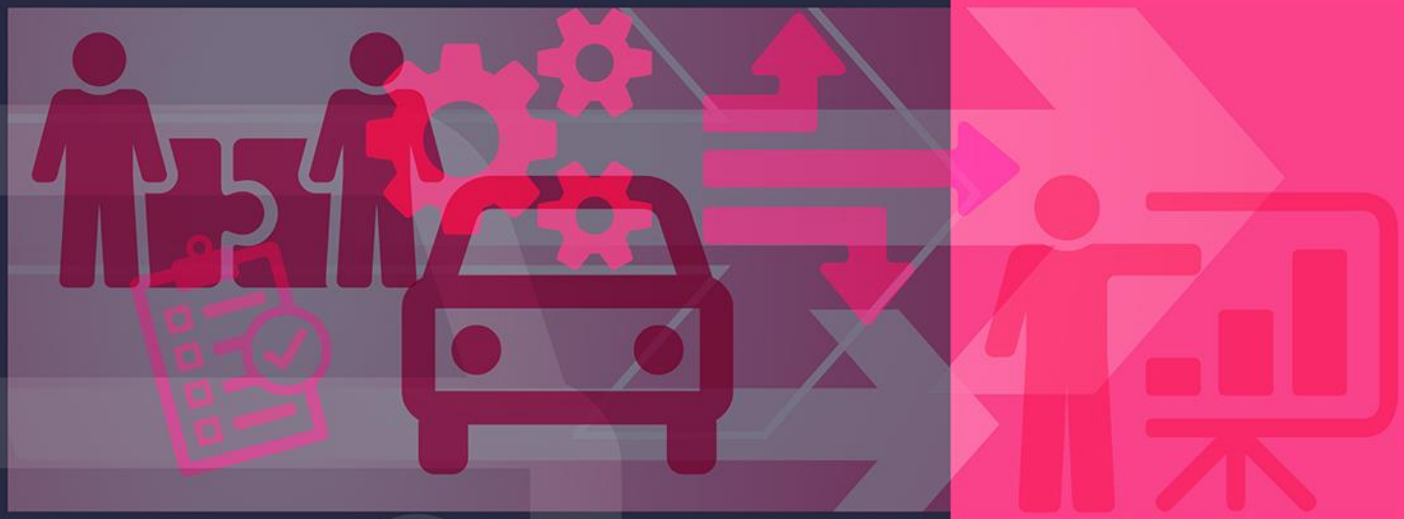
FOCAL Initiative
Future of Canadian Automotive Labourforce
Sur l'avenir de la main-d'œuvre de l'industrie automobile canadienne

LABOUR MARKET FORECAST

AUTOMOTIVE INDUSTRY LABOUR MARKET ANALYSIS

Importance of the Canadian Automotive Manufacturing Sector



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

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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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CSTEC Canadian Skills Training and Employment Coalition

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TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

Over the past three years, the FOCAL initiative has produced more than 40 reports examining trends and forecasting employment in Canada's automotive manufacturing sector. The project has resulted in numerous significant findings relating to the size and the impact of this sector within the context of the Canadian Economy. Previously perceived as an industry employing around 125,000 people, FOCAL's research has indicated that the sector is much larger in size and output, with 188,000 jobs in automotive production, and an additional 22,000 jobs in automotive research and technology. With other primary automotive suppliers accounted for within the broader automotive manufacturing supply chain, the importance, impact and contributions of the sector for the entire economy are more significant than previously apparent.

This main purpose of this report is to summarize FOCAL's research and findings on the size, importance, and impact of the automotive manufacturing and technology sector. The report is divided into three main sections. The first focuses on the broader definition of the sector, with subsections on defining the sector beyond industry classifications, FOCAL's workforce model, the employment within the broader automotive manufacturing sector, and the links to the automotive technology clusters. The second section highlights the contributions of the automotive production sector and exports to Canada's economic development.

A third section summarizes the main findings of the "The Economic Impact of Expanding Automotive Production" report which simulates and measures the impact of two scenarios: (1) a 20% increase in vehicle assembly, and (2) a 20% increase in vehicle parts exports. Additional technical details on the direct, indirect and induced changes, and on the provincial distribution of this impact can be found in the economic impact report.

A final section concludes this report, touching on the main findings and figures of FOCAL's research on the size and impact of the automotive manufacturing sector.

BROADER DEFINITION OF THE AUTOMOTIVE SECTOR

The automotive industry is a complex and dynamic network of connected businesses. These include not only vehicle assemblers and parts manufacturers, but also many suppliers, including companies that might self-identify as producers of metal, plastic, rubber or glass products. The automotive production supply chain also includes computer and electronics manufacturers, engineering, design, management consulting and software services. The largest and most visible industry segments are the vehicle assembly complexes of automotive Original Equipment Manufacturers (OEMs), some of which typically employ thousands of workers per facility when operating at full capacity. These facilities, in turn, rely on a multi-tiered network of captive (facilities owned by OEMs such as Ford and Toyota) and independently owned suppliers (e.g., Magna) for modules, components, parts, materials, and tooling.

Many of the manufacturing and service facilities within these supplier networks are dedicated wholly to supplying the automotive industry (and in many cases dedicated wholly to supplying one vehicle assembly plant or higher-tier parts manufacturing facility on a just-in-time or just-in-sequence basis). However, some of these manufacturing and service facilities supply industries outside of automotive and in addition to exporting significant production to automotive industries in other nations, especially the United States. Given these complex industry connections, it is challenging to quantify the economic impact of the automotive industry. One of the goals of the FOCAL project has been to develop an approach that:

1. addresses the limitations of analysis of the automotive industry supply network that relies on use and the selection of a limited number of industry classification codes (NAICS codes);

2. identifies the wide network of vehicle parts and technology supplier firms and their facilities and includes both traditional manufacturers and firms that produce and develop emerging automotive technologies; and

3. captures the total employment impact of the fully defined automotive industry across Canada.

