

The Future of Work

Addressing Skill Imbalances in Canada





The Future Skills Centre – Centre des Compétences futures (FSC-CCF) is a forward-thinking centre for research and collaboration dedicated to preparing Canadians for employment success. We believe Canadians should feel confident about the skills they have to succeed in a changing workforce. As a pan-Canadian community, we are collaborating to rigorously identify, test, measure, and share innovative approaches to assessing and developing the skills Canadians need to thrive in the days and years ahead.

The Future Skills Centre was founded by a consortium whose members are Toronto Metropolitan University, Blueprint, and The Conference Board of Canada.

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Key findings

- Skill imbalances will contribute to rising job vacancies in Canada. Job vacancies will reach 917,000 by 2040 and the job vacancy rate will reach 3.8 per cent, resulting in over \$11 billion in lost economic activity.
- Vacancies in technical and manual services are expected to increase by 30 per cent between 2023 and 2040, reaching 366,000 by the end of the period. Demand for foundational and interpersonal skills—like oral comprehension and coordination—will grow in this sector, while imbalances in technical skills will decline.
- Vacancies in knowledge-based services are expected to increase by 35 per cent between 2023 and 2040, reaching 365,000. While this sector requires a high level of proficiency across a wide range of skills, the imbalance for foundational and interpersonal skills is expected to increase the most.
- Vacancies in goods-producing industries are expected to increase by 9 per cent between 2023 and 2040, reaching 161,000. While technical skills will remain the most prominent source of skill imbalances in this sector, the imbalance will grow for analytical skills, such as problem-solving, evaluation, systems analysis, and critical thinking.

Recommendations

- Tailoring apprenticeships and post-secondary education programs to focus on in-demand skills is necessary for addressing skill imbalances, especially within goods-producing and knowledge-based services industries.
- As immigration continues to be a main source of population growth in Canada, attracting and integrating immigrants with high levels of the required skills will help ensure they find well-matched jobs and will also address the economic challenges posed by skill imbalances.
- Leveraging data to adapt curricula can help meet the expected increase in demand for management of material resources, active listening, and social perceptiveness skills.
- High-quality early education is essential for developing foundational skills like active listening and oral comprehension, which are increasingly needed across all industries.
- Promoting lifelong learning by encouraging workers to adapt their skills to ongoing technological and societal changes is key to reducing skill imbalances. Employer supported training programs can play an important role in supporting this effort.



We've lost our balance

Skill imbalances are evident in Canada. The C.D. Howe Institute estimates that, in 2019, 13.0 per cent of Canadians were employed in jobs that did not match their skills, compared to an OECD average of 10.0 per cent.¹



Skills shortages were especially acute during the post-pandemic recovery. A Statistics Canada survey from 2022 revealed that over half of employers were grappling with skills gaps and more than two-thirds were struggling to find candidates with the necessary skills.² In the spring of 2023, over half of small businesses expected recruiting and retaining skilled workers to be a significant obstacle in the next three months.³ Although skill imbalances have eased, our forecasts show that they will continue to be a problem.

Without interventions to help the workforce gain the necessary skills, imbalances will impede future productivity and limit Canada's growth.⁴ Moreover, adjustments to education and training programs take months or even years to impact workforce skills, highlighting the need for immediate action.

1 Mahboubi, "Bad Fits: The Causes, Extent and Costs of Job Skills Mismatch in Canada."

2 Fissuh and others, "Determinants of Skill Gaps in the Workplace and Recruitment Difficulties in Canada." The study considers a firm to have a skills gap if less than 100 per cent of its employees were fully proficient to do their jobs.

3 Statistics Canada, "Analysis on Labour Challenges in Canada, Second Quarter of 2023."

4 Conference Board of Canada, The, "Skills and Productivity: Which Skills Shortages Are Impacting Canadian Productivity?"; OECD, "Employment outlook 2014"; ILO, "Skills and jobs mismatches in low- and middle-income countries"; Deming and Noray, "Earnings dynamics, changing job skills, and STEM careers"; Deming and Kahn, "Skill requirements across firms and labour markets: Evidence from job postings for professionals."



What is a skill imbalance?

Skill imbalances occur when the skills needed in the workforce do not match those of the available workers. They encompass both skills shortages and skills mismatches.

Skills shortages arise when the skills sought by employers are not available in the pool of candidates. Skills mismatches occur when a worker's skills exceed or fall short of those required for their job. Skills shortages can lead to skills mismatches when firms employ workers who are under-skilled for the job.⁵

We measure skill imbalances as the share of vacancies requiring a particular skill at proficiency level 3 (out of 5) or above within each industry cluster.⁶ This allows us to observe the change in the composition or the intensity of the unmet skills demand over time.

See [Appendix A](#) for our full methodology.

⁵ OECD, "Getting Skills Right: United Kingdom."

⁶ Skill proficiencies by occupation are from the Occupational and Skills Information System skills framework.

We forecast skill imbalances to 2040 using The Conference Board of Canada's Model of Occupations, Skills, and Technology (MOST)⁷ and the Occupational and Skills Information System (OaSIS) skills framework.⁸ Our forecast captures the dynamics of job vacancies by occupation and industry, driven by matching job openings to job seekers based on skill similarities. We account for factors such as economic growth, demographic shifts, technological advances, automation, and the transition to a net-zero economy.

We examine skills within three industry clusters: goods-producing industries, knowledge-based services industries, and technical and manual services industries.⁹

The goods-producing cluster includes:

- agriculture,
- forestry, fishing, mining, quarrying, and oil and gas,
- utilities,
- construction,
- manufacturing.

The knowledge-based cluster includes:

- finance, insurance, real estate, rental and leasing,
- professional, scientific and technical services, and management of companies,
- educational services,
- healthcare and social assistance,
- information and culture, and recreation.

⁷ For more information on MOST, please visit the [MOST website](#). To see how we used MOST to inform this research, please see the methodology in Appendix A.

⁸ We assume that skills proficiency levels, as defined by the OaSIS framework, remain consistent within each unit occupation (5-digit NOC) from 2023 to 2040.

⁹ Note: Public administration [NAICS 91] is not classified into the three clusters and, therefore, is not included in the analysis in this report. See Appendix A for more information on the industry composition of each cluster.

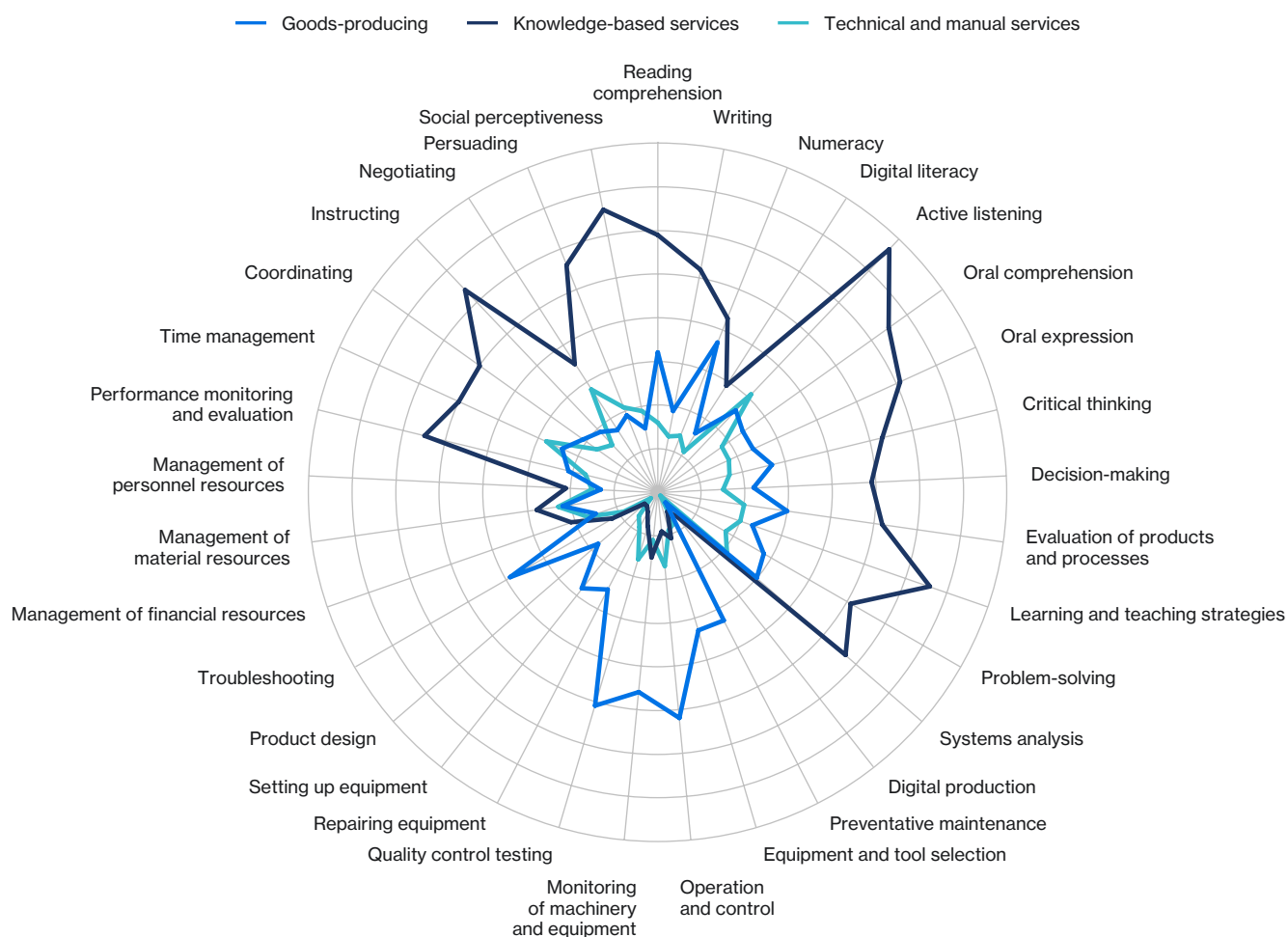
The technical and manual cluster includes:

