



Hamilton

# INFORMATION REPORT

<b>TO:</b> Mayor and Members General Issues Committee	<b>WARD(S) AFFECTED:</b> CITY WIDE
<b>COMMITTEE DATE:</b> January 15, 2014	
<b>SUBJECT/REPORT NO:</b> The Current and Future State of Hamilton's Advanced Manufacturing Sector (PED14006) (City Wide)	
<b>SUBMITTED BY:</b> Joe-Anne Priel Acting General Manager Planning and Economic Development Department	<b>PREPARED BY:</b> Alfonso Principato (905) 546-2424 Ext. 5363
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Advanced manufacturing is best viewed as a cluster of economic activities encompassing much more than a manufacturing focused enterprise alone. Advanced manufacturing includes all facets of research, development, production, sales, distribution, logistics, customer service, marketing, and support, extending from the development of physical products to the delivery of services.

## Introduction

Due to the changing economic climate facing manufacturing companies around the globe, it is important to understand the current state of Hamilton's advanced manufacturing sector to determine key strategic objectives and initiatives that will assist the City of Hamilton and its partners in economic development to establish the City of Hamilton as a destination for investment and provide a supportive environment for industrial growth.

To gain expert advice, global insight and strategic direction, the City of Hamilton requested proposals from industry consultants to study the local manufacturing sector and provide specific recommendations to guide Hamilton's industrial sector along the path to continued success.

Several high quality proposals were submitted and evaluated. Deloitte was chosen to conduct this study based on their demonstrated experience and ability to produce high quality, sector profile reports for public sector clients that focused on provincial and

global manufacturing trends. Deloitte also demonstrated a clear advantage in their knowledge and experience of industrial real estate, specifically regarding heavy industrial zones, industrial parks and port lands.

### **Scope of Work**

Deloitte worked closely with members of the City of Hamilton's Economic Development Division, key community stakeholders and representatives of the City of Hamilton's advanced manufacturing business community. Through their consultations, market research and stakeholder engagement, Deloitte reported on the current state of the City of Hamilton's manufacturing sector and other key deliverables including:

- North American advanced manufacturing outlook and trends
- An evaluation of the City of Hamilton manufacturing sector's strengths, weaknesses, opportunities and threats (SWOT analysis)
- Strategic directions
- Action Plan

### **Key Findings**

#### **Hamilton's Manufacturing Advantages**

Within an advanced manufacturing context, the City of Hamilton possesses a number of market strengths, assets and capabilities. Amongst the City's major strengths are its location within a rapidly growing and competitive region, access to an expansive market and major trade corridors, an accelerating industrial market, and a positive manufacturing outlook. Key assets include a significant established manufacturing base, strong infrastructure assets, access to talent and strong education institutions, critical innovation networks, and the ability to leverage its position within a super-regional advanced manufacturing cluster.

Hamilton is well positioned to leverage its strengths in the areas of materials / steel, food and beverage, machinery, automotive equipment, clean technology and life sciences based manufacturing. Foreign direct investment and export expansion also represent significant opportunities, given the role that advanced manufacturing plays in Ontario's international trade activity.

#### **Challenges and Vulnerabilities in Hamilton's Manufacturing Sector**

Although the City is well-positioned within the marketplace, this is not to suggest that the advanced manufacturing sector does not face obstacles to future growth. Major challenges include global, low cost competition, relatively high municipal industrial property taxes and a tightening industrial space and land market. Market vulnerabilities include growing competition for Foreign Direct Investment (FDI), demographic challenges, future skill shortages, and a challenging regulatory and union environment.

The perception of the City as a traditional steel producing town is also a potential barrier to new investment.

## **Recommendations**

A summary of the strategic directions as recommend by Deloitte's are as follows:

- Continue to make advanced manufacturing a high economic development priority
- Ensure existing firms remain competitive
- Continue to expand innovation infrastructure and other enabling factors
- Aggressively pursue high-profile advanced manufacturing investments
- Monitor and report on the state of the industry

In order to implement this strategy, it is recommended that specific actions be taken within the five categories, which are identified below.

### **1. Marketing and Branding**

- Showcase the City of Hamilton's advanced manufacturing sector;
- Update City's advanced manufacturing sector's marketing material / industry profiles ;
- Continue to position Hamilton as part of Ontario and the broader GTA and beyond;
- Market Hamilton as a top location to work, live and play;
- Leverage trade show opportunities.

### **2. Business Retention**

- Understand the needs of large and strategic advanced manufacturing firms;
- Identify key service providers and supply chain linkages;
- Identify opportunities to assist existing businesses;
- Maintain regular contact with key industry leaders and foster community collaboration.

### **3. Investment Attraction**

- Assess the opportunity for targeted financial incentives;
- Continue to lead tours of the City's advanced manufacturing facilities;
- Regularly monitor foreign direct investment (FDI) opportunities;
- Aggressively pursue high profile investments with the appropriate tools.

### **4. Talent and Skills Development**

- Identify gaps in the local demand and supply of advanced manufacturing talent;

- Support and expand education and technical training programs;
- Encourage local entrepreneurship.

**5. Local Industry Engagement**

- Identify an advanced manufacturing champion for the City;
- Leverage regional expertise;
- Improve local sector collaboration to drive partnership, innovation and productivity.

**Financial Impact**

Based on the strategic directions and action plan recommended by Deloitte in the study of Hamilton’s manufacturing sector, there will not be any additional financial implications to the City of Hamilton. Implementation of the recommendations is achievable through the Economic Development Division’s normal operating budget, and therefore, will not have any additional impact to the City of Hamilton’s budget.

**Conclusion**

The global manufacturing industry continues to advance and evolve. Based on recent trends, it is anticipated that advanced manufacturing will continue to become increasingly automated and technologically intensive. Advances in materials and systems designs are likely to lead to entirely new products and processes, with a growing focus on flexibility and sustainability in the production process. Talent driven innovation will continue to be the top driver of global manufacturing competitiveness, which bodes well for Canada and the United States.

In the short term, Canada’s global manufacturing competitiveness is expected to be potentially challenged and the national manufacturing economy faces a cautious outlook. However, given a number of global shifts in advanced manufacturing, Canada is in the position to potentially leverage such shifts to its advantage. In particular, rising costs in developing economies such as China is anticipated to result in a re-shoring of industrial / manufacturing investment back to North America. While Canada is currently experiencing rising labour costs and there is an increasing presence of other low cost competitors, Canada may be well positioned to move its advanced manufacturing sector forward, given appropriate strategy and investment in technology, talent, and innovation.

**APPENDICES / SCHEDULES**

Appendix “A” to Report PED14006 – City of Hamilton: The Current and Future State of Hamilton’s Advanced Manufacturing Sector

AP/dkm



# City of Hamilton

## The Current and Future State of Hamilton's Advanced Manufacturing Sector



October 2013

# Table of Contents

Table of Contents .....	ii
Executive Summary .....	1
Introduction .....	9
The Shifting Global Manufacturing Landscape .....	11
North American Advanced Manufacturing Outlook and Trends .....	27
City of Hamilton Market Strengths, Assets and Capabilities.....	41
City of Hamilton Market Challenges and Vulnerabilities .....	80
Strategic Directions and Action Plan.....	87
Appendix A – Stakeholder Interviews .....	93
Appendix B - Industry 1: Steel / Metal Manufacturing Trends .....	96
Appendix C - Industry 2: Food and Beverage Manufacturing Trends .....	102
Appendix D - Industry 4: Machinery Manufacturing Trends.....	107
Appendix E - Industry 3: Automotive Equipment Manufacturing Trends .....	111
Appendix F – Potential Trade Show Considerations .....	117
Appendix G - Endnotes .....	118

# Executive Summary

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Advanced manufacturing is best viewed as a cluster of economic activities encompassing much more than a manufacturing focused enterprise alone. Advanced manufacturing includes all facets of research, development, production, sales, distribution, logistics, customer service, marketing, and support, extending from the development of physical products to the delivery of services. This sector is a critical contributor to the Canadian economy, with significant impact, and ability to advance innovation, competitiveness and prosperity across the nation, regions and municipalities.

Situated at the western end of Ontario's Golden Horseshoe region, the City of Hamilton is centrally located in Canada and Ontario's manufacturing heartland. Historically, industrial manufacturing has represented the driving force of the City of Hamilton's local economy. In more recent periods, the City of Hamilton's manufacturing sector faced a number of challenges, such as significant global economic turbulence, and fluctuating costs of doing business. These challenges have tested the City's manufacturing sector, to respond, diversify and capitalize on new opportunities, resulting in some recent expansion in the auto and steel service sectors, indicating a positive shift in the sector. Increasing global competition, attracting, retaining and advancing talent, improving productivity and leading collaboration and innovation in order to remain competitive in a shifting global environment, are among numerous drivers of future opportunities and the need for adaption and adjustment for Hamilton's advanced manufacturing sector.

## The shifting global manufacturing landscape

The global manufacturing landscape will continue to impact the City of Hamilton's advanced manufacturing sector. Over the last two decades, manufacturing has become steadily less reliant on labour and more technologically intensive, a trend which is anticipated to accelerate in the future. Advances in materials and systems designs will lead to entirely new products and processes, with a growing focus on flexibility and sustainability in the production process. Talent driven innovation will continue to be the top driver of global manufacturing competitiveness, which bodes well for the US, Canada and the City of Hamilton.



Canada is well positioned to leverage several recent shifts in the competitive environment, in particular rising labour costs in developing economies and rising supply chain costs and risks, which are anticipated to result in some "re-shoring" of manufacturing employment and investment back to North America.

Although the manufacturing sector faces a number of challenges, Canada is anticipated to remain one of the top manufacturing competitors in the world. Looking to the future, it is clear that Canadian manufacturers will need to adapt to a shifting global environment in order to remain competitive.

2010, 2013 and 2018 country manufacturing competitiveness index rankings

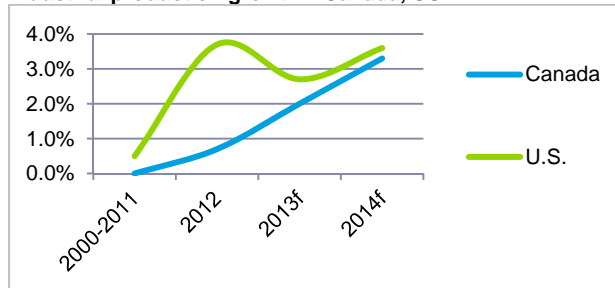
2010 Competitiveness		2013 Competitiveness		2018 Competitiveness (forecast)	
Rank	Country	Rank	Country	Rank	Country
1	China	1	China	1	China
2	India	2	Germany	2	India
3	South Korea	3	US	3	Brazil
4	US	4	India	4	Germany
5	Brazil	5	South Korea	5	US
6	Japan	6	Taiwan	6	South Korea
7	Mexico	7	Canada	7	Taiwan
8	Germany	8	Brazil	8	Canada
9	Singapore	9	Singapore	9	Singapore
10	Poland	10	Japan	10	Vietnam

Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council, Global Manufacturing Competitiveness Index  
Note: In the 2010 Global Manufacturing Competitiveness Index Canada ranked 13<sup>th</sup>

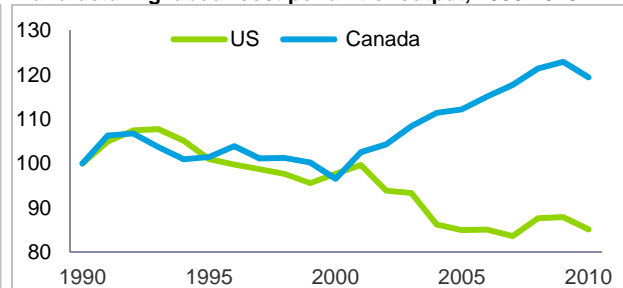
The productivity imperative

While industrial production growth between Canada and the US is anticipated to align, there is a substantial gap in manufacturing productivity between the two nations, which also presents a significant challenge for the City's advanced manufacturing sector. As shown in the chart below, Canada's gap in manufacturing productivity growth is more than 3.5 times the size of the productivity growth gap across the entire economy. This poses a concern as productivity relates to the average value produced per hour worked, and a growing gap is a threat to Canada's future standard of living.

Industrial production growth – Canada, US



Manufacturing labour cost per unit of output, 1990-2010



Source: Scotiabank, Global Economic Research, 2013, Deloitte, The future of productivity - Clear choices for a competitive Canada

Hamilton's strategic position

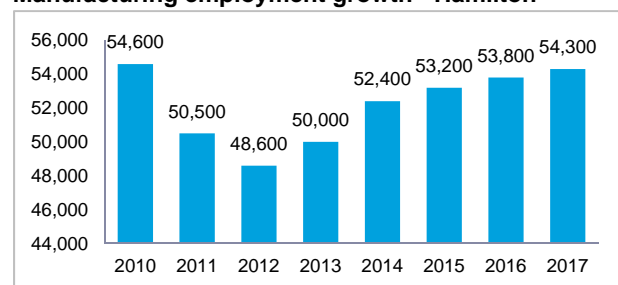
Within an advanced manufacturing context, the City of Hamilton possesses a number of market strengths, assets and capabilities. As shown in the chart below, amongst the City's major strengths are its location within a rapidly growing and competitive region, access to an expansive market and major trade corridors, an accelerating industrial market, and a positive manufacturing outlook. Key assets include a significant established manufacturing base, strong infrastructure assets, access to talent and strong education institutions, critical innovation networks, and the ability to leverage its position within a super-regional advanced manufacturing cluster.

Market access / trade corridors



Source: Conference Board of Canada, 2012

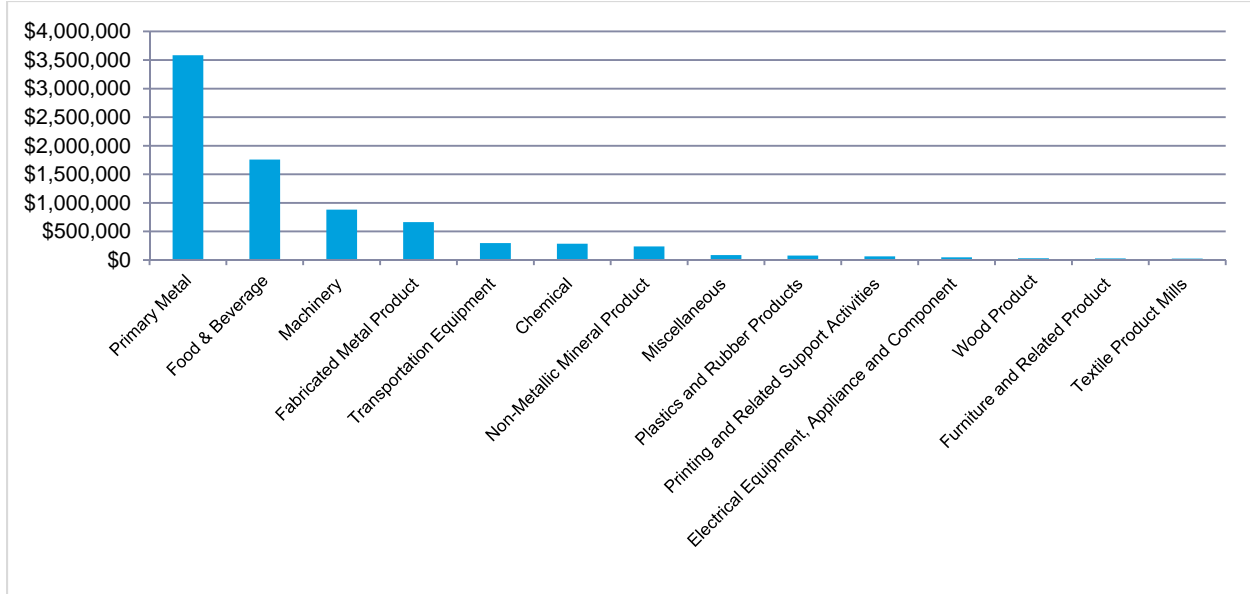
Manufacturing employment growth - Hamilton





Hamilton is well positioned to leverage its strengths in the areas of materials / steel, food and beverage, machinery, automotive equipment, clean technology and life sciences based manufacturing. Foreign direct investment and export expansion also represent significant opportunities, given the role that advanced manufacturing plays in Ontario's international trade activity.

**Top Hamilton manufacturing industries by revenue (thousands)**



Source: Statistics Canada, All Manufacturing Industries

**Summary of City of Hamilton advanced manufacturing strengths, assets and capabilities**

Strengths	Assets	Capabilities
<ul style="list-style-type: none"> <li>Located within a competitive economic region</li> </ul>	<ul style="list-style-type: none"> <li>Diverse economy, sectors and major employers</li> </ul>	<ul style="list-style-type: none"> <li>Materials / metal / steel manufacturing</li> </ul>
<ul style="list-style-type: none"> <li>Expansive market access</li> </ul>	<ul style="list-style-type: none"> <li>Established manufacturing base</li> </ul>	<ul style="list-style-type: none"> <li>Food and beverage manufacturing</li> </ul>
<ul style="list-style-type: none"> <li>Industrial market accelerating</li> </ul>	<ul style="list-style-type: none"> <li>Strong, diverse infrastructure and transportation assets</li> </ul>	<ul style="list-style-type: none"> <li>Machinery manufacturing</li> </ul>
<ul style="list-style-type: none"> <li>Manufacturing forecast to rebound</li> </ul>	<ul style="list-style-type: none"> <li>Potential to provide large parcels of development land</li> </ul>	<ul style="list-style-type: none"> <li>Automotive equipment manufacturing</li> </ul>
<ul style="list-style-type: none"> <li>Positive GDP growth projected across all sectors</li> </ul>	<ul style="list-style-type: none"> <li>Access to talent / Strong education and research institutions</li> </ul>	<ul style="list-style-type: none"> <li>Clean technology</li> </ul>
<ul style="list-style-type: none"> <li>Longer term population and employment forecast to grow rapidly</li> </ul>	<ul style="list-style-type: none"> <li>Available networks and innovation infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Life sciences / healthcare</li> </ul>
<ul style="list-style-type: none"> <li>Relatively low competitive development costs</li> </ul>	<ul style="list-style-type: none"> <li>Quality of life factors and relatively inexpensive housing</li> <li>Established position within regional advanced manufacturing cluster</li> </ul>	<ul style="list-style-type: none"> <li>Advanced manufacturing FDI and export opportunities</li> </ul>

**Market challenges and vulnerabilities**

Although the City is well-positioned within the global advanced manufacturing marketplace, this is not to suggest that the advanced manufacturing sector does not face obstacles to future growth. Major challenges include global, low cost competition, relatively high municipal industrial property taxes and a tightening industrial space and land market. Market vulnerabilities include growing competition for Foreign Direct Investment (FDI), demographic challenges, future skill shortages, and a challenging regulatory and union environment. The perception of the City as a traditional steel producing town is also a potential barrier to new investment.

Some of these challenges cannot be directly addressed at the municipal level, for example global low cost competition or provincial or federal policy conditions. Other issues such as tax rates, the lack of land and space availability within the local real estate market, perception challenges, and the need to attract and retain innovative manufacturing talent can potentially be addressed by the City of Hamilton.

Within this context, the strategic directions below are recommended to ensure that the City of Hamilton is in the best possible position to meet the needs of the market and capitalize on future opportunities in this important sector. A subsequent section will identify specific corresponding recommendations and action items for these strategic directions.

## Strategic directions

The following section outlines general strategic directions identified for the City of Hamilton and its advanced manufacturing sector.

### Continue to Make Advanced Manufacturing a High Economic Development Priority

Raising the awareness of advanced manufacturing is important, as the sector plays a key role in wealth creation and has the ability to drive economic prosperity and productivity growth in the City, Provincial and National economy. A focus on the top sub-sectors and emerging sub-sectors identified in this study is recommended, including:

- Materials / metal / steel manufacturing;
- Food & beverage manufacturing;
- Machinery manufacturing;
- Transportation / automotive manufacturing;
- Life sciences / healthcare manufacturing;
- Clean technology manufacturing; and
- Emerging technologies such as additive manufacturing, nanotechnology and synthetic biology and genetic engineering.



