



Industrie 2030

Roadmap to **2030**:

A path towards doubling Canadian
manufacturing output and exports



**Canadian
Manufacturers &
Exporters**

**Manufacturiers et
Exportateurs du
Canada**



CMC

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Introduction

Manufacturing is the bedrock of the Canadian economy. Its impact extends deeply throughout the country. It generates demand for raw materials, semi-finished goods and professional services. It supplies a host of sectors with critical products and materials. It pays higher-than-average wages, which feed into government tax revenue, retail sales and local real estate markets. Research and innovation in manufacturing contribute to the betterment of Canadians' lives.

Manufacturing isn't the dark, dirty and dangerous sector it is often made out to be. Neither is it simply making a product out of local raw materials and selling it to customers in your backyard. Manufacturing is adding value by transforming goods into a new product or service and selling those to a global customer base. And increasingly, manufacturing is about the use of advanced technologies in both the production process and the product itself. These technologies enable forward-thinking businesses to develop customized consumer solutions, positioning them for global success and leaving their less agile competitors behind.

We need look no farther than the cars we drive every day. Once, the manufacturing process involved a single integrated factory where raw materials entered one end and, through the efforts of many assembly-line workers, thousands of identical cars rolled out the other end. Today, cars are produced by combining parts from hundreds of suppliers from around the world, with the aid and support of thousands of robots. These cars are far more customizable. Each has several models and each model can be adapted in countless ways to meet customers' needs and wishes. Moreover, today's cars are anchored by computer systems and technologies such as fuel consumption monitoring and a GPS to ensure we don't run out of gas or get lost on the way to our next appointment.

The integration of technology — both hardware and software — into our manufacturing processes and the goods we make is rapidly changing the business of manufacturing. These technologies are disrupting established markets and supply chains. They are blurring the lines between goods-producing industries, technology companies and service providers. They are changing customer demands and expectations of the products they consume. This integration of technology into our processes and products is often referred to as the Fourth Industrial Revolution.

These changes can be either a threat or an opportunity. Unless manufacturers embrace the use of advanced technologies that improve production speed, reduce downtime and increase flexibility, they will not be able to produce goods that meet the quality, cost and operational requirements of their customers. Conversely, those who do incorporate advanced manufacturing technologies will enjoy dramatically lower production costs and the flexibility to create innovative new products to meet changing customer demands.

Many countries around the world have developed national strategies aimed at capitalizing on the benefits of the Fourth Industrial Revolution. Canada, to date, has not. This country needs a national



strategy that establishes a long-term growth target for the sector and positions Canadian manufacturers at the forefront of innovation, technological adoption and product commercialization. Our manufacturers need to be able to produce and compete on a global scale. A successful strategy will mean the difference between a strong and growing manufacturing sector that builds prosperity nation-wide, and long-term manufacturing stagnation, leading to a declining standard of living for all Canadians.

It is for this reason that Canadian Manufacturers & Exporters (CME) is launching *Industrie 2030*. Through this year-long research and consultation process, CME will help drive the creation of a national strategy to position Canadian manufacturers for global success.

Industrie 2030 is modelled after CME's successful *Manufacturing 20/20* plan. That 2004 initiative produced the most extensive consultations ever undertaken exclusively by the private sector in the history of Canadian industry. The direction provided by more than 2,500 executives in roughly 100 consultation meetings, directly or indirectly resulted in a number of significant policy changes to improve manufacturing competitiveness across the country, including:

- The adoption of advanced manufacturing as a priority for government science & technology strategies;
- The introduction of the Accelerated Capital Cost Allowance (ACCA) for investments in manufacturing and processing machinery & equipment;
- Lower corporate tax rates for manufacturers;
- Elimination of duties on manufacturing inputs;
- Improved Canada-US border access through the Beyond the Border and regulatory cooperation initiatives; and
- New direct supports for employer training through the Canada Jobs Grant.

More than a decade has passed since the findings and recommendations from *Manufacturing 20/20* were released. Since then, the pace of global change and technological advancement has only accelerated. It is time for a new manufacturing strategy to guide Canada into the future.

The *Industrie 2030* initiative is centred on an ambitious goal to double manufacturing output and value-added exports by 2030. Through a series of cross-country discussions with industry and innovation leaders, we will create a roadmap and implementation strategy to help us achieve this goal. *Roadmap to 2030* — this paper — is the foundation upon which these discussions are based.

This paper will set the stage for CME's *Industrie 2030* initiative by setting out the importance of manufacturing to the Canadian economy, providing the global context of the Fourth Industrial Revolution, and identifying the key areas of focus for the consultation exercise.

Quantifying Success: The Impact of Doubling Manufacturing Output and Exports by 2030

What does success look like?

For *Industrie 2030*, success is about creating the conditions necessary to allow Canadian manufacturers and exporters to thrive in the digital world. *Industrie 2030* will build the strategic foundation to usher in a new era of prosperity for Canadian manufacturers. Success will be nothing short of doubling Canadian manufacturing output and exports within 15 years.

What Would Doubling Manufacturing Output and Exports Mean?

In 2015, manufacturing sales across Canada were valued at \$610 billion and exports of manufactured goods were worth \$348 billion. Doubling these numbers sets a goal of \$1.2 trillion

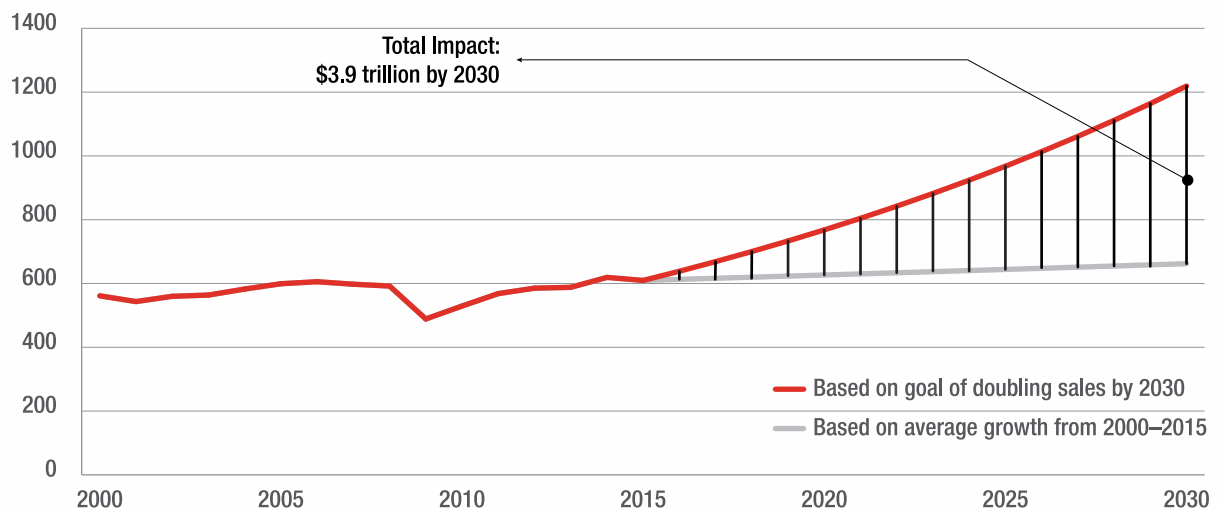
in total manufacturing output and \$696 billion in manufactured goods exports in just 15 years.

These are ambitious targets. They require sustaining and accelerating the momentum that manufacturers have built since the 2008–2009 recession, while also addressing the fundamental challenges which were limiting growth before the recession hit.

Canada's track record on manufacturing sales and export growth has been mixed over the past 15 years. For most of the 2000s, growth was essentially flat, as a high Canadian dollar exposed our competitive shortcomings relative to other countries. The recession itself triggered a sharp drop in exports and domestic sales as global demand plummeted. Since then, however, manufacturers have rebounded. Sales have risen by an average of 3.8 per cent per year since 2009 and exports have averaged 6.8 per cent growth per year.

Doubling manufacturing sales by 2030

(Projected sales, in \$billions)





For Canada to double manufacturing sales and exports by 2030 requires achieving and sustaining an annual growth rate of about 4.7 per cent. This target may seem relatively easy to meet based on post-recession growth rates, but a significant share of the growth since 2009 can be attributed to economic activity returning to its pre-recession levels. Sustaining a 4.7 per cent growth rate over the long term is a more difficult task.

