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Tech-Driven Skill Shifts in Canada's Mining and Oil and Gas Industries

Data briefing | October 21, 2025

Future Skills Centre | Centre des Compétences futures

The Future Skills Centre (FSC) is a forward-thinking centre for research and collaboration dedicated to driving innovation in skills development so that everyone in Canada can be prepared for the future of work. We partner with policymakers, researchers, practitioners, employers and labour, and post-secondary institutions to solve pressing labour market challenges and ensure that everyone can benefit from relevant lifelong learning opportunities. We are founded by a consortium whose members are Toronto Metropolitan University, Blueprint, and The Conference Board of Canada, and are funded by the Government of Canada's Future Skills Program.

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Key findings

- Nearly 60.0 per cent of oil and gas extraction firms use advanced technologies—well above the economy average of 47.2 per cent in 2022. Mining firms (48.9 per cent adoption) are close to the economy average, while support service firms for mining and oil and gas (44.8 per cent adoption) are slightly below the economy average during the same time.
- Business intelligence tools such as Power BI and Tableau are the most widely used technology in Canada's primary industries (collectively) in 2022. Adoption rates stand at 42.0 per cent of oil and gas firms, 20.1 per cent of mining firms, and 26.5 per cent of support service firms.
- After business intelligence tools, clean technologies (37.4 per cent) and security or advanced authentication systems (34.3 per cent) are the most used technologies by oil and gas firms in 2022.
- Material handling, supply chain or logistics technologies (23.6 per cent) and processing or fabrication technologies (16.1 per cent) are the most used technologies by mining firms in addition to business intelligence tools in 2022.
- After business intelligence tools, security or advanced authentication systems (18.9 per cent) and design or information control technologies (16.3 per cent) are the most used technologies by support service firms in 2022.
- Digital skills in professional roles are rising across all industries, but focus varies by industry. From 2021 to 2025, Power BI demand grew by 33.3 per cent in oil and gas, while Electronic Data Interchange (EDI) surged by 104.5 per cent in mining and by 113.5 per cent in support services. Microsoft Suite skills saw consistent growth: 22.6 per cent (oil and gas), 84.8 per cent (mining), and 74.9 per cent (support services) over the same period.
- Instrumentation and refrigeration skills nearly doubled in production roles across industries from 2021 to 2025. Instrumentation demand rose by 91.6 per cent in oil and gas, 96.1 per cent in mining, and 95.9 per cent in support services. Refrigeration system skills followed closely: 84.4 per cent in oil and gas, 76.8 per cent in mining, and 64.9 per cent in support services, respectively.

Primary industries

Mining and oil and gas industries are entering a period of rapid technological transformation—and the workforce is evolving with it.[1] Yet these industries are often absent from future skills research. We chose to focus on them in this study for two reasons.

First, mining plays a vital role in Canada's transition to a low-carbon economy, particularly in the extraction of critical minerals, which are strategically important for national growth.[2,3] Second, the mining and oil and gas industries are major economic drivers, with both industries contributing 5.1 per cent to Canada's gross domestic product (GDP) in 2024—nearly triple the contribution of agriculture, forestry, fishing, and hunting combined.[4] To understand how emerging technologies are reshaping work in these industries—and what that means for skills—we drew on two complementary data sources:

- technology adoption data from Statistics Canada's 2022 Survey of Advanced Technology;
- job postings analysis (450,110 postings from January 2021 to June 2025) from our high-frequency labour market data (formerly Vicinity Jobs).

We tracked changes in technology skills and tool and equipment skills over time using compound annual growth rates (CAGR) in the unique mention of skills in job postings.[5] The findings offer a strong foundation for future workforce planning. They highlight real opportunities to build the right skills, close key gaps, and help Canada's resource-based sector stay resilient and competitive.

1 Primary industries include NAICS 11 - Agriculture, forestry, fishing and hunting and NAICS 21 - Mining, quarrying, and oil and gas extraction. We covered NAICS 11 in a previous FSC research: Conference Board of Canada, The, *The Next Frontier in Canada's Agri-Food Sector.* Our focus in this research is NAICS 21, which comprises oil and gas extraction (NAICS 211), mining and quarrying (NAICS 212), and support activities for mining, and oil and gas extraction (NAICS 213). For brevity and ease of understanding, we refer to "support activities for mining, and oil and gas extraction" as "support services" throughout the briefing.

