



*DRIVE
TO WIN*

Automotive Advisor Report

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MESSAGE FROM THE AUTOMOTIVE ADVISOR



After more than two years as the Automotive Advisor to the federal Minister of Innovation, Science, and Economic Development (ISED) and the Ontario Minister of Economic Development and Growth (MEDG), I have summarized my findings and recommen-

dations in the report that follows. This comes as a culmination of extensive consultations, engagements, and collaboration with various stakeholders in Canada, Michigan, and other international jurisdictions.

During this time, I have worked in close cooperation with the Canadian Automotive Partnership Council (CAPC). Established in 2002, CAPC includes all principal stakeholders relative to the automotive industry in Canada, with the objective of creating a unified voice on how we can improve our automotive industry in Canada. As one of the founding members of CAPC, I played an active role in chairing various committees as well as contributing to the publishing of both versions of CAPC's *Call to Action*, including the recommendations listed in this report (see pages 10–13).

CAPC has been a great model for how the industry, labour, academia, and governments can work together and my experience with CAPC was one of the main reasons that I accepted the role of Automotive Advisor. I am passionate about our industry and its future and I understand the impact the automotive industry has on our economy in terms of jobs and prosperity—that is my motivation!

As I close the chapter in this role, I would like to express my sincere appreciation to ISED and MEDG staff for their relentless professional support on all my activities. The Memorandum of Understanding (MOU) with Michigan, the research for a Technology Roadmap developed for the automotive industry, and the North American automotive competitive benchmarking analysis, all complement the thinking outlined in this report. When you look at Annex A, all this outreach was coordinated by ISED and MEDG in our effort to better

understand with our own eyes and ears. I appreciate the support and encouragement by CAPC and industry leadership. You all made my job as Automotive Advisor interesting and rewarding—*thank you*.

Box 1: Mr. Réal (Ray) Tanguay

On June 9, 2015, Mr. Réal (Ray) Tanguay was named to the position of Automotive Advisor to the Minister of Innovation, Science and Economic Development Canada and the Ontario Minister of Economic Development and Growth. Mr. Tanguay retired as Chair of Toyota's Canadian operations on March 31, 2015.

In 1991, Mr. Tanguay joined Toyota Motor Manufacturing Canada Inc., and was a leading force in instilling innovation within the company. Under his stewardship, TMMC became the first Toyota manufacturing plant outside of Japan to produce Lexus vehicles, beginning in 2003. In 2005, the decision of TMMC to build a new \$1.2-billion plant in Woodstock, Ontario was bolstered by the excellent reputation of its Canadian operations. In 2005, he became Managing Officer of Toyota Motor Corporation in Japan, Executive Vice-President at Toyota Motor Engineering in North America, Senior Vice-President at Toyota North America, and Chief Risk Officer of Toyota North America.

In 2011, Mr. Tanguay was promoted to Senior Managing Officer of Toyota Motor Corporation, being the first non-Japanese individual to hold that position.

In 2012, Mr. Tanguay was recognized with an honorary Doctorate of Laws from Laurier University and an honorary Doctorate of Engineering from the University of Waterloo. His achievements were further recognized in 2017 when Mr. Tanguay was inducted into the Order of Canada, one of Canada's highest civilian honours for "his contributions to strengthening and promoting the automobile manufacturing sector in Canada".

EXECUTIVE SUMMARY

This report, on the *state of the Canadian automotive industry and actions for the future*, arrives during a period of unprecedented disruption stemming from climate change, new technologies, and shifting expectations and uncertainties surrounding trade and investment. For Canadians and communities across the country who are dependent on a viable and enduring Canadian automotive industry, the expectations are that policy makers at all levels will identify the impacts of these transformations and challenges and take deliberate measures to protect and strengthen our automotive industry in Canada.

By many standards, I am pleased by the progress we have made over the past two years. Governments at all levels have demonstrated a willingness to engage with industry to advance Canada's automotive sector. Labour has been a thoughtful partner. Educational institutions and research centres have reinforced their commitment to timely research and relevant instruction. The private sector has provided a strong and common voice. By continuing to work together for a common purpose, this will ensure that Canada is poised to seize opportunities for future growth—both in manufacturing and in our research and development (R&D).

In targeting prospects for a stronger automotive industry in Canada, we have to understand and remove barriers for investors because in order for Canada to win investments we cannot just be competitive—we need to be better than other jurisdictions south of the border.

In the past two years, there has been a renewed commitment to the automotive industry by both the federal and Ontario governments, highlighted by the realignment of their investment policies with the needs of the industry. In the 2017 federal Budget, major changes included:

1. The Government of Canada's former Automotive Innovation Fund (AIF), that was changed from an interest-free loan to a grant, is now part of the Strategic Innovation Fund. It is now working in a more complementary manner with the Ontario Jobs and Prosperity Fund;
2. The Government of Canada and the Ontario Government announced the creation of investment organizations in response to industry needs. These organizations will facilitate the process of investment by providing "one stop-shop" or concierge services important for investors and site selectors.

While these are important changes, the challenge for attracting manufacturing investments remains in our ability to be the most cost competitive. Ontario and Canada do well on key performance indicators like safety, quality, and productivity as well as our ability to manage complexity resulting from our highly educated workforce. Our performance in these areas is well recognized and appreciated by parent headquarters. Our challenge is in the local processing costs, which includes elements and factors such as labour and benefits (wages and number of paid days off), electricity costs, Cap and Trade, administrative burdens, and currency exchange risk. When Ontario is compared to other automotive jurisdictions across North America, our local processing costs place us in the middle of the group. With our lower Canadian dollar, Ontario costs are lower than in the Great Lakes, similar to the Southern US, and higher than Mexico.

This is an important comparison for governments to recognize as it affects manufacturing investments. When a corporate decision is made to invest, company executives will ask for a comparison of various sites and options. An Evaluation Matrix (as the one shown on page 29) is typically prepared by site selectors and consultants along with in-house specialists. It becomes the most influential document for decision making. This serves as a reminder of key factors where Canada must always be better than others to even be shortlisted for investments.

Beyond manufacturing, the industry is undergoing massive change with new technologies on the horizon defining the *car of the future*. Thanks in part to our manufacturing base and our R&D capabilities, Canada is incredibly well positioned. For example, Canada has strong capacity in **emerging technologies** such as light-weighting materials, mobile communications, sensors and controls, software development, data analytics, artificial intelligence, cybersecurity, and advanced battery research.

These capabilities, backed by our talent pool and access to globally recognized researchers, are putting Canada on the map. As a result, significant progress has been made in attaining new investments by both the private and public sectors in strategic and innovative areas. A series of important policies and measures have also been announced that are energizing innovation in the industry. The Innovation and Skills Plan and the development of Superclusters will move us in the right direction. The demands for new technologies along with our capabilities to support their development has led to the need for an updated vision that includes technology and people development. As such, I recommend the following statement as Canada's Automotive Vision:

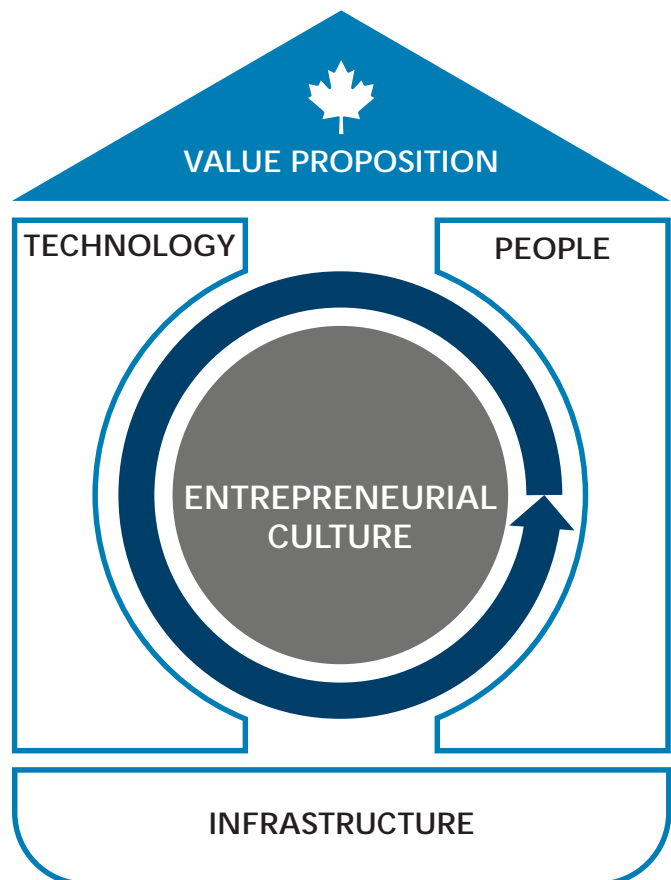
“To be the location of choice for automotive manufacturing, services, and research by developing our people, skills, and technology to compete and to contribute to a prosperous Canada.”

Our mission statements highlight what is needed to propel Canada's automotive industry to attract investment in both R&D and manufacturing:

1. Foster a culture of innovation, creativity, and continuous improvement;
2. Encourage investment in people to provide prosperity and quality of life for Canadians;
3. Leverage and attract talent to position Canada as a centre of excellence;
4. Support technologies that are key to advancing the automotive manufacturing and research sectors;
5. Address the operating environment factors to enhance competitiveness and growth; and
6. Focus on branding Canada by raising our visibility and showcasing new technologies in key markets.

To grow investments, we need to focus on key areas of development: technology, people, and infrastructure. These fundamental pieces all come together in the following diagram, meant to depict a house where we connect all the components as an integrated structure that makes up our value proposition for investments.

FIGURE 1: FRAMEWORK FOR SUCCESS



The value proposition is what Canada has to sell for both manufacturing and R&D investments. Under each of the main components of the house, I recommend actions that can help to improve Canada's overall value proposition.

In regards to **technology**, Stephen Carlisle, Chair of the CAPC Advanced Technology Committee, and I, are aligned in recommending the following actions:

- Use the Automotive Technology Roadmap that was developed to identify and fill the gaps to promote innovation and investment in technology (see Annex B);
- Complete our Canadian capabilities inventory and benchmark against other jurisdictions; and
- Promote the use of advanced technologies in manufacturing.

From what I have learned over the past two years about Canada's strengths, areas to build upon include artificial intelligence, cybersecurity and 5G capabilities, which are important technologies for the car of the future.

Technology also plays a critical role in improving our manufacturing competitiveness. We must remain committed to making manufacturing relevant and ensuring that we introduce some of the latest technology such as Industry 4.0. As such, investment into the manufacturing sector could yield major benefits.

The second critical pillar is **people development**. Working alongside Bob Magee, Chair of the CAPC People Skills and Development Committee, we recognize the benefit of using the Automotive Technology Roadmap as a model to develop a "talent map". One of the key actions recommended in this report is to ensure we have the talent needed to handle emerging technologies in both R&D and manufacturing.

To continue the emphasis on people development, I stress the importance to:

- Establish a culture based on making things and to promote continuous improvement in manufacturing through employee engagement;
- Build and leverage talent needed to provide capacity for targeted areas of strategic interest;

- Create a workforce that enables successful adoption of emerging technologies; and
- Develop an educated workforce for all levels of the organization.

Under **infrastructure** I include a variety of elements to support both manufacturing and R&D innovation. Based on what I have seen and heard from competing jurisdictions, many countries and jurisdictions understand that infrastructure is the enabler to deploy emerging technologies. It includes education systems, clusters, smart cities, transportation, computing power, communities, etc. We need to ensure that our infrastructure environment is supportive for the adoption of new technologies. In my report I include a number of actions, such as:

- Develop "urban transit models" that incorporate emerging technologies;
- Benchmark against best practices and collaborate with other jurisdictions;
- Develop test facilities and test beds to validate our technology; and
- Develop advanced communication networks that enables connectivity.

As these and other actions are implemented to improve Canada's position as a location of choice for investments, it's important for Canada to continue to sell its **value proposition**. Working closely with my co-chair of the CAPC Capital Investment Committee, Rob Wildeboer, we have focused on the importance of cost competitiveness as a base for a strong narrative for investing in Canada. To develop and sell our narrative, we need to:

- Define our value proposition and re-assess our cost competitiveness;
- Showcase Canadian talent and their innovative projects;
- Develop a comprehensive sales plan; and
- Commit a budget and resources to support the sales plan.

I am pleased with the sense of partnership and purpose that has emerged across stakeholders in the automotive industry and I am encouraged by the fact that policy makers at all levels recognize the essential role they play in nurturing the automotive industry. We have escalated the profile and importance of the automotive

industries. It is clear that sustained success will demand commitment and partnership from all stakeholders at the highest level. I look forward to an escalation of positive policies and actions that will create more jobs and prosperity for our communities.

In summary, there are three key focus areas:

1. Remain competitive in manufacturing

- a. Promote productivity improvements
- b. Reduce local processing costs
- c. Accelerate the implementation of Industry 4.0

2. Invest in advanced technologies and infrastructure

- a. Develop and implement an urban transit model
- b. Implement smart highways

- c. Provide national testing facilities to validate new technologies

3. Continue to develop our talent pool at all levels

- a. Incentivize training in the workplace
- b. Expand apprenticeships and co-operative education
- c. Develop technology clusters with local investors

In the end, it's all about selling our value proposition to the world.

WHY AN AUTOMOTIVE ADVISOR?

In November 2014, the Canadian Automotive Partnership Council (CAPC) released a report entitled “A Call for Action II”, in which it recommended the creation of an investment board made up of federal, provincial, and industry members to accelerate the implementation of the recommendations.

When CAPC’s first report was released in 2004, the automotive industry was producing at a near record level and the low Canadian dollar ensured that labour and manufacturing costs remained highly competitive. In the decade that followed, significant changes occurred in the industry: the dollar soared, major industry players were restructured, and new labour agreements were negotiated. The financial crisis of 2008–2009 was particularly difficult, causing an unprecedented decline in automotive manufacturing. The automotive industry in North America collapsed, going from sales of 17 million units annually down to 10 million units—the equivalent of losing 35 full-production assembly lines. While the drop was dramatic, production and sales began to grow again in 2010 and have continued their upward trajectory. Beginning in 2010, the Canadian dollar was high, Canada saw its competitive edge in automotive manufacturing erode and lost its fair share of investments.

Competition for automotive investment in the years after the financial crisis was heated, with areas such as Mexico, the Southern United States (US), and—to a lesser extent—the Great Lake States all making highly competitive bids to win investments—and they did. Recognizing that Canada could make changes in order to compete for new investments, CAPC highlighted that there should be a renewed focus to attract investment to the automotive industry in Canada. A proactive approach for more investments was seen as necessary.

Due to the complexity of creating a of board within the governments’ structures, the decision by CAPC and the Ministers from Ontario and Canada was to establish the Automotive Advisor position. I was pleased to take on this new role in June 2015—the timing was right given that I had just retired from my position as Chair of Toyota Canada.

This came at a time of significant disruptions to the automotive industry such as fuel efficiency and safety standards as well as the growing customer demands for connectivity and autonomous vehicles. It was understood that major technological advances to both products, processes, and infrastructure would accelerate the need for innovation. The fusion between advanced technologies and the automotive industries has resulted in a unique opportunity. In order to manage change, it is important to continue to have concentrated efforts to deepen our understanding of emerging technologies and to coordinate the actions needed to remain ahead of our competition.

It is also important for Canada to continue to maintain and grow the automotive manufacturing footprint through proactive action and to avoid becoming a ‘have not’ jurisdiction. Part of being proactive is ensuring that we accurately measure and assess the automotive industry performance on a regular basis and that we work to change the results of key metrics that we use (see Annex C).

REVIEW AND PROGRESS OF CAPC'S 2014 RECOMMENDATIONS

There has been notable progress made since CAPC's "Call for Action II" put forward recommendations in 2014. I have summarized the progress of those recommendations below:

1. Compete for assembly mandates with globally competitive investment support

The 2017 federal budget announced the creation of the Strategic Innovation Fund which incorporates the former AIF and its sister program the Automotive Supplier Innovation Program. It will provide grants with an expanded budget of \$1.26 billion for multiple sectors, to be allocated over five years. The Government of Ontario incentives have always provided grants and typically match the federal allocations.