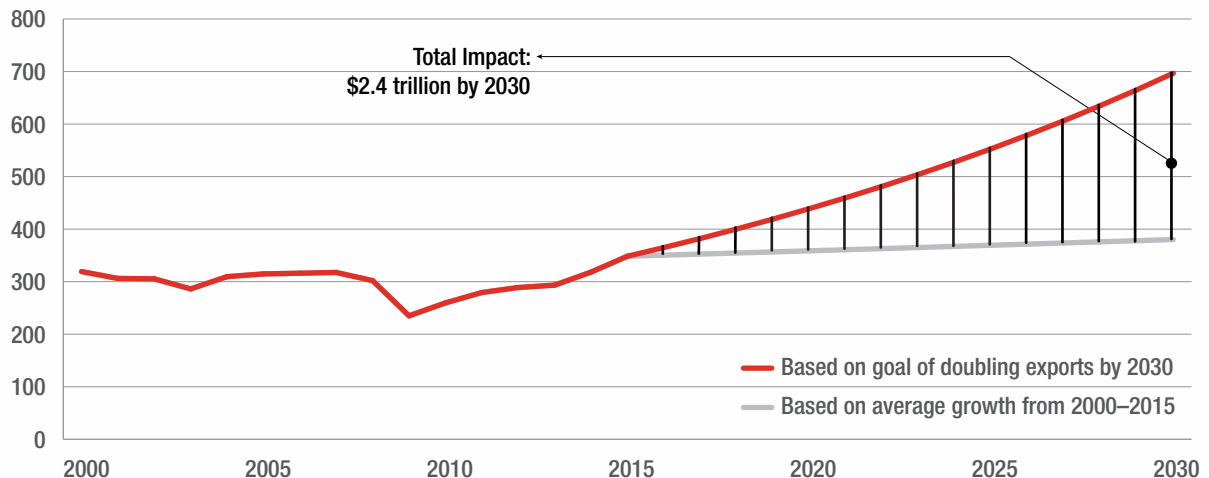
Is this target achievable? Canadian Manufacturers & Exporters firmly believes that it is. However, it will require a concerted effort on the part of industry, government, labour and a wide range of stakeholders to make it happen. *Industrie 2030* is the vehicle through which these groups will come together to address the challenges and obstacles preventing growth in manufacturing today, and to propose solutions aimed at improving innovation, competitiveness and market access for tomorrow.

As great a challenge as this growth target may be, the potential rewards are even greater. Compared to baseline expectations that growth continues at its 15-year average of 0.6 per cent, doubling manufacturing sales and exports would generate \$3.9 trillion in total new manufacturing sales and \$2.3 trillion in total new exports by 2030.

These additional sales would have tremendous spinoff effects across the Canadian economy. Based on the most recent available information on existing input/output linkages across industrial sectors, doubling manufacturing output would add \$448 billion in GDP to the Canadian economy through direct, indirect and induced effects. It would also create 4.1 million additional new jobs by 2030 — 1.5 million jobs directly in manufacturing and 2.6 million across the economy through indirect and induced effects.¹

Doubling manufacturing exports by 2030

(Projected exports, in \$billions)



¹ These figures are calculated using the most recent data available from Statistics Canada's input/output model. It is important to note that this model is based on current linkages across industries. Since these linkages evolve over time, multiplier numbers grow less reliable the farther into the future projections are made. As such, although these models represent the best information available, the precise impact numbers for 2030, though insightful, should be considered illustrative.



Summary of Impacts

Direct Impact on Manufacturing Sales:

- Manufacturing sales would rise from \$610 billion in 2015 to \$1.2 trillion by 2030.
- Based on annual growth rates over the last 15 years, sales would otherwise only rise to \$662 billion.
- By 2030, sales would be \$557 billion higher than under baseline growth assumptions.
- Doubling manufacturing output would generate \$3.941 billion in cumulative additional sales from 2015 through 2030.

Direct Impact on Manufacturing Exports:

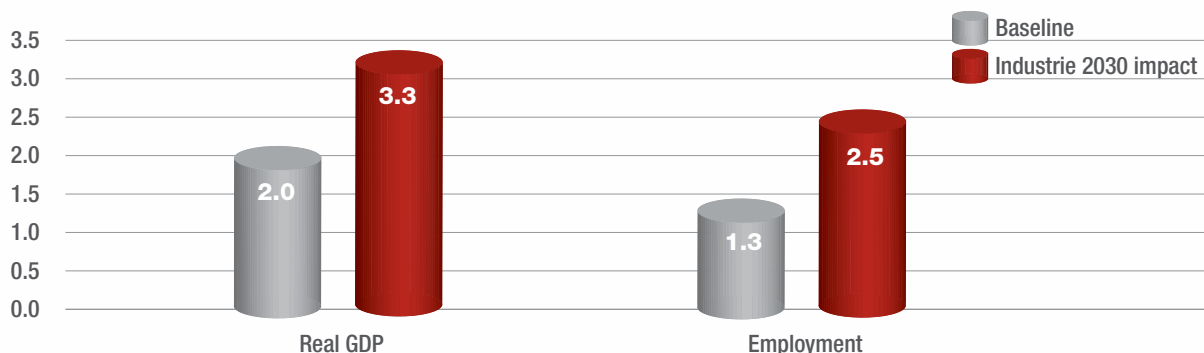
- Exports of manufactured goods would rise from \$348 billion in 2015 to \$696 billion by 2030.
- Based on annual growth rates over the last 15 years, exports would otherwise only rise to \$380 billion.
- By 2030, exports would be \$316 billion higher than under baseline growth assumptions.
- Doubling manufacturing exports would generate \$2.235 billion in cumulative additional sales from 2015 through 2030.

Spinoff effects:

- An estimated \$448 billion in additional GDP to the Canadian economy through direct, indirect and induced impacts.
- \$448 billion is about equivalent to the size of the Quebec and Saskatchewan economies combined.
- The economic spinoffs would lift the projected GDP growth rate in Canada from 2.0 per cent per year to 3.3 per cent from 2015 through 2030.
- An estimated 4.1 million additional jobs by 2030 — 1.5 million directly in manufacturing and 2.6 million spinoff jobs across the Canadian economy.
- Those jobs would increase the projected employment growth rate in Canada from 1.3 per cent per year to 2.5 per cent from 2015 through 2030.
- 4.1 million jobs would take Canada from 17.9 million jobs in 2015 to 22.1 million by 2030, assuming no other employment growth took place anywhere else in the Canadian economy.
- 4.1 million people is about the size of the entire workforce in Quebec in 2015.

Growth impacts of *Industrie 2030* goals

(Average annual growth from 2015-2030)



Manufacturing in Canada Today

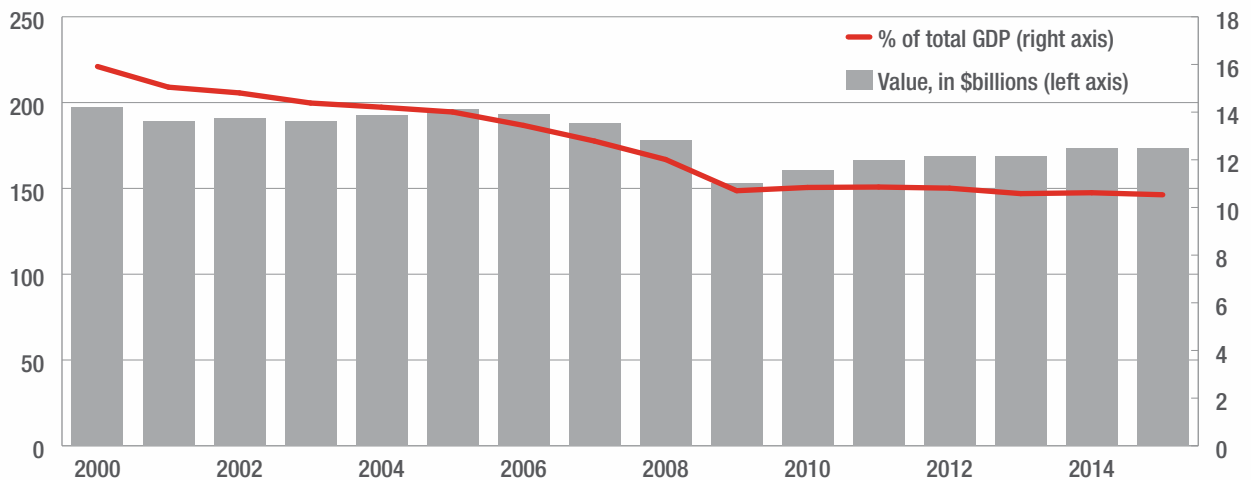
Establishing a goal to double value-added manufacturing and exporting is good, but in order to achieve that goal we need to first understand the current state of manufacturing in Canada, identify its strengths and weaknesses, and determine how we can build off them or overcome them.

Manufacturing is already a vital contributor to Canada's economy and to the prosperity and living standards of all Canadians. It is the largest single business sector in Canada. It directly represents:

- 1.7 million employees — 10 per cent of the Canadian total;
- \$114 billion paid in total compensation to workers — more than any other sector;
- \$174 billion in GDP — 10.5 per cent of Canada's total;
- \$348 billion in exports — 67 per cent of Canada's total; and
- 42 per cent of all private sector research and development activity.

This is only the beginning. The strategic roadmap developed through *Industrie 2030* will build on this impact and set Canada on the path to even greater economic success.

Manufacturing GDP in Canada





Overall Contribution to the Economy

The manufacturing sector added \$174 billion to Canadian GDP last year, accounting for close to 11 per cent of all economic activity in the country. This share has been largely unchanged since the 2008–2009 recession.

Recent Trends

After falling steadily through most of the 2000s, manufacturing GDP has since stabilized and is gradually recovering. From 2000 to 2009, manufacturing GDP fell by 22.3 per cent, from \$197 billion to \$153 billion. Since that time, GDP in manufacturing has increased by 13.3 per cent and is now at its highest level since 2008.

