurisdictions (based on the relative historical mobility and attractiveness of the occupations).

Figure 41 shows MiHR's forecast of how new immigrants are spread across various occupational categories. Similar to school leavers, of the immigrants expected to enter the mining industry, there is an emphasis on *production occupations*;

however, the industry also draws strongly from *trades occupations* and *professional and physical sciences occupations*.

This result further highlights the significance of *production occupations* to the mining industry. That is, among the occupations tracked by MiHR, the mining industry is expected to draw more from these types of occupations compared to other industries. It is also important to note that this is somewhat expected, since many of these occupations are mining-specific.

Figure 41: Forecasted immigrants by occupational group, for selected occupations in all industries and the mining industry (2018–2027)



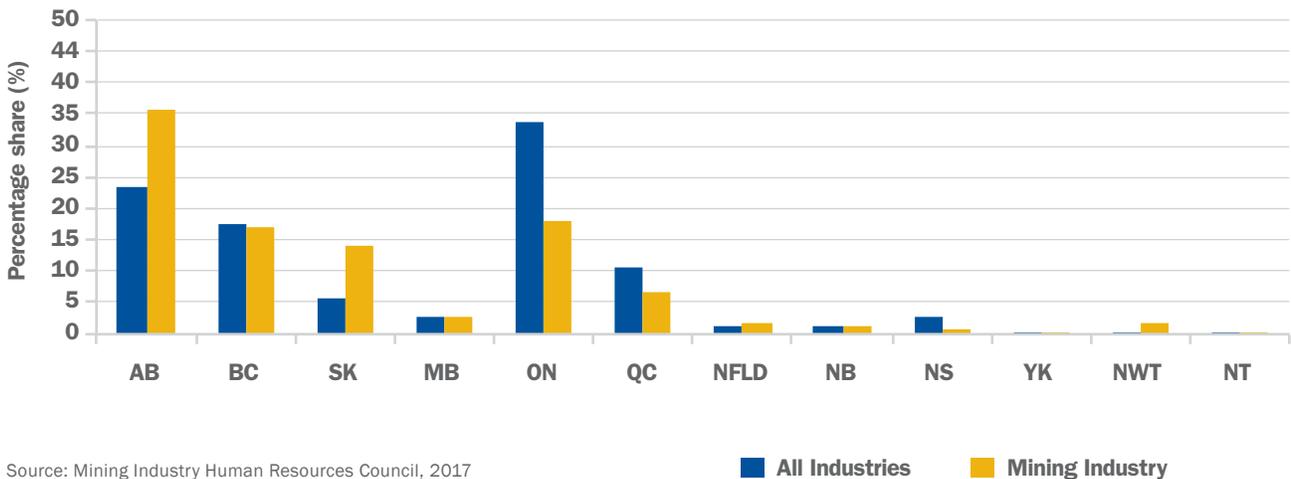
Source: Mining Industry Human Resources Council, 2017

MiHR’s available talent model also projects the entries of migrants on a provincial and territorial basis. Movement between the provinces is relevant to each individual province along with international in-migration. Figure 42 shows how forecasted in-migrants – coming from both

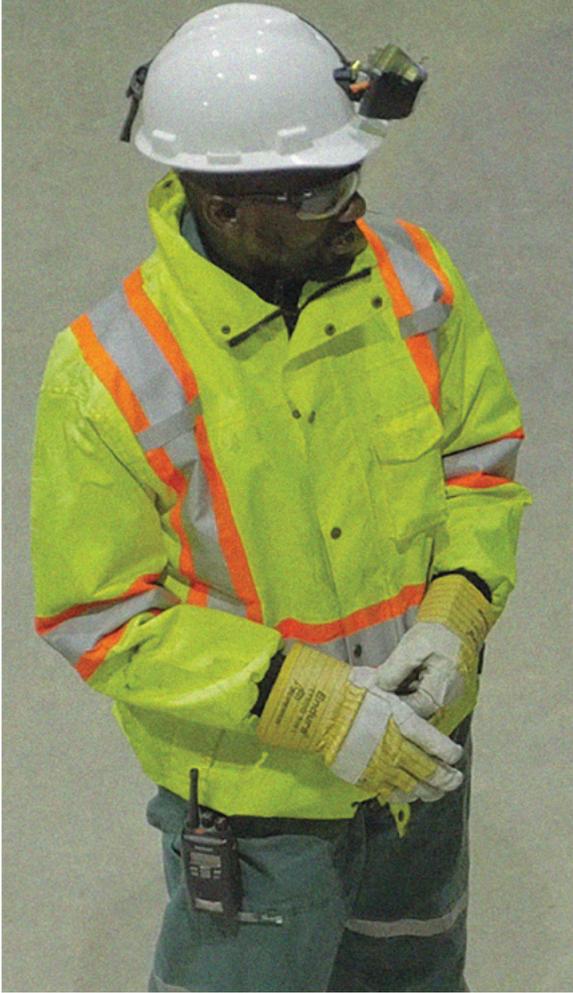
international and interprovincial sources – are spread across the provinces, based on the available talent forecast for selected occupations. Ontario is expected to capture the greatest share of in-migrants; yet, the share that is inbound for the mining

industry is noticeably diminished by contrast. Alberta, on the other hand, shows the opposite trend, with a relatively greater draw on mining entrants compared to other industries.