2 Export Development Canada, "Priority sectors."

3 Government of Canada, "The Canadian Critical Minerals Strategy"; and Royal Bank of Canada, "The New Great Game."

4 Statistics Canada, "Gross domestic product (GDP) at basic prices."

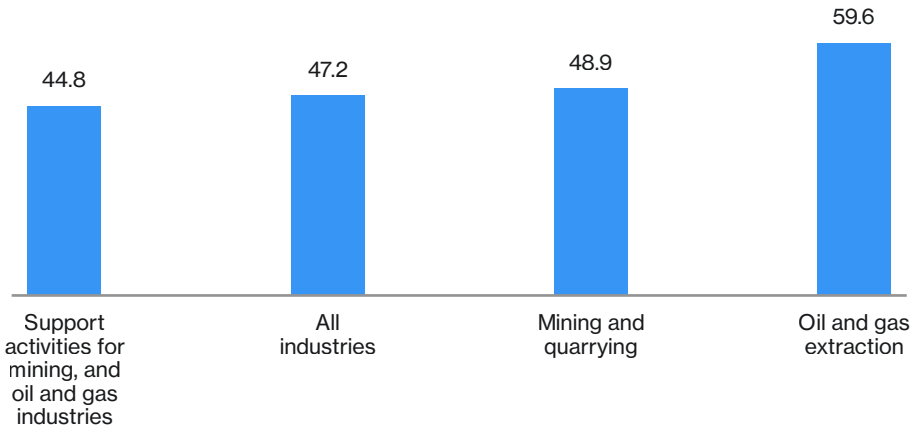
5 See Appendix A for methodological details.

Technology adoption rates vary by industries

Oil and gas extraction leads all extractive industries in advanced technology use, with 59.6 per cent of firms reporting adoption—well above the all-industry average of 47.2 per cent. (See Chart 1.) Mining follows with a 48.9 per cent adoption rate, slightly above the average but still trailing oil and gas. In contrast, firms in support activities for mining and oil and gas report a lower rate of 44.8 per cent, highlighting uneven tech uptake across the sector.

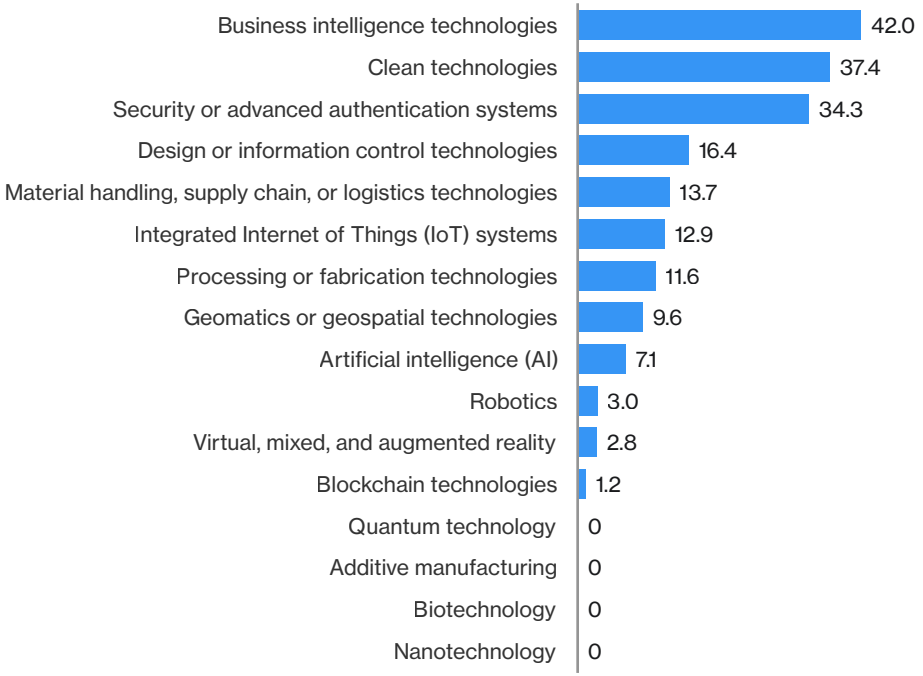
Oil and gas firms are way ahead in adopting data-driven technologies, with 42.0 per cent using business intelligence tools and 37.4 per cent implementing clean technologies and advanced security systems. This high adoption rate showcases the industry's strategic shift toward digital performance and environmental resilience. (See Chart 2.)

Chart 1
Oil and gas firms use advanced technology more often than mining firms
(percentage share of firms that use given advanced technology, 2022)



Sources: Statistics Canada, "Survey of Advanced Technology"; The Conference Board of Canada.

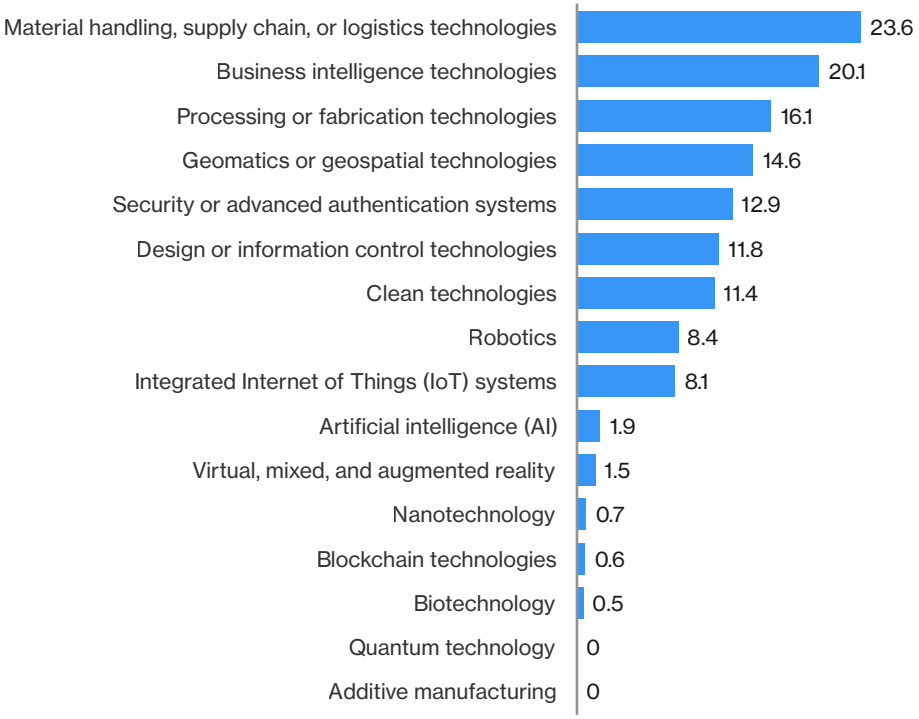
Chart 2
Business intelligence tools, clean technologies, and security systems lead adoption among oil and gas firms
(percentage share of firms that use given advanced technology, 2022)