Even so, this recovery has not quite been enough to keep pace with growth in the overall economy. In the post-recession years,

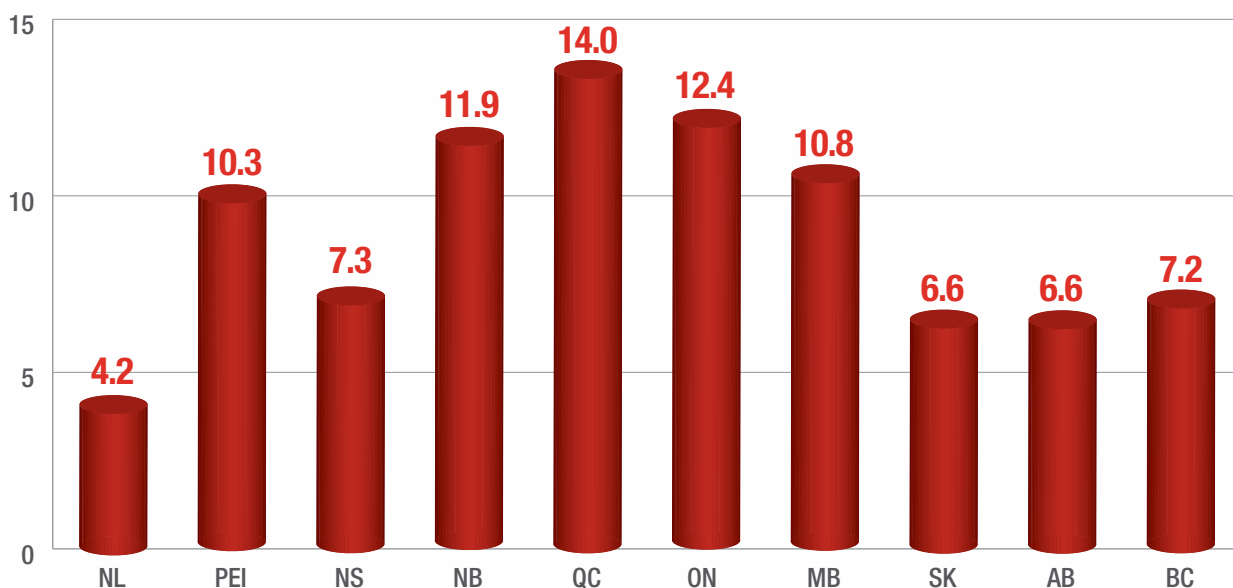
the Canadian economy has grown by an average of 2.4 per cent per year, while manufacturing GDP has risen by 2.1 per cent per year. As a result, manufacturing's overall contribution to the economy has continued to decline, albeit marginally. In 2000, manufacturing businesses generated close to 16 per cent of all economic activity across the country. By 2009, that share had fallen to 10.7 per cent and stands at 10.5 per cent today.

Importance by Province

Although Ontario has the largest manufacturing sector in Canada, it is in Quebec where manufacturing makes the most important contribution to the provincial economy. In 2014, manufacturing directly accounted for 14.0 per cent of total GDP in Quebec. Ontario was next at 12.4 per cent. Manufacturing is relatively less important in Newfoundland and Labrador, Alberta and Saskatchewan, mostly because of the size of the oil and gas sector in those provinces.

Importance of manufacturing across Canada

(% of GDP, 2014)





Manufacturing Sales

Canadian manufacturers enjoyed a near-record year in 2015, generating total sales of \$610 billion. While sales are down slightly from 2014, the difference was the result of low oil prices affecting the value of petroleum sales. Non-petroleum manufacturing output has never been higher.

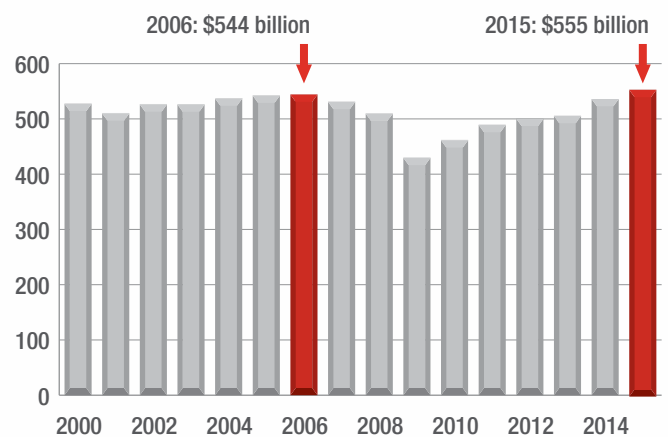
Overview

After being hit hard by the 2008-2009 recession, the manufacturing sector in Canada has been gradually recovering. Sales grew steadily through to 2014, when they reached a record \$619 billion.

Last year, economic conditions changed dramatically. Falling oil prices had a significant impact on manufacturers both upstream and downstream of the energy sector. The value of refined petroleum production fell by nearly 30 per cent, and sales of primary metals, fabricated metals and machinery were all lower. Meanwhile, conditions were much better for Canada's export-oriented industrial manufacturers who benefited from a more favourable exchange rate.

Non-petroleum manufacturing hits a record high in 2015

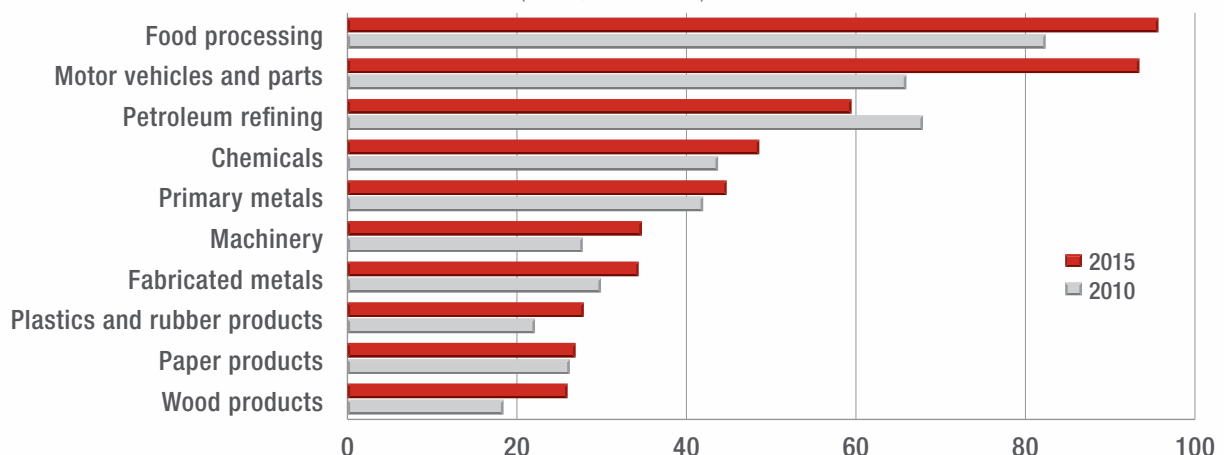
(Sales, in \$billions)



All said, overall manufacturing sales fell from \$619 billion in 2014 to \$610 billion last year. However, outside of petroleum refining, 2015 was a good year for most manufacturers. Non-petroleum manufacturing output rose from \$542 billion in 2014 to an all-time high of \$555 billion last year.

Top manufacturing industries in Canada

(Sales, in \$billions)





Major industries

Food processing and motor vehicles and parts are Canada's two largest manufacturing industries. Each accounts for slightly more than 15 per cent of total manufacturing production nation-wide. Both have also been important drivers of manufacturing growth over the past five years. Food processing output has increased by 16 per cent since 2010, while motor vehicles and parts production is nearly 42 per cent higher.

Businesses in the wood products and machinery industries have also been important growth drivers in manufacturing over the past five years, although as noted above, machinery sales were flat last year.

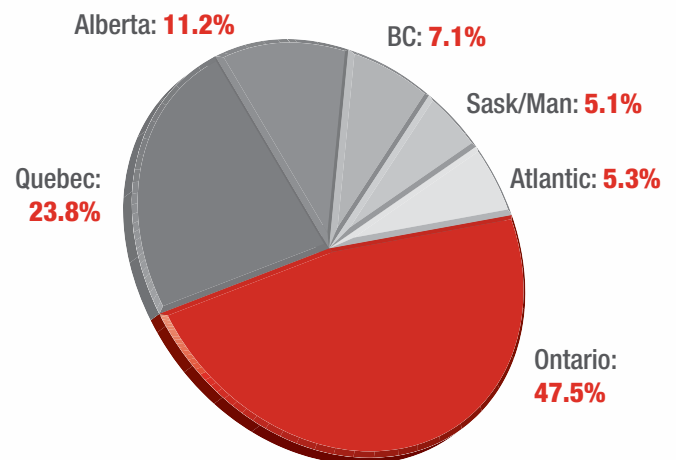
Manufacturing by Province

Ontario and Quebec are by far Canada's largest manufacturing provinces. At just under \$290 billion in sales in 2015, Ontario alone accounts for close to half of all manufacturing output nation-wide. Another 24 per cent of sales (\$145 billion in 2015) are generated in Quebec.