Figure 42: Forecasted in-migrant entrants by province, for selected occupations in all industries and the mining industry (2018–2027)



Source: Mining Industry Human Resources Council, 2017



HUMAN RESOURCES CHALLENGES IN CANADA'S MINING INDUSTRY

Throughout each of the previous sections, this report has developed various components and forecasts that, when brought together, describe Canada's mining labour market and the potential human resources pressures it faces. This section ties together the elements of labour demand/supply, expansion/contraction and entries/exits to create a full picture of the challenges that are relevant to MiHR's key stakeholder groups. Of key interest are the following:

- Whether the labour market will perform at a level that will allow the industry to remain sustainable in the long run;
- The extent that additional resources are required to ensure that the industry can

find skilled workers in the future in order to stay globally competitive;

- The specific labour market pressures and opportunities for particular occupations/industry sub-sectors; and,
- Factors that underpin identified labour market pressures (e.g., economic, demographic, etc.)

Industry hiring needs

MiHR's hiring requirements forecast gauges the human resources efforts (i.e., "hiring effort") that will be required to ensure the forecasted employment level (shown above) is attained over time.

MiHR considers two main factors that cause industry employers to hire or adjust the size of their workforce:

- Net change in employment describes changes in labour demand due to industry expansion or contraction; and
- Exits refer to those leaving Canada's mining industry, either through retirement, out-migration, or other avenues.

Both of these factors represent a need to hire workers. At the same time, net change in employment is underpinned by labour demand, while exits are primarily shaped through labour supply influences.

Table 4 presents industry-wide hiring requirements for the period of 2018 to 2027. The table provides three forecasted scenarios over a 10-year forecast period.

The 10-year cumulative hiring requirements are projected to be 87,830 workers under a baseline scenario; 130,410 workers in an expansionary scenario; and 43,200

workers in a contractionary scenario. The most significant hiring requirements are anticipated to come from replacing exiting workers.

Table 4: Cumulative hiring requirements forecast by scenario (2018–2027)

	Net Change in Employment	Replacement Requirements		Cumulative Hiring Requirements
		Retirement	Non-Retirement	
Contractionary	-24,940	47,710	20,430	43,200
Baseline	12,780	52,630	22,420	87,830
Expansionary	48,520	57,490	24,400	130,410

Source: Mining Industry Human Resources Council, 2017

Occupational gaps

Table 5 brings previously discussed elements into one comparative table to provide a forecasted gap analysis for the mining industry, organized by broad occupational categories (under the baseline scenario). These are described from left to right below.

From Section Five, “net change in employment” describes changes in labour demand due to industry expansion or contraction, and the net adjustment

needed to ensure the workforce will remain at an optimal level to meet production targets and support industry growth. From Section Six, a forecast of “exits” considers those leaving Canada’s mining industry, either through retirement, out-migration, or other avenues. Both net change in employment and exits represent a need to hire or replace workers. At the same time, net change in employment is underpinned by labour demand, while exits are primarily shaped through labour supply influences. Finally, Section Six also forecasts new

entrants, describing those coming into the mining labour force from in-migration, school-to-work transition (or school leavers), and from other sources.

The far-right column compares the hiring/replacement requirements generated by industry growth or contraction (net change in employment), plus replacement requirements generated by exits (retirement, outmigration and others) – with offsetting entries to produce a gap analysis for each occupational category.

Table 5: Forecasted occupational gaps in the mining industry, baseline scenario (2018–2027)

	Net Change in Employment	Exits			Entrants			Gap-Analysis and Hiring Challenge
		Retirement	Out-migration	Other	In-migration	School leavers	Other	
Human Resources and Financial Occupations	285	1,650	100	675	440	1,095	575	-600
Professional and Physical Science Occupations	2,660	4,690	440	1,895	1,225	1,970	965	-5,525
Supervisors, Coordinators, and Foremen	440	6,225	180	1,610	655	1,720	1,360	-4,720
Support Workers	495	2,200	100	710	415	1,530	860	-700
Technical Occupations	2,245	3,890	405	1,980	1,045	2,270	1,200	-4,005
Trades Occupations	425	6,840	210	2,480	1,010	4,620	2,575	-1,750
Production Occupations	670	13,675	470	5,525	1,530	10,810	5,820	-2,180
Total	7,220	39,170	1,905	14,875	6,320	24,015	13,355	-19,480