- wholesale and retail trade,
- transportation and warehousing,
- administrative and support, waste management and remediation services,
- accommodation and food services,
- other services (except public administration).

Industries within each cluster exhibit similar trends in skill imbalances, however, these trends differ across clusters. Goods-producing industries see larger imbalances for technical skills, while knowledge-based services industries have imbalances for a wide range of foundational, interpersonal, and analytical skills. (See Chart 1.)

Chart 1

Skill imbalances differ between industry clusters
(share of vacancies per skill, 2023)



Source: The Conference Board of Canada.

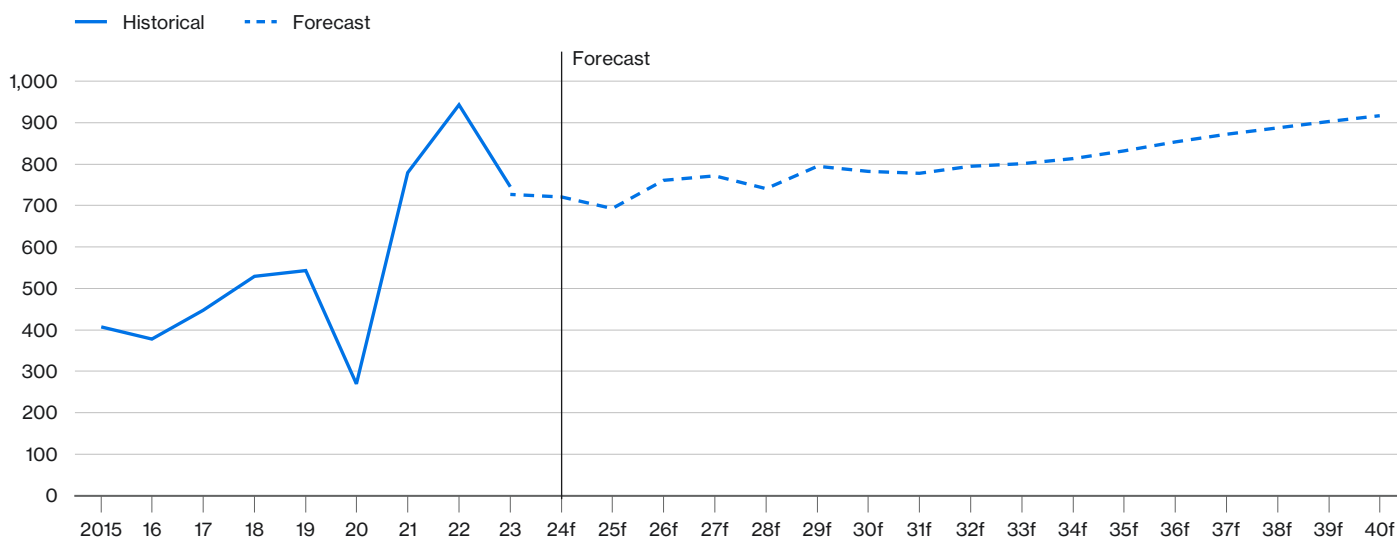
Job vacancies in Canada are expected to grow

After reaching a peak of over one million job vacancies with a 6.0 per cent vacancy rate in the second quarter of 2022,¹⁰ job vacancies are projected to decrease to under 700,000 by 2025, reducing the vacancy rate to 3.3 per cent.¹¹ (See Chart 2.) However, this leaves vacancies 50.0 per cent above the pre-pandemic average.¹² Beyond 2025, vacancies are forecast to steadily increase. By 2040, we expect there to be approximately 917,000 vacancies and a vacancy rate of 3.8 per cent—almost double the pre-pandemic levels— due to skill imbalances.



Chart 2

Job vacancies in Canada are projected to increase over the next two decades
(number of job vacancies in Canada, thousands)



f = forecast

Note: The Conference Board of Canada's MOST estimate for total vacancies for 2023 is approximately 3 per cent lower than in Statistics Canada's JVWS, primarily due to the exclusion of unclassified occupations in the CBoC's estimates and occupation suppression and aggregation in the JVWS.

Source: Statistics Canada's Job Vacancy and Wage Survey (JVWS), and The Conference Board of Canada.

¹⁰ Statistics Canada, "Table 14-10-0371-01 Job vacancies, payroll employees, and job vacancy rate by provinces and territories, monthly, unadjusted for seasonality."

¹¹ Vacancy rates report the number of vacancies as a share the total labour demand (employment plus vacancies).

¹² Pre-pandemic average is the average from 2015 to 2019.



What is a vacancy and how does it relate to skills?

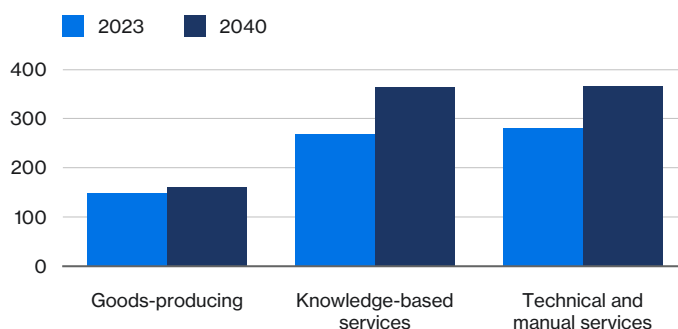
A vacancy is defined as a role an employer is actively seeking to fill. Vacancies measure the level of unmet labour demand in an economy, whereas met labour demand is measured by the employment level. While some level of vacancies is always expected, due to frictions or time lags between postings and filling jobs, increasing vacancies can signal heightened labour market tightness.

For each vacancy in a given occupation, we know the required skills. Therefore, we understand the skills employers are seeking but cannot find—i.e., the skill imbalances. In turn, the projections of skill imbalances are based on the changing occupational composition of vacancies over the forecast period.

Vacancies will grow the most within the knowledge-based services industries, increasing by 35.0 per cent between 2023 and 2040. Vacancies in technical and manual services industries will grow by 30.0 per cent, while vacancies in goods-producing industries will only grow by 9.0 per cent over the period. (See Chart 3.) The growth in vacancies indicates that skill imbalances are widening the most in knowledge-based services industries and in technical and manual services industries.

Chart 3

Vacancies growing fastest in knowledge-based services industries
(number of job vacancies, thousands)



Source: The Conference Board of Canada.