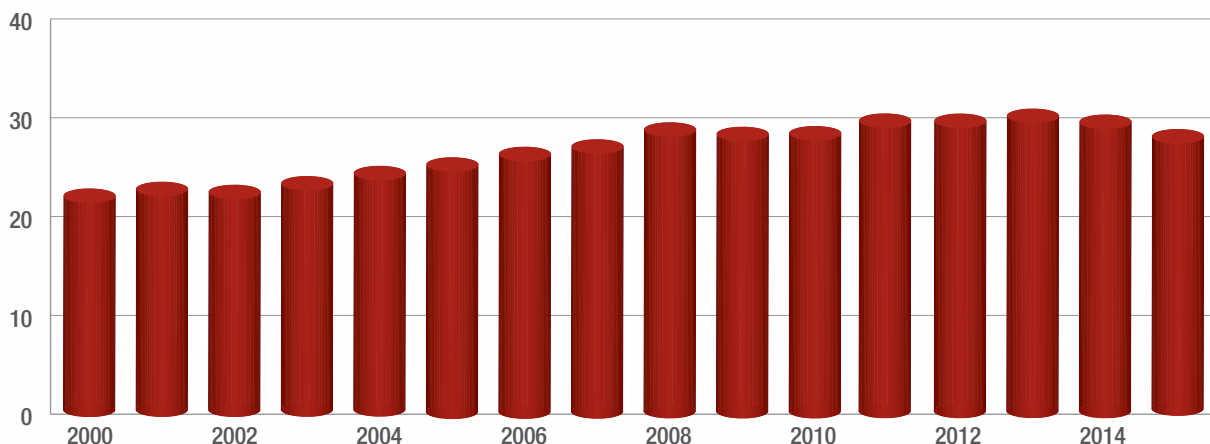
Although provinces where manufacturing is linked to energy production all suffered sharp declines in sales last year, the recent trend has been towards a gradual diversification of Canada's manufacturing base away from this traditional Ontario-Quebec hub. Fifteen years

ago, Ontario and Quebec accounted for 77 per cent of all manufacturing sales in Canada. By 2015, that share had fallen to 71 per cent, owing in large part to a boom in resource-sector-based manufacturing activity in western Canada.

Distribution of manufacturing activity across Canada – 2015



Distribution of manufacturing activity outside of Ontario and Quebec – 2000–2015 (%)





Manufacturing Exports

A falling Canadian dollar helped manufacturers export a record \$348 billion in goods to countries around the world in 2015. Led by sales to the United States, manufacturers account for more than two thirds of Canada's total exports last year.

Overview

Canadian manufacturers have seen steady growth in exports since the 2008–2009 recession. In 2015, manufactured goods exports rose by 9.5 per cent to reach \$348 billion — the second consecutive year of record exports. Although the falling exchange rate did not have an immediate effect on exports, the impact has begun to filter through, contributing to accelerating export growth.

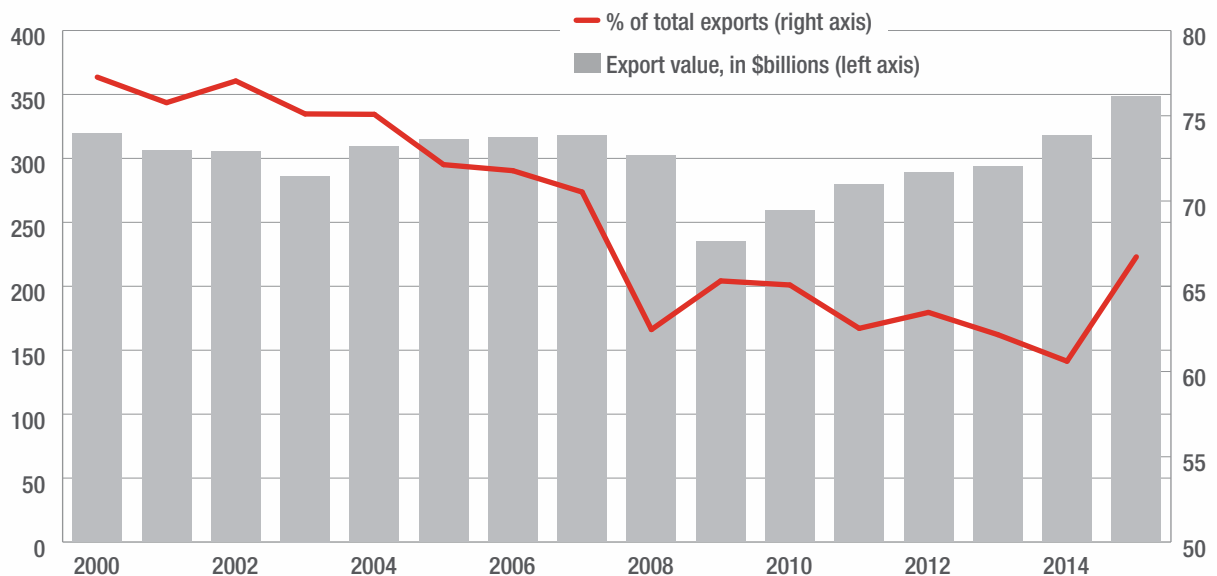
Although manufactured goods make up a full two thirds of Canada's total exports, that share has been declining over

the past 15-20 years. The combination of a rising dollar and booming crude oil exports diminished the relative value of manufacturing exports. In the late 1990s, manufactured goods accounted for about 80 per cent of Canada's total exports. That share fell to 61 per cent in 2014, before recovering to 67 per cent last year.

Major Destinations

The vast majority of Canada's manufactured goods exports — over 80 per cent in 2015 — go to the United States. Manufactured goods exports to the US were actually in decline for most of the 2000-2010 period, owing to a range of factors including a rising Canadian dollar and the thickening of the Canada-US border post-9/11. Prior to 9/11, Canadian manufacturers exported as much as 88 per cent of their total foreign sales into the US. Since 2010, however, exports have rebounded and have risen by 40 per cent in just five years, including a year-over-year increase of 11.3 per cent last year alone.

Canadian manufactured goods exports





Meanwhile, China has emerged as an important trading partner for manufacturing businesses. In the late 1990s, China accounted for only 0.5 per cent of Canada's total manufactured goods exports. Today, China is the country's second most important destination for manufactured goods, with record sales of \$1.7 billion last year accounting for 3.4 per cent of the total worldwide.

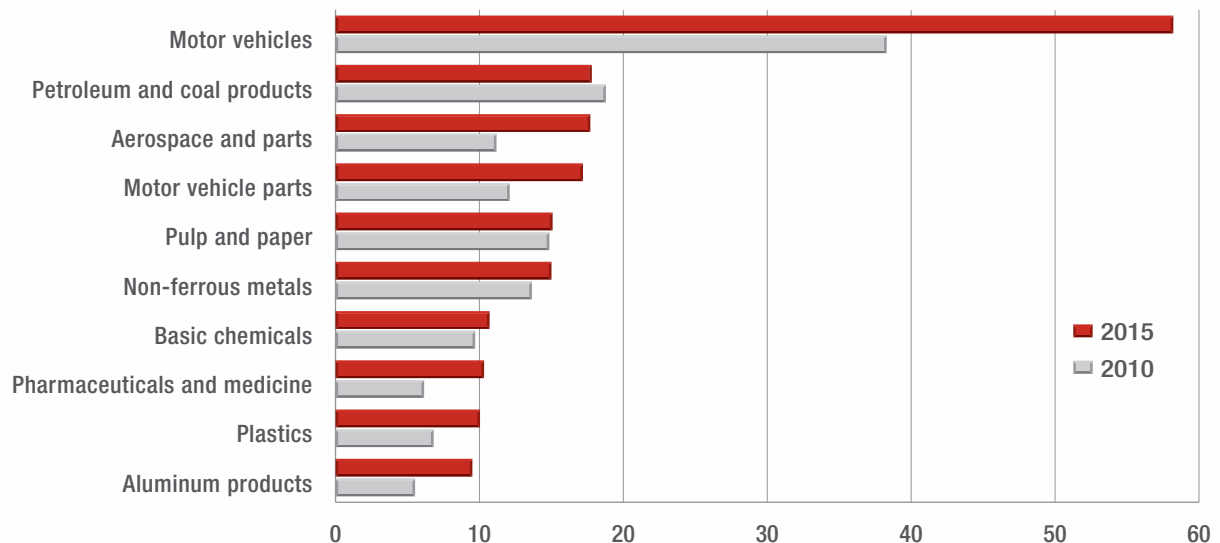
Major Products

Motor vehicles and parts are by far Canada's most important manufactured exports. Vehicles alone accounted for close to 17 per cent of all manufactured goods exports in 2015, while parts accounted for an additional 5 per cent. Moreover, exports of those products have risen dramatically in recent years, with total growth of nearly 50 per cent since 2010. By comparison, exports of all other manufactured goods are up 31 per cent over that same period.

Even though price effects drove down the value of refined petroleum and coal products by 16 per cent last year, those products remain Canada's next most important manufactured goods exports, followed by aerospace vehicles and parts.

Top Destinations for Manufactured Goods Exports					
	2010		2015		Growth: 2010-2015
	\$ billions	% of total	\$ billions	% of total	
US	200.3	77.2	280.6	80.5	40.0
China	8.0	3.1	11.7	3.4	46.4
UK	5.7	2.2	5.6	1.6	-3.2
Mexico	3.9	1.5	5.4	1.5	39.2
Japan	4.5	1.7	5.0	1.4	10.3
Germany	2.5	1.0	2.8	0.8	9.3
Netherlands	2.6	1.0	2.5	0.7	-3.1
France	1.9	0.7	2.3	0.7	19.0
S. Korea	1.9	0.7	1.9	0.5	0.6
Norway	2.5	1.0	1.8	0.5	-28.4
All others	25.7	9.9	29.0	8.3	13.0
Total	259.5	100.0	348.4	100.0	34.2

Top manufactured goods exports (\$billions)





Employment and Wages

Manufacturing provides high-quality employment to Canadians. One of every 10 jobs in Canada is in manufacturing. Those jobs are more likely to be full-time, stable and pay above-average wages.