Source: Mining Industry Human Resources Council, 2017

A gap exists if the hiring needs exceed the number of new entrants over the forecast period; in such a case, mining employers are expected to struggle to find the workers they are projected to need in the long term. A gap signifies that projected vacancies in each occupational

group are likely to remain unfilled, unless corrective collaborative actions are taken to manage the future availability of workers to mining. This poses a significant risk to mining operations, given that a thin labour supply has the potential to derail projects, drive up the cost of finding workers and

ultimately undermine an operation's ability to continue to run competitively. Overall, Table 5 demonstrates gaps in each occupational category shown, especially in *professional and physical science occupations, supervisors, coordinators, and foremen, and technical occupations.*

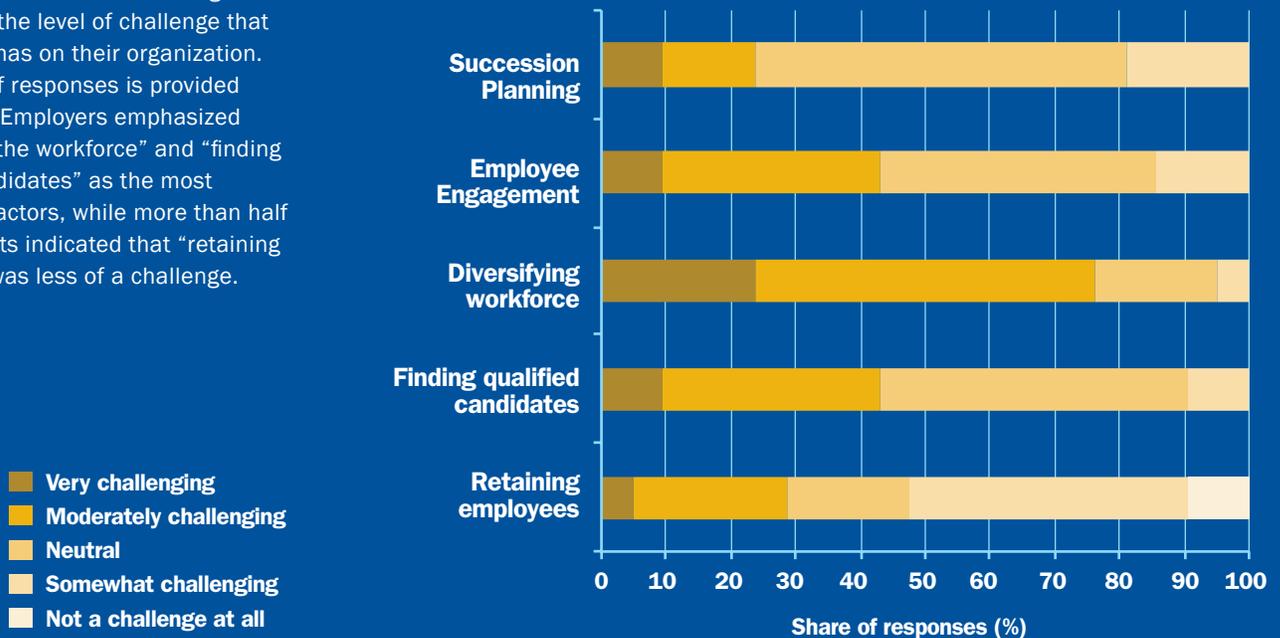


“Diversifying the workforce” & “finding qualified candidates”

The most challenging factors.

MiHR’s 2017 National Employer LMI Survey asked employers to evaluate various human resources challenges and indicate the level of challenge that each aspect has on their organization. A summary of responses is provided in Figure 43. Employers emphasized “diversifying the workforce” and “finding qualified candidates” as the most challenging factors, while more than half of respondents indicated that “retaining employees” was less of a challenge.

Figure 43: MiHR’s 2017 National Employer LMI Survey: Please rate each of the following human resources challenges in terms of how challenging it is for you company.



Source: Mining Industry Human Resources Council (National Employer LMI Survey), 2017

Respondents were also asked to list the positions/occupations for which they had the most difficulty recruiting. Among the occupations stated, trades and production occupations (mechanics, underground miners, operators, electricians, etc.) represented 38 per cent of all positions identified as most challenging; front-line supervisors and managers (underground or surface mining supervisors/managers,

project managers, etc.) represented 20 per cent of these challenging positions; and engineers (mining, electrical, metallurgical) represented 19 per cent of the positions identified.

Finally, respondents were asked to identify any other top-of-mind human resources challenges that their organization faces.

These responses included the following:

- An aging workforce;
- Changing performance management;
- Recruiting and retaining Indigenous employees;
- Sourcing qualified people willing to relocate and/or work on rotation; and
- Work scheduling for older employees and single parents.

Tightness in the labour market

A tight labour market can result from a shortfall of available workers or from a robust demand for workers (or a combination of both factors). In either 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 their labour inputs.