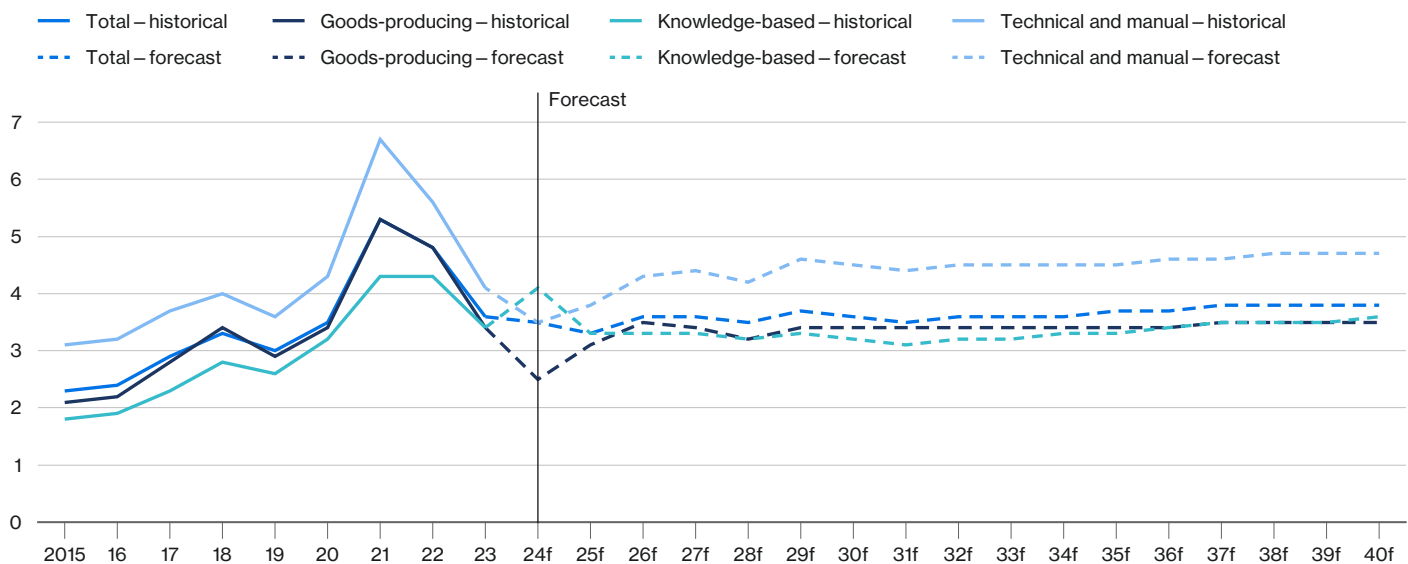
In terms of vacancy rates:

- The knowledge-based cluster will also experience the largest growth in vacancy rates, reaching 3.6 per cent in 2040—57.0 per cent higher than their pre-pandemic average.¹³
- The technical and manual services industry cluster, which often has the highest vacancy rates, will see a 34.0 per cent increase from its pre-pandemic average, reaching 4.7 per cent by 2040.
- The vacancy rate for the goods-producing cluster will increase by 32.0 per cent over its pre-pandemic average, reaching 3.5 per cent in 2040. (See Chart 4.)

¹³ The pre-pandemic average is the average from 2015 to 2019.

Chart 4

Technical and manual services industries have the highest vacancy rates
(vacancy rates, Canada)



f = forecast

Source: Statistics Canada's Job Vacancy and Wage Survey (JVWS), and The Conference Board of Canada.

Skill imbalances will cost the economy

Labour market tightness, as measured by vacancy rates, reduces productivity.¹⁴ As skill imbalances drive higher vacancy rates, we estimate this will cost the economy over \$11 billion in lost gross domestic product (GDP) in 2040.¹⁵ Roughly half of this lost economic activity will be in knowledge-based services industries. To combat this decline, we need to reduce the skills gaps in specific industries.



¹⁴ Conference Board of Canada, "Skills and Productivity: Which Skills Shortages Are Impacting Canadian Productivity?"

¹⁵ This estimate is based on the deviation in the vacancy rate in 2040 from its 2015-2019 average. We translate the deviation in the vacancy rate to a productivity effect, based on i) the estimated relationship between vacancy rates and our labour tightness indicator, and ii) the relationship between labour market tightness and productivity, explored in the Conference Board of Canada's report "Skills and Productivity: Which Skills Shortages Are Impacting Canadian Productivity?"



Goods-producing industries

Modest gains are expected in goods-producing vacancies

In 2023, the goods-producing industry cluster employed 4.0 million workers, accounting for 21.0 per cent of employment in Canada. It also accounted for about 21.0 per cent of total vacancies, representing over 147,000 vacant jobs. Vacancies are expected to increase by 9.0 per cent between 2023 and 2040, reaching 161,000 by the end of the period. However, employment growth will slightly outpace this growth in vacancies, leading to a 0.1 percentage point decrease in the vacancy rate, which will reach 3.5 per cent in 2040.

The occupations in this cluster with the most vacancies in 2023 included:

- construction trades helpers and labourers (14,473 vacancies),
- carpenters (7,359 vacancies),
- electricians (4,350 vacancies),
- transport truck drivers (4,060 vacancies),
- heavy equipment operators (3,514 vacancies).¹⁶

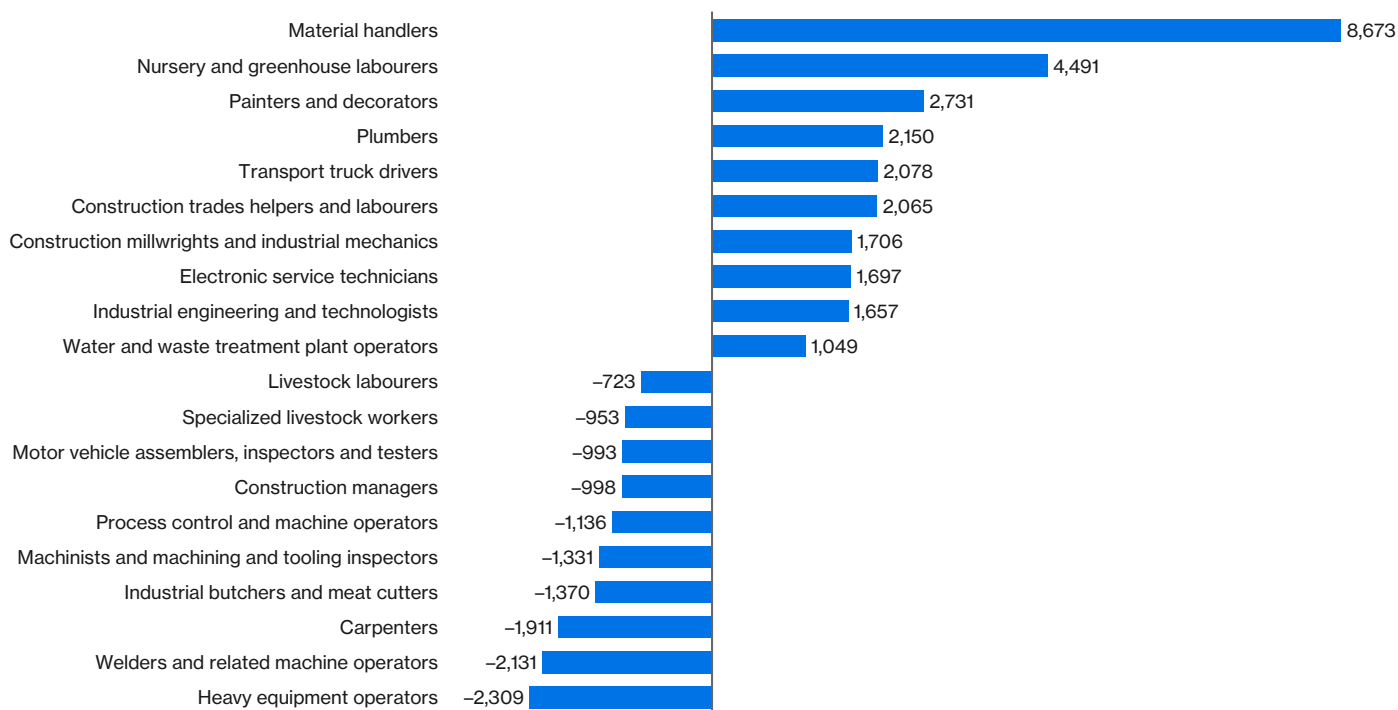
As shown in Chart 5, the occupations expected to see the largest increases in the number of vacancies between 2023 and 2040 are:

- material handlers (+ 270.0 per cent),
- nursery and greenhouse labourers (+ 430.0 per cent),
- painters and decorators (+ 138.0 per cent),
- plumbers (+ 78 per cent), and
- transport truck drivers (+ 51.0 per cent).

¹⁶ The Conference Board of Canada, Model of Occupations, Skills, and Technology.

Chart 5**Material handlers will see the largest increase in vacancies**

(change in number of job vacancies, occupations with the largest growth and decline, 2023–40)



Source: The Conference Board of Canada.

