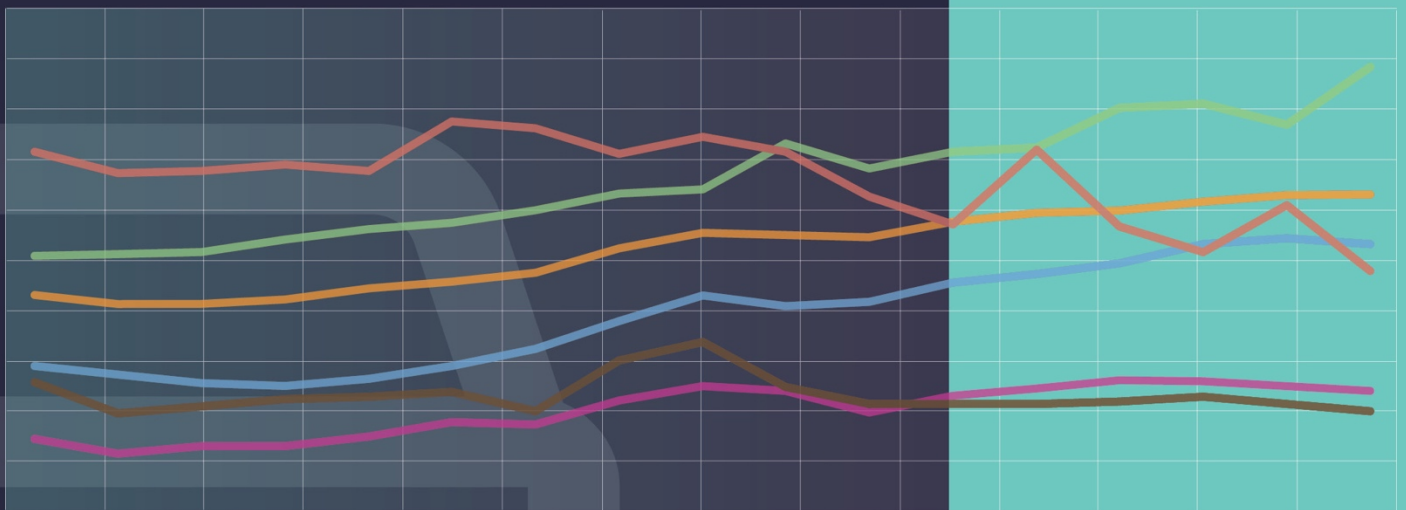


# AUTOMOTIVE INDUSTRY LABOUR MARKET ANALYSIS

## REGIONAL AUTOMOTIVE TECHNOLOGY CLUSTERS: WINDSOR CLUSTER



The project is a collaboration of the Canadian Skills Training and Employment Coalition, Prism Economics and Analysis, and the Automotive Policy Research Centre.

**THIS PAPER** was prepared for the Auto Labour Market Information (LMI) Project, now known as the Future of *Canadian Automotive Labourforce (FOCAL) Initiative*.

The goal of the project is to help stakeholders better understand the automotive labour market. The Project will create industry-validated, regional, occupational supply and demand analyses and forecasts and skill profiles for skilled trades and other key skilled occupations in the broader automotive sector including vehicle assemblers, parts manufacturers and technology companies that supply the industry. The project will also examine various labour market trends in the sector and facilitate discussions among stakeholders about how to address any forecasted skills shortages and other labour market challenges. The planned outcome of the project is enhanced regional labour market information that will support colleges, employers, policy makers and other stakeholders in taking practical steps to address skills shortages and other labour market challenges in the automotive sector.

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# TABLE OF CONTENTS

*Introduction* ..... 4

*Background on the Windsor Technology Cluster* ..... 5

*WINDSOR’s Cluster Profiling and Occupational Analysis* ..... 7

    Distribution of Companies and Organizations ..... 7

    Distribution of Employment and Skills..... 9

    Occupational Distribution ..... 11

        Management Occupations ..... 11

        Engineering Occupations..... 12

        Engineering Technologists and Technicians Occupations ..... 13

*Highlights and Concluding Remarks on the Windsor Cluster* ..... 14

*References* ..... 16

## LIST OF FIGURES

Figure 1. Distribution of automotive-related technology companies and organizations in Windsor by technology .....	8
Figure 2. Distribution of employees and associated individuals (by percentage) in Windsor by technology .....	9
Figure 3. Distribution of employees and associated individuals (by numbers) in Windsor by technology .....	10
Figure 4. Occupational distribution for management occupations in the automotive technology companies in Windsor .....	11
Figure 5. Occupational distribution for engineering occupations in the automotive technology companies of Windsor .....	12
Figure 6. Occupational distribution for engineering technologist and technician occupations in the automotive technology companies of Windsor .....	13

## INTRODUCTION

In this series of reports, we observe the contributions of Canada's six automotive technology clusters located in Vancouver, the Greater Toronto and Hamilton Area (GTHA), Kitchener-Waterloo-Cambridge (KWC), Windsor, Ottawa and the Greater Montreal Area (GMA). In doing so, we shed light on each regional cluster's domains of technological expertise, its employment and skills distribution, and the factors that sustain its development. Moreover, we examine the pivotal role played by Canada's automotive technology clusters in the advancement of the country's broader automotive sector through their contributions to its manufacturing capability, development of new product technologies and enhancements to product quality.