From Table 5, it is evident that the projected hiring challenges are mostly driven by labour supply issues, which promise to create a tighter labour market in the mining industry. While the hiring that will be needed to address industry expansion (i.e., net change in employment) is positive for all occupational categories, the majority of hiring pressure is expected

to come from forecasted exits, which are comparatively greater. This result indicates a challenge that is rooted in the labour supply, and in the collective actions and decisions of individuals. Among the forecasted exits, retirement accounts for the greatest share at roughly 70 per cent. For mining employers and other stakeholders, a substantial number of exits are indicative of the potential cost associated with replacing exiting workers, which commonly involves a combination of advertising, interviewing, selecting, onboarding and training an individual to the company standards and to meet regulatory requirements. This process can be time-consuming, especially in tight labour supply situations. Compounding this challenge are geographical limitations and the ability of employers to recruit workers

to locations that are remote and far from the regular amenities found in larger population centres.

Entries, on the other hand, indicate the opportunity to neutralize the pressures and costs associated with hiring. That is, the burden of replacing a worker is less of a burden, if there is an abundance of qualified candidates available. Yet, as Table 5 demonstrates, the forecast of entries for each occupational category is not sufficient to completely alleviate the hiring pressures generated by net change in employment and exits – resulting in an occupational gap in each category. This result is an indication that the industry has a thin labour supply, which will not be able to match the forecasted needs of the industry.



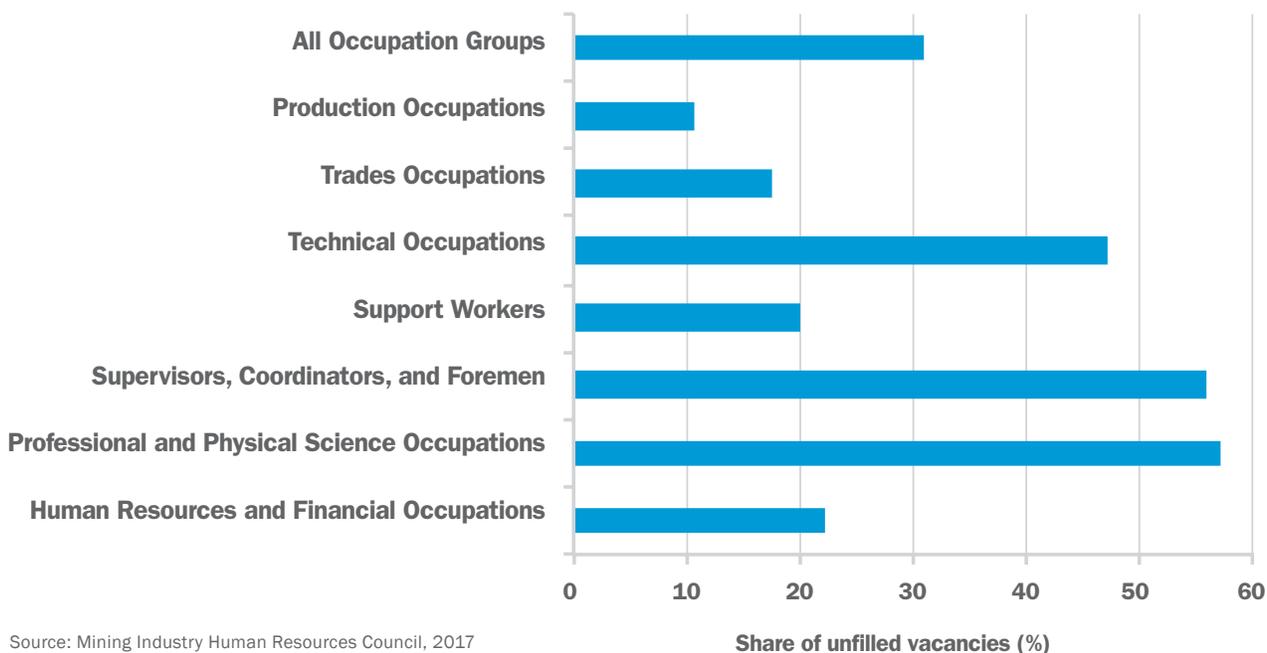
MiHR’s 2016 report introduced the idea of “gap intensity” – the share of hiring needs that is projected to remain unsatisfied. An occupation becomes more gap-intensive as the proportion of unfulfilled hiring needs increases. In other words, the higher the “gap intensity” – the greater the number of vacancies that are expected to remain unfilled, given the forecast of new entrants. Figure 44 shows the gap intensities for broad occupational groups; all of the

occupational groups demonstrate a portion of unfulfilled hiring needs; moreover, *professional and physical science occupations* and *supervisors, coordinators, and foremen* have among the highest gap intensities in the figure.

Further signs of a thin labour supply are found throughout this report. Factors such as the increasing share of older workers (and the decreasing share of younger

workers) have the potential to undermine the industry’s ability to secure sustainable labour sources. Likewise, the shortfall in women participants in mining, and the observation that much of the inbound labour force is not heading into the goods-producing sector, suggest the industry is disadvantaged in its capacity to respond quickly to new growth and development, especially considering that these are long-term trends.