In so doing, this report demonstrates that the size, importance and impact of Canada's automotive manufacturing sector is substantially larger than previous reports by government or industry stakeholders suggest.

Sector's Definition Beyond Industry Classifications

One of the main limitations addressed by the FOCAL project has been the use of NAICS codes in defining the sector and quantifying employment within. While **Vehicle Assembly (NAICS 3361)** and **Vehicle Parts Manufacturing (NAICS 3363)** together were often understood to be the entire industry; FOCAL extends this definition to include other suppliers to both **3361** and **3363**. In addition to the two main and core segments of the automotive manufacturing supply chain, the **Other Primary Automotive Suppliers** segment includes companies and facilities which do not self-identify under either of **NAICS 3361** or **NAICS 3363. These companies,** however, are producers and suppliers of automotive products and services (metals, materials (non-metals), tooling and automation, computer and electronics, or other products or services). Following this inclusive approach and using FOCAL's economic model (detailed in the section below), the project estimates a total of 188,000 jobs within the broader automotive manufacturing supply chain[1]. An additional 22,000[2] automotive research and technology jobs can be found in six major automotive technology clusters using an enterprise-level analysis. Combining both parts of the sector brings employment to approximately 210,000 automotive manufacturing and

[1] FOCAL's labour market analysis refers to 2018 data.
[2] FOCAL estimates a total of 29,100 automotive research and technology jobs across six automotive technology clusters. While 7,100 jobs were captured using FOCAL's economic model, 22,100 jobs were added through an enterprise-level analysis of the automotive research and technology companies and organizations in six major automotive technology clusters.

technology jobs. The sections below will provide further detail on both the FOCAL-defined broader automotive manufacturing supply chain, and the automotive technology clusters.

FOCAL's Workforce Model

Previously detailed in the Provincial Automotive Industry Forecast Profile reports, FOCAL's workforce model combines two distinct but complementary approaches to define and estimate employment in the broader automotive manufacturing sector. Figure 1 summarizes the workforce model used to estimate employment within the automotive production sector. The model consists of a "top-down" element which examines and tracks inter-industry transactions among 41 NAICS-defined industries through Statistics Canada's input-output tables, to establish linkages in the automotive manufacturing supply chain, and to estimate the number of jobs in automotive production. One of the main advantages of this approach is in the ability to trace industry transactions flowing from non-automotive industries to vehicle assembly (**NAICS 3361**) and vehicle parts manufacturing (**NAICS 3363**). This determines each industry's contribution to employment in the broader automotive manufacturing sector.

The "top-down" analysis is coupled with a "bottom-up" approach to validate the findings of the economic analysis. The "bottom-up" employs an establishment-level analysis through the use of a database of 950 automotive manufacturing companies and facilities. This comprehensive database includes detailed information on individual facilities such as the products manufactured, processes used and head count, which are collected from publicly available information, industry contacts, company websites, literature, and several other sources. The database is used to identify individual facilities and employers on both national and regional levels within the broader automotive industry.

Figure 1. FOCAL's workforce model to determine employment in automotive production and automotive technology

