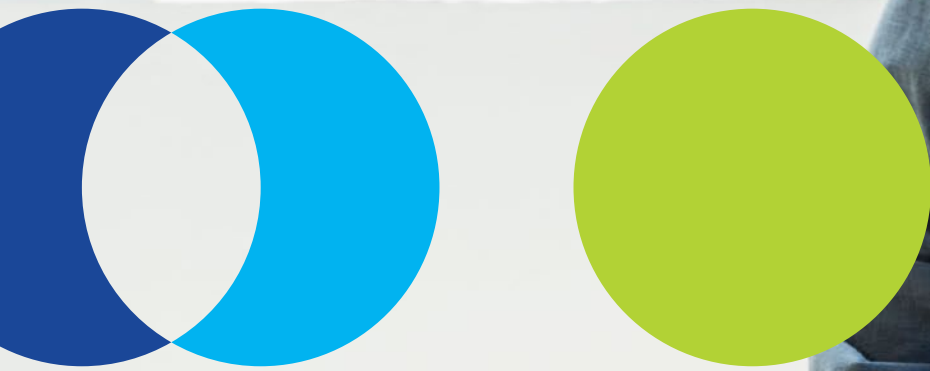**The Conference Board of Canada**

Beyond Blue and White Collar

A Skills-Based Approach to Canadian Job Groupings

Issue Briefing | August 3, 2022

Future Skills Centre

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.

If you would like to learn more about this report and other skills research from FSC, visit us at fsc-ccf.ca or contact info@fsc-ccf.ca.
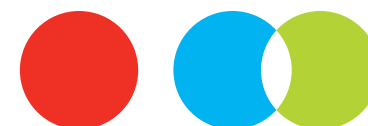
fsc-ccf.ca

Contents

Key Findings

- Canada needs a modern, skills-based approach to talk about employment opportunities. An aspect of this is how we group jobs together. We identified eight new employment clusters in Canada based on underlying skill similarities.

- STEM professionals have skills like programming, technology design, science, mathematics, and opertions analysis that are in high demand. The labour market outlook for this cluster is strong.

- Knowledge workers are the most highly educated group. They need strong basic and social and emotional skills. The outlook for this group is good.

- The personal services cluster emphasizes negotiation, speaking, persuasion, writing, and management of financial resources at levels that are modestly above average.

- Supervisers have a well-rounded but moderate skill set that emphasizes basic, social and emotional, and managerial skills.

- Most technical trades require some credentialing after high school, such as apprenticeships or college programs. Overall skill requirements are generally low, but there is often a need for highly specialized, occupation-specific skills.

- A high school diploma is usually all that's needed for non-technical trades jobs. Skill requirements tend to be low, but skills like operation and control, equipment maintenance, repairing, equipment selection, and troubleshooting are needed.

- Builders have the highest risk of being replaced by automation. Their top skills include repairing, installation, equipment maintenance, troubleshooting, and equipment selection. The labour market outlook for this group is weak.

- Doers have the strongest labour market prospects among the clusters with lower levels of educational attainment.

Introduction

In Canada's modern, knowledge-based, and service-centric economy, employers are increasingly thinking about work from a skills perspective. Old-fashioned labels like "blue collar" and "white collar" are no longer relevant.

As well, factors such as educational attainment or work experience are only proxies for assessing the skills of workers. This means that we need a more sophisticated way to talk about employment opportunities.

To address this need, we considered how jobs can be grouped based on underlying skill similarities.[1] The result was eight new groupings for Canadian jobs:

- **STEM professionals**
- **Knowledge workers**
- **Personal services**
- **Supervisors**
- **Technical trades**
- **Non-technical trades**
- **Builders**
- **Doers**

We then matched these clusters with labour market information, including average income, employment growth forecasts, and unemployment rates. The results can then be used as profiles that different groups—such as students, career development professionals, educators, and policy-makers—can use to inform their decision-making and program design.

The rest of this briefing describes each of the clusters using a variety of labour market indicators. The methodology we used for clustering is detailed in Appendix A. In Appendix B, we also provide a full list of which occupations fall into which cluster.

---
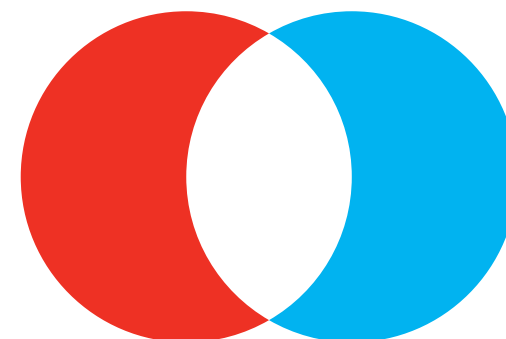
1   As specified by the 35 skills and occupation-specific skill scores posited in the U.S. Department of Labor's O*NET system.

STEM Professionals

- STEM professionals have the strongest growth prospects, no automation risk,[2] and tight labour market conditions, giving them the strongest outlook.

- Examples of occupations in this cluster include chemists, computer network technicians, and numerous engineering roles, such as mining, mechanical, and metallurgical and materials engineers.

- STEM professionals tend to earn the highest salaries, with a median annual income of just over $78,000.

- The top skills for this cluster are programming, technology design, science, mathematics, and operations analysis. Many skills need to be present at a high level (65 per cent of these workers have at least a bachelor's degree). Skills like programming and technology design need to be exceptionally strong and specialized, while other technical skills, like operations monitoring and equipment maintenance, are much less important.

- While most STEM professions need some higher education, there are a few jobs that don't require a university degree. These include web designers and developers, electrical and electronics engineering technologists and technicians, computer network technicians, and construction estimators.
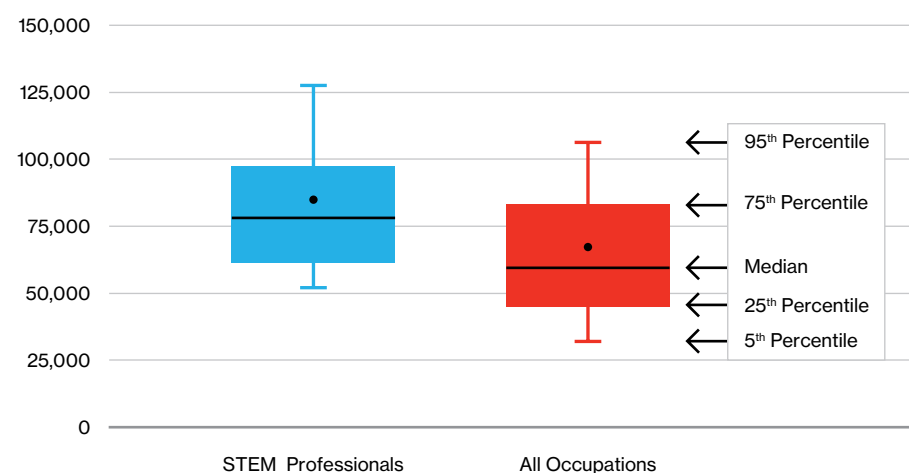
Table 1
Outlook: Good

Size of cluster	1.28 million workers
Share of total employment	7.10%
Share of employment that is high-risk, low-mobility	0%
Ten-year employment growth forecast	12.30%
Ten-year unemployment rate forecast	4.30%

Sources: The Conference Board of Canada; Statistics Canada.

Chart 1
Annual Income: Wide Range and Highest Level
(C$)