The current need for technical skills will decline

Today, goods-producing industries need workers with technical skills. In 2023, 52.0 per cent of these industries had vacancies, equivalent to 76,000 jobs requiring at least one technical skill. The technical skills most in demand today are quality control testing, operation monitoring of machinery and equipment, and operation and control.¹⁷

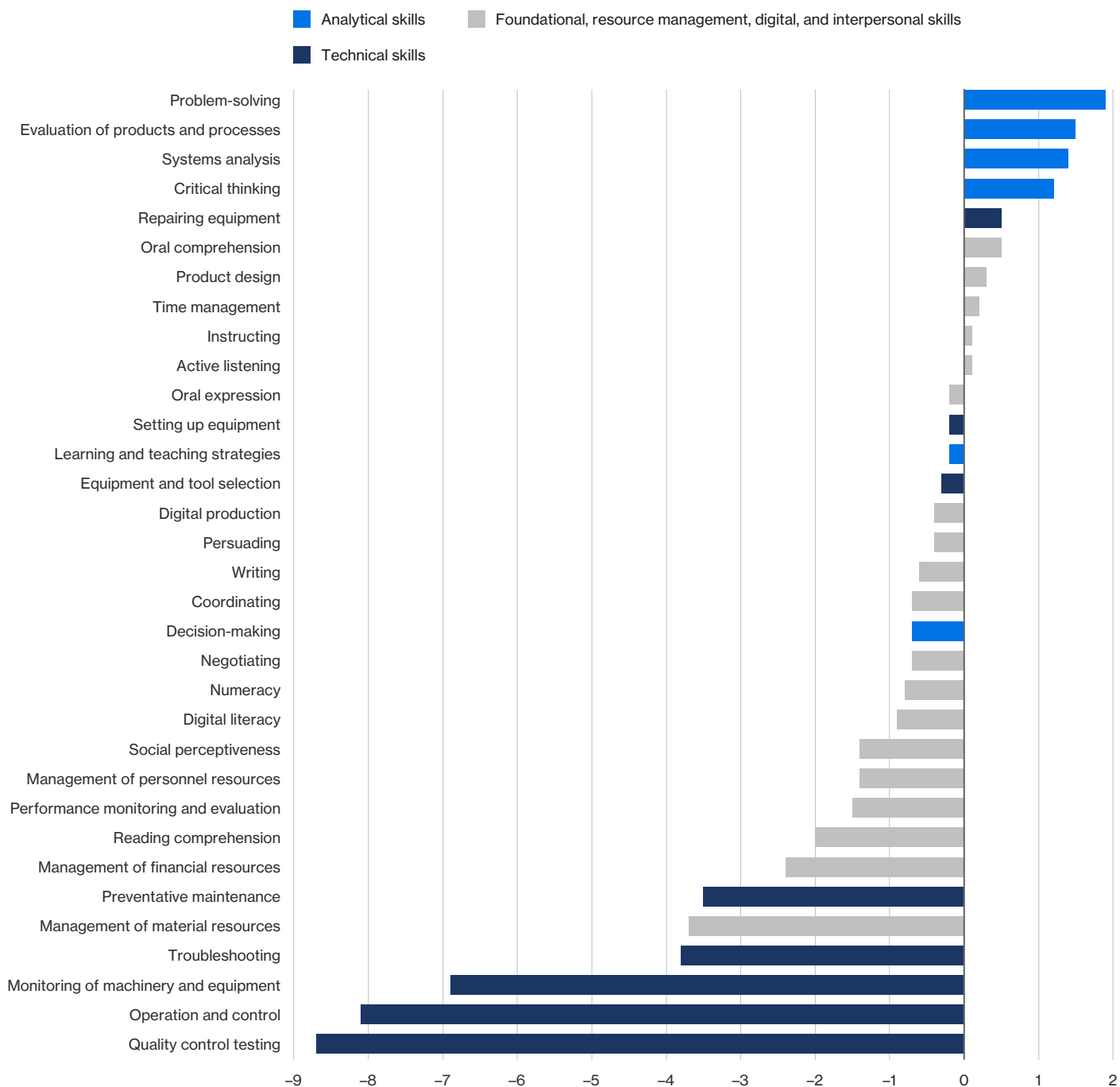
As technology and automation transform goods-producing industries, the imbalance for technical skills is expected to decline. By 2040, only 43.0 per cent of vacancies, equivalent to 70,000 jobs, will require one or more technical skills. Analytical skills will be a growing part of the skills imbalance within this industry cluster.

The share of vacancies requiring one or more analytical skills will increase from 30.0 per cent in 2023 to 32.0 per cent in 2040, equivalent to 51,000 jobs. (See Appendix B, Chart 1.) The top-growing analytical skills will include problem-solving, evaluation, systems analysis, and critical thinking. (See Chart 6.)

¹⁷ See the OaSIS website for descriptions of each skill: <https://noc.esdc.gc.ca/TaxonomyStructure/OasisSkillsCompetencies>.

Chart 6**Analytical skills imbalances grow while technical skills decline**

(change in share of vacancies in the goods-producing cluster, percentage points, 2023–40)



Source: The Conference Board of Canada.



Knowledge-based services industries

Healthcare to drive knowledge-based vacancies

In 2023, the knowledge-based industry cluster employed 8.1 million workers, accounting for 43.0 per cent of employment in Canada. This cluster accounted for about 39.0 per cent of total vacancies, representing 270,000 job openings. The level of vacancies is expected to increase by 35.0 per cent between 2023 and 2040, reaching 365,000 jobs. The growth in vacancies within knowledge-based services is expected to outpace employment growth, causing the vacancy rate to increase to 3.6 per cent by 2040 – up by 4.0 percentage points from 2023.

The occupations in the cluster with the most vacancies in 2023 included:

- registered nurses and registered psychiatric nurses (28,198 vacancies),
- nurses' aides, ordinaries, and patient service associates (19,991 vacancies),
- licensed practical nurses (13,009 vacancies),
- social and community service workers (12,088 vacancies),
- early childhood educators and assistants (10,709 vacancies).¹⁸

As Chart 7 shows, the occupations expected to see the largest increases in the number of vacancies between 2023 and 2040 are:

- nurses' aides, ordinaries, and patient service associates (+ 214.0 per cent),
- registered nurses and registered psychiatric nurses (+ 32.0 per cent),
- licensed practical nurses (+ 64.0 per cent),
- light duty cleaners (+ 160.0 per cent),
- software engineers and designers (+ 152.0 per cent).

The evolution of occupations in this cluster is driven by two main factors: the increasing demand for healthcare professionals to meet the needs of Canada's aging population, and the expected increase in technology adoption, specifically artificial intelligence (AI), in industries in this cluster.

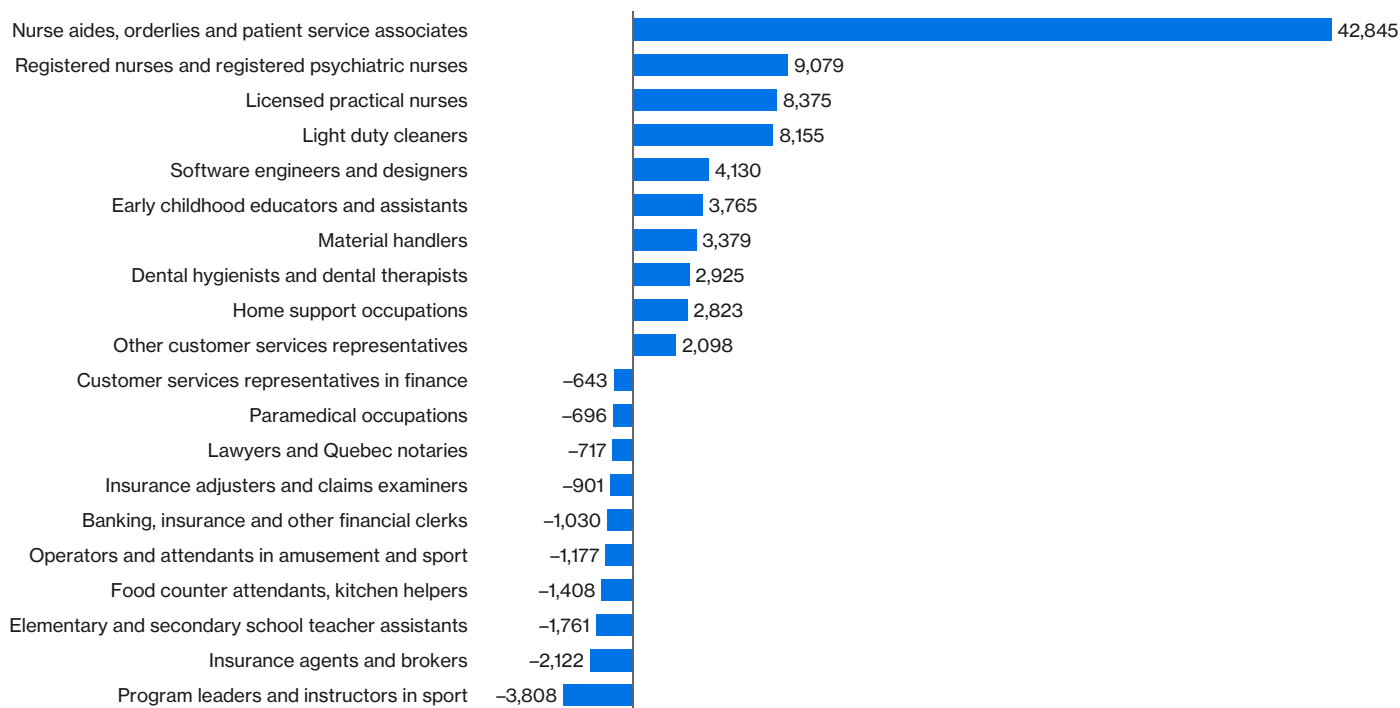
Knowledge-based occupations need a wide range of skills

Knowledge-based services industries need workers with a mix of foundational, analytical, interpersonal, and resource management skills.