2. Improve transportation infrastructure and border policy

The 2017 federal budget addressed industry concerns by providing:

- \$120 million to deploy infrastructure for electric vehicle charging and natural gas and hydrogen refueling stations,
- \$76.7 million to update regulations and standards for the safe adoption of connected and autonomous vehicles; and,
- \$2 billion for a national trade corridors fund and \$5 billion for the Canada Infrastructure Bank to address trade and transportation priorities.

- In addition, the Government of Ontario is currently in a 13-year, \$190 billion infrastructure investment program across the province, including the infrastructure that facilitates the deployment of new and emerging technologies.

3. Provide a one-stop support for investment attraction

The federal government announced the creation of the "Invest in Canada" Hub within Global Affairs Canada. Its purpose is to be a dedicated high-impact sales force to promote Canada and to work with global companies. The Hub is meant to work in partnership with ISED, Canadian trade commissioners, and with provincial and municipal investment attraction offices. Similarly, the Government of Ontario created the Ontario Investment Office within MEDG to be more proactive and effective in attracting investments. Both organizations will coordinate and work together to create a "single-window concierge" service that will facilitate investments.

4. Ease regulatory burden

The Government of Ontario launched the Red Tape Challenge. This online consultation is designed to help identify and fix regulations that are unclear, outdated, redundant or unnecessarily costly for business. The number of regulations have decreased through consolidations but the requirements for reporting and the administrative burden has not changed. The introduction of Cap and Trade and possibly the introduction of new rules of origin in the North American Free Trade Agreement (NAFTA) will increase the administrative burden.

5. Pursue a free and balanced trade agenda

The automotive industry has been involved in the original Trans-Pacific Partnership (TPP) negotiations and now with NAFTA. It is important to continue this kind of collaboration as new developments arise. While trade agreements such as Canada-Korea Free Trade Agreement (CKTA) and the Comprehensive Economic Trade Agreement (CETA) have been negotiated to have tariff free trade flow between Canada and other markets, this could amplify the trade deficit for the automotive sector given that Canadian vehicles and parts are minimally exported back to those countries. On the other hand, the automotive trade between Canada and the US is fairly balanced and integrated. The outcome of NAFTA negotiations have a big impact on the future of Canadian automotive industries. The current state of uncertainty has the potential to put manufacturing investments on hold in Canada.

6. Reduce fully loaded costs of labour and align number of working days with competing jurisdictions

The 2016 collective round of bargaining amongst the D3 and Unifor has structured our labour costs to be competitive with the United Automobile Workers (UAW) at a par-dollar.

The Government of Ontario's changes to the workplace regulations introduced in 2017 will have a negative impact to our cost competitiveness and our ability to attract investments. Bill 148 and its regulations will add more days off and paid days off along with some restrictions to shift flexibility. The government needs a better understanding of competition and the impact of its changes. At the same time, we realize that modernizing labour laws is necessary to keep pace with the changing workplace. On a positive note, the regulatory exemptions for the automotive sector will offset and mitigate some of the broader impacts from Bill 148.

7. Invest in plants, machinery, and equipment

All original equipment manufacturers (OEMs) have made large investments in their Canadian facilities, including:

- In March 2017, Ford Motor Company of Canada committed \$1.2 billion to transform its Windsor Operations into a world-class engine facility, further research at its Powertrain Engineering R&D Centre in Windsor, Ontario and establish an all new Research and Engineering Centre.
- In January 2017, Honda of Canada Manufacturing made a \$492 million investment in their facilities in Alliston, Ontario to update their main assembly lines in preparation for the next generation of Civic and CRV models, as well as completing a new state-of-the-art and energy efficient paint shop.
- In October 2016, Fiat Chrysler Automobiles Canada made a \$325 million investment commitment to rebuild the paint shop at their facility in Brampton, Ontario.
- In September 2016, General Motors of Canada committed \$554 million in investments towards their facilities in Oshawa, St. Catherines, and Ingersol, Ontario.
- In November 2015, Toyota Motor Manufacturing Canada announced that they would be moving additional RAV4 production including a hybrid version to Cambridge, Ontario as a replacement for the Corolla.
- In January 2015, Linamar Corporation announced a \$507 million investment in manufacturing facilities in Guelph, Ontario.
- Magna International is investing approximately \$300 million a year in its Canadian operations.

While progress has been made, some long term product mandates need to be confirmed in order for some plants to build their capacity. For example, the future of the FCA Brampton plant and the GM Oshawa plant are essential to maintaining the existing vehicle assembly footprint. Currently, investment in the supply chain is still lower than expectations.

8. Invest in people

We recognize the increased effort to support people development by governments and by industry. The 2017 federal budget provided a \$7.8 million fund to support the Global Skills Strategy. In Ontario, we have some excellent initiatives that have been announced, including the Premier's Specialist High Skills Major (SHSM) program and commitment to increase science, technology, engineering and mathematics (STEM) graduates by 25% from 40,000 to 50,000 is commendable. The Ontario 2017 budget has also announced a \$1.9 billion Post-Secondary Institutions Strategic Investment Fund and a renewed math strategy.

Under the leadership of Chair Bob Magee, the CAPC People Development and Skills Committee is focusing on promoting lean manufacturing, skilled labour development, pathway education, and lifelong learning.

9. Invest in research and innovation

Canada has successfully attracted investments in research and innovation. Some examples include:

- In March 2017, Ford Motor Company of Canada committed to establishing their new Research and Engineering Centre in Ottawa, Waterloo, and Oakville.

- In June 2016, General Motors of Canada announced it will increase its engineering base in Ontario from approximately 300 to 1,000 engineering jobs as well as to establish a new software development centre in Markham focused on self-driving software, safety and connected-vehicles.
- Apple Inc. to open a 22,000 square foot office in Kanata, Ontario to develop an operating system for connected vehicles.
- Uber to invest \$5 million in the Vector Institute (AI) in Toronto under the leadership of Raquel Urtasun.
- Tesla Motors has initiated a five-year research partnership with Dalhousie University to develop the next generation of lithium-ion battery under the leadership of Dr. Jeff Dahn.
- DeepMind Technologies Ltd., a leading artificial intelligence (AI) company owned by Google, will establish their first international office in Edmonton to work with the University of Alberta and its leading researcher Dr. Richard Sutton.
- Montreal-based Element AI, a research lab and incubator for AI led by world-leading researcher Yoshua Bengio, is hiring 250 new employees and has received a \$135 million investment from the tech community.

The 2017 federal budget emphasized the government's support for research and innovation by announcing additional funds as follows:

- \$125 million for a Pan-Canadian Artificial Intelligence Strategy to promote collaboration between Montreal, Toronto, and Edmonton Centres of Expertise;
- \$950 million for developing innovation superclusters;
- \$300 million over 11 years to launch a smart cities challenge fund; and,
- Doubling the number of companies in digital, clean energy, and health technologies from 14,000 to 25,000 by 2025.

The 2017 Ontario budget also supported innovation with:

- \$50 million for the Perimeter Institute for Theoretical Physics in Waterloo;
- \$50 million to establish the Vector Institute for Artificial Intelligence;
- \$130 million over five years to support a 5G telecommunications network;
- \$20 million over five years to support the development of the Waterloo Quantum Valley Ideas Lab;

- \$75 million for advanced computing and big data strategy;
- \$80 million over five years to create the Automotive Vehicle Innovation Network (AVIN);
- \$4 million to enhance cybersecurity; and,
- the Automotive Supplier Competitiveness Improvement Program (ASCIP).

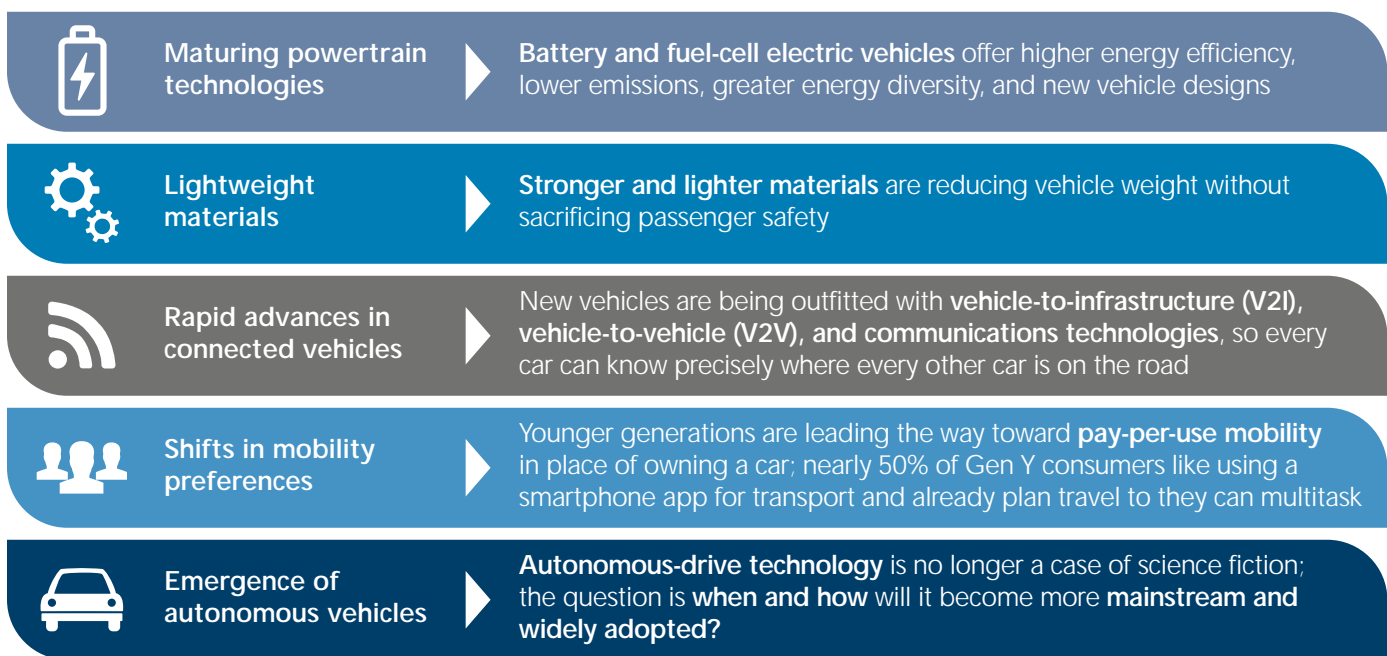
10. Develop a clear and compelling narrative for Canadian investment

We have come a long way since 2014. Through the engagement and collaboration of CAPC and both governments, and with the development of enhanced investment attraction tools, we have made significant progress in raising Canada and Ontario's profile as a location of choice with automotive decision makers (see Annex D: Promotional Material). We are now in a better position to tell a compelling story about Canada's strengths and value.

CHANGING DEFINITION OF THE AUTOMOTIVE INDUSTRY

Major technological advances to both products and manufacturing processes are accelerating innovation throughout the automotive industry. This is in response to the need to reduce emissions and improve fuel efficiency and safety standards, as well as growing customer demands for connectivity and infotainment. Transformations in the automotive industry are seemingly due to disruptive technologies (as seen in the illustration). These technological advancements will present new business models and opportunities.

FIGURE 2: HIGHLIGHTS OF THE TECHNOLOGY ROADMAP



Source: "The Future of Mobility: How Transportation Technology and Social Trends are Creating a New Business Ecosystem" Deloitte University Press, September 2015

The industry is increasingly defined by technological innovation with both automotive and non-automotive companies working in the same space. This leaves Canada well positioned to take advantage of these opportunities. Canada has a mature automotive cluster with R&D and supplier strengths that are well aligned with the projected future of the industry, including information technology (IT), sensors, network security, advanced lightweight materials, and alternative powertrains (e.g., EVs in Quebec, fuel cells in British Columbia). Canada has multiple automotive R&D facilities, including federal

government research labs such as CANMet and the National Research Council's facilities plus over 40 universities and colleges contributing to automotive research. Most global suppliers are part of our automotive manufacturing cluster. Canada has a highly educated and skilled workforce with roughly 64 percent of Canadians holding post-secondary degrees, 18.6 percent of which are in STEM fields. Building on this foundation, Canada has positioned itself to be an innovation and manufacturing leader, attracting new R&D and vehicle mandates that will shape the future of the industry.

FIGURE 3: CANADIAN AUTOMOTIVE CAPABILITIES



Canada's automotive industry is well-positioned to capture future growth through R&D and supplier innovation

Over 700 traditional parts suppliers, including most global suppliers

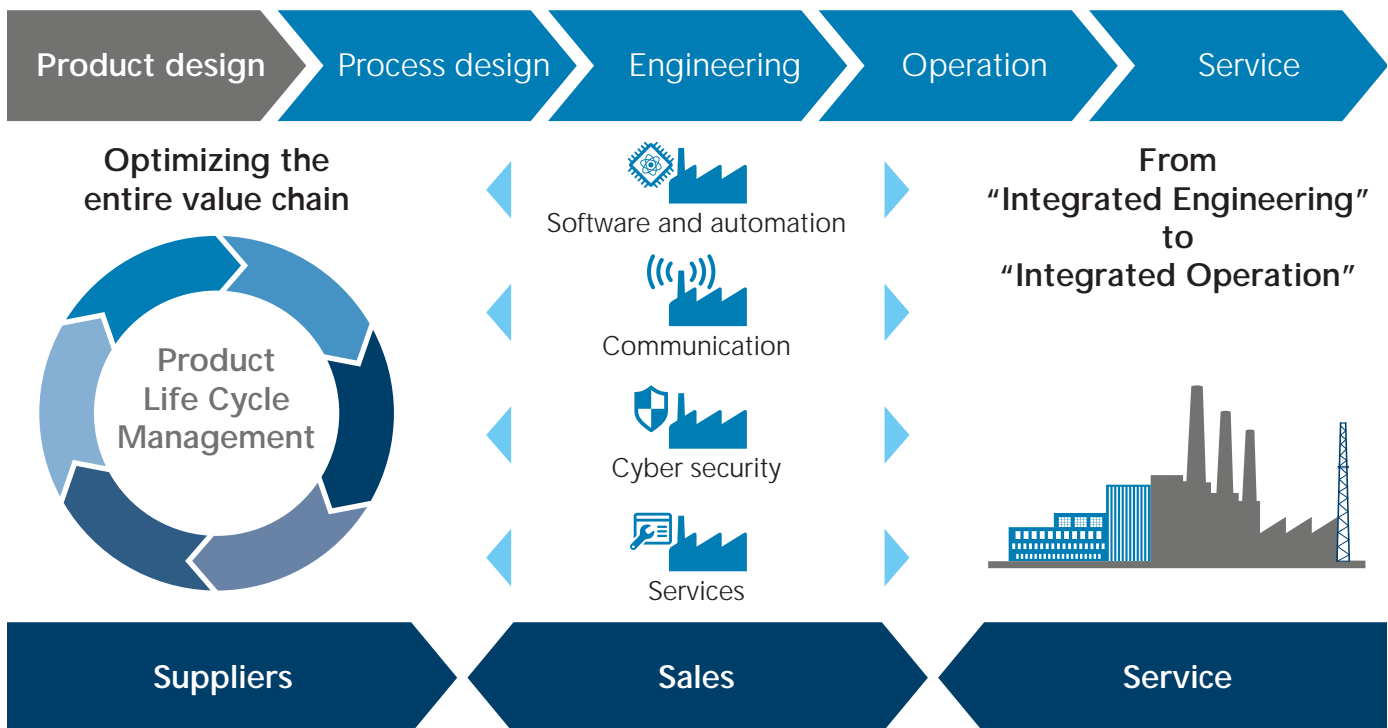
Canada has a highly educated workforce: 64% of Canadians hold post-secondary degrees and 18.6% in STEM fields

Another major change point is the introduction of the fourth industrial revolution—Industry 4.0. It will change the way business will be conducted in the future. Industry 4.0 is defined as the end-to-end digitization of all the business processes and integration into a digital platform, including value-chain partners and aftermarket service. This enables the transfer of data seamlessly across all aspects of the business cycle.

