Labour Market Research Insights: **Automotive and Mobility Sector**

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Ontario

Ontario Vehicle Innovation Network (OVIN)

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OCI
Where Next Happens

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The roadmap features the main components of the labour market insights

Automotive and Mobility Sector Labour Market Insights

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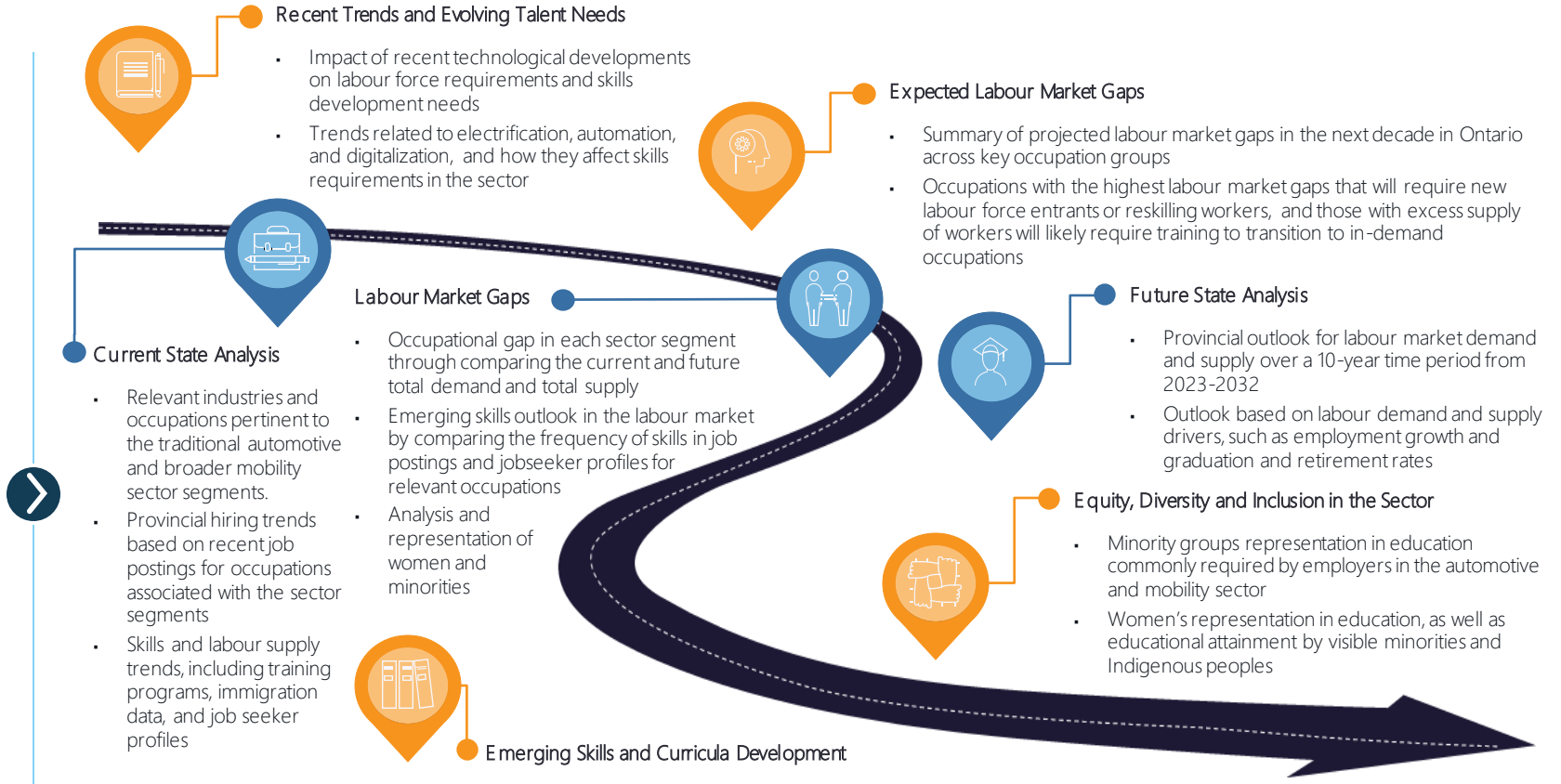


Upskilling

Upskilling refers to the process of gaining new knowledge and skill to advance in one's career

Reskilling

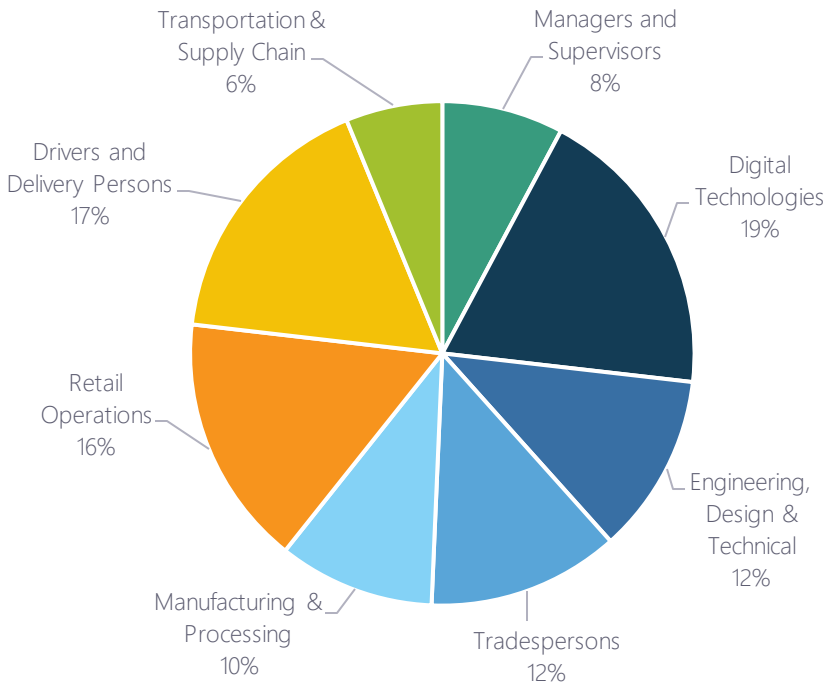
Reskilling refers to gaining new knowledge and skills to shift or transition into a new role or industry

Executive Summary

Ontario has a dynamic and evolving workforce in the automotive and mobility sector

Current State of the Automotive and Mobility Sector

Employment by Occupation Categories

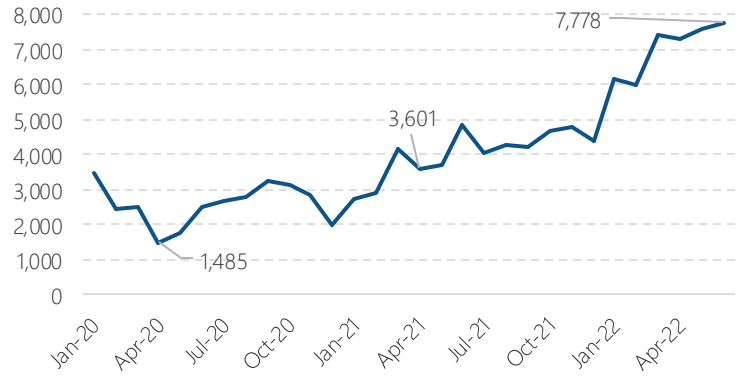


709,170 workers were employed in the automotive and mobility sector in Ontario in 2021.

Labour Demand

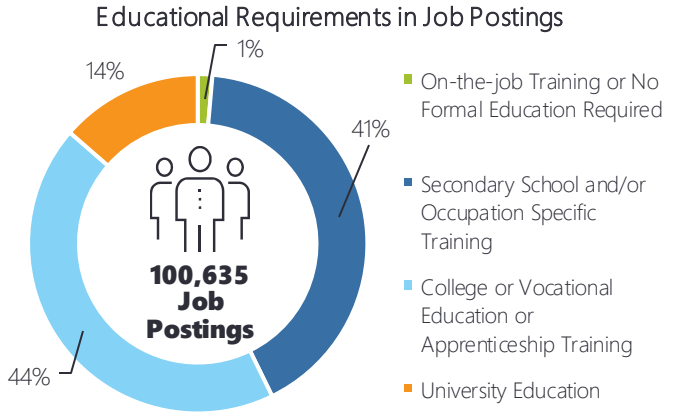
Monthly Job Postings

- Job postings across all relevant occupations have been trending upwards in recent years.
- The posting volume has increased rapidly since the beginning of the COVID-19 pandemic, in particular for Transportation & Supply Chain, Drivers and Delivery persons, and Retail Operations roles.
- The average number of monthly postings was 1,485 in April 2020 and 7,288 in April 2022. Between April 2021 and April 2022, the number of monthly job postings doubled, surpassing pre-pandemic levels. This resonates with the recent general economic trends and a tight labour market environment.



In-demand Qualifications

- The automotive and mobility sector has seen 100,635 job postings between 2021 and 2022. Most of these occupations require college or vocational education (44%) or secondary school (41%).
- Employer requirements for University education in the sector have declined since 2018.
- Employer requirements for College, Apprenticeship and Secondary School have stayed the same, with an increase in Secondary School or Occupation Specific training.



Sources: Statistics Canada, Vicinity Jobs. Note: Relevant occupation and occupation categories in the automotive and mobility sector are defined in the Appendix.

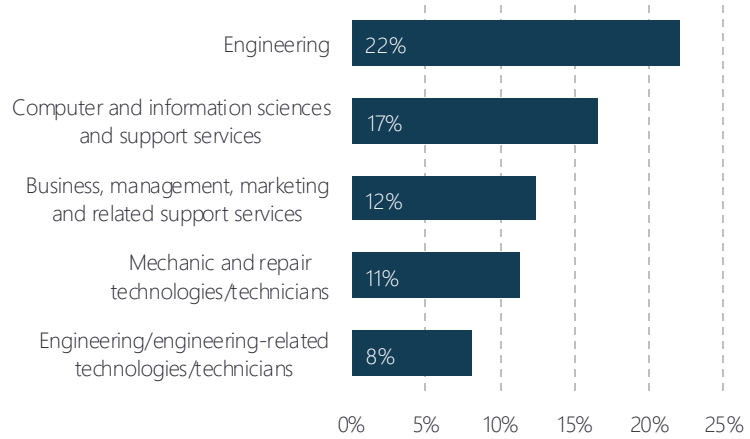
Executive Summary

Graduation data provides a snapshot of potential workforce entrants in the current labour market

Current State of the Automotive and Mobility Sector

Workforce Education Background

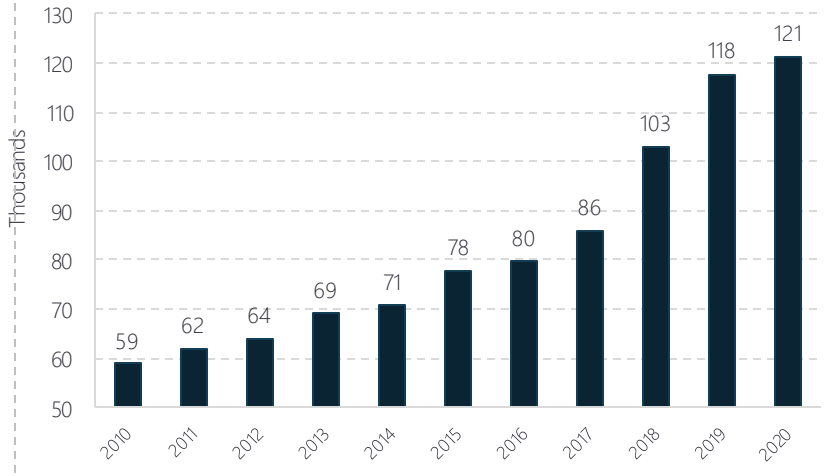
Employment by Field of Study, 2021



In 2021, the automotive and mobility sectors employed mostly workers with engineering educational backgrounds, totalling 30% of all workers in Ontario, followed by workers with computer and information sciences backgrounds at 17%.

Graduations Trends

Ontario Post-Secondary Graduates, STEM



Science, Technology, Engineering and Mathematics (STEM) graduation data in Ontario over the last decade indicates an expanding qualified labour pool for the automotive and mobility labour market.

Equity, Diversity and Inclusion

27%

The share of **female employment** in Ontario for the automotive and mobility sector, compared to 47% across all industries.

41%

The share of **visible minority employment** in Ontario for the automotive and mobility sector, compared to 34% across all industries.

2%

The share of **Indigenous employment** in Ontario for the automotive and mobility sector, compared to 2% across all industries.

Top Industries with Highest Employment Share of Persons with Disabilities in the Automotive and Mobility Sector

1. Retail and wholesale trade
2. Manufacturing
3. Transportation and warehousing

Sources: Statistics Canada, Census 2021.

Executive Summary

Technological advancements in the sector are prominent and command repositioning of the labour market

In recent years, the emergence of new technologies in the automotive and mobility sector impacted skills and training that workers require to be successful in the field. Below is a breakdown of major trends in **electrification, automation,** and **digital transformation** that are driving training, education, and skills requirements for workers in the sector. These trends and technological advancements have raised upskilling and talent development needs for individuals seeking employment in the sector. In particular, job seekers may need to gather an increasingly technical and specialized skillset to fulfill employers' needs.

Electrification

Increased demand for electric vehicles

Increasing affordability, shifts in consumer preferences, along with considerable government incentives have made electric vehicles (EVs) an attractive option in a rapidly changing market.

Battery technology advancements and development

Advancements in battery technology, including improved affordability and capacity, have incentivized manufacturers to rapidly adopt battery-powered vehicles in their offerings.

Growth and development of electric vehicle charging infrastructure

The rapid growth of vehicle electrification and consumer adoption of EVs has increased the demand for infrastructure, such as charging stations, needed to support the EV ecosystem.

Automation

Advancements in IoT for automotive applications

Increasing affordability and adoption of systems such as sensors and cameras in vehicles have popularized the use of Internet of Things (IoT) systems that leverage sensor data for optimized performance.

Self-driving vehicles enabled by machine learning and AI

Rapid advancements in machine learning (ML) and artificial intelligence (AI) technologies enable vehicle self-driving functionality. The automotive sector has rapidly evolved thanks to this technology.

Increased adoption and complexity of autonomous driving systems

Rapid adoption of autonomous driving systems, enabled by multiple connected devices has increased the reliance on expertise in computer science and software engineering.

Digital Transformation

Increased connectivity-enabled technologies

Technologies enabled by internet connectivity, including telematics and sensor data, have been rapidly adopted in the automotive sector and require specialized knowledge.