The City has many competitive advantages that will allow it to capitalize on future opportunities, in particular the potential re-shoring of more specialized manufacturing to North America. Hamilton's strategic location, access to transportation infrastructure and land supply will be major advantages.

### Ensure Existing Firms Remain Competitive

It is critical to ensure that the existing base of firms in the City's advanced manufacturing sector remains as competitive as possible. It is clear that manufacturing firms in Canada and Ontario are under measurable cost pressures. The City should seek to ensure that existing firms are able to adapt to these pressures and remain competitive. Of particular importance will be small and medium size enterprises, whose continued growth will play a major role in closing the productivity gap between Canada and the US.

### Continue to Expand Innovation Infrastructure and Other Enabling Factors

The City should seek to create an environment in which a wide range of breakthrough advances can be made and commercialized in the form of new materials, products and manufacturing processes. To this end it is important to maintain and expand the infrastructure and other enabling factors that supports advanced manufacturing, including: higher education and training; innovation, research and development capabilities; information and communications systems; availability of skilled labour; access to capital and incentives; and a stable, competitive business cost environment.

### Aggressively Pursue High-Profile Advanced Manufacturing Investments

Although Hamilton will experience a certain amount of investment in the normal course of growth, this may not reflect the City's full economic potential. To fully capitalize on future opportunities, the City should aggressively pursue advanced manufacturing investments, in particular high profile users, to raise the profile of the sector and set the tone for the future. An aggressive approach is also necessary to keep pace with competing communities, for which advanced manufacturing is also a high priority and, in some cases, where direct incentives are being offered to attract investment.

## Monitor and Report on the State of the Industry

Fundamentally, the City's advanced manufacturing strategy must focus on putting in place the business conditions, infrastructure and other enabling factors that will make Hamilton an attractive location for new investment, combined with an active pursuit of high profile users. Since this strategy cannot be followed without relevant market intelligence, the final initiative is to regularly monitor and report on the state of the industry. The information and insights gathered will be required for several purposes, including the communication of success stories, identifying the requirements of existing and future advanced manufacturing firms and tracking trends and changes in the industry.

## Action plan

In order to implement these strategic areas, it is recommended that specific actions be taken within the following five categories, which are identified in detail below.

### Marketing and Branding

#### 1) Continue to position Hamilton as part of Ontario and the broader GTAH and beyond

Given the City of Hamilton's strategic position within the broader regional, provincial and national advanced manufacturing sector, it is recommended that the City continue to work with other municipalities and industry partners to market the broader Greater Toronto and Hamilton Area (GTAH), Ontario and national advanced manufacturing industry. The City should seek to service or partner with new advanced manufacturing businesses that may choose to locate in other municipalities in close proximity to Hamilton. The City's ability to build its reputation, relationships and partnerships with members of the broader regional advanced manufacturing sector will be critical to realizing such opportunities.

#### 2) Showcase the City of Hamilton's advanced manufacturing sector

A strategic marketing plan for the City of Hamilton's advanced manufacturing sector should be prepared to address the broader challenges associated with the traditional perceptions of manufacturing in Hamilton. The sector needs to be showcased as technologically advanced and sophisticated and one that represents a substantial economic opportunity for the City, the Province and Canada. A focus on the top sub-sectors and emerging sub-sectors identified in this study is recommended, including:

- Materials / metal / steel manufacturing;
- Food & beverage manufacturing;
- Machinery manufacturing;
- Transportation / automotive manufacturing;
- Life sciences / healthcare manufacturing;
- Clean technology manufacturing; and
- Emerging technologies such as additive manufacturing, nanotechnology and synthetic biology and genetic engineering.

#### 3) Update City's advanced manufacturing sector's marketing material / industry profiles

The City of Hamilton's advanced manufacturing sector requires marketing material with information for the industry as a whole, as well as specific targeted sub-sectors and industries. Historical marketing materials should be updated to address current and emerging opportunities such as the rise of lightweight materials, new production processes, and the changing needs of the automotive industry. Hamilton's entire advanced manufacturing sector is well positioned to support all these activities. Key marketing channels to be updated include:

- Hardcopy and electronic marketing materials;
- Industry research;
- Website content; and
- Social media communication.

#### **4) Market Hamilton as a top location to work, live and play**

It is recommended that Hamilton undertake further marketing initiatives to challenge and continue shifting the perception of the City of Hamilton as a location for traditional industrial based manufacturing, smoke stacks and other "old economy" activities. The City should instead be positioned as a rapidly growing, technologically advanced and cost-effective location to live and conduct business. A "brand enhancement" program is recommended to articulate the quality of life opportunities in the Hamilton region.

#### **5) Leverage trade show opportunities**

While the specific trade shows that the City of Hamilton might choose to target and attend will vary by sub-sector and the City's priorities with respect to target sub-sectors, it is recommended that advanced manufacturing trade shows be utilized to leverage marketing and branding and investment attraction opportunities in accordance with these strategies that the City will develop, including both domestic and foreign exposure. Participation focus should be given to the largest and emerging advanced manufacturing sub-sectors in Hamilton, and include shows catering to small to medium sized businesses, as well as larger, high profile advanced manufacturing firms. Potential trade shows for consideration may include those supported by key manufacturing associations such as Canadian Manufacturers and Exporters (CME), Excellence in Manufacturing Consortium (EMC), etc., national and international economic development trade shows, and corporate real estate trade shows where numerous site selectors are in attendance, such as CoreNet. A sample of potential advanced manufacturing oriented trade shows or conferences for additional consideration are provided in Appendix F.

### **Business Retention**

#### **6) Understand the needs of large and strategic advanced manufacturing firms**

The City of Hamilton currently maintains a detailed business listing across advanced manufacturing, as well as various other data sets and information gathering tools such as its corporate calling initiative. These tools should continue to be used to properly understand and potentially predict the requirements and growth opportunities of large or potentially high-growth firms.

#### **7) Identify key service providers and supply chain linkages**

Local stakeholders consistently noted the importance of understanding the availability and access to critical suppliers following the choice to locate in Hamilton. Stakeholders noted that the clear identification of such suppliers at the site selection and business development stage is important for understanding how to effectively locate and source necessary services. The City should take steps to ensure that existing firms are aware of key providers and supply chain linkages.

#### **8) Identify opportunities to assist existing businesses**

Providing a cost competitive environment is important to assist local established businesses, and plays a key role to the ability of these organizations to expand and experience future growth. The City currently offers a range of incentive programs for property owners and developers to help offset the costs of development including: reductions in property tax rates, grants for brownfields, heritage properties, core area properties, and LEED certified buildings. The City should seek to ensure that existing firms are aware of the various available incentive programs.

#### **9) Maintain regular contact with key industry leaders and foster community collaboration**

The City should maintain regular contact with key industry leaders to ensure a thorough understanding of the needs of local businesses and be well positioned to respond. Given Canada's challenge of realizing growth across its more maturing organizations, and closing the productivity gap, there is an important role for the City to play in supporting advanced manufacturing industries and organizations. Similarly, the City should seek opportunities to foster collaboration and further develop the local manufacturing community through events, trade shows, etc.

## Investment Attraction

### 10) Assess the opportunity for targeted financial incentives

Financial incentives can play an important role in influencing business location decisions, and are particularly relevant given that many of Hamilton's competitors offer financial incentives. The City currently offers a range of incentive programs for property owners and developers, but none specifically able to target the advanced manufacturing sector. It is recommended that the City consider options for developing a targeted incentive program, similar to the Imagination, Manufacturing, Innovation Technology (IMIT) Financial Incentive Program in the City of Toronto.

### 11) Continue to lead tours of the City's advanced manufacturing facilities

The City should highlight potential opportunities within its entrepreneurial, innovation, and collaboration spaces by leading more frequent tours of the City's major assets and state of the art manufacturing facilities, such as the McMaster Innovation Park. Such tours could enable prospective organizations to better understand and envision the investment opportunity in Hamilton, and enable Hamilton's existing advanced manufacturing organizations to gain further exposure to the broader regional, national and international community. The local commercial real estate community should be leveraged further to strategically market and lease available space, and target advanced manufacturing investment.

### 12) Regularly monitor foreign direct investment (FDI) opportunities

Given that advanced manufacturing activities figure prominently in FDI, it is recommended that the City regularly monitor these opportunities. Such monitoring should include such issues as the site selection drivers for various foreign markets, foreign views of Hamilton as a potential location for investment and what investments could potentially be attracted. The results would be used to identify the top target countries, industries and organizations to pursue as part of a formal FDI strategy led by the City of Hamilton.

### 13) Aggressively pursue high profile investments with the appropriate tools

The City should continue to aggressively pursue high profile advanced manufacturing users in its key industry sectors, notably steel and fabricated metal products, food and beverage, automotive equipment and manufacturing. These are also sectors that figure prominently in the broader GTHA economy. The "full sales team" should be brought to the table including municipal experts in business development, economic development and planning. Steps should also be taken to provide greater clarity on the regulatory and union environment as well as options to streamline the approvals process.

## Talent and Skills Development

### 14) Identify gaps in the local demand and supply of advanced manufacturing talent

It is critical to connect industry directly with training to effectively match the supply and demand for employment opportunities in Hamilton's advanced manufacturing market. Through its workforce planning research, studies, analysis, and surveys, the City should seek to strengthen the alignment of local businesses and institutions by specific program area. Areas of focus could include identifying local growing firms to contribute to future post-secondary education program advisory, identification of future skill needs / gaps, and support and encouragement of job training / retraining across industries.

### 15) Support and expand education and technical training programs

The City should seek to support and expand education and training, given the projected shortage of manufacturing skills in Ontario, the importance of science, technology, engineering and mathematic (STEM) based education programs and the presence of such specialized programming and research at McMaster University and Mohawk College. The City should also promote the positive graduation employment statistics in these programs and need for skills in STEM areas, in order to inform high school students on the technical and strong future career opportunities in advanced manufacturing.

### **16) Encourage local entrepreneurship**

The City should continue to support and encourage innovation and entrepreneurship at the local level, including high school and post-secondary education events and talent competitions around advanced manufacturing to drive positive, and identify key sources of local talent, innovation and future entrepreneurs. One option would be for the City to host a “Dragon’s Den” type series, among local high schools and colleges to foster innovation and entrepreneurial activities, and feature innovative businesses in support of Hamilton entrepreneurial economy.

## **Local Industry Engagement**

### **17) Identify advanced manufacturing champions for the City**

Given the various actions required to lead expansion in the City’s advanced manufacturing sector, it is recommended that “champions” be identified. This could be through a permanent fulltime position, complemented by an advisory board. The position should be filled by an individual with experience in the advanced manufacturing sector and also knowledge of the municipal decision making process. As such, the champions could comprise representatives from the local manufacturing private sector, with a significant relationship with the City of Hamilton, or a public sector representative from the City of Hamilton with extensive relationships across the private sector manufacturing community. A similar approach has been taken by the City of Pittsburgh: a specific strategy was developed for senior industry leaders to actively engage in the attraction, recruitment and retention of high profile businesses to the Pittsburgh area.

### **18) Leverage regional expertise**

The City should continue to engage, consult and leverage the expertise of local industry, innovation, and academic organizations such as:

- McMaster University;
- Mohawk College
- Excellence in Manufacturing Consortium (EMC);
- Innovation Factory;
- Canadian Manufacturers and Exporters (CME);
- Business Development Bank of Canada (BDC);
- Export Development Canada (EDC); and
- local manufacturing firms, among other groups.

These organizations will continue to provide critical insight into future manufacturing growth opportunities for the City of Hamilton, and additional recommendations for realizing future growth.

### **19) Improve local sector collaboration to drive partnership, innovation and productivity**

Hamilton’s manufacturing based firms, associations, academic institutions and public sector leaders share common interests and concerns around productivity, effective collaboration, locating critical talent and investing in innovation, among others. While the City has a breadth of local expertise across the manufacturing sector, there are clear benefits to improving collaboration across these groups, to effectively support partnership and drive innovation. For example one issue identified by stakeholders is a lack of identified venue / space and means for such collaboration to take place. The City should consider options to supply space to accommodate regular manufacturing specific events, such as a “Productivity / Innovation Series”, across key industries, as well as hold other regular meetings with industry leaders to discuss key issues and facilitate development when opportunities arise.



# Introduction

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Advanced manufacturing is a critical contributor to the Canadian economy, with significant impact, and ability to advance innovation, competitiveness and prosperity across the nation, regions and municipalities.

Situated at the western end of Ontario's Golden Horseshoe region, the City of Hamilton is centrally located in Canada and Ontario's manufacturing heartland. Historically, industrial manufacturing has represented the driving force of the City of Hamilton's local economy.

The City of Hamilton's location, growing population and labor profile, established advanced manufacturing base with leading industries in steel / materials with the presence of Canada's largest integrated steel mills, food and beverage, machinery and automotive equipment manufacturing, market access, and developed infrastructure represent some of the drivers that have typically served as a foundation for attracting and expanding the region's manufacturing based industries.

In more recent periods, the City of Hamilton's manufacturing sector has faced a number of challenges, largely due to factors such as significant global economic turbulence, and fluctuating costs of doing business. The City's manufacturing sector has been traditionally focused in industrial based manufacturing and the steel industry, which was especially challenged in the recent recession, and resulting downturn in the autos and parts industry, as observed through decreases in industry employment and revenue in local automotive equipment manufacturing in the late 2000's. Such challenges have tested the City's manufacturing sector, to respond, diversify and capitalize on new opportunities. However the City has recently seen some large expansion in the auto and steel service sectors, indicating a positive shift in the sector.

Increasing global competition, attracting, retaining and advancing talent, improving productivity and leading collaboration and innovation in order to remain competitive in a shifting global environment, are among numerous drivers of future opportunities and the need for adaption and adjustment for Hamilton's advanced manufacturing sector.

## Deloitte's study

In order to leverage critical assets, address challenges and strategize to realize future opportunities and truly prosper as an advanced manufacturing sector and local economy, the effective support and critical engagement across industry, academia, research, public sector and other key community groups is required. As such, in order to further describe, understand and identify key strategic recommendations regarding the current and future state of the City of Hamilton's (the "City") manufacturing sector, the City engaged Deloitte LLP ("Deloitte") to undertake the following study (the "Study").

Through this Study, the City of Hamilton's Planning & Economic Development Department is looking to define the current state of Hamilton's advanced manufacturing cluster, and identify key realistic and implementable recommendations to formulate strategic objectives and initiatives that will assist the City and its significant economic development partners to establish Hamilton as a destination for investment and a supportive environment for industrial growth.

## Approach and method

Our approach and methodology for the following Study involved several critical tasks, including:

- Holding preliminary consultation with members of the City of Hamilton's Planning & Economic Development Department to understand the composition of the City's manufacturing based industries;
- Conducting research and literature review within the advanced manufacturing sector, including a review of the City of Hamilton's manufacturing based industry profiles, business listings, and economic development strategies; global, national and local manufacturing data and a number of external publications and sources; as well as internal research, trends and analysis prepared by Deloitte;
- Conducting market research and preparing data analytics on demographic, economic, and industry statistics trends and forecasts, at the local Hamilton level relative to provincial, national and other municipal comparisons, which impact local advanced manufacturing sector dynamics;
- Leading local stakeholder engagement and interviews across the City's advanced manufacturing sector, from which key themes, strengths, challenges, opportunities and recommendations were identified (a detailed listing of stakeholders is identified in Appendix A, and stakeholder consultation guide is contained in Appendix B);
- Based on the results of the above noted tasks:
  - Identified a selection of global trends which will influence the future of advanced manufacturing globally;
  - Identified key trends and the future outlook of advanced manufacturing in North America;
  - Identified the City of Hamilton's market strengths, assets and capabilities that support the City's advanced manufacturing sector;
  - Identified the City of Hamilton's market challenges and vulnerabilities that potentially challenge the City's advanced manufacturing sector; and
  - Identified future opportunities, key conclusions and actionable recommendations for the City of Hamilton, as well as its strategic partners, in order to further support and drive future growth of the City's advanced manufacturing sector.



# The Shifting Global Manufacturing Landscape

## The Evolution of Advanced Manufacturing

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Advanced manufacturing is best viewed as a cluster of economic activities encompassing much more than a manufacturing focused enterprise alone. Advanced manufacturing includes all facets of research, development, production, sales, distribution, logistics, customer service, marketing, and support, extending from the development of physical products to the delivery of services<sup>1</sup>.

Over the past few decades, manufacturing has evolved from a more labour-intensive set of mechanical processes, or “traditional manufacturing”, to a sophisticated set of information-technology-based processes “advanced manufacturing”. Some of the key aspects of current manufacturing activities include:

- The ubiquitous role of Information Technology (IT);
- A growing reliance on modeling and simulation in the manufacturing process;
- The acceleration of innovation in global supply chain management;
- A move towards rapid changeability and flexibility in the production process.
- A growing acceptance and support of “sustainable” manufacturing.

Within existing or mature manufacturing industries, these trends have given rise to an “enterprise-level” concept of advanced manufacturing where advances occur through the integration of innovation, research development and process controls with production. Enterprise-level refers to an advanced manufacturing enterprise to describe a firm that takes advantage of each of these trends in combination to create innovative business opportunities<sup>2</sup>. Some of the key factors driving innovation and advances within the manufacturing industry today are continued innovation in semi-conductors to improve computing speed and the rise of advanced materials which are leading to transformative changes in many industries, in particular aerospace and the automotive sector as well as renewable energy applications.<sup>3</sup>

## The third industrial revolution

For less mature industries, a number of other trends are emerging which have the potential to completely reconfigure the manufacturing process as we know it. Described by the Economist as the “third industrial revolution”, manufacturing is going digital, and remarkable new technologies are converging, including advanced software, materials, robotics, processes and a range of web-based services<sup>4</sup>. While the factory of the past was based on mass production of identical products, the factory of the future will be increasingly focused on some of the new processes and products described below.

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Manufacturing is going digital, and remarkable technologies are converging, including advanced software, materials, robotics, processes and a range of web-based services<sup>5</sup>. The factory of the past was largely based on the mass production of identical products, while the factory of the future will potentially focus on mass customization.

### Additive manufacturing

A product can now be designed on a computer and “printed” on a 3D printer, which creates a solid object by building up successive layers of material. The digital design can be tweaked with a few clicks of a mouse, and can run unattended, and produce many things which are too complex for a traditional factory to handle. The possible applications of 3D printing include hearing aids and high-tech parts of military jets, which are being printed in customized shapes. The geography of supply chain has the potential to shift even further, where an engineer working in a remote location lacking a certain tool no longer needs to have it delivered from the nearest city, and instead can simply download and print the design. Projects will no longer be delayed due to the lack of a specific part or piece of kit, or when customers are in need of spare parts.

### Nanotechnology

Nanotechnology involves the engineering of functional systems at the molecular scale, or structures between 1 nanometer and 100 nanometers in size. Many manufacturing based experts note nanotechnology as a focus of future growth opportunity in manufacturing, and most major universities in North America now have research institutions which focus specifically on nanotechnology. Nanotechnology is enhancing products extensively, and has led to the development of bandages that help heal cuts, engines that run more efficiently and kitchenware that cleans more easily.

### Synthetic biology and genetic engineering

Genetically engineered viruses are being developed to make products, such as batteries that have the same energy capacity and power performance as state of the art rechargeable batteries being considered to power plug-in hybrid cars, and they could also be used to power a range of personal electronic devices<sup>6</sup>. Genetically engineered bacteria and viruses are also used to manufacture a variety of commercial products including food products, such as aspartame, a form of rennin (an ingredient in cheese), tryptophan (a feed supplement for livestock), and bovine somatotropin (a hormone used to increase the milk production of cows).

As a result of these trends, the concept of advanced manufacturing does not necessarily relate to specific economic sectors, particularly the distinction between traditional or “high-tech” activities. This is because advances in manufacturing have the potential to transform any economic sector, including the steel and relative automotive sector activities that characterize large parts of the Hamilton economy.