Sources: The Conference Board of Canada; Statistics.
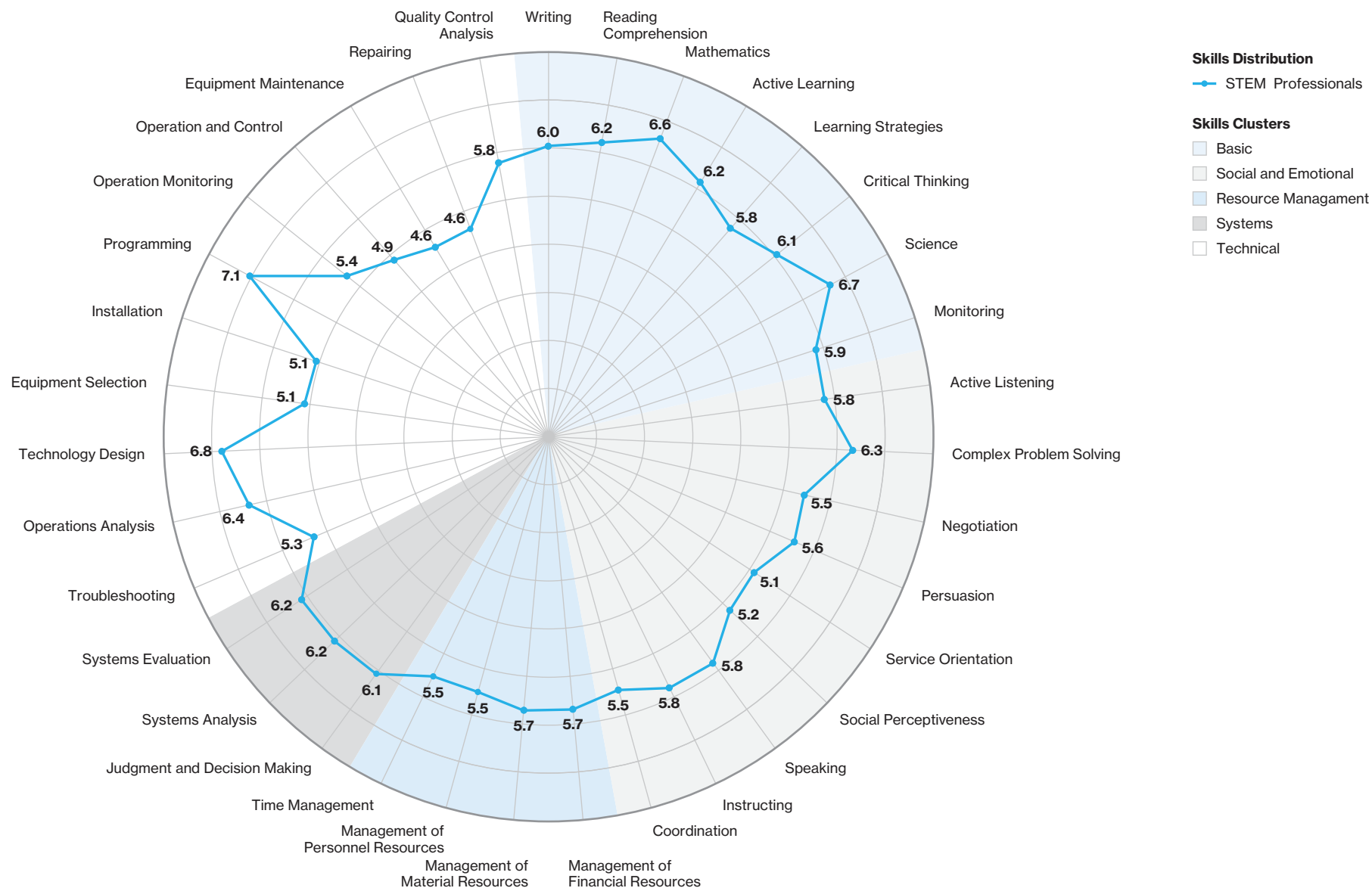
2   The risk of automation for each cluster and its constituent occupations was identified using The Conference Board of Canada's earlier work on high-risk, low-mobility (HRLM) occupations. These are the subset of Canadian jobs most likely to be automated, while also facing limited opportunities for transitioning to more promising jobs without significant retraining.

Chart 2

Skills Distribution: High-Level of Skills, Especially for Science, Technology, Math, and Programming

Skills Distribution

— STEM Professionals

Skills Clusters

- Basic
- Social and Emotional
- Resource Managament
- Systems
- Technical

Sources: The Conference Board of Canada; Statistics Canada; O*NET.

Knowledge Workers

- Knowledge workers have the highest educational requirements, tight labour market conditions, and minimal automation risk. They are also the largest cluster.

- Example of occupations in this cluster include financial and investment analysts, economists and economic policy researchers and analysts, pharmacists, secondary school teachers, and other liberal arts professions (e.g., business management, advertising, marketing, and public relations).

- The top skills for this cluster are judgment and decision-making, social perceptiveness, monitoring, complex problem solving, and active listening.

- Knowledge workers are the second-highest-paid cluster, with a median annual income of just over $66,500 (a quarter of these workers have graduate degrees).

- The skill set required in this cluster is broad but uneven. Most skills need to be present at a high level, especially for basic daily skills (e.g., writing) and social and emotional skills, such as social perceptiveness.

- This cluster needs little in the way of task- and- technically oriented skills. These include skills more common in STEM professions (e.g., programming) and among builders and doers (e.g., equipment maintenance).

- Most knowledge workers need a university-level education, but there are some exceptions. A few examples include telecommunication carriers managers, retail and wholesale trade managers, administrative officers, property administrators, and purchasing agents and officers.

Table 2
Outlook: Good

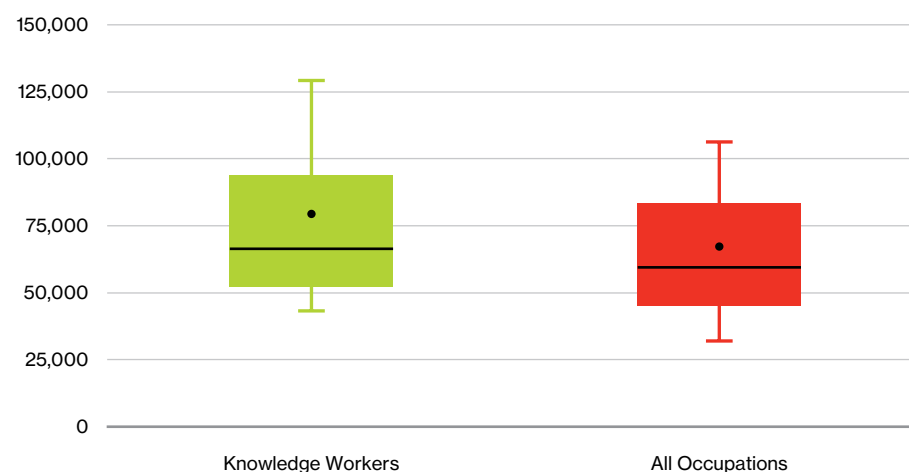|	
Size of cluster	4.85 million
Share of total employment	26.90%
Share of employment that is high-risk, low-mobility	4.40%
Ten-year employment growth forecast	9.90%
Ten-year unemployment rate forecast	3.40%

Sources: The Conference Board of Canada; Statistics Canada.

Chart 3
Annual Income: Widest Range and Second-Highest Level
(C$)

Sources: The Conference Board of Canada; Statistics Canada.

Chart 4

Skills Distribution: Uneven Skill Set With Strong Basic and Social and Emotional Skills

Skills Distribution
— Knowledge Workers

Skills Clusters
- Basic
- Social and Emotional
- Resource Managament
- Systems
- Technical

Sources: The Conference Board of Canada; Statistics Canada; O*NET.

Personal Services

- Personal services is a large cluster with a healthy growth outlook, but some automation risk and looser labour market conditions.

- Example of occupations in this cluster include accounting and related clerks, data entry clerks, dispatchers, legal administrative assistants, and retail salespersons.

- The top skills for this cluster are negotiation, speaking, persuasion, writing, and management of financial resources.

- Personal services are generally lower-paying jobs, with a median annual income of just under $39,500 (two-thirds of these workers have high school or some post-secondary training).

- The requirements emphasize basic daily (e.g., reading comprehension), social and emotional (e.g., instructing), and managerial (e.g. management of financial resources) skill sets, but most of these are needed at levels that are only modestly above average.

- The requirements for most task and technically oriented skills are generally low. Exceptions include technology design, operations analysis, and programming.

Table 3
Outlook: Moderate

Size of cluster	3.69 million
Share of total employment	20.40%
Share of employment that is high-risk, low-mobility	26.50%
Ten-year employment growth forecast	11.00%
Ten-year unemployment rate forecast	6.00%