Data analytics needs for vehicle performance analysis

Vehicles with interconnected digital technology devices generate a great amount of data, which major players in the sector can leverage to optimize performance and carry out predictive maintenance.

Cybersecurity in modern interconnected vehicles

Connectivity in modern vehicles has caused security concerns for manufacturers and consumers, driving the need for individuals with expertise in data and software security.

Sources: International Energy Agency, Victoria Transport Policy Institute, National Center for Manufacturing Sciences, Ericsson, Frontiers in Future Transformation

Executive Summary

Skills and training programs need to capture the evolving talent needs of the sector

Upskilling and Reskilling Needs

As innovation and development of new technologies takes place in the automotive sector, job requirements have evolved to fulfill the needs of the sector. As such, workers in traditional roles in the sector need to learn new skills to adapt to the needs of employers, and some workers may be displaced. Below is a selection of major upskilling and reskilling needs for workers in the automotive sector.

Specific vehicle electrification technology

Aftermarket technicians need to upskill to service EVs, while assembly workers may find training related to advanced manufacturing more useful. Power companies will need to develop solutions to the challenges on the electrical grid's capacity to provide electricity at peak hours to EVs.

Sensor technology and IoT systems

Workers in the automotive sector may benefit from learning skills and gaining working knowledge related to sensor technology, such as radar and lidar, and other IoT automotive applications.

Regulation and safety knowledge

The rise of autonomous vehicles and vehicle electrification put pressure on transportation authorities to adapt safety and transportation regulations, as well as compliance requirements for manufacturers going forward.

Battery technology

Canadian workers are at risk of being displaced by the changing requirements for EV manufacturing.[1] The government has shown interest in supporting reskilling programs to help develop the country's battery supply chain.

Data science, artificial intelligence and machine learning

These fields are amongst the key enablers of up-and-coming technologies such as vehicle automation, therefore, professionals with skills in these areas will likely be in high demand in the near future.

Cybersecurity knowledge and skills

Workers with working knowledge and skills in computer system security will likely be in high demand in the coming years as automotive connectivity is vulnerable to cyber attacks and privacy concerns.

Sources: Conference Board of Canada, Future Skills Centre, IBM, Catapult, Information and Communications Technology Council; 1 CBC News "Stellantis confirms layoffs coming to Windsor, Brampton plants"

2 Recent Labour Market Trends

Automotive and Mobility Sector Definitions

Labour market insights are presented for key sector segments and occupational categories

Automotive and Mobility Segments

Automotive and mobility sector segments include traditional automotive sectors, such as auto and parts manufacturing, automotive aftermarket, as well as emerging segments focusing on new technologies, such as advanced air mobility (AAM) and connected & autonomous vehicles (CAV). The analysis also includes broader mobility sectors, including mobility planning and infrastructure, marine and rail transportation.

Auto & Parts Manufacturing

The production and assembly of components for vehicles, often using advanced manufacturing techniques.

Aftermarket, Maintenance & Repair

The services provided to vehicles after the initial purchase, which include repair and maintenance, as well as purchases of parts and accessories.

Freight & Goods Movement

The movement of materials and other goods in the sector, which includes shipping, logistics, and supply chain management.

Mobility Planning & Infrastructure

The planning and development of infrastructure and systems for transportation and mobility, such as public transit and roads.

Tool, Die & Mold

The design and development of tooling, dies, and molds used in the vehicle and components production.

Electrification

The development and implementation of electric technologies, such as electric powertrain systems, to power vehicles.

Advanced Air Mobility

Technologies that allow transportation of people and cargo utilizing electric vertical takeoff and landing, as well as unmanned aerial vehicles.

Light Weighting

The use of lightweight materials, such as aluminum or carbon fiber, to reduce vehicle weight and improve fuel efficiency and handling.

Propulsion Systems

The design, development, and production of machines that produce thrust to propel vehicles forward.

Rail Transportation

The movement of goods and passengers by rail, which include freight transportation, passenger rail services, and development of railway infrastructure.

Marine Transportation

The movement of goods and passengers by water, which include shipping and ports, as well as development of marine infrastructure.

Safety Management & Controls

The technologies and processes that are designed to improve the safety of vehicles, such as driver assistance systems.

Connected & Autonomous Vehicles

The development and implementation of technology that allows vehicles to communicate with surrounding infrastructure and witheach other, as well as operate autonomously.

Traditional Emerging Broader mobility segment

Note: Detailed segment and occupational categories definitions are provided in the Appendix.

Occupational Categories

The labour market analysis is categorized into eight relevant occupational categories that encompasses various roles embedded in the thirteen automotive and mobility segments.

Managers & Supervisors

Workers who oversee multiple business aspects in the sector, such as development, production, sales, and after-sales services.

Engineering, Design & Technical

Professionals who design, develop, and test components using advanced tools and technologies.

Tradespersons

Skilled technicians or mechanics who diagnose and fix problems, ensuring efficiency and safety.

Digital Technologies

Workers who develop and implement technologies, such as telematics, to improve user performance and experience.

Retail Operations

Individuals who work in sales and marketing of vehicles, auto parts, and automotive repair and maintenance services.

Transportation & Supply Chain

Workers who manage logistics, shipping, and supply chains in the sector to ensure timely delivery of vehicles and components.

Manufacturing & Processing

Individuals responsible for the production and assembly of components utilizing advance manufacturing processes.

Drivers & Delivery persons

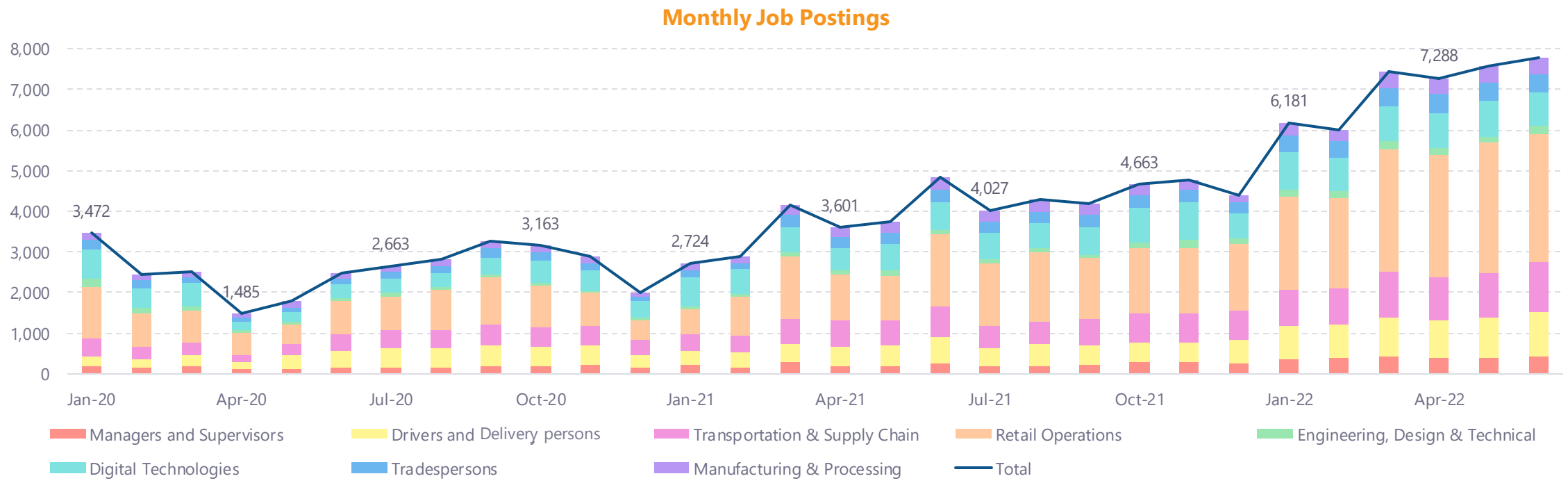
Workers who operate vehicles, such as trucks and delivery vehicles, to transport goods safely and efficiently.

Job Postings Trends

The number of monthly job postings has doubled between April 2021 and April 2022

Job postings data from January 2020 to June 2022 reveal important trends since the beginning of the COVID-19 pandemic in March 2020 and reflect the demand for select occupation groups:

- Job postings across all relevant occupations have been trending upwards in recent years. The average number of monthly postings was 1,485 in April 2020, 3,601 in April 2021 and 7,288 in April 2022. Between April 2021 and April 2022, the number of monthly job postings more than doubled.
- Job postings totals vary on a monthly basis for each occupation group due to cyclical hiring patterns. For example, the number of postings tends to fall in November and December and increase in the early months of the year (January to April).
- Engineering, Design & Technical roles have had the fewest postings of any occupation category; however, the number of postings has increased year-over-year in 2022.
- The average number of monthly postings was the highest for Retail Operations (2,215) over the past year.
- The posting volume has increased rapidly since the beginning of the COVID-19, in particular for Transportation & Supply Chain, Drivers and Delivery persons, and Retail Operations roles.



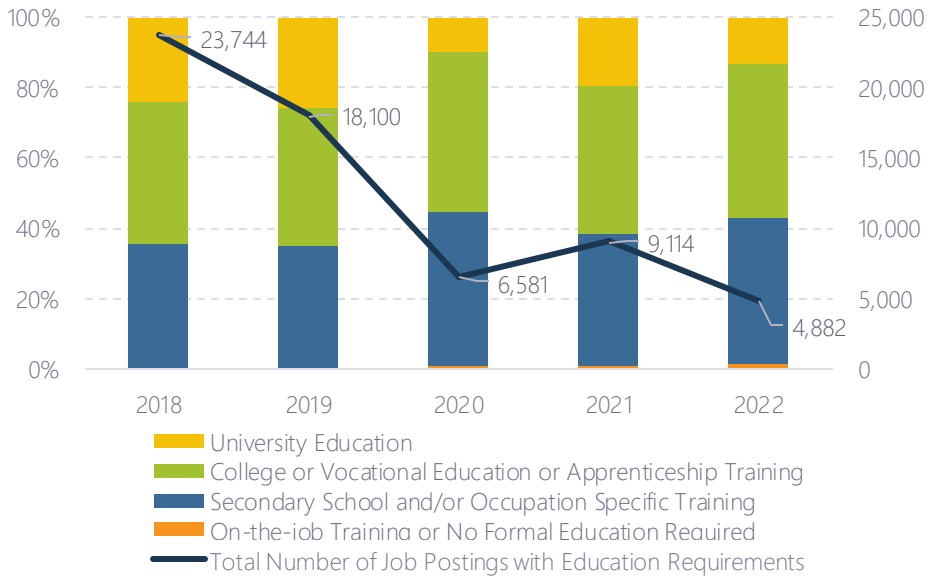
Source: Vicinity Jobs.

In-demand Occupations and Credentials

In-demand occupations may indicate a rise in employment or high levels of turnover

- In-demand occupations were identified by computing the ratio of the total number of job postings for each occupation to its total employment in the occupation within relevant industries for the segment "job postings per worker". Occupations with a ratio above the average (all shown in chart) are considered in-demand, and could indicate either a rise in employment or high levels of turnover. **Mathematicians, statisticians, actuaries and data scientists and retail salespersons and managers** were high in demand in the last two years.
- Some job postings also identify the level of education required by employers, which is a key component of understanding labour demand. Job postings for relevant occupations were categorized by educational requirements in each year between 2018 and 2022 to illustrate trends.
- **Requirements for University education have declined since 2018**. Requirements for College, Apprenticeship and Secondary School have stayed the same, with an increase in Secondary School or Occupation Specific training.

Educational Requirements, Ontario



Source: Vicinity Jobs and Statistics Canada.

In-demand Occupations

Occupation	Total Job Postings (Ontario, 2021-2022)	Total Employment (Ontario, 2021)	Job Postings per Worker
Mathematicians, statisticians, actuaries and data scientists	7,295	3,245	2.24
Retail salespersons and non-technical wholesale trade sales and account representatives	21,272	18,135	1.17
Retail and wholesale trade managers	11,448	11,800	0.97
Transport equipment operators, utility maintenance and related maintenance workers	2,339	3,020	0.77
Mail and message distribution occupations	7,626	15,020	0.50
Transportation and production logistics coordinators and customs and related broker occupations	2,163	7,675	0.28
Water and rail transport operators and labourers and related occupations	240	855	0.28
Supply chain logistics, tracking and scheduling coordination occupations	4,544	21,035	0.21
Longshore workers and material handlers	8,133	38,385	0.21
Labourers in processing, manufacturing and utilities	2,863	14,795	0.19
Computer and information systems professionals	7,295	40,550	0.17
Automotive service technicians	1,358	8,290	0.16
Machinery and transportation equipment mechanics (except motor vehicles)	1,334	8,330	0.16
Machining, technical metal forming, shaping and erecting trades	2,833	18,410	0.15
All Automotive and Mobility Sector	100,635	709,170	0.14

Occupation Category Legend

- Managers and Supervisors
- Digital Technologies
- Drivers and Delivery persons
- Tradespersons
- Transportation & Supply Chain
- Manufacturing & Processing
- Retail Operations
- Engineering, Design & Technical

Graduation and Immigration Trends in Ontario

Current labour supply and new workforce entrants are reflected in graduation and immigration trends

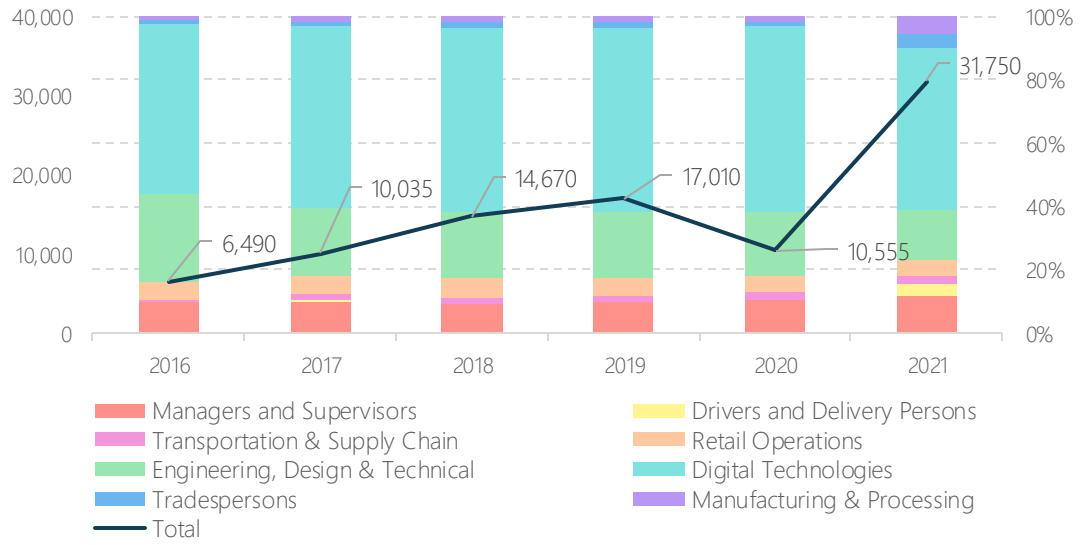
- Graduation data provides a snapshot of the current state of labour supply since these individuals are able to immediately enter the workforce. Growth rates in graduation by field of study can help establish trends for emerging skills. The strongest growth occurred in **Computer related** (20.0%), followed by **Business** (12.8%). Total average growth across all applicable fields of study was 5.3%.
- Degrees required by employers in the automotive and mobility sector are reflected in the most common fields of study for workers currently employed in the segment. These fields are identified by triangulating education (CIP), occupation (NOC), and sector (NAICS) data. **Engineering** is the primary field of study (22%), with **Computer related** coming at 17%. The **Engineering fields**, which include engineering and engineering related, combine for 30% of current employment in the segment.
- The workforce benefits from the addition of skilled workers through immigration. Between 2016 – 2021, the majority of immigrants in the segment indicated the intention of working in **Digital Technologies**, followed by **Engineering**. Additionally, between 2016-2021, immigration patterns show that those indicating **Digital Technologies** and **Engineering** as their intended occupation have decreased, compared to other occupation categories which have gone up in aggregate numbers.

