AVIN INSIGHTS
Skills and Talent Series

Spotlight
on Skills & Competencies

A brief guide to in-demand and emerging skills and competencies for the automotive and mobility sector in Ontario

Automotive and Parts Manufacturing edition*

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Introduction

Ontario is a world-leading jurisdiction in automotive and parts manufacturing and assembly. The province is home to five of the top global automakers – FCA, Ford, GM, Honda, and Toyota- and was ranked as North America's top automotive producing region in 2017.

The automotive production industry employs around 160,800 workers in Ontario across a wide range of occupations [1]. These occupations cover vehicle assembly, parts manufacturing and other supporting jobs related to material, metal and electronics production. Additionally, 19,300 workers are employed in automotive technology and research jobs related to connected and autonomous vehicles, vehicle safety, advanced manufacturing and artificial intelligence. Vehicles include cars, buses, trucks, and heavy equipment; fuel-powered, electric and hybrid.

Driven by insights from industry executives and primary research and labour market insights, some of the key technical knowledge areas and tools and non-technical skills that are in high demand by the industry employers in Ontario were identified.

As the automotive and parts manufacturing industry transitions to the low carbon economy and embraces advanced digital and automation technologies, a workforce with a broader mix of skills, training and experience will be required.

Some of these emerging skills include digital skills related to databases and file storage, knowledge of software for project management and electronic design. Additionally, as vehicles become increasingly clean and digitized there will be an emergence of skills related to cybersecurity, data analytics and battery and charging technologies.

In addition to this technical knowledge, what differentiates top talent are non-technical skills and abilities, such as communication skills, leadership, motivation, a continuous learning mindset, and a drive to solve problems.

About this Booklet

This booklet highlights **some** of the technical knowledge areas and tools and non-technical skills and abilities that are currently in-demand or forecast to grow in demand for the automotive and parts manufacturing industry.

This booklet is intended to be used as a high-level guide. It forms part of a spotlights series to cover more segments of the automotive and mobility sector. More information on the highlighted knowledge, tools, skills, and abilities may be found in the cited references and/or other relevant sources including other AVIN insights.

For each of the highlighted knowledge, tools, skills, and abilities, the urgency (in-demand vs. emerging) is indicated using the below graphic.

In-demand Skills that are intrinsic to the industry and have been and are still in-demand by employers

Emerging Skills that are emerging and increasingly becoming in demand by employers and are forecast to grow in demand (over the next 5-10 years)

Based on the Government of Canada's taxonomy[1], the following are definitions of knowledge, tools, skills and abilities as outlined in this booklet:

Knowledge: organized sets of information used for the execution of tasks and activities within a particular domain.

Tools and Technology: tools and technology used to perform tasks.

Skills: developed capacities that an individual must have to be effective in a job, role, function, task, or duty such as problem solving, time management, and working with others.

Abilities: innate and developed aptitudes that facilitate the acquisition of knowledge and skills to perform at work such as motivation, leadership, and continuous learning.

Technical Knowledge & Tools

This section highlights key technical knowledge and tools that are in-demand or emerging for the automotive and parts manufacturing industry. These are usually acquired through specialized training or education.

- Auto Parts
- Advanced Manufacturing
- Advanced Materials
- Battery Knowledge
- CNC Machining
- Computer Aided Design (CAD)
- Data Analytics
- Data Entry Software
- Database User Interface
- Enterprise Resource Planning
- Electronic Design
- HVAC
- Lean Manufacturing
- Lathe Machines
- Mechatronics
- Milling Machines
- Product Design
- Production Management
- Project Management
- Quality Control Analysis
- Supervisory Control and Data Acquisition
- Systems Engineering
- MATLAB
- Tools and Machines
- Troubleshooting
- Workplace Collaboration Tools
- 3D Printing

Auto Parts

In-demand

Automotive industry knowledge and understanding of automotive parts and components manufacturing processes. This covers engines, electrical/electronics, fuels, transmissions, drivelines, steering, suspension and brakes.

Advanced Manufacturing

Emerging

Knowledge and ability to apply advanced manufacturing techniques to support faster, more agile and more efficient processes through the use of automation technologies for consistent quality and productivity [2]. Some of the advanced manufacturing techniques include additive manufacturing, advanced materials, and robotics and automation.