The common views and definitions of advanced manufacturing reflect this:

- Advanced manufacturing entails both leading-edge methods of manufacturing new and existing products as well as improved approaches to designing and coordinating operations<sup>7</sup>;
- Advanced manufacturing increasingly integrates new innovative technologies in both products and processes; and
- Advanced manufacturing comprises a family of activities that depend on the use and coordination of information, automation, computation, software, sensing, and networking, and/or make use of cutting edge materials and emerging capabilities<sup>8</sup>.

Regardless of the definition examined, numerous manufacturing, academic, research, economic development, and policy leaders will likely agree that that within a North American context, traditionally defined “manufacturing” is becoming an increasingly unfamiliar and dated concept, and today – all manufacturing oriented production and enterprise increasingly involves some form of advanced process, technology, or innovation, and thus can be considered “advanced” in some nature. Or in other words, there is very little manufacturing that is no longer advanced to some degree.

We broadly define advanced manufacturing as manufacturing that builds on and encompasses the use of science, engineering, and information technologies, along with high-precision tools and methods integrated with a high-performance workforce and innovative business or organizational models, to improve existing or create entirely new materials, products, and processes<sup>9</sup>.

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Traditionally defined “manufacturing” is becoming an increasingly unfamiliar and dated concept, and today – all manufacturing oriented production and enterprise increasingly involves some form of advanced process, technology, or innovation, and can be considered “advanced”.

Through the progression of Deloitte’s Study, it is evident that Hamilton’s numerous manufacturing based firms not only drive the City’s diverse manufacturing sector, various service industries and significant economic activity and comprise some of the most significant employers of the City, many of these organizations are also home to state of the art production and research and development (“R&D”) facilities, and adopt and invest heavily in R&D, technology and innovation based activities, processes and tools in order to advance their productivity and remain competitive.

### The globalization of the manufacturing ecosystem

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Over the past several decades, the globalization of manufacturing has driven more change and impacted the prosperity of more companies, nations and people than at any time since the industrial revolution<sup>10</sup>.

A number of factors have enabled such rapid globalization, including:

- a significant change in geopolitical relations between eastern and western nations;
- the widespread growth of digital information;
- physical and financial infrastructure;
- computerized manufacturing technologies; and
- the development of bilateral and multilateral trade agreements.

Such factors have permitted the disaggregation of supply chains into complex global networks allowing a company to interact in the design, sourcing of materials and components, and manufacturing of products from virtually anywhere while also satisfying end consumers.

Nations around the world have participated in and benefited from the rapid globalization of industry and expansion of manufacturing. For example, globalization of manufacturing has been a key driver of higher-value job creation and a rising standard of living for the growing middle class in emerging nation economies, dramatically shifting the nature of competition between emerging and developed nations and between companies.

Given factors such as advancing technology, modern transportation, and growing consumer demand in emerging economies, a new age of trade is here to stay. While digital technology and free trade proliferation will continue to enable the flattening of the globalization of manufacturing supply chains, the dominant factors that shaped the disaggregated supply chains of today will not be the same as those of the next several decades.

Manufacturers are considering multiple locations for critical operations to avoid supply chain interruptions and raise their level of responsiveness and dependability. A developing trend among leading manufacturers is to structure their production footprints to balance the low cost of production in emerging economies with the lower logistical costs, greater industrial engineering capabilities and fewer risks that exist in the shorter supply chain of Canada or the US.

Changes in the global trading environment have also been a primary driver in the industrial real estate market for over twenty years. Extensive growth in eastern and western trade from Asia, the world's fastest growing manufacturer to the US, the world's largest consumer has had a profound impact on supply chain management and related real estate decisions. Trade growth has also meant more attention to supply chain strategies that expedite production and ease trade flows across borders<sup>11</sup>.

Trade agreements, integration of the economies of North, Central, and South America, and the expectation of higher fuel costs, a global economic downturn, and the growing sophistication of "near-shore" markets are causing manufacturers and logistics professionals to take a closer look at supply-chain efficiencies that can be found within the Americas.

Many emerging economies used by multinationals as locations of low-cost labour, have developed significant manufacturing and innovation capabilities permitting them to produce increasingly advanced manufactured products. These economies have also started to experience a corresponding escalation in wages and costs, as experienced by their developed nation counterparts. Greater prosperity and higher wages are facilitating an increased ability and desire to consume in these growing middle classes, this positioning them as a viable market of new consumers and much less a source for low-cost labour.

## Global manufacturing markets and Canadian competitiveness

### Canada among top ten nations in manufacturing sector performance

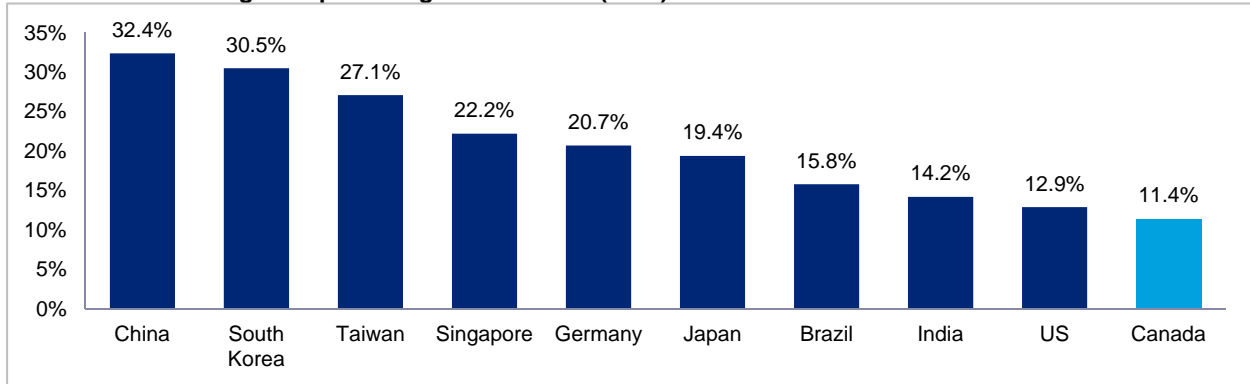
Canada ranks among the top ten nations globally, with respect to manufacturing sector performance. The following table outlines some key indicators which highlight Canada's manufacturing performance relative to its global competitors:

Country Manufacturing Competitiveness Ranking	1	2	3	4	5	6	7	8	9	10
	China	Germany	US	India	South Korea	Taiwan	Canada	Brazil	Singapore	Japan
Manufacturing GDP CAGR (2005–10)	11.90%	-0.50%	0.50%	8.50%	6.00%	7.90%	-3.60%	1.90%	7.10%	-0.20%
Manufacturing GDP percentage of total GDP (2010)	32.40%	20.70%	12.90%	14.20%	30.50%	27.10%	11.40%	15.80%	22.20%	19.40%
Labor costs (US\$/hour) (2011)	2.8	46.4	35.4	0.9	17.7	9.2	38.3	12	21.9	35.4
Manufacturing exports percentage of total exports (2011)	93.20%	82.70%	64.30%	50.30%	85.30%	88.20%	44.90%	32.90%	68.10%	88.00%
Manufacturing jobs created per hundred persons (2001–2010)	3.1	-1.8	-3.1	1.6	-4.5	NA	0.0	2.1	-1.3	-3.0
Highest corporate tax rate (2012)	25.00%	33.00%	39.10%	32.40%	24.20%	17.00%	31.00%	34.00%	17.00%	38.00%
Researchers per million population (INSEAD 2012)	1,071	5,305	4,663	136	6,286	NA	4,260	1,100	6,991	7,039
Per capita personal disposable income (US\$) (2011)	2,302	27,720	37,041	1,271	12,221	10,169	30,780	7,951	22,416	28,370
Per capita personal disposable income (2011) CAGR (2001– 2011)	16.50%	6.60%	3.30%	11.70%	6.90%	2.00%	8.20%	14.00%	6.50%	4.10%

Source: Deloitte Touche Tohmatsu Limited & US Council on Competitiveness (Council. "2013 Global Manufacturing Competitiveness Index"

With respect to manufacturing GDP as a percentage of total GDP, at 11.4%, Canada is currently significant on a global scale. In comparison, China's ratio is the highest at 32.4%, followed by South Korea (30.5%), and Taiwan (27.1%). The US is slightly higher than Canada, at 12.9%.

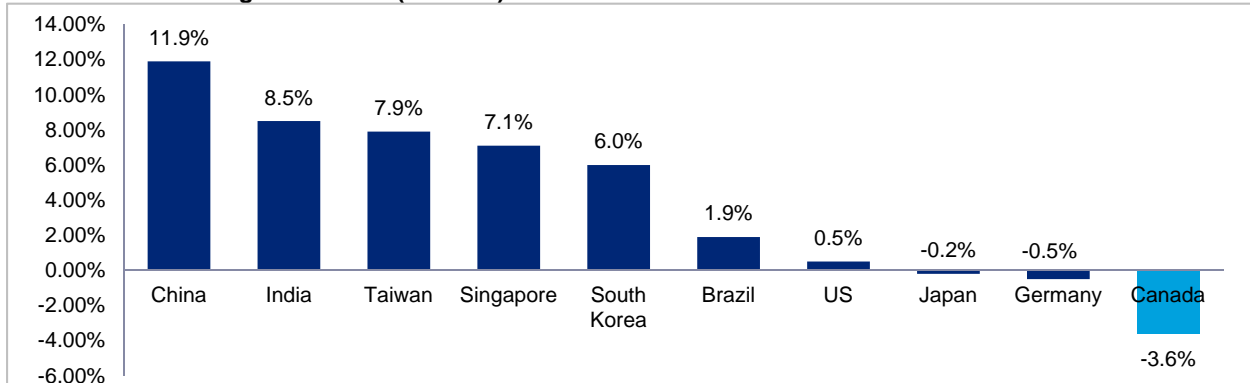
**Global Manufacturing GDP percentage of total GDP (2010)**



Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council. "2013 Global Manufacturing Competitiveness Index"

The compound annual growth rate ("CAGR") of manufacturing GDP from 2005 to 2010 is negative for Canada, at -3.6%. Comparatively, China's manufacturing GDP has grown at a CAGR of 11.9%, followed by India (8.5%) and Taiwan (7.9%). The US has experienced a manufacturing GDP CAGR of 0.5%.

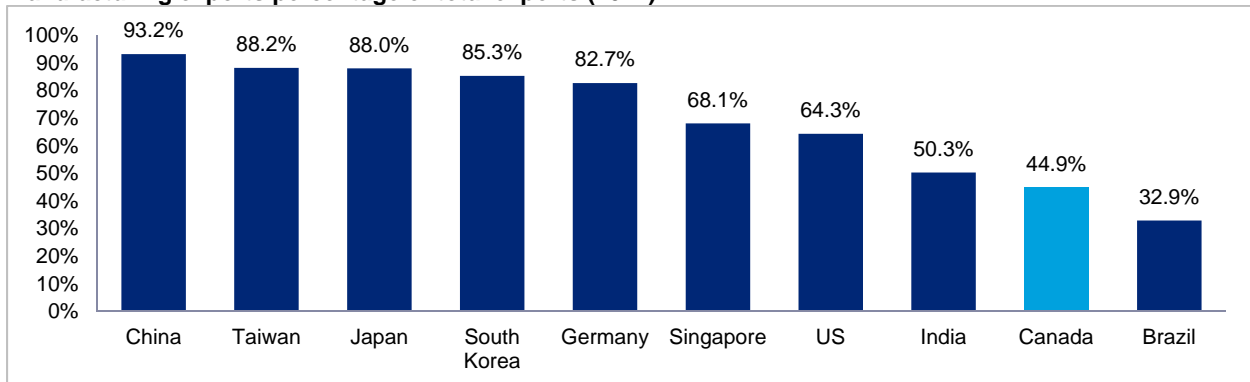
**Global Manufacturing GDP CAGR (2005–10)**



Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council. "2013 Global Manufacturing Competitiveness Index"

Canada continues to have a significant manufacturing based export activity, with nearly 45% of exports resulting from manufacturing. China's export economy is the most heavily dependent on manufacturing exports, comprising over 93% of total exports, followed by Taiwan (88.2%) and Japan (88.0%). The US is also more manufacturing export focused than Canada, at over 64%.

**Manufacturing exports percentage of total exports (2011)**



Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council. "2013 Global Manufacturing Competitiveness Index"

## The rise of developing economies

In order to further quantify country manufacturing competitiveness more precisely, Deloitte's Global Manufacturing Industry group and The US Council on Competitiveness undertook a multi-year *Global Competitiveness in Manufacturing* initiative, whereby over 550 manufacturing executives worldwide were asked to rate the overall manufacturing competitiveness of 38 countries, over the currently and five year projection period.

According to these surveyed executives, China is currently the most competitive nation within the manufacturing global sector, and this is expected to continue in the short-term. In addition to China, other emerging markets are expected to remain or become more competitive in the near future, with India and Brazil rising second and third rankings, respectively. Brazil's rise is the largest increase expected over the next five years. Vietnam is also anticipated to increase in competitiveness. Meanwhile, developed economy nations are expected to decline, with Germany, the US, South Korea, Canada and Japan falls decreasing in global competitiveness.

Global executives believe developed economy nations will decline in global manufacturing competitiveness in five years, with the US shifting from third to fifth, and Canada from seventh to eighth.

### 2010, 2013 and 2018 Country manufacturing competitiveness index rankings

2010 Competitiveness			2013 Competitiveness			2018 Competitiveness (forecast)		
Rank	Country	Index Score, 10=high, 1=low	Rank	Country	Index Score, 10=high, 1=low	Rank	Country	Index Score, 10=high, 1=low
1	China	10	1	China	10	1	China	10
2	India	8.15	2	Germany	7.98	2	India	8.49
3	South Korea	6.79	3	US	7.84	3	Brazil	7.89
4	US	5.84	4	India	7.65	4	Germany	7.82
5	Brazil	5.41	5	South Korea	7.59	5	US	7.69
6	Japan	5.11	6	Taiwan	7.57	6	South Korea	7.63
7	Mexico	4.84	7	<b>Canada</b>	<b>7.24</b>	7	Taiwan	7.18
8	Germany	4.80	8	Brazil	7.13	<b>8</b>	<b>Canada</b>	<b>6.99</b>
9	Singapore	4.69	9	Singapore	6.64	9	Singapore	6.64
10	Poland	4.49	10	Japan	6.6	10	Vietnam	6.5

Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council.2010/ 2013 Global Manufacturing Competitiveness Index

Note: In the 2010 Global Manufacturing Competitiveness Index Canada ranked 13<sup>th</sup>

### Talent driven innovation the top driver of global manufacturing competitiveness

With respect to critical drivers of manufacturing competitiveness, global manufacturing executives cited talent driven innovation as the most important driver of a country's ability to compete, and as such, the quality and availability of scientists, researchers, and engineers and the quality and availability of skilled labor are top factors to manufacturing competitiveness.

Additional key factors to global manufacturing competitiveness include economic, trade, financial and tax system of a nation. CEOs' recent experiences with economic volatility, trade barriers, structural cost tax burdens, and national indebtedness, combined with high degrees of policy and regulatory uncertainty, has likely caused them to now place government-related forces and actions as more important to determining a nation's competitiveness than anything other than the quality of its workforce.

Government driven trade, financial, and tax policies are potentially increasingly important relative to factors such as labor and materials costs, supplier networks, infrastructure, energy costs, and local market attractiveness as a more important driver of a nation's competitiveness. This appears to be driven by corporate concerns that economic, trade and tax policies are often detracting from competitiveness for manufacturers versus helping create an advantage.

Government driven trade, financial, and tax policies are considered increasingly important relative to labour and materials costs, supplier networks, infrastructure, energy costs, and local market attractiveness as top driver of competitiveness. This appears to be driven by corporate concerns that economic, trade and tax policies are often detracting from competitiveness for manufacturers rather than creating an advantage.

#### Global drivers of manufacturing competitiveness index ranking

Rank	Main driver	Most important drivers	Index Score, 10 = high, 1 = low
1	Talent-driven innovation	<ul style="list-style-type: none"> <li>Quality and availability of researchers, scientists, and engineers</li> <li>Quality and availability of skilled labor</li> </ul>	10.00
2	Economic, trade, financial and tax system	<ul style="list-style-type: none"> <li>Tax rate burden and system complexity</li> <li>Clarity and stability of regulatory, tax and economic policies</li> </ul>	8.42
3	Cost and availability of labor and materials	<ul style="list-style-type: none"> <li>Cost competitiveness of materials</li> <li>Availability of raw materials</li> </ul>	8.07
4	Supplier network	<ul style="list-style-type: none"> <li>Cost competitiveness of local suppliers</li> <li>Ability of supply base to innovate in products and processes</li> </ul>	7.76
5	Legal and regulatory system	<ul style="list-style-type: none"> <li>Stability and clarity in legal and regulatory policies</li> <li>Labor laws and regulations</li> </ul>	7.60



Rank	Main driver	Most important drivers	Index Score, 10 = high, 1 = low
6	Physical infrastructure	<ul style="list-style-type: none"> <li>Quality and efficiency of electricity grid, IT and telecommunications network</li> <li>Quality and efficiency of roads, airports, ports, and railroad networks</li> </ul>	6.47
7	Energy cost & policies	<ul style="list-style-type: none"> <li>Cost competitiveness of energy</li> <li>Ongoing investments to improve and modernize energy infrastructure</li> </ul>	6.25
8	Local market attractiveness	<ul style="list-style-type: none"> <li>Size and access of the local market</li> <li>Intensity of local competition</li> </ul>	3.99
9	Healthcare system	<ul style="list-style-type: none"> <li>Cost of quality healthcare for employee and society</li> <li>Regulatory policies (e.g., pollution, food safety, etc.) that are enforced to protect public health</li> </ul>	2.48
10	Government investments in manufacturing and innovation	<ul style="list-style-type: none"> <li>Government investments in R&amp;D: science, technology, engineering and manufacturing</li> <li>Private and public sector collaboration for long-term investments in R&amp;D: science, technology, engineering and manufacturing</li> </ul>	1.00

Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council, "2013 Global Manufacturing Competitiveness Index".

## Canada's competitive drivers

### Highly innovative and technology-driven sector

Manufacturing is a vibrant, highly innovative and technology-driven sector of the Canadian economy<sup>12</sup>, representing over 11% of Canada's GDP. Manufacturing exports comprise nearly 45% of total Canadian exports, and Canada has a higher number of researchers per million of population (4,300), relative to China.

Canada's manufacturing sector outpaces all other Canadian sectors / industries in the introduction of process, organizational, product and marketing innovations<sup>13</sup>.

Additionally, Canadian industry relies heavily on resource-based manufacturing, and is one of the few developed countries that is a net energy exporter.



National manufacturing statistics	Canada
Manufacturing GDP CAGR (2005–10)	-3.60%
Manufacturing GDP percentage of total GDP (2010)	11.40%
Labor costs (US\$/hour) (2011)	38.3
Manufacturing exports percentage of total exports (2011)	44.90%
Manufacturing jobs created per hundred persons (2001–2010)	0.0
Highest corporate tax rate (2012)	31.00%
Researchers per million population (INSEAD 2012)	4,260
Per capita personal disposable income (US\$) (2011)	30,780
Per capita personal disposable income (2011) CAGR (2001–2011)	8.20%

Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council, "2013 Global Manufacturing Competitiveness Index".

### Strategic advantages driven by strong industries, and government and corporate investment

Executives surveyed by Deloitte noted Canada's established manufacturing industry and strong automotive, industrial machinery, aircraft and telecommunications exports as strong contributors to the country's manufacturing competitiveness.

Other perceived advantages include Canada's favorable government support and investment in manufacturing, and proximity to the US. Canada is also pursuing additional free trade agreements, and has recently announced that it will fund capital costs associated with the construction of the new bridge between Windsor, Ontario and Detroit, Michigan, in order to improve the efficiency of goods that flow through this trade corridor, which total approximately 25% of all trade between the US and Canada, and allow for increased commercial traffic that is forecasted to triple over the next 30 years.