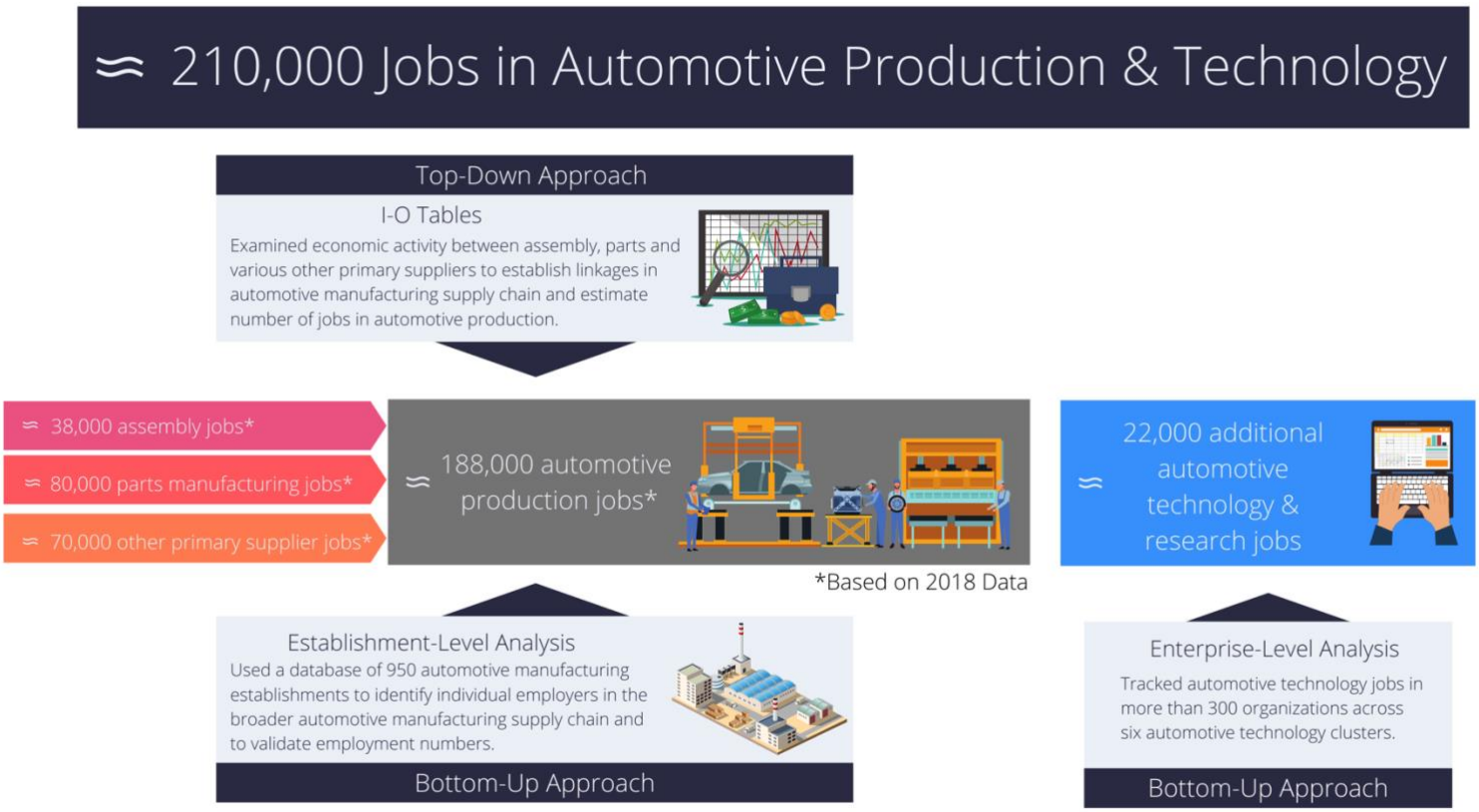


Figure 2 defines the **FOCAL-defined Automotive Production** sector (188,000 employees) in three parts:

- **NAIC 3361 - Vehicle Assembly** (38,000 employees),
- **NAICS 3363 - Vehicle Parts Manufacturing** (80,000 employees),
- **Other Primary Automotive Suppliers** (70,000 employees).

Note that the above employment numbers are based on 2018 data. Beyond the **FOCAL-defined Automotive Production Sector**, the **FOCAL-defined Automotive Supply Chain** includes the three segments of the FOCAL-defined automotive production sector, in addition to **Other Automotive Suppliers** in industries such as banking, fuel & energy and transport services.