Sources: Statistics Canada, "Survey of Advanced Technology"; The Conference Board of Canada.

Mining firms are slow to adopt cutting-edge technologies like AI and robotics (8.1 per cent and 1.9 per cent adoption, respectively), but they show stronger uptake of practical tools that enhance operations. Nearly one-quarter (23.6 per cent) use material handling, supply chain, or logistics technologies, and 20.1 per cent use business intelligence tools. (See Chart 3.)

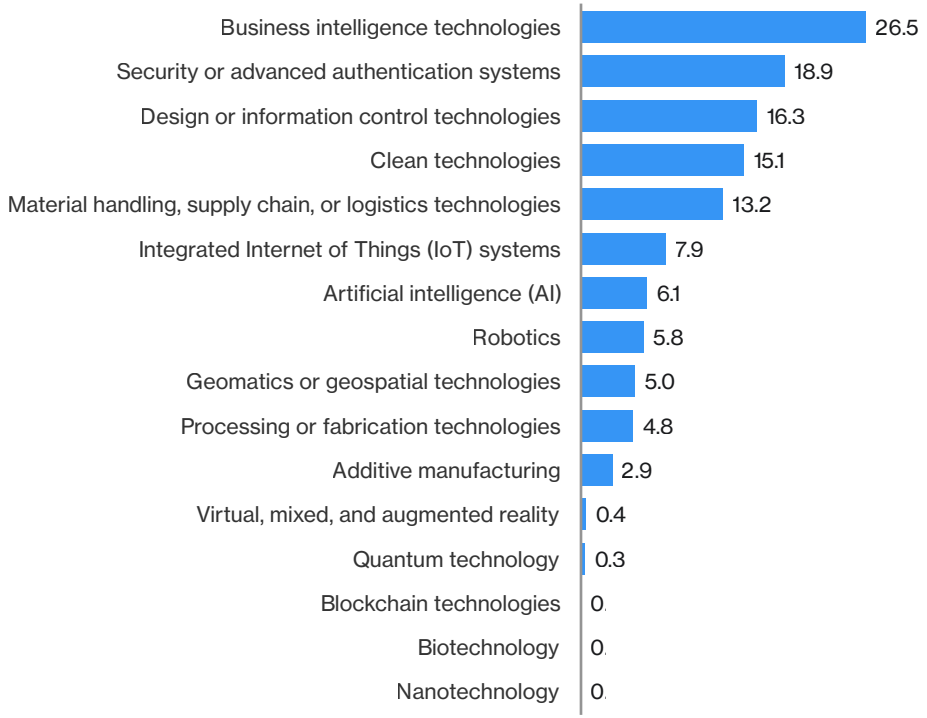
Chart 3
Flow of materials and business intelligence tools lead adoption among mining firms
(percentage share of firms that use given advanced technology, 2022)



Sources: Statistics Canada, "Survey of Advanced Technology"; The Conference Board of Canada.

In support services, adoption of advanced technologies is more limited, but there's notable uptake in business-oriented tools. One in four firms (26.5 per cent) use business intelligence technologies, while 18.9 per cent of firms use security and advanced authentication technologies. (See Chart 4.) The use of design and information control technologies (at 16.3 per cent)and clean technologies (at 15.1 per cent) see relatively high uptake compared to other technologies.

Chart 4
Business intelligence tools, security systems, and information control lead adoption among firms supporting mining, oil and gas industries
(percentage share of firms that use given advanced technology, 2022)



Sources: Statistics Canada, "Survey of Advanced Technology"; The Conference Board of Canada.

Comparing skill requirements by industries

Skills demand in oil and gas industry

Technology skills for professional roles

From 2021 to 2025, skills related to business intelligence and enterprise systems have grown fastest, with Power BI (33.3 per cent), Microsoft Suite (22.6 per cent), and Enterprise Resource Planning (ERP) systems (21.8 per cent) leading the way, along with artificial intelligence (AI) at 18.8 per cent. (See Chart 5.)