¹⁸ The Conference Board of Canada, Model of Occupations, Skills, and Technology.

Chart 7**Nursing occupations will see the largest increases in vacancies**

(change in number of job vacancies, occupations with the largest growth and decline, 2023–40)



Source: The Conference Board of Canada.

In 2023, 77.0 per cent of vacancies (208,000 jobs) required at least one foundational skill, 66.0 per cent (178,000 jobs) one analytical skill, and slightly below 66.0 per cent (177,000 jobs) one interpersonal skill. This industry cluster requires a high level of proficiency across the largest number of skills.¹⁹

While jobs within this cluster are less at risk of being completely automated, they are being impacted by AI technologies.²⁰ In turn, imbalances for foundational and interpersonal skills will increase. By 2040, 81.0 per cent of vacancies (297,000 jobs) will require at least one foundational skill and 69.0 per cent (252,000 jobs) will require interpersonal skills. At the same time, skill imbalances for analytical and resource management skills will decline. (See Appendix B, Chart 2.) This is consistent with literature showing that the adoption of AI

technologies decreases demand for cognitive and financial skills and increases the importance of language and social skills.²¹

Skill imbalances for the knowledge-based cluster are spread across all skill groups. The top growing skill imbalances are for management of material resources, active listening, and social perceptiveness. These are skills needed in healthcare professions, specifically for nurses, which account for the largest share of vacancies within this cluster. Healthcare occupations are less at risk of automation and less impacted by AI technologies since they are highly dependent on interpersonal skills that cannot be routinized.²² Skill imbalances are decreasing for instructing, persuading, and learning and teaching strategies. (See Chart 8.)

¹⁹ High proficiency is a level 3 or higher on the OaSIS framework.

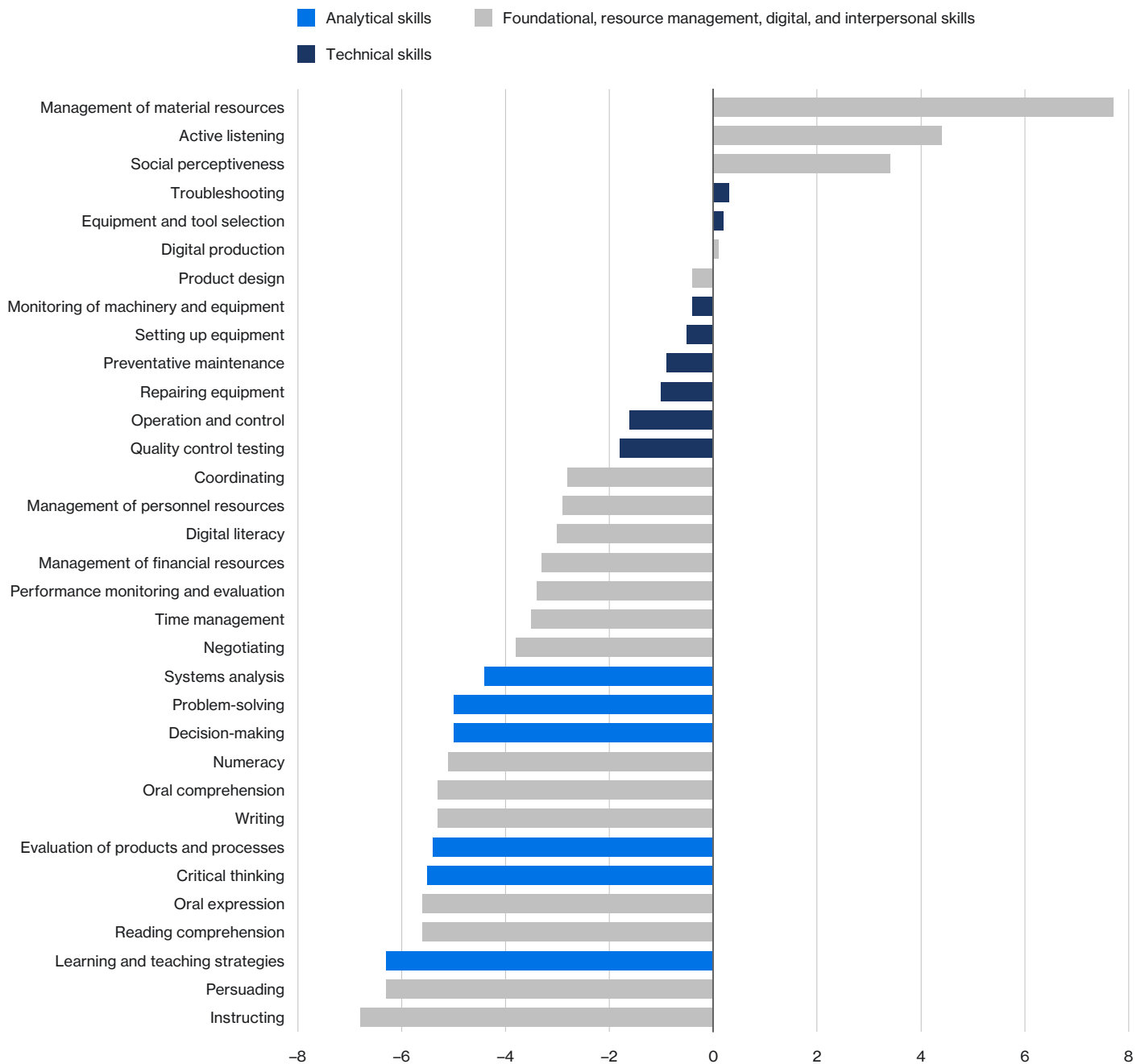
²⁰ Nedelkoska and Quintini, "Automation, skills use and training"; Green, "Artificial intelligence and the changing demand for skills in Canada: The increasing importance of social skills."

²¹ Green, "Artificial intelligence and the changing demand for skills in Canada: The increasing importance of social skills."

²² Nedelkoska and Quintini, "Automation, skills use and training."

Chart 8

Skill imbalances for management of material resources is expected to grow the fastest
 (change in share of vacancies in the knowledge-bases cluster, percentage points, 2023–40)



Source: The Conference Board of Canada.



Technical and manual services industries

Technical and manual services have the highest vacancy rates

In 2023, the technical and manual services industry cluster employed 6.6 million workers, accounting for 35.0 per cent of employment in Canada. Further, this cluster accounted for about 40 per cent of total vacancies in Canada, representing 281,000 jobs. Vacancies are expected to increase by 30.0 per cent between 2023 and 2040, reaching 366,000 jobs. The growth in vacancies within technical and manual services is expected to outpace employment growth, causing the vacancy rate to increase to 4.7 per cent by 2040—up by 0.6 percentage points from 2023. Overall, this industry cluster has the highest vacancy rate compared to the other clusters.

The occupations in this cluster with the most vacancies in 2023 included:

- food counter attendants and related support occupations (38,659 vacancies),
- retail salespersons and visual merchandisers (25,847 vacancies),
- transport truck drivers (16,033 vacancies),
- cooks (15,809 vacancies),
- food and beverage servers (12,766 vacancies).²³

As shown in Chart 9, the occupations expected to see the largest increases in the number of vacancies between 2023 and 2040 are:

- material handlers (+ 394.0 per cent),
- food service supervisors (+ 25.0 1 per cent),
- transport truck drivers (+ 94.0 per cent),
- light duty cleaners (+ 160.0 per cent),
- delivery service drivers (+ 402.0 per cent).