At the organizational level, Canadian manufacturers are increasingly investing in production facilities to increase agility, expand mass customization capabilities, capitalize market niches, and optimize prototyping and new product introductions. More than twice as many manufacturers increased production capabilities (25%) in Canada between 2007 and 2009 than reduced capabilities (11%), and more than twice as many manufacturers increased production (25%) and research and development (8%) capabilities in Canada between 2007 and 2009 than reduced capabilities (11% and 2%, respectively). Many large manufacturers expand other strategic activities in Canada when increasing their production capabilities, including R&D (27%), logistics (32%) and provision of services (28%).

### Future downward shift anticipated in manufacturing competitiveness

Despite these strengths and efforts towards growth, Canada is expected to decline in competitiveness rankings over the next five years, according to US Council on Competitiveness Council and Deloitte's global manufacturing competitiveness study.

Key factors contributing to this anticipated decline include:

- Canada's cost competitiveness;
- Canada's modest economic outlook;
- increased difficulty in finding highly educated workers who possess the skills required in today's advanced manufacturing operations; and
- rise of other low cost production nations will potentially threaten Canada's overall manufacturing competitiveness position.

The various current and future strengths and challenges associated with Canada's advanced manufacturing sector are explored in greater detail in the subsequent chapter of this report.

## Current global competitive environment

### China

#### The global leader in manufacturing

China is the largest exporter and the second largest importer in the world. In 2010, China became the largest manufacturing country in the world, overtaking the US. China's exports are primarily focused in the toys, apparel and electrical and electronics industries, and China is the world's largest manufacturer of toy products, with a 70% share.

Despite recent slowing in its economic growth, China has become the world's largest manufacturing nation, maintaining its ranking as the most competitive manufacturing nation in the world<sup>14</sup>.



National manufacturing statistics, China vs. Canada	China	Canada
Manufacturing GDP CAGR (2005–10)	11.90%	-3.60%
Manufacturing GDP percentage of total GDP (2010)	32.40%	11.40%
Labor costs (US\$/hour) (2011)	2.8	38.3
Manufacturing exports percentage of total exports (2011)	93.20%	44.90%
Manufacturing jobs created per hundred persons (2001–2010)	3.1	0.0
Highest corporate tax rate (2012)	25.00%	31.00%
Researchers per million population (INSEAD 2012)	1,071	4,260
Per capita personal disposable income (US\$) (2011)	2,302	30,780
Per capita personal disposable income (2011) CAGR (2001–2011)	16.50%	8.20%

Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council, "2013 Global Manufacturing Competitiveness Index".

#### China's competitiveness expected to continue despite growing competition of lower cost nations

Executives consistently noted China's traditional labour and materials cost advantage, strong government investment in manufacturing and innovation, and established supplier network as its key competitive strengths, and believe that the Chinese government is establishing positive policies in infrastructure, science and technology innovation, workforce development, safety, health and sustainability that would further enable future competitiveness advantages relative to other nations.

Potential challenges to manufacturing in China include factors such as rising labour / production costs, and shifts in investment attraction policy. Until 2008, many incentives were awarded to foreign companies that were mainly viewing China as an export platform. However, more comprehensive and specific criteria have been introduced in recent years, with China potentially providing similar treatment to national and international investment, and focusing more on supporting new technology, R&D and intellectual property development. Overall, China's manufacturing competitiveness is expected to continue, provided the country can maintain relatively low labor costs, which have been on the rise with the emergence of a strong middle class, resulting in increasing opportunities for Asian lower cost countries such as Vietnam, Indonesia and India<sup>15</sup>.

## Germany

### Manufacturing/exporting powerhouse

Primarily driven by a renewed focus on the manufacturing sector over the last decade, Germany's manufacturing exports grew nearly three times between 2000 and 2011<sup>16</sup>.

By 2011, Germany became the world's second largest exporter, after China. Germany's exports have contributed two-thirds of the country's economic growth over the past decade, and have driven its GDP per capita to increase faster than any other major industrialized country.



With approximately 1.2% of the world population, Germany is the world's fourth largest producer and the largest exporter of personal and commercial automobiles.

National manufacturing statistics, Germany vs. Canada	Germany	Canada
Manufacturing GDP CAGR (2005–10)	-0.50%	-3.60%
Manufacturing GDP percentage of total GDP (2010)	20.70%	11.40%
Labor costs (US\$/hour) (2011)	46.4	38.3
Manufacturing exports percentage of total exports (2011)	82.70%	44.90%
Manufacturing jobs created per hundred persons (2001–2010)	-1.8	0.0
Highest corporate tax rate (2012)	33.00%	31.00%
Researchers per million population (INSEAD 2012)	5,305	4,260
Per capita personal disposable income (US\$) (2011)	27,720	30,780
Per capita personal disposable income (2011) CAGR (2001–2011)	6.60%	8.20%

Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council, "2013 Global Manufacturing Competitiveness Index".

Germany has taken a somewhat different approach than China in improving manufacturing competitiveness, focusing its efforts on the development of new technologies and innovative capabilities, which requires a highly skilled workforce that commands high labor rates. Diversity within the manufacturing sector is also helping to build on its historical strength in automotive manufacturing and "made in Germany" premium brand, the country continues to grow the field of "mechatronics". The technological advancements and innovations stemming from investments in mechatronics is expected to result in significant demand for Germany's specialized manufacturing machines and systems from developing countries seeking more advanced manufacturing capabilities.

### Understanding the demand and supply of talent

Germany's "dual system" of vocational training, combining classroom instruction with work experience is a model several countries are trying to emulate. Nearly half of German high-school students undertake dual training in one of nearly 350 trades (i.e. from tanner to dental technician) in the country. Germany has a model system for technical training of workers, which provides its manufacturing sector with a steady supply of technicians, engineers and skilled workers through a highly functioning system of vocational training and technical apprenticeships.

Industry works closely with regional technical schools, sometimes sponsoring programs to prepare the graduates so they are immediately job-ready upon completing their education.

### The power of the SME

Beyond vocational training, another significant factor in Germany's manufacturing and export success is perceived to be its "mittelstand", or small and medium-size enterprises (SMEs). While Germany is home to a number of sizeable Fortune 500 companies such as BMW, Siemens, ThyssenKrupp, Volkswagen, Daimler and BASF, an estimated 99% of all German companies are SMEs, or enterprises with annual sales below EUR 50 million and fewer than 500 workers. The nation's SME's / Mittlestand, include an estimated three million companies which employ approximately 70% of the country's workforce<sup>17</sup>, which is higher than the United Kingdom (approximately 60%) and much higher than the US (approximately 50%). Nearly a third of Germany's SME workers are estimated to be employed in the manufacturing sector, but those workers account for a disproportionate share of Germany's total exports, about 40% (compared to US SMEs which account for 31% of US exports).

### Concentration of niche markets

While North America has traditionally concentrated on the mass market and quantity, Germany is also considered a leader of niche markets<sup>18</sup>. Such an entrepreneurial strategy has allowed German companies to be manufacturing and export leaders, providing developing nations like China and India with high tech precision tools required to become the mass production oriented factories of the world. A typical German manufacturing SME may focus on making a single, high quality product required by other industrial enterprises, and focus on exceling in such an area. For example, the German renewable energy sector (i.e. wind energy, solar photovoltaics and biomass) has been considered a leader for many years, and much of it is driven by SMEs that are now expanding into international markets. Such manufacturing SMEs are considered particularly strong in shop floor operations, with state of the art, lean manufacturing practices that flow from intensive investment in research and development.

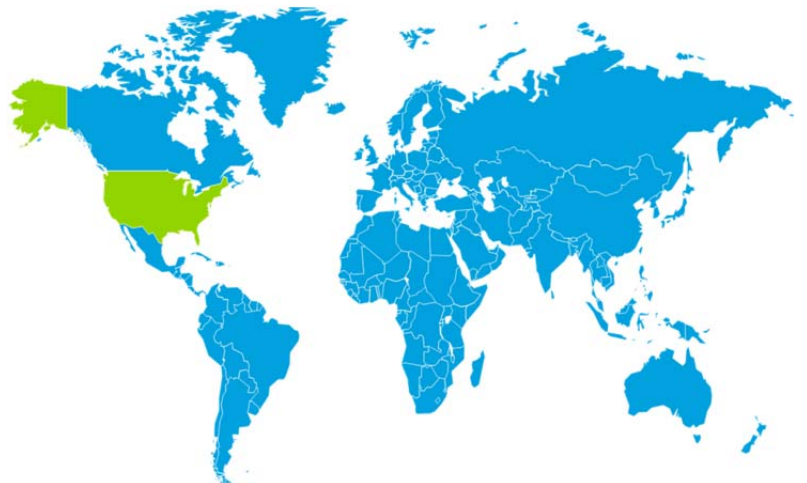
### Potential risks include labour, material and energy costs

Executives surveyed in Deloitte's global manufacturing competitiveness study expressed concern about Germany's ability to maintain its competitive advantage, as a result of labor and material costs, as well as energy costs and policies, which are disadvantages potentially negatively impacting the country's long-term competitiveness. Other factors noted as concerning include lack of venture capital for start-ups and ongoing instability across the Eurozone. These factors, exacerbated by rapid advancements in the manufacturing capabilities of countries like China, India and Brazil, may slowly erode Germany's competitiveness.

### United States

Manufacturing in the United States produces an estimated \$1.8 trillion of value each year, or 12.2% of US GDP<sup>19</sup>. The US was the second largest manufacturer of automobiles in 2011, and remains the most heavily invested into country in the world, with FDI stock inflow totaling \$3.5 trillion in 2011.

Where trade was responsible for about 6.0% of US GDP in 1950, it surged to 25% by 2007. The annual growth rate is staggering, about \$120 billion a year<sup>20</sup>.



The US has the sixth largest proven natural gas reserves, and low cost shale gas availability gives US manufacturers a competitive edge in the global markets.



### Key advantages driven by talent driven innovation, infrastructure and regulatory systems

Key advantages that contribute to the strength of the US as a manufacturing destination, include a core competency for talent-driven innovation, physical infrastructure, established supplier network, and strong legal systems. Other noted policy advantages that further strengthened US competitiveness included intellectual property protection laws and technology transfer, adoption, and integration. There are also a number of US states, regions and municipalities that have developed programs designed to encourage manufacturing and industrial based investment. Such programs offer strategic incentives to manufacturing based firms looking to locate / relocate their operations, particularly following the recent economic turbulence and recessions.

National manufacturing statistics, US vs. Canada	US	Canada
Manufacturing GDP CAGR (2005–10)	- 0.5%	-3.60%
Manufacturing GDP percentage of total GDP (2010)	12.9%	11.40%
Labor costs (US\$/hour) (2011)	35.4	38.3
Manufacturing exports percentage of total exports (2011)	64.3%	44.90%
Manufacturing jobs created per hundred persons (2001–2010)	-3.1	0.0
Highest corporate tax rate (2012)	39.1%	31.00%
Researchers per million population (INSEAD 2012)	4,663	4,260
Per capita personal disposable income (US\$) (2011)	37,041	30,780
Per capita personal disposable income (2011) CAGR (2001–2011)	3.3%	8.20%

Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council, "2013 Global Manufacturing Competitiveness Index".

### Challenges facing manufacturing competitiveness

The US share of the world's total GDP is likely to fall to 18.4% by 2015 due to China's rapid economic growth. Manufacturing employment in the US declined from 17.6 million jobs in 1998 to just 11.6 million jobs at the end of 2010. The US National Association of Manufacturers notes that there are a number of skills required in the US modern manufacturing workplace, translating into an estimated 600,000 unfilled manufacturing jobs.

Despite an increased focus in the US over the last five years by both public and private sector leaders with respect to America's manufacturing competitiveness, surveyed global executives almost consistently cited an overall sense of uncertainty that plagues much of the national regulatory system as a significant disadvantage. Clarity and permanency of R&D tax credits, competitive tax rates, ratification of free trade agreements, tort reform, healthcare policy, financial reforms, labor policy, innovation policy, energy policy and carbon regulation policy were all examples cited by executives of policy areas where competitive policies developed and enacted with clarity and maintained with stability would likely provide significant opportunities for American manufacturers. As a result of policy and regulatory disadvantages, as well as high labor, corporate tax, and unemployment rates, along with sluggish GDP growth, the US is expected to fall behind due to the rise of India and Brazil, and drop in manufacturing competitive in the near future.

### Global re-shoring patterns and potential future opportunities

According to many sources, China's historical overwhelming manufacturing cost advantage over North America is shrinking quickly. Real wages in Asia between 2000 and 2008 rose an estimated 7-8% annually, according to the International Labour Organization. Pay and benefits for the average Chinese factory worker rose by an estimated 10% annually between 2000 and 2005 and increased up to 19% a year between 2005 and 2010, according to BCG. The Chinese government has also set a target for annual increases of approximately 13% for minimum wage until 2015. Labour unrest and strikes are becoming more frequent, following which, wages at some factories have risen steeply. In addition the costs of transportation, duties, supply chain risks, industrial real estate and are also increasing in China.

Meanwhile, in advanced economies, labour costs, rose less than 1% a year between 2000 and 2008, according to the McKinsey Global Institute. In manufacturing, the recent financial crisis actually reduced pay, whereby real wages in US manufacturing have declined over 2% since 2005. Conversely, Canada's wage increase is one of the greatest among advanced economies. From 1997 and 2010, the US dollar cost of Canadian wages rose at an estimated compound annual growth rate of 5%<sup>21</sup>. The current pay for senior management in several emerging markets, such as China, Brazil and Turkey is similar to, or exceeds pay levels in the US and Europe, according to a recent study by the Hay Group.

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China's manufacturing cost advantage over North America is shrinking quickly. Overall pay for the average Chinese factory worker rose by an estimated 10% annually from 2000 to 2005, and 19% annually from 2005 to 2010. Meanwhile, in advanced economies, labour costs are estimated to have risen less than 1% annually from 2000 to 2008.

Additional drivers for North America as a destination for manufacturing include:

- Access to North American customers for quicker response to demand;
- Strong research, development and innovation capabilities;
- World class universities and laboratories;
- Strong infrastructure assets;
- Established supplier network;
- Talented and productive labour;
- Large middle class consumer base;
- Strong intellectual property protection policies; and
- Quality healthcare.

As such, some manufacturing production activities for the North American market has started to migrate back to North America, sometimes referred to as "re-shoring". A 2012 Boston Consulting Group survey of American manufacturing companies found that 37% of those with annual sales above \$1 billion said they were planning or actively considering shifting production facilities from China to North America. Of the largest firms, with sales above \$10 billion, 48% were identified as "re-shorers"<sup>22</sup>. Similarly, in 2012 the Massachusetts Institute of Technology examined over 100 US manufacturing firms with multinational operations, and found that 14% had firm plans to bring some manufacturing back to North America and one-third were actively considering such a move. The Hackett Group, a Florida-based firm that advises companies on offshoring and outsourcing, expects the outflow of manufacturing from high- to low-cost countries to slow over the next two years, and re-shoring to double over the previous two years.

Some experts believe that manufacturing for some goods may shift from China to other cost competitive nations such as Vietnam, Indonesia and Mexico. However, such moves are expected to be minimal, and higher end manufacturing can be expected to remain in China, or potentially migrate to North America. Boston Consulting Group estimates that this "re-shoring" trend could possibly reduce North America's merchandise trade deficit with China in future years.

According to the Conference Board of Canada, China and other developing economies have traditionally competed on the basis of their lower costs, while developed economies such as Canada increasingly compete on the basis of innovation. In the future, developing economies can be expected to continue to become more sophisticated, as their large populations of consumers become more highly educated, better compensated, and more demanding. In parallel, their businesses will also become more sophisticated. Eventually, these emerging economies will potentially reach a turning point where they begin to compete less on cost and more on innovation. As such, there will be a growing challenge to Canada and Ontario to engage with these emerging economies and advance Canadian innovation capabilities.

Developed economies such as Canada increasingly compete on the basis of innovation. In time, developing economies can be expected to become more sophisticated, as their large populations become more highly educated, better compensated, and more demanding. In parallel, their businesses will become more sophisticated. Eventually, these emerging economies may begin to compete less on cost and more on innovation, requiring Canada to advance its innovation capabilities.

### Summary

The global manufacturing industry continues to advance and evolve. Based on recent trends, it is anticipated that advanced manufacturing will continue to become increasingly automated and technologically intensive. Advances in materials and systems designs are likely to lead to entirely new products and processes, with a growing focus on flexibility and sustainability in the production process. Talent driven innovation will continue to be the top driver of global manufacturing competitiveness, which bodes well for Canada and the United States.

In the short term, Canada's global manufacturing competitiveness is expected to be potentially challenged and the national manufacturing economy faces a cautious outlook. However, given a number of global shifts in advanced manufacturing, Canada is in the position to potentially leverage such shifts to its advantage. In particular, rising costs in developing economies such as China is anticipated to result in a re-shoring of industrial / manufacturing investment back to North America. While Canada is currently experiencing rising labour costs and there is an increasing presence of other low cost competitors, Canada may be well positioned to move its advanced manufacturing sector forward, given appropriate strategy and investment in technology, talent, and innovation.



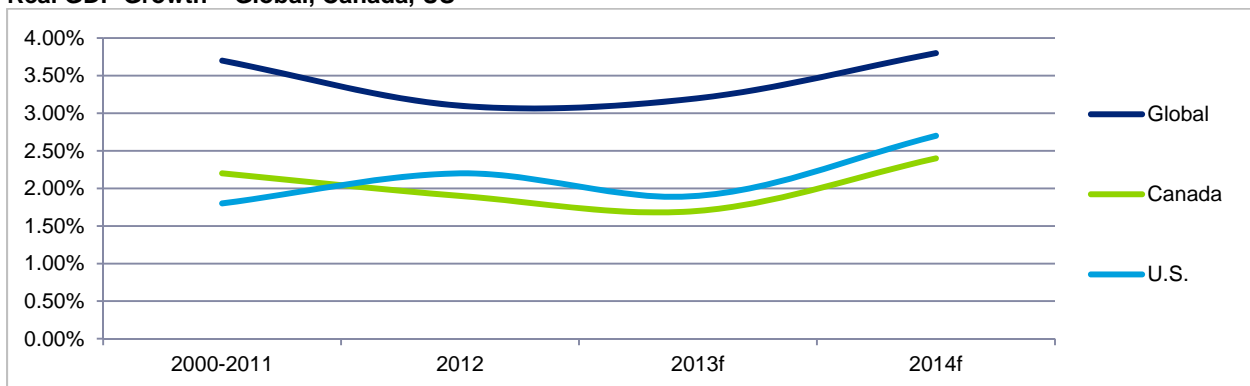
# North American Advanced Manufacturing Outlook and Trends

Canada and the US are considered to be among the top manufacturing competitors in the world, and this is generally expected to continue in the short-term future. While the growth outlook for advanced manufacturing in North America varies according to different sources, there appears to be significant consensus on a positive, but modest growth outlook, given a number of challenges facing the sector, such as slow economic growth and soft international demand.

## Canada and the US projected to experience positive economic growth overall

With respect to overall real GDP growth, Canada and the US are projected to grow in the short term, but trail behind the global average of 3-4% annual growth. Canada's real GDP is projected to grow at 1.7% in 2013 and 2.4% in 2014, while the US is projected to grow at 1.9% and 2.7%, respectively.