This report focuses on the automotive technology cluster located in Windsor, Ontario. It examines the distribution of automotive technology companies and organizations in the region, highlighting the cluster's technology focus domains. Furthermore, using the APRC's<sup>1</sup> comprehensive automotive database and through an establishment-level approach, it maps the regional distribution of employees and individuals that are engaged in advanced automotive technology manufacturing and research & development (R&D) activities. It sheds light on the concentration of labour and skills in specific technology fields within the cluster. Finally, through a survey of occupational profiles within selected companies, this report provides details on the occupations and skill streams that are in most demand in the local labour market.

In performing the profiling and occupation analysis, we refer to FOCAL's "Canada's Automotive Technology Clusters: Labour Market Characteristics and Regional Specializations" report. That report outlines the full spectrum of current trends shaping innovation in the automotive industry and provides details on the ten main domains of technological progress in the sector. Those ten automotive technology domains include: (1) Autonomous Vehicle (AV) Technologies, (2) Connected Vehicle Technologies, (3) Artificial Intelligence & Machine Learning (AI & ML), (4) Materials & Light Weighting, (5) Battery Electric & Hybrid Vehicle Technologies, (6) Hydrogen Fuel Cell (HFC) Technologies, (7) Internal Combustion Engine (ICE) Powertrain Technologies, (8) Production Technologies, (9) Vehicle Safety & Security and (10) Other Software & Electronics.

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<sup>1</sup> APRC: Automotive Policy Research Centre

Additionally, FOCAL's report "Canada's Automotive Technology Clusters: Labour Market Characteristics and Regional Specializations" sets out the methodology that we used to identify and profile each cluster. It also provides details on the 18 highly-skilled automotive occupations selected to examine the clusters' occupational distribution.

## BACKGROUND ON THE WINDSOR TECHNOLOGY CLUSTER

In recent years, Windsor has developed into a critical location for both manufacturing and innovation in the Canadian automotive industry. The region derives its significance from the numerous automotive manufacturers and tool, die and mould makers. Many of those companies are highly integrated with the automotive assemblers and parts manufacturers situated nearby in the Great Lakes States. Increasingly, as we will show in this report, many of those organizations are also engaged in the local design and development of new vehicle technologies.

Windsor is home to two main OEM<sup>2</sup> facilities: Ford Motor Company's engine plants and Fiat Chrysler Automobiles' (FCA) assembly plants. Both OEMs are leading contributors to R&D in the region and provide innovations in several technology fields. For example, in 1996, a partnership between the University of Windsor and FCA led to the initiation of the Automotive Research and Development Centre (ARDC) (UWindsor, 2016). The ARDC researches various automotive technology fields and maintains expertise in automotive simulation, software development and vehicle testing capabilities. Additionally, the centre hosts more than 500 highly skilled engineering students and industry experts, many of whom had direct exposure to the ARDC's various automotive design, software development, simulation and testing techniques.

Ford has also established an R&D centre in the region. Located in its Essex Engine Plant, Ford's Powertrain Engineering Research & Development Centre (PERDC) focuses on ICE powertrain performance research and testing (Autos, 2003). The PERDC employs numerous techniques involving computer-aided testing on engines and transmissions. At the centre, Ford's dedicated engineering team works directly with students from the University of Windsor's Faculty of Engineering, exposing them to a wide range of skills, including digital signal processing and data collection and analysis.

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<sup>2</sup> OEM: Original Equipment Manufacturer

In addition to the numerous automotive companies located in the region, Windsor hosts several public university-based research organizations. In 2001, the Canadian federal government established the AUTO21 network at the University of Windsor under its National Centres of Excellence (NCE) Program. In operation between 2001 and 2016, the AUTO21 NCE emphasized industry-university collaboration in various fields, including vehicle manufacturing ergonomics, fuel cell technologies, and new casting techniques. The AUTO21 network brought together more than 500 experts from engineering, business, health and the social sciences with nearly 700 industry and public sector partners.