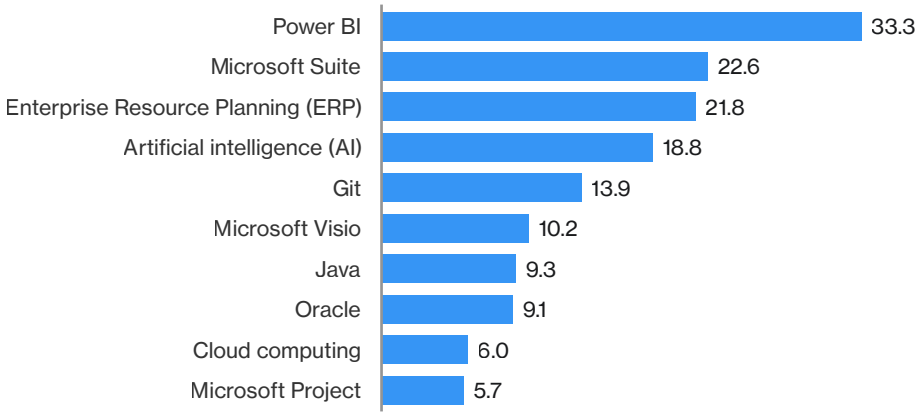
The rising demand for skills like Power BI, AI, and cloud computing aligns closely with the industry's most adopted technologies, particularly business intelligence and the Internet of Things (IoT).

Tool and equipment skills for production roles

Between 2021 and 2025, skill demand for instrumentation and refrigeration systems nearly doubled, rising by 91.6 per cent and 84.4 per cent, respectively. In addition, competencies in backhoes, calipers, and sewer systems saw strong gains of 28.5 per cent, 24.1 per cent, and 24.0 per cent, respectively. (See Chart 6.)

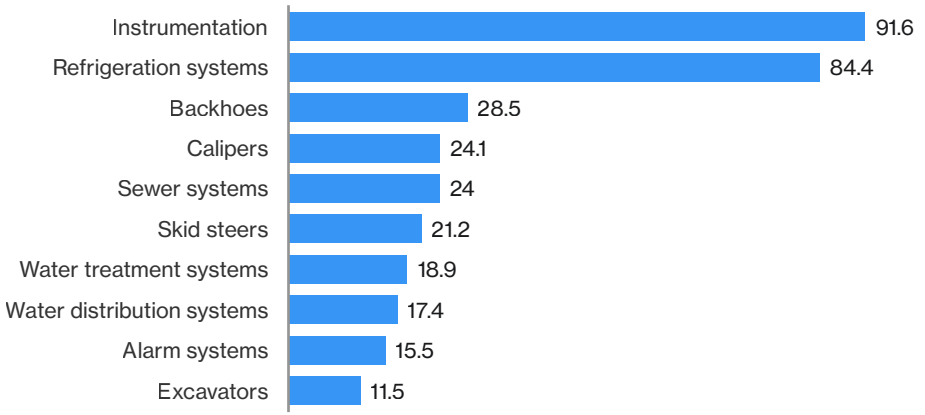
The rapid growth in tool and equipment skills such as instrumentation and refrigeration systems are not directly tied to the most widely adopted advanced technologies in the oil and gas industry.

Chart 5
Power BI, Microsoft Suite, and ERP are the fastest-growing technology skills for professional roles in the oil and gas industry
(CAGR from 2021 to 2025 for the top 10 skills appearing in at least 100 job postings in the industry in 2025; per cent)



Note: We started seeing OpenAI in the 2023 job postings.
Source: The Conference Board of Canada.

Chart 6
Instrumentation and refrigeration systems are the fastest-growing tool and equipment skills for production roles in the oil and gas industry
(CAGR from 2021 to 2025 for the top 10 skills appearing in at least 100 job postings in the industry in 2025; per cent)



Source: The Conference Board of Canada.

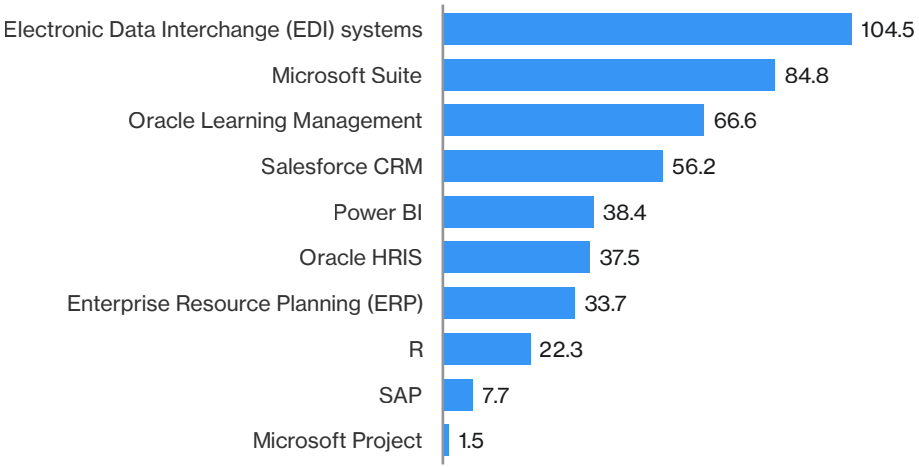
Skills demand in the mining industry

Technology skills for professional roles

From 2021 to 2025, demand for Electronic Data Interchange (EDI) systems more than doubled (104.5 per cent), Microsoft Suite skills demand increased by 84.8 per cent, and Oracle Learning Management and Salesforce CRM demand rose 66.6 per cent and 56.2 per cent, respectively. (See Chart 7.)