Figure 44: Forecasted occupational gap intensities, baseline scenario (2018–2027)



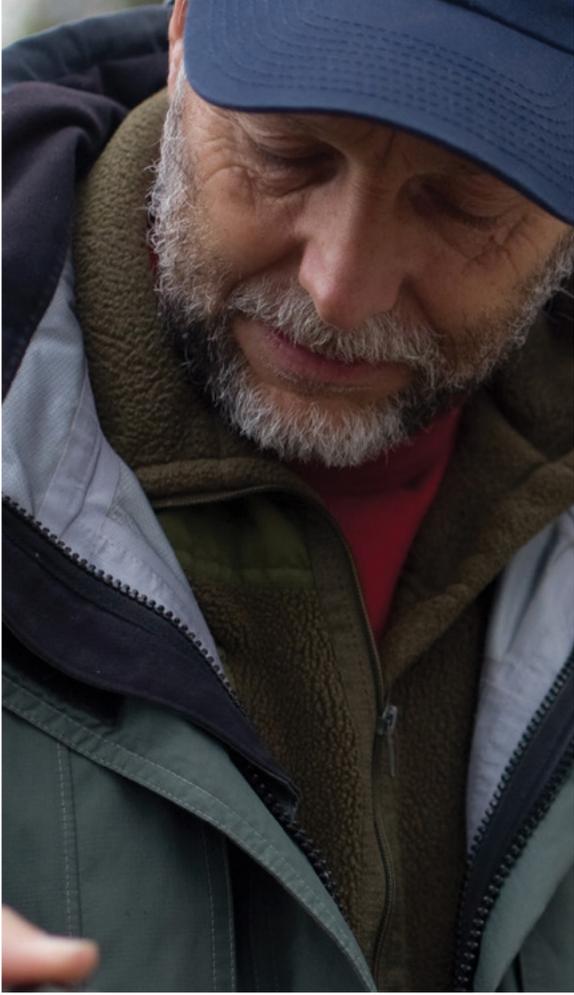
Source: Mining Industry Human Resources Council, 2017

Final thoughts

Overall, the most significant challenge facing Canada’s mining industry is ensuring that the supply of labour will be sufficient to meet demand throughout the downturns and upswings that characterize the industry. Given that the industry is largely a price-taker in the international marketplace, growth cycles are largely 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, associations, etc. – have a vested interest in managing the supply of labour, especially in the longer term. MiHR’s key programing areas have traditionally and will continue to focus on improving the labour supply for the mining industry; each is designed to thicken the industry’s labour supply by creating opportunities for job seekers to match their skills with the needs of mining employers (e.g., the Mining Essentials program), and for improving employers’ ability to find and recognize skilled job seekers in the highest demand occupations (e.g., the Canadian Mining Certification Program (CMCP)). Other strategic efforts can also retain the talents

of the existing and incoming labour supply for the industry, or increase participation among those not in the mining industry. MiHR’s Gender Equity in Mining (GEM) initiative seeks to identify and address barriers to inclusion for women in the industry. Programs aimed at increasing mentorship from one generation to the next, as well as efficient collaboration between educators and employers, are examples of mining stakeholders working to enhance the supply of workers for the industry. Overall, 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.



APPENDIX

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 where assignment to a specific industry is based on primary activity, enabling it to group

together establishments with similar activities. MiHR uses the following NAICS codes to define the mining industry:

Extraction & Milling	
NAICS 2121 (Coal mining)	This industry group comprises establishments primarily engaged in mining bituminous coal, anthracite and lignite by underground mining, and 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)	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).
Fabrication & 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)

Adjustments to NAICS codes for 2017

MiHR has reviewed and updated its definition for each mining sub-sector.

A summary of these adjustments is provided in the table below.

Table A-1: Adjustments to mining sub-sectoral NAICS codes for 2017

Industry Sub-sector	Previous Definition	Adjusted Definition for 2017
Extraction & Milling	NAICS 212 Mining and quarrying (except oil & gas)	NAICS 212 Mining and quarrying (except oil & gas)
		NAICS 211114 Non-conventional oil extraction
Support Services	NAICS 2131 Support activities for mining and oil and gas extraction	NAICS 21311B Support activities for mining
Fabrication & Manufacturing	NAICS 3311 Iron and steel mills and ferro-alloy manufacturing	NAICS 3311 Iron and steel mills and ferro-alloy manufacturing
	NAICS 3313 Alumina and aluminum production and processing	NAICS 3313 Alumina and aluminum production and processing
	NAICS 3314 Non-ferrous metal (except aluminum) production and processing	NAICS 3314 Non-ferrous metal (except aluminum) production and processing
Exploration	A portion of NAICS 5413 Architectural, engineering and related services	A portion of NAICS 5413 Architectural, engineering and related services

Occupation classification

Listed below are the 70 NOC codes that MiHR uses to define the occupations that

are considered to be important to the mining industry in Canada. Note that the

occupation titles listed below are those used in the Statistics Canada system.