Graduation Growth, Ontario

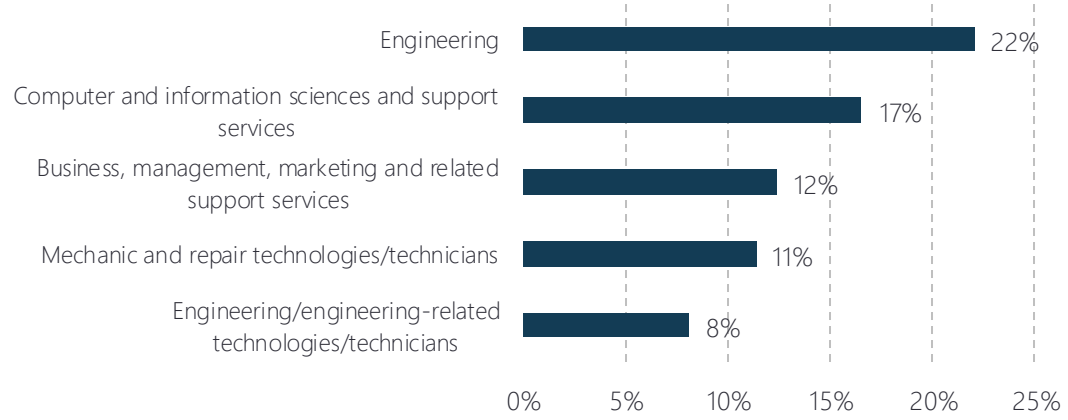
Field of Study	Avg. Annual Growth in Graduates (2017-2020)	Relevant Skills
Engineering/engineering-related technologies/technicians*	9.1%	Basic engineering principles and techniques
Mechanic and repair technologies/technicians	4.0%	Adjustment, maintenance, part replacement and repair
Business, management, marketing and related support services	12.8%	Management, technical support, applied research, communication
Computer and information sciences and support services	20.0%	Programming, data processing, software design
Engineering*	7.1%	Mathematical and scientific principles
Total, all fields of study	5.3%	--

Source: Statistics Canada, Postsecondary Student Information System (PSIS). *Note: Engineering comprises of instructional programs that prepare individuals to apply mathematical and scientific principles to the solution of practical problems. Engineering technologies/technicians comprises of instructional programs that prepare individuals to apply basic engineering principles and technical skills in support of engineering and related projects.

Immigration by Intended Occupation Category, Ontario



Employment by Field of Study, 2021



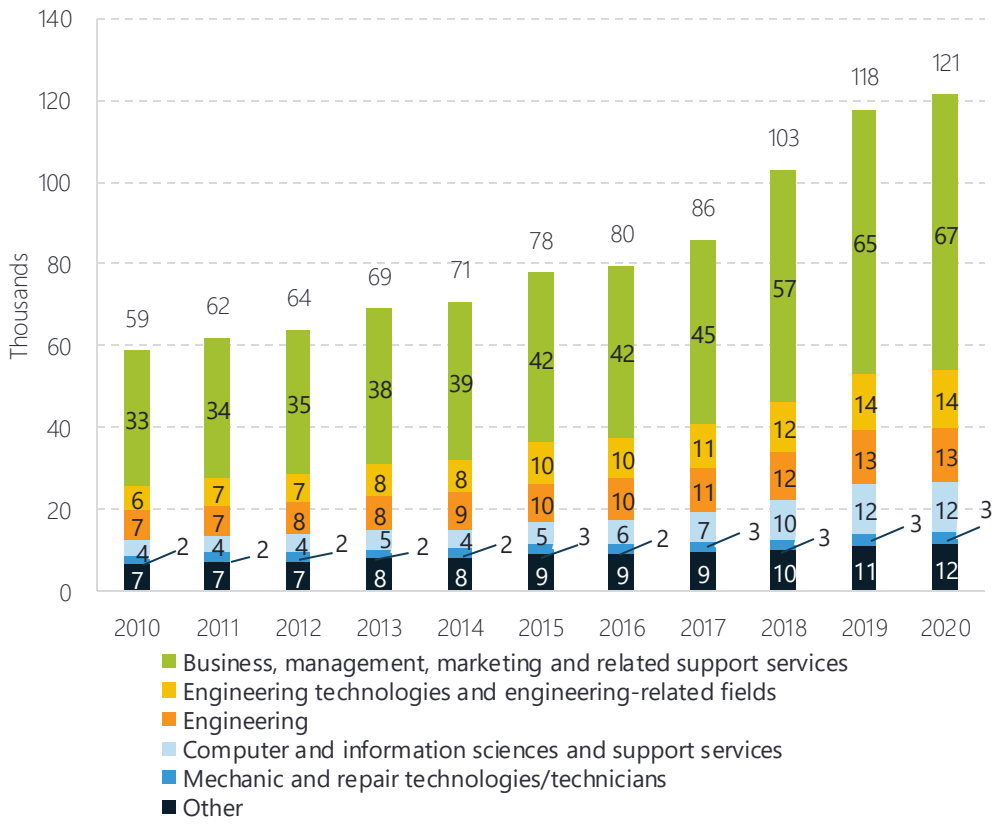
Source: Statistics Canada and Immigration, Refugees and Citizenship Canada (IRCC).

Postsecondary Enrollment and Graduation

Trends in postsecondary enrollment and graduation in Ontario indicate an expanding qualified workforce

- The total number of graduates in fields of study commonly requested by employers in the automotive and mobility sector grew by over 50% between 2016 and 2022. The fastest growth was seen in **Business, management, marketing, and related fields**, which is increasingly in demand in a wide range of sectors in Ontario, including in the automotive and mobility sector for strategic planning, and supply chain management capacities. Number of graduates in **Mechanic and repair technologies/technicians fields** stayed flat.
- University-level degrees are prominent in STEM-related fields of study, while non-tertiary education and short-cycle tertiary education is popular amongst those studying business administration and trades.

Postsecondary Graduates by Field of Study, Ontario



Enrollment and Graduation Rates by Field of Study and Degree Type, Ontario

Field of Study	Total Enrollment/ Graduation, 2020	Post-secondary non-tertiary education	Short-cycle tertiary education	Bachelors or Equivalent	Master's or Equivalent	Doctoral or equivalent
Enrollment Rates (2019/20)						
Science and Science technology	99,018	0.3%	2.3%	16.6%	8.4%	24.3%
Engineering and engineering technology	93,012	3.3%	13.7%	10.2%	11.6%	17.8%
Mathematics and computer and information sciences	67,956	3.3%	8.6%	7.4%	6.1%	6.5%
Business and administration	160,914	18.6%	27.4%	15.9%	13%	2.5%
Trades, services, natural resources and conservation	87,150	26.1%	19.1%	6.2%	6.5%	3.5%
Graduation Rates (2019)						
Science and Science technology	19,521	-	2.4%	14.5%	8%	29%
Engineering and engineering technology	27,486	0.5%	11.6%	9.4%	14.8%	19.1%
Mathematics and computer and information sciences	18,102	0.3%	8.1%	6.2%	6.4%	6.4%
Business and administration	66,849	16.8%	33.9%	17.1%	18.9%	2.1%
Trades, services, natural resources and conservation	32,127	30.9%	16.1%	6%	7.2%	2.9%

Source: Statistics Canada, Postsecondary Student Information System (PSIS).

Apprenticeships and Certifications

Trends in apprenticeships and certifications indicate the uptake of training opportunities in the sector

- For both **apprenticeship registration and completions** as well as certifications, there has been a **decline nationally and provincially**. This trend captures various trades in the automotive and mobility sector, including tradespersons, engineers and information technology developers. According to the Canadian Apprenticeship Forum, Ontario will require 52,843 new certifications in Red Seal trades by 2025.
- In 2020, there were 45,993 apprenticeship registrations in the automotive and mobility sector in Ontario, with an additional 4,875 successful completions. Across Canada, the sector saw 160,791 registrations with 13,938 total completions. Similarly, there were 5,787 certification completions in Ontario and 18,474 in Canada in 2020.

Average Growth Rates, 2017-2019

Ontario

-6%	4%	1%
apprenticeship registrations	apprenticeship completions	certifications granted

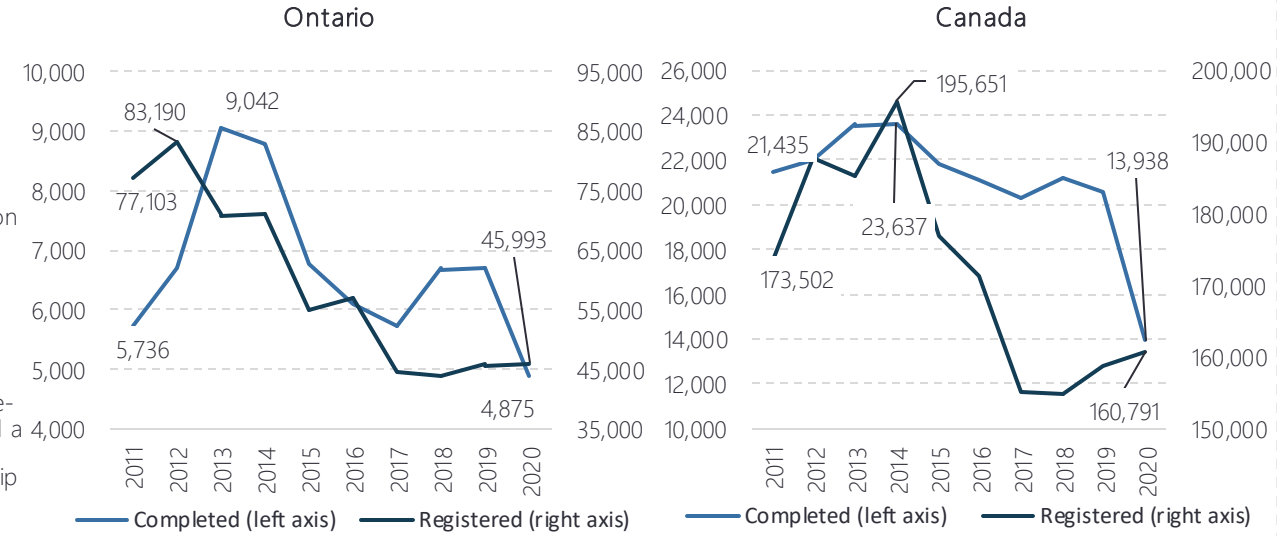
Canada

-2%	-1%	-2%
apprenticeship registrations	apprenticeship completions	certifications granted

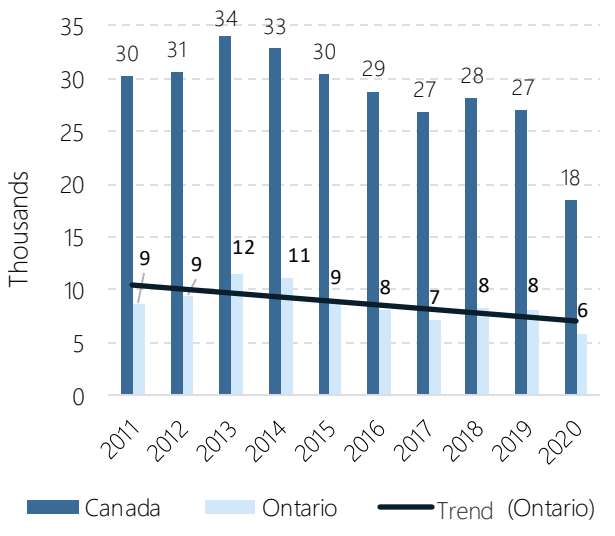
Apprenticeship Registrations and Completions

Registrations and completions in both Ontario and Canada have fallen drastically from **2014-2017**, and this is attributable to several factors including the impact of low crude oil prices in 2014 in Alberta in demand for skilled trades and adjustment of Statistics Canada data collection methods.

In contrast, apprenticeship uptake **went up from 2018 onwards** as a result of an increase in employment in the construction industry (which helps apprentices meet on-the-job training requirements) and a greater uptake of traditionally male-dominated apprenticeship programs by women.



Certifications Granted



Source: Statistics Canada, Registered Apprenticeship Information System (RAIS),

Note: The trade groups included in the figures above are automotive service, electricians, electronics and instrumentation, heavy duty equipment mechanics, heavy equipment and crane operators, machinists, metal workers, millwrights, sheet metal workers, user support technicians, welders, stationary engineers and power plant operators. Apprenticeship registrations reflect the number of apprentices who are newly registered or continuing and still registered, while completions indicate successful completion of the entire program with a certification granted.

3 Labour Market Outlook

Labour Market Gap Outlook

Expected labour market gaps are presented for key sector segments

Labour Market Outlook

- Labour market outlook is developed based on projected growth in:
  - **Demand:** sector expansion driven by economic growth and replacement demand arising from retirements in the sector; and
  - **Supply:** new workforce entrants, including new graduates and trainees, immigrants, and workers from related sectors.