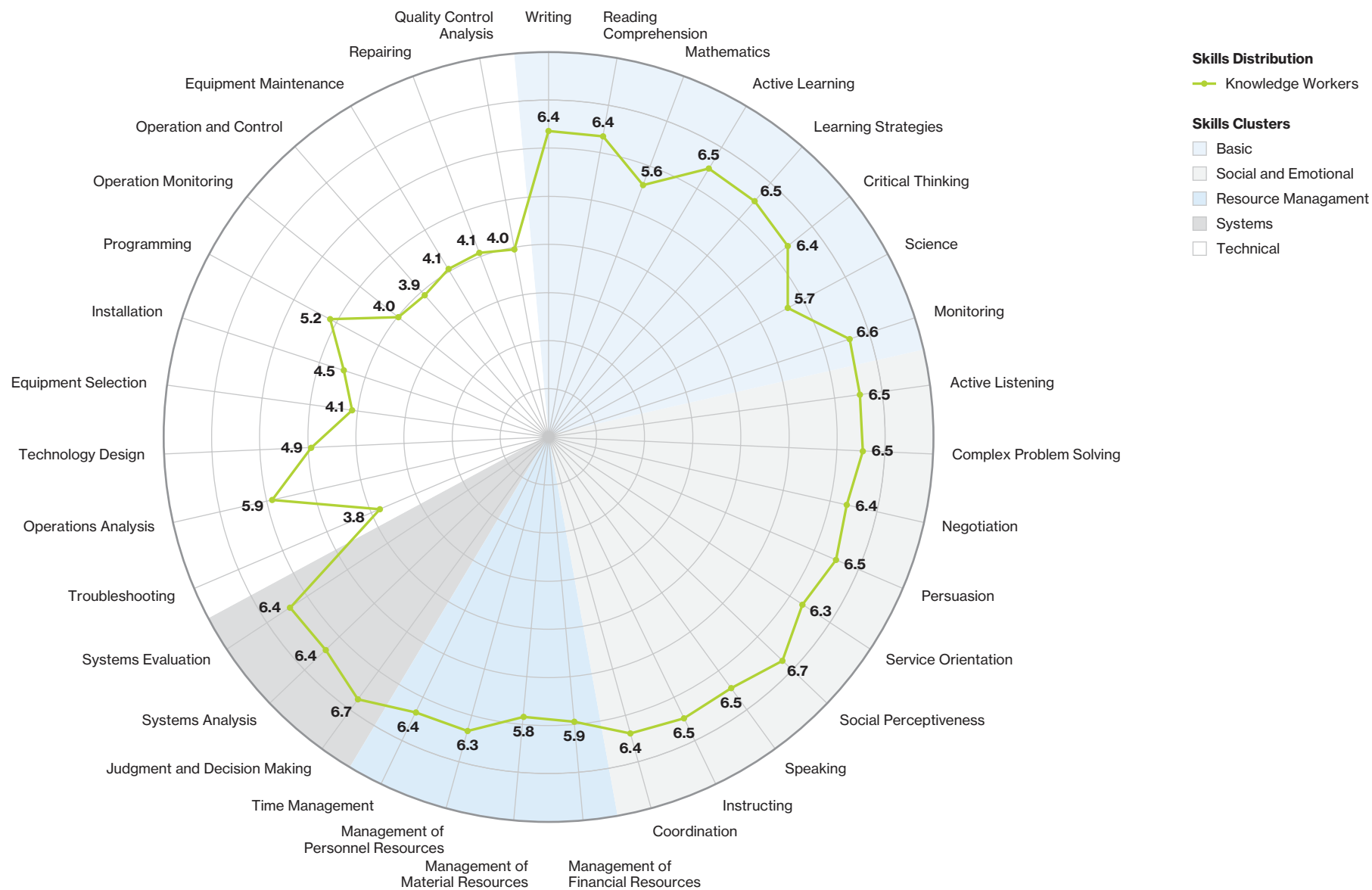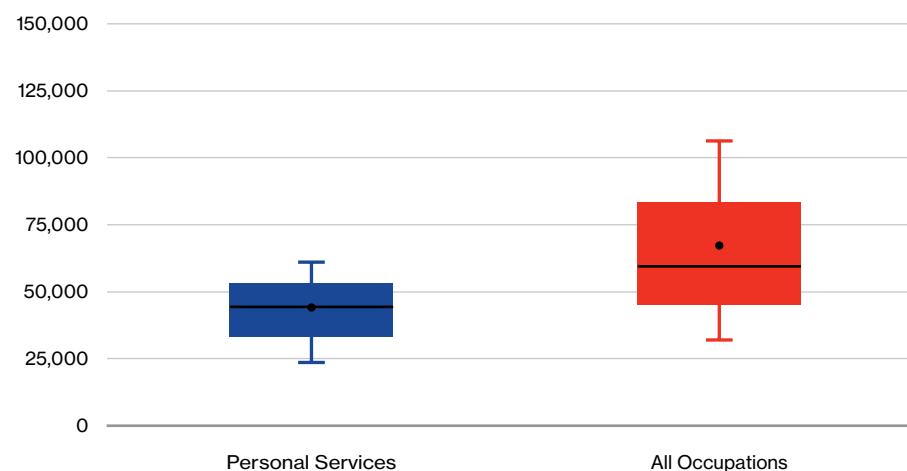Sources: The Conference Board of Canada; Statistics Canada.

Chart 5
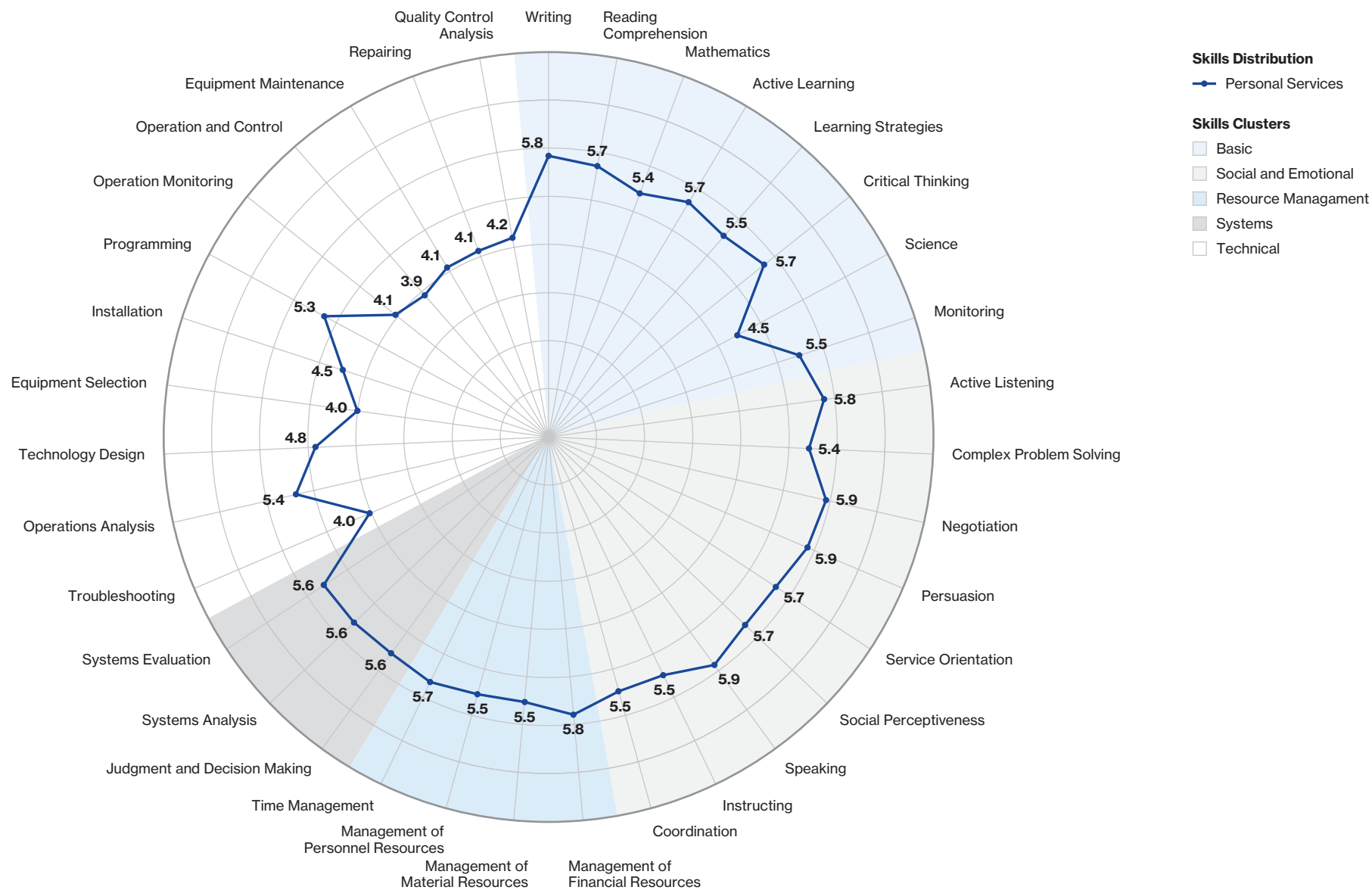**Annual Income: Narrow Range and Lower Level**
(C$)

Sources: The Conference Board of Canada; Statistics Canada.

Chart 6
Skills Distribution: Mid-range for Most Basic, Social and Emotional, and Managerial Skills

Skills Distribution
—●— Personal Services

Skills Clusters
- Basic
- Social and Emotional
- Resource Managament
- Systems
- Technical

Quality Control Analysis — Writing — Reading Comprehension — Mathematics — Active Learning — Learning Strategies — Critical Thinking — Science — Monitoring — Active Listening — Complex Problem Solving — Negotiation — Persuasion — Service Orientation — Social Perceptiveness — Speaking — Instructing — Coordination — Management of Financial Resources — Management of Material Resources — Management of Personnel Resources — Time Management — Judgment and Decision Making — Systems Analysis — Systems Evaluation — Troubleshooting — Operations Analysis — Technology Design — Equipment Selection — Installation — Programming — Operation Monitoring — Operation and Control — Equipment Maintenance — Repairing

5.8 5.7 5.4 5.7 5.5 5.7 4.5 5.5 5.8 5.4 5.9 5.9 5.7 5.7 5.9 5.5 5.5 5.8 5.5 5.5 5.7 5.6 5.6 5.6 4.0 5.4 4.8 4.0 4.5 5.3 4.1 3.9 4.1 4.1 4.2

Sources: The Conference Board of Canada; Statistics Canada; O*NET.

Supervisors

- Supervisors do not have particularly high educational requirements, and they benefit from limited automation risk, healthy job creation, and moderate labour market tightness.

- Example of occupations in this cluster include coaches, construction inspectors, surveyors, medical sonographers, and numerous supervisory roles, such as supervisors of petroleum, gas, and chemical processing and utilities.

- The top skills for this cluster are service orientation, social perceptiveness, learning strategies, instructing, and speaking.

- Supervisors generally command higher salaries, with a median income of just over $63,500 (about two-thirds don't have a university degree).

- These roles require a moderate level of well-rounded skills that includes basic daily skills (e.g. writing), social and emotional (e.g., service orientation), and managerial skills (e.g., time management).