Manufacturing employment

Canadian manufacturers employed 1.7 million Canadians in 2015, about 10 per cent of total employment nation-wide. While current employment is down by roughly 500,000 employees since 2000, much of the decrease stems from increased productivity and a shifting of jobs into the service sector as part of outsourcing by manufacturers. For example, customs and logistics support which was once housed inside of manufacturing is now often handled by a third party logistics service provider. The number of manufacturing jobs in the country has remained essentially unchanged since 2009 as the industry continues to increase automation and the use of new technologies.

As manufacturing becomes less labour-intensive, the number of jobs in the sector will not grow as rapidly as output and

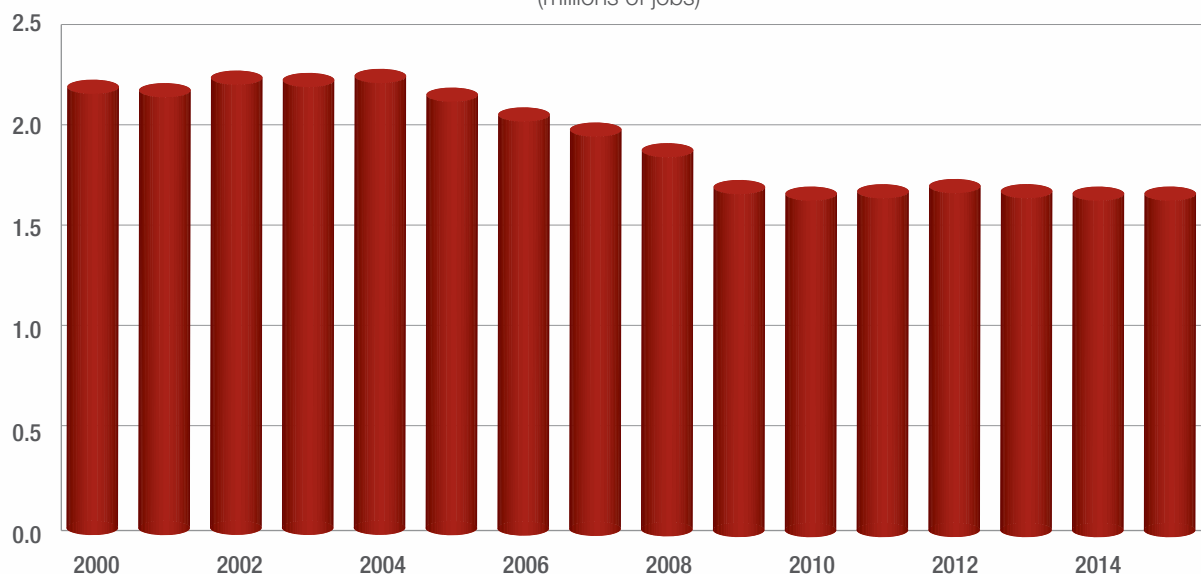
exports will. This should not be considered a negative, however. For one, the jobs that are available are generally of higher quality. Moreover, improving labour productivity is vital to making Canada a more attractive place in which to invest. That investment in new facilities is what will drive future manufacturing employment growth.

Employment by Industry

Employment in manufacturing depends on the number and size of industrial facilities in the country, as well as the relative labour intensity of each industry. For example, even though petroleum refining is a leading source of manufacturing sales, it is a capital-intensive industry and therefore a relatively small employer.

Food processors are Canada's leading employers in manufacturing, with about 240,200 jobs in 2014 (the most recent year for which data are available). While employment has fallen in many manufacturing sub-sectors, food processing has been adding positions — 7,000 new jobs since 2009 and nearly 11,000 since 2004. Transportation equipment production — motor vehicles, aerospace, rail and shipbuilding — is also a major employer, with about 209,400 jobs in 2014. Employment

Manufacturing employment
(millions of jobs)





has grown modestly since 2009, but remains well below levels seen in the early 2000s.

Wages and Salaries

Manufacturing generates high-quality jobs across Canada. Total compensation for a manufacturing job in Canada averaged \$72,444 in 2014 — fully 25 per cent higher than the all-industry average of \$57,924. However, there is considerable variation in salaries, depending on the specific industry. Average compensation ranges from over \$150,000 per job in petroleum refining to \$34,661 in clothing and textile production.

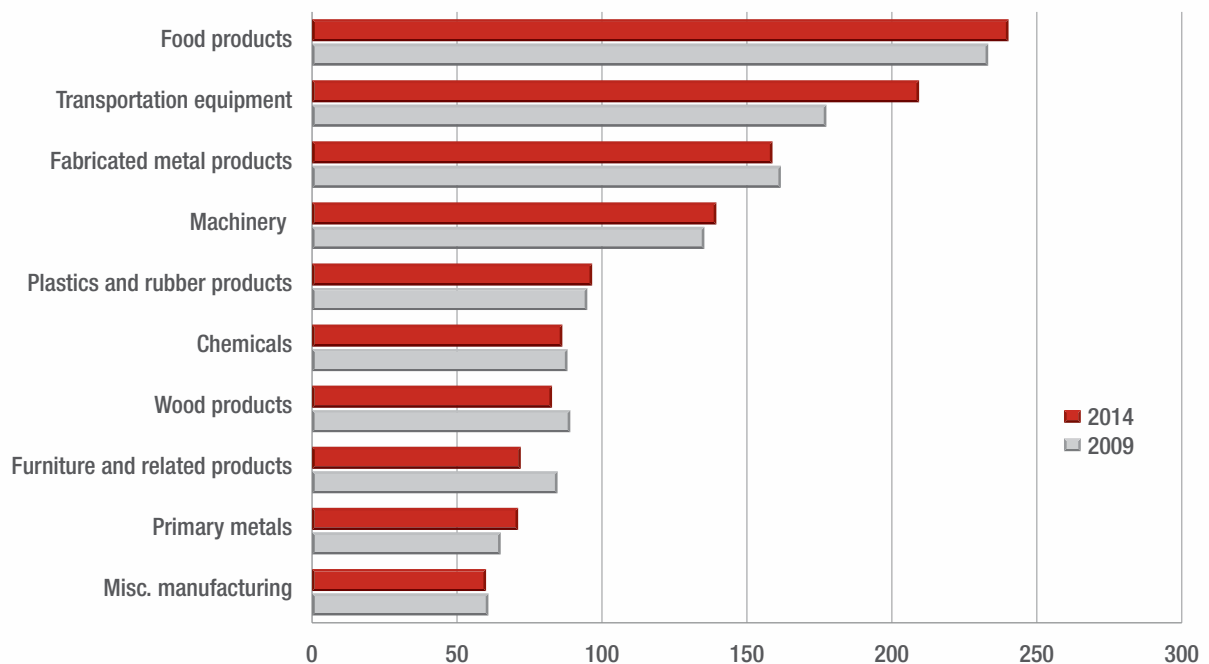
Job Quality

Not only are most manufacturing jobs relatively high-paying, they tend to be more stable and secure as well. Last year, nearly 96 per cent of all manufacturing jobs were full-time positions, compared to the all-industry average of 81 per cent. Moreover, 93 per cent of manufacturing jobs are permanent positions compared to 87 per cent for the economy as a whole.

Manufacturing Supports High-Quality Jobs		
	Manufacturing	All industries
Average compensation (\$)	72,444	57,924
% of full-time positions	95.8	81.1
% of jobs that are permanent	93	86.6
Average job tenure (months)	121.3	103.6

Manufacturing employment by industry

(000s of jobs)





Business Investment and Innovation

Manufacturing businesses invested \$22.4 billion in new capital in 2014 and account for 42 per cent of all research and development that takes place across the country. However, these numbers have been falling over time, raising concerns about lost capacity long-term economic competitiveness.

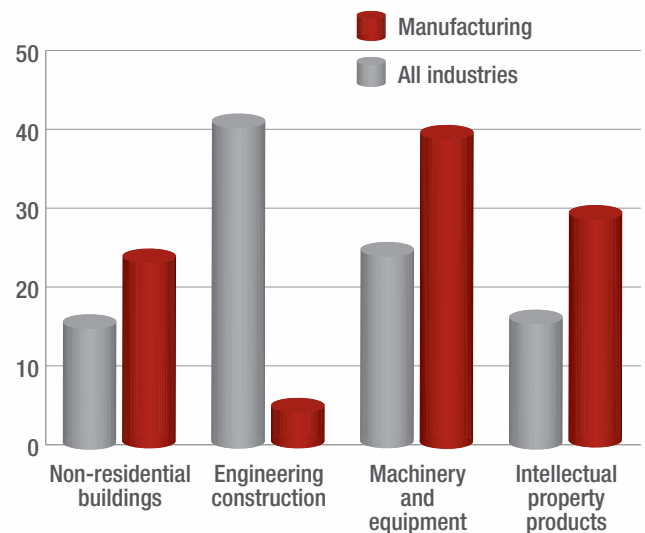
Capital Expenditures

Capital spending in manufacturing rose by 2.7 per cent in 2014 to reach \$22.4 billion. Although still significant, investment in the sector has been stagnant reflecting a combination of lost capacity and sub-optimal investment levels. Investment levels in nominal-dollar terms are about the same as they were a decade ago and are well below the \$26.0 billion total in 2000. As a result, manufacturing's share of total capital spending has been falling. In 2000, manufacturers accounted for 15.4 per cent of all capital spending in Canada. By 2014, that share had fallen to 6.7 per cent.