Figure 2. FOCAL-defined broader automotive manufacturing sector

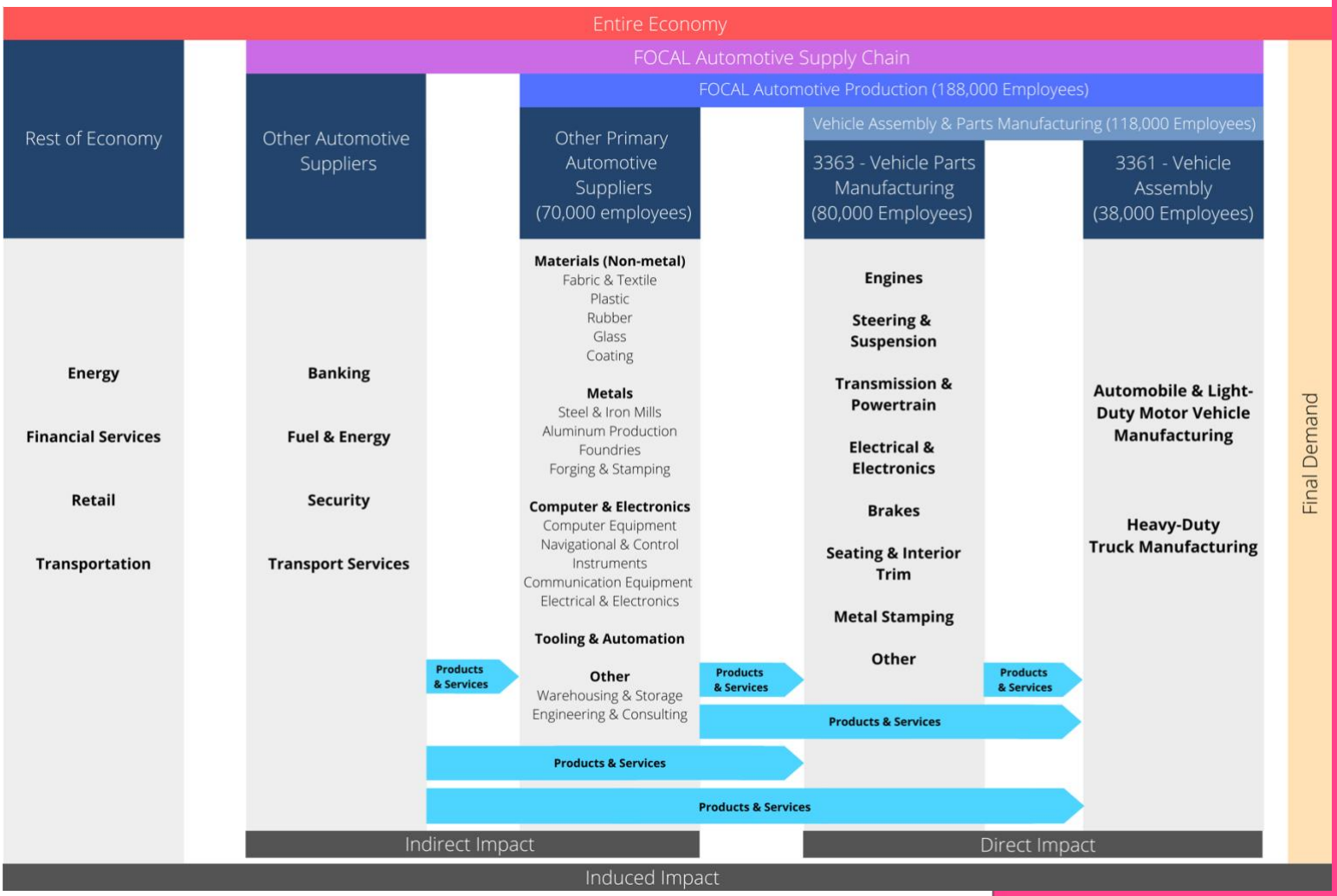
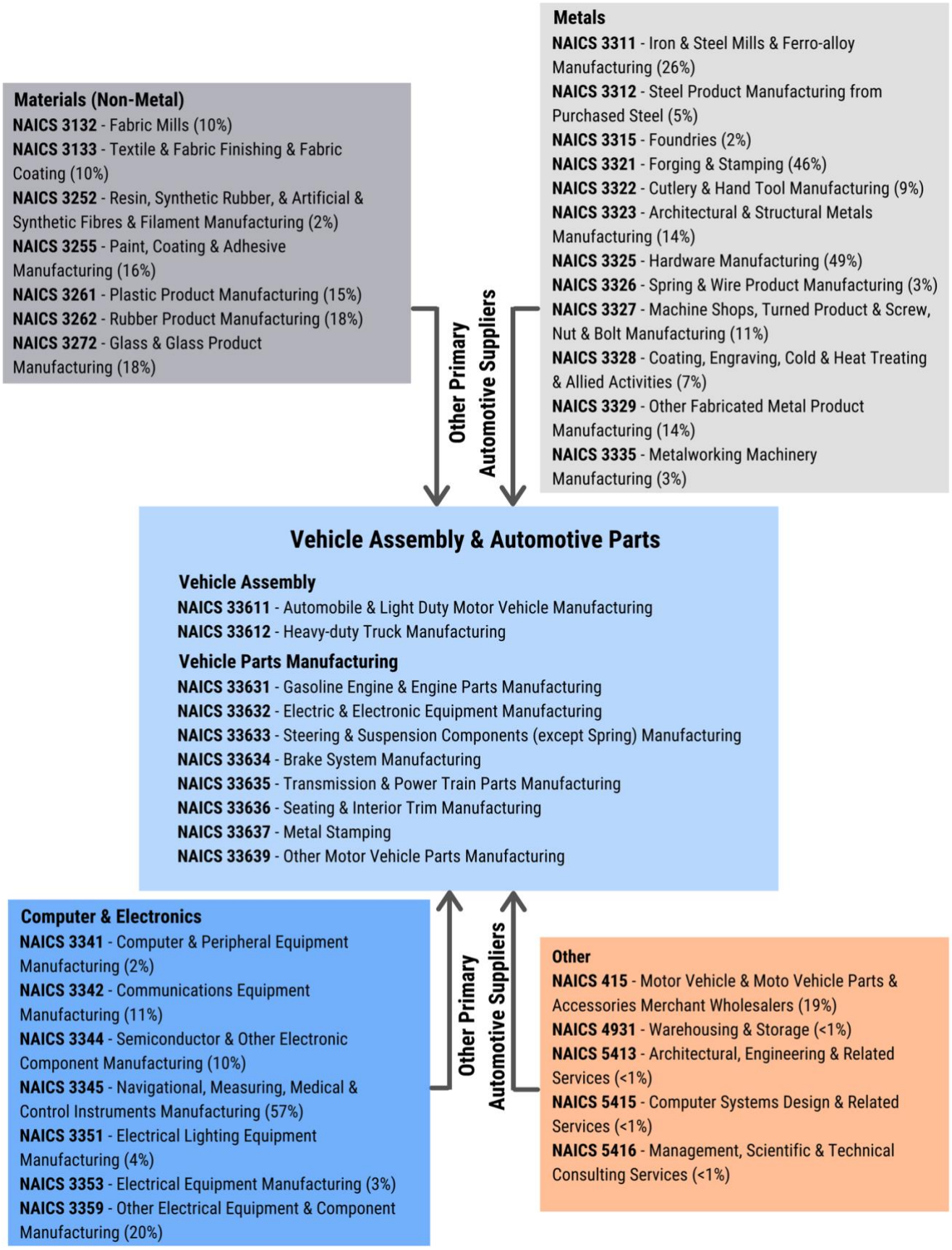


Figure 3 includes a list of the 41 NAICS-defined industries which are part of the FOCAL-defined automotive production sector. This large number of industries which are involved in supplying automotive assembly and parts manufacturing highlights the extent and significance of the automotive production within and beyond the Canadian manufacturing sector. The proportions of sales by each industry in the "Other Primary Supplier" group to the core assembly and parts industries are noted in parenthesis.

***Figure 3*. FOCAL automotive production sector defined**



Automotive Technology Clusters

Previous research conducted by the FOCAL Initiative on the technology strengths and capabilities of Canada's automotive industry has established that there are more than 300 automotive technology companies and organizations across six major Canadian automotive technology clusters. These companies and organizations directly employ over 29,100 skilled professionals and workers, among whom many contribute to the research and development of automotive vehicle technologies such as clean energy, autonomous and connected vehicle technologies, along with manufacturing technologies such as Industry 4.0. According to FOCAL estimates, almost 24% of the 29,100 auto tech jobs (≈6,984 jobs) were included in the FOCAL Automotive Production industry definition and modeling of the broader automotive supply chain, whereas the additional 22,116 auto tech jobs were captured through the establishment-level analysis of FOCAL's regional automotive technology cluster reports. These 22,116 jobs and their employers cannot be identified in the Input-Output Table system and, thus, cannot be linked to the Other Primary Supplier group.