Despite relatively low adoption rates of advanced technologies in mining, the rapid growth in some technology skills suggests firms are investing in digital and data infrastructure to modernize operations.

Chart 7
Electronic Data Interchange, Microsoft Suite, and Oracle Learning Management are the fastest-growing technology skills for professional roles in the mining industry
(CAGR from 2021 to 2025 for the top 10 skills appearing in at least 30 job postings in the industry in 2025; per cent)



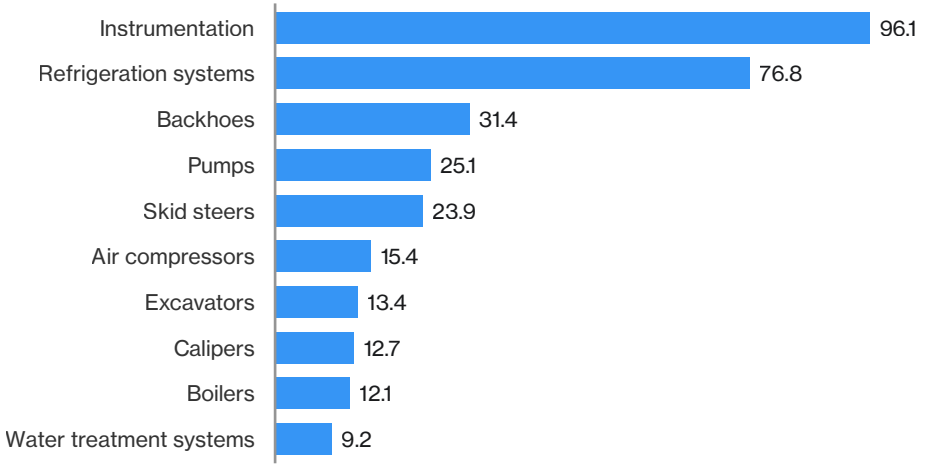
Note: We started seeing OpenAI in the 2023 job postings.
Source: The Conference Board of Canada.

Tool and equipment skills for production roles

Between 2021 and 2025, demand for some technical equipment skills rose sharply, with instrumentation and refrigeration systems leading growth at 96.1 per cent and 76.8 per cent, respectively. Backhoes (31.4 per cent), pumps (25.1 per cent), and skid steers (23.9 per cent) also saw substantial increases. (See Chart 8.)

The increasing demand for instrumentation aligns with processing and fabrication technologies ranking as the third most adopted technology category among mining firms.

Chart 8
Instrumentation and refrigeration systems are the fastest-growing tool and equipment skills for production roles in the mining industry
(CAGR from 2021 to 2025 for the top 10 skills appearing in at least 100 job postings in the industry in 2025; per cent)



Source: The Conference Board of Canada.

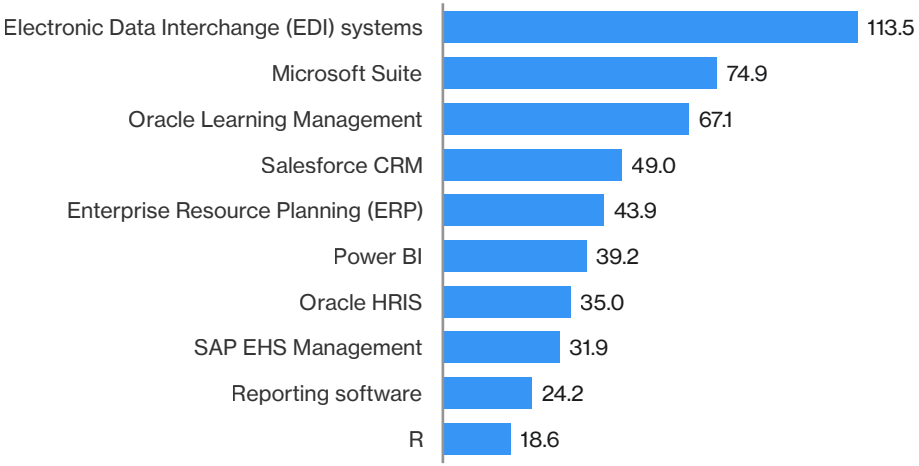
Skills demand in support services

Technology skills for professional roles

From 2021 to 2025, demand for EDI systems skills grew by 113.5 per cent, Microsoft Suite by 74.9 per cent, and Oracle Learning Management by 67.1 per cent. In contrast, Salesforce CRM and ERP software skills grew by 49.0 per cent and 43.9 per cent, respectively. (See Chart 9.)

Although Power BI and business intelligence are the top adopted technologies in support services, the fastest-growing technology skills do not reflect the most adopted technologies. Skills growth instead focuses on business software.