Imbalances grow for foundational and interpersonal skills

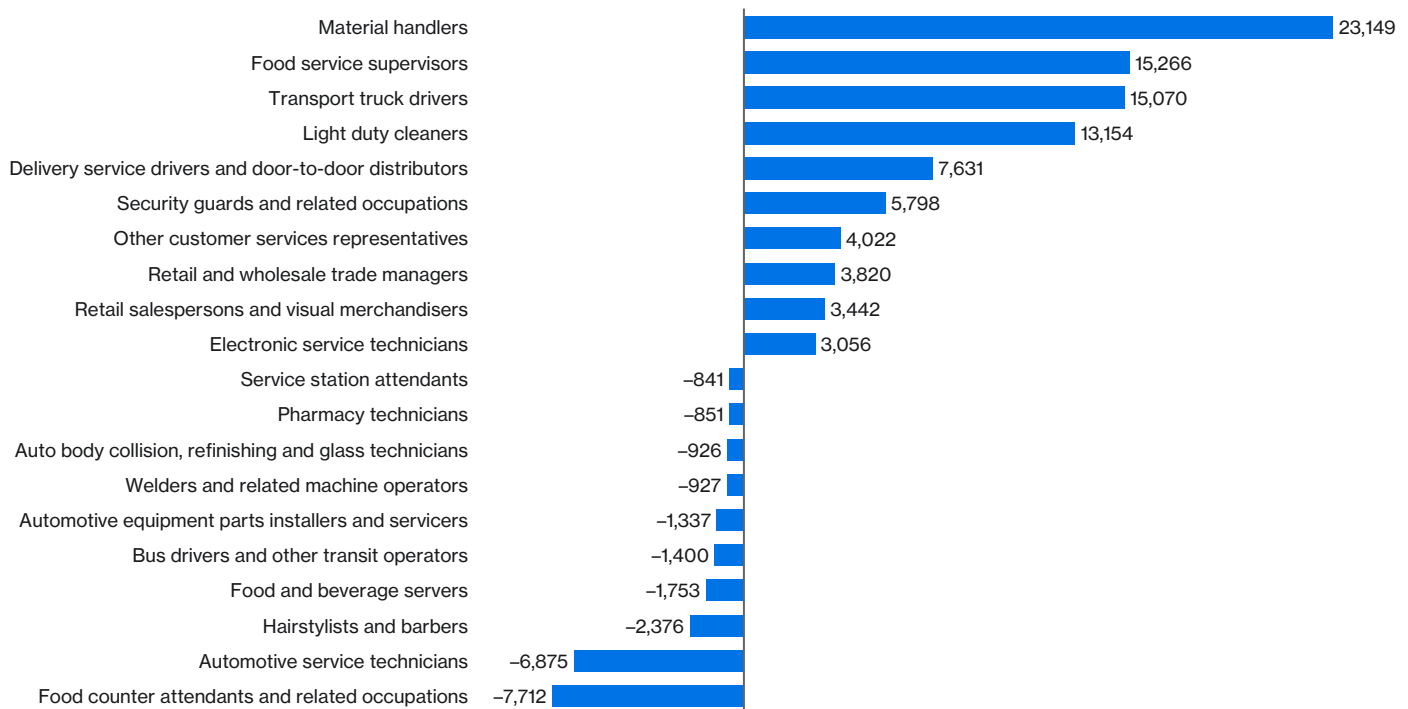
In general, jobs within the technical and manual services industries cluster require lower skill proficiency, with only 31.0 per cent of vacancies requiring high proficiency in any skill, compared to 52.0 per cent in the goods-producing cluster and 77.0 per cent in the knowledge-based cluster.²⁴ Nevertheless, foundational skills, interpersonal skills, and resource management skills are required for around 30.0 per cent of the vacancies in this cluster.

²³ The Conference Board of Canada, Model of Occupations, Skills, and Technology.

²⁴ High proficiency is a level 3 or higher on the OaSIS framework.

Chart 9**Material handlers will see the largest increase in vacancies**

(change in number of job vacancies, occupations with the largest growth and decline, 2023–40)



Source: The Conference Board of Canada.

Over the next two decades, automation and the adoption of other technologies will increase the demand for foundational and interpersonal skills. By 2040, 33.0 per cent of vacancies (121,000 jobs) in technical and manual industries will require at least one foundational skill and 31.0 per cent (113,000 jobs) will require at least one interpersonal skill. The largest skill imbalances among foundational skills will be for active listening, oral expression, and oral comprehension. Among interpersonal skills, the largest imbalances will be in negotiating, persuading, and social perceptiveness. Meanwhile, imbalances for resource management and technical skills will decline. (See Appendix B, Chart 3.)

Imbalances are growing for a variety of skills including problem-solving, financial resources, persuading, and coordinating. At the same time, skill imbalances are declining for technical skills, especially for quality control testing, monitoring of machinery and equipment operation and repair. (See Chart 10.) Our findings are consistent with previous evidence from OECD countries showing that automation leads to an increase in the skills in which humans have a comparative advantage, such as analytical and interpersonal skills.²⁵

25 Milanez, "The Impact of AI on the Workplace: Evidence from OECD Case Studies of AI."

Chart 10**Skill imbalances for all technical skills are declining**

(change in share of vacancies in the technical and manual cluster, percentage points, 2023–40)



Source: The Conference Board of Canada.

Recommendations

Finding balance

Skill imbalances pose significant costs to the Canadian economy.²⁶ There are different options available to policy-makers to address these imbalances. Education and training initiatives, employment strategies, and migration policies all play important roles in influencing the skills landscape.

Leverage skills data in education policies

Data on skill imbalances could be used to adapt curricula to develop skills that are expected to be in high demand, such as management of material resources, active listening, and social perceptiveness. In the United Kingdom, data from the Employer Skills Survey has been used to inform policies to stimulate the development of STEM skills.²⁷

Support early education in foundational skills

Foundational skills will continue to be important for all industries, with 52.0 per cent of vacancies requiring these skills in 2040, up by 4.0 percentage points from 2023. These skills are essential for full participation in the labour market, being both highly transferable and learnable.²⁸ Key foundational skills, such as active listening and oral expression and comprehension, are often taught early during compulsory education. Continuing to support quality education in Canada is vital to ensure the workforce is equipped with these essential skills.

Promote apprenticeships

To address skill imbalances for technical skills in the goods-producing cluster, one solution is to expand apprenticeships.²⁹ Apprenticeship programs help promote skilled trades and improve the perception of skilled trades as valuable career options among students and parents. Additionally, apprenticeship programs should incorporate analytical, foundational, interpersonal, and resource management skills to provide a comprehensive skills set for future workers.

Furthermore, we recommend a strategic plan that actively engages industry stakeholders, employers, and educators to emphasize the importance of apprenticeships and leverage the benefits of skilled trade participation across provinces. The Skilled Trades Ontario Strategic Plan 2023-2026 serves as a prime example of such a comprehensive strategy.³⁰

Fund secondary education

Vacancies are increasing the most for jobs in knowledge-based services industries, which require high-skilled workers with a wide variety of skills proficiencies. Ensuring students gain the skills needed in the workforce during their secondary education is critical to addressing these skill imbalances. This depends on both the demand-side preferences of students and the institutional supply-side constraints of the education system.³¹ Therefore, policy interventions should target both students and institutions. Such policies could promote certain programs or skills training by including funding for students and institutions.

26 Gabler and Gormley, "Lost Opportunities: Measuring the Unrealized Value of Skill Vacancies in Canada," found that, in 2020, the unrealized value of the skill imbalance in the Canadian economy hit \$25 billion.

27 OECD, *Getting skills right: Skills for jobs indicators*.

28 OECD, "OECD Skills Outlook 2013: First Results from the Survey of Adult Skills."

29 Statistics Canada, "Canada leads the G7 for the most educated workforce, thanks to immigrants, young adults and a strong college sector, but is experiencing significant losses in apprenticeship certificate holders in key trades."

30 Skilled Trades Ontario, "Strategic Plan 2023-2026."

31 Conzelmann and others, "Skills, Majors and Jobs: Does Higher Education Respond?"

Industry stakeholders are encouraged to participate in funding initiatives aimed at meeting the growing skill needs in their industries. It's also important to ensure that enough seats are available in post-secondary programs that feed into jobs in the knowledge-based services industries.

Foster lifelong learning

In the face of changing skill requirements, promoting lifelong learning is key to reducing skill imbalances by encouraging workers to adapt to ongoing technological and societal changes. Participation in learning activities is strongly correlated with skills proficiency.³²

Certain groups, including women, immigrants, and older workers, are disproportionately under-skilled for their jobs.³³ To address these disparities, we recommend designing and implementing policies that promote lifelong learning for the Canadian workforce, especially with programs that appeal to older workers.³⁴ Additionally, providing subsidies to encourage employers to train and upskill their workers could be crucial in preparing the workforce for future demands.

Recruit and retain immigrants

Immigration is the main source of population growth in Canada, and integrating immigrants into the labour market is crucial to addressing skill imbalances in the country. However, immigrants tend to struggle to find work that is commensurate with their qualifications and, as a result, many choose to leave the country.³⁵

To retain valuable immigrant talent and tackle the skills mismatches among immigrants, all three levels of government can support programs aimed at the recruitment and retention of immigrants. This includes implementing measures to support upskilling programs for immigrants, particularly in language training,³⁶ removing barriers related to the recognition of foreign credentials and international experience, and ensuring equitable access to employment opportunities.



32 OECD, "OECD Skills Outlook 2013: First Results from the Survey of Adult Skills."

33 Mahboubi, "Bad Fits: The Causes, Extent and Costs of Job Skills Mismatch in Canada."

34 Workers aged 55 to 64 were 10.0 per cent less likely to participate in training compared to other age groups (Statistics Canada, "Analysis on labour challenges in Canada, second quarter of 2023").