- Supervisors have minimal needs for many task and technical skills (e.g., repairing).
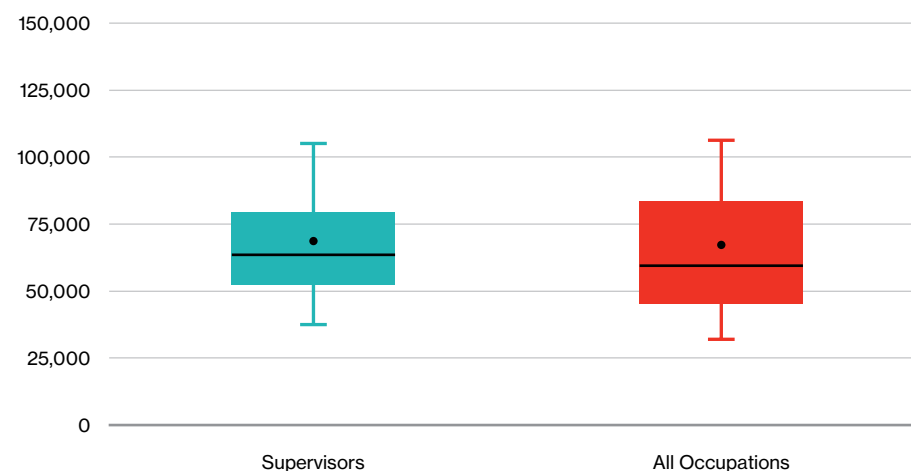
Table 4
Outlook: Moderate

Size of cluster	1.58 million
Share of total employment	8.60%
Share of employment that is high-risk, low-mobility	5.10%
Ten-year employment growth forecast	9.40%
Ten-year unemployment rate forecast	5.00%

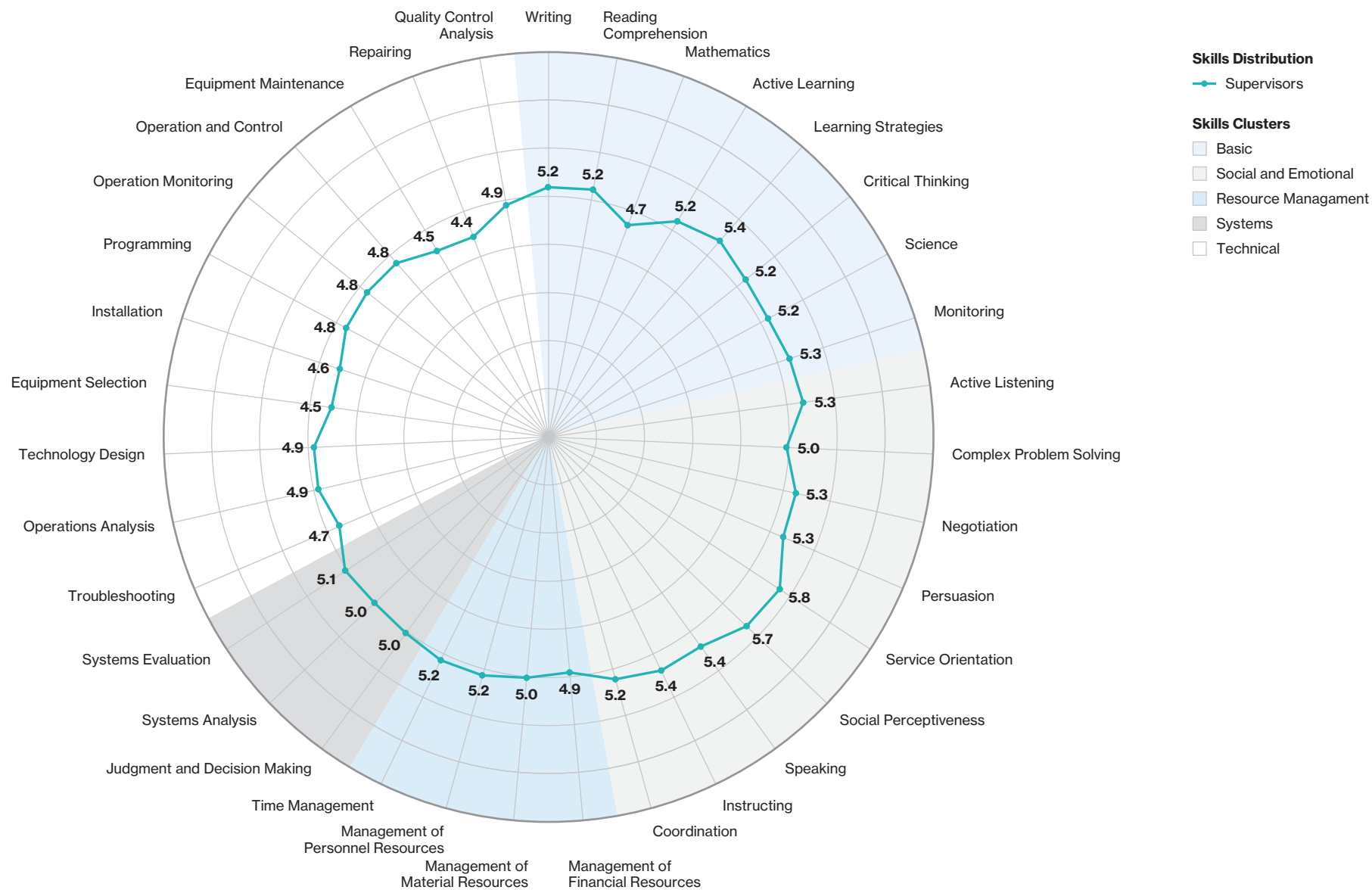Sources: The Conference Board of Canada; Statistics Canada.

Chart 7
Annual Income: Medium Range and Higher Level
(C$)

Sources: The Conference Board of Canada; Statistics Canada.

Chart 8
Skills Distribution: Mid-Range Overall

Skills Distribution
— Supervisors

Skills Clusters
- Basic
- Social and Emotional
- Resource Managament
- Systems
- Technical

Sources: The Conference Board of Canada; Statistics Canada; O*NET.

Technical Trades

- The technical trades cluster has low educational requirements, a weak outlook for job creation, and significant automation risk.

- Example of occupations in this cluster include boilermakers, carpenters, industrial electricians, tool and die makers, and water and waste treatment plant operators.

- The top skills required for this cluster are service orientation, active listening, speaking, writing, and reading comprehension.

- Most skills are required at a very low level. Even a top skill like service orientation is needed at only an average level.

- Technical trades are one of the higher-paying clusters, with a median income of just under $59,500 (most workers have college or apprenticeship training).

- Somewhat surprisingly, the top skills for technical trades are all basic and social and emotional skills. Conversely, there is little need for several technically oriented skills, such as quality control analysis, equipment maintenance, or operations monitoring.
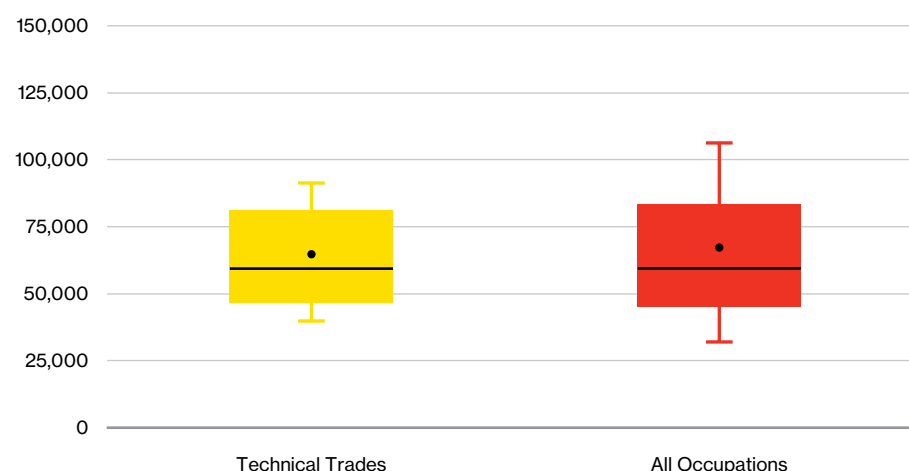
Table 5
Outlook: Moderate

Size of cluster	1.15 million
Share of total employment	6.40%
Share of employment that is high-risk, low-mobility	13.70%
Ten-year employment growth forecast	6.60%
Ten-year unemployment rate forecast	6.50%