Current university-based research in the region includes the Centre for Hybrid Automotive Research and Green Energy (CHARGE Labs) at the University of Windsor. CHARGE Labs specializes in the design, research simulation and testing methods relating to electric vehicle drive, control and charging systems. In addition to CHARGE Labs, the university hosts the Universal Testing Facility for Advanced Characterization of Automotive Materials. The facility performs materials and light-weighting research to optimize vehicle performance and manufacturing processes through numerical simulations and testing methods. The University of Windsor has also partnered with industry on research projects such as the Light Metals Casting Technology Research Group. A partnership between NSERC<sup>3</sup>, Ford-Nemak and the University of Windsor, the research group develops and improves new casting technologies.

Additional research and testing support are provided by not-for-profit organizations such as the Ontario Centres of Excellence's Autonomous Vehicle Innovation Network (AVIN), which established a virtual reality room (VR – CAVE) in the region (AVIN, 2019). The AVIN centre, located at the Institute for Border Logistics and Security (IBLS) in the Windsor-Essex Economic Development Corporation, supports the exchange of connected and autonomous vehicle technologies between local companies and stakeholders.

Windsor hosts two prominent post-secondary institutions that offer degree programs targeted towards the automotive industry: The University of Windsor's Faculty of Engineering and the St. Clair College's School of Skilled Trades. Both of those institutions provide critical inputs of skilled labour into the region. For example, St Clair College's Ford Centre for Excellence in Manufacturing delivers high-quality training in the automotive engineering and production technology fields.

Innovation is further supported in the Windsor cluster by several industry associations and non-governmental organizations. The Canadian Association of Mould Makers (CAMM),

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<sup>3</sup> NSERC: Natural Sciences and Engineering Research Council

formally the Windsor Association of Mould Makers, promotes the local mould making industry and has formed partnerships with post-secondary institutions to advance Canada's skilled trades agenda. In 2019, CAMM launched Automate Canada (AC), an organization designed to promote Canada's emerging industrial automation industry, assist small to medium enterprises (SMEs) and encourage the adoption of new manufacturing technologies in the sector. Additionally, the Automotive Parts Manufacturers Association (APMA) supports technology advancement and innovation in the region, especially in cybersecurity, through its recently launched Automotive Parts Manufacturers Association Institute of Automotive Cybersecurity (APMAIAC).

## WINDSOR'S CLUSTER PROFILING AND OCCUPATIONAL ANALYSIS

Of the 125 automotive companies located in Windsor, we identified 21 facilities and labs that design, develop or manufacture new automotive technologies. Those 21 facilities and labs include six companies, eight academic research labs and facilities, and four partnerships and not-for-profit organizations. They currently employ a total of 801 employees and associated-individuals<sup>4</sup>. This section provides a breakdown of the technologies, occupations and skills present in the Windsor automotive technology cluster.

### Distribution of Companies and Organizations

As presented in Figure 1, the Windsor cluster hosts several automotive technology companies and organizations. By organization count, the three most common technologies in the Windsor area are: (1) production technologies, (2) ICE powertrain technologies and (3) materials & light-weighting. Under the production technologies category, three companies, one academic lab and one partnership were identified in the region. Notable examples include Reko Automation, which provides customizable Industry 4.0 solutions for electric vehicles and battery systems manufacturing, and Tessonics (established in 2003 with the support of DaimlerChrysler and the University of Windsor), which develops ultrasonic imaging-based weld quality control solutions. The University of Windsor also hosts the Intelligent Manufacturing Systems Centre (IMSC), which is active in R&D for production technologies.