Labour Market Gaps

- Expected labour market gaps are determined based on the difference in future labour demand and supply.
  - **High labour force gaps** indicate that projected total demand for workers exceeds availability of workers in the labour market, suggesting potential challenges in finding qualified workers.
  - **Moderate labour force gaps** indicate that the excess demand for workers compared to availability is less acute, indicating hiring challenges are less significant, albeit still present.
  - **Low labour force gaps** indicate sufficient availability of workers in the labour market compared to what employers demand.

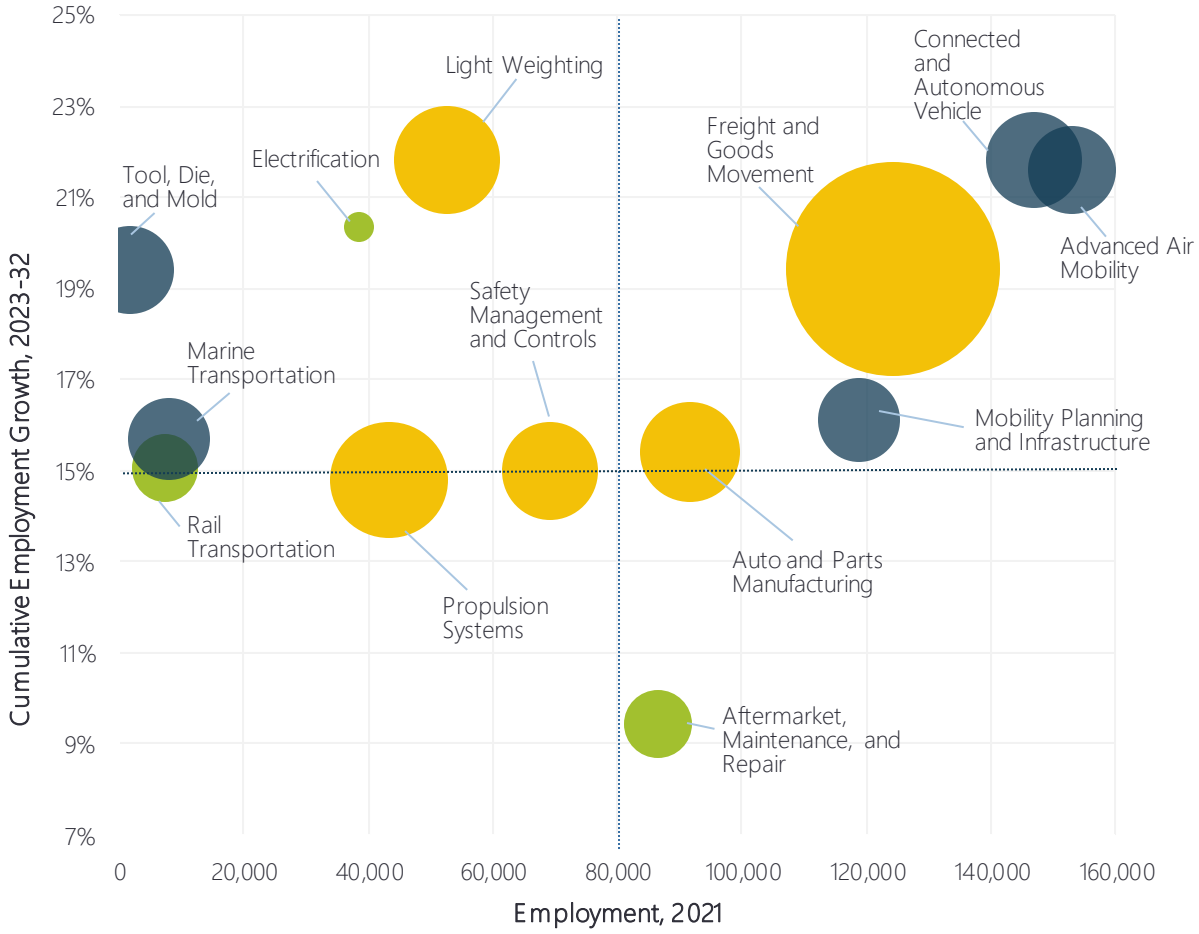
Reskilling and/or upskilling as well as talent attraction efforts are an important mechanism for supporting labour market rebalancing. Workers in segments with low labour force gaps may be absorbed in the automotive and mobility sector segments with high gaps.

High labour market gaps are expected in freight and goods movement, propulsion systems, light weighting, auto and parts manufacturing, and safety management controls segments.

Additionally, given high level of employment and expected growth over the next decade, segments such as **advanced air mobility, connected and autonomous vehicle, freight and goods movement, and mobility planning and infrastructure** can seen as priority areas for talent development and attraction.

While segment-level gaps indicate the overall difference between expected labour demand and supply growth, there may be a further mis-match in specific occupations, tasks, and skills required in the evolving sector.

Labour Gap Outlook by Automotive and Mobility Segment, Ontario



Note: The size of the bubble indicates the relative magnitude of the expected occupational gap in each segment.

Detailed segment definitions are provided in the Appendix.

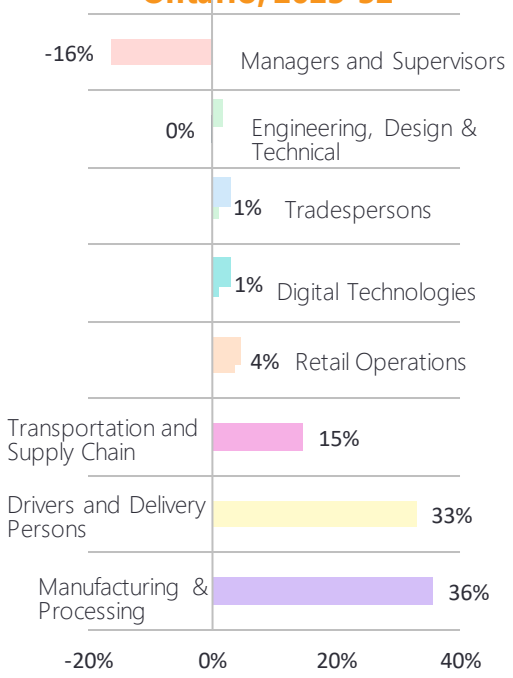
Source: Statistics Canada and Oxford Economics.

Labour Market Gap Outlook

Expected labour market gaps are presented for key occupation categories

- Occupational gaps in the automotive and mobility sector are expressed as a share of projected employment growth.
- Positive occupational gaps are expected in manufacturing and processing, drivers and delivery persons, and transportation and supply chain roles.
- Low occupational gaps are expected in managers and supervisors category.

Expected Occupational Gaps, Ontario, 2023-32



Labour Gap Outlook by Occupation Category, Ontario, 2023-32

High Occupational Gap

The highest occupation gaps indicate a potential shortage of workers. This means that to fulfill automotive and mobility sector demand for workers in these occupations, talent attraction and retention efforts may be required. Additionally, these occupations may absorb workers from low occupational gap categories through reskilling and upskilling opportunities.

Occupation Category	Top 10 Occupations with High Occupational Gap
	Motor vehicle assemblers, inspectors and testers
	Transport truck drivers
	Delivery and courier service drivers
	Couriers, messengers and door-to-door distributors
	Material handlers
	Computer programmers and interactive media developers
	Letter carriers
	Software engineers and designers
	Other labourers in processing, manufacturing and utilities
	Computer network technicians

Low Occupational Gap

Occupations with the lowest occupational gap indicate excess availability of workers in the labour market compared to what automotive and mobility employers demand. This points to the potential need for reskilling and/or upskilling for workers in these occupation so that they transition to in-demand occupations in the automotive and mobility sector.

Occupation Category	Top 10 Occupations with Low Occupational Gap
	Computer and information systems managers
	Automotive service technicians, truck and bus mechanics/repairers
	Information systems analysts and consultants
	Supervisors, motor vehicle assembling
	Manufacturing managers
	Construction millwrights and industrial mechanics
	Power engineers and power systems operators
	Electrical power line and cable workers
	Contractors and supervisors, mechanic trades
	Industrial electricians

Source: Statistics Canada, Vicinity Jobs. Note: The occupational gap in Ontario is expressed in terms of the number of workers for the timeframe of 2023-32.

Technical Skills Outlook

These technical skills are expected to be in-demand to mark ongoing digital transformations in the sector

Emerging Skills

Managers & Supervisors

Managerial roles increasingly require knowledge of digital tools and software, including ERP, Microsoft Vision, and project management software, among others. These tools will help managers to make data-driven decisions, automate business processes and increase operational efficiencies.

Manufacturing & Processing

With increased opportunities for automation, manufacturing and processing roles will require CAM and CNC skills to control machinery and equipment. Troubleshooting tasks are expected to be enhanced by using diagnostic software such as asTech.

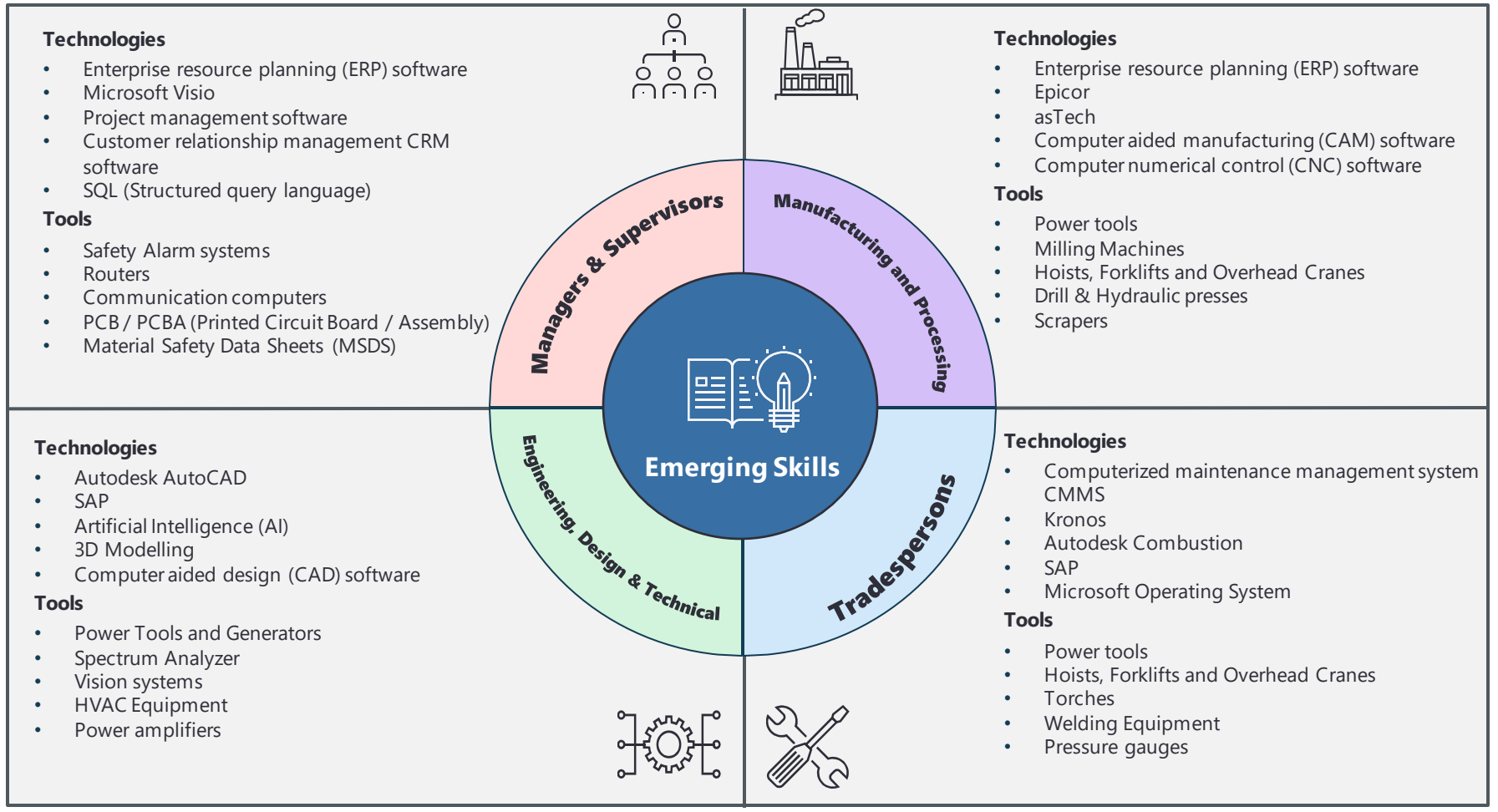
Engineering, Design & Technical

Engineers and graphic/technical designers are expected to use CAD and 3D modelling to develop complex designs and improve testing and performance. Knowledge of AI is required to develop autonomous vehicle technologies, improve safety, and optimize vehicle performance.

Tradespersons

Tradespersons are expected to use more digital solutions in their everyday tasks, including CMMS to organize maintenance activities, Kronos to manage scheduling, Autodesk to create and modify design, and SAP to manage production, supply chain, and logistics.

Emerging Technologies and Tools by Occupation Category



Source: Statistics Canada and Vicinity Jobs. Note: Emerging technical skills are identified based on occupational labour market outlook and skills requirements in job postings. Please see Appendix B for glossary of tools and technologies mentioned here.

Technical Skills Outlook *(continued)*

These technical skills are expected to be in-demand to mark ongoing digital transformations in the sector

Emerging Skills

Digital Technologies

Workers in digital technologies will need to be proficient in coding languages, AI, cloud computing to develop applications, automate tasks, develop autonomous vehicles and predictive maintenance systems. CAD knowledge will help to create and modify 3D designs.

Retail Operations

Retail operations roles are expected to be enhanced by digital transformation and, therefore, require workers to be familiar with software to manage sales, CRM, and inventory management. There tools are expected to improve supply chain and customer relationship management.

