
OBSERVATION

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TECHNOLOGICAL ADVANCEMENT IN AUTOS PRESENTS GREAT OPPORTUNITIES FOR CANADA

Highlights

- The rate of technological advancement in automobiles has risen dramatically in recent years, with electronics becoming a more integral part of each new generation of vehicles. This is a trend that is set to continue in the coming years.
- Going forward, new technologies and innovations will be focused on improving fuel efficiency, increasing safety and expanding the connectivity of vehicles.
- This presents significant opportunities, not just for traditional automakers, but for suppliers as well as engineering and communications firms to develop new products for automobiles that will meet these goals.
- Given its highly skilled labour force and growing high-tech industry, Canada is well-positioned to take advantage of this changing vehicle landscape. While much of the focus on Canada's auto sector recently has been on its inability to attract assembly production into the country, developing new technologies for vehicles could help to increase its footprint in the automotive sector.

Twenty years ago, the thought of a self-driving car was just science fiction. Today, it is becoming more of a reality. Technological change in automobiles over the last couple of decades has been dramatic – and the pace seems to be quickening. While self-driving cars are far from mainstream, the reality is that several aspects of a so-called autonomous vehicle are making their way into mass market automobiles now. In fact, as cars become 'smarter', developing them is becoming as much about electronics as it is about mechanics.

Going forward, the rate of technological advancement in vehicles is only going to rise as automakers and auto suppliers compete in this rapidly changing high-tech environment. There are three key areas in which new technologies and innovations will be focused: reducing the environmental footprint, increasing safety and expanding connectivity.

These developments will present significant opportunities for research, design and engineering of vehicles – not just for automakers and suppliers, but also for firms with no direct automotive experience, such as those involved in engineering, software and communications. Canada is well-positioned to take advantage of this revolutionary advancement in the automotive industry, given its high-skilled labour force and industry experience in the development of hardware, software and communications technologies. As such, despite the challenging environment for assembly production, Canada's footprint in the automotive sector could grow in the coming years.

Lighter, greener, not yet cheaper

The CAFE (corporate average fuel economy) standards that are currently in place in the U.S. requiring an automaker's average fuel economy to hit 54.5 miles per gallon by 2025 – about double the requirements today – will prove challenging for most automakers to reach. Still, these environmental

regulations have prompted automakers to find new ways to improve fuel economy in all areas of vehicle design.

One way is through different types of powertrains. Hybrid, electric, and hydrogen fuel cell engines have been developed and the number of these alternatively powered vehicles on the market continues to grow. As well, producers have also greatly improved the fuel efficiency of the traditional internal combustion engine, making gasoline powered vehicles more environmentally friendly.

The idea of lightweighting has also moved into the forefront, with automakers constantly looking for ways to reduce vehicle weight in order to improve fuel efficiency. Over the years, vehicles became heavier due to a number of new safety features that became required by law. The goal is to use lighter weight materials while maintaining vehicle safety and performance, as well as limiting cost.

While automakers and suppliers have certainly taken a step in the right direction, fuel economy is still a long way from the 2025 CAFE requirements. What's more, despite the number of hybrid and electric vehicles available in the market, they still account for a small sub-5% share of total auto sales in North America. The higher cost likely plays a large role in limiting sales of these vehicles. Moreover, North American consumers prefer to drive larger vehicles which are typically less fuel efficient – a trend that may grow if gas prices remain low. A common complaint among automakers is that government policies seem to be an effort to dictate which vehicles consumers should buy – but in the end it is the consumer that decides, and they will continue to purchase vehicles that they like and want.

Hence, in order for automakers to meet the CAFE guidelines, a great deal of innovation and technology will be required in the coming years – not just to improve fuel economy, but to also reduce the cost of these new technologies to make them more affordable and appealing to consumers.