I continued to investigate the impact Industry 4.0 could have on our ability to compete. I attended the largest industrial show Hannover-Messe in Germany as well as a presentation by Dr. Deiter Wegener, Vice-President of Siemens AG Germany, where he explained the Siemens

experience with Industry 4.0 and why it was such a high priority for them and for Germany. This diagram (below) shows the digitization of the entire enterprise and how all steps are integrated into one process—from supply chains, to operations, to services. The idea underpinning Industry 4.0 is that a firm can have a “digital twin” for their processes that represents the ideal conditions, which can then be compared to reality to identify inefficiencies and problems. This way any variation becomes visible. Information and data can be easily transferred from location to location to improve the effectiveness of the whole enterprise.

FIGURE 4: INDUSTRY 4.0 DIGITIZED BUSINESS CYCLE



Germany has successfully created a sense of urgency. They recognized that unless they embraced Industry 4.0 and digitization, they were at risk of losing their ability to compete against low cost jurisdictions and afraid the digital world would leave them behind. The benefits of Industry 4.0 explained by Cisco, listed below, are remarkable:

TABLE 1: BENEFITS OF INDUSTRY 4.0

PRODUCTIVITY MEASURES	PERCENTAGE REDUCTION
Time between new product introductions	23%
Number of defects	49%
Average downtime of production	48%

In Canada, we have strong digital expertise but our understanding of Industry 4.0 is lagging and we are at risk of being left behind. At the Hannover-Messe industrial show I attended, most countries had a very strong presence, especially Europe, Asia, and the US. However, Canada was not even there. We need to create a sense of urgency in not only understanding Industry 4.0 but in how it will help us compete over the next several years. Those companies that have

successfully digitized their enterprise will be technology ready for the next revolution—Industry 5.0. Industry 5.0 will integrate artificial intelligence and deep machine learning into the entire digital enterprise process.

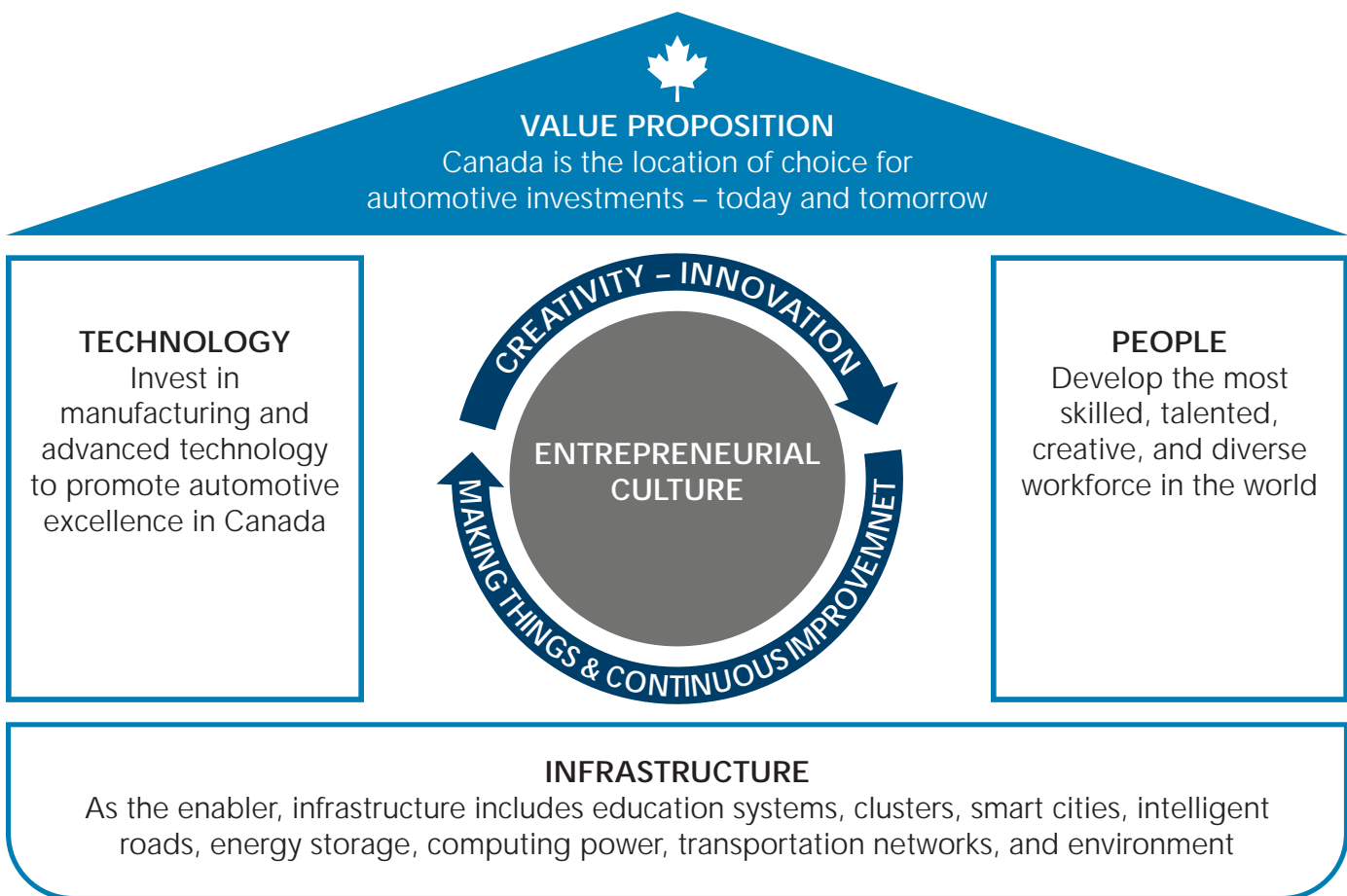
We need to leverage our know-how and accelerate the implementation of this new way of doing business.

FRAMEWORK FOR FUTURE SUCCESS

These major changepoints, from the digital economy and Industry 4.0, highlight the importance of building a structure that focuses on technology, people development, and infrastructure. We have identified the structure that we need to build upon to be a leader

in technology for both products and manufacturing and to develop our talent resources. These fundamental pieces all come together in the following diagram, meant to depict the house where we need to connect all the components into a comprehensive structure.

FIGURE 5: FRAMEWORK FOR CANADIAN SUCCESS



TECHNOLOGY

Emerging Technology

Innovation promises to change the way we make things, the way we get around, the way we communicate; in short the way we live. The automotive industry is currently undergoing a radical transformation with the convergence of innovation in four key areas referred to as ACES – Autonomous, Connected, Electric and Shared. It is becoming increasingly clear that the approaches which companies and jurisdictions take will distinguish those who survive and thrive from those that will not.

The best evidence of the impact that emerging technologies are already having on the automotive industry is in the major acquisitions, partnerships and transformative investments that companies are making right now.

These new technologies will be disruptive, but Canada has an amazing opportunity to be a truly global leader in the development of technologies and business models in the 21st century. Canada is an attractive place for automotive R&D investment and we need to do everything in our power to leverage the strengths that we have and promote those strengths to the world. Many digital companies have already discovered the advantage of doing research in Canada in terms of talent and cost-benefits. It is a great opportunity to develop the ecosystems where research will evolve into new businesses in Canada and be able to export to global markets.

The Automotive Technology Roadmap (see Annex B) developed by the Center for Automotive Research (CAR) in collaboration with ISED, MEDG, and CAPC, focused on vehicle technology, production technology, and new business models. This Roadmap is a key asset that has been validated by Canadian industry stakeholders and should be used as a strategic planning tool for the sector going forward. It is important to have such a map generated and renewed over time.

The Automotive Policy Research Centre (APRC) and Trillium have worked together to populate and display our supply chain and innovation centres through a geo-mapping tool (<http://trilliumgis.ca>). It provides us with the basis to assess our strengths and to build on areas needed to support the further growth of the Canadian automotive industry.

The reason it is so important for us to focus on emerging technologies is precisely because of the speed at which transformation will occur.



A plan to seize the opportunity would need to include these actions:

1. Understand our position versus competing jurisdictions

ACTIONS

- a. Complete and share the Automotive Technology Roadmap with policy makers, academia, and industry groups to guide decision making.
- b. Conduct an assessment to identify who has the capabilities to meet emerging technologies.
- c. Complete an inventory of Canada's capabilities around the supply chain, universities, colleges, and research institutions to complement our technology roadmap.
- d. Benchmark Canadian institutions against international institutions to identify where Canada needs to improve.

2. Invest in disruptive technologies that give Canada a competitive advantage.

Canada can, and should, stay ahead of the industry with the introduction of advanced technologies, data analytics, and new business models. Federal and provincial governments have already recognized the importance of program funding, such as the Innovation and Skills Plan. This supports initiatives for building superclusters, AI centres, smart cities, clean tech and autonomous vehicle capabilities.

ACTIONS

- a. Leverage government initiatives and emerging technologies to manage traffic congestion, connect communities, and support a globally competitive economy.

- b. Promote and support industry-led projects related to technology development and demonstration.
- c. Encourage Canadians to invest in technology start-ups by allowing tax incentives similar to those provided for donations given to registered institutions. The closer the funds get to the inventor, the better the chance they will stay in Canada.

3. Test new technologies by leveraging adoption in public transit

There is an opportunity to use public transit as a test bed for the adoption of new technologies across the country. Partnerships between multiple players would be required to develop a new system for transporting goods and people.

ACTIONS

- a. Leverage public transit and infrastructure investments to set standards for new technologies and facilitate the adoption of clean, automated, and connected transportation systems.
- b. Develop solutions to optimize the "first and last mile" delivery of goods and people.
- c. Allow for the testing and implementation of autonomous long-haul transportation.

Manufacturing

The OEMs that operate in Canada are incredibly important to the broader manufacturing ecosystem as they anchor the supply chain and manufacturing base that surrounds them. The supply chain, including Tier One and Two suppliers, as well as many smaller firms, are all integral to supporting the operations of the OEMs. Investments by the OEMs and suppliers are critical as there is a widespread effect across the entire supply chain. Canadian plants including the supply chain must continuously improve their manufacturing process by a certain percentage each year. The administration of each manufacturing facility should implement both cost reduction and continuous improvement targets. Most importantly, plants in Canada must be a benchmark for innovation, productivity, and quality.

The importance of automotive manufacturing is highlighted in this chart, however, the benefits are far greater than the statistics presented. Through the process of manufacturing, we develop people, support our communities, and contribute to the development of the infrastructure to make Canada more prosperous.

The implementation of lean manufacturing is an effective way to make a better process and an important step towards the implementation of Industry 4.0. Industry 4.0 will create a digital twin of the process as an ideal condition. To introduce a new technology into a process that has inefficiencies and bottlenecks will not provide the same benefits as a streamlined process. We should learn from other countries such as Germany and Japan where the desire to improve is part of their culture in manufacturing. Germany and Japan, even though their labour costs are high, are determined to be competitive because they understand the importance of manufacturing contributions to the economy and prosperity.

FIGURE 6: IMPORTANCE OF AUTOMOTIVE MANUFACTURING INDUSTRY



126,000
direct jobs



\$9.6
billion
in wages



\$18.2
billion
to GDP



\$86.5
billion
in exports



1 auto
assembly job
creates
6 additional jobs



\$54
billion
in purchases

We can strengthen our competitive position by taking the following actions:

1. Remain committed to making manufacturing relevant and competitive in Canada

We can do this by taking the following actions:

ACTIONS

- a. Encourage the industry to promote continuous improvement (such as lean manufacturing) by recognizing companies that improve their performance and allocate special awards for companies and facilities that meet specific benchmarks.
- b. Develop a “Perpetual Improvement Fund” to make process improvement consultants available to the industry at low cost, with a percentage of first annual savings going back into the fund to ensure continuity.
- c. Accelerate the education and implementation of Industry 4.0 by conducting a self-assessment (<https://www.industrie40-readiness.de/?lang=en>) followed by a “go-and-see”.
- d. Provide a service to de-risk investments by implementing a system similar to Germany’s Fraunhofer Institute that would involve universities, colleges, and equipment suppliers to help in the implementation of new technologies.
- e. Continue to support industry-led advanced manufacturing initiatives such as Ontario’s Automotive Supplier Competitiveness Improvement Program.

PEOPLE DEVELOPMENT

Talent is the driving force for future prosperity. A recurring comment that has been mentioned is that industry cannot find the quantity of people that they require to be successful while we have many that cannot find employment. We have a gap between the demand for labour and the supply. According to the Conference Board of Canada, the skills gap in Ontario costs \$24.3 billion in income and \$3.7 billion in provincial tax annually. Similar to our Automotive Technology Map, we need to develop a “talent map” to identify the current and forecasted gaps based on the trends and growth of the new economy. This will require the following actions:

ACTIONS

1. Conduct a detailed analysis and assessment of our gaps and develop the talent map using internal and external consultants/experts.

2. Train the existing workforce and the unemployed that do not meet current requirements.

- a. Develop basic skills in manufacturing such as stamping, welding, painting, molding, machining, and assembly. We need to train the workforce to do these jobs. A good model was the one I saw at Valiant in Windsor, where they took low-income individuals and trained them to be machinists and learn to operate numerical control (N/C) machines, providing them with a good and rewarding job.
- b. Create “pathway education” to allow individuals to build upon each successive level of education and receive credits to pursue higher education.
- c. Promote employee engagement, problem-solving, and training in the workplace to empower the organization and motivate employees to accept manufacturing as a good place to work.
- d. Increase our skilled labour capacity by identifying the bottlenecks in the certification process and by promoting skilled labour as a rewarding profession.

3. Develop our youth to fill the gaps and future needs.

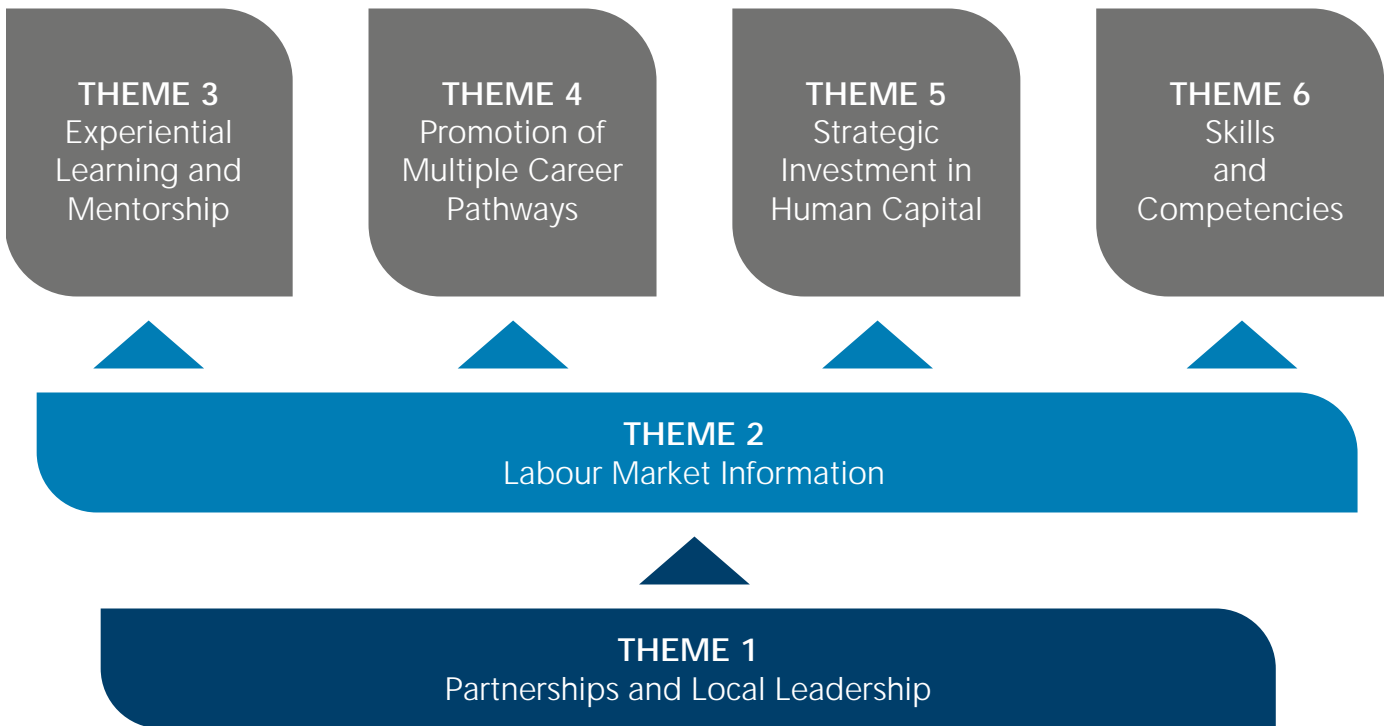
Some progress has been made on this front, for example, in September 2016 the Premier’s mandate letter instructed the Minister of Education to build the *Workforce of Tomorrow* by expanding the participation rate of grade 11 and 12 students in the Specialist High Skills Majors Program by 10 percent. Further, on October 18, 2017, Ontario announced that it is boosting the number of graduates in STEM from 40,000 to 50,000 per year and to accelerate the growth of applied masters in artificial intelligence to 1,000 per year.