Real GDP Growth – Global, Canada, US

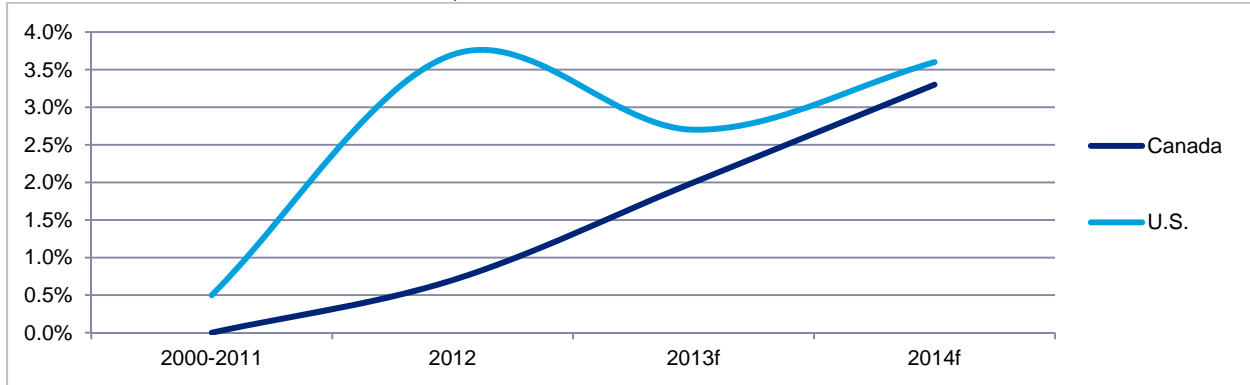


Source: Scotiabank, Global Economic Research, 2013

## Canada and US projected to converge to similar positive industrial production growth

With respect to industrial production, Canada's growth was relatively flat from 2000 to 2011, while the US experienced slightly higher growth over this period, and spiked in industrial production growth in 2012 relative to Canada. It is projected that Canada will continue its modest increase and maintain similar growth as the US declines in growth, by 2014.

**Industrial Production Growth – Canada, US**



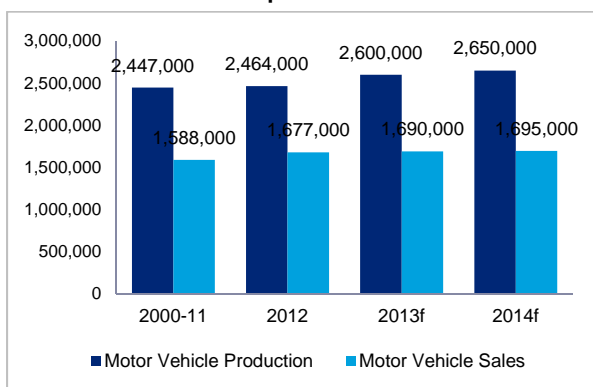
Source: Scotiabank, Global Economic Research, 2013

## Automotive industry continues to be a key driver of North American manufacturing, but with modest growth

The US automotive industry consists of 13 international automakers, which produced 8.7 million cars and commercial vehicles in 2011, accounting for 11% of all global output. Canada is the ninth largest vehicle producer in the world. The auto sector is Canada's biggest contributor to manufacturing GDP and its largest manufacturing employer. The Canadian vehicle assemblers account for 3.7% of total world production of nearly 70 million units.

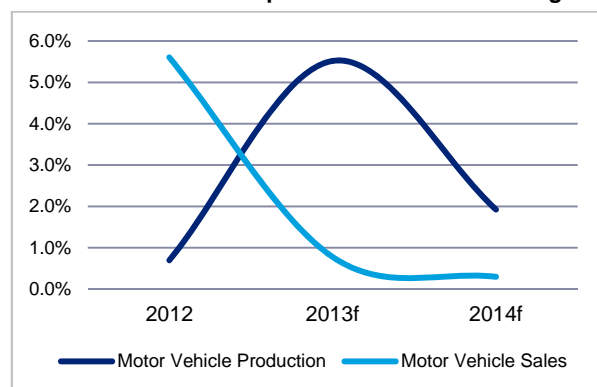
As a result of various challenges facing the manufacturing sector, recent growth in automotive industries has been limited and the outlook for these sectors remains modest. Overall, motor vehicle production and sales is expected to continue to remain fairly flat in Canada, with some pick up in the US.

**Canadian Motor vehicle production and sales units**

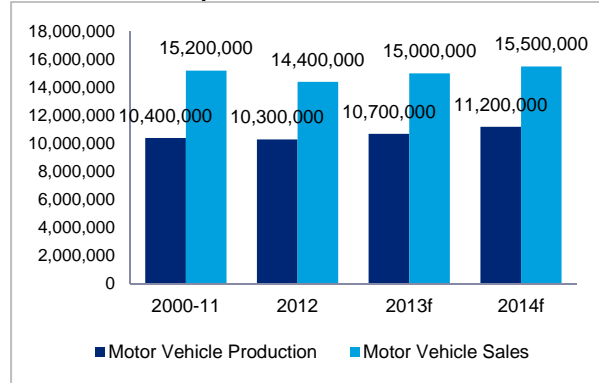


Source: Scotiabank, Global Economic Research, 2013

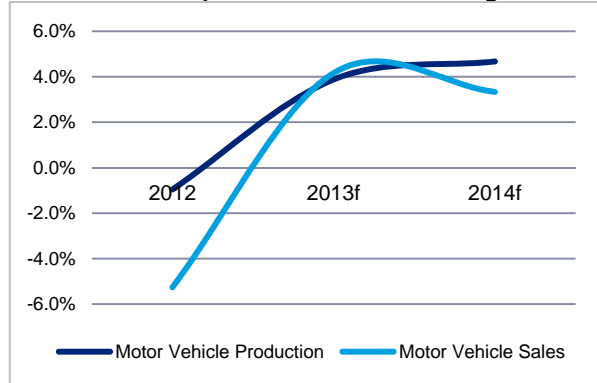
**Canadian Motor vehicle production and sales unit growth**



**US Motor vehicle production and sales units**



**US Motor vehicle production and sales unit growth**

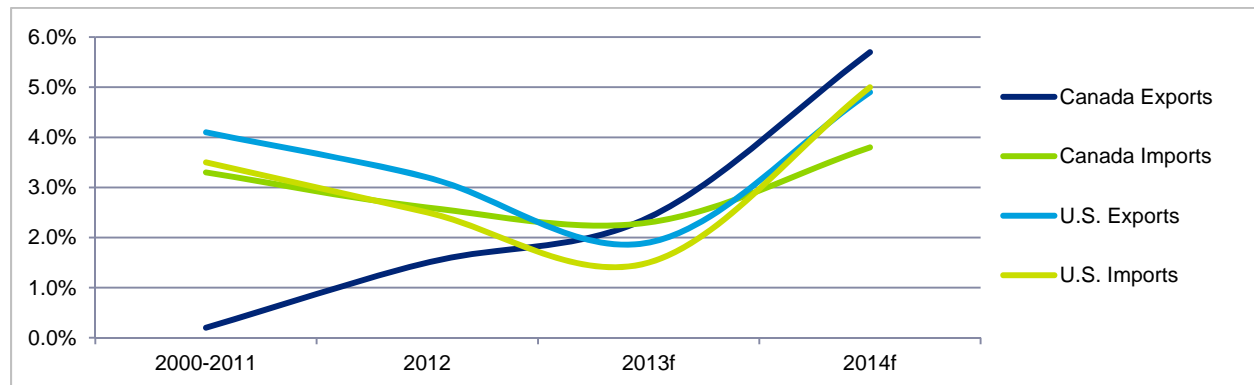


Source: Scotiabank, Global Economic Research, 2013

### Canada's global trade patterns are diversifying

Canada's exports have continued to grow from 2000 to 2012, and started to stall into 2013, but are projected to outpace the growth of US exports later this year and over 2014.

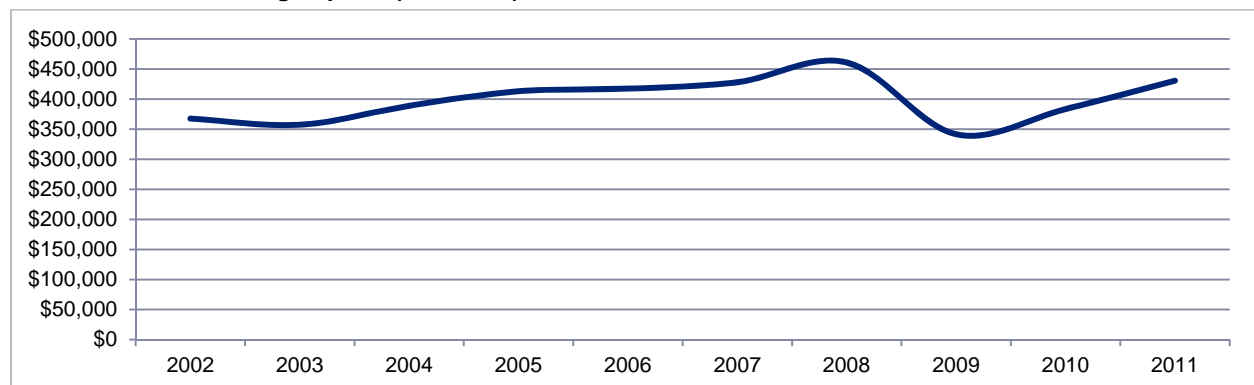
**Export and Import Growth – Canada, US**



Source: Scotiabank, Global Economic Research, 2013

Canadian manufacturing exports was over \$280 million in 2011, exhibiting nearly 8% growth over 2010. While the US continues to be Canada's dominant trading partner, accounting for 70% of total exports and imports, its share of Canada's international trade volume has been declining over the past decade. During this period, the European Union and China have increased their share of trade with Canada, and other major developing economies such as Brazil, India, and Russia are becoming more important participants in trade.

**Canadian Manufacturing Exports (\$ millions)**



Source: Statistics Canada, 2012

### North American FDI driven by advanced manufacturing sector investment

The number of FDI projects into North America declined by 9.5% in 2012, with the region attracting nearly 1,700 FDI projects during the year. Capital investment in 2012 decreased by an estimated 12.6% and job creation by an estimated 2.4% compared to 2011. Despite these declines, North America was the best performing region of the world in 2012.

In 2012, the top sectors for FDI Projects were largely driven by advanced manufacturing based activity, including information and communication technology, followed by business and financial services, transportation equipment, engines, turbines and industrial machinery and chemicals, plastics and rubber.

**In 2012, the top sectors for North American FDI Projects were largely driven by advanced manufacturing based activity, including information and communication technology, transportation equipment, engines, turbines and industrial machinery, chemicals, plastics and rubber.**

California was the leading state, attracting 205 projects, over 10% of FDI into North America. The top five states for FDI into North America remained unchanged from 2010 and in total accounted for 39% of the market in 2012. California accounted for 12.3% followed by New York (8.7%), Ontario (7.4%), Texas (6.9%) and Florida (4.0%). Ontario ranked third overall with respect to the 123 FDI projects it was able to secure in 2012<sup>1</sup>, a slight decline from 2010.

#### FDI in North America

2010		2012	
Destination State/Province	No. of FDI Projects	Destination State/Province	No. of FDI Projects
California	172	California	205
<b>Ontario</b>	<b>127</b>	New York	146
New York	126	<b>Ontario</b>	<b>123</b>
Texas	92	Texas	116
Florida	72	Florida	66
North Carolina	70	Massachusetts	57
Ohio	56	North Carolina	53
Georgia	52	Illinois	49

Source: fDi Intelligence, Financial Times

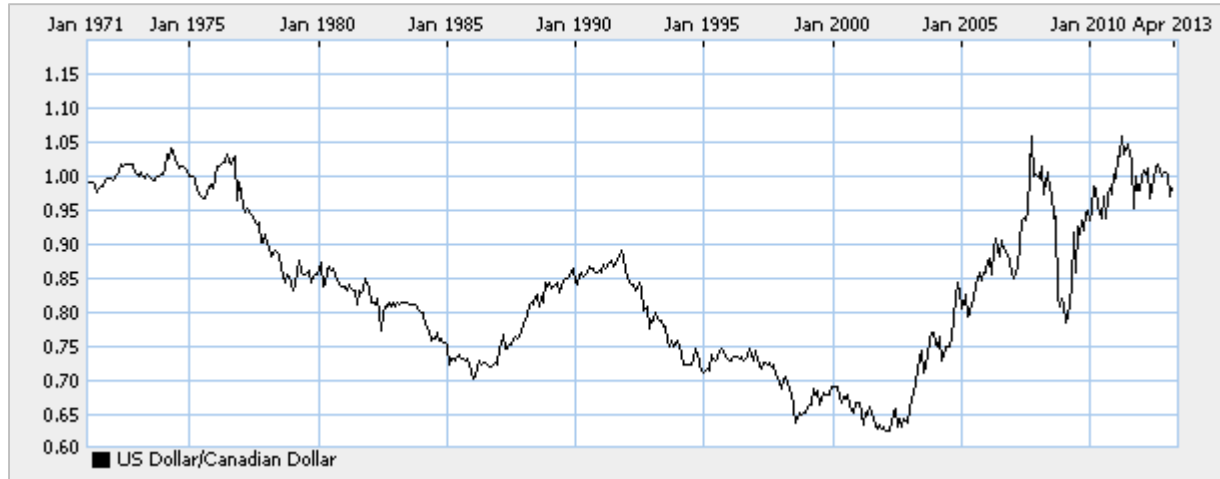
<sup>1</sup> Refers to greenfield investment projects, and does not include mergers and acquisitions, or other equity-based or non-equity investments.

## Canadian market volatility challenges

### Currency fluctuations have challenged Canadian manufacturing cost competitiveness

Throughout the 1990's, Canada enjoyed a significant cost advantage when exporting to the US due to a low dollar. In more recent periods, the dollar has hovered at par, challenging one of Canada's traditional manufacturing competitive advantages. As such, Canadian manufacturing businesses have been required to learn to adapt to currency and other competitive pressures over the medium and long term. The depreciation in the Canadian dollar in early 2013 is expected to help manufacturers regain some international competitiveness in the short term.

#### Canadian Exchange Rate – CAD / USD

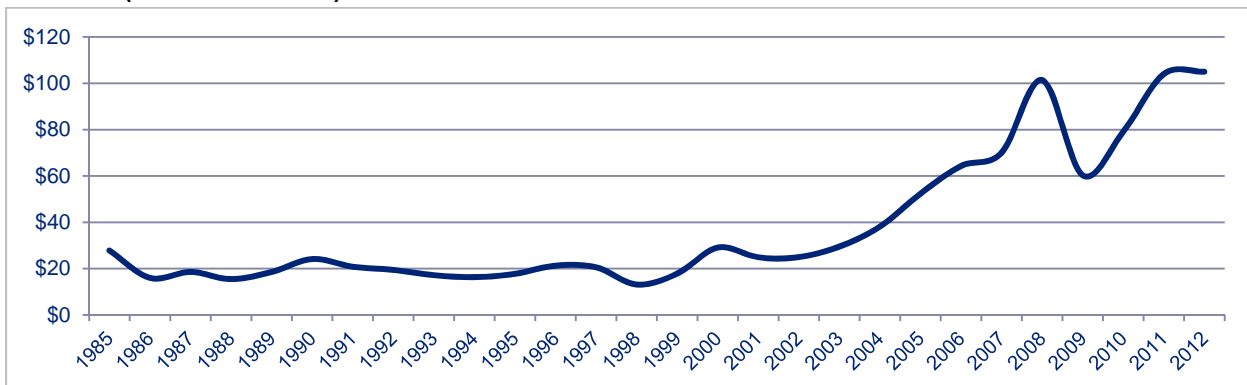


Source: Thomson Reuters, 2013

### Continued volatility in oil markets

Over the past five years the price of oil has fluctuated drastically, impacting the economy and manufacturing sector on a global scale. In 2008 the cost of crude oil reached over \$130 per barrel, undermining global growth before the financial crisis truly hit. After some stabilizing, in 2011, supply disruptions pushed the price of oil to over \$115. At January 2013, prices sat at approximately \$105 per barrel<sup>2</sup>.

#### Oil Prices (USD/ barrel crude)



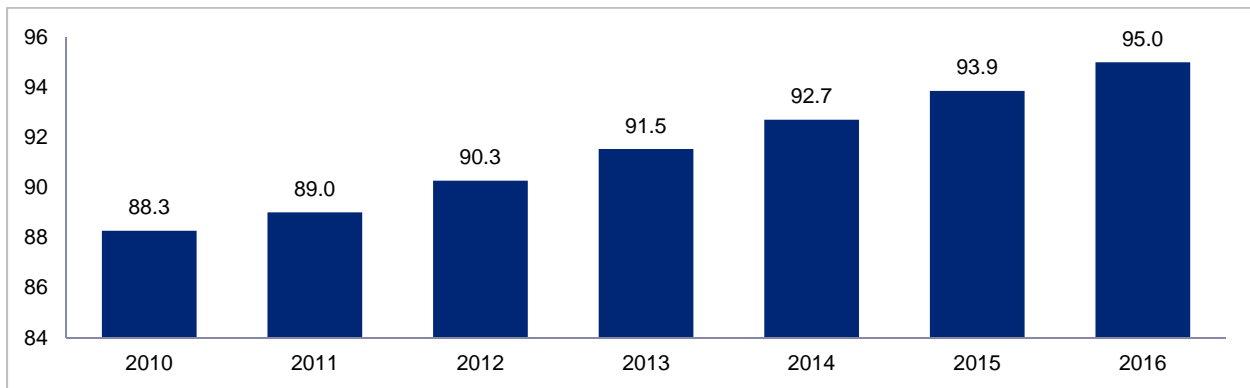
Source: OECD Canada Statistical Profile – Price of Crude Oil

<sup>2</sup> The Economist, The World Economy: "Another Oil Shock?". March 2012.

Persistently high crude oil prices impact the Canadian economy through a variety of channels. As the world's sixth largest producer of crude oil and a net exporter of the commodity, higher crude prices are considered a boom for Canada's resource-rich western and eastern provinces (i.e. Alberta, Saskatchewan, and Newfoundland & Labrador). In contrast, central Canada is more vulnerable to a rise in oil prices, as its oil-intensive sectors, including manufacturing and transportation face an increase in production costs, potentially slowing economic activity. Additionally, high oil prices can also dampen consumer confidence and crimp consumer spending.<sup>23</sup> Concerns about oil pricing are also causing companies to reassess how far goods travel and by what means<sup>24</sup>.

Oil is expected to continue to be in high demand globally in future years; the International Energy Agency projects rising global demand for oil through to 2016, presenting an ongoing challenge to Canadian manufacturers.

**Global Demand for Oil, Million Barrels per Day**



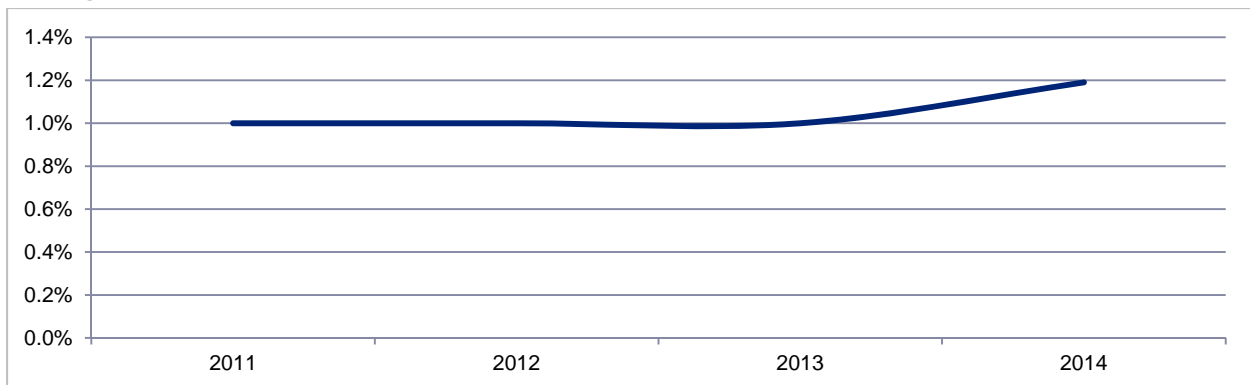
Source: International Energy Agency

**Interest rate remains fairly flat**

Sluggish domestic growth and global economy uncertainty has kept the Bank of Canada from increasing interest rates. The Bank of Canada's target for the overnight rate has remained at 1% since 2010, and is projected for an increase in 2014.

Lower interest rates enable manufacturing based businesses to borrow funds to invest in equipment, inventories, technology, real estate, etc. Also, low interest rates enable consumers to borrow funds in order to purchase vehicles, homes, furniture, appliances, etc.