Table A-2: 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)
1214	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

NOC Code	Title
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 systems and power station 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 Science 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
2115	Other professional occupations in physical sciences
2112	Chemists
Human Resources and Financial Occupations	
1111	Financial auditors and accountants
112	Human resources managers
1112	Financial and investment analysts
111	Financial managers
1121	Human resources professionals

NOC Code	Title
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
811	Managers in natural resources production and fishing
711	Construction managers
7203	Contractors and supervisors, pipefitting trades
211	Engineering managers
9211	Supervisors, mineral and metal processing
7301	Contractors and supervisors, mechanic trades

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)	This was purchased by MiHR from Statistics Canada's National Household Survey/Census for 2006 and 2011. 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)	This was purchased by MiHR from Statistics Canada's Labour Force Survey 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' research often turns to publically available Labour Force Survey 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 also often 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 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.
Canadian Mines Handbook	MiHR purchased a subscription to the Canadian Mines Handbook (2016), which provides a list of all the major mining projects and development occurring in Canada for the year. This data set provides a summary for each project, which may include factors such as employment levels, commodities sought, and reserves, etc.
Other Sources	MiHR is continually looking for data that may be relevant to the mining labour force.

APPENDIX-C

MiHR's employment forecast: summary of main variables

MiHR uses a number of variables to construct its 10-year forecast of employment for the mining industry. These variables regularly include (but are not exclusive to): commodity prices, the capital stock (i.e. the value of machines and equipment), gross domestic product (GDP), the productivity of labour, exchange rates, interest rates and other factors that influence the industry's ongoing activities and employment levels. The specific impacts of these variables are discussed below.

Commodity Prices:

Prices have a significant impact on the viability of mining operations. An increase in price generally translates to greater profits for mining companies, as well as higher returns for investors, particularly in the mineral exploration sub-sector. As such, prices are a catalyst for mining activities.

As prices move above the cost of extraction, newly viable mining projects emerge and existing operations may look to expand their production capacity to capitalize on the higher price; these activities require an expansion of the workforce. Therefore, commodity prices are positively correlated with employment in the industry. This relationship also applies to negative price movements. As prices begin to drop, mining activities tend to slow down and in turn, this may lead to reduced hours of work and/or layoffs. As commodity prices are constantly in flux, the size of the workforce can also change accordingly, although there are often lags between price changes and workforce adjustments. It should be noted that employers may choose to ignore short-term price adjustments in the interests of maintaining production levels and remaining competitive over the long run.

The Canadian mining industry is currently enduring a prolonged period of depressed commodity prices.

Capital Stock:

The stock of capital refers to the fixed assets – the buildings, machinery and equipment – that are used in mining operations. The mining industry naturally uses significant capital inputs in its production process, together with extensive labour inputs (i.e. workers).

Changes to the capital stock can have an ambiguous effect on employment. The addition of capital can increase the need for workers, to the extent that workers are required to interact with it. For example, a new truck requires a driver. On the other hand, with advancements in technology, additional capital can act as a labour substitute. For example, a larger-scale truck reduces the number of drivers needed. Finally, more sophisticated machinery may change the skills requirements for the operator.

In the last decade, mineral extraction operations in Canada have utilized more capital (in value terms) than ever before. A higher ratio of capital dollars for every worker indicates that the industry has become more capital-intensive and that the workforce's interaction with capital has changed; as a result, the recent surge in capital has not necessarily meant a parallel increase in the industry's level of employment.

Gross Domestic Product (GDP):

Gross Domestic Product (GDP) measures the value of goods or services produced over a given period of time. A rise in GDP can be the result of many factors, including an increase in prices (above general inflation) and additional capital or labour inputs (number of workers and hours worked), among other influences. Generally, an increase in GDP corresponds to an increase in production and employment levels. In other words, given that production increases are typically made possible with more workers, changes to GDP provide a gauge on the ongoing adjustments to the industry's employment.

Real GDP in Canada's mining industry has grown in each of the last three decades – even with the significant economic turbulence that suppressed growth in the late 2000s.

Labour Productivity:

Labour productivity describes the value of output that is produced for every input of labour. This measure indicates how labour is being used to produce output over time; it is commonly expressed as real GDP divided by the number of hours worked or the value of output per hour of work. Many factors can influence labour productivity: the skills and composition of the workforce; the arrival of new technologies; and additional capital in the form of larger-scaled machines and equipment. Each of these factors can affect the manner in which workers are utilized and how they interact with the capital inputs in the process. If labour productivity rises, it is not obvious whether the increase was primarily due to an increase in output or a decrease in workers (or hours). As a result, a change in labour productivity does not explicitly suggest a corresponding change in employment.

Labour productivity in Canada's mining industry has increased from previous decades. While the cause of this increase is difficult to quantify – or even specify – the effect echoes a combination of factors, including increased and larger-scaled capital, evolving technologies and even hyper-increases in mineral prices.

Interest Rates:

Interest rates have an ambiguous effect on employment in the industry. On the one hand, a decrease in interest rates makes it less expensive to borrow money. For a mining enterprise looking to finance its activities, an adjustment to the interest rate can therefore affect the optimal mix of capital and labour inputs the company decides to use in its operations.

Interest rates also provide a barometer of the performance of the overall economy.