“Talent has the power to attract investment.”

These initiatives announced by Ontario, along with the federal strategy outlined in the Innovation and Skills Plan and the 2017 Budget are platforms to build upon.

- a. Establish a culture that celebrates and rewards the power of making things by teaching teamwork and continuous improvement. A good example is the FIRST (For Inspiration and Recognition of Science Technology) program, where 83% of participating students eventually go into STEM education—unfortunately, only 6.8% of Canadian schools participate in the program. Therefore, this program should be included in the curriculum.
- b. Encourage schools, high schools, and universities to have “makers space” to showcase skills on a regional, national, and global level through various competitions.

FIGURE 7: ONTARIO'S SPECIALIST HIGH SKILLS MAJOR (SHSM) KEY THEMES



- c. Incentivize the participation in skills segments where a shortage exists by eliminating tuition fees for post-secondary education. Ontario has made steps in the right direction by transforming the Ontario Student Assistance Program (OSAP) to make tuition free for more than 210,000 post-secondary students in the province.

4. Make co-op education as a standard for our engineers and technologists, allowing them to graduate with experience and less financial debt.

- a. Develop an excellent talent pool for university entrance by raising our high school standards, especially in STEM education, while ensuring that high school students graduate and continue on to post-secondary education.
- b. Upgrade K-12 standards to provide a better base of talent for post-secondary education.

5. Develop a retention strategy for scientists and PhD candidates to ensure we have the talent needed to develop the new and emerging technology through actions such as:

- a. Develop the ecosystem for start-ups from incubator to accelerator, as we see at Waterloo's Communitech and similar good examples across the country.
- b. Continue to promote advanced technologies such as artificial intelligence, cyber security, and 5G in order to put Canada as a frontrunner.
- c. Provide tax-incentives to start-ups to help them scale-up and become global players.

This section has highlighted many key actions to take in order to maintain our position as a well-educated and intelligent workforce that is well-positioned to compete in the future.

FIGURE 8: BRAIN POWER

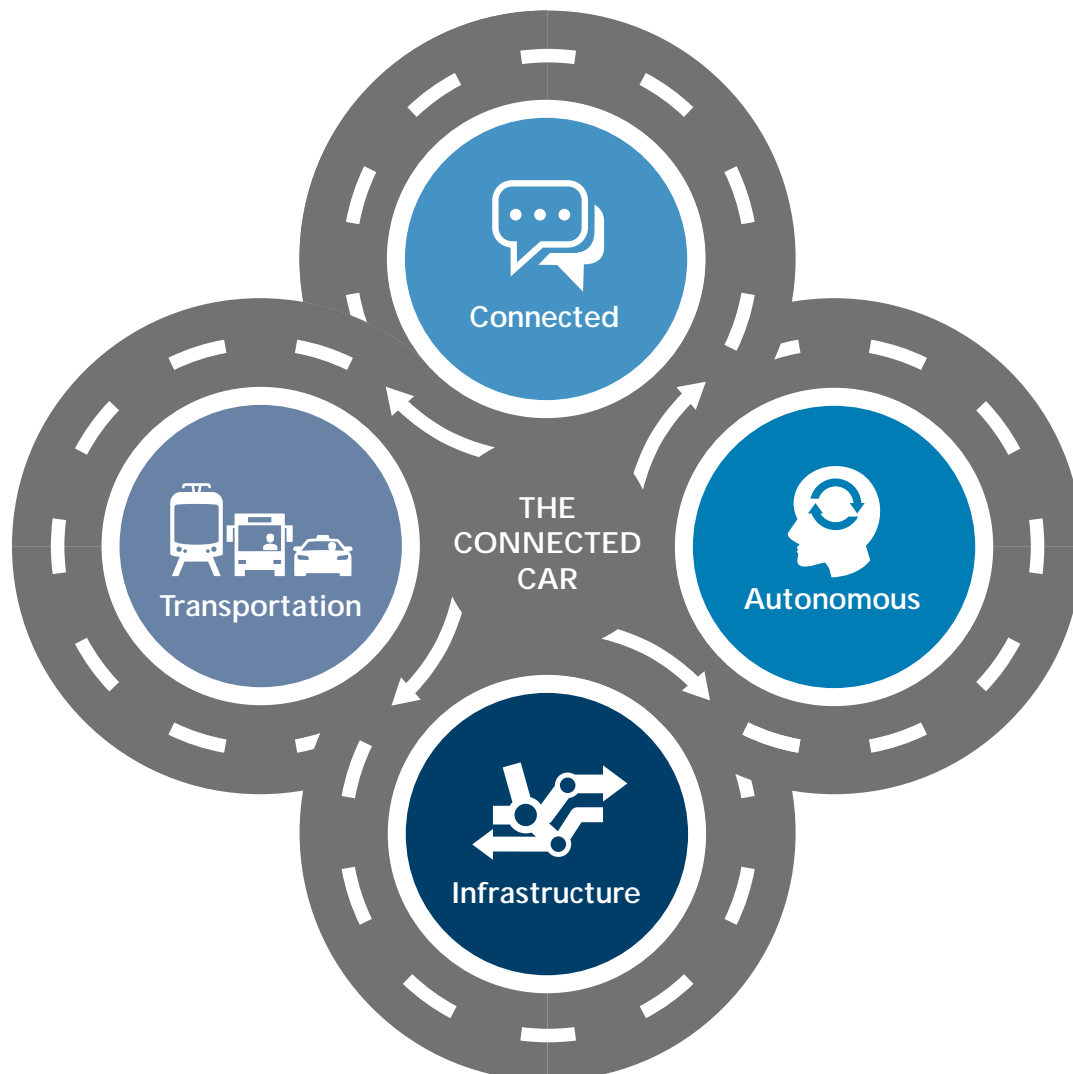


INFRASTRUCTURE

Building a robust infrastructure is necessary to enable the adoption of the car of the future. Unlike previous times where we saw cars introduced to market independent of the surrounding environment, the difference today is the connected and clean car will need to be part of an integrated transportation system and innovative ecosystem.

For the connected car this means communications such as V2V (vehicle-to-vehicle), V2I (vehicle-to-infrastructure), and V2X (vehicle-to-everything). It also means being prepared to introduce 5G as well as smart highways and cities. For clean technologies, we need charging and alternative fuel stations and a whole set of regulations that support new expectations and requirements for safety and security.

FIGURE 9: BUILDING THE CAR OF THE FUTURE



Other important enablers to ensure the right infrastructure include: education systems, energy storage, smart cities, intelligent roads, energy storage, computing power, transportation networks, environment, and public transit.

The 2017 federal budget included some major investments, including:

- \$120 million to deploy infrastructure for EV charging, including natural gas and fuel cells;
- \$76.7 million to update regulations and safety standards for the adoption of autonomous vehicles;
- \$2 billion for National Trade Corridors fund to address trade and transportation problems; and,
- \$300 million to launch Smart Cities challenge fund, including Smart Roads.

Ontario also committed to a number of infrastructure investments:

- \$90 Million for improved EV uptake through Electric Vehicles Incentive Program and the electric vehicle charging infrastructure;
- Additional \$22 Million across the province, including at government facilities for EV charging infrastructure, making EVs a viable option for more people across Ontario;
- \$67 Million to ENCQOR (Evolution of Network services through a Corridor in Quebec and Ontario for Research and Innovation) and \$63 Million for CENGN (Center of Excellence in Next Generation Networks);
- \$84 billion over 10 years in the transportation sector; and
- \$190 billion in public infrastructure over a 13-year period.

These are good initiatives and we can expedite our progress through collaborations and partnerships with our neighbours and other regions. Partnerships will help solidify the business models that can support timely and cost-effective measures for the implementation of the infrastructure needed.

ACTIONS

1. Develop an “Urban Transit Model” to integrate multi-modal transportation to provide better service at a lower cost, to reduce emissions, congestion and travel time.

2. Benchmark and collaborate with other industries and countries to learn best practices with respect to infrastructure. For example, collaborate with Michigan to develop and implement smart highways and border crossings.

3. Develop and deploy advanced communications technology to support connected vehicles, building on Canada’s existing strengths and reputation in this area such as 5G communications.

4. Provide national and regional test facilities to validate the development and implementation of emerging technologies and to perform the testing here in Canada.

VALUE PROPOSITION

Over the past two years, we have seen important shifts in the government's policies towards the automotive industry—including funding program alignment between the Government of Ontario and the Government of Canada and more structured governance of the investment process. The creation of the Invest in Canada Hub and the Ontario Investment Office are good examples of where the government is streamlining the process for attracting investment by creating a “one-stop shop” or concierge service. However, there is the need to expedite the implementation of these offices.

The value proposition is what we have to sell—the advantage of doing business in Canada. We have an excellent reputation for building quality cars, for an educated workforce, for national healthcare, low corporate taxes, and a secure place to live in a diversified culture. Our immigration policies are more conducive to bringing the talent needed into Canada which is an advantage that we must leverage.

For R&D, we have a great story to tell with artificial intelligence and 5G leadership and world class researchers. That story—the story of our strengths—still needs to be told repeatedly because the rest of the world still does not know what we have to offer. I found it extremely difficult to uncover what we have, like our world class leaders in technology (e.g., lithium-ion expert, artificial intelligence pioneers, and cybersecurity and 5G specialists). When doing R&D in Canada our costs are more than competitive, plus our intellectual property management is advantageous compared to universities in the US.

For manufacturing, we have a tremendous reputation for building quality, managing complexity, and advanced technology. Canadian plants have been the benchmark within their own company's due in part to their successful product launches and for innovation in achieving World Class Manufacturing Status. Our competitiveness is something we all contribute to, for example, successful labour negotiations in 2016 between Unifor and the D3 OEMs. While the governments have a role to play, the partnerships and successful working relationship between all groups—government, industry, and labour—all contribute to developing and maintaining a competitive environment in Canada. It is imperative that we support and work together to build a prosperous Canada.

Based on competitive analyses comparing Ontario sites to sites in the US and Mexico, we place in the middle of the group in terms of local processing costs and incentives. As a profit centre, our corporate tax advantage has puts us in a favorable position compared to the US. However, with the current administration in the US, the advantage will disappear if they reduce their corporate tax rate lower than Canada's. It is imperative that we maintain our corporate tax lower than that of the US.

When a corporate decision is made to expand their manufacturing capacity, a comparison is developed by site selectors, consultants, and in-house specialists to compare various factors and sites. That becomes the base for how decisions are made. I used a typical evaluation matrix to assess our current situation in Ontario.

TABLE 2: EVALUATION MATRIX FOR MANUFACTURING IN ONTARIO

KEY METRIC	SELECT CONSIDERATIONS FOR CANADA
<input type="checkbox"/> Local Processing Costs	<p>Ontario has clean energy but higher electricity costs than other jurisdictions</p> <p>With the current exchange rate we have by comparison average labour costs, lower healthcare costs, but more paid days off</p>
<input type="checkbox"/> Quality of Workforce	<p>Canada has a highly educated and skilled workforce and it shows in our quality performance</p>
<input type="checkbox"/> Availability of Workforce	<p>Even though we have some labour shortages, by comparison with other jurisdictions, we have a good pool of skilled and educated workers</p>
<input type="checkbox"/> Incentives	<p>Incentive packages have improved and are considered to be competitive when compared to competing jurisdictions</p>
<input type="checkbox"/> Environment	<p>Ontario’s Cap and Trade program and multiple regulatory reporting creates restrictions for business</p>
<input type="checkbox"/> Access to Market	<p>Highly integrated US/Ontario cluster; NAFTA concerns expressed by the US is creating uncertainty</p>
<input type="checkbox"/> Workplace Environment	<p>Right-to-Work states versus Ontario Bill 148; Ontario labour regulations are more restrictive for business to manage</p>
<input type="checkbox"/> Ease of Doing Business for Investors	<p>Recognizing that Canada’s multi-level government can be difficult to navigate, investment offices are being implemented to provide single window concierge service; there is a sense of urgency in their implementation</p>
<input type="checkbox"/> Corporate Tax	<p>Canada’s rate must stay lower than that of the US</p>
<input type="checkbox"/> Infrastructure	<p>Services and logistics are reliable in Canada and the Gordie Howe International Bridge should help the flow of traffic between Canada and the US; road congestion, especially in the big cities, needs to be addressed</p>
<input type="checkbox"/> Innovation	<p>Government has number of effective measures to support emerging technologies, talent, and commercialization</p>

To make the shortlist, we need to focus on four main areas of concern—electricity costs, Cap and Trade, workplace environment, and NAFTA.

To address cost competitiveness concerns, there are three key actions:

ACTIONS

1. Reduce electricity costs by working with industry to identify and implement efficient and effective measures.

- a. Reduce electricity rate to match market value and enable the sale of excess energy to other jurisdictions.
- b. Promote and incentivize co-generation to reduce costs and eliminate associated penalties. For example, through utilizing landfill gas or onsite co-generation engines.

2. Make workplace changes favourable for both industry and labour.

- a. Engage industry and labour to address the problems the government is trying to solve.
- b. Understand our competition and consult with stakeholders before making changes to regulations.
- c. Offset costs for policies that interfere with our ability to attract investment.

3. Maintain our corporate tax rate lower than the US, which will require quick action by the governments.

To promote and sell our value proposition, the following actions are required:

ACTIONS

1. Develop a comprehensive sales action plan

- a. What? Describe what we have to sell for both R&D and for manufacturing.
- b. Who? Identify the top candidates that could possibly invest in Canada.
- c. “Who will sell?”—from the Prime Minister, Ministers, Invest in Canada Hub, Ontario Investment Office, trade commissioners, and most importantly, internal business champions.
- d. How? We need a marketing plan, a budget, and the desire to showcase our value proposition around the world. This can be done by participating in major global events and shows, developing websites that put Canada at the forefront when people search for information, and by celebrating our superstars and their success stories.

2. Measure what we expect to attain, show trends, and what actions are needed.

3. Continue the outreach and engagement process that we have experienced in the last two years (see Annex A).

CONCLUSION

In this report, I have presented an overview of the automotive landscape in Canada, the pace at which it is changing, and the ways in which Canada can take advantage of these changes to develop the car of the future. Based on my two years of extensive observation by engaging with key stakeholders, my vision and goal for the recommendations in this report is to ensure that Canada is the **location of choice**. I had the fortunate opportunity to see the incredible contributions that Canada and Canadians are making to the automotive world. Building on these continued successes in innovation, education, and technology will help make Canada a location of choice.