It is worth noting that the nature of capital spending in manufacturing differs from other industries. Compared to other sectors, manufacturers tend to invest more heavily in machinery and equipment, as well as intellectual property products. They invest significantly less in engineering construction.

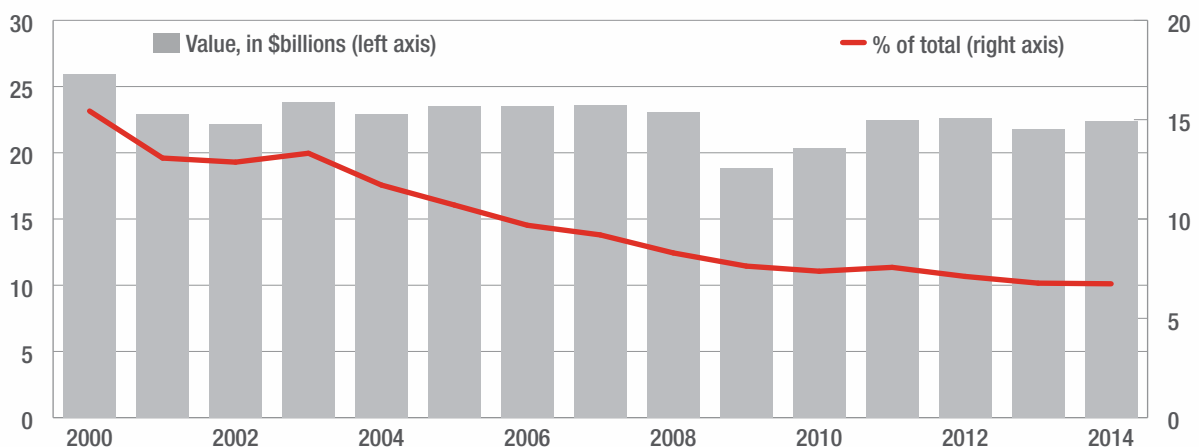
Capital expenditures by type — 2014

(% of total capital spending)



However, manufacturers are falling behind other sectors in all these categories. In 2000, manufacturing accounted for 21 per cent of all M&E expenditures, but by 2014, that share had fallen to 11 per cent. Similarly, IP expenditures were 18 per cent the national total in 2000, but only 12 per cent in 2014.

Capital spending in manufacturing — 2000–2014





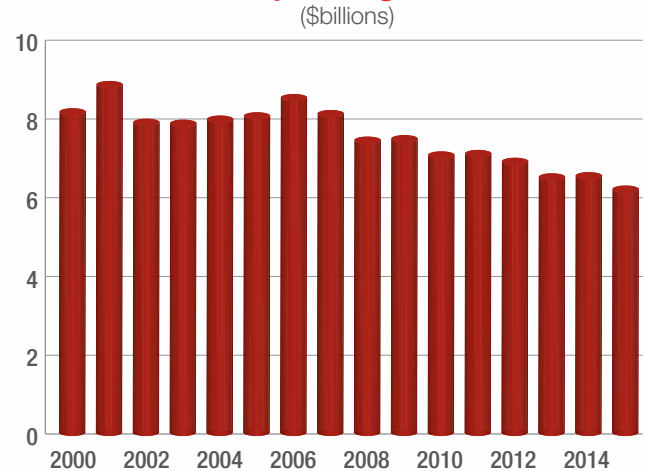
Research and Development

The trends for spending on research and development are even more concerning. In 2000, manufacturers spent \$8.5 billion on R&D activities in Canada, accounting for more than two thirds of the national total. R&D spending has been in steady decline since that time and by 2015 had fallen by nearly 25 per cent to \$6.4 billion. Manufacturing now accounts for 42 per cent of total R&D spending in Canada.

It is not clear whether this decline represents a legitimate decrease in R&D spending or if it is simply a measurement error. Data on R&D (and other variables) are assigned based on the principal activity of the business in Canada rather than its basic function. So as companies outsource their physical assembly operations around the world, R&D ends up being assigned to industries like wholesale trade because only functions like marketing and design actually take place in Canada.

In addition, Canada has historically used claims under its Scientific Research and Experimental Development (SR&ED) tax credit program as a proxy for business R&D spending. However, the scope of eligible spending under SR&ED has tightened over the years, meaning that not only is less R&D spending counted today than in years past, but also that many companies simply do not use the tax credit program any more.

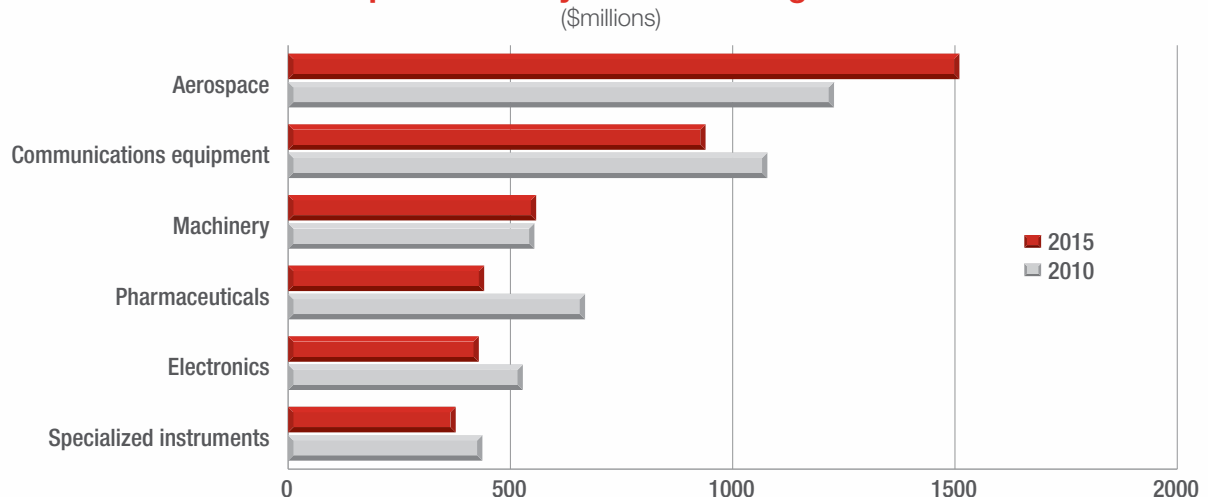
Business R&D spending in manufacturing



On top of all that, eligible SR&ED expenditures are much more narrowly defined than R&D spending in other countries.

The aerospace sector is by far Canada's largest investor in research and development activities. At \$1.5 billion last year, it accounted for over 23 per cent of all manufacturing R&D expenditures. Moreover, aerospace is the only major industry where R&D spending is on the rise. Since 2010, aerospace R&D expenditures have risen by nearly 23 per cent.

R&D expenditures by manufacturing industries



The Need for a Canadian Manufacturing Strategy

Evolving Global and Domestic Trends

The world of manufacturing has evolved significantly in the 12 years since CME's *Manufacturing 20/20* initiative and that trend is only expected to continue. Over the next fifteen years, Canada's manufacturers and exporters will face many changes in economic and market conditions, technologies, political circumstances, and government policy priorities that will affect their operating environment, give rise to new risks and opportunities for their business, and very likely reshape the nature of manufacturing and exporting in Canada and around the world.

Key Global Trends:

- Continued volatility in financial, currency and commodity markets
- Slower growth in major international markets (including China)
- Overcapacity in world industrial markets, especially in key sectors such as steel
- Increasing trade liberalization and the development/expansion of global supply chains
- More demanding customers
- Ageing population
- Penetration of technology in manufacturing processes and products
- Increasing global emphasis on climate change and environmental sustainability

Key Domestic Trends:

- Impact of low energy prices on capital investment and economic growth in Canada

- Overheated housing market and high levels of household debt
- Interest rates — and therefore borrowing costs — will remain low
- New federal infrastructure investment plans
- Rising tax burden through higher corporate rates in some provinces, as well as expected increases in other taxes and mandatory contributions (Canada Pension Plan, Ontario Retirement Pension Plan, carbon pricing initiatives, etc.)

There are also a series of impacts associated with the lower Canadian dollar. A low exchange rate makes it easier to sell into foreign markets but also raises the cost of imports, affecting not only input costs, but also the cost of importing new machinery and equipment. A lower dollar also makes Canada a more attractive destination for foreign investors, while also making Canadian companies relatively inexpensive targets for foreign acquisition.

Some of these changes are positive while others are negative. In most cases, however, what matters most is how manufacturers adapt and adjust. A crisis for one business can be an opportunity for another.

Further complicating matters is the pace of technological change. The world of manufacturing has transformed over the past 20–30 years, growing ever more complex, automated, sophisticated and technology-dependent. In fact, many believe the world to be on the cusp of a new industrial order that will dramatically alter what it means to manufacture goods. This Fourth Industrial Revolution has the potential to fundamentally change how we think about production, design, operations, customers, specialization and commercialization.

It is this combination of factors — evolving international and domestic conditions, along with the technological transformation of the Fourth Industrial Revolution — that makes the need for a national manufacturing strategy in Canada so timely and urgent.



The Fourth Industrial Revolution

The world has seen three industrial revolutions. Each has dramatically altered the economic, social and physical environments in which we live. After a sometimes painful adjustment, each has also ushered in a new era of wealth and prosperity.

Today, we stand on the cusp of a fourth revolution — one that promises to once again fundamentally transform how we live and work. This technological revolution — the interconnection and fusion of the physical and digital worlds — has the potential to eclipse the impact of all the others, not just in terms of scale, scope and complexity, but also opportunity.