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Advanced Materials

Emerging

Knowledge of production, integration or processing of new or improved materials that are capable of providing distinct advantage in terms of performance and efficiency when compared to conventional materials [3].

Battery Knowledge

Emerging

Knowledge of battery cell production and battery integration for all types of electric vehicles including battery electric vehicles (BEVs), fuel-cell electric vehicles (FCEVs), plug-in hybrid electric vehicle (PHEV), and full hybrid electric vehicle (HEV).

Fully Electric Vehicles

Fully electric vehicles (also known as all electric vehicles) have no combustion engine and are only powered through electric motors.

In **battery electric vehicles (BEVs)**, the electricity comes from a battery. Batteries in BEVs are charged from an external power supply, typically by plugging into the grid via an EV charger. All energy to run the vehicle comes from the rechargeable battery pack.

Fuel-cell electric vehicles (FCEVs) use fuel cells to power their onboard electric motor. Fuel cells in vehicles generate electricity by combining oxygen from the air and compressed hydrogen, which can be obtained from hydrogen fueling stations.

Hybrid Electric Vehicles

A hybrid electric vehicle contains both an internal combustion engine (ICE) and an electric engine.

The most popular form of hybrid vehicle is the **plug-in hybrid electric vehicle (PHEV)**. These vehicles can depend on their onboard battery to cover in-city traveling distances and can also switch to their combustion engine to cover long distances without worrying about electricity recharge. PHEVs can also have their batteries recharged via plugging into the power grid.

A **full hybrid electric vehicle (HEV)** is another form of hybrid vehicle that can run on a battery, an ICE, or a combination. HEV batteries can only be charged by on-board operations, not by plugging into the grid.

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CNC Machining

In-demand

Knowledge of computer numerical control (CNC) technology to operate a variety of manufacturing tools and equipment in the production of metal parts.

Machinists use precision measuring instruments to ensure accuracy and that the parts meet quality guidelines.

The process can be used to control a range of complex machinery, from grinders and lathes to mills and routers [4].

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Computer Aided Design

In-demand

Use of computer-aided design (CAD) software that architects, engineers, and construction professionals rely on to create precise 2D and 3D drawings of mechanical and electrical automotive components.

Examples of such software include Autodesk AutoCAD, Dassault Systemes SOLIDWORKS, PTC Creo Parametric and Bentley MicroStation.

Data Analytics

Emerging

Use of data analytics software for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision-making.

Data Entry Software

In-demand

Knowledge and use of data entry software that replaces inefficient and expensive manual data entry tasks with robust automated data entry processes.

This system provides tools to simplify the data ingestion processes including electronic forms, data validation, data cleaning, and data classification among others [5].

Enterprise Resource Planning

In-demand

Knowledge and use of enterprise resource planning (ERP) platforms that are used to integrate the management of main business processes, often in real time using a specific software and/or technology. An example of such software is SAP.

Database User Interface

Emerging

Use of database software programs used to create, edit, maintain and retrieve database files and records.

Electronic Design

Emerging

Designing, developing, testing and supervising the manufacturing of electrical equipment. Moreover, ability to use software tools for designing electronic systems (ex. Autodesk EAGLE) and equipment (ex. power generation equipment, communications systems, navigation systems, radar systems, and electric motors).

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HVAC

In-demand

Design, production and installation of vehicle heating, ventilation, and air conditioning (HVAC) systems and components including compressors, condensers, evaporators, pressure regulating devices, orifice tubes, thermal expansion valves, receiver-driers, and accumulators.

This requires knowledge of the principles of thermodynamics, fluid flow, and heat transfer and how they are utilized at different steps of the whole process in the HVAC system.

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Lean Manufacturing

Emerging

Knowledge and application of lean manufacturing methods to minimize waste without compromising productivity. This in turn will reduce operating costs and improve product quality and bring positive impacts on the environment through efficiency and reduction of both waste and emissions. .

With the growing interest in Industry 4.0 practices, more manufacturers are able to adopt lean manufacturing processes. As such, there is a growing need for talent that possess lean manufacturing knowledge and skills.

Lathe Machines

In-demand

Lathe machines are used to provide a specific design, shape and appearance to a workpiece. Using its rotating part, the lathe machine can perform different operations including cutting, drilling, grooving, and turning.

Lathe machines can be used to manufacture automotive parts like gearbox cases, engine cylinders and brake disks.