Hundreds of thousands of Canadians depend on a viable and enduring automotive sector. In order for Canada's automotive sector to sustain these jobs, it is important to continue the work that has been started during my time as Automotive Advisor and to ensure that the mechanisms are in place to support the industry. To that extent, there have been multiple projects initiated by government to transform their approach to the automotive industry. The federal Invest in Canada Hub and the Ontario Investment Office both serve as portals for investors. It is important that these organizations follow through on the recommendations outlined in this report. These are important first steps in ensuring that Canada can attract automotive investment.

While Canada and Ontario have made great strides, there is still work that needs to be done. I hope it has been clear that sustained success will demand commitment and partnership from all stakeholders, utilizing our collective knowledge and experience to implement the actions recommended in this report.

Box 2: Experience of ISED & MEDG

As a result of Mr. Tanguay's long career and dedication to the industry, he offered a unique perspective and comprehensive understanding for officials. His standing and reputation in Canada and abroad commanded respect and opened doors for ISED and MEDG, allowing officials to benefit from greater access to key industry stakeholders.

His work led to improved intelligence on the automotive industry, assisting in more informed decision making by bringing an industry perspective to the work. The collaboration between Mr. Tanguay, government officials, and industry stakeholders has allowed different perspectives to be brought to the table and for strengths to shine while leveraging the capacities of the collective group.

This collaboration has led to an increase in engagement by stakeholders who are genuinely invested in the work and offering to assist, even volunteering their time to support ongoing projects.

Moving forward, his work will guide Canada in positioning itself on the global automotive stage.

*Automotive, Transportation
and Digital Technologies Branch
Innovation, Science, and Economic
Development Canada*

*Automotive Manufacturing and Technology Branch
Ontario Ministry of Economic Development
and Growth*

From my past experience, I know that having a good process yields good results (see Annex E). My objective was also to help the automotive team develop their experience and provide them with insights on how decisions are made. I started by addressing the concerns of perception versus reality and helped to develop more concise tools to communicate effectively with the outside world on what we have to offer. Weekly engagement with staff from both ISED and MEDG allowed us to work as one group to coordinate many of the activities that have occurred over the past two years (see Annex A). The automotive teams from ISED and MEDG expressed to me their appreciation and the experience they gained through this whole process (see Box 2 on page 31). Further to this engagement, we also worked together to raise the profile and importance of the automotive industries with all levels of government, academia, and other jurisdictions. I also expanded the role to reach out to other jurisdictions for collaboration, as we have done with Michigan.

In summary, I remain an incredible believer not only in Canada's automotive industry, but the ability of Canadians—from government to manufacturing employees—to be innovative, creative, and to continuously improve. Canada has great advantages and expertise in many areas of emerging technology. I am certain that through the incredible talent and skills we have, Ontarians and Canadians will be able to seize on the opportunities before them and ensure that Canada is recognized as a global leader and a location of choice for automotive manufacturing and research.

ANNEX A: INDUSTRY OUTREACH AND ENGAGEMENT

Since being named to the position of Automotive Advisor in 2015, I have conducted extensive outreach with stakeholders in Ontario, across Canada, and around the world in order to develop Canada's value proposition and gather intelligence and insight on Canadian and global automotive capabilities. The following is a list of individuals, organizations, and events that I consulted with, many of them multiple times, over the course of my two years as Automotive Advisor. Some titles and organizations have changed since I engaged with them.

Industry, Trade, and Labour Associations

- Flavio Volpe, President, Automotive Parts Manufacturing Association (APMA)
- Mark Nantais, President, Canadian Vehicle Manufacturers' Association (CVMA)
- Jerry Dias, National President, Unifor
- Paul Boothe, Managing Director, Trillium Network for Advanced Manufacturing
- David Adams, President, Global Automakers of Canada
- David Worts, Executive Director, Japan Automobile Manufacturers Association (JAMA)
- John Manley, Chief Executive, Business Council of Canada (BCC)
- Mark Fisher, Chief Executive Officer, Council of the Great Lakes Region (CGLR)
- Ontario Automotive Communities Alliance (OACA)
- Perrin Beatty, President, Canadian Chamber of Commerce (CCC)
- Richard Gauthier, President and Chief Executive Officer, Canadian Automobile Dealers' Association (CADA)

Original Equipment Manufacturers

- Dianne Craig, President and Chief Executive Officer, Ford Motor Company of Canada
- Shuichi Kaneko, President, Hino Motors Canada
- JB Straubel, Chief Technical Officer, Tesla
- Jerry Chenkin, President and Chief Executive Officer, Honda Canada
- Fred Volf, President, Toyota Motors Manufacturing Canada
- Reid Bigland, President and Chief Executive Officer, Fiat Chrysler Automobiles (FCA) Canada
- Stephen Carlisle, President and Managing Director, General Motors Canada
- Sylvain Allano, Chief Scientific Officer, PSA Peugeot

Parts Suppliers

- Don Walker, Chief Executive Officer, Magna International Inc.
- Rob Wildeboer, Executive Chairman, Martinrea International Inc.
- Linda Hasenfratz, Chief Executive Officer, Linamar Corporation
- Bob Magee, Chairman of the Board, The Woodbridge Group
- Sean Donnelly, President and Chief Executive Officer, ArcelorMittal Dofasco

Technology Firms

- Bob Moran, Chief Executive Officer and President, Weather Telematics
- Catherine Carroll, President, Sober Steering
- Dan Bergeron, President, SigmaPoint Technologies Inc.
- Grant Courville, Senior Director - Product Management, QNX
- Matt Stevens, Chief Executive Officer, CrossChasm Technologies
- Nathan Shaeff, Chief Executive Officer, Sciometric Instruments
- ClearPath Robotics
- F-Tech/Dynamig

Opinion Leaders/Industry Experts

- Denis Cuneo, owner of DC Strategic Advisors
- Ron Harbour, former President, Harbour Consulting
- Sandra Papatello, Strategic Advisor: Industry, Global Markets, and Public Sector; Price WaterhouseCoopers

Presentations Delivered

- "Future of Canadian Manufacturing : Attracting Global Mandates", Ivey Tangerine Leadership Centre
- 2016 TalkAUTO (JD Power)
- Auto Mayors (April 2016)
- AutoConnect Conference (Nashville, TN) Keynote Address: *Ready to Compete*
- Automotive Parts Manufacturing Association Annual Conference
- Automotive Policy Research Centre Advisory Group
- AutoTech Symposium
- Canadian Association of Mold Makers (CAMM), Expo & AGM
- CAR Management Business Seminars: Automotive Communities Partnership (ACP) Luncheon
- Dennis Shea, President, FDI Forum – Area Development Conference

- Federal Steering Committee on Foreign Direct Investment (Deputy Ministers)
- Global Affairs Canada – Trade Commissioners
- Munk School Presentation: Stakeholder Presentation
- Stratford Advisory Board Meeting
- Stratford Economic Enterprise Development Corporation Annual General Meeting
- Council of Deans of Engineering and Applied Science
- “Manufacturing Matters” – London Region Manufacturing Sector
- Pete Mateja Luncheon (Odette Business School – University of Windsor)
- Toronto Auto Show / AutoNews Canada Congress
- Waterloo Innovation Summit
- Windsor Essex Chamber of Commerce - Policy Solutions Forum
- DM Investment Retreat Meeting with Paul Halucha

Events Attended

- Automotive Parts Manufacturing Association Board Meeting and Conference
- Canada’s Technology Triangle 7th Annual International Reception & Dinner
- Canadian Club of Toronto (Presentation by GM Stephen Carlisle: *Innovation and the Future of the Auto Industry in Canada*)
- Deloitte University North “Canada at the Crossroads: What’s Next?” Forum
- McMaster Manufacturing Forum
- Ontario Global 100 (OG100)
- Automotive Policy Research Centre (APRC)
- Accelerator Centre
- Canadian Centre for Product Validation
- Catalyst 137, University of Waterloo
- Communitech Hub
- Conestoga College
- David Fransen, Fellow, Public Policy Forum
- FIRST Robotics
- McMaster University – Automotive Research Centre
- Mohamed Lachemi, President, Ryerson University (Digital Media Zone – DMZ)

Academia/Research Facilities

- National Research Council (NRC)
 - Iain Stewart, President
 - Michelle Dumoulin, Vice President, Engineering
 - Craig Ceppetelli, Portfolio Business Advisor, Automotive and Surface Transportation
 - Tour of facilities in Montreal and Boucherville
- Rafik Goubran, Professor and Dean of Engineering, Carleton University
- Salim Teja, President of Venture Services, MaRS Discovery District
- Tim McTiernan, President, University of Ontario Institute of Technology (UOIT)
- Université de Montréal
- University of Toronto
 - Bryn MacPherson, Assistant Vice-President, Office of the President & Chief of Protocol
 - Sain Mohini, Director, Biocomposites and Biomaterials Processing, Faculty of Forestry
- Creative Destruction Lab
- University of Waterloo – Dean’s Advisory Council Meeting
- University of Windsor Cross-Border Institute

Governments/Political leaders

Federal Government and Agencies

- ISED
 - The Honorable Navdeep Bains, Minister of Innovation, Science, and Economic Development
 - David McFarlane, Director of Policy (ISED-MINO)
 - Mike Moffatt, Chief Innovation Fellow
 - John Knubley, Deputy Minister, Innovation, Science, and Economic Development Canada (ISED)
 - Automotive, Transportation and Digital Technologies Branch (ATDTB)
- Global Affairs Canada (GAC)
 - Susan Bincoletto
 - Louis Marcotte
 - Nathalie Béchamp
 - Terrie Romano and Detlef Engler, Canadian Trade Commissioners (Germany)
 - Trade Commissioners from posts in Detroit, Mexico, and Japan
- Federal Innovation and Skills Plan and Roundtable
- Export Development Canada (EDC)
- Mary Ann Wenzler-Wiebe, Vice-President, South West Ontario & Automotive Group Ontario, Business Development Bank of Canada (BDC)
- Peter Lawler, Executive Vice-President of Advisory Services, Business Development Bank of Canada (BDC)
- Consul General of Japan

Ontario Government and Agencies

- Ministry of Economic Development and Growth
 - The Honorable Brad Duguid, Minister of Economic Development and Growth
 - Giles Gherson, Deputy Minister, Ministry of Economic Development and Growth
 - The Honorable Kevin Flynn, Minister of Labour
 - John C. Murray, Special Advisor
 - Michael Mitchell, Special Advisor
 - Karim Bardeesy, Deputy Principal Secretary, Office of the Premier of Ontario
- Electric and Hydrogen Vehicle Advancement Program Consultations
- Ontario Centres of Excellence – Discovery Event
 - Claudia Krywiak, Vice President, Corporate Development, Planning, and Strategic Initiatives
- Lean Management Pilot with Ontario Centres of Excellence (OCE)
- Memorandum of Understanding (MOU) between Ontario and Michigan
- Waterloo Economic Development Corporation (Waterloo ECD)
- Jeff Lyash, President and Chief Executive Officer, Ontario Power Generation

Municipal Governments

- Rob Burton, Mayor of Oakville and Chair of Ontario Auto Mayors
- Drew Dilkins, Mayor, City of Windsor

- Dorothy St. George, Director of Economic Development, City of Oakville

Quebec Government and Agencies

- Denis Hvizdak, Business Development Manager, Investissement Quebec
- Benoît Breton, Trade Officer, Investissement Quebec

The United States of America

- University of Michigan and Tour of M-City
- Government of Michigan
- Consumer Electronics Show (CES)
- ACP Meetings - Plant Tour & Dinner
- Original Equipment Suppliers Association (OESA)
- North American International Auto Show (NAIAS) 2016, 2017, 2018
- CAR Management Briefing Seminar 2015, 2016, & 2017

International

- Hannover Messe Industrial Show (Hannover, Germany)
- Tokyo Motor Show (Tokyo, Japan)

ANNEX B: TECHNOLOGY ROADMAP

FIGURE B1: FUTURE TRENDS IN AUTO INDUSTRY

		TODAY	2020
VEHICLE TECHNOLOGY	Powertrain, ICEs and Energy Storage	<ul style="list-style-type: none"> • Mostly gasoline, few diesels and few electric and hybrids • 6–7 speed transmissions • Low energy prices make economics favor gasoline 	<ul style="list-style-type: none"> • Downsized—boosted gasoline engines dominate, Atkinson cycle for non-hybrids may add efficiency • HCCI, and variable compression ratio begin to enter market • 12-volt stop/start becomes wide spread, 48-volt see growth • 9–10 speed transmissions, CVTs in NA market; dual clutch and manuals focused in Europe • Increased acceptance for hybrids, battery electric vehicles, but cost difference remains • Regional differences in powertrain mix may grow
	Materials	<ul style="list-style-type: none"> • Mostly Steel Structure; common grades Mild, BH, HSLA, DP and HF • Aluminum: few closures and all engine blocks • Plastics and polymers composites used in interior & exterior trims, semi-structural applications, and aerodynamic applications • Primary Joining: resistance spot welding, some adhesive 	<ul style="list-style-type: none"> • Greater use of high strength steels in structural components • Mostly aluminum closures • Application of carbon fiber reinforcement polymers in semi-structural and structural applications increase • Primary Joining: resistance spot welding, additional growth in adhesive
	Intelligent Mobility	<ul style="list-style-type: none"> • Passive safety—airbags, seat belts, etc. • Active safety—electronic stability control, forward collision warning, lane departure warning, etc. • Vehicle models with SAE Level 1 automation capabilities; few models with Level 2 capabilities 	<ul style="list-style-type: none"> • Advanced Driver Assistance Systems (ADAS) available on all new vehicle models • Emerging V2V connectivity—through DSRC and/or 5G • Wide deployment of SAE Level 2 vehicles; first Level 4 vehicles in limited release (robotaxis, shuttles)
PRODUCTION TECHNOLOGY	Manufacturing	<ul style="list-style-type: none"> • 5–10 platforms depending on company size • Cold stamping of parts • Injection molding of instrument panel, facias, trim components. • Robotic welding—1 material type 	<ul style="list-style-type: none"> • Reduction in number of platforms, common parts/global platforms • Hot forming and warm forming of metals • Hybrid molding. Insert overmolding of metal and thermoplastic composites with plastics • Higher speed resin transfer molding of thermoset composites • Initial collaborative robots • Robotic welding—steel to aluminum
	Production Systems	<ul style="list-style-type: none"> • Assembly lines: dedicated transfer lines • Programmable automation 	<ul style="list-style-type: none"> • Programmable locators enabling multiple platforms • The connection of production systems to a central cloud within plants begins. Analyzing this data able to predict machine failure or process delays which will feed maintenance queue. • Growth in flexible material systems
NEW BUSINESS MODEL	Mobility	<ul style="list-style-type: none"> • 4% of global miles traveled are shared (ride hailing + taxi) • New mobility concepts and companies are emerging • New mobility services like Uber, Lyft etc., are growing in cities 	<ul style="list-style-type: none"> • 6.5% of global miles traveled are shared (ride hailing, taxi, robotaxi) • New mobility services spread beyond cities

Key: The colors of the chart represent the breakdown of the synthesized literature.