At its core, the Fourth Industrial Revolution is about harnessing knowledge and digital information to spark a dramatic leap forward in terms of innovation, product development and process efficiency.

The beginnings of this revolution are all around us. As computer processing power, storage space and access to knowledge expand at an exponential rate, they open up new possibilities that never before existed outside the realm of science fiction. Personal mobile devices, drones and instant translation are just a few examples of the changes we already see in our daily lives.

For manufacturers, the possibilities are endless. Manufacturers have been using robots for decades to speed production and increase output. However, today a new generation of robots are being deployed that work side-by-side with skilled workers, learning from them and assisting them in complex tasks.

3-D printers are allowing businesses to make three dimensional solid objects from a digital model. The applications for this technology range from transforming how companies develop, design and test new products, all the way to how final goods are physically manufactured. As costs decline and the technology improves, accessibility and opportunity only increase.

The Internet of Things is another example of a technological advance that will revolutionize production efficiency.

Four Industrial Revolutions

- **First Industrial Revolution (1780s):**
Mechanized production by harnessing water and steam power.
- **Second Industrial Revolution (1870s):**
Mass production through the use of electric power and division of labour.
- **Third Industrial Revolution (1960s):**
Automated production through the use of electronics and information technology systems.
- **Fourth Industrial Revolution (present):**
Cyber-physical production through the fusion of physical and digital operations.

The Internet of Things refers to a developing network of physical objects or machines with imbedded sensors and other technology that allows them to communicate with one another. Machine-to-machine communication decentralizes control of production, allowing control from a smart phone or computer from anywhere in the world. There is untold potential to optimize production and eliminate waste through the gathering and analysis of real-time data.

Driven by increasingly demanding customers, these technologies are transforming manufacturing around the world. In order to thrive today, manufacturers must be globally-integrated, innovative, service-oriented, and efficiently employing the right people and technologies to allow for competitive production. At the same time, manufacturing is becoming increasingly globalized — from customer and supplier bases to capital investments, manufacturing can take place anywhere in the world and service customers in any market — which is providing massive new opportunities and challenges at home.



Advanced Manufacturing Strategies in other Countries

Recognizing the transformative potential of the Fourth Industrial Revolution for businesses and society at large, many countries have begun implementing national strategies to harness and leverage the opportunities for positive change. The United States, Germany, China and others have all developed national strategies that aim to accomplish two simultaneous tasks: develop transformational technologies; and leverage those technologies to the broadest section of business as possible. In large part, their national strategies are aimed at maximizing the potential of advanced technologies to drive long term economic benefits for their countries through a manufacturing renaissance — nurturing business innovation and accelerating the development, commercialization and adoption of advanced manufacturing methods.

United States: National Network for Manufacturing Innovation (NNMI)

Formalized in December 2014, the National Network for Manufacturing Innovation (NNMI) program is a federal government initiative created to improve manufacturing competitiveness and productivity in the US by accelerating innovation and implementation of advanced manufacturing capabilities. It does so by coordinating public and private investments in a network of manufacturing innovation institutes across the country — each focused on a specific technical or workforce challenge. The NNMI advances manufacturing innovation by developing industrial and academic infrastructure in research and development, technology transition, and workforce training and education in order to solve industry-

relevant manufacturing problems. In essence, it works to bridge the gap between basic research and production.²

The NNMI has four major goals:

1. To increase the competitiveness of US manufacturing.
2. To facilitate the transition of innovative technologies into scalable, cost-effective, and high-performing domestic manufacturing capabilities.
3. To accelerate the development of an advanced manufacturing workforce.
4. To support business models that help institutes to become stable and sustainable.

Germany: Industrie 4.0

Industrie 4.0 is the German strategic plan to strengthen the competitiveness of the country's manufacturing sector by becoming a global leader in innovative, internet-based production technology and service provision. First introduced in 2011 then adopted in 2013, Industrie 4.0 is Germany's approach to capitalizing on the opportunities created by the Fourth Industrial Revolution. By digitizing processes, Germany expects to see huge benefits in the form of improved quality, lower costs and increased efficiency.

The German government is working closely with the academic and business communities to spur Industrie 4.0 research. Many major German companies are at the forefront of these efforts, including Deutsche Telekom, SAP and Siemens.³

² More information on the NNMI Program is available at <https://www.manufacturing.gov/files/2016/02/2015-NNMI-Strategic-Plan.pdf>

³ Details on Industrie 4.0 are available at http://www.gtai.de/GTAI/Content/EN/Invest/_SharedDocs/Downloads/GTAI/Brochures/Industries/industrie4.0-smart-manufacturing-for-the-future-en.pdf



China: Made in China 2025

It is not only advanced economies that are developing strategies to bring manufacturing into the digital world. China — once the epicenter of labour-intensive, low-cost manufacturing — is also charting a way forward through its “Made in China 2025” initiative introduced last year.

Although modeled after Industrie 4.0, China’s strategy is far broader as it attempts to address a wider range of challenges, including the fact that production quality and efficiency can vary significantly from one operation to the next. Moreover, China is caught in the middle of new, emerging low-cost producers

and more advanced economies using digital technologies to improve their own manufacturing competitiveness.

According to the Chinese government, the guiding principles of Made in China 2025 are: to move towards innovation-driven manufacturing; to emphasize quality over quantity; to achieve green development; to optimize the structure of the Chinese economy; and to nurture human talent. The ultimate goal is a comprehensive upgrade of Chinese industry and to move up global production chains. China has set a target of raising domestic content of core components and materials to 40 per cent by 2020 and 70 per cent by 2025.⁴

⁴ More information on Made in China 2025 can be found at <http://esis.org/publication/made-china-2025>

Industrie 2030: Manufacturing a New Future for Canadian Industry

A Canadian Manufacturing Strategy for the Fourth Industrial Revolution

Canadians are far from the hewers of wood and drawers they sometimes fear themselves to be. This uncharitable characterization not only misrepresents the highly technical nature of resource extraction, it is simply not borne out by the facts.

In reality, Canada is a country of innovators. We have historically leveraged the strengths of our natural resources to create and sell products that the world needs. For evidence of this, we need look no farther than our trade relationship with the world. Our exports are dominated by innovative, high-tech manufactured goods — cars, planes, machinery and equipment, structural steel, chemicals, computer equipment and technology, and food products to name just a few.

However, over the past several decades, the strength and importance of Canada's manufacturing base has been slipping. While still the largest economic sector in Canada, manufacturing today directly accounts for less than 11 per cent of total GDP — a drop from nearly 16 per cent a decade ago and 20 per cent in 2000. By comparison, Germany's manufacturing sector has held strong, accounting for over 22 per cent of GDP — effectively unchanged over the past ten years.

The Fourth Industrial Revolution is the opportunity to reverse these long-term trends and re-establish Canada and Canadian

manufacturing in a new global context. The creation and deployment of new advanced technologies — such as 3-D printers, advanced robotics and connected computers — are centred on adding more value and increasing efficiency to manufacturing processes. They are also allowing companies to create new products and services to meet the needs of an increasingly demanding customer base.

At present, Canada is a follower of global trends in these areas. In order to achieve our goal of doubling manufacturing output and exports by 2030, this must change. Canada needs to become a world leader when it comes to the development, adoption and commercialization of these advanced manufacturing technologies.

Canadian manufacturers already have many of the tools and assets they need: access to resources; an educated workforce with a strong technology focus; strong, stable institutions; and high quality physical and technological infrastructure. The challenge is to leverage these assets to take advantage of the opportunities of the Fourth Industrial Revolution and, by so doing, to drive manufacturing-led innovation and economic growth.

Unlike Germany, China, the US and many other nations, Canada has no national strategy to guide that process forward. *Industrie 2030* is the vehicle through which that will happen. Through our research and consultation process, we will develop and work to implement a strategy to strengthen Canada's manufacturing sector and achieve the goal of doubling manufacturing output and exports by 2030.



Industry Consultations and Strategic Outcomes

The ultimate goal of *Industrie 2030* is to create the roadmap to success that will see Canada double value-added manufacturing output and exports by 2030. While governments are instrumental in creating and supporting national strategies, we believe this strategy must be created and driven by Canadian manufacturers and exporters themselves. The reason is simple: governments help create the conditions in which business operate, but businesses are responsible for developing the strategies that create the products, service the customers and grow their operations.

In order to achieve our strategic objective to double value-added manufacturing and exporting activities, we must first identify the business outcomes needed to reach those targets. Manufacturers cannot simply just double production. Rather, they must invest in their facilities, processes and products and they must find new customers in Canada and around the world. These are necessary conditions for *Industrie 2030*'s growth targets to be met.

The required business outcomes for Canadian manufacturers include:

- **Retaining and attracting investment to expand manufacturing capacity.**

Expanding manufacturing capacity in Canada is critical. Over the past decade, manufacturing capacity has decreased significantly and existing facilities are running at or near

peak capacity. Canada needs new capital investment from domestic and foreign sources that both increases the capacity of existing facilities and adds new capacity as well.

- **Manufacturing more products and technologies in Canada.**

Developing, commercializing and manufacturing new products in Canada leads to new investment and new opportunities to service customers around the world. Canada has a strong history of developing and commercializing new innovative products, but we must accelerate these processes to expand demand for Canadian made products.