Safety first

For automakers, consumers and regulators alike, vehicle safety is of the utmost importance. Not surprisingly, automobiles have become much safer over time thanks to significant advancements in technology. Rearview cameras, parking sensors, adaptive cruise control, lane assist and brake assist are just a few examples of technologies that already exist in several vehicles, helping to prevent accidents and improve overall safety. What's more, these features are becoming more widely available rather than restricted to

higher end models. This is a trend that is expected to continue, with automakers and suppliers continuously looking to find new ways to make the roads safer.

In theory, if all vehicles were equipped with vehicle-to-vehicle or vehicle-to-infrastructure communication – technology that allows vehicles to communicate with each other, including location, speed, direction, traffic lights, etc. – the number of collisions would be greatly reduced. Enter the self-driving car. While still far from mainstream, this technology (among much more) has brought self-driving cars closer to reality, with autonomous vehicles being tested in Europe, Japan, China and some regions in the United States.

Still, there are still several questions that need to be answered before these cars hit the mass market, including: what would happen if the system malfunctions, how to switch control to the driver, and who is responsible should something happen. Some have advocated the technology as an aid for drivers rather than a fully automated car. However, there are issues surrounding when it is safe to give the vehicle full control and how quickly a driver can take over if they aren't paying any attention to what is going on around them. As such, others believe that autonomous vehicles should be simply that – entirely autonomous, with no need for driver interaction. All these issues need to be ironed out – along with regulatory approval – before self-driving cars can be produced on a commercial basis.

That said, a number of technologies and systems that are used in autonomous vehicles are making their way into mass market vehicles. Indeed, the number of sensors in each new car is rising dramatically. So while it may be years before completely autonomous vehicles hit the streets, a great deal of the technologies can be utilized in the vehicles that are on the roads today.

Connectivity the way of the future

Technological advancement in vehicles goes well beyond safety and fuel efficiency. The electronic content now available for even low-end autos has risen dramatically, as consumers look for a more personalized driving experience and the ability to instantly access information and entertainment. Examples of these electronics include navigation systems (showing traffic), DVD players, built-in bluetooth, infotainment systems and services that can allow drivers to talk to a real person through the car with the push of a button.

For many consumers, staying 'connected' has become second nature – look no further than the rapid growth seen in the smartphone market. Automakers are responding to

this demand by continuously innovating. For example, it is now possible for a vehicle to send a text message while driving (through a cell phone), smartphones can be connected to the vehicle dashboard, internet is now available in some vehicles and there are smartphone apps that allow consumers to control their cars remotely, including starting the engine, locking and unlocking the doors, and opening or closing the windows.

If the smartphone market is any indication, consumers' desire to be connected to their cars and to be connected to the outside world while they are in their cars is only going to grow. Automakers will continue to innovate and develop new products to accommodate this insatiable appetite, while concurrently implementing safety controls so as to not distract drivers.

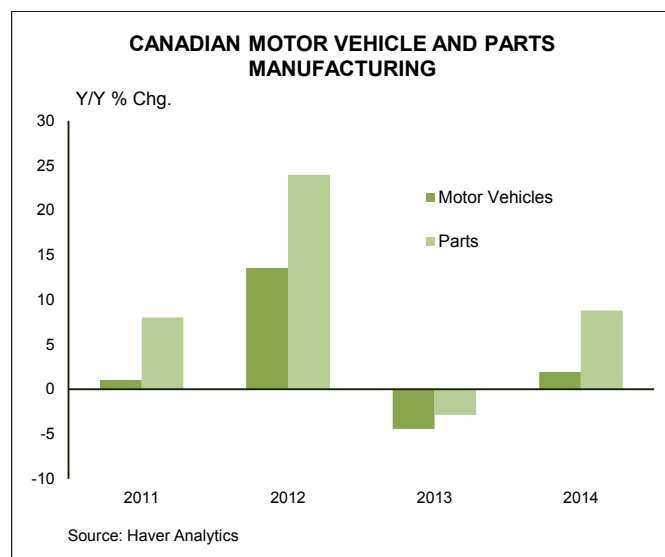
Given all the electronics and software that is available for cars today – and that which will become available in the future – questions have been raised surrounding the security of these systems. Like any computer system, there is a risk of someone hacking into the vehicle. This could potentially be quite dangerous if it inhibits the driver's ability to control the car. As a result, there is likely to be an increase in demand for cyber-physical security of vehicles as well.