During these times when the vehicle is undergoing fundamental technological changes, it is important for Canada's automotive technology industry to be well-positioned to play a leading role in the innovation and commercialization of these technologies. Domestic research & development (R&D) may be associated with the ability to gain production-related benefits (Yates & Holmes, 2019). Moreover, domestic technology development may bring along the associated testing infrastructure and the ability to commercialize automotive technologies, many of which will be part of the vehicle of the future (ISEDC, 2018). In the United States, IP-intensive industries[3] contributed US$6.6 trillion to the U.S. economy in 2014 (USPTO, 2016). With the new technology markets and innovation economies operating on the concept of the winner-take-all principle, R&D and IP ownership may be crucial for securing additional production mandates in the future (Barwise, 2018).

[3] IP-Intensive Industries: Intellectual Property Intensive Industries (e.g., Computer & communications equipment, semiconductors & electronics, advanced machinery…). Many of IP-intensive industries are among FOCAL's 42 NAICS codes used to define the broader automotive manufacturing sector.

Canada has been, and continues to be, a contributor to development of important and emerging automotive technologies. For example, as of 2020, Canada's BlackBerry QNX software is embedded in more than 175 million vehicles across the world, much of which was developed in QNX's Ottawa and Waterloo offices (QNX, 2020). Similarly, Ford's 2020 infotainment "Sync 3" system, which is used in all Ford Explorer vehicles, was mostly developed at Ford's Connectivity and Innovation Centre in Ottawa's tech cluster (Bostelaar, 2019). With more than 300 auto tech companies and organizations in six major automotive technology clusters across Canada, Canada is capable of leading the development of automotive vehicle and manufacturing technologies, especially in the field of autonomous, connected and electric vehicle technologies.

THE CONTRIBUTION OF AUTOMOTIVE PRODUCTION TO CANADA'S ECONOMIC DEVELOPMENT

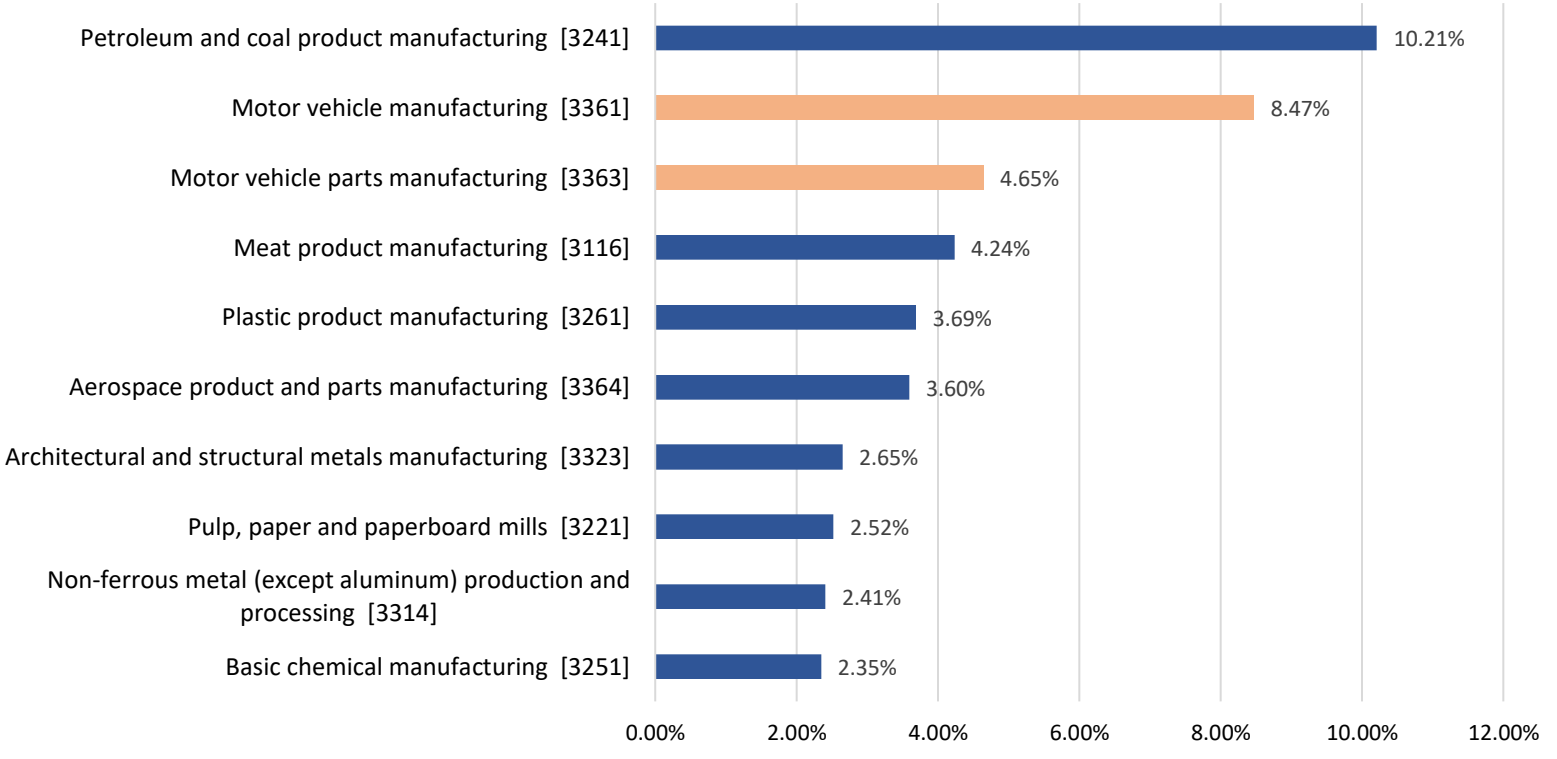
As discussed in the previous sections, the contribution to Canada's economic development that comes from Automotive Production depends on a network of over 950 businesses that employed around 188,000 workers in 2018. Activity in **Vehicle Assembly** and **Vehicle Parts Manufacturing** forms the core of this complex. Both industries are linked to the national economy through impacts to the supply chain and to consumer spending, so changes in assembly or parts production impact employment among suppliers and related spending by consumers. This is demonstrated in the third section on the economic impact of the expanding automotive production.