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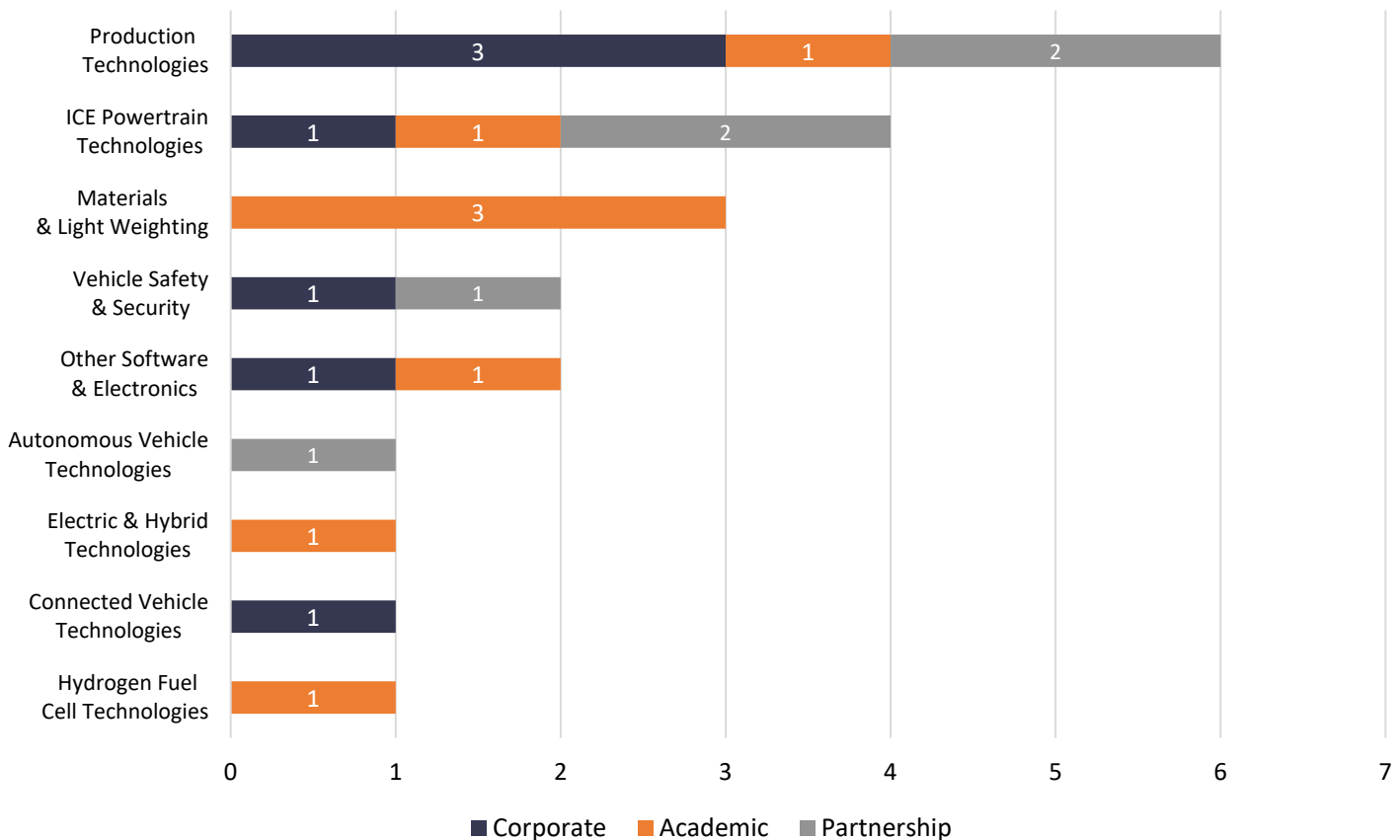
<sup>4</sup> In this report, 'employees' refers to employees of private companies, as well as professors, researchers and students working in university labs and other research partnerships.



Besides the organizations active in developing production technologies, we identified four facilities and labs that perform R&D activities relating to ICE powertrain technologies within the Windsor cluster. Those facilities included Ford’s Advanced Powertrain Engineering Research and Development Centre (PERDC), Fiat Chrysler’s Automotive Research and Development Centre (ARDC) and the Clean Combustion Engine Laboratory (CCEL) at the University of Windsor.

The region is also home to three academic labs specializing in automotive materials & light-weighting R&D (i.e., Universal Testing Facility for Advanced Characterization of Automotive Materials and the Tribology of Materials Research Centre (TMRC) at the University of Windsor). Other technology companies, labs and offices in the region include a company and a partnership in vehicle safety & security, a connected vehicle technologies company, an autonomous vehicle technology partnership, and two academic labs conducting research on hydrogen fuel cell technologies and battery electric and hybrid vehicle technologies.