	2025	2020
	<ul style="list-style-type: none"> • Increase in battery electric vehicle, better range • Improved infrastructure for battery charging and faster charging • Fuel cell pilot infrastructure • Significantly improved fuel mileage and reduced emissions for entire fleet 	<ul style="list-style-type: none"> • ICE still represent significant portion of market, • BEV nears cost competitiveness • Fast battery charging infrastructure, and battery performance • Major reduction in battery cost
	<ul style="list-style-type: none"> • Mixed material body architecture: steel, aluminum, magnesium and composites • Mostly aluminum with some use of magnesium in closures • Greater use of composites in structural powertrain components • Primary Joining: Adhesives with fasteners 	<ul style="list-style-type: none"> • Highly optimized mixed material architecture with greater use of plastics and polymer composites. Part consolidation. • Bio inspired designs • Primary Joining: Adhesives
	<ul style="list-style-type: none"> • Expanded deployment of Level 4 robotaxis, shuttles, and commercial trucks • Wider availability of V2V communication; infrastructure investments for V2I communication 	<ul style="list-style-type: none"> • Worldwide adoption of Level 4 robotaxis, shuttles, and commercial vehicles; deployment of Level 4 vehicles for personal use • Full availability of V2V; continuing expansion of V2I infrastructure
	<ul style="list-style-type: none"> • Increased inter group platform sharing; company partnerships • High volume injection/compression molding of composites • Additive manufacturing for tools, prototype parts and low volume specialized parts • Growth in collaborative robots 	<ul style="list-style-type: none"> • Modular toolkit strategy • Additive manufacturing for production parts • Automation of high volume composite processing • High level of vehicle customization • Additional growth collaborative robots • Internet of Things • Possible integration of all the industrial machinery, collaborative robots, inventory and logistics systems talking to each other not only within a plant but across company and various suppliers.
	<ul style="list-style-type: none"> • Reduced CO₂ emissions from the plant • Compact paint shops. Multi material capable. • Mobile and wireless technologies 	<ul style="list-style-type: none"> • Energy efficient plant machinery which might run on renewable energy sources. For e.g. application of stationary fuel cells to run plant machinery. High utilization of renewable energy • Compact assembly footprint • Virtual Factory / Reduced labor
	<ul style="list-style-type: none"> • 11.7% of global miles traveled are shared • New mobility services are well established in urban and suburban area • Vehicle sharing models are a convenient alternative to vehicle ownership 	<ul style="list-style-type: none"> • 26.2% of global miles traveled are shared • New mobility services gain interest in rural areas • Vehicles sharing models are largely adopted in urban areas

Materials, Manufacturing Tech, and Production Systems

Intelligent Mobility Technology

Powertrain, ICEs, and Energy Storage

BACKGROUND

The automotive industry is in a period of immense change. To capture the scope of major technological advances to both products and manufacturing processes, Innovation, Science, and Economic Development Canada (ISED) called on CAR to develop and validate a technology roadmap for the automotive sector. The technology roadmap provides a broad understanding of the automotive industry's product technology trends.

The content of the CAR-ISED roadmap was drawn from existing roadmaps augmented by a survey of the literature and a review of announcements at key industry events in order to identify any emerging technologies that were not covered in existing roadmaps. CAR synthesized the existing roadmaps and additional research into three sections: Vehicle Technology (Powertrain, ICEs, and Energy Storage; Materials; and Intelligent Mobility), Production Technology (Manufacturing and Production Systems) and New Business Models for Mobility.

Once a technology roadmap was developed, CAR convened a roundtable of twenty-five experts separated into three different sessions to provide validations on the findings.



FIGURE B2: ENABLERS AND BARRIERS TO TECHNOLOGY DEVELOPMENT AND ADOPTION

	CONSUMERS	COST	COMMUNICATION	POLICY AND REGULATION
Enablers	The more accepting consumers are of new materials, technologies, or new mobility services—the more likely these technologies will advance.	Widespread adoption of new materials, technologies, processes, and business models will occur as costs decline.	Adopting new materials, technologies, and processes requires increased communication between automakers and their suppliers, as well as within the supply chain, to effectively incorporate the changes into the product.	Long-term agreements on the regulatory future can enable technology advancements. Automakers and suppliers are risk-averse, and desire certainty in the direction set by governments.
Barriers	The market determines the success of a vehicle, not regulators or technology advancements. Consumers are concerned with safety, privacy and security issues, environmental impacts, efficiency, and cost.	The uncertain path of technology development and the pace of cost reductions create uncertainty. Key examples include Industry 4.0, Additive Manufacturing/3D Printing, and New Mobility Business Models. Another issue is cost-constraints which limits the pursuit of advanced technology/processes due to added cost to the vehicle.	Breakdown of communication between automakers and suppliers can lead to several inefficiencies including increased cost and waste of materials.	Uncertainty in public policy or the regulatory environment can be a barrier to technology advancement. If one government sets lower regulatory standards, overall global OEMs will continue to advance technologies to meet standards set in other countries, but may not be able to amortize those development costs over the entire global fleet when one large market differs substantially from the rest.

ANNEX C: ASSESSMENT OF THE INDUSTRY

As a significant contributor to the Canadian economy, the automotive landscape warrants our attention and continual monitoring. While it is important to measure the industry's outputs—such as vehicle and parts production, employment, shipments, and Gross Domestic Product (GDP) contribution—sustaining and energizing the industry will be contingent on inputs, that is to say ***the investments made in Canada's automotive industry***. It is these key investments (inputs) that will drive and improve employment, production, and shipments (outputs) and ultimately strengthen the industry.

Status of Production

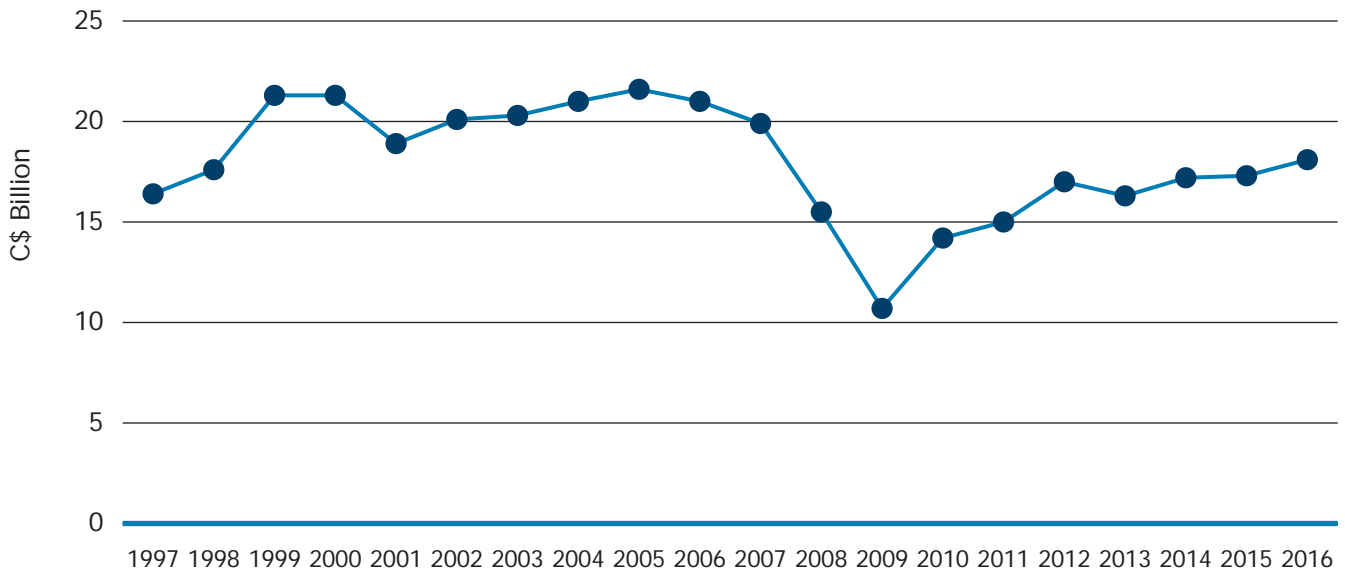
The automotive industry is the second largest manufacturing sector, contributing \$18 billion to Canada's GDP (Figure C1). It is Canada's largest export sector, accounting for 17 percent of total merchandise exports, of which over 95 percent is US destined. Driven by the operations of five global automotive manufacturers and close to 700 automotive parts suppliers (a number that continuously changing as new companies enter the market), the industry is a key source of high-paying manufacturing jobs. It employs 126,900 Canadians directly and another 401,800 indirectly (Figure C2).

As Figure C3 shows, automotive parts and vehicle manufacturing have risen steadily since their low in 2009. However, while the outputs of Canada's automotive industry may seem to indicate that the industry is thriving (i.e. increasing employment, sales, and production since 2009), the inputs—investments that drive the outputs—have been stagnant or decreasing over the last decade. One cannot minimize the fact that the industry has shrunk in relation to other North American jurisdictions in recent years.

As a result of the economic downturn in 2009 as well as the appreciation of the Canadian dollar during recovery, Canada was no longer the lower cost jurisdiction it once was, making the Southern US and Mexico more attractive alternatives. Canada's share of North American production has decreased from 17 percent in 2010 to 13 percent in 2016 (Figure C4).

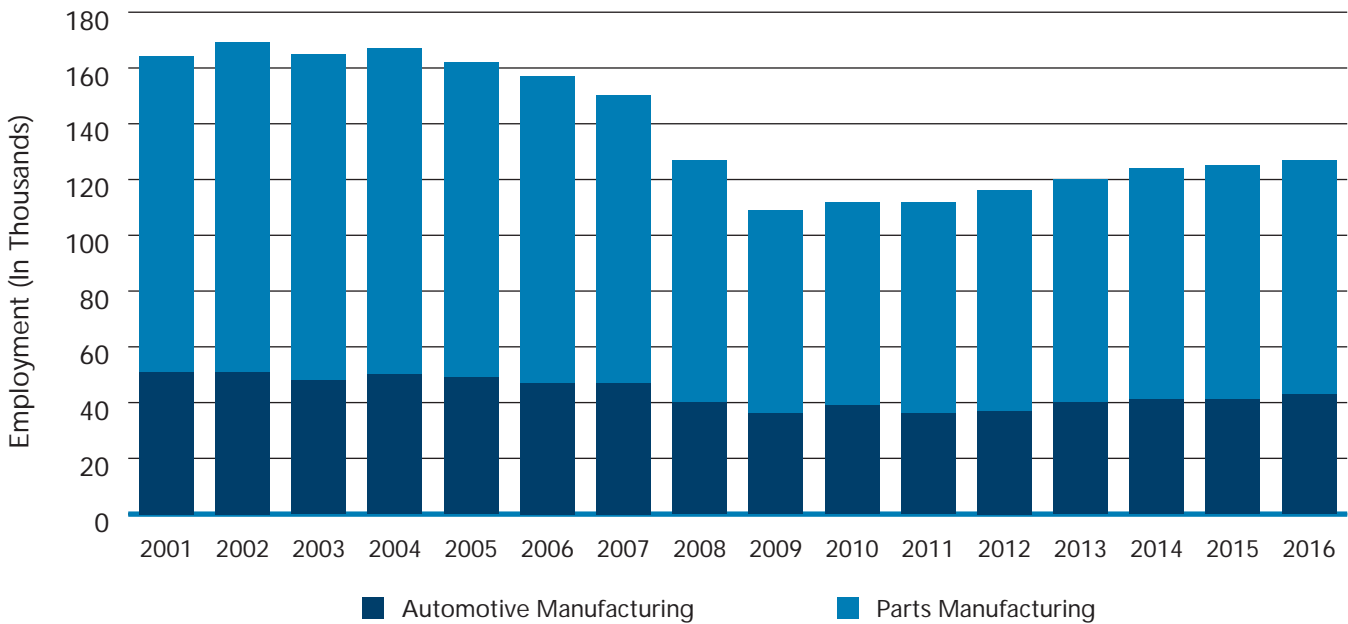
During the economic downturn, Canada and Ontario supported the restructuring of their automotive industry, and this paid off with the volume of production rebounding to near pre-recession levels. While automotive parts and vehicle manufacturing have risen steadily since 2009 to nearly their pre-recession levels, we saw in Figure C2 that automotive manufacturing employment in Canada has not recovered to its pre-recession levels.

FIGURE C1: AUTOMOTIVE MANUFACTURING REAL GDP
(C\$ Billion, 1997–2016)



Source: Statistics Canada, Table 379-0030, 379-0031.

FIGURE C2: CANADIAN AUTOMOTIVE EMPLOYMENT 2001–2016



Source: Statistics Canada, Table 281-0023

FIGURE C3: AUTOMOTIVE MANUFACTURING SHIPMENT (SALES)
(C\$ Million, 1992–2016)