Lathe Machine

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Mechatronics

In-demand

Mechatronics combines the technologies of mechanics, pneumatics, hydraulics, electronics, information processing, basic electricity, and motor and motion control.

The ability to apply this knowledge in the assembly, manufacturing, maintenance and commissioning of automation machinery, products and production systems is sought after in the automotive and parts manufacturing industry.

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Milling Machines

In-demand

Use of milling machines to manufacture high precision products and parts in different shapes and sizes.

Milling *is a process performed with a machine in which the cutters rotate to remove the material from the work piece. With the help of the milling machines one can perform many operations and functions starting from small objects to large ones. [6].*

Product Design

In-demand

Preparing design sketches, detailed drawings, illustrations, or blueprints using drafting instrument and/or software for automotive parts and components. This includes knowledge of specifications and design standards where applicable.

Production Management

In-demand

Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacturing and distribution of goods.

Project Management

In-demand

Knowledge of planning and scheduling tools to develop schedules, assign resources to tasks, track progress and analyze workloads. Some examples of project management and scheduling tools include Microsoft Project and Primavera.

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Quality Control Analysis

In-demand

Conducting tests and inspections of products, services, or processes to evaluate quality or performance.

Quality control in automotive allows Original Equipment Manufacturers (OEMs) to identify any mechanical problems and other details in the design or the production of automotive components that can be improved; in their performance, efficiency and safety.

Supervisory Control & Data Acquisition

In-demand

Use of a supervisory control and data acquisition (SCADA) systems. SCADA generally refers to an industrial computer system that monitors and controls a process and includes software and hardware elements.

This system can control industrial processes, monitor real-time data, and interact with devices through human-machine interface (HMI) software [7].

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Systems Engineering

Emerging

Knowledge of systems engineering and use of associated software. These software provide graphical programming and modeling features to model complex systems and simulate industrial system performance. It is also used to simplify the development of complex industrial systems as well as to create diagrams of how an industrial system should function [8].

MATLAB

In-demand

Use of the MATLAB programming platform to analyze and design systems and products. MATLAB is a programming language and numeric computing environment. It helps in analyzing data, developing algorithms, creating user interfaces, models and applications [9].

Tools and Machines

In-demand

Drill Presses

Use of drilling and cutting tools and machines.

Forklifts

Use of powered industrial trucks used to lift materials in warehousing and/or industrial settings.

Measurement Tools

Use of proper tools, devices and metrological instruments such as Calipers and Micrometers for measurements of mechanical and machining components.

Power Tools

Use of power tools such as air compressors, grinders, saws, drills, sanders, etc.

Troubleshooting

In-demand

Determining source of operational failure of products and processes and identifying the best solution to solve them.

Workplace Collaboration Tools

Emerging

Use of online collaboration platforms and software to do things like sharing information, managing tasks, and engaging with team members. Workplace collaboration tools can support a more efficient, productive and interactive working environment.

3D Printing

Emerging

Knowledge of 3D printing processes including designing, repairing, and modifying 3D models. This also includes use of tools and machines such as 3D CAD and 3D printers.

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Non-Technical Skills and Abilities

Non-technical skills and abilities are also referred to as soft, interpersonal or human skills. These skills and abilities complement technical knowledge and expertise and allow for better communication, management, execution of tasks and projects to improve overall efficiency and effectiveness.

- Communication
- Complex Problem Solving
- Continuous Learning
- Judgment and Decision Making
- Monitoring
- Time Management
- Working with Others

Non-Technical

Communication

In-demand

Being able to give and receive different types of information is important in any job. It helps workers to work together as a team and share ideas and knowledge.

There are many skills that form the building blocks for effective communication skills such as active listening, feedback, empathy and respect.

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Related Skills and/or Abilities

Active listening

Paying close attention to the person that you are speaking with.

Adaptive communication style

Knowing when and how to communicate in different scenarios.

Feedback

The ability to give and receive feedback.

Empathy

The ability to understand and share the emotions of others.

Complex Problem Solving

In-demand

Problem solving refers to using logic and imagination, to make sense of a situation and derive an intelligent solution. Problem solvers can also actively anticipate potential future problems and act to prevent them or to mitigate their effects.

Problem solving abilities are connected to a number of other skills, such as analytical skills, innovative and creative thinking, and adaptability and flexibility[10].