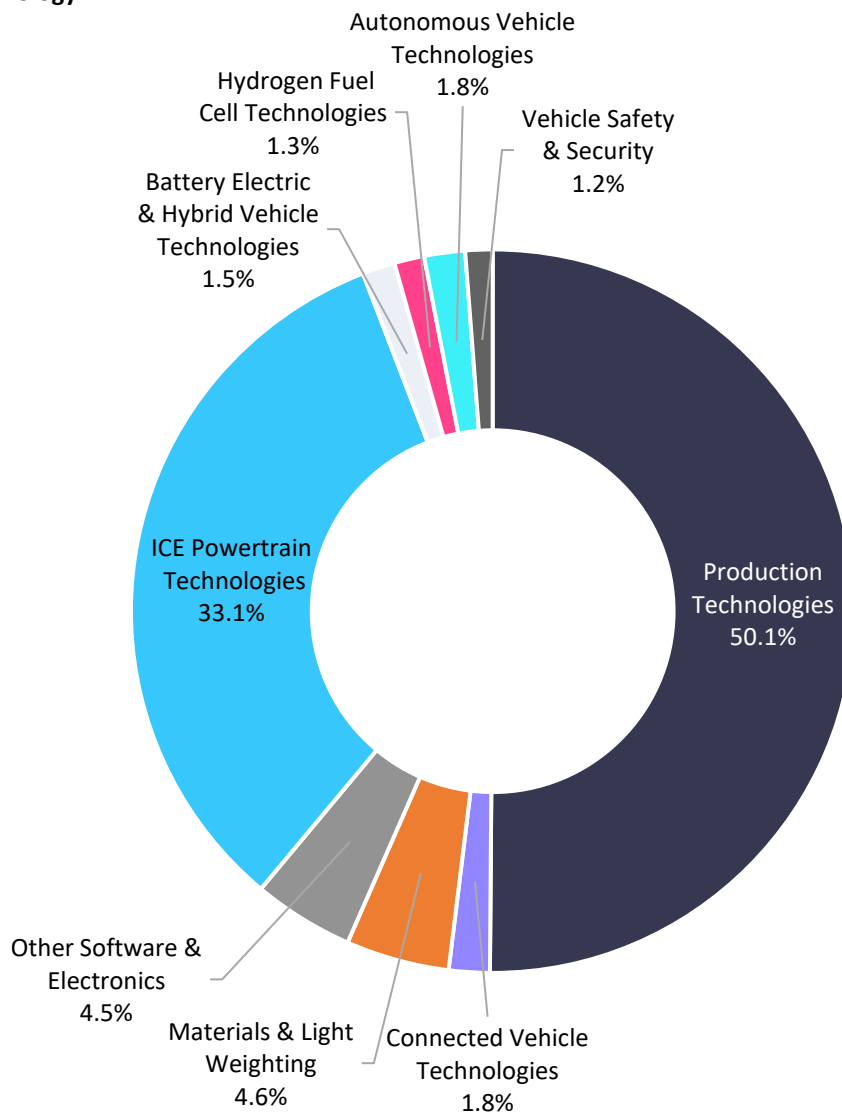
**Figure 1. Distribution of automotive-related technology companies and organizations in Windsor by technology**



## Distribution of Employment and Skills

Within the 21 companies, labs and facilities in Windsor, we identified a total of 801 employees. As shown in Figure 2, most of those individuals are engaged in the design, development and testing of two main technology categories: 50.1% in production technologies and 33.1% in ICE powertrain technologies. These findings highlight that most facilities and employees in the Windsor cluster are engaged in making improvements to existing production processes and automotive technologies.

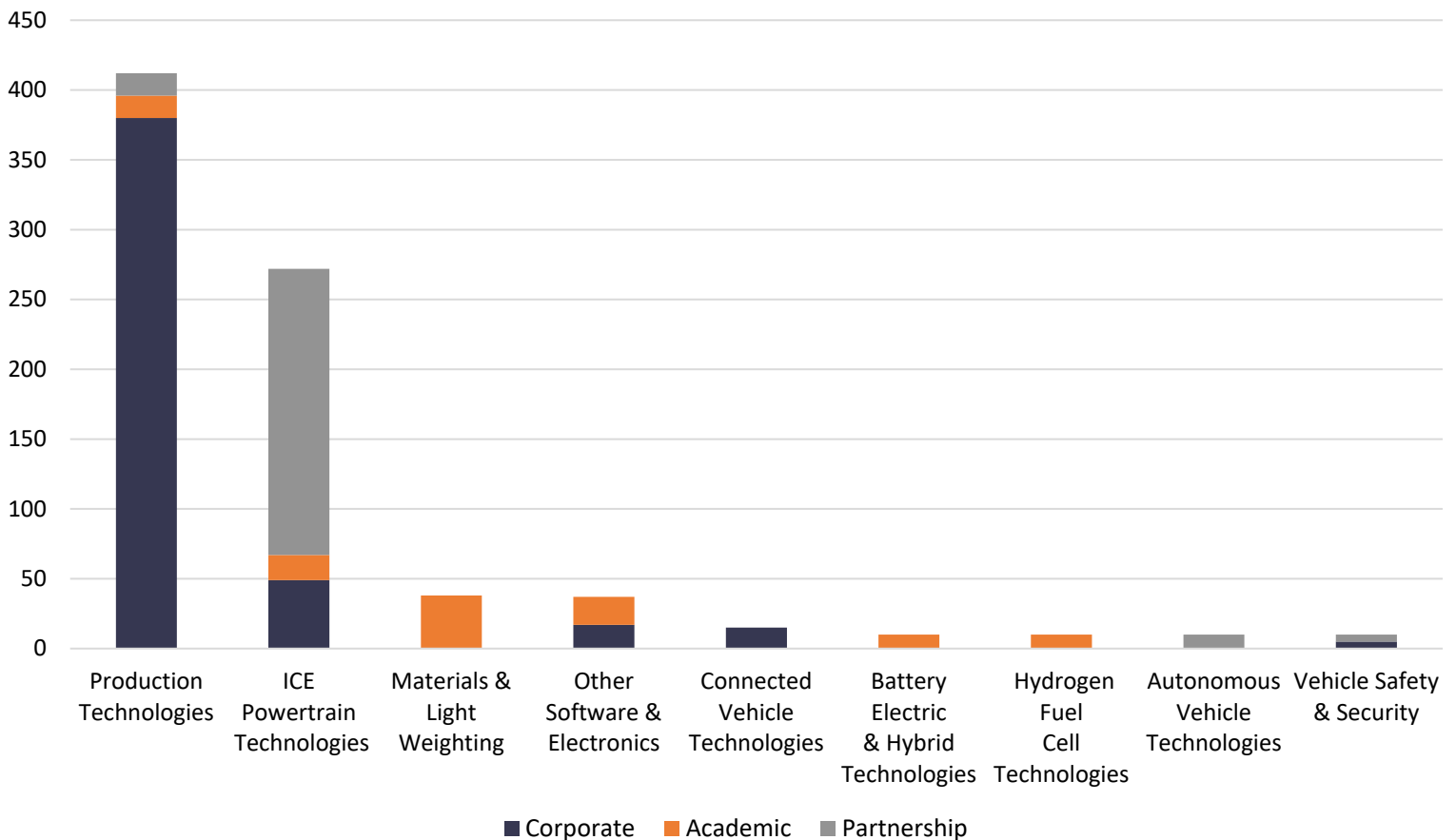
**Figure 2. Distribution of employees and associated individuals (by percentage) in Windsor by technology**