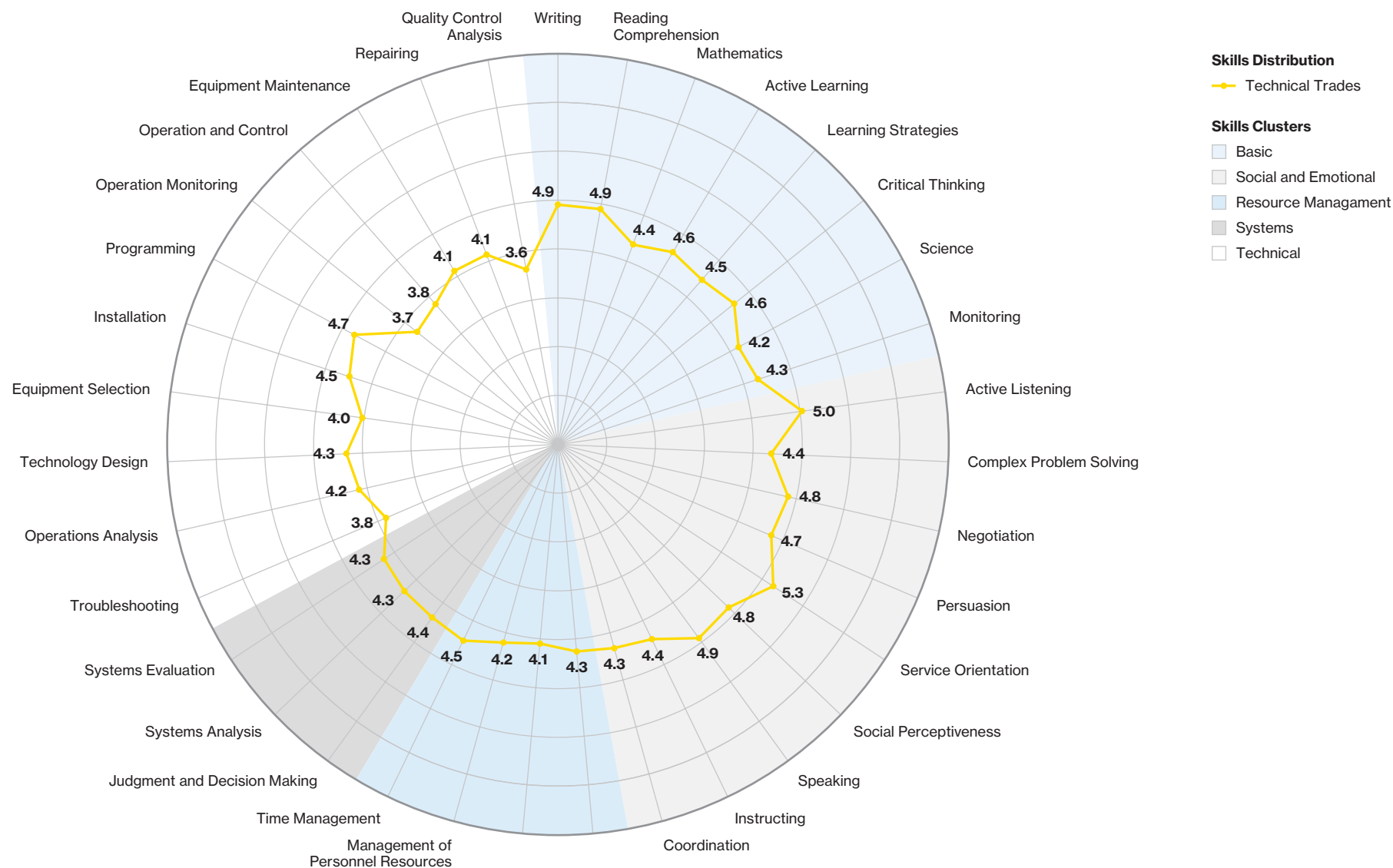Sources: The Conference Board of Canada; Statistics Canada.

Chart 9
Annual Income: Medium Range and Higher Level
(C$)

Sources: The Conference Board of Canada; Statistics Canada.

Chart 10
Skills Distribution: Well-Rounded Overall but Mostly Lower Level

Skills Distribution
— Technical Trades

Skills Clusters
- Basic
- Social and Emotional
- Resource Managament
- Systems
- Technical

Sources: The Conference Board of Canada; Statistics Canada; O*NET.

Non-technical Trades

- Non-technical trades are the smallest cluster. Like technical trades, they also face elevated automation risk and a below-average pace of job creation.

- Example of occupations in this cluster include bakers and bartenders, hair stylists and barbers, photographers, printing press operators, and sports officials and referees.

- The top skills for this cluster are operation and control, equipment maintenance, repairing, equipment selection, troubleshooting.

- Jobs in non-technical trades tend to be lower paying, with a median income of just under $37,500 (eighty two per cent of these workers don't have university degrees).

- Most skills are needed at very low levels. There is some specialization, with requirements for the top-five skills being relatively higher. But even for these top-five skills, the overall level of competence is average.
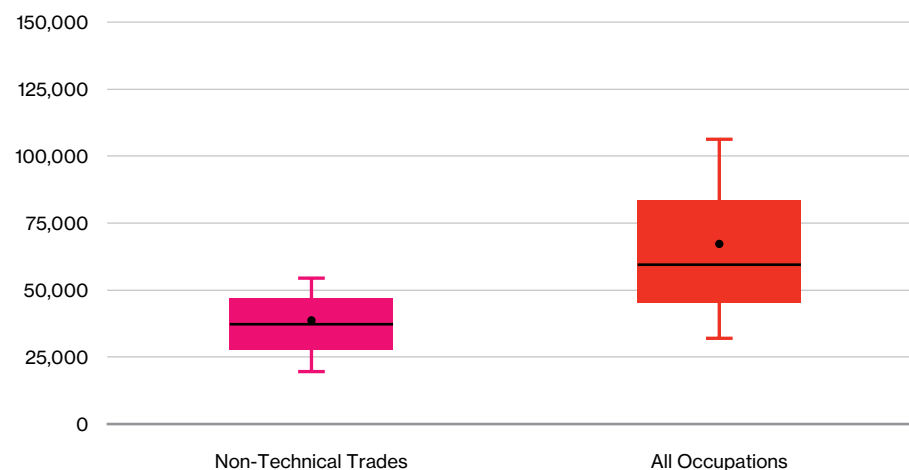
Outlook: Moderate

Size of cluster	1.09 million
Share of total employment	6.00%
Share of employment that is high-risk, low-mobility	29.10%
Ten-year employment growth forecast	7.40%
Ten-year unemployment rate forecast	5.90%

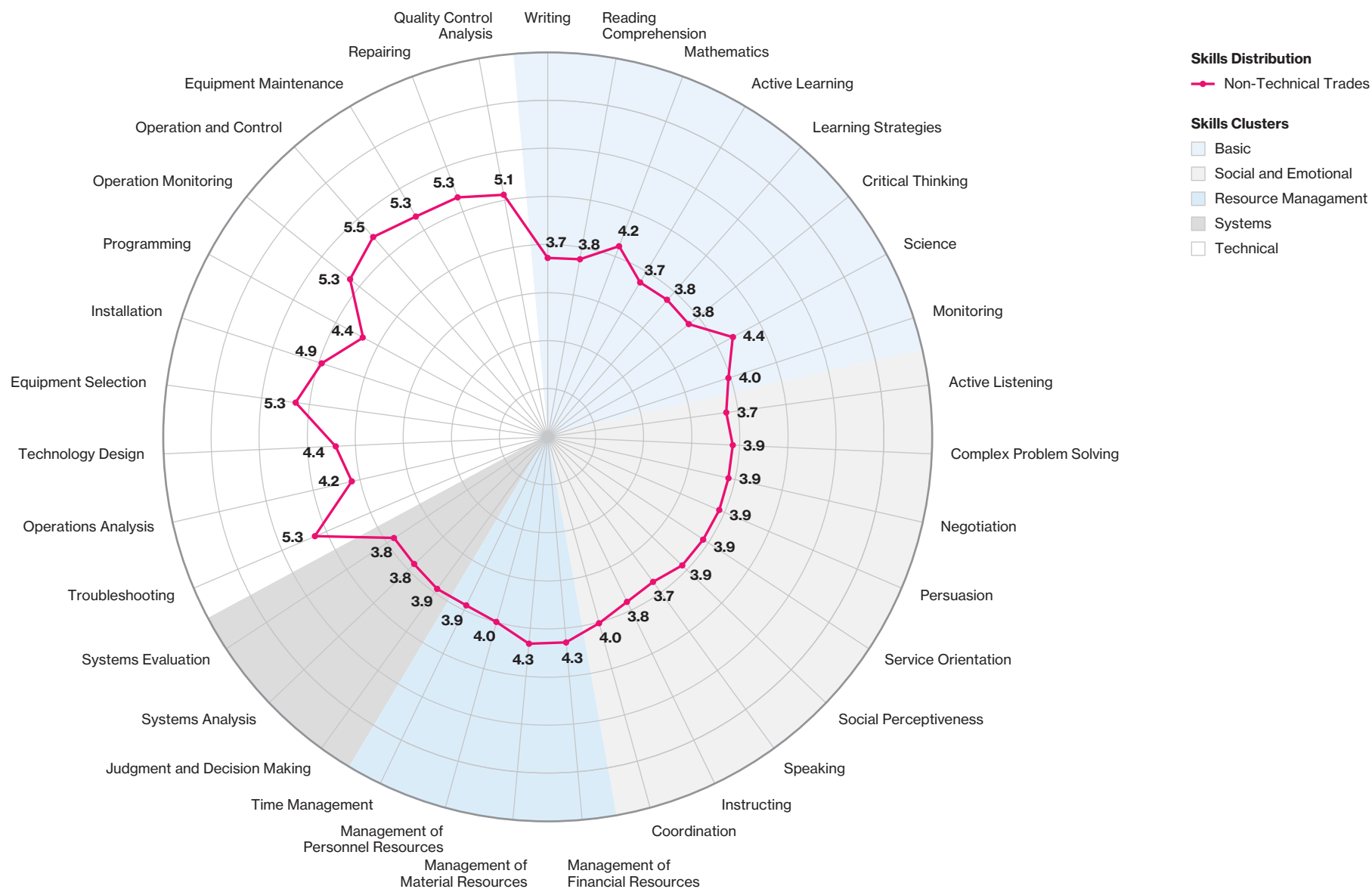Sources: The Conference Board of Canada; Statistics Canada.

Chart 11

Annual Income: Medium Range and Higher Level
(C$)

Sources: The Conference Board of Canada; Statistics Canada.

Chart 12

Skills Distribution: Lower-Level and Uneven Skill Set Skewed Toward Several Task and Technical Skills

Skills Distribution
- Non-Technical Trades

Skills Clusters
- Basic
- Social and Emotional
- Resource Managament
- Systems
- Technical

Sources: The Conference Board of Canada; Statistics Canada; O*NET.