In 2019, vehicle assembly and vehicle parts manufacturing were Canada's second and third largest manufacturing industries. Moreover, in 2019, Ontario - being Canada's vehicle assembly powerhouse - was the second largest North American vehicle

assembly jurisdiction after Michigan, producing over 1.9 million vehicles[4] (Invest Ontario, 2020).

As shown in Figure 4, vehicle assembly and vehicle parts manufacturing made up 8.47% and 4.65% of the total manufacturing revenue respectively. Combined, the output of both industries is larger than the output of Petroleum and coal product manufacturing (13.12% of total manufacturing revenue). In 2019, the total revenue of vehicle assembly (**NAICS 3361**) was at $63.5 billion, while that of vehicle parts manufacturing (**NAICS 3363**) was around $34.8 billion. Given the size and output of both vehicle assembly and vehicle parts manufacturing, Canada's automotive production is one of the main sources of value for the manufacturing sector and the Canadian economy.

Figure 4. Top 10 Manufacturing Industries by Share of Total Manufacturing (NAICS 31 - 33) Revenue (2019)

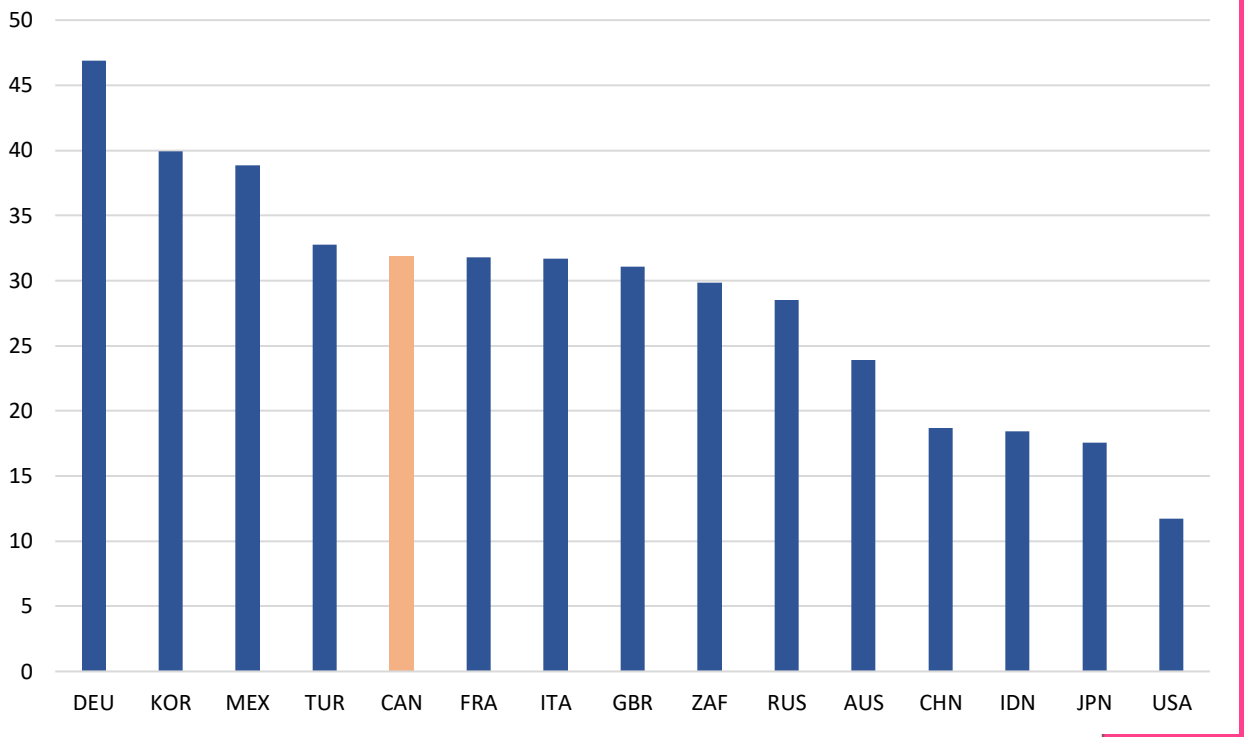


[4] According to IHS Markit 2020 rankings.

Importance of Exports

Exports bring value from other countries to Canadian industries, investors, workers, and consumers. Canada is among a group of industrial countries with a high dependence on exports as a source of activity. Figure 5 displays exports as a proportion of the total economy across the G-20 countries. In 2019, only Germany, South Korea, Mexico and Turkey had a greater reliance on exports than Canada. This key structural feature dictates a policy focus on export development.