Chart 9
Electronic Data Interchange, Microsoft Suite, and Oracle Learning Management are the fastest-growing technology skills for professional roles in the support services industry
(CAGR from 2021 to 2025 for the top 10 skills appearing in at least 30 job postings in the industry in 2025; per cent)

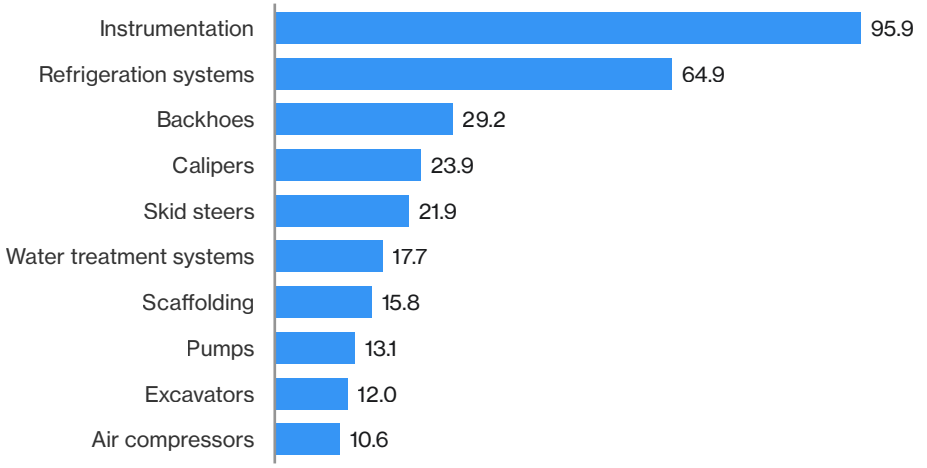


Note: We started seeing OpenAI in the 2023 job postings.
Source: The Conference Board of Canada.

Tool and equipment skills for production roles

Between 2021 and 2025, two skills saw substantial growth: instrumentation at 95.9 per cent and refrigeration systems at 64.9 per cent. (See Chart 10.)

Chart 10
Instrumentation and refrigeration systems are the fastest-growing tool and equipment skills for production roles in the support services industry
(CAGR from 2021 to 2025 for the top 10 skills appearing in at least 100 job postings in the industry in 2025; per cent)



Source: The Conference Board of Canada.

Appendix A

Methodology

About the research

This project assesses the skills needed to effectively harness emerging technologies in Canada's primary industries (i.e., mining, oil and gas) and identify solutions for closing critical workforce gaps. Specifically, we ask the following:

- To what extent are businesses in mining and oil and gas in Canada adopting and innovating with emerging technologies, and what barriers, if any, are affecting their ability to fully integrate these technologies?
- What skills do employers in mining and oil and gas need to support technology adoption and innovation, and what are the gaps between current workforce skills and emerging skill needs?
- What are the cross-cutting factors (economic, demographic, institutional) causing skill shortages in mining and oil and gas?

To answer some aspects of these questions, we analyzed:

- Statistics Canada data on the use of advanced technologies by mining, oil and gas, and supporting activities for these industries;
- job postings in mining, oil and gas, and supporting activities for these industries.

An upcoming issue briefing will answer the remaining parts.

Advanced technologies

According to Statistics Canada, "An advanced technology is one that performs a new function or significantly improves an existing function performed by a more commonly used technology."[1] You can see the list and definition of 15 advanced technologies on the Statistics Canada website.

Detailed methodology

To assess the main automation technologies currently in use across Canada's mining, oil and gas, and support services industries, we analyzed data from Statistics Canada's 2022 Survey of Advanced Technology. This firm-level survey captures adoption patterns for 15 categories of advanced technologies, including robotics, clean technologies, AI, and business intelligence tools. We focused on three industry groups within the extractive sector: mining (NAICS 212), oil and gas extraction (NAICS 211), and support activities for mining and oil and gas (NAICS 213). The survey responses were used to determine which technologies are most widely adopted across these groups and to identify industrial differences in digital maturity.

To evaluate how these technologies are shaping workforce needs, we analyzed 450,110 online job postings collected from 2021 through June 2025 using our high-frequency labour market data platform (formerly Vicinity Jobs). Because we were able to observe only six months of data for 2025, in consultation with the maintainer of the database, we assumed that the skills demand for the rest of the year will be same as the first six months of the year.

The sample included 126,488 postings in mining, 176,017 postings in oil and gas extraction, and 147,605 postings in support activities. Job posting text was parsed using a structured skills taxonomy and grouped into two main skill categories: technology skills, and tool and equipment skills.

Within respective industries, we downloaded and analyzed job postings data by two role types: professional roles and production roles. (See tables 1, 2, and 3). We made this decision given the different skills requirements of those roles. We also focused on those roles that are at least five times more likely to be found in respective primary industries than the economy as a whole. We used concentration quotient (CQ) to determine the relative concentration of roles in industries. The CQ measures the relative importance of any given occupation to each sector compared with the overall economy. The CQ formula is:

$$\boldsymbol{CQ} = \left(\frac{Occupatios's\ share\ of\ sectoral\ employment}{Occupatios's\ share\ of\ national\ employment} \right)$$

1 Statistics Canada, "Survey of Advanced Technology, 2022."

Theoretically, values greater than 1 indicate that a given occupation is more important to the primary industry than the overall economy. Values less than 1 indicate that a given occupation is less important to the primary industry than the overall economy. Values equal to 1 indicate that a given occupation is equally important to the primary industry and the overall economy. For example, a CQ value of 95.7 for mining engineers indicates people with this occupation are nearly 96 times more concentrated in the mining industry than the economy as a whole.