The Conference Board of Canada **17**

Builders

- Builders make up the third largest cluster. Their employment outlook is weak due to slower job creation and the highest level of automation risk.

- Example of occupations in this cluster include bricklayers, concrete finishers, longshore workers, roofers and shinglers, and transport truck drivers.

- The top skills for this cluster are repairing, installation, equipment maintenance, troubleshooting, and equipment selection.

- Builders tend to be lower-paid as well, with a median annual income of just under $38,500 (over sixty per cent of workers have high school or less).

- Most skills are needed at lower levels. However, the skill set is lopsided and some skills require expertise. Indeed, several of the task- and- technically oriented skills, like repairing and installation, need to be highly specialized.
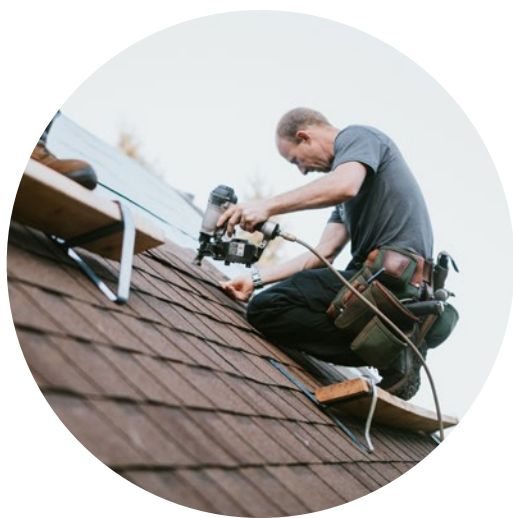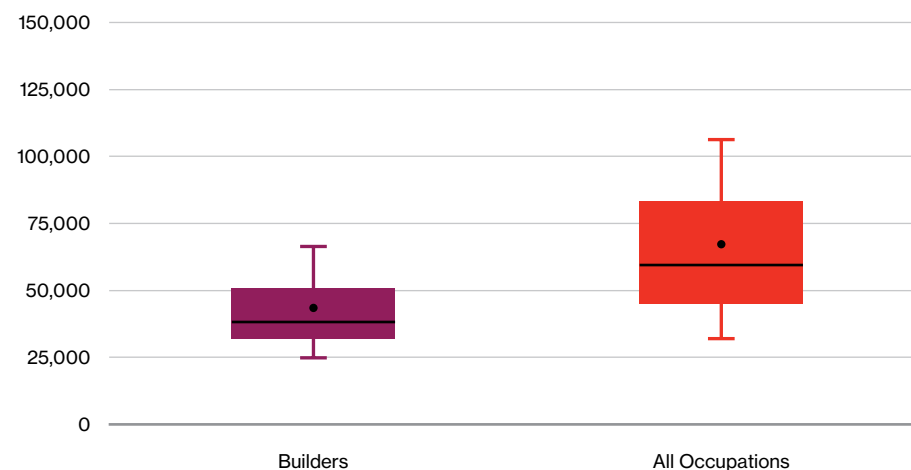

Table 7
Outlook: Weak

Size of cluster	2.27 million
Share of total employment	12.60%
Share of employment that is high-risk, low-mobility	42.70%
Ten-year employment growth forecast	5.70%
Ten-year unemployment rate forecast	8.60%

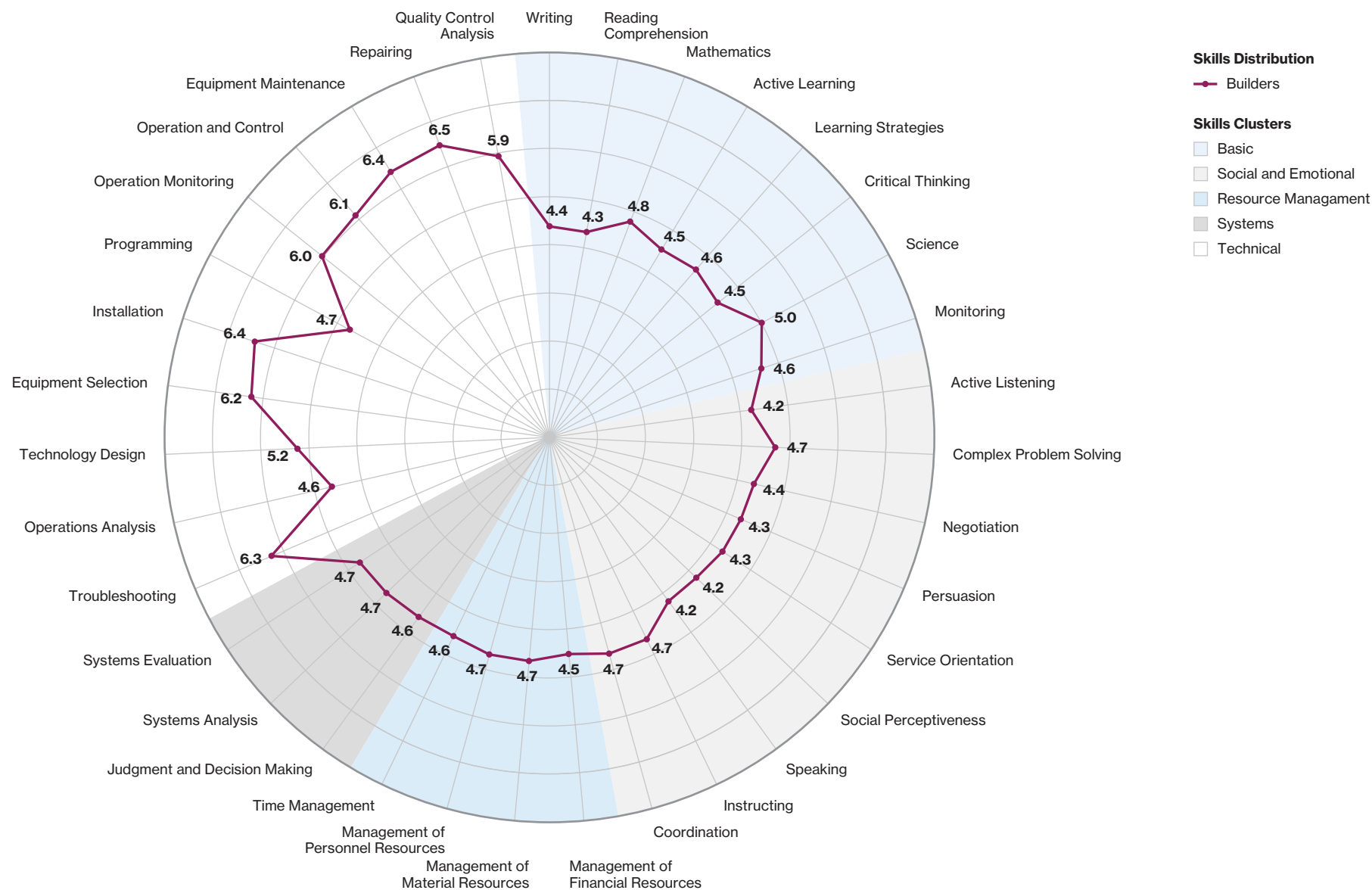Sources: The Conference Board of Canada; Statistics Canada.

Chart 13
Annual Income: Narrow Range and Lower Level
(C$)

Sources: The Conference Board of Canada; Statistics Canada.

Chart 14
Skills Distribution: Mostly Mid-Range but Has Several Areas of Expertise

Skills Distribution
—●— Builders

Skills Clusters
☐ Basic
☐ Social and Emotional
☐ Resource Managament
☐ Systems
☐ Technical

Sources: The Conference Board of Canada; Statistics Canada; O*NET.

The Conference Board of Canada **19**

Doers

- The Doers face a moderate outlook overall. The cluster has good growth prospects, but also faces high unemployment. Moreover, it has the second-highest level of automation risk.

- Example of occupations in this cluster include cashiers, food and beverage servers, light-duty cleaners, nursery and greenhouse workers, pet groomers, shippers and recievers, and store shelf stockers, clerks, and order fillers.

- The top skills for this cluster are management of personnel resources, operation monitoring, operation and control, time management, and quality control analysis.

- Doers make up the lowest paying cluster, with a median annual income of just under $25,000 (sixty per cent of workers have high school or less).