Continuous Learning

In-demand

Continuous learning requires workers in an occupational group to participate in an ongoing process of acquiring skills and knowledge.

This ability is used when learning as part of regular work or from co-workers and when accessing training in the workplace or off-site [11].

Judgment and Decision Making

In-demand

Considering the relative costs and benefits of potential actions to choose the most appropriate one. This requires thinking and understanding situations and forming sensible conclusions through assessment, comparison and/or deliberation [12].

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Monitoring

In-demand

Monitoring and assessing the performance of yourself, other individuals, or organizations to make improvements or take corrective action.

Time Management

In-demand

The efficient management of time creates a more structured work approach which supports in achieving goals in a timely manner.

Time management skills include but are not limited to organization, prioritization, planning, delegation, and stress management [13].

Working with Others

In-demand

Working with others refers to the extent to which employees work with others to carry out their tasks.

This skill is used when working as a member of a team or jointly with a partner, and when engaging in supervisory or leadership activities [14].

The ability to work with others means working as part of a team; carrying out assigned tasks and sharing skills and knowledge.

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AVIN Skills and Talent Strategy

Ontario's Autonomous Vehicle Innovation Network (AVIN) is undertaking work on skills and talent, which focuses on ensuring the sector's workforce is prepared to meet the needs of the future and maintain its global competitiveness.

Through this work, AVIN aims to support the futureproofing of the automotive and mobility sector's workforce, drive collaboration between industry, educational and post-secondary institutions and government, and support an approach to strengthening and diversifying the next generation talent pipeline and building capacity within all regions of Ontario.

In addition to this spotlight series, AVIN is releasing regular insights pieces on skills and talent. Check out the below channels to access these insights and other regular updates on this work and more:

Access to AVIN Insights

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About AVIN

The Autonomous Vehicle Innovation Network (AVIN) is a key component of Driving Prosperity, the Government of Ontario's initiative to ensure the automotive sector remains competitive and continues to grow and thrive. The Government of Ontario has committed $85 million in innovative programming to support research and development (R&D) funding, talent development, technology acceleration, business and technical supports, and testing and demonstration sites.

These programs support small- and medium-sized enterprises (SMEs) to develop, test and commercialize new automotive and transportation products and technologies, and cultivate the capacity of a province-wide network to drive future mobility solutions, reinforcing Ontario's position as a global leader.

The AVIN Central Hub is the driving force behind the programming, province-wide coordination of activities and resources, and Ontario's push to lead in the future of the automotive and mobility sector globally.

Led by a dedicated team, the Central Hub is the focal point for all stakeholders across the province, a bridge for collaborative partnerships between industry, post-secondary institutions, broader public sector agencies, municipalities and the government, all while serving as a concierge for new entrants into Ontario's thriving ecosystem.

The Central Hub drives public education, research, analysis, and thought leadership activities, convenes stakeholder groups, and raises awareness around the potential of these technologies, the opportunities for Ontario and for its partners.

AVIN, 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, Training and Skills Development (MLTSD) and Ministry of Transportation (MTO).

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Acronyms

2D	two dimensional
3D	three dimentional
AVIN	Autonomous Vehicle Innovation Network
BEVs	Battery electric vehicles
CNC	Computer numerical control
CAD	computer-aided design
ERP	enterprise resource planning
FCEVs	fuel-cell electric vehicles
HEV	hybrid electric vehicle
MATLAB	Matrix Laboratory
MEDJCT	Ministry of Economic Development, Job Creation and Trade
MLTSD	Ministry of Labour, Training and Skills Development
MTO	Ministry of Transportation
OCI	Ontario Centre of Innovation
OEMs	Original Equipment Manufacturers
PHEV	Plug-in hybrid electric vehicle
SMEs	Small- and Medium-Size Enterprises
SCADA	Supervisory control and data acquisition

Glossary of Terms

Algorithms: a set of instructions designed to perform a specific task.

Commissioning: is the process of assuring that all systems and components of assembled vehicles and/or parts and components are designed, installed, tested, and operated according to the operational requirements and guidelines.

Industry 4.0: is the ongoing automation of traditional manufacturing and industrial practices using modern smart technology.

Suspension: is the system of tires, tire air, springs, shock absorbers and linkages that connects a vehicle to its wheels and allows relative motion between the two [15].

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