**Overnight Rate**



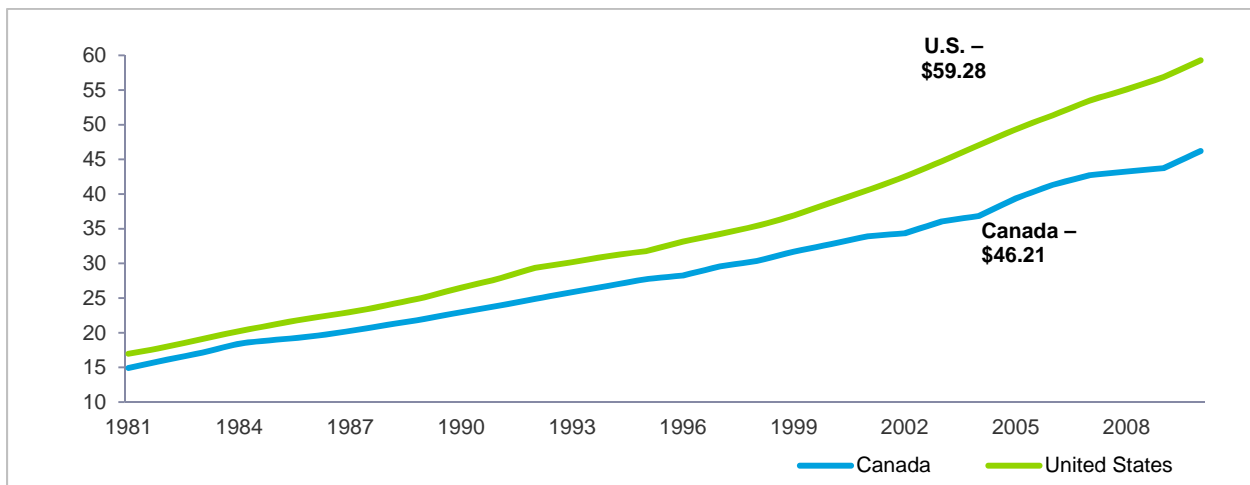
Source: BMO Capital Markets Economics, 2012

### Canada's manufacturing productivity gap<sup>25</sup>

Deloitte recently completed a series of studies around the future of productivity in Canada, and the nation's performance relative to the US in particular. The results of this analysis have significant implications to advanced manufacturing in Canada, as the following section will outline.

Over the past several decades, a major gap has emerged between Canada and the US in the most important driver of prosperity – productivity, defined as the average value produced per hour worked<sup>26</sup>.

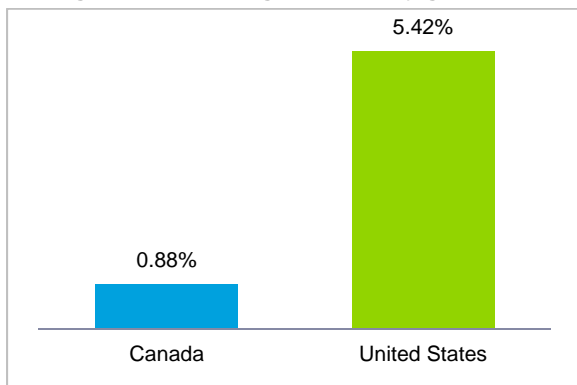
#### GDP per hour - Canada vs. US



Source: Deloitte, *The future of productivity - Clear choices for a competitive Canada*

From 1990 to 2009, Canadian manufacturing posted annual productivity growth of 2.3%, well below the 3.3% rate of the comparable US sector. Performance from 2000-2008 was particularly weak at an annual rate of 0.88%, less than one sixth of the US growth rate<sup>27</sup>. The result is a gap in manufacturing productivity growth more than 3.5 times the size of the productivity growth gap across the entire economy.

#### Average manufacturing productivity growth in Canada and U.S. (2000-2008)



Source: Deloitte, *The future of productivity - Clear choices for a competitive Canada*

The gap in manufacturing productivity growth is more than 3.5 times the size of the productivity growth gap across the entire economy.

The productivity challenge facing Canadian manufacturing is not unique to a single region, nor is it focused on any one sub-sector. Only two of sixteen sub-sectors (non-metallic mineral products and primary metals) exhibited productivity growth equal to or higher than the US. The gap in the transportation sub-sector was -5.6%; in paper products and printing it was -3.7%, and in chemical products it was -3.2%. In computer and electronic products, accounting for a not insignificant 4.2% of total manufactured goods output, the gap was 24.5%.

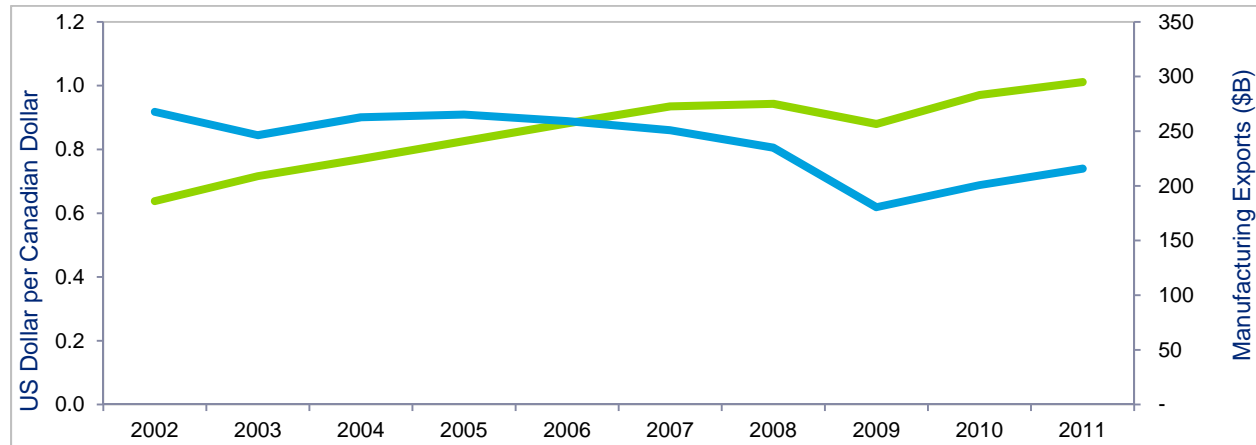
**The productivity challenge facing Canadian manufacturing is not unique to a single region, nor is it focused on any one sub-sector.**

**Need for adaptation in the absence of labour cost competitiveness**

Throughout the 1990's, Canada enjoyed a significant cost advantage when exporting to the US due to a low dollar and preferential NAFTA status. In more recent periods, the dollar has hovered at par and a rapid expansion of US bilateral trade agreements means that NAFTA no longer provides Canada the competitive advantage it once did. As such, Canadian manufacturing businesses must learn to adapt to currency and other competitive pressures over the medium and long term.

Exports, which remained flat during rising exchange rates from 2004-2008<sup>28</sup>, declined significantly in 2008 on decreased consumer demand in global markets, particularly in the US. Since then, there has been a limited rebound with exports growing 11.2% in 2010 and 7.5% in 2011<sup>29</sup>. However, it is unclear if this is a return to normal state, as the US emerges from the recent recession or evidence that the Canadian manufacturing sector is able to compete in a more challenging environment.

**Impact of the Canada-US Exchange Rate on Manufacturing Exports**



Source: Deloitte, *The future of productivity - Clear choices for a competitive Canada*

**Canadian manufacturing businesses must learn to adapt to currency and other competitive pressures over the medium and long term.**

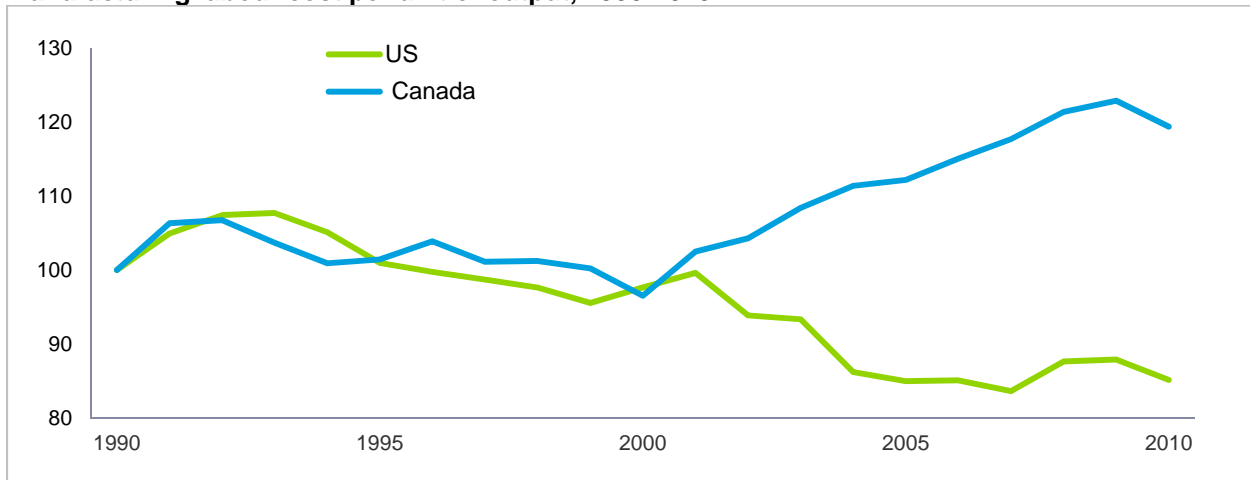


### Labour costs outpace productivity

The most significant challenge that the rising Canadian dollar has created for manufacturers is labour costs. Between 1997 and 2010, the US dollar cost of Canadian wages rose at one of the fastest rates in the OECD; a compound annual growth rate of 5%, 46% of which can be attributed to the appreciation of the Canadian dollar<sup>30</sup>. This increase has brought the Canadian labour rate roughly on par with the US, eliminating a traditional cost advantage.

However, higher wage rates are not necessarily incompatible with productivity growth. Highly skilled workers producing large volumes of high value items can and thus should command high wages in a competitive marketplace. If rising labour costs indicates that workers are producing greater value per hour, the ratio of labour costs to output would begin to decline. Unfortunately, this is not the situation with Canadian manufacturers. Since 2000, manufacturing labour costs per unit of Canadian output have risen rapidly, diverging from the trend in the United States<sup>31</sup>.

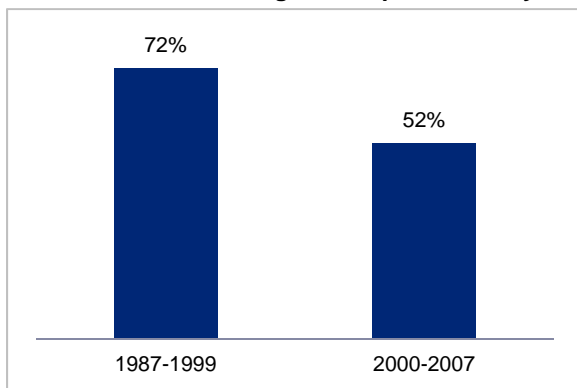
#### Manufacturing labour cost per unit of output, 1990-2010



Source: Deloitte, *The future of productivity - Clear choices for a competitive Canada*

A lack of labour cost competitiveness is particularly troubling given that manufactured goods comprise approximately 60% of total Canadian exports, the majority of which are bound for the US<sup>32</sup>. Also of concern is the limited investment being made by Canadian firms into technologies that could support employees becoming more productive. On average from 2000 to 2007, Canadian manufacturers made only 52% of the US investment per worker on labor-saving machinery and equipment.

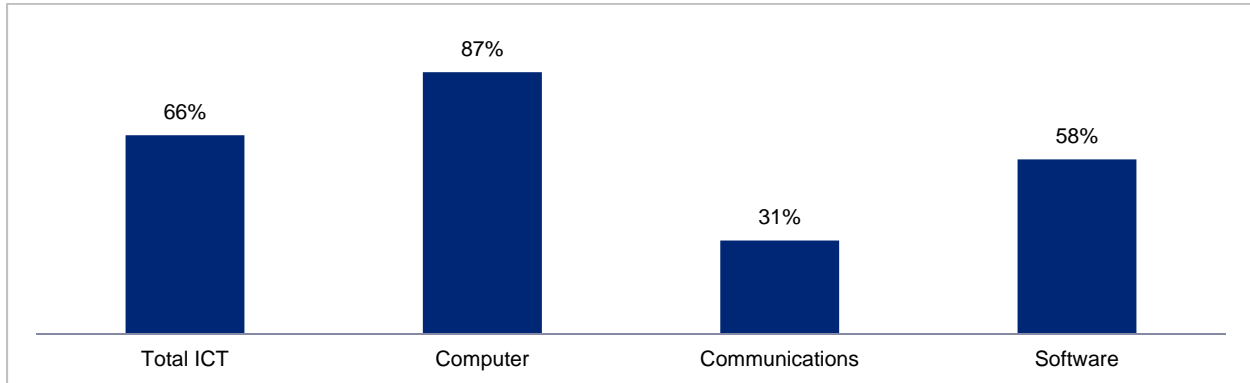
#### Canadian manufacturing M&E capital intensity, as % of US



Source: Deloitte, *The future of productivity - Clear choices for a competitive Canada*

In the critically important area of Information and Communication Technology ("ICT"), Canadian manufacturers spent roughly 66% that of US levels, with only 31% of the US rate on communications<sup>33</sup>.

**Canadian manufacturing ICT investment per worker, as % of U.S., 2010**



Source: Deloitte, *The future of productivity - Clear choices for a competitive Canada*

**Canadian manufacturing firms are successful in achieving early, high growth rates**

Many Canadian firms are successful in achieving high rates of growth within their first five years<sup>34</sup>. Commonly known as "gazelles," these firms are defined by the Organization for Economic Co-operation and Development ("OECD") as being less than five years old with greater than 20% annualized employment growth in the last three years<sup>35</sup>.

According to the OECD, at over 25%, Canada has the highest reported penetration rate of gazelles among OECD countries in the manufacturing sector<sup>36</sup>. This rate exceeds that of in Norway, Sweden, and the start-up hotbed of Israel. The US, as a percentage of total firms, had barely one quarter the share of manufacturing gazelles in Canada. The high penetration of gazelles among Canadian manufacturing firms suggests a dynamic business environment with an active pool of risk-embracing entrepreneurs<sup>37</sup>.

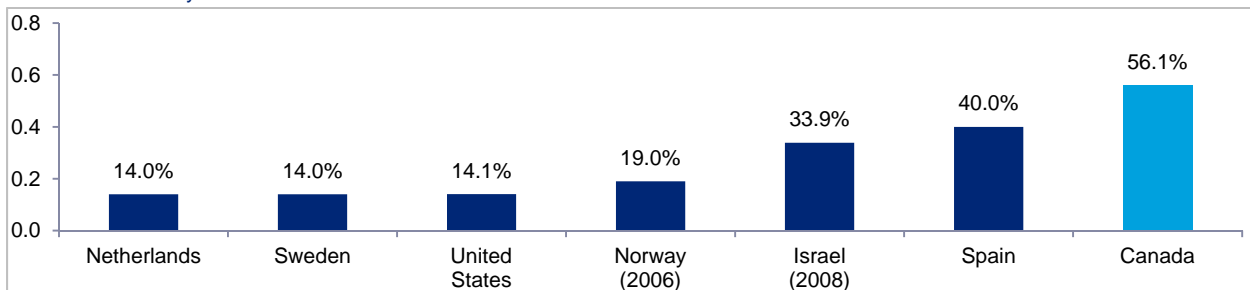
Canada's streamlined approach to the creation of new enterprises is likely a contributing factor to these conditions. The World Bank has consistently ranked Canada as one of the world's most favorable regulatory environments for starting a new business<sup>38</sup>. Canadian entrepreneurs face the smallest number of procedures required to start a business, and the third shortest time required to complete registration. In terms of overall ease of starting a business, Canada ranked at third compared to the United States at 13th, Israel at 43rd and Switzerland at 85th.

**As these firms mature, they are less successful in maintaining growth**

Unfortunately, evidence shows that as Canada's manufacturing gazelles mature, they are less successful in maintaining high growth rates. Among firms more than five years old, only 3.2% of Canadian manufacturers qualify as high growth, ranking them third from last and fifth from last, respectively, among reporting OECD countries.

**Young High Growth Firms in the Manufacturing Sector, 2005-2007**

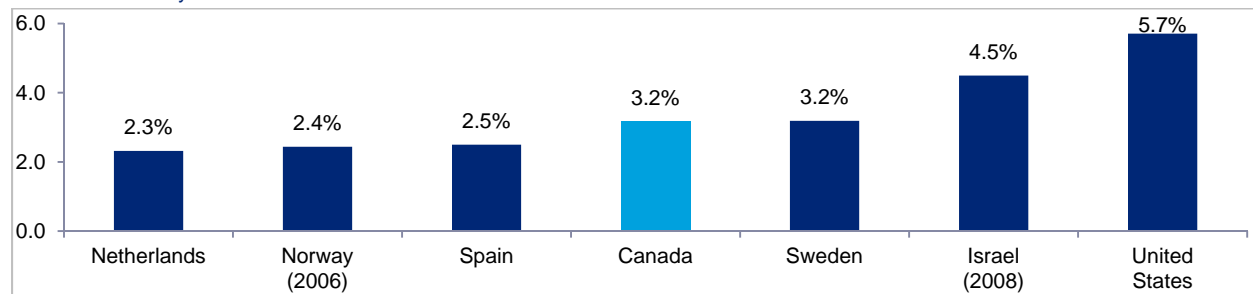
% of firms under 5 years old



Source: Deloitte, *The future of productivity - Clear choices for a competitive Canada*

### Established High Growth Firms in Manufacturing Sector, 2005 – 2007

% of firms over 5 years old



Source: Deloitte, *The future of productivity - Clear choices for a competitive Canada*

### Export activity a key driver of manufacturing sector productivity

Improving Canada's export performance is particularly important in light of a 2012 Statistics Canada study showing that exporting firms in the manufacturing sector outperformed their non-exporting peers in terms of productivity growth.<sup>39</sup> The study found that firms initiating export activities between 1990 and 1996 exhibited annual productivity growth of 2.9% compared to -2.3% among firms that did not export.

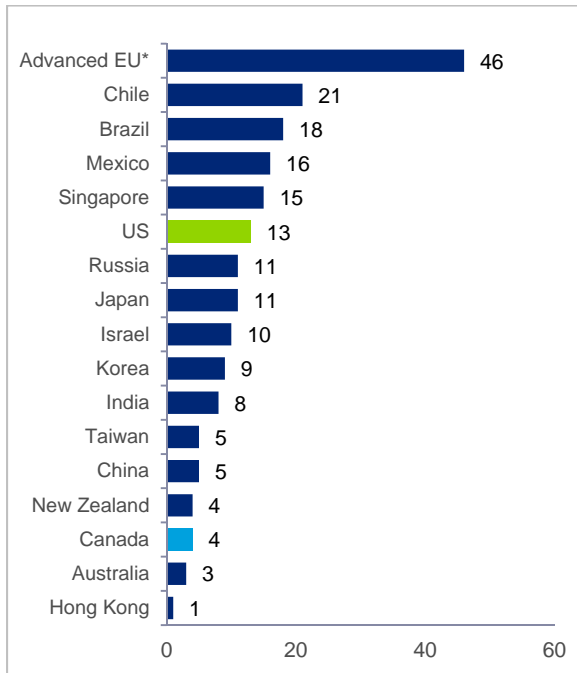
### Exporting firms in the manufacturing sector outperform their non-exporting peers in terms of productivity growth.

This phenomenon is somewhat self-selecting, as highly competitive firms are more likely to expand internationally than their less successful peers. For example, the productivity of firms that began exporting between 1990 and 1996 was 30% higher at the beginning of the period than those firms never engaging in any kind of export activity<sup>40</sup>. Exporting firms also tended to be more focused on market expansion, both internationally and domestically, than non-exporting firms, and had stronger track records for process innovation. They incorporated flexible job design, self-directed work groups, information sharing between employees and joint labour-management committees into their business activities<sup>41</sup>.