Opportunities abound

Given the pace of technological change outside the automotive industry, there is unlikely to be any slowdown in the technological developments within the industry. This presents automakers and suppliers with a breadth of opportunities to innovate and develop new products that will improve fuel efficiency, safety and connectivity.

In Canada, where assembly production falling due to hefty competition from the U.S. and Mexico, parts suppliers will have ample opportunity to thrive in this business. Already, diversification and ongoing innovation have benefited Canadian parts makers, with top suppliers in the country recording strong earnings growth and parts manufacturing far outperforming assembly production in recent years (See Chart).

Suppliers will continue to face pressures to compete for business in other regions around the globe – and manufacture closer to assembly plants – however, there is a great deal of work that can be done here in Canada. Indeed, the auto industry is not just about manufacturing anymore. Software and communications are becoming a more integral part of each new generation of automobiles, a trend that is likely to continue going forward. As such, electronic research



and engineering will be in high demand within the industry. Hence, it is not just the traditional auto parts makers that can benefit from this shift in automotive technology. Firms that have no experience in the industry could become auto suppliers, including those involved in engineering, software and communications. In fact, this is an area where Canada's highly skilled labour force has an advantage over the lower cost manufacturing markets, which are not as technologically advanced.

Canadian firms are already delving into this space, as evidenced by the APMA's Connected Car project. The modified Toyota Lexus RX350 SUV – which exhibits a plethora of Canadian-made cutting-edge technologies relating to connectivity, infotainment, safety, lighting among other things – was unveiled in mid-2014, and of which over a dozen companies contributed to. This type of innovation and technological development could be a great strategy for Canadian firms looking to successfully compete in the global auto industry.

Cyber-physical security is also a potential area where Canada could distinguish itself in the auto market, given that a Canadian-owned firm offers the highest level of security in the smartphone industry.

Canada has several post-secondary education programs that will continue to churn out high-quality, high-skilled workers that will be able to take advantage of such opportunities. Moreover, the Canadian government is providing support for research and development in the auto sector through a number of programs. For example, the Automotive Innovation Fund is a \$750 million program aimed at projects that focus on innovation and environmental technologies. Auto21 and Natural Sciences and Engineer-

ing Research Council of Canada (Automotive Partnership Canada) are programs designed to bring businesses and academics together on a number of auto related projects. Current projects include testing a new chemical process that would reduce the cost of electric vehicles and developing driver assistance programs. The Ontario Centres of Excellence has partnered with the Ministry of Transportation and the Ministry of Research and Innovation on a Connected Vehicle/Autonomous Vehicle research program, of which supported several of the technologies exhibited in the modified Lexus RX350 mentioned above.

While there are many long term headwinds facing the auto manufacturing sector, Canada's automotive footprint could still grow if firms are able to take advantage of the changing vehicle landscape. This could lead to increased demand for high-quality, high-skilled workers and put Canada on the map in a competitive global industry.

Bottom line

Vehicles today are becoming more and more high-tech, as electronics arguably play as large a role as mechanics. This trend is set to continue, as automakers are focused on looking for new ways to improve fuel efficiency, safety and connectivity. Increasingly, suppliers are being called upon to help come up with new innovations to meet these goals. This presents a significant opportunity for not only parts makers, but also software, engineering and communications firms, to help meet this consumer and regulatory demand. Ongoing investments in new technology and innovation will go a long way to making Canadian firms competitive on a global scale. If Canadian firms are able to take advantage of these opportunities, it would help to increase its presence in an industry in which Canada is otherwise likely to continue to lose market share.

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