Within the Windsor automotive cluster, the majority of employment is provided by several prominent companies and organizations. For instance, Radix (AIS Technologies Group), Reko Automation and Tessonics, which maintain operations relating to production technologies and Industry 4.0, collectively accounted for most employment in the cluster (close to 380 employees working under the production technologies category) (Figure 3). Fiat Chrysler’s Automotive Research and Development Centre (ARDC) at the University of Windsor and Ford’s Advanced Powertrain Engineering Research and Development Centre (PERDC) accounted for most employment under the ICE powertrain technologies category (a total of 270 employees).

Lastly, the University of Windsor was identified as a significant contributor to jobs in the cluster. Three labs at the university are engaged in materials research, contributing a total of 40 researchers (i.e., faculty members, researchers and lab technicians). Other labs in the University involved in BEV-H, HFC and microelectronics R&D contributed an additional 50 individuals.

**Figure 3. Distribution of employees and associated individuals (by numbers) in Windsor by technology**



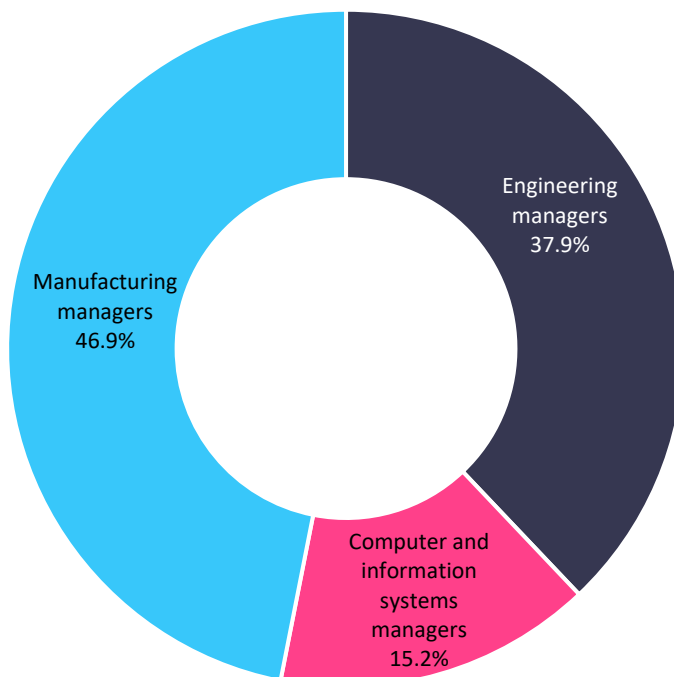
## Occupational Distribution

Our occupational distribution analysis entailed reviewing 321 profiles out of the total 461 employees in the region’s seven automotive technology companies. Of those 321 profiles, 203 were found to be relevant to the 18 highly skilled occupations selected for this study. Our results showed that mechanical, electrical, and industrial engineering streams are the region's most prevalent occupations. This section reviews the distribution of occupations in three categories: management, engineering, and engineering technicians and technologists.

### Management Occupations

Under the management occupations category, “Manufacturing managers” represented close to 47% of the management profiles that we surveyed (Figure 4). “Engineering managers” accounted for 38% of the sample, whereas “Computer and information systems managers” represented 15.2% of the profiles surveyed. The abundance of “Manufacturing managers” in the region can be explained by its composition of new automotive technology firms and organizations (see Figure 1). The majority of new technology companies and organizations in the region are engaged in designing, developing, and testing new production technologies (i.e., areas where manufacturing managers are most experienced and suited). Similarly, the high percentage of “Engineering managers” aligns with the cluster’s specialization in ICE powertrain technologies.