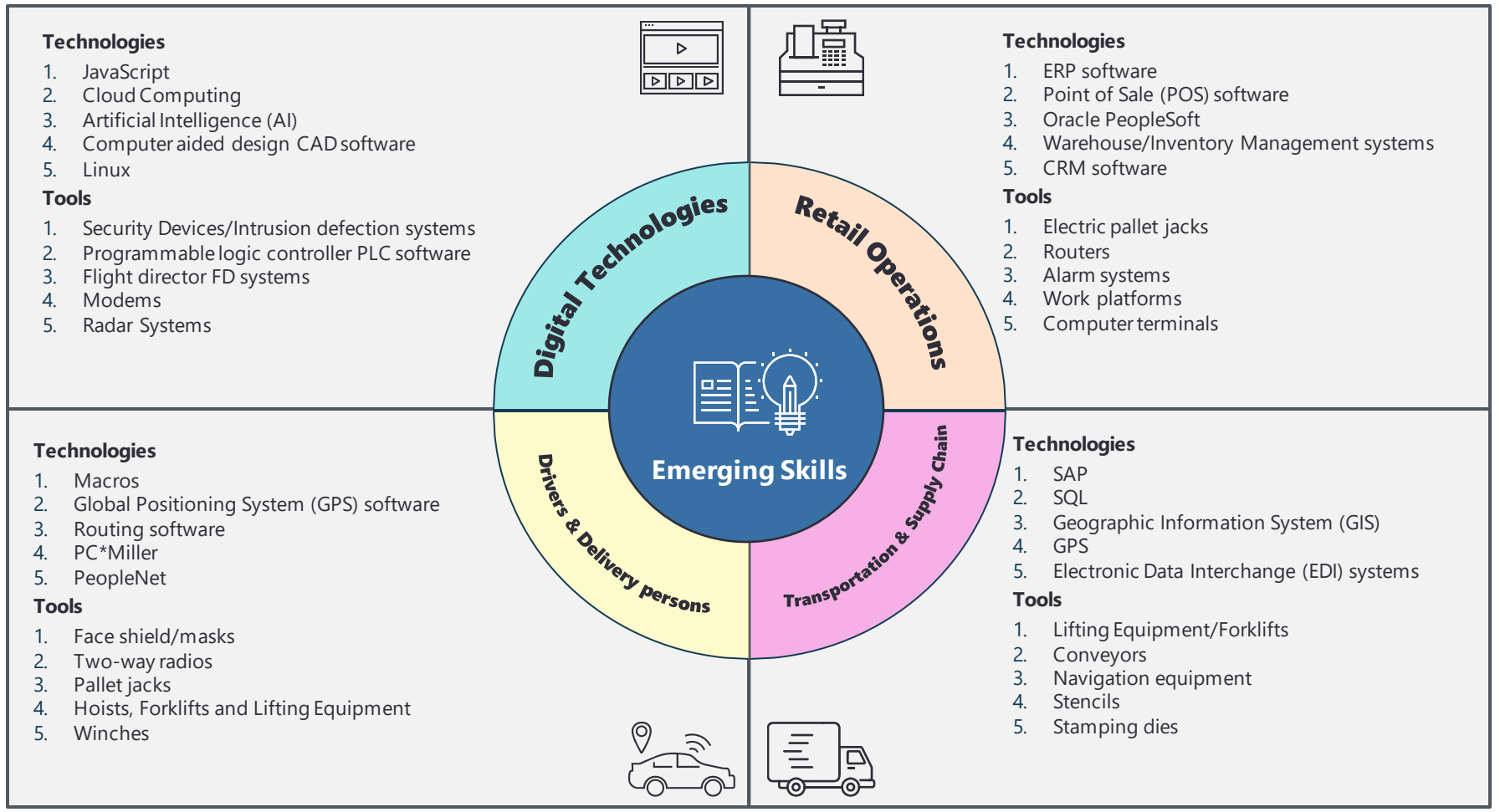
Drivers & Delivery persons

Drivers and delivery persons are expected to rely on digital tools such as GPS and routing software to optimize their routes, and fleet management systems (e.g., PeopleNet) to manage fleets.

Transportation & Supply Chain

Transportation and supply chain roles are expected to adopt digital and automation tools, including SAP to optimize supply chain processes, GIS and GPS to track shipments and optimize delivery routes, and adopt Electronic Data Interchange systems to streamline exchange of documents.

Emerging Technologies and Tools by Occupation Category



Digital Technologies

Technologies
1. JavaScript
2. Cloud Computing
3. Artificial Intelligence (AI)
4. Computer aided design CAD software
5. Linux

Tools
1. Security Devices/Intrusion defection systems
2. Programmable logic controller PLC software
3. Flight director FD systems
4. Modems
5. Radar Systems

Retail Operations

Technologies
1. ERP software
2. Point of Sale (POS) software
3. Oracle PeopleSoft
4. Warehouse/Inventory Management systems
5. CRM software

Tools
1. Electric pallet jacks
2. Routers
3. Alarm systems
4. Work platforms
5. Computer terminals

Drivers & Delivery persons

Technologies
1. Macros
2. Global Positioning System (GPS) software
3. Routing software
4. PC*Miller
5. PeopleNet

Tools
1. Face shield/masks
2. Two-way radios
3. Pallet jacks
4. Hoists, Forklifts and Lifting Equipment
5. Winches

Transportation & Supply Chain

Technologies
1. SAP
2. SQL
3. Geographic Information System (GIS)
4. GPS
5. Electronic Data Interchange (EDI) systems

Tools
1. Lifting Equipment/Forklifts
2. Conveyors
3. Navigation equipment
4. Stencils
5. Stamping dies

Source: Statistics Canada and Vicinity Jobs. Note: Emerging technical skills are identified based on occupational labour market outlook and skills requirements in job postings. Please see Appendix B for glossary of tools and technologies mentioned here.

4 Equity, Diversity, and Inclusion

Gender and Race Diversity in the Workforce

Gender and race diversity in the workforce is integral to building a successful automotive hub

An Inclusive Workforce

As the automotive and mobility sector advances, promoting inclusive economic opportunities and diversity in the workforce will be integral to talent and development of the future workforce. Increased participation of women, visible minorities and Indigenous groups will expand the pool of qualified talent in the labour market.

One way this can be achieved is through supporting underrepresented communities in their access to education and training opportunities, especially for STEM fields and technical skills training.

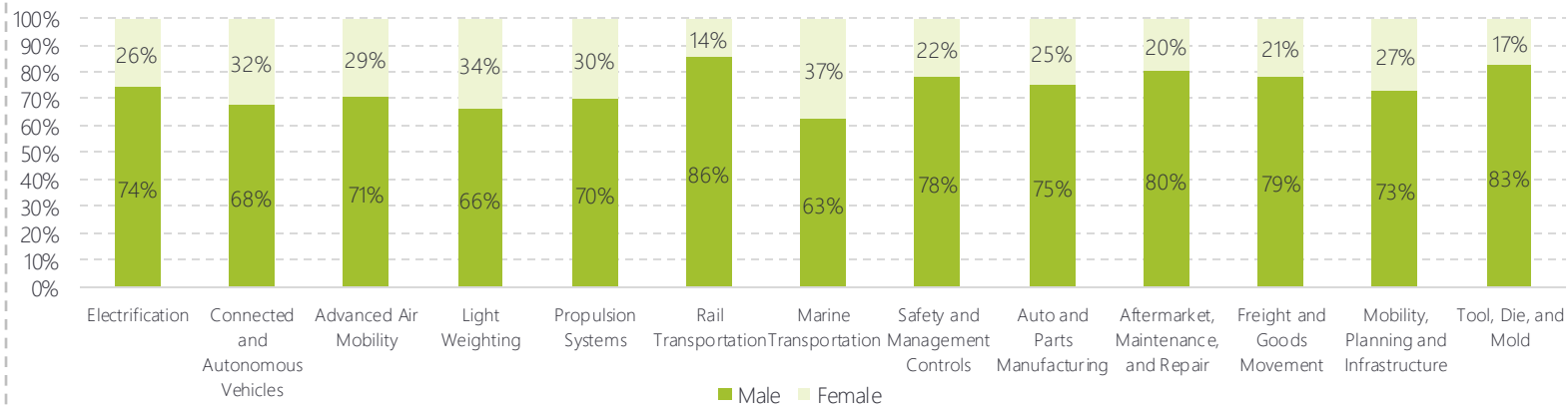
Gender Diversity

- **The share of female employment in the workforce in Ontario is 47%.** To that end, the share of female employment in all the segments of the automotive and mobility sector is lower than the average for Ontario's economy.
- Among the 13 segments of automotive and mobility sector illustrated in this report, female workforce representation is lowest for Rail Transportation and highest for Marine Transportation.

Race Diversity

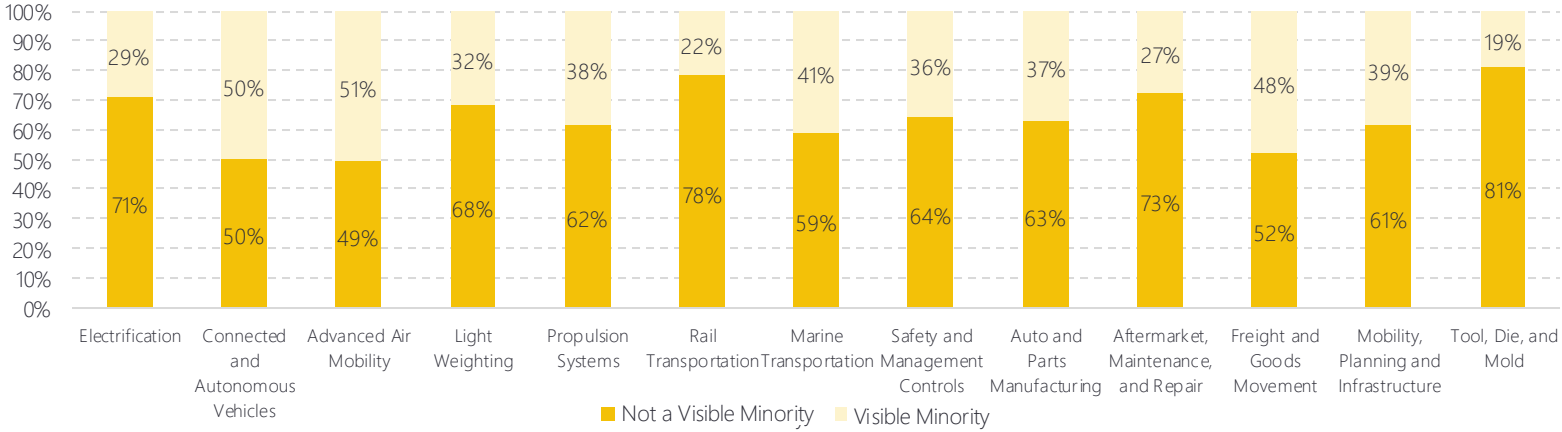
- **The share of employment of visible minorities across all industries in Ontario is 34%** while the share is **2% for Indigenous Peoples**.
- Among the 13 segments of automotive and mobility sector illustrated in this report, visible minority representation is lower than average for Electrification, Light Weighting, Rail Transportation, Aftermarket, Maintenance and Repair, and Tools, Die and Mold.

Share of Women in Employment, Ontario, 2021



Note: Detailed segment definitions are provided in the Appendix. Data for people with non-binary genders is not available at this level of granularity.

Share of Visible Minorities in Employment, Ontario, 2021



Note: Detailed segment definitions are provided in the Appendix. Visible minorities are defined as persons, other than Aboriginal peoples, who are non-Caucasian in race.

Source: Statistics Canada, PSIS

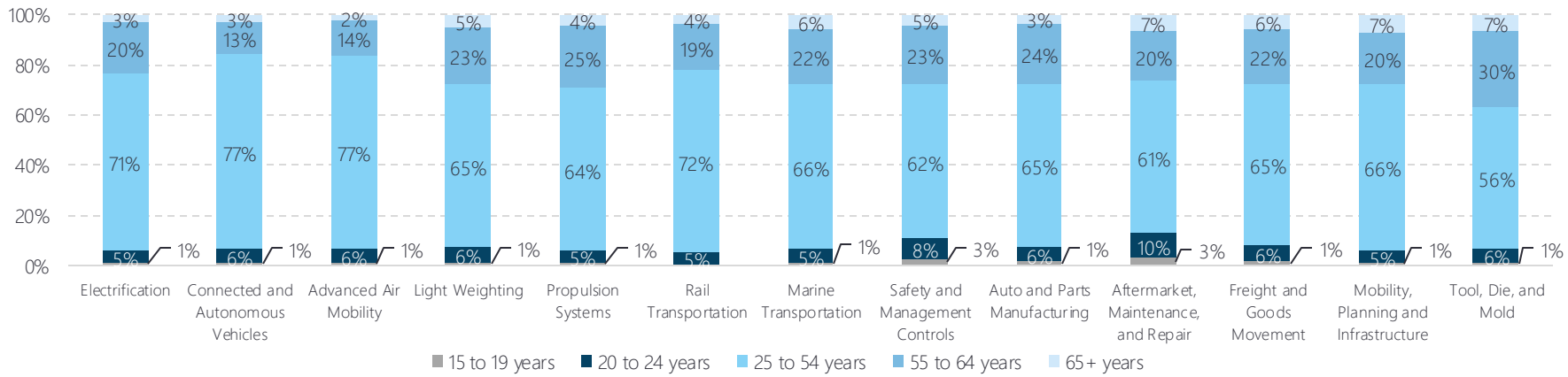
Youth and Persons with Disabilities in the Workforce

Representation of youth and persons with disabilities in imperative to creating an inclusive workforce

Youth Representation

- Among the 13 segments of the automotive and mobility sector illustrated in this report, workforce representation of those under 25 years old is low across all segments, signalling an opportunity to attract young talent.
- Through K-12 programs and work-integrated learning opportunities, attracting and training the youth for emerging skills will be another opportunity to expand the pool of qualified talent.

Employment by Age Group, Ontario, 2021



Note: Detailed segment definitions are provided in the Appendix.

24.1%

of Ontarians over the age of 15 identify as disabled

22% male

26% female

Highest Employment Share, Persons with Disabilities	
Occupation Group	Share
Trades, transport and equipment operators and related occupations	15.1%
Management occupations	12.1%
Occupations in manufacturing and utilities	4.4%

Highest Employment Share, Persons with Disabilities	
Sector Group	Share
Retail and Wholesale trade	13.9%
Manufacturing	9.2%
Transportation and warehousing	5.0%

Persons with Disabilities

According to the 2019 Canadian Survey on Disability, the unemployment rate for persons with disabilities is 9.8%. This gap can be minimized in the automotive and mobility sector through:

- Job modifications for persons with disabilities
- Increase and encourage uptake of STEM education amongst persons with disabilities and explore assisted learning opportunities
- Offer technical skills training with appropriate accommodations for persons with disabilities.

Sample job modifications for adults with disabilities

Job Redesign | Reduced Work Hours | Technical Aids | Modified and/or Ergonomic Work Station

MARCH OF DIMES CANADA

March of Dimes Canada offers various digital learning programs on in-demand information and communications technology skills to prepare those with disabilities for the job market, along with career coaching and job placement assistance.