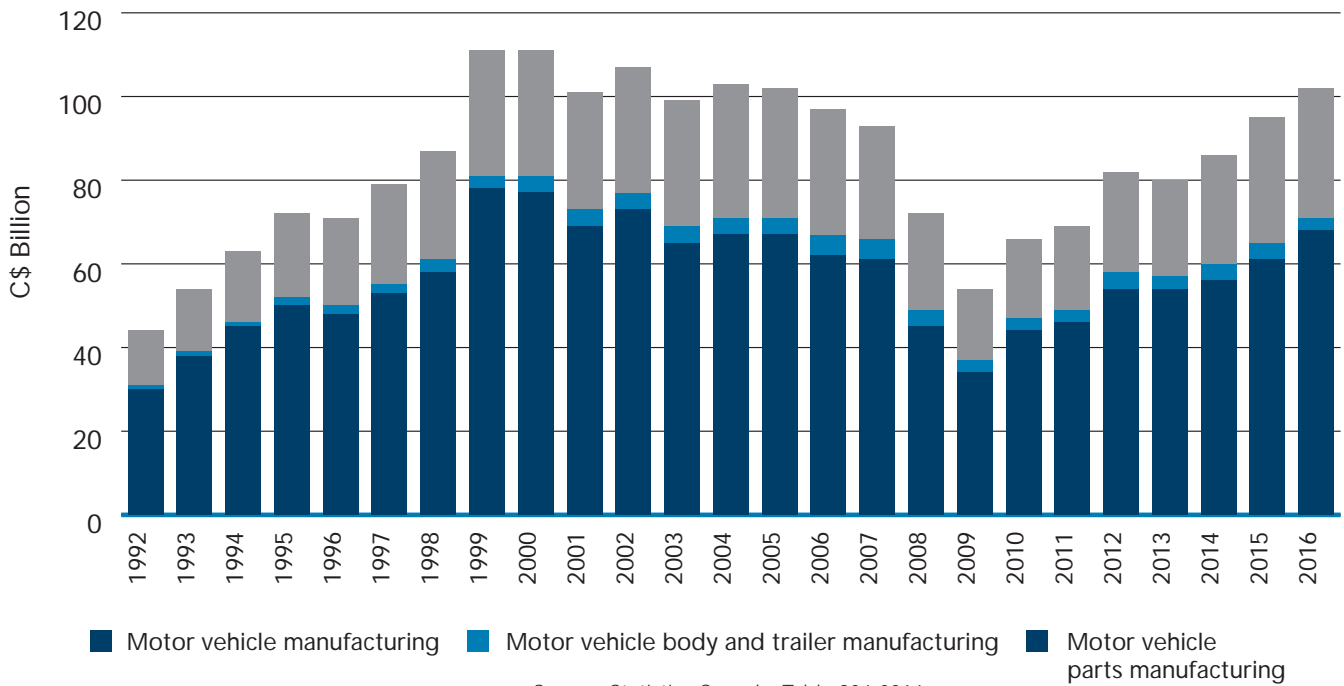


FIGURE C4: LIGHT VEHICLE PRODUCTION SHARES

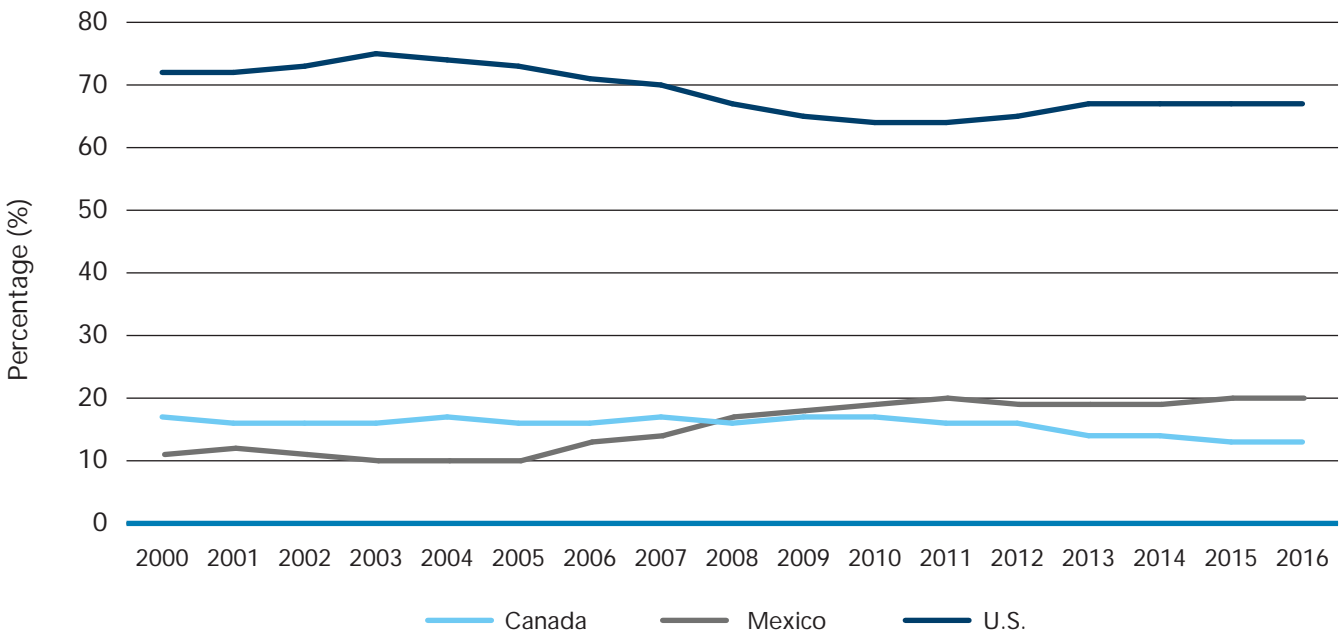
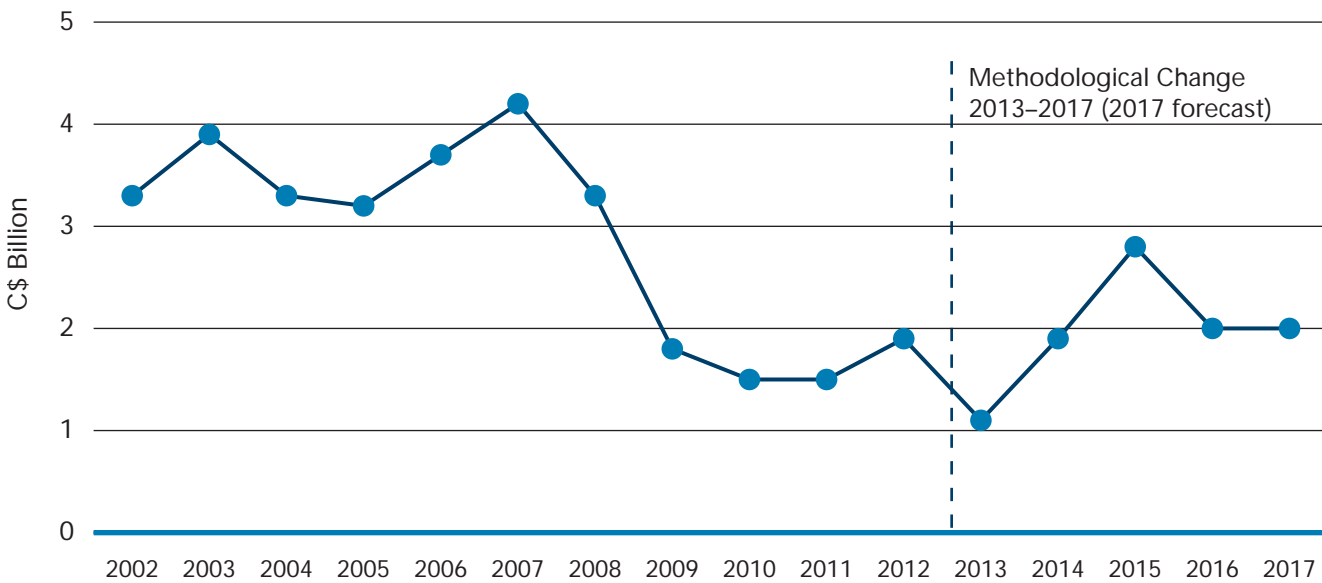


FIGURE C5: AUTOMOTIVE CAPITAL EXPENDITURES IN CANADA
(C\$ Billion, 2002–2017)



Source: Statistics Canada, Survey of Capital and Repair

Investments in Canada

Since 2006, 10 out of the 16 new plants in North America have gone to Mexico, with the remaining 6 going to the Southern US. Canada is no longer the lowest cost jurisdiction to build cars in North America, and international politics have generated significant uncertainty for investors, further stifling investments in Canadian facilities. In that same time period, Canada has not had a single new facility. This is not to say that there have been no investments in Canada—in the last two years there has been \$3.2 billion in investments—only that Canada has not attracted investments in a new facility and these investments have arguable only maintained the footprint rather than expanding it. Our investments have been for plant re-tooling or for R&D, the latter of which Canada can leverage as we continue to build significant strengths in important strategic areas.

Over the last decade, we have seen a decline in automotive capital expenditures (Figure C5) and a decline in automotive business R&D expenditures. Incentive programs have played a large role in this phenomenon, being perceived as less competitive in Canada than in other jurisdictions during a critical period (2010 to 2015), where we saw significant investments go to Mexico and the Southern US. This led to an expansion of the supply chain in the South along with the necessary infrastructure to support large scale investments. Further stifling for Canada is that the industry as it stands, is profitable, meaning that there is no immediate compelling need for companies to invest in advanced manufacturing or in the development of their workforce. Profitability can elicit complacency. Finally, the higher cost of doing business in Ontario (due in part to the workplace changes, Cap and Trade, and high energy costs) can create additional disincentives for investment.

Recent Investments

From February 2016 to March 2017, there has been over \$3.2 billion of automotive investments in Canada announced. Many of these investments were crucial in securing Canada's automotive footprint.

We are seeing large investments being made in R&D in Canada, and we can see the stark difference between investment in existing facilities (traditional investments)

and those establishing new facilities focused on R&D (new R&D investments) (Figure C6). Canada's strengths and opportunities lie in the fact that automakers and parts manufacturers are leveraging Canada's world class R&D expertise and the investments we have seen are from traditional automotive companies and those just entering the automotive space, such as those operating in the information and communication technology sector.

FIGURE C6: RECENT INVESTMENTS IN CANADA BY AUTOMOTIVE MANUFACTURERS

MANUFACTURING INVESTMENTS	NEW R&D INVESTMENTS
<p>GM: \$554 million to extend the mandate for both the Cadillac XTS and the Chevrolet Impala at its Oshawa facility, and increase flexibility for final assembly of the Chevrolet Silverado.</p>	<p>GM: plans to open an innovation research zone at Communitech, and award leading mandates at its Oshawa Tech Centre to build connected and autonomous vehicles. Most recently, GM announced it would increase its engineering base in Ontario from 300 to 1,000 and construct a new software engineering centre in Markham.</p>
<p>FCA: \$325 million to overhaul Brampton's existing paint shop and \$6.4 million for upgrades to its Etobicoke facility.</p>	<p>Uber: plans to invest \$5 million in the Vector Institute (AI) in Toronto.</p>
<p>Ford: \$1.2 million for a new engine mandate at its Windsor engine plant and \$100 million to update the Ford Edge and Lincoln MKT crossovers assembled at Oakville.</p>	<p>Ford: Part of Ford's \$1.2 billion investment, is the opening of a new innovation centre for connected and autonomous vehicles, creating 295 jobs.</p>
<p>Honda: \$492 million to upgrade its Alliston facilities to build new models of the Civic and CR-V.</p>	<p>Apple: plans to open a 22,000 square foot office in Kanata, ON. Speculation is this facility would work on an operating system for connected vehicles.</p>
<p>Toyota: Toyota Canada has announced their plan to bring new vehicle mandates to their operations in Woodstock and Cambridge.</p>	<p>Magna: \$5 million investment in the Vector Institute (AI) in Toronto.</p>

ANNEX D: PROMOTIONAL MATERIALS

When I was first named Automotive Advisor to the governments of Canada and Ontario in June 2015, it became clear that it was of the utmost importance to not only understand the current condition of the automotive sector in Canada and Ontario, but to simultaneously ensure that the benefits of investing here were communicated and common misconceptions were dispelled. I found that industry leaders were ill-informed about the benefits and strengths of Canada's automotive sector. This precipitated the development of promotional material based on a compelling narrative for investment in the automotive sector that highlighted key metrics and the strengths of the industry. This material allowed us to address common misconceptions about the sector and engage in consequential and substantial conversations with leading decision makers of automotive companies, suppliers, and researchers. This material is now routinely used by government to support investment in the sector and informs Canada and Ontario's value propositions.

For the federal government, I developed two fact sheets. The first is an overview of the Canadian automotive industry that highlights Canada's strengths and benefits across nine metrics, including the extensive contribution automotive companies and suppliers make to Canada's exports, capital investments, and economic gains. The second identifies and promotes Canada's strengths in research, development and innovation.

The promotional material that was developed for the Ontario Ministry of Economic Development and Growth consisted of three fact sheets which can be found attached in this annex:

- **Ontario's Auto EVolution:** Describing the benefits that come with the concentration of auto-related resources in Southern Ontario, including expertise across the supply chain in emerging technology such as electric vehicles.
 - **From Lab to Line: A Unique Innovation Ecosystem:** Highlights Ontario's place as North America's second largest IT region and the benefits of the unique interaction between incubators, accelerators, expertise, tax benefits, and talent.
- Ultimately, these fact sheets were a distillation of a larger narrative that was developed as Canada's automotive value proposition, which is now used by government and industry leaders alike to inform investors and the global community of the benefits and strengths to investing in Canada's automotive sector.
- By developing targeted promotional materials, we have been able to erase the myths and misconceptions about Canada's automotive industry and create a compelling story on the strengths that Canada has to offer in the automotive landscape. This promotional material can be found attached to this annex.
- **Ontario, Canada: Perception vs. Reality:** To dispel misconceptions about the automotive industry in Canada, this fact sheet highlights the benefits of investing in Ontario's automotive sector across nine key metrics, including cost-effective labour rates, low corporate tax rates, and J.D. Power IQS Awards.

THE CANADIAN AUTOMOTIVE INDUSTRY

- Drives the Canadian economy forward
- Accelerates innovation in advanced technologies, such as connectivity, safety, environmental and advanced materials
- Develops people skills to compete globally
- Contributes to society and communities by creating high paying jobs and supporting Canadian infrastructure



1 ACTIVE INDUSTRY



1 CAR EVERY 13 SECONDS
 With 23 hrs labour/vehicle
 8 assembly plants

11 PRODUCTION LINES
APPROXIMATELY 700 PARTS SUPPLIERS
 2.4M vehicles produced in 2016

2 EMPLOYMENT



126,900 jobs
 43,200 in assembly
 83,700 in parts production

AWARD-WINNING, HIGHLY SKILLED, EDUCATED AND MOTIVATED WORKFORCE

3 WAGES



C\$9.6B in wages and total benefits

MAJOR CONTRIBUTOR TO TAX AND LOCAL COMMUNITIES

Employee benefits include: EI, health, dental & pension benefits

4 JOB MULTIPLIER



1 auto assembly job creates 6 additional jobs

MORE PLANTS → MORE SUPPLIERS

5 CAPITAL INVESTMENTS



C\$2.0B anchors automotive investment in Canada

AUTOMAKERS RANK AMONG TOP INNOVATORS AND AS LEADERS IN CAPITAL INVESTMENTS

6 INDUSTRY PURCHASES



C\$54B in products and services annually

- Transportation Services
- Financial Services
- Iron & Steel
- Aluminum
- Glass
- Oil & Gas

SUPPORTS INDUSTRIES BEYOND AUTOMOTIVE

7 CANADIAN MADE PRODUCTS



C\$103.2B in Canadian made automotive goods
 Assembly: C\$69B
 Automotive Parts: C\$34B

RECOGNIZED FOR QUALITY AND INNOVATION

8 EXPORTS



C\$86.5B exported
 Over 95% to the U.S.
 Canada's largest export sector

CANADA IS A GLOBAL PLAYER

9 ECONOMIC GAINS



2nd largest manufacturing industry
 Contributes C\$18.2B to GDP

IMPORTANT CONTRIBUTOR TO CANADA

The bottom line is the auto industry is important to this country. Canada must continue to be a global player.

Data as of June 2017

ONTARIO, CANADA PERCEPTION VS. REALITY



Would it surprise you to know just how low our corporate taxes, employer healthcare expenditures and overall business costs are compared to other jurisdictions? We also have comprehensive tax credits and incentives tailored to maximize your investment. And with one of the most skilled and motivated workforces in the world, we are unique in offering high quality production and low costs too—in an environment where union and non-union enterprises work in harmony. Our commitment to a sustainable auto industry has led our automotive partners to invest heavily in manufacturing and R&D that will lead to continuous innovation in the marketplace.

1. Low corporate tax rates

Combined Federal/State/Provincial Rates for 2014 (%) on manufacturing



Depreciation: Accelerated rate of depreciation of machinery and equipment for faster write-off, creating a tax shield.

Tariff Rates: 0% tariffs on incoming parts (U.S. = 2.5%), 0% tariffs on imported machinery and equipment (U.S. and Mexico levy tariffs).

2. Global corporations conduct R&D here

Ontario is home to the largest IT cluster outside Silicon Valley

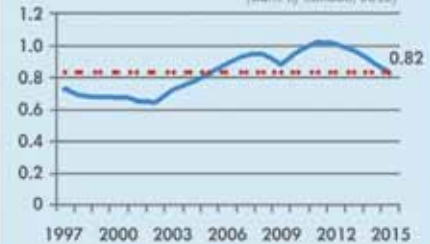
- 20,000+ IT firms, 280,700+ workers, 39,600 STEM grads, 44 colleges and universities
- Salaries in Ontario are nearly 30% lower for software engineers and developers with one and five years' experience than in the U.S.



3. Your dollar goes further

Canada's economic stability protects your investment.

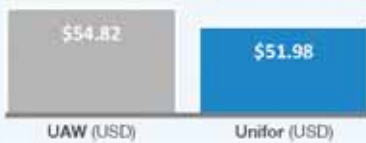
CAD/USD Exchange Rate (Bank of Canada, 2015)



4. Labour rates are more cost-effective

Our competitive all-in labour rates can be attributed to low health care costs.

UAW vs. Unifor fully-loaded hourly labour rates (with 1 CAD = 0.80 USD)



5. A workforce you can trust

Over 120,000 highly skilled workers.



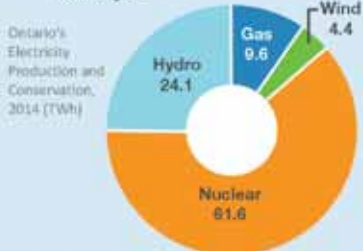
6. J.D. Power IQS Awards

Since 1990, 1/3 of North American awards go to Ontario assemblers.



7. Clean energy for a green economy

Ontario has completely phased out coal, ramping up conservation and promoting renewable energy technologies.



8. Great Lakes Production Cluster

The most important region in North America. Over 8.1M vehicles produced annually and the hub of R&D, design and mission critical suppliers.



9. Auto partners continue to invest heavily in Ontario

Recent Commitments include:

TOYOTA	Next Gen Lexus	\$421 M
LINAMAR	Next Gen Transmissions	\$500 M
FCA	Global Van Plant	\$2 B
HONDA	Lead Civic Plant	\$857 M
FORD	Global Flex/Edge Plant	\$716 M

Ontario's Auto EVolution

Along a 400-kilometre (250-mile) corridor lies the richest concentration of auto-related resources anywhere in the world. Whether your focus is fuel storage, power management, lightweighting, or composite materials, we have what no other jurisdiction can offer – all the problem-solving expertise you need close at hand.

"We can do it faster here.
We can do it better here."