- The skill set in this cluster is well-rounded. All skills are needed at an average level, without any required specializations.
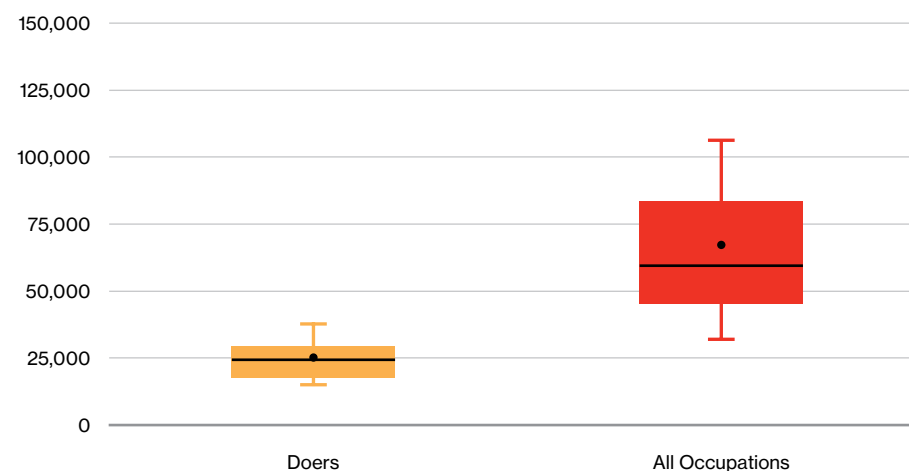
Table 8
Outlook: Moderate

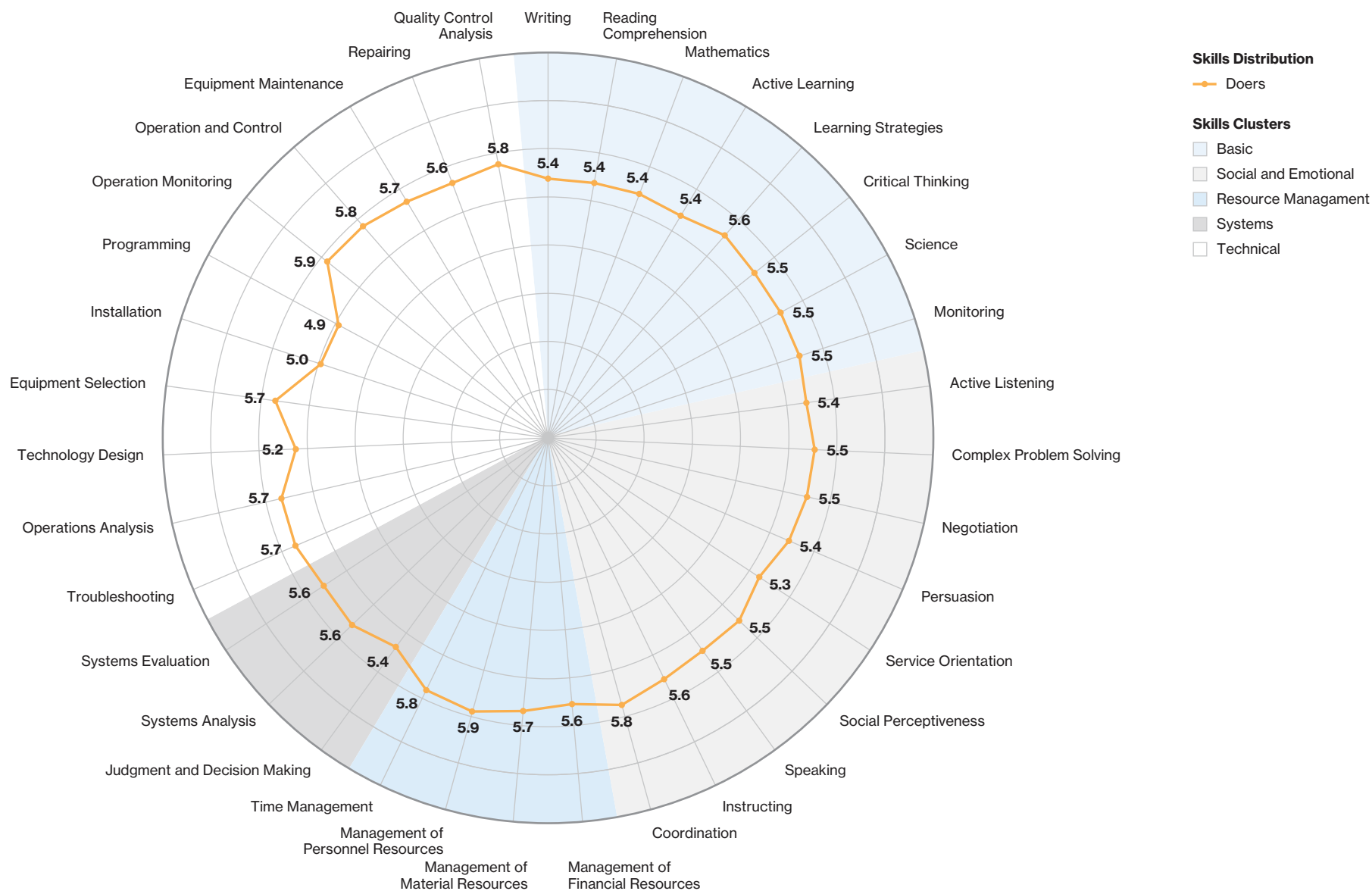|	
Size of cluster	2.18 million
Share of total employment	12.10%
Share of employment that is high-risk, low-mobility	35.00%
Ten-year employment growth forecast	11.30%
Ten-year unemployment rate forecast	6.90%

Sources: The Conference Board of Canada; Statistics Canada.

Chart 15
Annual Income: Narrowest Range and Lowest Level
(C$)

Sources: The Conference Board of Canada; Statistics Canada.

Chart 16
Skills Distribution: Mid-Range and Well-Rounded

Skills Distribution
— Doers

Skills Clusters
- Basic
- Social and Emotional
- Resource Managament
- Systems
- Technical

Sources: The Conference Board of Canada; Statistics Canada; O*NET.

The Conference Board of Canada **21**

Implications

Based on a similarity of skills perspective, we identified eight different Canadian job clusters or profiles. We expect all of the clusters to experience some employment growth, and there will be job opportunities for all types of work regardless of educational attainment or skill set development. But there is a lot of variation across the clusters. The growth outlook for each cluster is based on a 10-year employment forecast produced by The Conference Board of Canada's new Model of Occupations, Skills, and Technologies. More details about the employment growth forecast are provided in the appendices.

Some areas, like STEM professionals and knowledge workers, clearly have better prospects than others. This is consistent with how Canada's labour market has shifted toward the knowledge-based and services industries. Other groups, like non-technical trades and builders may offer less favourable employment prospects in the future, but some opportunities will continue to exist. Ultimately, people should try to align their education and skill development toward those groups that include jobs where their interests and skills are best utilized. The implications of these findings will vary depending on what your needs are. We outline some of those here.

For Students and Guidance Counselors

There are opportunities in every group, regardless of your level of educational attainment.

Each cluster has unique skill requirements. If students understand their strengths and interests, they can choose the best aligned cluster.

Knowing the typical educational requirements of your area of interest and investing appropriately can maximize your opportunities and minimize over-investment in education.

Some clusters face higher automation risks than others. Those who are worried about job security may want to explore occupations found in clusters with lower risks of automation.

Clusters with the strongest growth profiles may be the ones best suited to people who are comfortable with changing occupations more frequently.

Guidance counselors can use the clusters to advise students about which areas of the economy, as well as which jobs within those clusters, have the brightest future employment prospects and which have dimmer prospects.

For Educational and Public Policy-Makers

Skills clustering can offer valuable insights into which types of educational and training programs support clusters with stronger employment outlooks, and which programs should receive funding priorities to support workers considering jobs in those stronger clusters. It also shows which subset of occupations could potentially benefit most from retraining programs.

For educators and workforce planners, knowing which clusters are at greater risk of automation can indicate where big investments in career retraining will likely be required.

Defining the clusters can also help workforce planners and policy-makers identify subsets of occupations that are more at risk of dwindling employment prospects and relatively high unemployment in the future.

Investments in post-secondary schooling should be targeted toward knowledge workers and STEM professionals, where growth prospects are especially bright.

For Career Development Consultants

Understanding the clusters can help identify other roles that may have similar skill requirements and need only minimal retraining.[3]

Career development professionals can improve their recommendations for when investments in new skills or specific types of retraining are advisable and offer the biggest return.

3   Earlier research found that job transitions are easier within occupational groups versus between groups. For more details, see Nachum Gabler, Sheila Rao, and Thomas Hindle, *A Path Forward: Job Transitions in Canada* (Ottawa: The Conference Board of Canada, 2021). https://www.conferenceboard.ca/e-library/abstract.aspx?did=11070.

Appendix A

Methodology

Identifying Clusters

We used k-means clustering to identify occupational groups based on skills sets that describe each of the 500 NOC occupations. K-means clustering is a quantitative methodology that can partition similar data points into sensible groups based on an array of descriptive variables that characterize each data point. In our case, we wanted to divide 500 NOC occupations into a specified number of clusters based on their associated O*NET characteristics, especially the 35 skill variables. For our analysis, Euclidean distance was used to measure the degree of similarity of occupations as described by occupational characteristics defined in O*NET. The assignment of any given occupation to a cluster is based on the minimization of Euclidean distance.

We start by pre-specifying the number of clusters into which the data should be partitioned, based on *elbow graphs* and *cluster silhouettes*. Elbow graphs and silhouettes plot the number of clusters against the explained variability. Partitioning the data into more clusters will generally increase the amount of explained variability, but the incremental addition to explained variability recedes as more and more clusters are added. The goal is to use the number of clusters that explain maximal variability before the statistical benefit of adding more clusters starts to dissipate.[1]

The k-means algorithm assigns each occupation to the cluster for which the Euclidean distance is minimized to a respective *cluster centre*. In our analysis, the elbow graphs and silhouettes indicated that eight clusters would be optimal. The k-means algorithm then assigned each of the 500 NOC occupations to the cluster it was nearest to, thereby partitioning into eight clusters based on the similarity of underlying O*NET characteristics.