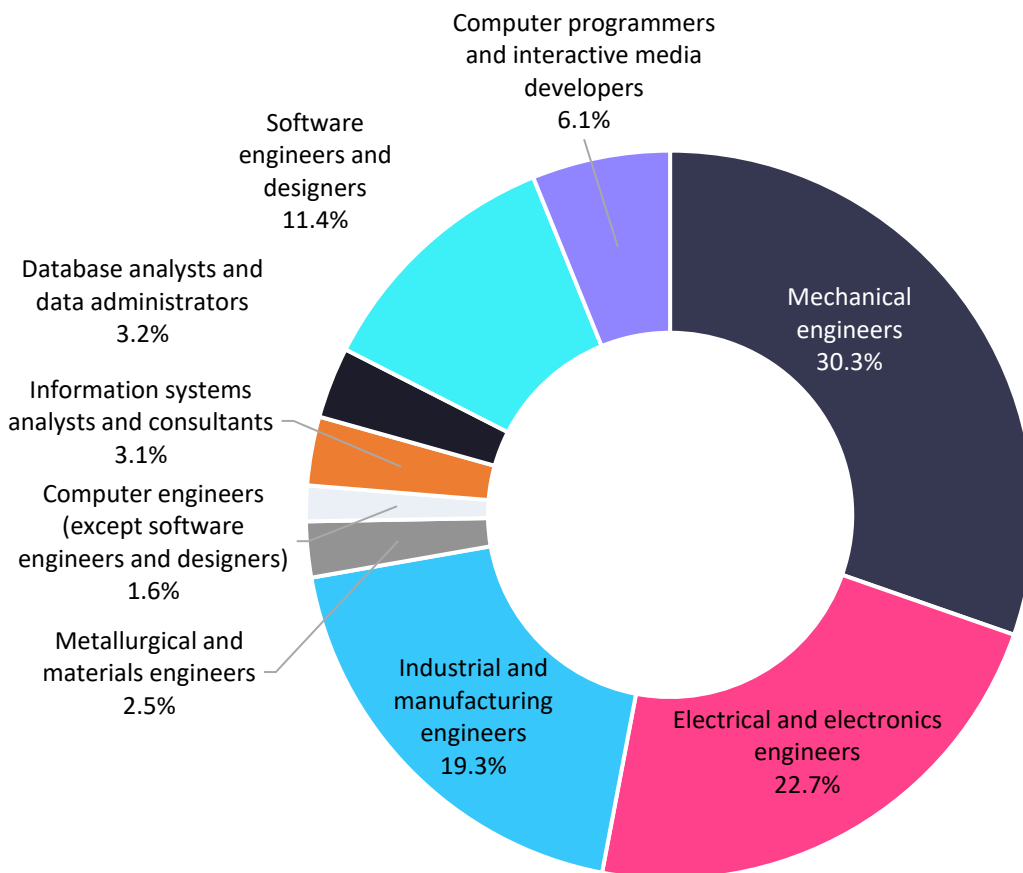
**Figure 4. Occupational distribution for management occupations in the automotive technology companies in Windsor**



## Engineering Occupations

As shown in Figure 5, “Mechanical engineers,” “Electrical and electronics engineers,” and “Industrial and manufacturing engineers” collectively accounted for 72.3% of the engineering occupations in the companies that we reviewed. Those occupations are essential for activities in the development and design of production and ICE powertrain technologies. For instance, “Mechanical engineers” and “Industrial and manufacturing engineers” contribute expertise and knowledge of automation systems, robotics and sensors in production technologies. “Mechanical engineers” are also essential to the R&D activities in the field of ICE powertrain technologies through their knowledge, skills, and expertise in optimizing mechanical systems, especially internal combustion engines.