35 Dennler, *The Leaky Bucket: A Study of Immigrant Retention Trends in Canada*, Bérard-Chagnon, Hallman, Dionne, Tang, and St-Jean. "Emigration of Immigrants: Results from the Longitudinal Immigration Database.

36 Immigrants are more likely to be under-skilled in literacy (Mahboubi, "Bad Fits: The Causes, Extent and Costs of Job Skills Mismatch in Canada").

Appendix A

Methodology

Defining skill imbalances

Skill imbalances occur when the skills needed in the workforce do not match those of the available workers. Skill imbalances encompass both skill shortages and skill mismatches.¹ The term “skill imbalances” can be understood in many ways, often leading to confusion and disagreement. Therefore, it is crucial to explain the conceptual distinction of commonly used terms, including skills mismatch, skills shortage, skills imbalance, and skills gap. These terminologies describe different but related aspects of skills misalignments in the labour market.²

The term “skills shortage” is used in situations where employers in certain fields or occupations struggle to find enough workers with the required skills for the available positions. This can occur due to an insufficient number of workers pursuing the degrees or training needed for in-demand occupations, or the emergence of new occupations requiring previously non-existent skills, such as cybersecurity or AI programming. Skills shortages are specific to a region and occupation, similar to labour shortages.

A “skills mismatch” occurs when a worker’s current skills do not align with those required for their current job; either they are overqualified or underqualified. This mismatch occurs when the worker has skills in areas that are no longer in demand or has invested in education or training in areas with limited job opportunities.³ An individual may be well-matched at some point but may become mismatched if the job’s requirements or the worker’s skills change.

Measuring skill imbalances

Skill imbalances are measured as the share of vacancies requiring a particular skill at proficiency level 3 (out of 5) or above within an industry cluster.⁴ This allows us to observe the changes in the composition or the intensity of in-demand skills over time.

When examining skill imbalances by job-vacancy levels, all skill imbalances increase as vacancies rise over time. Instead, by looking at the shares of vacancies, we gain greater insight into how the relative demand or intensity for specific skills changes over time. For example, we observe relatively less demand for technical skills and more demand for foundational skills. In this case, we say the skills imbalance is decreasing for technical skills and is growing for foundational skills.

Forecasting skill imbalances

We forecast the skill imbalances by forecasting job vacancies, our measure of unmet labour demand, for over 500 occupations (5-digit NOCs) in over 300 industries (4-digit NAICS), using The Conference Board of Canada’s Model of Occupation, Skills, and Technology (MOST).⁵ We then map our forecast of vacancies with the skills profiles for each occupation, provided by the Occupational and Skills Information System (OaSIS) framework.⁶

We use MOST to forecast vacancies by occupation and industry, based on two key components: job openings and job seekers. (See Exhibit 1.)

1 OECD, “Getting Skills Right: United Kingdom.”

2 The conceptual framework in this paper is based on a review of the work presented in the following: OECD, “Getting skills right: Skills for jobs indicators”; Fissuh, and others, Determinants of skill gaps in the workplace and recruitment difficulties in Canada”; LMIC, “What’s in a Name? Labour Shortages, Skills Shortages, and Skills Mismatches”; ILO, “Skills and jobs mismatches in low- and middle-income countries”; Donovan, Stoll, and Bradley, 2022. “Skills Gaps: A Review of Underlying Concepts and evidence”; and Cappelli, “Skill Gaps, Skill Shortages, and Skill Mismatches: Evidence and Arguments for the United States.”

3 ILO, “Skills and Jobs Mismatches in Low- and Middle-Income Countries.”

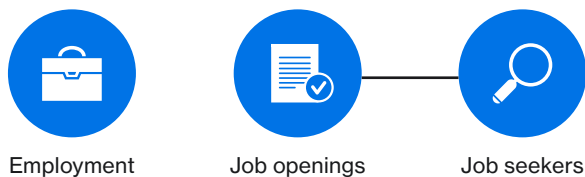
4 We follow the industry clusters in the Conference Board of Canada, “Skills and Productivity: Which Skills Shortages Are Impacting Canadian Productivity?”

5 Bonen and Loree, “How to Forecast Skills in Demand” provides a review of the main approaches in forecasting the demand for skills.

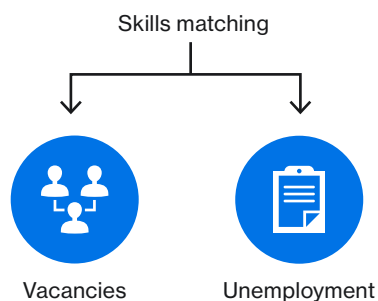
6 Use of the OaSIS skills taxonomy section in this appendix summarizes the OaSIS skills taxonomy developed by Employment and Social Development Canada, while ESDC’s webpage <https://noc.esdc.gc.ca/Oasis/OasisWelcome> provides a detailed description of the OaSIS framework.

Exhibit 1 MOST key components

Exogenous



Endogenous



Source: The Conference Board of Canada.

Job openings are derived from both expansion demand and replacement demand, including mortality, retirement, interprovincial migration, emigration, and turnover. The distribution of job openings by occupation is also adjusted for automation. Job openings is a flow variable.

Job seekers are primarily driven by school leavers, immigrants, interprovincial migration, temporary foreign workers, and net turnovers. To measure the stock of unemployment and vacancies, MOST estimates labour market transitions by matching job openings and job seekers, using skills similarities and preference metrics. Job seekers is a flow variable.

The uniqueness of this model lies in its ability to capture the impact of both cyclical and structural factors affecting the Canadian labour market.

The MOST is also advantageous because of its granularity. We can forecast employment and vacancies at multiple dimensions, including for over 700 occupations (5-digit NOCs) and 300 industries (4-digit NAICS) for each province and territory.

Modelling automation

We use work from McKinsey and Company⁷ and Frey and Osborne⁸ to identify the share of automatable tasks by occupation and the likelihood of automation over the next 10 to 20 years. Occupations with a higher probability of automation are anticipated to grow more slowly compared with historical prevalence. Our baseline projections assume a modest impact of 50.0 per cent due to the uncertainty of automation's true impact. We assume implementation will be gradual, with the full effect expected by 2045. New occupations will be spun off by automation, naturally flowing from occupations with above-average prospects, which we call digital enablers.

The choice of this model is further justified by its granularity, forecasting labour demand at multiple dimensions, including by occupation (5-digit NOCs), industry (4-digit NAICS), and Canadian province or territory.

Use of the OaSIS skills taxonomy

The Occupational and Skills Information System (OaSIS) offers an extensive framework outlining the typical skills, competencies, personal qualities, knowledge, and interests typically needed for employment across more than 900 distinct occupations in Canada.

The framework measures skills, using two dimensions: applicability and proficiency level. Applicability is a binary measure indicating the necessity of a given skill for an occupation (1 if the skill applies, 0 if not). The proficiency level is graded on a scale from 1 to 5. In our analysis, we assume that proficiency levels of 3 and above are essential for performing daily tasks within occupations.

⁷ Chui, Manyika, and Miremadi, "Four fundamentals of workplace automation."

⁸ Frey and Osborne, "The future of employment: How susceptible are jobs to computerization?"

Using the OaSIS framework taxonomy, we classified skills into six categories presented in Table 1:

Table 1
Skills taxonomy

Analytical skills	Foundational skills
Critical thinking	Numeracy
Decision-making	Active listening
Evaluation of products and processes	Oral comprehension
Learning and teaching strategies	Oral expression
Problem-solving	Reading comprehension
Systems analysis	Writing
Interpersonal skills	Resource management skills
Coordinating	Management of financial resources
Instructing	Management of material resources
Negotiating	Management of personnel resources
Persuading	Performance monitoring and evaluation
Social perceptiveness	Time management
Technical skills	Digital skills*
Equipment and tool selection	Digital literacy
Operation and control	Digital production
Monitoring of machinery and equipment	Product design
Preventative maintenance	
Quality control testing	
Repairing equipment	
Setting up equipment	
Troubleshooting	

*On top of OaSIS skills categories, we added a **digital skills** group. These skills were removed from the other skills categories.
Source: The Conference Board of Canada.

The OaSIS database provides skill requirements by occupation, with 7-digit NOCs. To bridge the gap in data granularity, we aggregate the OaSIS 7-digit NOCs into 5-digit NOCs by taking the average skill score across the group.

Research limitations

The skills needed in the workforce depend on two trends:

- the evolution of the skill requirements for each occupation (i.e., increased demand for programming skills among economists), and
- the evolution of the occupational composition of the labour force (i.e., fewer cashiers and more engineers building automated cash registers).