- **Accelerating adoption of new technologies and processes.**

The adoption of new advanced manufacturing technologies can dramatically improve operational efficiency and flexibility while reducing production costs, and improving environmental performance. In this way, new technologies are critical to improving the competitiveness of Canadian manufacturing. They create new opportunities to manufacture more products in Canada and sell them to the world.

- **Selling more to customers in Canada and around the world.**

Canadian companies must expand their customer bases both in traditional markets and beyond. The development of innovative products will accelerate market demand, as will the opening of new markets around the world through free and fair trade liberalization agreements. In addition, Canada must be better at recognizing the value of goods “made in Canada” and promote and celebrate those products that are designed, engineered and manufactured right here.

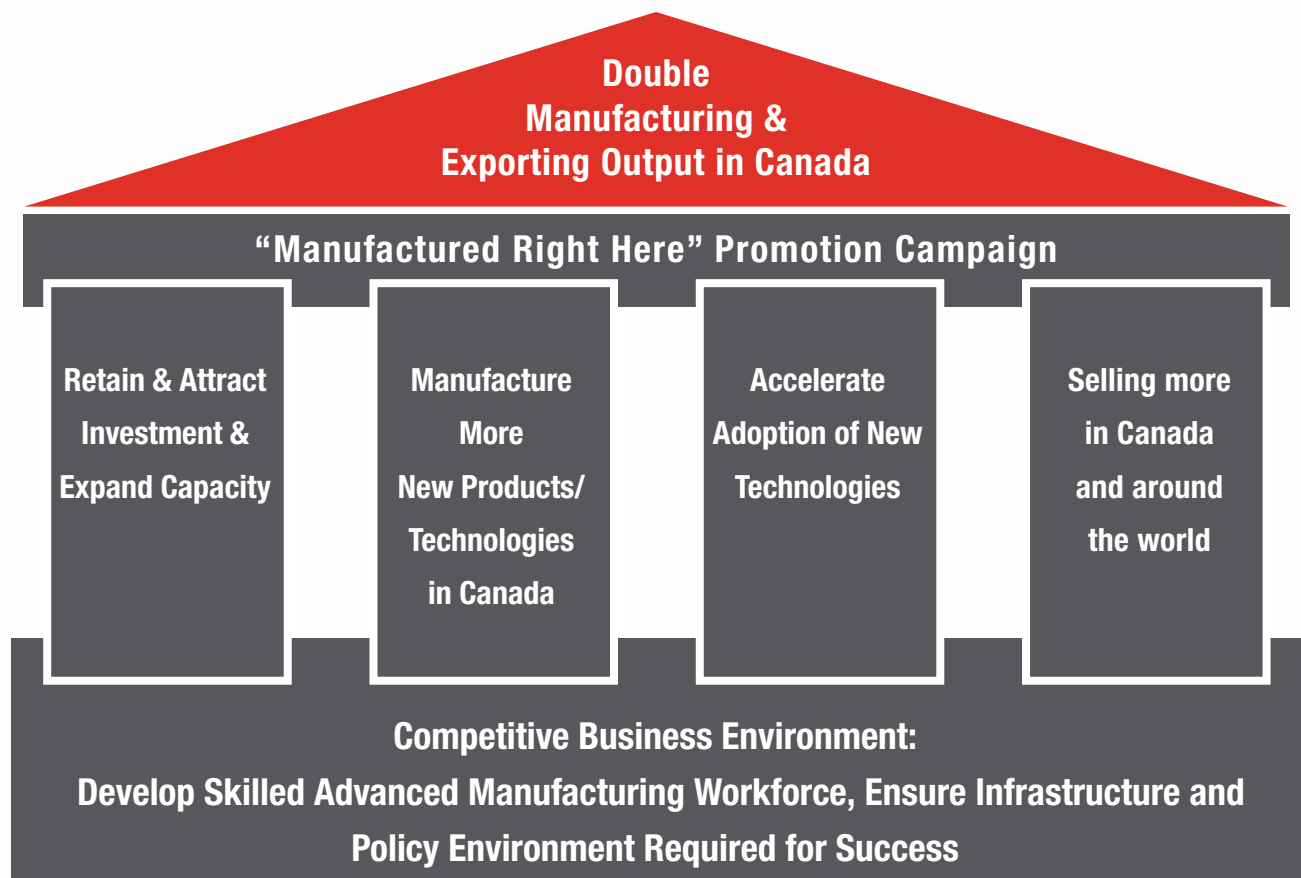


While identifying these strategic business outcomes is relatively straightforward, addressing the broad range of issues within each outcome is not. Each outcome depends on building a competitive foundation — the business environment and supporting policy and physical infrastructure that will enable success. This foundation includes: economic and market conditions; skills of employees; infrastructure; and government policies, regulations and supports. While global economic conditions are outside our control, most of the foundational business environment is within the scope of government, business and the many institutions that support manufacturing and exporting.

As such, in order to create the Roadmap to Success as part of *Industrie 2030*, consultations will focus on two specific questions for each of the identified business outcomes:

- What is standing in the way of achieving this result?
- What is required to accelerate growth and move forward?

The consultation exercise will allow businesses to identify the specific issues and obstacles that prevent them from achieving these business outcomes, as well as to propose solutions to those issues, where possible. This information will feed into CME's final report and strategic vision for a robust manufacturing future in Canada.



Next Steps

Industrie 2030 is a comprehensive, long-term process aimed at creating a brighter future for manufacturing in Canada. It began with a public launch in February 2016 during an annual Celebration of Manufacturing on Parliament Hill in Ottawa, attended by the Minister of Industry, Science and Economic Development.

This discussion document — *Roadmap to 2030* — was written to help establish a common starting point and set a framework for the national cross-country consultations that are the foundation of the *Industrie 2030* initiative. These consultations will identify the challenges and solutions that will inform our final report and recommendations as part of *Industrie 2030* and help establish a national strategy for manufacturing and the Fourth Industrial Revolution.

These consultations start now. We will be seeking input, direction and recommendations from Canada's manufacturing and exporting community, innovation leaders, and key support organizations that help foster the growth of Canada's economy. A series of cross-country discussions via direct community roundtables, issue-specific consultations on priority challenges, and online surveys will be conducted to seek this input. Specifically this will include:

- **Community Roundtables:** Roughly 60 moderated discussions with 15–20 senior executives focused on the primary opportunities: what are the obstacles to growth, and how can we accelerate growth? The feedback from these roundtables will be used to create the national (and, where possible, regional) *Industrie 2030* strategies and implementation roadmap that will lead to doubling manufacturing and exporting in Canada by 2030.
- **Focused Summits:** Roughly 10 moderated discussions based on the key priorities of innovation and investment, technology creation and adoption, trade and global supply chains, and skills and human capital development. These focused sessions will allow greater detail and attention

on how we must align the support network to enable growth of manufacturing and exporting. The input from these focused summits will feed directly into the national *Industrie 2030* strategy as well as into issue-strategies to address key challenges in manufacturing and exporting that will support the overall objectives.

- **Management Issues Survey:** CME's bi-annual survey of manufacturers and exporters will allow industry leaders to make their voice heard on exporting and manufacturing issues impacting their businesses. The themes of the survey questions will be aligned with the in-person consultation to add quantitative details to the qualitative feedback that is received. The responses from the Management Issues Survey are confidential and will be compiled and published during the Manufacturing Summit.

We will conclude the first phase of *Industrie 2030* with a National Manufacturing Summit in Ottawa in October during Manufacturing Month. The Summit will bring together business and political leaders with key decision makers and thought leaders to deliver and discuss the results from the consultations and prioritize an implementation plan. However, most critically, we will seek input and support for the creation of an action plan to implement the recommendations that will come out of the *Industrie 2030* report in October. We will also work with our partners to create yardsticks against which to measure and monitor our progress towards the goal of doubling value-added manufacturing and exporting in Canada.

Ensuring success in the process towards our ultimate objectives will be based on the direct input and support of Canadian industry and the large support network that helps sustain and grow this most important business sector. CME and our partner organizations look forward to working throughout this process and beyond with Canadian manufacturers and exporters to establish a clear vision and concrete roadmap for success.

Together, we can manufacture change.

About Canadian Manufacturers & Exporters www.cme-mec.ca

Since 1871, we have made a difference for Canada's manufacturing and exporting communities. Fighting for their future. Saving them money. Helping them grow.

The association directly represents more than 2,500 leading companies nationwide. More than 85 per cent of CME's members are small and medium-sized enterprises. As Canada's leading business network, CME, through various initiatives including the establishment of the Canadian Manufacturing Coalition, touches more than 100,000 companies from coast to coast, engaged in manufacturing, global business and service-related industries.

CME's membership network accounts for an estimated 82 per cent of total manufacturing production and 90 per cent of Canada's exports.

About Canadian Manufacturing Coalition www.manufacturingourfuture.ca

The Canadian Manufacturing Coalition is comprised of more than 50 major industry groups, united by a common vision for a world-class manufacturing sector in Canada.

The Coalition speaks with one voice on priority issues affecting manufacturers, and what must be done to ensure all Canadians continue to enjoy economic growth, high-value outputs and high-paying jobs. The Canadian Manufacturing Coalition's member organizations represent roughly 100,000 companies through their collective networks.



To get involved in Industry 2030, visit the website or contact:

Mathew Wilson
Senior Vice President
mathew.wilson@cme-mec.ca

Mike Holden
Director of Policy and Economics
mike.holden@cme-mec.ca

Marie Morden
Manager, Stakeholder Relations
marie.morden@cme-mec.ca



Industrie 2030



**Canadian
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