Linking Labour Market Indicators to Clusters

Once all of the clustering computation was complete, we mapped each cluster to standard labour market indicators, like unemployment rates and annual earnings. Based on the group of occupations contained within each cluster, we averaged across all the occupations to calculate cluster-wide averages for the respective labour market indicators. For some indicators, such as annual income, the overall distribution was analyzed as well. We calculated the following measures for each cluster:

- educational attainment
- average unemployment rate
- average employment growth forecast
- average annual income
- share of high-risk, low-mobility occupations

---

1   Using too many clusters can lead to overfitting the data and k-means results that exhibit high
     variance (i.e., estimated results that are very sensitive to small changes in the underlying data).

Employment Growth Forecast

The growth outlook for each cluster is based on a 10-year employment forecast produced by The Conference Board of Canada's new Model of Occupations, Skills, and Technologies (MOST). The MOST employment projections at the two-digit NAICS level align with the Conference Board's most recent national, provincial, and territorial employment projections. At the three- and four-digit levels, the MOST accounts for recent trends (as reported by custom profiles using detailed industry breakdowns from Statistics Canada's Labour Force Survey), as well as assumptions about longer-terms trends and labour productivities. Longer-term projections are further influenced by both the trend demonstrated between the 2011 and 2016 census periods in Canada at the three- and four-digit NAICS level and the trend stemming from other North American-based, longer-term projections (particularly the U.S. Bureau of Labor's employment projections for 2020–30). Occupational forecasts are themselves derived from not only the respective industry projections, but also the distinct trends that apply to occupations both through the COVID-19 recovery phase and over the longer term.

Key Terms

Cluster silhouette is a way to interpret and validate clustered data using a graph showing how well each individual cluster member has been classified. Basically, it measures how similar a cluster member is to its own cluster versus the other clusters. Similarity is measured using standard mathematical distance calculations, like Euclidean or Manhattan distances.

Cluster centres are representative values, defined by an array of variables averaged across all cluster members. For instance, if a cluster contained 10 members and each cluster member is represented by an array of five variabes, then the value for those five variables averaged across the 10 cluster members is the cluster centre.

Elbow graphs help determine the number of clusters in a data set. The graph shows the number of clusters on the X-axis and the amount of "explained variation" on the Y-axis. Dividing the data into more clusters will always explain more variation, but the amount of additional variation explained will start to diminish.

High-risk, low-mobility (HRLM) occupations are jobs that prior Conference Board of Canada research has identified as particularly prone to automation, as well as having limited opportunities for transitioning to more promising jobs in the absence of significant retraining.[2]

2   For more details, see Joel Thomson and Darren Gresch, *Responding to Automation: Technology Adoption in Canadian Industries* (Ottawa: The Conference Board of Canada, 2021). https://www.conferenceboard.ca/e-library/abstract.aspx?did=10880.

O*NET Skill Groups

Basic	Social and emotional	Resource management	Systems	Technical
Active learning	Active listening	Management of personnel resources	Judgment and decision-making	Equipment maintenance
Critical thinking	Speaking	Management of financial resources	Systems analysis	Equipment selection
Learning strategy	Coordination	Management of material resources	Systems evaluation	Installation
Mathematics	Social perceptiveness	Time management		Operations and control
Monitoring	Complex problem solving			Operations analysis
Reading comprehension	Instructing			Operations monitoring
Science	Service orientation			Programming
Writing	Negotiation			Quality control analysis
b	Persuasion			Repairing
				Technology design
b				Troubleshooting

Exhibit 1
Annual Income—All Clusters
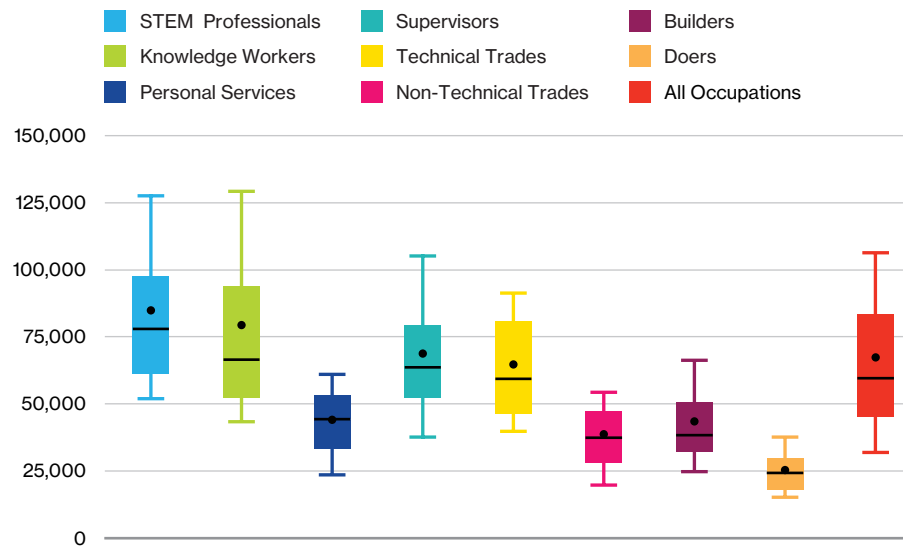
Sources: The Conference Board of Canada; Statistics.
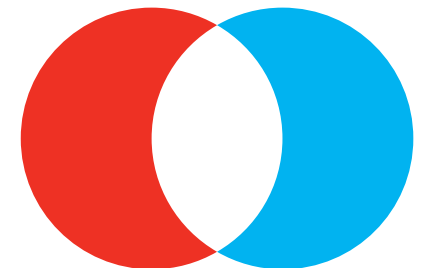
Exhibit 2
Skills Distribution—All Clusters

Skills Distribution
- STEM Professionals
- Knowledge Workers
- Personal Services
- Supervisors
- Technical Trades
- Non-technical Trades
- Builders
- Doers

Skills Clusters
- Basic
- Social and Emotional
- Resource Managament
- Systems
- Technical

Chart axes (clockwise from top): Writing, Reading Comprehension, Mathematics, Active Learning, Learning Strategies, Critical Thinking, Science, Monitoring, Active Listening, Complex Problem Solving, Negotiation, Persuasion, Service Orientation, Social Perceptiveness, Speaking, Instructing, Coordination, Management of Financial Resources, Management of Material Resources, Management of Personnel Resources, Time Management, Judgment and Decision Making, Systems Analysis, Systems Evaluation, Troubleshooting, Operations Analysis, Technology Design, Equipment Selection, Installation, Programming, Operation Monitoring, Operation and Control, Equipment Maintenance, Repairing, Quality Control Analysis

Sources: The Conference Board of Canada; Statistics Canada; O*NET.

Appendix B

Cluster Membership
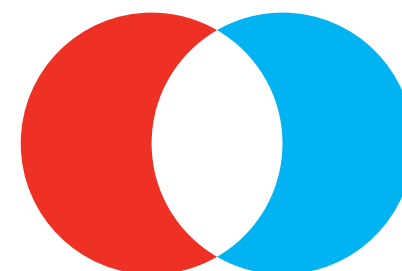
Appendix C

Bibliography

Conference Board of Canada, The. "See Where Your Skills Can Take You." OpportuNext. Accessed June 15, 2022. https://www.opportunext.ca/.

Government of Canada. "About the National Occupational Classification–Concepts and Conventions." January 2020. Accessed June 15, 2022. https://noc.esdc.gc.ca/Home/ConceptsConventions/424f5d0833204d259c2d942b8a170ce6?wbdisable=true.

Nachum Gabler, Sheila Rao, and Thomas Hindle. *A Path Forward: Job Transitions in Canada*. Ottawa: The Conference Board of Canada, 2021. https://www.conferenceboard.ca/e-library/abstract.aspx?did=11070.

O*NET Resource Center. "The O*NET-SOC Taxonomy." Accessed June 15, 2022. https://www.onetcenter.org/taxonomy.html.

O*NET OnLine. "Browse by Cross-Functional Skills." Accessed June 15, 2022. https://www.onetonline.org/find/descriptor/browse/Skills/.

Statistics Canada. Data table 98-400-X2016355. "National Occupational Classification (NOC) 2016, Employment Income Statistics, Highest Certificate, Diploma or Degree, Immigrant Status and Period of Immigration, Work Activity During the Reference Year, Age and Sex for the Population Aged 15 Years and Over Who Worked in 2015 and Reported Employment Income in 2015, in Private Households of Canada, Provinces and Territories, 2016 Census." Accessed June 15, 2022. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/dt-td/Rp-eng.cfm?LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FREE=0&GC=0&GID=0&GK=0&GRP=1&PID=112123&PRID=10&PTYPE=109445&S=0&SHOWALL=0&SUB=0&Temporal=2017&THEME=124&VID=0&VNAMEE=&VNAMEF=.

Thomson, Joel, and Darren Gresch. *Responding to Automation: Technology Adoption in Canadian Industries*. Ottawa: The Conference Board of Canada, 2021. https://www.conferenceboard.ca/e-library/abstract.aspx?did=10880.
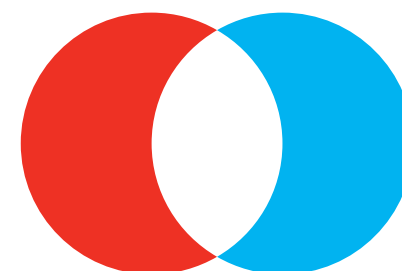
Beyond Blue and White Collar: A Skills-Based Approach to Canadian Job Groupings
The Conference Board of Canada

Where insights meet impact

The Conference
Board of Canada