**Figure 5. Occupational distribution for engineering occupations in the automotive technology companies of Windsor**

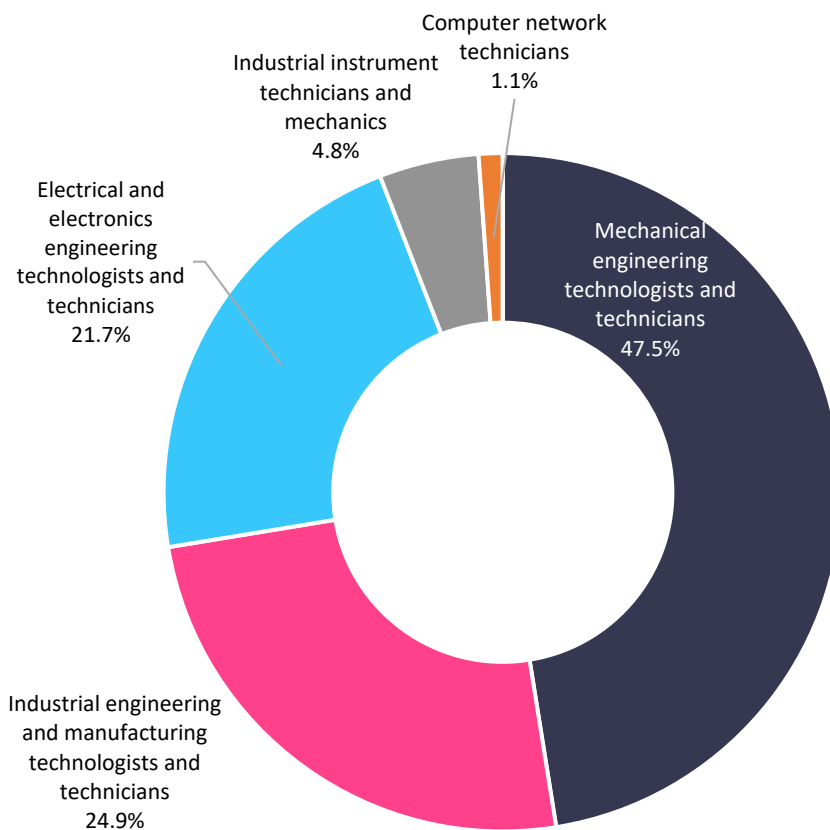


“Software engineers and designers” comprised 11.4% of the sample. Those employees are critical to the design and development of software for automation systems, as well as for control modules designed for ICE powertrain technologies. The vast majority of software engineers were found in companies developing connected vehicle technologies and other software & electronics.

The higher proportion of mechanical, electrical and industrial engineers compared to software engineers and developers indicates that the majority of production technology companies in the region perform operations related to the mechanical and electrical aspects of Industry 4.0 (e.g., advanced robotics, smart sensors and additive manufacturing). Fewer organizations appear to be engaged in designing and developing the digital solutions associated with the production technologies (e.g., cloud, cybersecurity, internet of things and big data analytics).

### Engineering Technologists and Technicians Occupations

**Figure 6. Occupational distribution for engineering technologist and technician occupations in the automotive technology companies of Windsor**



The engineering technicians and technologists category similarly reflects the concentration of skills and expertise in the automotive technology companies that we examined in Figures 1 and 2. The “Mechanical engineer technologists and technicians” category represented 47.5% of the surveyed technologist and technician profiles. Such skill streams are essential to the manufacturing of production systems components and may contribute to the development of ICE technologies. By contrast, the “Industrial engineering and manufacturing technologists and technicians” and the “Electrical and electronics engineering technologists and technicians” categories comprised just 24.9% and 21.7% of the surveyed sample.

## HIGHLIGHTS AND CONCLUDING REMARKS ON THE WINDSOR CLUSTER

The preceding analysis has demonstrated that there are several key players in the Windsor automotive technology cluster. Those organizations drive research, development and innovation in several of the automotive technology fields highlighted by this report. Of particular importance in the region is the University of Windsor, which hosts numerous research facilities. Many of the university’s facilities perform research directly relating to automotive vehicle systems and automotive production technologies. Moreover, the university is a source of skills and expertise to many companies and research centres in the region. It also plays a critical role in the cluster’s development through its numerous labs and affiliated centres that offer students and local companies exposure to advanced automotive engineering techniques and skills.

Furthermore, Ford and FCA’s longstanding presence has played a vital role in shaping the type of research conducted within the region. Both organizations strongly benefit from the region’s research expertise and the skills of the numerous graduates from the University of Windsor and St. Clair College. Ford and FCA are also direct contributors to local programs and research partnerships. Other important organizations in the region include Radix (AIS Technologies Group), Reko Automation and Tessonics, which advance Industry 4.0 solutions.

As we identified in this report, the companies and organizations that make up the Windsor automotive technology cluster specialize in ICE and new production technologies; 84.2% of the employment and skills fall under those two technological categories. The relevant skills and expertise in those two technology fields are the mechanical, electrical and industrial engineering streams. As one would expect, those three streams represent most of the

engineering and engineering technologist and technician occupations in the cluster. “Software engineers & designers” are less pervasive but are likely to increase in number as the industry adopts the new production technologies associated with Industry 4.0.

In conclusion, this report has identified that the Windsor automotive technology cluster specializes in the research, design and development of two automotive technologies: ICE powertrain technologies and production process technologies. It is therefore not surprising that the vast majority of employees in the Windsor automotive technology cluster fall under the mechanical, electrical and industrial engineering streams and contribute to the design, development, and testing of those two technology categories. But in addition to this strength, the region has proven that it can adapt to changing technological trends and provides vital research, design, development and testing capabilities to the broader Canadian automotive industry.



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