Figure 5. Exports as a percentage of GDP in the G20 (2019)

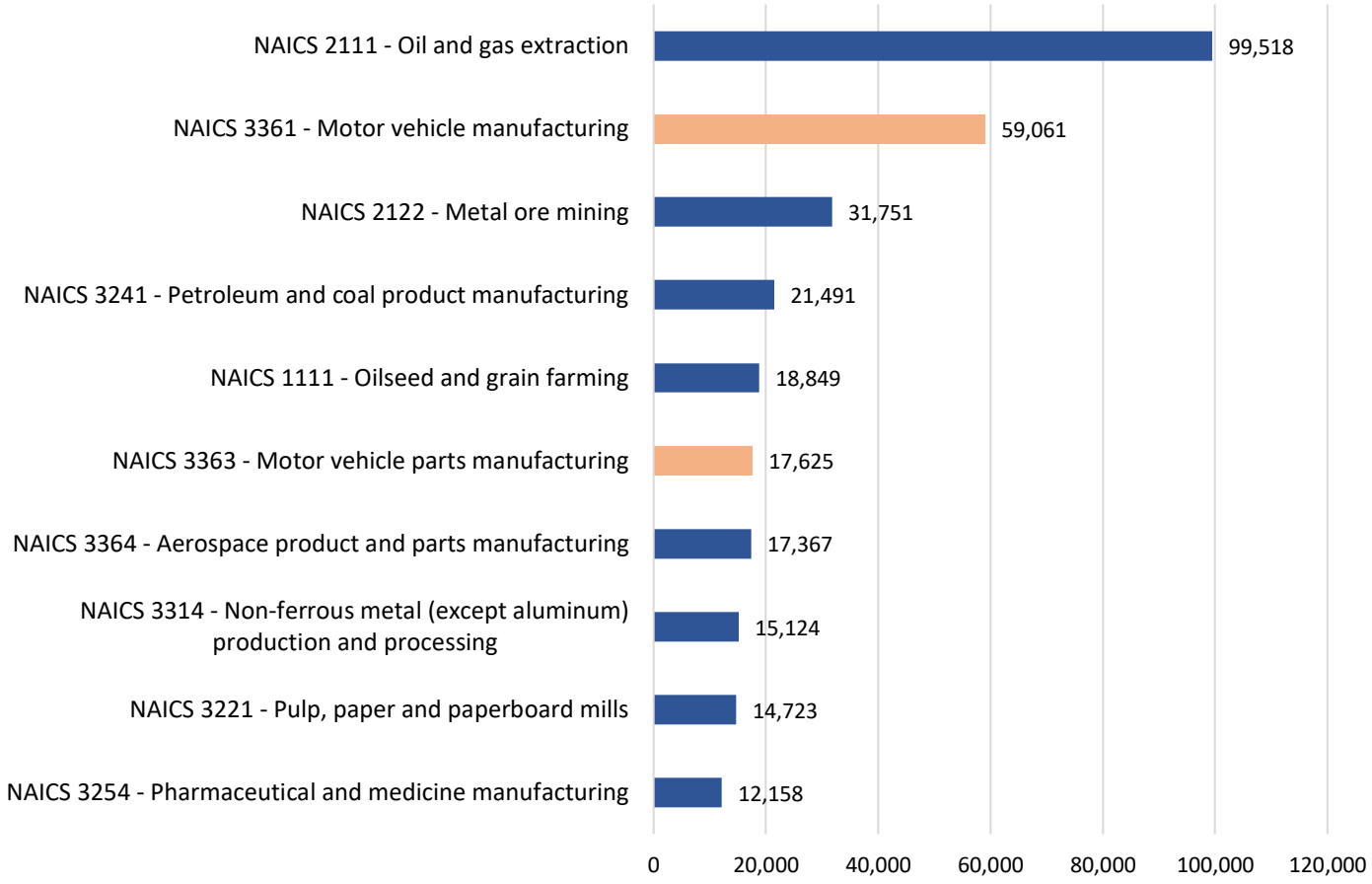


Source: Organization for Economic Co-operation and Development (OECD); Trade in goods and services; Exports as percentage of GDP (2019).

Canadian exports are heavily concentrated - just ten industries supply 52% of total exports. Figure 6 shows that vehicle assembly and vehicle parts manufacturing are the second and sixth largest exporting industry in Canada respective. This report argues that close interindustry linkages tie assembly, parts manufacturing and Other Primary Automotive Suppliers to Canada's second largest export sector. This is a major structural advantage as automotive production, creates high value-added, high

income jobs and is linked to key global technology development. Emerging changes in policy and technology will drive strong global change in vehicle production. These linkages and export scale makes the FOCAL Automotive Production industry an essential national source of activity and wealth.

Figure 6. Exports by Industry, Canada Top Ten (2019, in millions of Canadian Dollars)



Source: Trade Data Online - Import, Export, and Investment Canada - Industry Canada

THE ECONOMIC IMPACT OF EXPANDING AUTOMOTIVE PRODUCTION

The purpose of this section is to summarize the results of FOCAL's report on "The Economic Impact of Expanding Automotive Production". Given the size and contributions of automotive manufacturing, FOCAL ran two simulations to quantify and demonstrate the economic-wide impact of the sector. The simulations represent two scenarios whereby activity within the automotive production industry is expanded, and both the change in industry output, and the number of jobs created within the FOCAL-defined automotive supply chain are measured.

To carry both simulations, FOCAL employed Statistics Canada's Interprovincial IO Model. The two scenarios selected for this simulation include:

(1) An increase of 20% in vehicle assembly; **and**
(2) An increase of 20% in vehicle parts exports.