Sources: Canadian Survey on Disability, Statistics Canada.

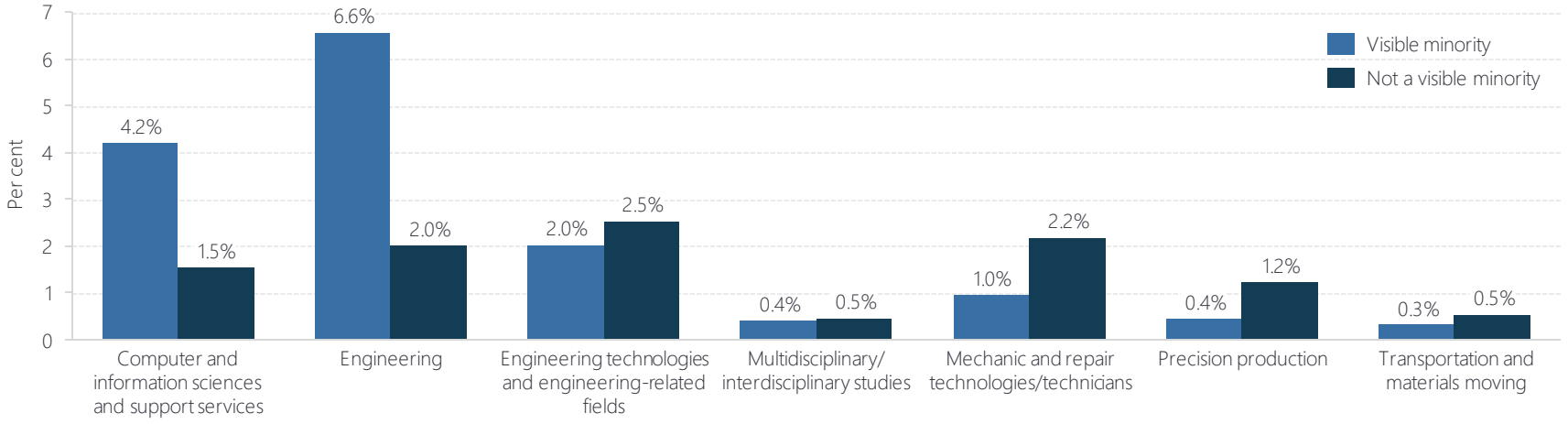
Equity, Diversity, and Inclusion Snapshot

Improving representation of minorities in STEM fields will expand the qualified workforce

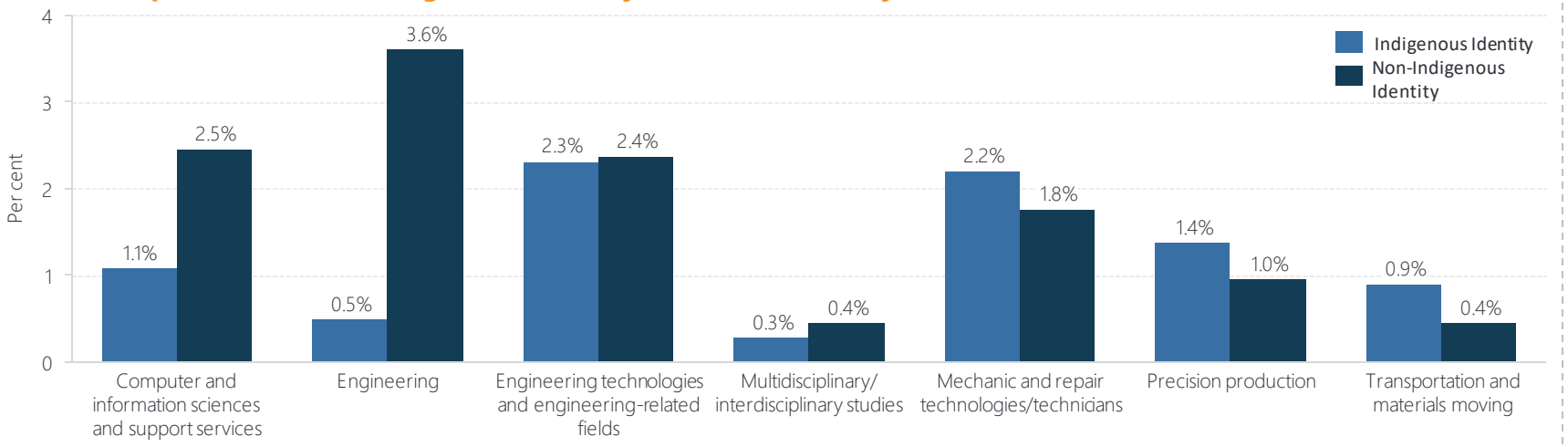
The visible minority and Indigenous educational attainment figures represent the educational attainment in the overall Ontario's labour force.

- The share of total visible minority with postsecondary degrees in the major fields of study is lower than the share of non-visible minority population, with the exception of the computer related and engineering field, which were 2.7% and 4.6% higher, respectively.
    - In general, the Black population has significantly lower educational attainment than the other minorities, whereas South and West Asian minorities show the highest.
- The share of Indigenous peoples with postsecondary degrees in major fields of study considered is lower than the share of Non-Indigenous population.
- The fields of mechanic and repair technologies and technicians, precision production, along with transportation and materials moving are the fields in which the proportion of Indigenous population is greater than in the Non-Indigenous population.
    - The fields of computer related and engineering show a much greater proportion of Non-Indigenous population pursuing degrees in the field, in comparison to the Indigenous Population.

Representation of Visible Minorities in Labour Force by Educational Attainment, Ontario, 2021



Representation of Indigenous Identity in Labour Force by Educational Attainment, Ontario, 2021



Source: Statistics Canada, Census 2021. Note: Indigenous identity refers to whether the person identified with the Indigenous peoples of Canada.

Equity, Diversity, and Inclusion Snapshot *(continued)*

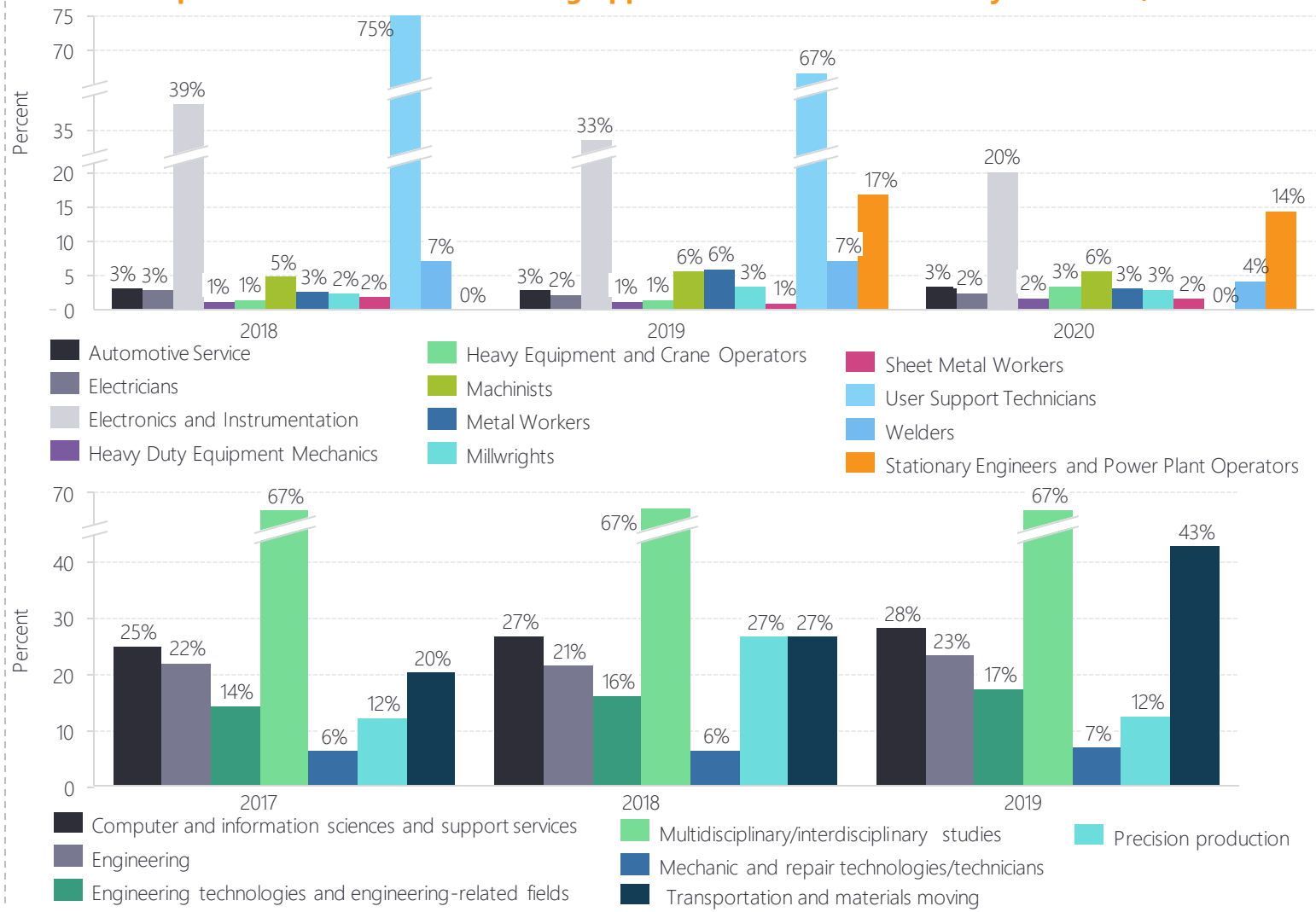
Improving representation of women in STEM fields will expand the qualified workforce

Gender diversity in education is analyzed across segments in the automotive and mobility sector:

- In 2019, women accounted for approximately **two thirds** of all postsecondary graduates in multidisciplinary and interdisciplinary studies and over 40% in the transportation and moving field.
- Between 2017 and 2019, there has been a steady increase in female representation across all fields selected, noting **a substantial increase in the transportation and materials moving sector**, growing from 20% to 43%.

Postsecondary Graduates (Ontario)			
		2018	2019
Computer and information sciences and support services	*Male*	6,957	8,493
	Female	2,535	3,306
Engineering	*Male*	9,504	10,095
	Female	2,580	3,039
Engineering technologies and engineering-related fields	*Male*	9,963	11,418
	Female	1,899	2,382
Multidisciplinary/ interdisciplinary studies	*Male*	1,764	1,869
	Female	3,588	3,756
Mechanic and repair technologies/technicians	*Male*	2,496	2,940
	Female	171	216
Precision production	*Male*	1,206	1,296
	Female	435	183
Transportation and materials moving	*Male*	366	420
	Female	132	312

Representation of Women Among Apprentices and Post Secondary Graduates, Ontario



Source: Statistics Canada, RAIS; Canadian Apprenticeship Forum (2016) "Women and Apprenticeship in Canada", PSIS. Data for people with non-binary genders is not available at this level of granularity.

5 Talent and Workforce Development

Talent and Workforce Development

Shaping the future workforce synchronously with sectoral transformations require an integrated framework

Key Labour Market Trends

1. Technological disruptions and market volatility require greater resilience in the talent development embedded in the automotive and mobility sector.
2. Acute demand can be expected in Ontario in three broad areas: computer programmers and software developers, assemblers and testers, and truck drivers.
3. Future skills requirements reveal the importance of digital skills in AI, design and automation in manufacturing processes.
4. An integrated approach is required for talent and workforce development for the future of the automotive and mobility sector.

Elements of Approach for Talent and Workforce Development

Education

There is a greater need for high-skilled labour and new graduates in technology-focused occupations, including software and computer engineering. Additionally, University education requirements by employers have declined since 2018, while there is greater demand for on-the-job training.

Training

Apprenticeships and work-integrated learning in the automotive sector help to gain hands-on experience and training. For various automotive trades, uptake of apprenticeships have been declining both for Canada and Ontario, but there is growing demand for it in the sector.

Reskilling/Upskilling

Technological disruptions indicate that as the sector evolves, skill requirements change with it and displaced workers can be absorbed back into the sector through reskilling and/or upskilling programs.

Diversity

Improving representation of women, visible minorities, and Indigenous people in STEM fields will provide employers with qualified workers, helping to address skill gaps. This will also strengthen the sector's diversity and inclusion efforts underscoring talent and workforce strategies.

Talent and Workforce Development

Ontario is home to a variety of programs to equip the future workforce with the required qualifications

Presented below is a sample of programs and tools in Ontario and across Canada, available to support potential workers in the automotive and mobility sector to acquire the necessary knowledge and training needed for the emerging technologies and tools shaping the sector. Outlined below is a selection of training and education programs available in Ontario and Canada.

Apprenticeship Programs

Skilled Trades Ontario

The Automotive Service Technician program consists of three different curriculum levels aimed at the repair and service sector. It is administered by the Minister of Labour, Immigration, Training and Skills Development.

OYAP – Ontario Youth Apprenticeship Program

The Automotive Service Technician program is aimed at youth with Grade 12 education and higher, and involves 6,500 hours of training and 8 week in-class training sessions with focus on maintenance and repair.

Upskilling and Reskilling Programs

George Brown College

The EV Technician Program is a training program that intends to teach skills in the diagnosis, service, and repair of high voltage EVs and commercial charging stations.

APMA – Lead. Reach. Connect.

The Automotive Parts Manufacturer's Association offers the DRIVEN Digital Learning Program, which is an online learning platform that offers certifications and courses for current and new workers in the sector.

Online Courses and Micro Credentials

McMaster University

The McMaster Manufacturing Research Institute Industrial Training Program is an educational program with the aim of training individuals in the core areas of advanced manufacturing, including processes, material characterization, and sector.

I-CAR

I-CAR's collision repair sector Gold and Platinum certifications are a sector standard recognition for collision repair professionals who have achieved and maintained the highest levels of role-relevant training.

Work-integrated Learning

OntarioTech University

The Automotive Engineering Co-op and Internship program focuses on the design and manufacturing of automobiles, components, and assemblies. Students enrolled in this program have had placements in Tesla, GM, Siemens, BMW Group and others.

Centennial College

The Automotive Service Technician Co-op program provides technician training, with an 8-month work placement. Program partners are Trillium Automobile Dealers Association and Fiat Chrysler Automobiles.