However, these effects do not fully explain the productivity boost among newly exporting firms, where productivity growth was higher than those who began their export activities prior to 1990. This suggests that entry into new markets launches a temporary period of particularly high productivity growth, followed by a higher baseline level. This burst of productivity growth is likely driven by changes in firm behavior in response to the greater competitive intensity of international markets. Newly exporting firms increased investment in R&D, formed a greater number of research collaboration agreements with foreign firms, and significantly expanded the use of foreign technology. Access to a larger, more international, pool of potential clients also tended to increase plant and product specialization among these firms<sup>42</sup>.

Evidence shows that macroeconomic factors such as the rate of trade liberalization and relative currency values impact both a firm's decision to enter international markets and the resulting productivity benefits<sup>43</sup>. From 1990 to 1996, free trade agreements and our low dollar created an extremely favourable environment for Canadian exports, which grew at an annual rate of 7.5%<sup>44</sup>. Between 2000 and 2006, however, few new bilateral agreements were signed<sup>45</sup>, and the added impact of a strong Canadian dollar meant that average growth in exports dropped to only 0.5% annually<sup>46</sup>.

Number of FTAs with developing countries, 2010



Source: World Bank, OECD, International Trade Centre

## Innovation and commercialization

### Success will be defined by rate of effective innovation

Innovation is the creation and commercialization of new products and services, and the development of new processes, including new methods of distribution and pioneering marketing techniques<sup>3</sup>. According to Deloitte, innovation is widely recognized as one of the most important contributors to persistent and sustained productivity growth, and the ability to innovate at an accelerated pace, will be the most important capability differentiating the success of countries and companies<sup>47</sup>. Based on Deloitte analysis, companies regarded as more innovative grew net income over two times faster and their market capitalization nearly two times faster from 2006 to 2010 compared to their non-innovative counterparts. Countries that are more successful at fostering innovation perform better, whether looking at GDP or GDP per capita.

Companies must innovate to stay ahead of competition, and must be enabled by infrastructure and a policy environment that better supports university/research lab breakthroughs in science and technology and investment budgets that permit dedicated pursuits. In the 21st century manufacturing environment, being able to develop creative ideas, addressing new and complex problems and delivering innovative products and services to global markets will be the capabilities most coveted by both countries and companies. But even more essential for innovation to flourish will be access to a workforce capable of driving it.

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**The ability to innovate, at an accelerated pace, will be the most important capability differentiating the success of countries and companies.**

<sup>3</sup> "The future of productivity". Deloitte, 2011.

**Canada and Ontario exhibit low innovation and commercialization**

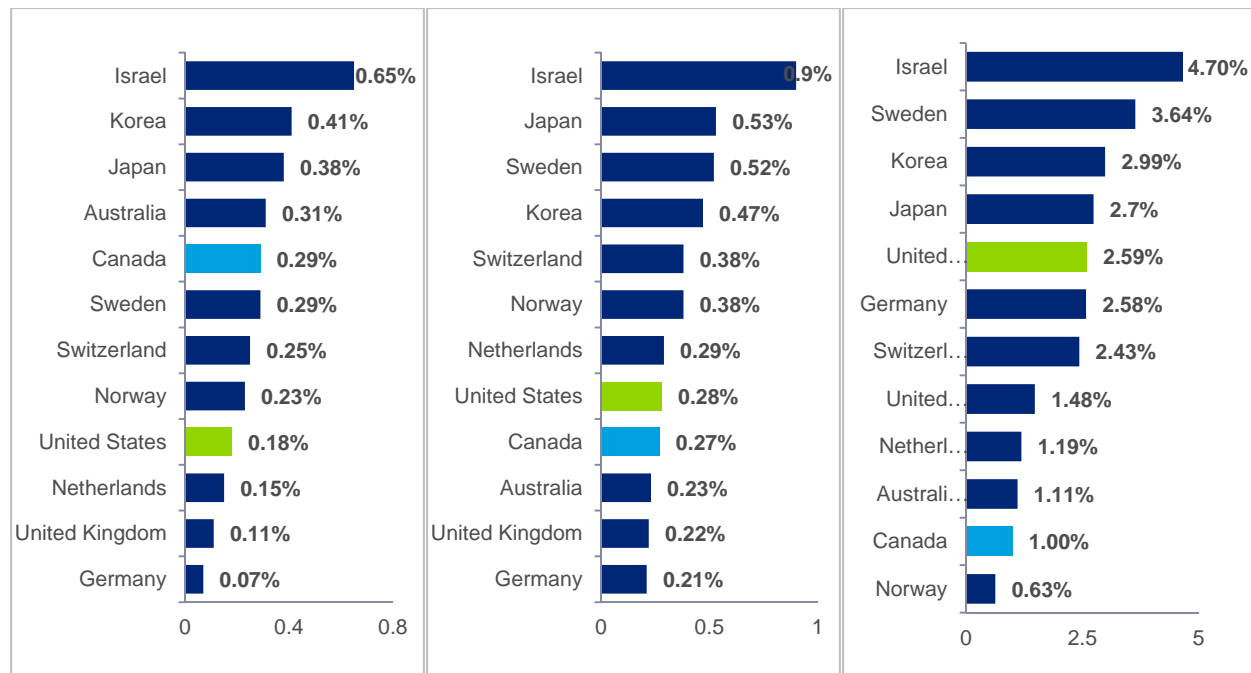
Canada and Ontario are widely recognized as under performers in innovation, as evidenced by:

- low productivity;
- limited patent output;
- under investment in technology; and
- weak performance of clustered industries.

A wide number of processes can lead to innovation, but R&D is often considered among the most important. According to Deloitte's 2011 productivity study, despite Canada's incentives program, the level of R&D conducted by the private sector remains well below the Organisation for Economic Co-operation and Development (OECD) average. In fact, Canada currently yields the lowest business expenditure in R&D per dollar of government support.

Insights into the causes of this may be visible in the propensity of firms involved in innovation to collect tax credits. While firms with over 500 employees were very likely to do so (45%), those with less than one hundred employees were not (15%). Over the past decade, the Canadian Revenue Agency has made a concerted effort to increase Scientific Research and Experimental Development (SR&ED) filings among small firms, which is believed by many to have significantly improved these figures. However, a Deloitte survey suggests that many small firms are still deterred by real or perceived complexities of the SR&ED application process. Canadian firms indicated they were much more likely to increase R&D in response to reduced application complexity than their mid-sized counterparts.

**Global Business R&D percentage of industry value added, 2007**



Source: Centre for the Study of Living Standards

Canada and Ontario are widely recognized as under performers in innovation, as evidenced by low productivity, limited patent output, under investment in technology, and weak performance of clustered industries.

The Ontario 2012 Budget references the federal activity regarding the effectiveness of encouraging innovation and R&D in Canada, specifically the SR&ED tax credit program. The Ontario Budget indicates that Ontario agrees that there are inefficiencies when it comes to the effectiveness of R&D tax credits and cites better efficiency required for provincial-federal collaboration with respect to R&D incentives.

The poor performance of Canadian private sector R&D spending is particularly troubling when considering the extensive work being done at Canadian universities in the areas of science and technology. Higher-education spending on research and development in Canada, as a percentage of GDP, is among the highest in the developed world. This contributes to Canada consistently generating more science and engineering publications per capita than many other OECD nations. Canada's poor performance in international patent intensity rankings despite strong publication credentials suggests that ideas and academic discoveries are not reaching the point of commercialization or protection, thus limiting their impact on productivity.

## Summary

Canada and the US are considered to be among the top manufacturing competitors in the world, and this is generally expected to continue in the short-term future. While the growth outlook for advanced manufacturing in North America varies according to different sources, there appears to be significant consensus on a positive, but modest growth outlook, given a number of challenges facing the sector, such as slow economic growth and soft international demand.

Both Canada and the US projected to experience similar positive industrial production growth, and the automotive industry continues to be a key contributor to North American economies, but with a modest outlook, particularly for Canada. Canada's global trade patterns are diversifying, while the US continues to be Canada's primary trading partner, the European Union and China have increased their share of trade with Canada, and other major developing economies such as Brazil, India, and Russia are becoming more important participants in trade. Canada's manufacturing sector faces a number of challenges, including significant currency fluctuations which have hindered the traditional cost advantage of Canadian manufacturing, continued volatility in oil markets, a manufacturing productivity gap relative to the US, and low levels of innovation. As a result of such challenges, there is an increasing need for Canada to adapt in the absence of labour cost competitiveness, support critical M&E and ICT investment, high growth firms, and export activity in manufacturing, and drive its ability to innovate within the manufacturing sector.

# City of Hamilton Market Strengths, Assets and Capabilities

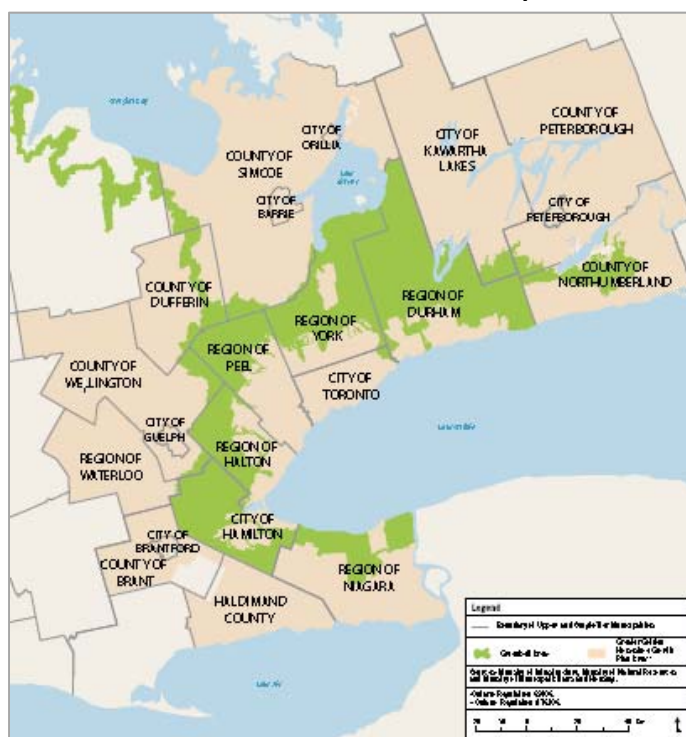
While Canada’s manufacturing sector outlook has implications across the country, some regional sectors exhibit unique advantages. The City of Hamilton in particular has a number of market strengths, assets and capabilities that make it very well-positioned to compete for advanced manufacturing investment.

## Strengths

### Located within a competitive economic region

The Greater Golden Horseshoe (“GGH”) area of southern Ontario extending west from Toronto through Hamilton to the region of Niagara is one of the fastest-growing regions in North America. It is projected that the GGH population is expected to grow from 3.7 million in 2001 to 11.5 million by 2031, accounting for over 80% of Ontario’s population growth<sup>48</sup>.

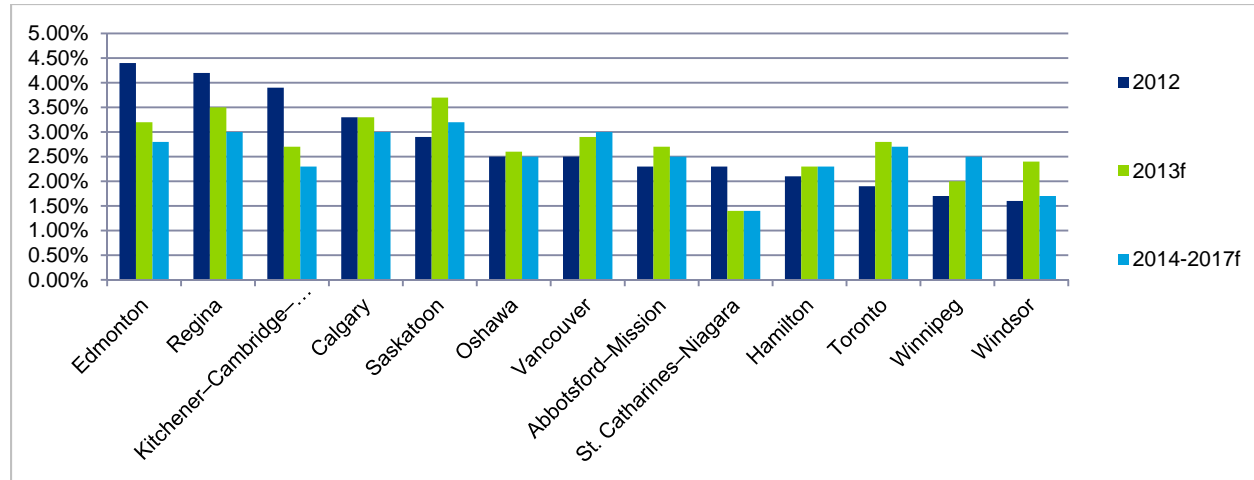
Greater Golden Horseshoe – Growth Area Map



The City of Hamilton is located at the western end of Ontario's Golden Horseshoe, in the centre of Canada's most densely populated corridor of economic activity.

In 2012 the City experienced the 10th highest GDP growth across Canadian CMAs, placing it ahead of Toronto. From 2013 to 2017, Hamilton is projected to maintain GDP growth of 2.3%.

**GDP growth – Canadian municipalities**

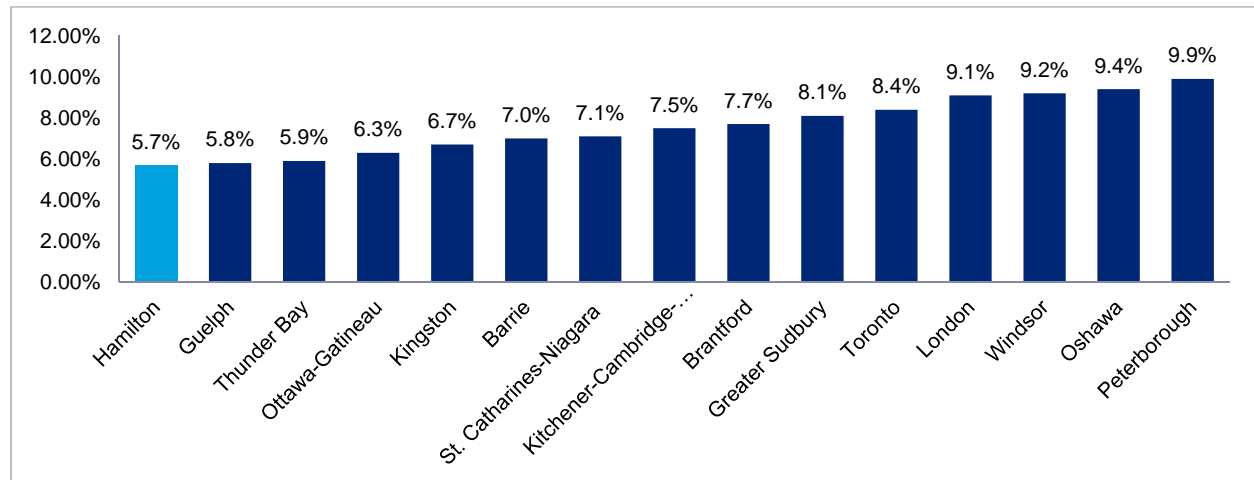


Source: Conference Board of Canada, 2013

As of March 2013, Hamilton's unemployment rate has dropped for the seventh consecutive month. According to Statistics Canada, Hamilton's unemployment rates have steadily dipped from 7.5% in July 2012 to 5.7% in February 2013, according to Statistics Canada.

In February 2013, Hamilton had the lowest unemployment rate in the province and the eighth lowest in the country. Hamilton sits well below the national unemployment rate of 7%. Many nearby municipalities have faced higher, and / or rising unemployment.

**February 2013 Unemployment Rate – Ontario Municipalities**



Source: Statistics Canada, 2013



### Expansive market access

Hamilton is strategically located, and has the capacity to reach 150 million people in major markets in Toronto, Montreal, New York, Boston, Philadelphia, Columbus, Dayton, Chicago, and Detroit. Additionally, Hamilton is located in close proximity to the GTA and other significant centres of manufacturing activity in Southern Ontario, strengthening its presence as part of a regional economy.



#### North American Market Access – Distance and Driving Time

Destination	Km	Driving Time	Destination	Km	Driving Time
Toronto	70 km	1 hour	Pittsburgh	450 km	4.5 hours
Waterloo	70 km	1 hour	Boston	830 km	8 hours
Guelph	50 km	45 min	Washington	720 km	8 hours
Ottawa	520 km	5 hours	Baltimore	680 km	7.5 hours
Montréal	610 km	6 hours	New York	730 km	11 hours
Detroit	310 km	3 hours	Chicago	775 km	7 hours
Cleveland	415 km	4 hours			

Hamilton’s location at the western end of Ontario’s Golden Horseshoe provides businesses with easy access to a network of highways, international rail lines, and the Port of Hamilton, as identified above:

- Local air connections to international destinations are close by with John C. Munro Hamilton International Airport, Lester B. Pearson International Airport in Toronto and Buffalo Niagara International Airport just across the border in New York.
- The Queen Elizabeth Way provides easy access to both the Greater Toronto Area with a regional market of over 6 million people, and Highway 401 - the Canadian link to the NAFTA super highway connecting Ontario with the I-75 serving Michigan, Ohio, Kentucky, Tennessee, Georgia and Florida and the I-90 connections to the eastern seaboard. With the U.S. border only an hour’s drive away, Hamilton is within half a day’s drive of key major urban markets in the United States.
- The Port of Hamilton is the busiest port in all of the Great Lakes, providing Hamilton’s manufacturing / advanced manufacturing businesses with extensive export opportunities.
- Canada’s two national railways, CP and CN, provide complete rail freight services across North America for Hamilton’s industries and the city has a complete highway and ring road system to move goods throughout the city quickly.

The Hamilton area also has access to major markets through GO train and VIA Rail connections.

**Industrial market accelerating**

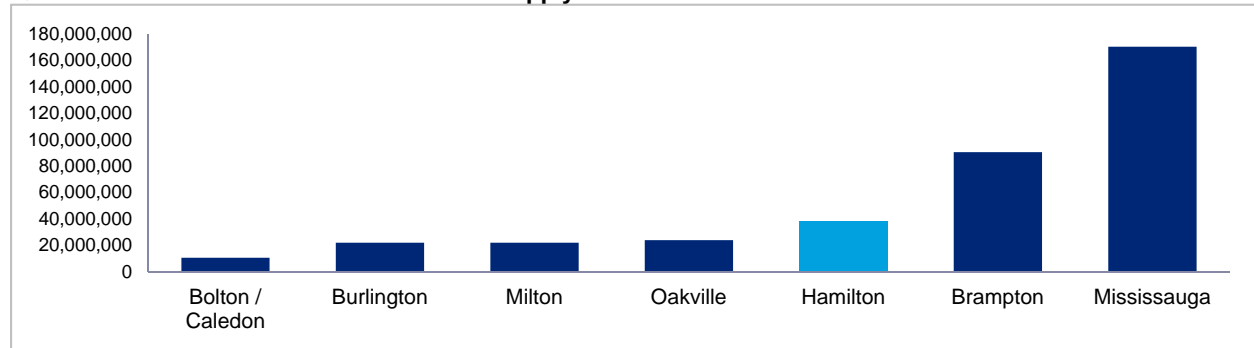
The City of Hamilton supports a strong industrial base given its significant manufacturing oriented sectors. The City's supply of industrial space totals approximately 38.1 million square feet. This inventory represents a large inventory relative to various markets in the western GTA area, including Oakville (28.3 million square feet), Burlington (22.6 million square feet), Milton (21.5 million square feet), and Bolton / Caledon (12.7 million square feet).