High interest rates over a long period of time signal that the economy is robust – given that businesses are keen on borrowing to further their endeavours. As a result, a sustained increase in interest rates is, in general, positively correlated with employment growth in the mining industry. Interest rates are determined by a number of factors, notably, the Bank of Canada’s monetary policy governing the supply of money in the country.

Currently, interest rates are exceptionally low by historical standards. The low rates coincide with a slower economy, which has, in turn, initiated a reduced cost of borrowing.

Exchange Rate:

Canada’s exchange rate denotes the relationship between the Canadian dollar and another foreign currency – most commonly, in terms of US dollars. Canada’s resource-based economy is primarily made up of exporters. A depreciation of the Canadian dollar makes exports relatively cheaper for a buyer in another country, thus making Canadian exports more attractive and in-demand. For Canada’s mining industry, this could mean a potential increase in the number of workers needed to sustain mining activities. Even for those exporters who receive payment in US dollars, a depreciating Canadian dollar makes their wage bill and other

operational costs of production in Canada, less expensive in the short term.

The exchange rate in Canada (specifically the Canada-US rate) has fallen significantly over the past couple of years. While this movement is considered favourable to exporting sectors of the economy, including the mining industry, it is still not evident that mining operations will significantly alter their production capacity or levels of employment in response to short-term movements in the exchange rate.

Table C-1 summarizes the effects that each of the above-mentioned variables has on employment in Canada’s mining industry.

Table C-1: Summary of factors impacting mining industry employment

	Production	Exploration Activity	Employment	Current Status
Commodity Prices	A price increase makes production more profitable, leading to an increase in employment. A price decrease has the opposite effect.	A price increase produces a higher return for investors in the mineral exploration sub-sector and increases exploration activities and employment. A price decrease has the opposite effect.	A price increase generally leads to an increase in employment. A price decrease has the opposite effect.	The Canadian mining industry is currently experiencing sharp decreases for a number of key commodity prices.
Capital Stock and Investment	An increase in the capital stock increases production levels and vice versa.	An increase in exploration’s capital stock increases exploration activities and vice-versa, although this sub-sector is less capital-intensive than the extraction & milling sub-sector.	An increase in the capital stock has an ambiguous effect: - A decrease in employment to the extent that technological advancements in capital replace the need for labour. - An increase in employment to the extent that workers are needed to interact with the additional capital.	In the last decade, mineral extraction operations in Canada have utilized more capital (in value terms) than ever before.

	Production	Exploration Activity	Employment	Current Status
GDP	Generally, an increase in extraction-related GDP corresponds to an increase in production. A decrease has the opposite effect.	Generally, an increase in exploration-related GDP corresponds to an increase in exploration activities. A decrease has the opposite effect.	Generally, an increase in mining GDP corresponds to an increase in employment. A decrease has the opposite effect.	Real GDP in Canada's mining industry has grown in each of the last three decades – even with the significant economic turbulence that suppressed growth in 2008–2009.
Labour Productivity	Assuming that employment remains constant, an increase in labour productivity corresponds to an increase in production. A decrease has the opposite effect.	Assuming that employment remains constant, an increase in labour productivity corresponds to an increase in exploration activity. A decrease has the opposite effect.	A change in labour productivity does not explicitly suggest a corresponding change in employment.	Labour productivity in Canada's mining industry has increased from previous decades.
Interest Rates	An adjustment to interest rates has an ambiguous effect: - To the extent that it makes it more or less expensive to borrow, it can affect the level of production. - High interest rates over a long period of time signal that the economy is robust and that production will be greater.	An adjustment to interest rates has an ambiguous effect: - To the extent that it makes it more or less expensive to borrow, it can affect the level of exploration activities. - High interest rates over a long period of time signal that the economy is robust and that exploration activities will be greater.	An adjustment to interest rates has an ambiguous effect: - To the extent that it makes it more or less expensive to borrow, it can affect the mix of capital and labour inputs an operation uses. - High interest rates over a long period of time signal that the economy is robust and that industry employment will be greater.	Interest rates are exceptionally low by historical standards.
Exchange Rate	A depreciation of the Canadian dollar makes Canadian exports more attractive, potentially leading to an increase in production.	A depreciation of the Canadian dollar makes Canadian exports more attractive. However, the exploration sub-sector is less affected, as it does not export goods to the same degree as the extraction & milling sub-sector.	A depreciation of the Canadian dollar makes Canadian exports more attractive – and for Canada's mining industry – a potential increase in the number of workers needed to sustain mining activities.	The exchange rate in Canada (specifically the Canada-US rate) has fallen significantly over the past couple of years.