Career Development Tools

Government of Canada

Job Bank

Online resource that provides job seekers access to a wide range of job opportunities in Canada. It also offers resources to support with career planning, resume writing, and job search strategies.

Skills & Career Navigator

Comprehensive resource offering detailed information pertinent to a range of audience, outlining current and forthcoming sector transformations, skills needs, career and learning pathways, etc.

Talent and Workforce Development

Organizations in Canada and across the world are developing policies and programs to improve EDI

Select Programs in Ontario and Canada

APMA – The Automotive Parts Manufacturers' Association hosts the EDI fund, which is designed to support employers and community partners in building, attracting and developing a diverse talent pipeline.

Future Skills Centre – The Future Skills Centre issued the Risking Skills project which explores barriers to upskilling and reskilling, including financial and age-related challenges, and suggest ways to strengthen training in the sector.

AIA Canada – The Automotive Industries Association of Canada holds the annual Women in Auto Care Leadership Conference, which serves to connect, empower and mentor women in the auto care industry.

Select Programs Globally

Women of Electric Vehicles – The Women of EVs is a global space which allows women to share ideas, resources, and strategies in order to become better leaders and innovators in electrification.

UITP Advancing Public Transport – The International Association of Public Transport organizes an online training on Diversity and Inclusion in Public Transport, which allow for public transport staff understand EDI in the context of transportation.

CADIA Center for Automotive Diversity, Inclusion & Advancement – The Center for Automotive Diversity, Inclusion and Advancement is an organization that was born with the purpose of creating avenues of success for people of all diversity dimensions in the automotive sector.

Opportunities to Improve EDI

Fostering a Culture of Diversity and Inclusion

Companies in the sector can seek to create an inclusive workforce by promoting internal policies, allowing for current and potential workers to feel included regardless of their background or gender.

Engaging with Indigenous Communities

Stakeholders in the industry may seek engage with Indigenous communities to promote greater diversity, incorporate Indigenous knowledge and perspectives, as well as build and improve relations.

Advocating for Equal Opportunity Policies

A key for EDI promotion is to create consciousness and advocate to local and national authorities for legislature and policy to allow for equal advancement opportunities and treatment.

Opportunities to Increase Women's Representation in the Automotive and Mobility Sector

Providing Women with Information Platforms

Stakeholders can support this by developing information materials and creating educational partnerships so that women may have accessible knowledge of open opportunities in the field.

Addressing Women Turnover Rate

Companies can implement internal policies to support an inclusive workforce for women where working conditions and advancement opportunities are fair and equitable regardless of gender.

Promoting Women in Leadership Positions

Companies in the field can make an active effort to promote women's representation in leadership positions across all levels, ensuring a platform for women's advocacy in the workplace.

About OVIN

Leading Ontario's Automotive and Mobility Transformation

The automotive sector is undergoing a significant shift, with technological advances and evolving mobility preferences redefining its future.

OVIN, led by the Ontario Centre of Innovation (OCI), is supported by the Government of Ontario's Ministry of Economic Development, Job Creation and Trade (MEDJCT), Ministry of Labour, Immigration, Training and Skills Development (MLITSD) and Ministry of Transportation (MTO). Through OVIN, Ontario is at the forefront of major sectoral trends in electrification, automation, and digital transformation. OVIN capitalizes on the economic potential of advanced automotive technologies and smart mobility solutions such as connected and autonomous vehicles, and electric and low-carbon vehicle technologies, while enabling the province's transportation and infrastructure networks to plan for and adapt to this evolution.

OVIN is accelerating the development and commercialization of next generation electric, connected and autonomous vehicle and mobility technologies and supporting Ontario's role as the manufacturing hub of Canada, while leveraging critical minerals development in Ontario's North.

OVIN has five main objectives:

1. Foster the commercialization of Ontario-made advanced automotive technologies and smart mobility solutions
2. Showcase the Province of Ontario as the leader in the development, testing, piloting and adoption of the latest transportation and infrastructure technologies
3. Drive innovation and collaboration among stakeholders at the convergence of automotive and technology
4. Leverage and retain Ontario's highly skilled talent, and prepare Ontario's workforce for jobs of the future in the automotive and mobility sectors
5. Harness the Province of Ontario's regional strengths and capabilities, and bridge its automotive and technology clusters to promote the development of EV and power train technologies in Ontario

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Appendix A: Automotive and Mobility Segment Definitions

Appendix A: Segment Definitions

Electrification

Industries

1. Metal ore mining (NAICS 2122)
2. Electric power generation, transmission and distribution (NAICS 2211)
3. Basic chemical manufacturing (NAICS 3251)
4. Non-ferrous metal (except aluminum) production and processing (NAICS 3314)
5. Semiconductor and other electronic component manufacturing (NAICS 3344)
6. Electrical equipment manufacturing (NAICS 3353)
7. Other electrical equipment and component manufacturing (NAICS 3359)
8. Computer and communications equipment and supplies merchant wholesalers (NAICS 4173)
9. Remediation and other waste management services (NAICS 5629)

Occupations

Engineering & Technical

1. Mechanical engineers (NOC 2132)
2. Electrical and electronics engineers (NOC 2133)
3. Electrical and electronics engineering technologists and technicians (NOC 2241)

Digital Technologies

1. Computer and information systems managers (NOC 0213)
2. Information systems analysts and consultants (NOC 2171)
3. Software engineers and designers (NOC 2173)
4. Computer programmers and interactive media developers (NOC 2174)

Tradespersons

1. Power system electricians (NOC 7243)
2. Electrical power line and cable workers (NOC 7244)
3. Construction millwrights and industrial mechanics (NOC 7311)
4. Power engineers and power systems operators (NOC 9241)
5. Electronics assemblers, fabricators, inspectors and testers (NOC 9523)
6. Other labourers in processing, manufacturing and utilities (NOC 9619)

Connected and Autonomous Vehicles

Industries

1. Communications equipment manufacturing (NAICS 3342)
2. Navigational, measuring, medical and control instruments manufacturing (NAICS 3345)
3. Other transportation equipment manufacturing (NAICS 3369)
4. Specialized design services (NAICS 5414)
5. Computer systems design and related services (NAICS 5415)

Occupations

Retail Operations

1. Business development officers and marketing researchers and consultants (NOC 4163)

Engineers

1. Electrical and electronics engineers (NOC 2133)
2. Computer engineers (except software engineers and designers) (NOC 2147)
3. Software engineers and designers (NOC 2173)

Digital Technologies

1. Computer and information systems managers (NOC 0213)
2. Information systems analysts and consultants (NOC 2171)
3. Computer programmers and interactive media developers (NOC 2174)
4. Web designers and developers (NOC 2175)
5. Computer network technicians (NOC 2281)
6. User support technicians (NOC 2282)

Appendix A: Segment Definitions

Advanced Air Mobility

Industries

1. Communications equipment manufacturing (NAICS 3342)
2. Navigational, measuring, medical and control instruments manufacturing (NAICS 3345)
3. Aerospace product and parts manufacturing (NAICS 3364)
4. Non-scheduled air transportation (NAICS 4812)
5. Wired and wireless telecommunications carriers (except satellite) (NAICS 5172)
6. Computer systems design and related services (NAICS 5415)

Occupations

Managers and Supervisors

1. Computer and information systems managers (NOC 0213)
2. Manufacturing managers (NOC 0911)

Digital Technologies

1. Information systems analysts and consultants (NOC 2171)
2. Software engineers and designers (NOC 2173)
3. Computer programmers and interactive media developers (NOC 2174)
4. Computer network technicians (NOC 2281)

Engineering & Technical

1. Mechanical engineers (NOC 2132)
2. Aerospace engineers (NOC 2146)
3. Aircraft mechanics and aircraft inspectors (NOC 7315)

Tradespersons

1. Welders and related machine operators (NOC 7237)
2. Material handlers (NOC 7452)
3. Aircraft assemblers and aircraft assembly inspectors (NOC 9521)
4. Other labourers in processing, manufacturing and utilities (NOC 9619)

Light Weighting

Industries

1. Metal ore mining (NAICS 2122)
2. Resin, synthetic rubber, and artificial and synthetic fibres and filaments manufacturing (NAICS 3252)
3. Plastic product manufacturing (NAICS 3261)
4. Alumina and aluminum production and processing (NAICS 3313)
5. Machine shops, turned product, and screw, nut and bolt manufacturing (NAICS 3327)
6. Specialized design services (NAICS 5414)
7. Remediation and other waste management services (NAICS 5629)

Occupations

Design & Technical

1. Graphic designers and illustrators (NOC 5241)
2. Construction millwrights and industrial mechanics (NOC 7311)

Managers and Supervisors

1. Manufacturing managers (NOC 0911)
2. Supervisors, plastic and rubber products manufacturing (NOC 9214)

Manufacturing & Processing

1. Machinists and machining and tooling inspectors (NOC 7231)
2. Tool and die makers (NOC 7232)
3. Welders and related machine operators (NOC 7237)
4. Material handlers (NOC 7452)
5. Machining tool operators (NOC 9417)
6. Plastics processing machine operators (NOC 9422)
7. Motor vehicle assemblers, inspectors and testers (NOC 9522)
8. Plastic products assemblers, finishers and inspectors (NOC 9535)
9. Labourers in rubber and plastic products manufacturing (NOC 9615)
10. Other labourers in processing, manufacturing and utilities (NOC 9619)

Appendix A: Segment Definitions

Propulsion Systems

Industries

1. Boiler, tank and shipping container manufacturing (NAICS 3324)
2. Engine, turbine and power transmission equipment manufacturing (NAICS 3336)
3. Motor vehicle parts manufacturing (NAICS 3363)
4. Electrical, plumbing, heating and air-conditioning equipment and supplies merchant wholesalers (NAICS 4161)
5. Other machinery, equipment and supplies merchant wholesalers (NAICS 4179)

Occupations

Engineering & Technical

1. Computer and information systems managers (NOC 0213)
2. Manufacturing managers (NOC 0911)

Manufacturing

1. Manufacturing managers (NOC 0911)
2. Machinists and machining and tooling inspectors (NOC 7231)
3. Tool and die makers (NOC 7232)
4. Welders and related machine operators (NOC 7237)
5. Material handlers (NOC 7452)
6. Metalworking and forging machine operators (NOC 9416)
7. Machining tool operators (NOC 9417)
8. Motor vehicle assemblers, inspectors and testers (NOC 9522)
9. Other labourers in processing, manufacturing and utilities (NOC 9619)

Rail Transportation

Industries

1. Rail transportation (NAICS 4821)
2. Other transit and group passenger transportation (NAICS 4859)

Occupations

Managers and Supervisors

1. Managers in transportation (NOC 0731)
2. Supervisors, supply chain, tracking and scheduling co-ordination occupations (NOC 1215)
3. Contractors and supervisors, heavy equipment operator crews (NOC 7302)
4. Supervisors, railway transport operations (NOC 7304)

Technical

1. Industrial electricians (NOC 7242)
2. Heavy-duty equipment mechanics (NOC 7312)
3. Railway carmen/women (NOC 7314)
4. Railway and yard locomotive engineers (NOC 7361)

Tradespersons

1. Material handlers (NOC 7452)
2. Heavy equipment operators (except crane) (NOC 7521)
3. Railway yard and track maintenance workers (NOC 7531)
4. Railway and motor transport labourers (NOC 7622)

Transportation

1. Railway traffic controllers and marine traffic regulators (NOC 2275)
2. Ground and water transport ticket agents, cargo service representatives and related clerks (NOC 6524)
3. Railway conductors and brakemen/women (NOC 7362)
4. Bus drivers, subway operators and other transit operators (NOC 7512)

Appendix A: Segment Definitions

Marine Transportation

Industries

1. Boiler, tank and shipping container manufacturing (NAICS 3324)
2. Navigational, measuring, medical and control instruments manufacturing (NAICS 3345)
3. Ship and boat building (NAICS 3366)
4. Deep sea, coastal and Great Lakes water transportation (NAICS 4831)
5. Inland water transportation (NAICS 4832)
6. Support activities for water transportation (NAICS 4883)
7. Freight transportation arrangement (NAICS 4885)

Occupations

Design

1. Architectural technologists and technicians (NOC 2251)
2. Drafting technologists and technicians (NOC 2253)

Engineering & Technical

1. Engineering managers (NOC 0211)
2. Civil engineers (NOC 2131)
3. Mechanical engineers (NOC 2132)
4. Electrical and electronics engineers (NOC 2133)
5. Civil engineering technologists and technicians (NOC 2231)
6. Electrical and electronics engineering technologists and technicians (NOC 2241)

Tradespersons

1. Longshore workers (NOC 7451)
2. Material handlers (NOC 7452)
3. Boat assemblers and inspectors (NOC 9531)

Transportation

1. Managers in transportation (NOC 0731)
2. Dispatchers (NOC 1525)
3. Deck officers, water transport (NOC 2273)
4. Engineer officers, water transport (NOC 2274)
5. Railway traffic controllers and marine traffic regulators (NOC 2275)
6. Water transport deck and engine room crew (NOC 7532)
7. Boat and cable ferry operators and related occupations (NOC 7533)

Safety Management and Controls

Industries

1. Other leather and allied product manufacturing (NAICS 3169)
2. Electrical equipment manufacturing (NAICS 3353)
3. Motor vehicle parts manufacturing (NAICS 3363)
4. Automotive repair and maintenance (NAICS 8111)

Occupations

Engineering & Technical

1. Mechanical engineers (NOC 2132)
2. Electrical and electronics engineers (NOC 2133)
3. Industrial and manufacturing engineers (NOC 2141)
4. Metallurgical and materials engineers (NOC 2142)
5. Mechanical engineering technologists and technicians (NOC 2232)
6. Industrial engineering and manufacturing technologists and technicians (NOC 2233)
7. Non-destructive testers and inspection technicians (NOC 2261)
8. Automotive service technicians, truck and bus mechanics and mechanical repairs (NOC 7321)

Tradespersons

1. Material handlers (NOC 7452)
2. Other automotive mechanical installers and servicers (NOC 7535)
3. Rubber processing machine operators and related workers (NOC 9423)
4. Motor vehicle assemblers, inspectors and testers (NOC 9522)

Appendix A: Segment Definitions

Auto and Parts Manufacturing

Industries

1. Spring and wire manufacturing (NAICS 3326)
2. Metalworking machinery manufacturing (NAICS 3335)
3. Semiconductor and other electronic component manufacturing (NAICS 3344)
4. Electrical equipment manufacturing (NAICS 3353)
5. Other electrical equipment and component manufacturing (NAICS 3359)
6. Motor vehicle manufacturing (NAICS 3361)
7. Motor vehicle body and trailer manufacturing (NAICS 3362)
8. Motor vehicle parts manufacturing (NAICS 3363)