Both simulations use 2015 as the base year for the analysis. In the section below, the impact of the two scenarios across the four segments of the FOCAL-defined automotive supply chain (**Vehicle Assembly**, **Vehicle Parts Manufacturing**, **Other Primary Automotive Suppliers**, and **All Other Automotive Suppliers**) is summarized. For the purpose of simplicity, the impact presented in the scenarios in this section represents the *Total impact* on the FOCAL-defined automotive supply chain. A more detailed breakdown of the impact which includes specifics on the direct, indirect and induced changes, as well as the provincial distribution of the impacts can be found in the "The Economic Impact of Expanding Automotive Production" report.

Each simulation measures the impact on each group of suppliers as vehicle assembly or parts manufacturing activity increases. Expanding activities in both vehicle assembly and parts manufacturing can bring vast benefits not only to automotive production, but also across the broader automotive supply chain and the entire economy. As presented in the sections below, the national economic impact of both expansions can be also felt in industries such as materials (non-metals) manufacturing, metals manufacturing, computer and electronics, engineering and management, and in other automotive supplying industries (eg. electricity, truck and rail transportation, finance…). For these reasons, the importance and contributions of vehicle assembly and parts manufacturing are not limited to vehicle production only but extend to other industries and sectors in the economy.

Simulation # 1: An Increase of 20% in Vehicle Assembly

Canada's vehicle, heavy truck and bus assembly industry produced $62 billion in output in 2015. FOCAL simulated the impact of a 20% expansion in vehicle assembly in Canada, which is equivalent to a $12 billion increase in the vehicle manufacturing

industry (NAICS 3361). A 20% increase in vehicle assembly can be equivalent to the addition of two vehicle assembly plants operating at full capacity, *or* the expansion of the industry's production capacity and the increase in vehicle production.

The initial $12 billion increase in vehicle assembly translates to a $1.55 billion increase in output in the domestic vehicle parts manufacturing industry. The 20% expansion in vehicle assembly also adds $1.89 billion and $4.1 billion in output within the industries of Other Primary Automotive Suppliers and All Other Automotive Suppliers respectively, which is equivalent to more than 29% of the total impact ($20.45 billion).

The job gains across the automotive supply chain are also significant (≈ 35,000 jobs). The expansion in production will lead to a total hiring requirement of 11,515 in both **Vehicle Assembly** (7,816 jobs) and **Vehicle Parts Manufacturing** (3,699 jobs). More jobs are added within the **Other Primary Automotive Suppliers** segment (5,974 jobs), mainly within the materials (non-metals) industries and the wholesale and distribution industries. Such jobs are essential to the automotive manufacturing supply chain, as they directly supply both vehicle assembly and vehicle parts manufacturing.

Simulation # 2: A 20% Increase in Vehicle Parts Exports

Canada's vehicle parts industry produced $30.6 billion worth of products and parts in 2015. On average, over 60% of this production across the eight vehicle parts industries was exported. FOCAL's second simulation assumes a 20% increase in vehicle parts exports (equivalent to a $4.2 billion increase). The impact of this increase on industry output and jobs was assessed.

Industry output increase is mainly distributed among the vehicle parts manufacturing industries, other primary automotive supplying industries and other automotive supplying industries. While the increase in industry output in vehicle parts manufacturing ($3.76 billion) is expected as it is directly linked to exports, however the increase in output within both Other Primary Automotive Suppliers and Other

Automotive Suppliers is notable ($1.21 billion and $2.54 billion respectively). This impact is mainly concentrated in the Metal industries, as well as the distribution, engineering and management service industries.

The distribution of job gains is also concentrated in the three supply chain segments: **Vehicle Parts Manufacturing**, **Other Primary Automotive Suppliers** and **Other Automotive Suppliers**, adding up to ≈22,800 jobs in the broader automotive manufacturing supply chain. However, the job gains are the largest in the industries of the **Other Automotive Suppliers** (10,445 jobs) such as energy, finance, truck transportation and other transportation services. Job gains in vehicle parts manufacturing are almost 8,500 jobs. Additional details on the distribution of job gains and industry output within the direct, indirect, and induced changes can be found in the report titled “The Economic Impact of Expanding Automotive Production”.

Overall, the two simulations demonstrate the potential gains in industry output and employment within and beyond the automotive production sector. More importantly, both scenarios indicate significant increases in industry output and jobs in non-automotive industries and sectors (e.g. metals, distribution, engineering & management, fuel & energy, transport services…) highlighting the importance of automotive production for the broader manufacturing sector and the entire economy. The many new jobs tied to the automotive manufacturing sector, include many skilled occupations which also bring value to Canada’s innovative ecosystem. Finally, there are strategic technology links with expanding automotive production, as the need for new technological improvements rises with the increase in manufacturing. This is expanded upon in the report “The Economic Impact of Expanding Automotive Production”.

CONCLUDING REMARKS

This report summarized FOCAL's key findings on the size and impact of the FOCAL-defined automotive manufacturing sector. The broader definition of the sector expands the perceived dimensions of Canada's automotive production and its impact, with around 210,000 employees in Canada's automotive manufacturing and technology sector. With the significant number of industries involved in its broader supply chain, and with the potential impacts of expanding automotive production, the Canadian automotive manufacturing sector is more important to Canada's economy and innovation ecosystem than previously perceived.

Notable potential job gains are apparent beyond vehicle assembly and vehicle parts manufacturing in the two simulations carried by FOCAL. Overall, the 35,000 potential jobs from expanding vehicle assembly, and the 23,000 potential jobs from increasing vehicle parts exports include skilled occupations which bring value to the Canadian labour force and economy. Ties to technology and innovation make this expansion even more valuable, as Canada's automotive research and technology industry has the capabilities to lead in several automotive technology fields. Therefore, by demonstrating the broader scale and impact of the automotive manufacturing sector, this report highlighted the significant potential value and outcomes of investing in Canada's automotive production.

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