After analyzing the descriptions of the occupations above the cut-off point of 1, we determined that occupations with a CQ value of 5 or greater provide a suitable list of relevant occupations for each of the three industries. A CQ value of 5 indicates a given occupation is five times more concentrated in a given primary sector than the national economy average. With this cut-off value, the occupations included in the analysis account for 56.8 per cent, 59.2 per cent, and 51.7 per cent of total industry employment, respectively, in oil and gas, mining, and support services.

To identify skill trends, we calculated the compound annual growth rate (CAGR) in the frequency of mention for each skill appearing in at least 100 postings in the case of oil and gas industry or at least 30 postings in the case of technology skills in mining and support services in 2025. We designated a lower threshold for technology skills in mining and support services as the frequency of technology skills in job postings is lower in these industries than it is in the oil and gas industry. Specifically, in the oil and gas industry, there are 34 technology skills for which we observed at least 100 or more mentions in job postings, while there are only 10 mentions in the mining industry and 13 mentions in the support services industry. This allowed us to pinpoint the fastest-growing skills among common skills and track the evolving demand for capabilities that align with technology adoption.

The formula for calculating CAGR is as follows:

$$\boldsymbol{CAGR} = \left(\left(\frac{V_{ending}}{V_{beginning}} \right)^{\frac{1}{n}} - 1 \right) x\ 100$$

Where:

- “V ending” equals the ending value in the time series (number of mentions at end date).
- “V beginning” equals the beginning value in the time series (number of mentions at start date).
- “n” equals the number of years in the time series.

There are a few limitations to keep in mind. First, Statistics Canada data reflects 2022 adoption, and fast-moving innovation trends may have changed. Second, job postings may under-represent some skill needs, especially technology skills. The frequency that some technology skills are mentioned is too low (i.e., <30) to be representative of the industry-wide trends.

Table 1

There are 18 production roles and 15 professional roles in the oil and gas industry that are included in the skills analysis
(occupational employment by industry, 2021)

Occupation definition	Role type	National employment	Industry employment	Concentration quotient (CQ)
Petroleum engineers	Professional	4,835	2,585	128.4
Oil and gas well drilling and related workers and services operators	Production	4,695	1,545	79.0
Central control and process operators, petroleum, gas and chemical processing	Production	21,470	6,640	74.3
Contractors and supervisors, oil and gas drilling and services	Production	9,405	2,645	67.5
Oil and gas well drillers, servicers, testers and related workers	Production	5,965	1,115	44.9
Managers in natural resources production and fishing	Production	9,470	1,665	42.2
Geoscientists and oceanographers	Professional	10,280	1,355	31.6
Oil and gas drilling, servicing and related labourers	Production	5,760	725	30.2
Industrial instrument technicians and mechanics	Professional	8,515	1,030	29.0
Geological and mineral technologists and technicians	Professional	7,125	795	26.8
Mining engineers	Professional	3,255	350	25.8
Power engineers and power systems operators	Production	32,365	3,145	23.3
Chemical engineers	Professional	10,795	1,030	22.9
Supervisors, petroleum, gas and chemical processing and utilities	Production	11,530	880	18.3
Industrial electricians	Production	20,015	1,135	13.6
Chemical plant machine operators	Production	7,275	390	12.9
Heavy equipment operators	Production	80,835	3,975	11.8
Steamfitters, pipefitters and sprinkler system installers	Production	18,420	800	10.4
Non-destructive testers and inspectors	Professional	5,835	245	10.1
Procurement and purchasing agents and officers	Professional	47,710	1,950	9.8
Supervisors, logging and forestry	Production	5,815	225	9.3
Industrial and manufacturing engineers	Professional	15,680	585	9.0

(continued ...)

Table 1 (cont'd)
There are 18 production roles and 15 professional roles in the oil and gas industry that are included in the skills analysis
(occupational employment by industry, 2021)

Occupation definition	Role type	National employment	Industry employment	Concentration quotient (CQ)
Metallurgical and materials engineers	Professional	2,585	85	7.9
Utilities managers	Production	10,905	355	7.8
Heavy-duty equipment mechanics	Production	43,095	1,360	7.6
Engineering inspectors and regulatory officers	Professional	6,735	210	7.5
Geological engineers	Professional	3,625	110	7.3
Records management technicians	Professional	2,670	75	6.7
Mechanical engineers	Professional	53,795	1,480	6.6
Insulators	Production	8,075	215	6.4
Engineering managers	Professional	30,750	785	6.1
Boilermakers	Production	3,300	80	5.8
Construction millwrights and industrial mechanics	Production	61,650	1,420	5.5
Subtotal	**All role types**	**574,235**	**40,985**	**na**
Total	**All role types**	**17,321,700**	**72,145**	**na**
Share (percentage)	**All role types**	**3.3**	**56.8**	**17.1**

Sources: Statistics Canada; The Conference Board of Canada.