Patrick Horgan
Vice President, Manufacturing,
Development and Operations
IBM Canada



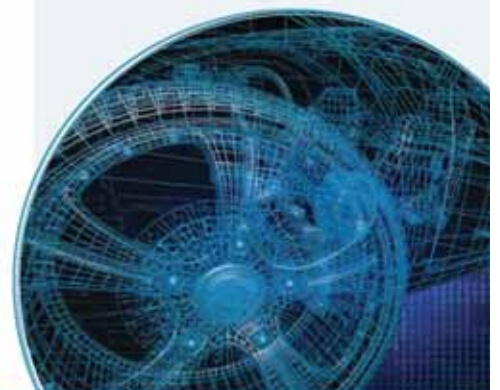
DID YOU KNOW?

- 30% of the vehicles manufactured in the Great Lakes region are built in Ontario
- 1/3 of J.D. Power Initial Quality awards presented in North America have gone to Ontario OEMs.
- Toyota builds the Lexus RX 450h and RX 350 in Cambridge, Ontario.
- In 2019, Toyota will build its RAV4h in Ontario.
- Ontario is the 2nd largest IT region in North America.
- Ontario has three unique extreme weather testing facilities: the University of Ontario Institute of Technology's ACE Climatic Wind Tunnel, the Canadian Space Agency's David Florida Laboratory and the National Research Council's climatic testing facility.

This is where FCA, Ford, GM, Honda and Toyota – along with more than 700 parts suppliers and 500 tool, die and mould makers – work together to develop the next generation of automobiles, including connected, autonomous and electric vehicles. And if you're developing EV technology and need to be at the forefront of the EVolution, you should be in Ontario too.

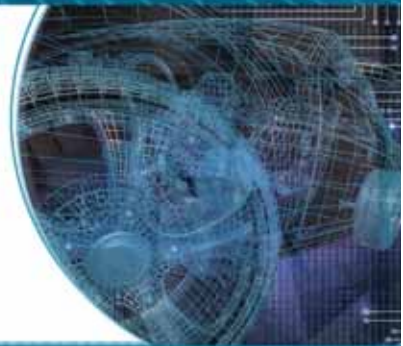
WHAT DOES 400 KM MEAN TO YOU?

From	To	Kilometres	Miles
Windsor	Oshawa	400	250
Detroit	Columbus	300	185
	Cincinnati	425	265
	Chicago	460	285
Beijing	Jinan	440	270
Tokyo	Kyoto	450	280
Berlin	Frankfurt	390	245
	Cologne	590	365
	Wolfsburg	600	370

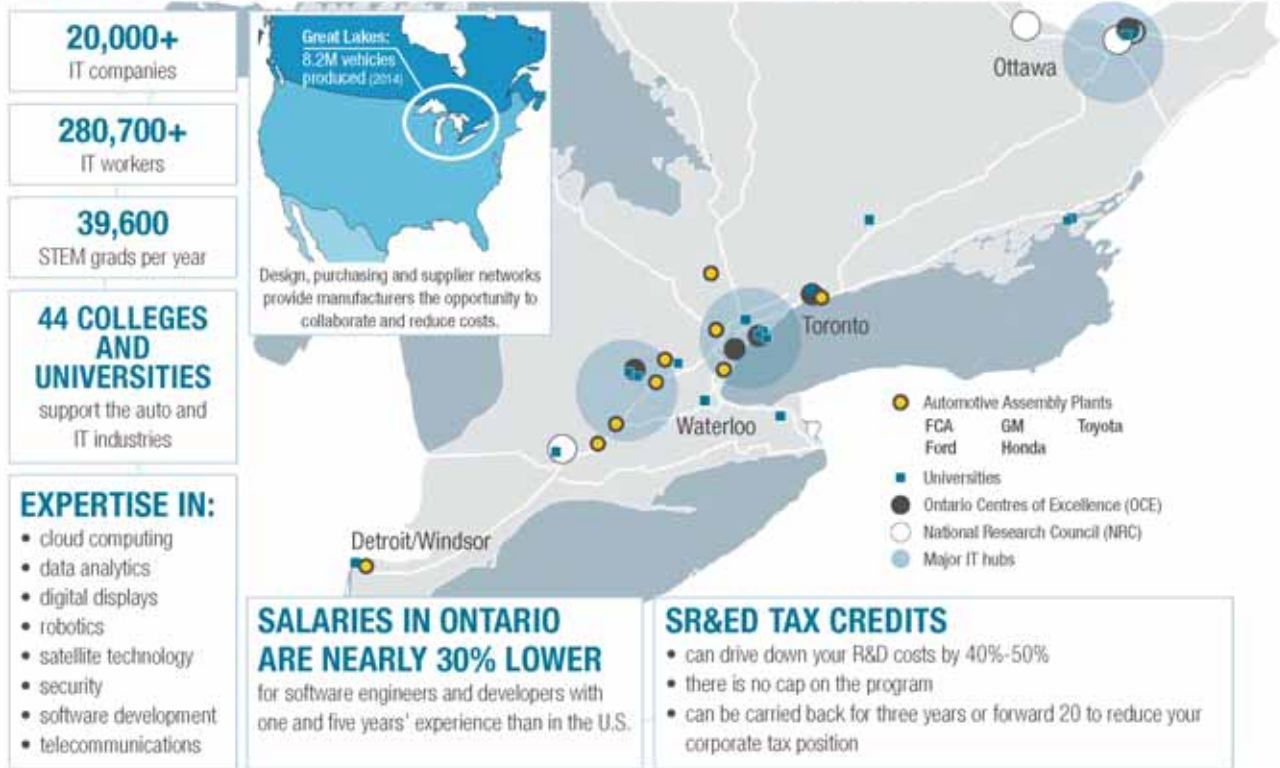


FROM LAB TO LINE: A UNIQUE INNOVATION ECOSYSTEM

Ontario is the largest IT region in North America outside of Silicon Valley. Here you can collaborate with universities and R&D facilities to drive innovation from lab to market quickly while retaining your IP. Our extensive network of incubators and accelerators ensures a steady stream of innovative concepts, ideas and products that strengthen the entire ecosystem. And when it comes to talent, we have an abundance of sophisticated engineers with the expertise to herald the era of connected, autonomous and electric vehicles. Innovation lives here—problems get solved here—awards are won here.



WHY ONTARIO?



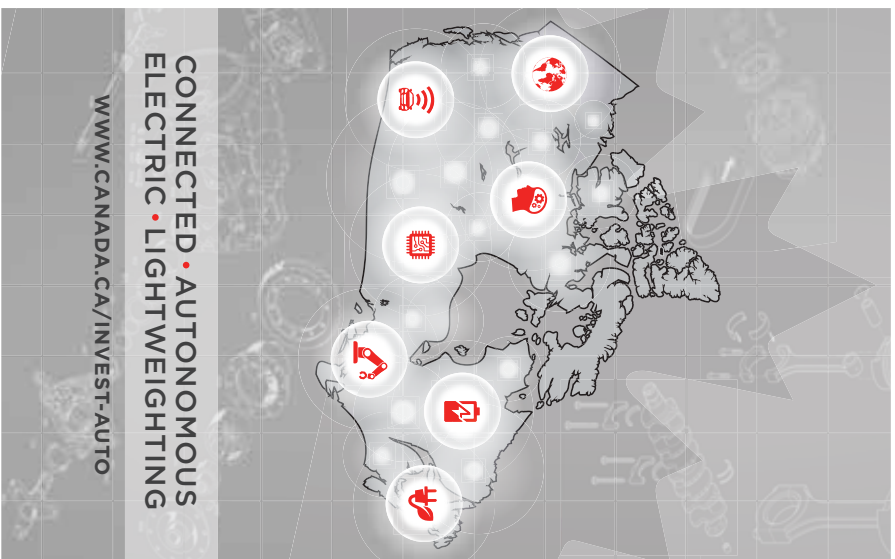
GLOBAL CORPORATIONS CONDUCT MAJOR R&D INITIATIVES IN ONTARIO

These are just some of the companies funding applied research to address today's real challenges.



CUSTOMIZED INVESTMENT
INFORMATION ON THE AUTO
INDUSTRY IN CANADA

INVEST IN
CANADA




CONNECTED • AUTONOMOUS
ELECTRIC • LIGHTWEIGHTING
WWW.CANADA.CA/INVEST-AUTO




TOP REASONS TO PUT CANADA'S RESEARCH AND DEVELOPMENT TO WORK FOR YOU

WE HAVE: WORLD-CLASS TALENT

 Canada wins **1/3 of J.D. Power and Associates initial quality awards**, with only **1/7 of North America's assembly plants**.

 Canada's workforce is one of the **most highly educated in the world**. Nearly **2/3 of adults** have post-secondary education.

 Dr. Jeff Dahn won the Gerhard Herzberg medal for increasing the lifespan and storage capacity of **lithium-ion batteries**.

 Researchers like Yoshua Bengio and Geoffrey Hinton have **revolutionized artificial intelligence**, partnering with **tech leaders IBM and Google**, and paving the way for autonomous vehicles.

COMMERCIALIZATION INFRASTRUCTURE

 **Canada offers 40-60% savings** on R&D costs, a **network of incubators and accelerators**, and the **test infrastructure** to commercialize automotive tech.


WE ARE: GLOBALLY COMPETITIVE

 **Ranked 10th worldwide**, Canada is the **only country in the Americas** on *Forbes Magazine's* Top 10 Best Countries for Business List.

 Canada is part of an integrated Great Lakes automotive supercluster, a mega marketplace with **over 141 million consumers**.

DRIVING THE FUTURE OF TECH

 More than 50 million cars run industry-leading QNX software that was **developed in Canada**.

 **Ontario has the 2nd largest tech hub** in North America. Canada is best in the G7 for available engineers and skilled trades.

INVEST IN
CANADA

VISIT OUR WEBSITE
WWW.CANADA.CA/INVEST-AUTO

*Make Canada part of
your winning formula.*

ANNEX E: PROCESS OF THE AUTOMOTIVE ADVISOR

The evolution of Canada's automotive industry has greatly informed the work that I have done since 2015. My mandate was to provide strategic advice on the state of the automotive industry in Canada and on solutions to improve the industry's competitiveness. It was clear to me early on that I needed to start by gaining a better understanding of the current state of the industry and the issues it faced. While I had been immersed in the industry for nearly 30 years, I needed to map out Canada's strengths, weaknesses, competitive advantages, and barriers to success. I feel very strongly that it is only by fully understanding the industry that we can find ways to improve its competitiveness and market Canada's world-leading capabilities in the global market.

My process was simple and can best be described by the following 8 steps:

TABLE 3: PROCESS OF THE AUTOMOTIVE ADVISOR

Step 1 *Clarify mission and identify problem*

- Engaged with various stakeholders and leaders, including industry and government
- Gathered information at industry events
- Regular meetings with government officials

Step 2 *Breakdown the problem—what is the current state, what needs to be solved?*

- Challenges to Canada's competitiveness
- Ill-defined value proposition and lack of compelling narrative
- Need for detailed information and data to support promotional efforts

Step 3 *Set targets to close the gap; set concrete goals and measurements*

- Focus on changing perceptions and busting myths
- Developed promotional materials to support investment attraction efforts

Step 4 *Cause analysis—identify as many potential causes as possible without prejudice*

- Address competitiveness challenges resulting from post-restructuring era and currency disadvantage
- Foster and promote R&D investments

Step 5 *Obtain consensus on the priorities and develop action plan—what, by whom, by when*

- With CAPC Committees, identify key priorities and develop action plans
- Focus on strengthening technology adoption, people development and improving ease of doing business to enable investments

Step 6 *Implementation—appoint resources with clear responsibilities, measure progress and review effectiveness*

Step 7 *Measure expectations—evaluate results from the perspective of decision-makers*

Step 8 *Develop long term sustainable model*

Understanding the problem

To clarify my mission and identify the problem, I engaged with government, industry, research facilities, universities, colleges, and researchers in Ontario and throughout Canada. I met with stakeholders representing all corners of the automotive supply chain, from conceptualization to commercialization, in industries ranging from traditional manufacturing to emerging technology firms. Meeting with leaders and innovators working in this space allowed me to understand not only their concerns about the industry, but their vision for the automotive industry in Canada.

I also gathered input by attending and participating in industry events, where I delivered presentations to share my perspective on the industry, Canada's leadership role, and challenges for the future. At these events, I also met with attendees to informally gain knowledge and share my views. A full list of my outreach activities is included in Annex A.

Process

This work was advanced by weekly discussions with the automotive teams at the Ontario MEDG as well as ISED who supported my efforts and facilitated the vast majority of my engagement activities. I have also been called to provide advice to government leaders on various issues, including how public policy could support research and innovation in Canada.

Definition and scope

It is through talking to the many key players in the early weeks and months of my tenure that I came to understand that Canada's automotive industry value proposition was ill-defined. While the strengths of the industry were broadly understood, there was no compelling narrative or material that would allow those strengths to be readily communicated to the world. A lack of clarity surrounding the appropriate metrics to tell a compelling story further stymied efforts to promote the value of the industry.

Part of my process has been to ensure that both governments had a clear and common message about the strengths of the sector, and that the weaknesses were also understood. To do this, I engaged with many key Canadian stakeholders—universities, industry, analysts, and government—to develop the metrics that would paint an accurate and compelling picture of the Canadian automotive industry which would support the creation of a marketable tool to attract foreign direct investment to Canada.

Changing perceptions

Initially, the focus was on developing promotional materials with clear and concise messaging on Canada's automotive industry, with the goal of dispelling myths and highlighting Canada's manufacturing strengths. Combined together the four infographics developed with ISED and MEDG form a compelling narrative for investment in the Canadian automotive industry and serve to inform industry leaders, leaders in government, and interested stakeholders of the value of the industry. In fact, the data and promotional material has been used by other interested stakeholders to support their activities (see Annex D).

Collaboration with CAPC

Given the genesis of the Automotive Advisor role, my work is closely aligned with the priorities and mandate of the Canadian Automotive Partnership Council and I have collaborated with each of its committees to achieve common goals. In late 2015, CAPC revised the structure of its committees to better address current challenges. Areas of focus include:

- The Advanced Technology Committee was focused on assessing strengths and opportunities, and on addressing challenges related to innovation and advanced technology development and adoption in the sector. A report entitled “Technology Roadmap Analysis: Current Year to Beyond 2030” was commissioned by ISED and produced by the Center for Automotive Research (CAR) in Ann Arbor, Michigan, to support this work.
- The report provides a broad understanding of the automotive industry’s product technology trends in order to accurately identify where the industry is headed during this period of immense change. This report has allowed governments and industry players to focus on the areas of technology that will have the highest market penetration and biggest impact over the next 40 years, allowing Canadian institutions to become proactive rather than reactive actors to the wave of change that confronts them.
- The Capital Investment Committee, which I co-chaired, worked with OEM and supplier members, and with expert advisors representing academia, site selection expertise and labour, to gain a deeper understanding of competitiveness factors as well as Canada’s value proposition for investment attraction, developing and communicating a compelling investment rationale, and dispelling misperceptions about Canada as a location to invest. This work served to inform Canada’s value proposition and provide strategic knowledge on investment attraction.

- The People and Skills Development Committee worked to analyze and assess the skills profile of the automotive industry and to determine whether Canada has the talent and skills pipeline to support product design, manufacturing, R&D, innovation, commercialization and adoption of new technologies in future years. The committee worked extensively with the Ontario MEDG and the Ontario Centres of Excellence to develop and implement the Automotive Supplier Innovation and Competitiveness Program to encourage Canadian facilities to adopt globally-leading practices that would enhance and improve their operational efficiency, ultimately creating a more competitive automotive landscape in Canada.

Enhanced Value Proposition

The process of developing the promotion materials ultimately resulted in the development of an enhanced value proposition narrative, providing a tool that can be marketed and which accurately highlights Canada’s strengths. See Annex D for more information.

Measuring Effectiveness

The value proposition was shared with domestic industry and analysts, to verify the information and validate the strength of the Canadian benefits. Further, the materials were shared with industry leaders outside of Canada, where many were surprised at Canada’s strengths and the opportunities that we had to offer. The messaging from the value proposition also informed and supplemented briefings provided to senior management in both government, as well as to support trips abroad by both Ministers.