Both trends are influenced by the changing demand for skills. For example, if there is more demand for programming skills when conducting economic research, firms could hire economists with programming skills and/or hire data scientists instead of economists.

Forecasting skill imbalances requires forecasting future skill requirements for each occupation and also forecasting which types of occupations will be in demand in the future. Unfortunately, forecasting future skill requirements for each occupation was unfeasible for this project. Theoretically, predicting future skills requirements would require experts for all 900+ occupations and across 33 skills. However, using the Model of Occupations, Skills, and Technology (MOST), we can forecast the labour demand, including the vacancies, by occupation. In our forecast, we assume that the skills required for each occupation remain fixed over time. Therefore, the changes in the skill imbalances observed in our forecast are only based on shifts in the occupational compositions of the vacancies over time.

In our analysis, we assume that skill imbalances drive vacancies or unmet labour demand. That is, skill imbalances as well as mismatches and shortages prevent employers from hiring the employees they need. However, unmet labour demand could also be caused by other factors, including wage levels, working conditions, and lack of access to affordable childcare or eldercare. Data on job vacancies do not provide sufficient detail to distinguish whether a job vacancy remains unfilled because of a skills mismatch or for other reasons. Therefore, we measure skill imbalances by attributing all job vacancies to skill imbalances, recognizing the complexity of isolating the causes of hiring challenges.

Defining industry clusters

To understand how skill requirements vary across industries, we used the K-means method to cluster industries based on the similarity of their skill requirements, resulting in three clusters,⁹ a goods-producing cluster, a knowledge-based services cluster, and a technical and manual services cluster.¹⁰

⁹ The k-means method is a popular unsupervised machine learning technique used for clustering data into groups based on similarities.

¹⁰ Conference Board of Canada, "Skills and Productivity: Which Skills Shortages Are Impacting Canadian Productivity?"

(See Chart 1). This segmentation allows for a more nuanced view of the skill imbalances across the economy, helping to identify the most beneficial policy interventions.

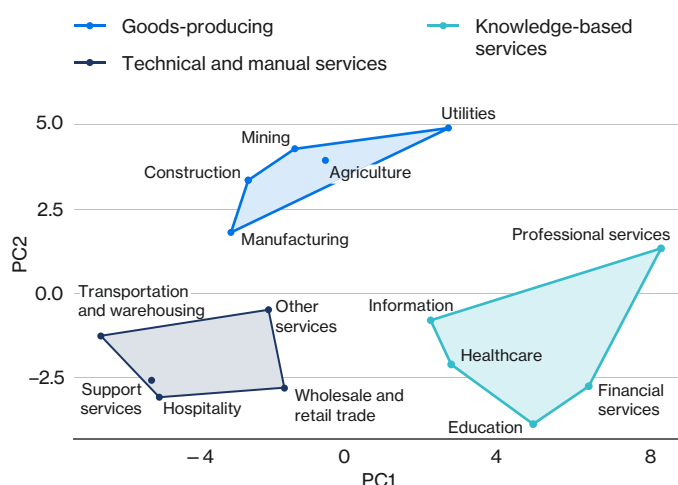
There are important variations in skill requirements across industries. Additionally, the impact of structural factors—including automation, zero net emissions, etc.—on skill requirements also vary significantly across industries.¹¹ Understanding the skills required by different industry clusters and identifying the skill imbalances can inform policies aimed at catalyzing industry transformation, promoting technology adoption, refining educational curricula, or other initiatives.

Table 2 presents the industry composition with the corresponding NAICS code for each cluster.¹²

Chart 1

There are three distinct groups of industries in terms of common skills demand

(k-means clusters, 1st and 2nd principal components)



Source: The Conference Board of Canada, "Skills and Productivity: Which Skills Shortages Are Impacting Canadian Productivity?"

Table 2
Industry clusters

Cluster name	Industry	NAICS Code
Goods-producing	Agriculture	11
	Forestry, fishing, mining, quarrying, oil and gas	21
	Utilities	22
	Construction	23
	Manufacturing	31–33
Knowledge-based services	Finance, insurance, real estate, rental and leasing	52–53
	Professional, scientific and technical services, and management of companies	54–55
	Educational services	61
	Health care and social assistance	62
	Information, culture and recreation	51, 71
Technical and manual services	Wholesale and retail trade	41, 44–45
	Transportation and warehousing	48–49
	Administrative and support, waste management and remediation services	56
	Accommodation and food services	72
	Other services (except public administration)	81

Note: Public administration (NAICS 91) is excluded from the cluster analysis as it is not classified under any of the three identified clusters.

Source: The Conference Board of Canada, "Skills and Productivity: Which Skills Shortages Are Impacting Canadian Productivity?"

11 See, for example, Conference Board of Canada, "Securing the Future: Cybersecurity Skill Trends"; Gabler and Gormley, "Lost Opportunities: Measuring the Unrealized Value of Skill Vacancies in Canada"; Gabler, "Beyond Blue and White Collar: A Skills-Based Approach to Canadian Job Groupings"; Gabler, Rao, and Hindle, "A Path Forward: Job Transitions in Canada"; Sopchokchai and Hermus, "The Labour Market of Tomorrow: Projections From the Model of Occupations, Skills, and Technology (MOST)."

12 Conference Board of Canada, "Skills and Productivity: Which Skills Shortages Are Impacting Canadian Productivity?" It is performed by fitting a K-means algorithm into the weighted average skills requirement by industry and occupation.

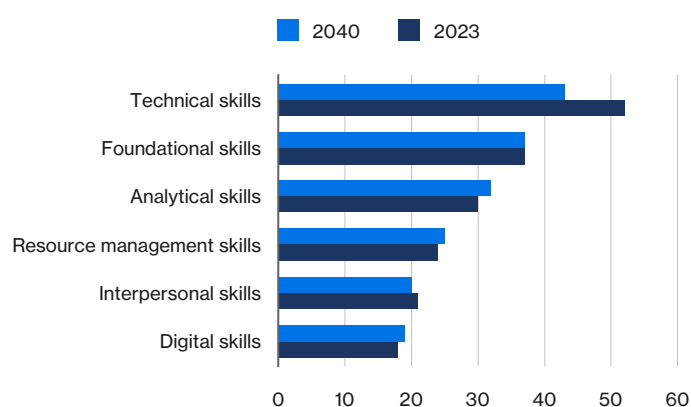
Appendix B

Additional charts

Chart 1

The skills imbalance for technical skills is dominant but declining

(share of job vacancies with at least one skill within each skills group, goods-producing cluster, per cent)

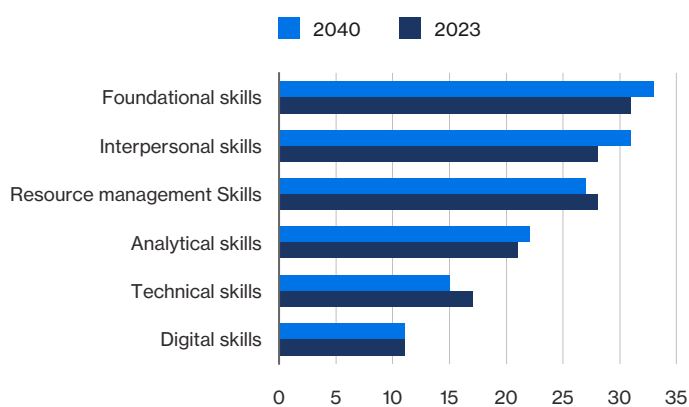


Source: The Conference Board of Canada.

Chart 3

The skills imbalance for foundational and interpersonal skills is growing

(share of job vacancies with at least one skill within each skills group, technical and manual cluster, per cent)

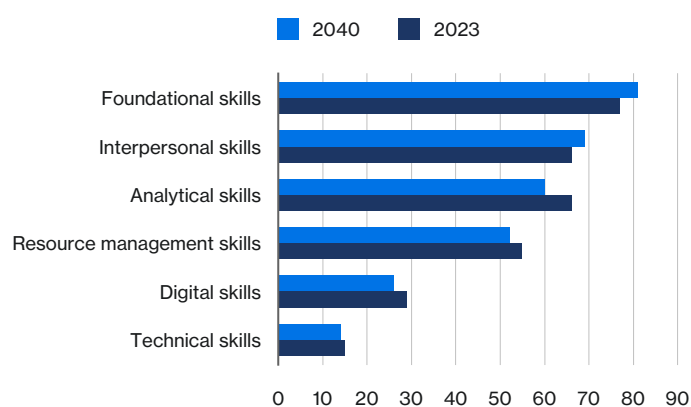


Source: The Conference Board of Canada.

Chart 2

The skill imbalances for foundational and interpersonal skills are growing

(share of vacancies with at least one skill within each skill group, knowledge-based cluster, per cent)



Source: The Conference Board of Canada.

Appendix C

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