Table 2

There are 17 production roles and 8 professional roles in the mining industry that are included the skills analysis

(occupational employment by industry, 2021)

Occupation definition	Role type	National employment	Industry employment	Concentration quotient (CQ)
Mine labourers	Production	2,440	1,750	160.7
Underground production and development miners	Production	12,875	8,940	155.6
Supervisors, mining and quarrying	Production	7,500	4,965	148.3
Underground mine service and support workers	Production	3,955	2,510	142.2
Mining engineers	Professional	3,255	1,390	95.7
Central control and process operators, mineral and metal processing	Production	2,235	730	73.2
Geological and mineral technologists and technicians	Professional	7,125	1,795	56.4
Managers, natural resources production and fishing	Production	9,470	2,075	49.1
Geoscientists and oceanographers	Professional	10,280	1,375	30.0
Machine operators, mineral and metal processing	Production	8,000	985	27.6
Industrial electricians	Production	20,015	1,905	21.3
Heavy equipment operators	Production	80,835	7,625	21.1
Heavy-duty equipment mechanics	Production	43,095	3,410	17.7
Drillers and blasters, surface mining, quarrying, and construction	Production	4,030	270	15.0
Construction millwrights and industrial mechanics	Production	61,650	3,995	14.5
Metallurgical and materials engineers	Professional	2,585	165	14.3
Concrete, clay, and stone forming operators	Production	3,565	195	12.3
Geological engineers	Professional	3,625	190	11.7
Industrial instrument technicians and mechanics	Professional	8,515	430	11.3
Supervisors, mineral and metal processing	Production	5,280	245	10.4
Other professional occupations in physical sciences	Professional	540	20	8.3
Inspectors and testers, mineral and metal processing	Production	2,065	50	5.4
Supervisors, logging and forestry	Production	5,815	140	5.4
Labourers, mineral and metal processing	Production	8,935	215	5.4
Occupational health and safety specialists	Professional	18,800	425	5.1
Subtotal	**All role types**	**336,485**	**45,795**	**na**
Total	**All role types**	**17,321,700**	**77,305**	**na**
Share	**All role types**	**1.9**	**59.2**	**30.5**

Sources: Statistics Canada; The Conference Board of Canada.

Table 3

There are 20 production roles and 10 professional roles in the support services industry that are included in the skills analysis

(occupational employment by industry, 2021)

Occupation definition	Role type	National employment	Industry employment	Concentration quotient (CQ)
Oil and gas drilling, servicing and related labourers	Production	5,760	3,450	149.5
Contractors and supervisors, oil and gas drilling and services	Production	9,405	4,615	122.4
Oil and gas well drillers, servicers, testers, and related workers	Production	5,965	2,870	120.1
Oil and gas well drilling and related workers and services operators	Production	4,695	2,050	109.0
Drillers and blasters, surface mining, quarrying, and construction	Production	4,030	1,380	85.4
Underground mine service and support workers	Production	3,955	900	56.8
Supervisors, mining and quarrying	Production	7,500	1,680	55.9
Mine labourers	Production	2,440	520	53.2
Managers, natural resources production and fishing	Production	9,470	2,000	52.7
Underground production and development miners	Production	12,875	2,590	50.2
Water well drillers	Production	585	80	34.1
Geoscientists and oceanographers	Professional	10,280	1,390	33.7
Geological and mineral technologists and technicians	Professional	7,125	800	28.0
Petroleum engineers	Professional	4,835	505	26.1
Central control and process operators, petroleum, gas, and chemical processing	Production	21,470	1,600	18.6
Mining engineers	Professional	3,255	240	18.4
Industrial instrument technicians and mechanics	Professional	8,515	615	18.0
Non-destructive testers and inspectors	Professional	5,835	310	13.3
Supervisors, logging and forestry	Production	5,815	280	12.0
Steamfitters, pipefitters, and sprinkler system installers	Production	18,420	830	11.2
Heavy equipment operators	Production	80,835	2,425	7.5
Other professional occupations in physical sciences	Professional	540	15	6.9
Industrial electricians	Production	20,015	550	6.9
Heavy-duty equipment mechanics	Production	43,095	1,160	6.7

(continued ...)

Table 3 (cont'd)

There are 20 production roles and 10 professional roles in the support services industry that are included in the skills analysis
(occupational employment by industry, 2021)

Occupation definition	Role type	National employment	Industry employment	Concentration quotient (CQ)
Construction millwrights and industrial mechanics	Production	61,650	1,495	6.1
Supervisors, petroleum, gas, and chemical processing and utilities	Production	11,530	270	5.8
Chemical plant machine operators	Production	7,275	165	5.7
Public and environmental health and safety professionals	Professional	19,405	415	5.3
Construction inspectors	Professional	15,205	315	5.2
Occupational health and safety specialists	Professional	18,800	385	5.1
Subtotal	**All role types**	**430,580**	**35,900**	**na**
Total	**All role types**	**17,321,700**	**69,415**	**na**
Share	**All role types**	**2.5**	**51.7**	**20.8**

Sources: Statistics Canada; The Conference Board of Canada.

Appendix B

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