Occupations

Managers & Supervisors

1. Manufacturing managers (NOC 0911)
2. Supervisors, motor vehicle assembling (NOC 9221)
3. Supervisors, electronics manufacturing (NOC 9222)
4. Supervisors, electrical products manufacturing (NOC 9223)
5. Supervisors, furniture and fixtures manufacturing (NOC 9224)
6. Supervisors, other mechanical and metal products manufacturing (NOC 9226)
7. Supervisors, other products manufacturing and assembly (NOC 9227)

Engineering & Technical

1. Mechanical engineers (NOC 2132)
2. Electrical and electronics engineers (NOC 2133)
3. Industrial and manufacturing engineers (NOC 2141)
4. Metallurgical and materials engineers (NOC 2142)
5. Mechanical engineering technologists and technicians (NOC 2232)
6. Industrial engineering and manufacturing technologists and technicians (NOC 2233)
7. Electrical and electronics engineering technologists and technicians (NOC 2241)
8. Industrial instrument technicians and mechanics (NOC 2243)

Occupations

Tradespersons

1. Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations (NOC 7201)
2. Machinists and machining and tooling inspectors (NOC 7231)
3. Welders and related machine operators (NOC 7237)
4. Industrial electricians (NOC 7242)
5. Construction millwrights and industrial mechanics (NOC 7311)

Manufacturing

1. Machining tool operators (NOC 9417)
2. Motor vehicle assemblers, inspectors and testers (NOC 9522)
3. Electronics assemblers, fabricators, inspectors and testers (NOC 9523)
4. Mechanical assemblers and inspectors (NOC 9526)
5. Plastic products assemblers, finishers and inspectors (NOC 9535)
6. Industrial painters, coaters and metal finishing process operators (NOC 9536)
7. Other labourers in processing, manufacturing and utilities (NOC 9619)

Appendix A: Segment Definitions

Aftermarket, Maintenance and Repair

Industries

1. Motor vehicle merchant wholesalers (NAICS 4151)
2. New motor vehicle parts and accessories merchant wholesalers (NAICS 4152)
3. Used motor vehicle parts and accessories merchant wholesalers (NAICS 4153)
4. Automobile dealers (NAICS 4411)
5. Automotive parts, accessories and tire stores (NAICS 4413)
6. Automotive repair and maintenance (NAICS 8111)

Occupations

Retail Operations

1. Retail and wholesale trade managers (NOC 0621)
2. Storekeepers and parts persons (NOC 1522)
3. Retail salespersons (NOC 6421)

Engineering & Technical

1. Mechanical engineering technologists and technicians (NOC 2232)
2. Electrical and electronics engineering technologists and technicians (NOC 2241)
3. Industrial instrument technicians and mechanics (NOC 2243)
4. Information systems testing technicians (NOC 2283)

Tradespersons

1. Contractors and supervisors, mechanic trades (NOC 7301)
2. Automotive service technicians, truck and bus mechanics and mechanical repairers (NOC 7321)
3. Other automotive mechanical installers and servicers (NOC 7535)

Freight and Goods Movement

Industries

1. General freight trucking (NAICS 4841)
2. Specialized trucking (NAICS 4842)
3. Postal service (NAICS 4911)
4. Couriers (NAICS 4921)
5. Local messengers and local delivery (NAICS 4922)

Occupations

Managers & Supervisors

1. Managers in transportation (NOC 0731)
2. Supervisors, supply chain, tracking and scheduling co-ordination occupations (NOC 1215)

Delivery persons

1. Mail, postal and related workers (NOC 1511)
2. Letter carriers (NOC 1512)
3. Couriers, messengers and door-to-door distributors (NOC 1513)

Supply Chain

1. Shippers and receivers (NOC 1521)
2. Dispatchers (NOC 1525)
3. Transportation route and crew schedulers (NOC 1526)
4. Material handlers (NOC 7452)

Drivers

1. Transport truck drivers (NOC 7511)
2. Delivery and courier service drivers (NOC 7514)

Appendix A: Segment Definitions

Mobility and Planning Infrastructure

Industries

1. Highway, street and bridge construction (NAICS 2373)
2. Urban transit systems (NAICS 4851)
3. Interurban and rural bus transportation (NAICS 4852)
4. Taxi and limousine service (NAICS 4853)
5. School and employee bus transportation (NAICS 4854)
6. Charter bus industry (NAICS 4855)
7. Other transit and ground passenger transportation (NAICS 4859)
8. Architectural, engineering and related services (NAICS 5413)
9. Scientific research and development services (NAICS 5417)

Occupations

Managers & Supervisors

1. Engineering managers (NOC 0211)
2. Architecture and science managers (NOC 0212)
3. Computer and information systems managers (NOC 0213)

Engineering

1. Civil engineers (NOC 2131)
2. Mechanical engineers (NOC 2132)
3. Electrical and electronics engineers (NOC 2133)

Digital Technologies

1. Information systems analysts and consultants (NOC 2171)
2. Database analysts and data administrators (NOC 2172)
3. Software engineers and designers (NOC 2173)
4. Computer network technicians (NOC 2181)
5. Information systems testing technicians (NOC 2183)

Infrastructure

1. Architects (NOC 2151)
2. Urban and land use planners (NOC 2153)
3. Civil engineering technologists and technicians (NOC 2231)
4. Drafting technologists and technicians (NOC 2253)

Transit

1. Bus drivers, subway operators and other transit operators (NOC 7512)
2. Taxi and limousine drivers and chauffeurs (NOC 7513)

Tool, Die and Mold

Industries

1. Foundries (NAICS 3315)

Occupations

Managers & Supervisors

1. Senior managers – construction, transportation, production and utilities (NOC 0016)
2. Manufacturing managers (NOC 0911)
3. Supervisors, mineral and metal processing (NOC 9211)
4. Supervisors, furniture and fixtures manufacturing (NOC 9224)
5. Supervisors, other mechanical and metal products manufacturing (NOC 9226)

Engineering & Technical

1. Mechanical engineers (NOC 2132)
2. Industrial and manufacturing engineers (NOC 2141)
3. Mechanical engineering technologists and technicians (NOC 2232)
4. Industrial engineering and manufacturing technologists and technicians (NOC 2233)
5. Electrical and electronics engineering technologists and technicians (NOC 2241)
6. Industrial instrument technicians and mechanics (NOC 2243)

Tradespersons

1. Contractors and supervisors, machining, metal forming, shaping and erecting trades and related occupations (NOC 7201)
2. Machinists and machining and tooling inspectors (NOC 7231)
3. Tool and die makers (NOC 7232)
4. Welders and related machine operators (NOC 7237)
5. Industrial electricians (NOC 7242)
6. Construction millwrights and industrial mechanics (NOC 7311)

Manufacturing & Processing

1. Machine operators, mineral and metal processing (NOC 9411)
2. Foundry workers (NOC 9412)
3. Inspectors and testers, mineral and metal processing (NOC 9415)
4. Machining tool operators (NOC 9417)
5. Labourers in mineral and metal processing (NOC 9611)

B Appendix B: Glossary of Tools, Equipment and Technologies

Appendix B: Glossary of Tools, Equipment and Technologies

- **3D Modelling:** Software that runs specialized programs for automating the manufacturing process, particularly the fabrication, assembly, and control aspects of manufacturing.
- **Artificial Intelligence (AI):** Artificial intelligence is the use of machines, tools and technologies to simulate human intelligence and automate tasks that typically required physical workers.
- **asTech:** asTech is a remote diagnostic tool used in collision shops by repair technicians, to scan the vehicle for issues before and after repair work.
- **Autodesk AutoCAD:** Software for designing various engineering, architectural, and industrial objects.
- **Autodesk Combustion:** Software for drawing, manipulating images, adding color, and using special effects for print or presentation programs.
- **Cloud Computing:** It is an on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user.
- **Computer aided design (CAD) software:** Software for designing various engineering, architectural, and industrial objects.
- **Computer aided manufacturing (CAM) software:** Software that runs specialized programs for automating the manufacturing process, particularly the fabrication, assembly, and control aspects of manufacturing.
- **Computer numerical control (CNC) software:** Software for controlling, configuring, and monitoring intelligent industrial control devices by operation from a computer or microprocessor.
- **Computerized maintenance management system CMMS:** Software for optimizing the resources of a company. This software offers built-in reporting capability for moves, assets, and space availability, C*Millerand can also schedule personnel relocation ahead of time. This software is often capable of much more and has provisions available for ad-hoc custom report generation to meet the unique needs of the company.
- **Customer relationship management CRM software:** Software for managing customer interactions.
- **Electronic Data Interchange (EDI) systems:** Software for integrating application data and processes.
- **Enterprise resource planning ERP software:** Software for enabling product planning and implementations.
- **Epicor:** Epicor software provides a wide range of solutions in the automotive sector, including enterprise resource planning, customer relationship management, supply chain management, and human capital management.
- **JavaScript:** JavaScript, often abbreviated as JS, is a programming language that conforms to the ECMAScript specification. JavaScript is high-level, often just-in-time compiled, and multi-paradigm. It has curly-bracket syntax, dynamic typing, prototype-based object-orientation, and first-class functions.
- **Kronos:** Kronos is a type of ERP software used for product planning and implementation.
- **Linux:** A free, open-source operating system, released under the GNU General Public License.
- **Macros:** An electronic data capture system for the collection and analysis of routing data.

Sources: National Center for O*NET Development.

Appendix B: Glossary of Tools, Equipment and Technologies

- **Material Safety Data Sheets (MSDS):** Software for providing tools and support documents that enable clients to effectively monitor, check, and correct essential areas of control. This software helps with achieving compliance with federal, state, standard, or local regulations devices.
- **Microsoft Operating System:** Software for providing the operation interface to the computer and providing higher-level services and application programming interfaces (APIs).
- **Microsoft Visio:** Microsoft Visio is a diagramming and vector graphics application and is part of the Microsoft Office family.
- **Milling Machines:** Milling is a machining process used in manufacturing processes.
- **Oracle PeopleSoft:** This is an ERP software for enabling product planning and implementations.
- **PC*Miller:** This is a routing, mileage and mapping software widely used in the transportation industry.
- **PCB / PCBA (Printed Circuit Board / Assembly):** Designing circuit boards and assembling them in engineering/industrial setting.
- **PeopleNet:** Software for fleet management for vehicle monitoring and other to supply chain management tasks.
- **Programmable logic controller PLC software:** A programmable logic controller (PLC) or programmable controller is an industrial digital computer that has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, robotic devices, or any activity that requires high reliability, ease of programming, and process fault diagnosis.
- **Project management software:** Software for assisting in the process of planning, organizing, staffing, directing, and controlling the production of a system.
- **Routing software:** Software for assisting the user in moving from one geography to another using a selected path or route.
- **SAP:** SAP, or Systems Applications and Products is a type of ERP software used for product planning and implementation.
- **Scrapers:** Scrapers are used in automotive manufacturing to remove the carbon deposited on the cylinder head, piston head, or other parts.
- **Spectrum Analyzer:** Spectrum analysers are used to measure electrical signals for frequency, power, distortion, etc.
- **SQL (Structured query language):** SQL is a domain-specific language used in programming and designed for managing data held in a relational database management system (RDBMS), or for stream processing in a relational data stream management system (RDSMS). It is particularly useful in handling structured data, i.e., data incorporating relations among entities and variables.
- **Vision systems:** Robotic systems with cameras and sensors that feeds information to the robot.
- **Warehouse/Inventory Management systems:** Software for maintaining the inventory of companies and restaurants. This software uses barcodes or unique ids for their inventory management system.
- **Winches:** A mechanical device, typically used for pulling and lifting.

Sources: National Center for O*NET Development.

C Appendix C:
Methodology and Data Limitations

Appendix C: Methodology and Data Limitations

Methodology

An overview of the methodology of the analysis is presented below:

- **Monthly job postings** were collected from Vicinity Jobs, a labour market analytics firm, at the level of occupations (4-digit NOC) and grouped into occupation categories based on the similarity of their roles within each segment of the automotive and mobility sector, including information regarding the education level and workforce characteristics (e.g., skills, knowledge, tools & technology) required in postings by occupation.
- **Skill gaps** were defined based on the average occurrence rate of a skill in job posting related to the segment and the average occurrence rate of the same skill in relevant job seeker profiles. Occurrence rate is the frequency or percentage of job postings that mention a given skill, tool, or technology, in relevant occupations. Skill gaps where demand exceeded supply are included in the report.
- **Occupational demand** is projected based on industry's forecasted growth as per Oxford Economics, in combination with expected changes in the demand for workers, including annual change in employment by occupation and replacement demand. Replacement demand is based on estimated rates of exit from the labour force due to retirement, emigration or death. Exit rates are based on the Canadian Occupational Projection System (COPS) data.
- **Occupational supply** is projected based on three distinct sources: school leavers (i.e. post-secondary graduates and apprenticeship completions), immigrants, and job changers (i.e. individuals currently in the workforce who may enter the sector).
- **Occupational labour gaps** were determined subtracting total projected supply from total projected demand across all forecast years (2023-2032). The skills outlook was based on occupational projections for a common set of skills available in both job postings (demand) and job seeker profiles (supply).

Data Limitations

Identified limitations with the datasets and approach used in the analysis include:

- The job posting are linked to occupations associated with the segment based on the National Occupational Classification (NOC) codes used by Statistics Canada. Additionally, it covers the period between January 2018 and June 2022. Due to the impact of the COVID-19 pandemic on the labour market the data during that period should be treated with caution.
- The job seeker profiles database covers only the period between September 2018 and February 2020. The relatively small sample size also means data trends should be treated with caution.
- Both the job posting and job seeker profiles databases include data from across Ontario, however, at the regional level the data is limited and may not provide reliable insights.
- The analysis of skills was limited by the availability and completeness of data. There were gaps in terms of job posting and job seeker profiles in Vicinity Jobs data, which means that the estimations of skills demand, supply, and gap should be considered as a ranking rather than a definitive estimation.
- Future skill insights were limited by the skills present in current state data from job posting and job seeker profiles, meaning "new" skills that are not related to occupations in the present could not be identified.
- The data used for the analysis of representation of women, visible minorities, and Indigenous groups in Ontario's employment by industry and by occupation is sourced from Statistics Canada's latest Census from 2021. While high level insights based on age and persons with disabilities is included, data for non-binary gender groups are not available at this level of granularity.