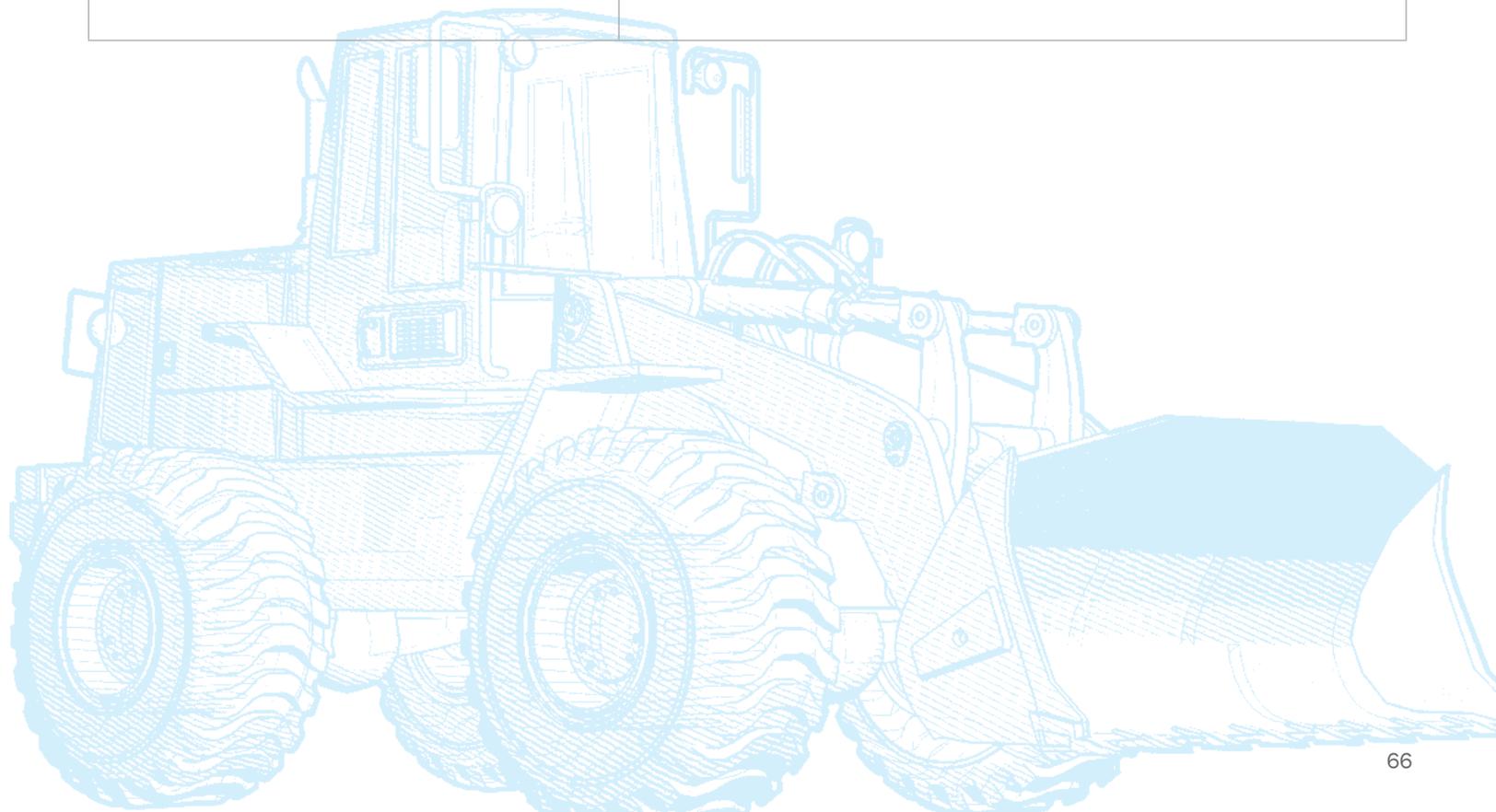
Table C-2 summarizes the variables and the data sources that are frequently

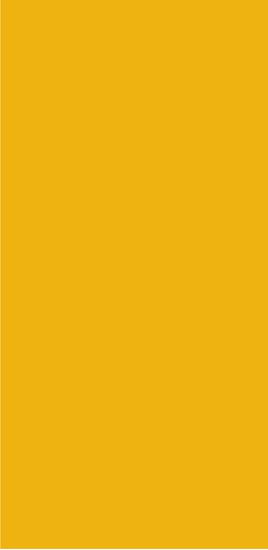
used in MiHR’s employment forecasting. Of course, other variables may also be

considered and included, depending on the individual demands of each forecast.

Table C-2: Common variables under consideration for an employment forecast

Employment Forecast	
Industry employment	MiHR’s custom data cross-tabulation from Statistics Canada’s Labour Force Survey or the System of National Accounts for selected NAICS codes.
Mineral prices	World Bank Commodities Price Forecasts
Mining GDP growth	Statistics Canada’s Canadian System of National Economic Accounts for selected NAICS codes (CANSIM 379-XXXX)
Measures of labour productivity	Statistics’ Canada’s Labour statistics consistent with the System of National Accounts (SNA) for selected NAICS codes (383-XXXX)
Investment in capital stock (i.e., machines, equipment, buildings)	Statistics Canada’s Flows and stocks of fixed non-residential capital for Selected NAICS codes (CANSIM 031-XXXX)







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