**Q4 2012 Hamilton Industrial Summary Statistics**

Inventory	Vacancy Rate	Under Construction	Asking Net Rent
38,093,165	2.2%	500,000	\$6.09

Source: Colliers International, 2012

**Q4 2012 Hamilton vs. GTA West Industrial Supply**

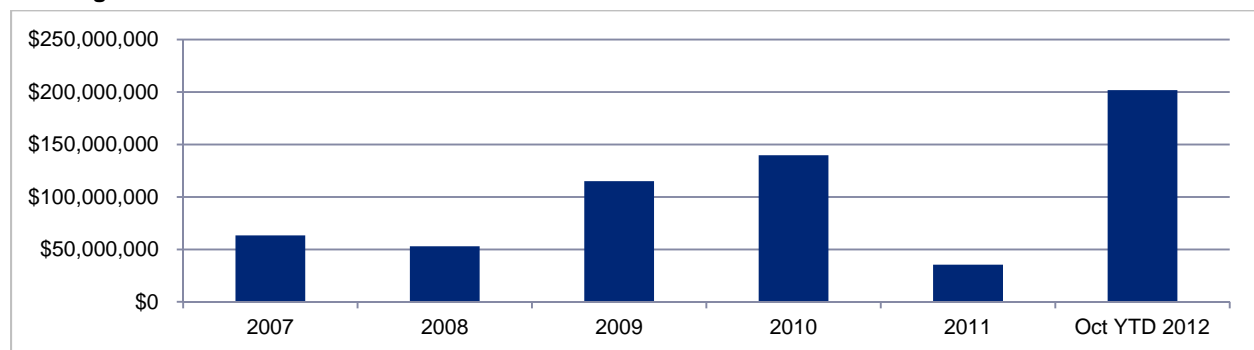


Source: Colliers International, Cushman & Wakefield, 2012

Hamilton's industrial real estate market is currently very tight, and has seen a substantial reduction in the amount of industrial space available on the market. The City's vacancy rate for industrial space was 2.2% at Q4 2012, a significant decrease from 2010 and 2011 levels, where vacancy ranged from 3.4% to nearly 7%.

At the end of 2012, approximately 500,000 square feet of industrial space was under construction, and building permit activity totaled an estimated \$200 million.

**Building Permits 2007-2012 YTD**

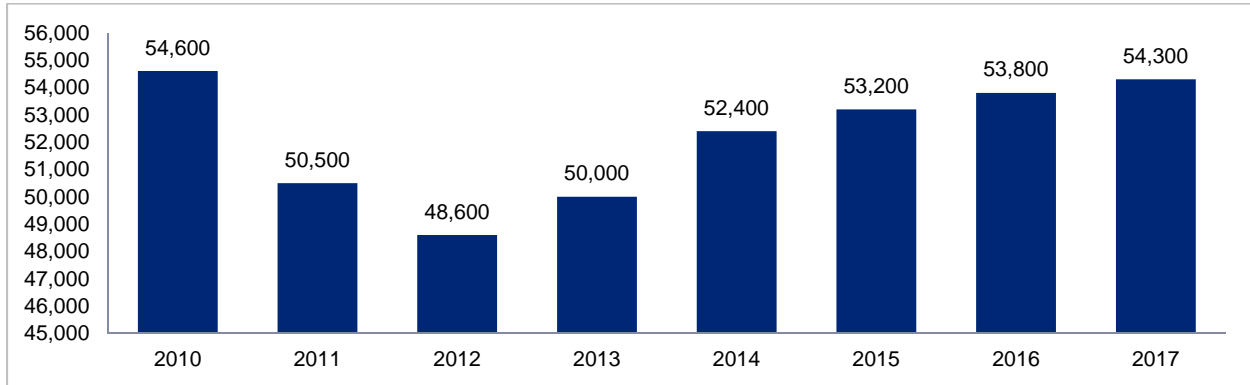


Source: Statistics Canada

### Manufacturing forecast to rebound

According to the Conference Board of Canada, manufacturing employment is projected to rebound and grow significantly in the longer term, reaching an estimated 54,300 by 2017. This forecast is largely fueled by some recovery in the steel industry, significant recent investment by Canada Bread and Maple Leaf Foods, and expansion of firms such as Bermingham Foundations Solutions, Stackpole and Columbian Chemicals.

#### Manufacturing employment growth - Hamilton

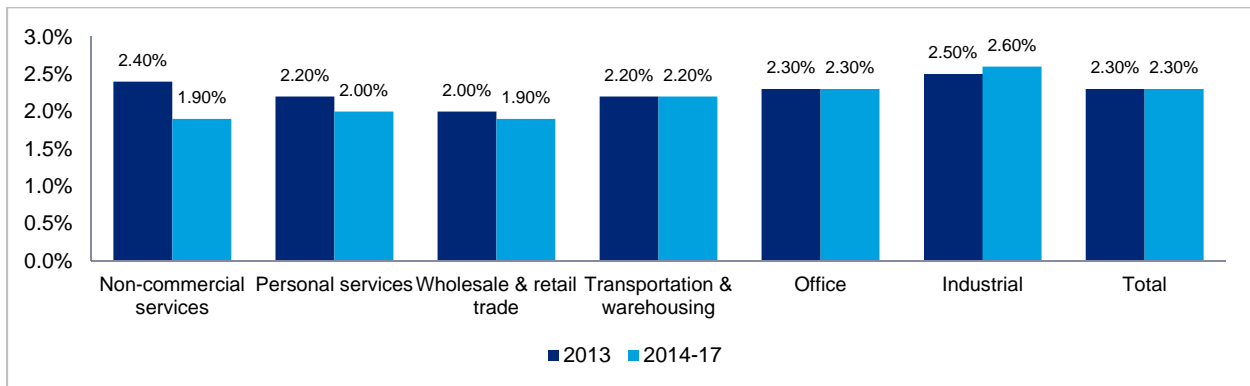


Source: Conference Board of Canada, 2012

### Positive GDP growth projected across all sectors

According to the Conference Board of Canada, industrial based GDP (which is defined to include manufacturing based activities) is projected to grow the greatest among all of Hamilton's sectors, from 2013 up to 2017.

#### GDP growth projections – by industry

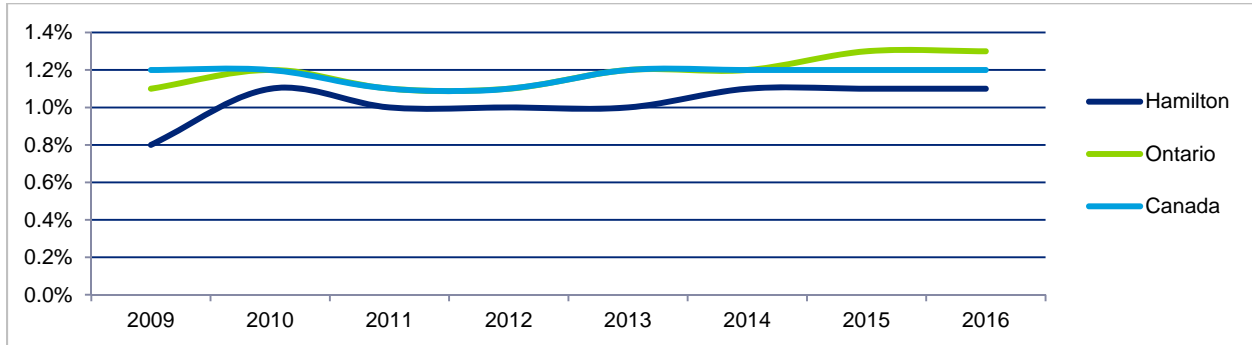


Source: Conference Board of Canada, 2012

### Longer term population and employment forecast to grow rapidly

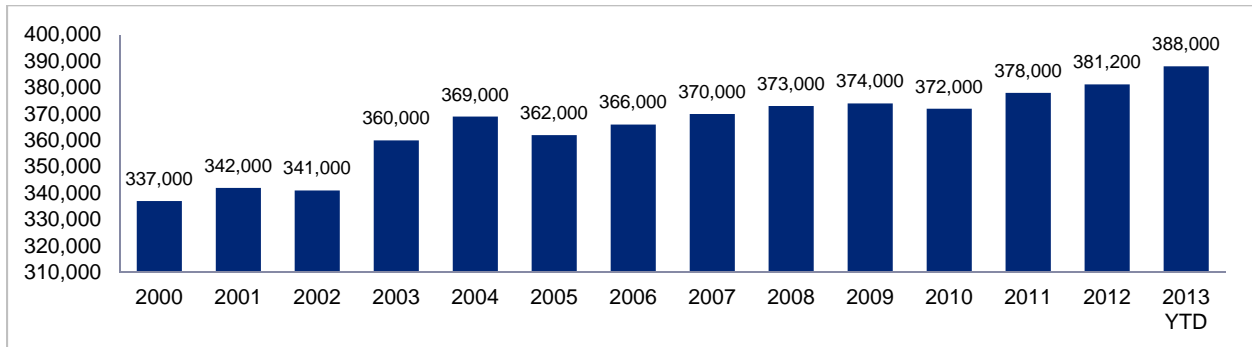
According to the Statistics Canada, the Hamilton census metropolitan area (CMA) has a current population of approximately 720,000, an increase of approximately 4% from 2006 levels. There are various reasons cited for such historical population growth, including immigration, and movement of residents from the GTA to Hamilton<sup>49</sup>. Hamilton's population is expected to continue growing at approximately 1.0% annually over the future short-term, according to Conference Board of Canada estimates.

#### Population growth – Hamilton, Ontario and Canada



Source: Conference Board of Canada, 2012

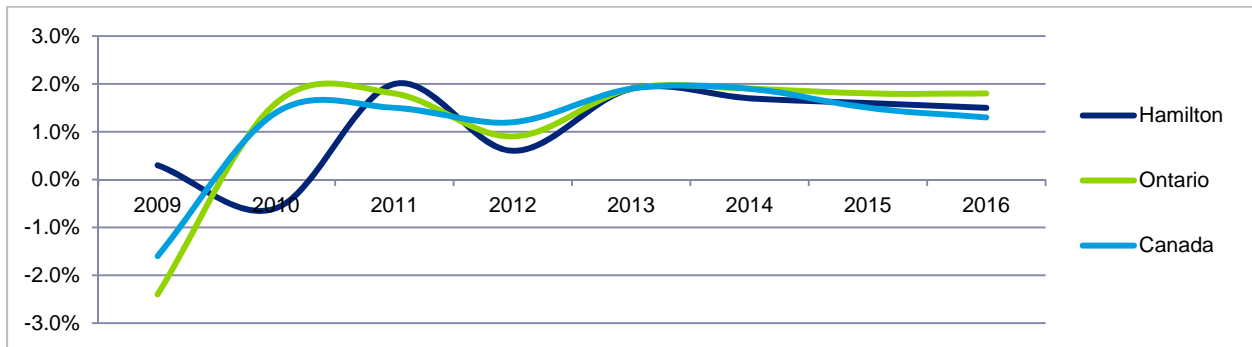
#### Hamilton Total Employment



Source: Statistics Canada, 2013

Hamilton has a current employment base of approximately 388,000, which started to stabilize in 2011, and is expected to continue to do so in the future short term.

#### Hamilton employment growth

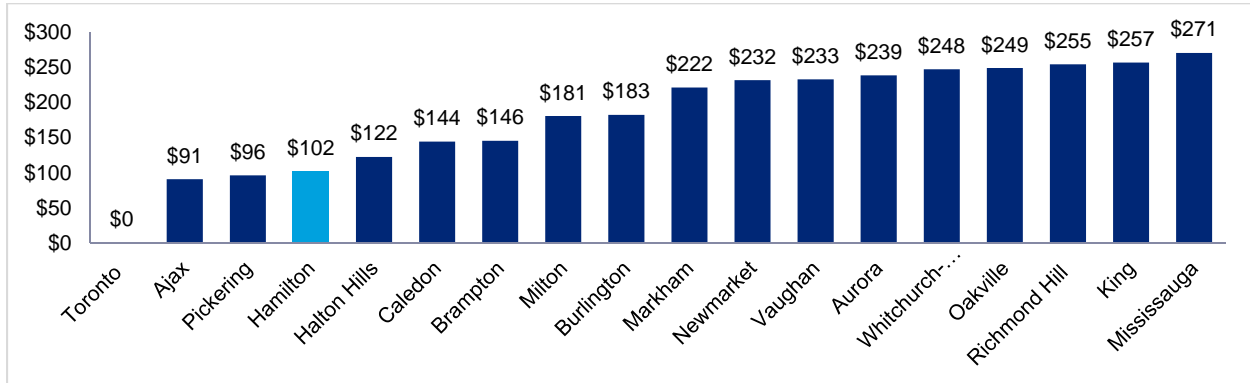


Source: Conference Board of Canada, 2012

### Relatively low competitive development costs

The City of Hamilton’s industrial development charge rates are notably lower than a number of other municipalities across the Greater Toronto Area and surrounding region, which range from having no development charge in place for industrial development, up to rates of \$271 per square metre (\$25.18 per square foot). The City’s 2012 industrial development charge rate was \$102 per square metre (\$9.48 per square foot). For new industrial development under 10,000 square feet, the City of Hamilton currently has a development charge rate of \$77 per square metre (\$7.15 per square foot).

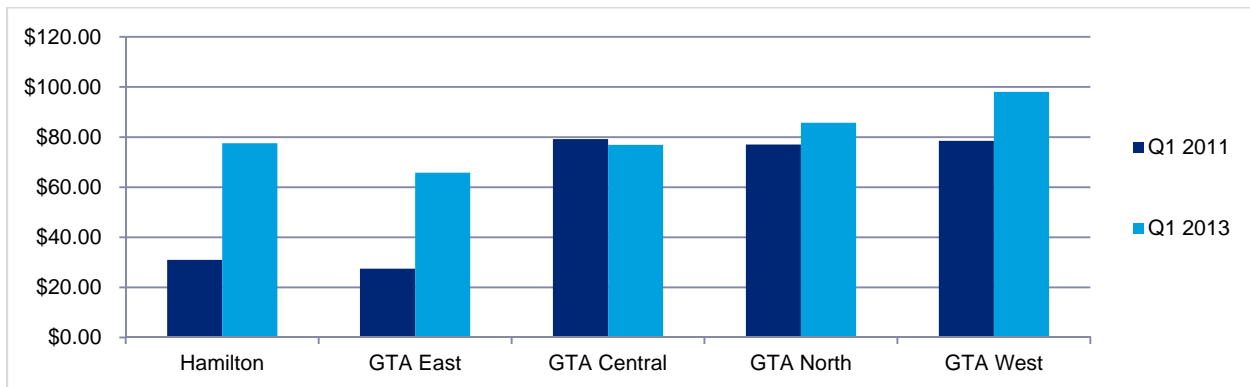
#### Industrial Development Charge Rates Per Square Metre – Various Ontario / GTA municipalities



2012 / 2013 Municipal, Regional and Board of Education Industrial Development Charge Rates  
Note: These industrial development charge rates include municipal, regional and education board development charges

Additionally, the cost of land is traditionally low relative to other parts of the Greater Toronto Area, but is on the rise. The average sales price per square foot for industrial property in Hamilton was \$30.97 per square foot (\$333.36 per square metre) in Q1 2011, and increased to \$77.54 per square foot (\$834.63 per square metre) in Q1 2013.

#### Industrial Sales Price Per Square Foot, Q1 2011 & Q1 2013



Source: Colliers International, Industrial Statistics 2011 - 2013

## Assets

### Diverse economy, sectors and major employers

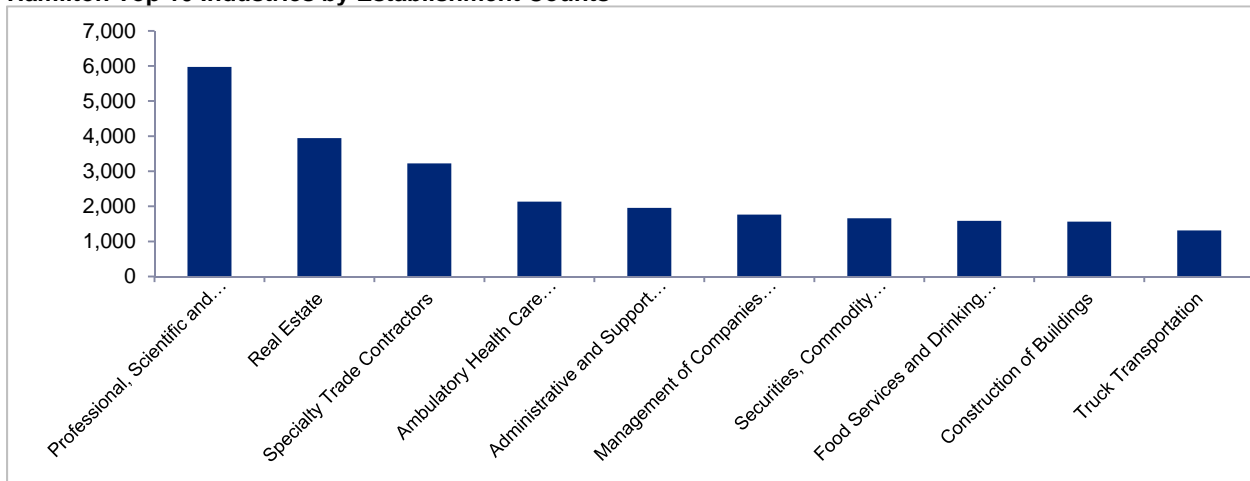
The City of Hamilton supports a diverse set of sectors and industries, including a significant existing advanced manufacturing sector, which is discussed in greater detail in a subsequent section. The City currently identifies its major sectors to include manufacturing, health care and life sciences, goods movement and agricultural related companies. Within these sectors, the City has identified six key industry clusters:

- Advanced manufacturing;
- Agri-business and food processing;
- Clean technology;
- Creative industries;
- Goods movement; and
- Life sciences.

These six industries were selected as key sectors because Hamilton has inherent strengths in each of these groups, and there is strong potential for growth in these industries. The City's current Economic Development Strategy and programs are based on growing and capitalizing on these industry clusters, some of which are described in further detail in a subsequent section.

With respect to top industries by establishment counts, Professional, Scientific and Technical Services is the largest Hamilton industry with nearly 6,000 establishments, followed by Real Estate, and Specialty Trade Contractors.

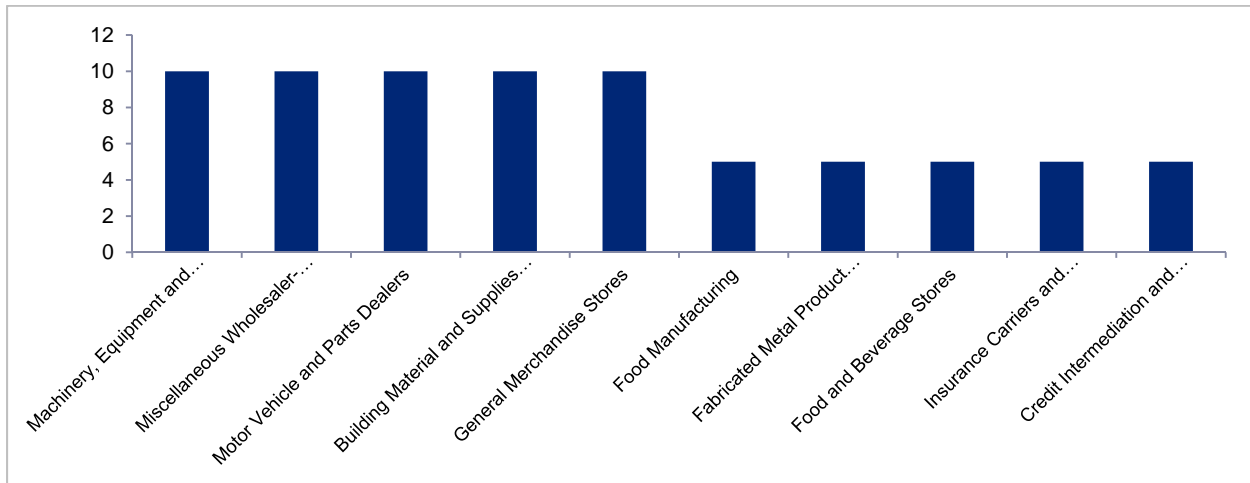
**Hamilton Top 10 Industries by Establishment Counts**



Source: Statistics Canada, Canadian Business Patterns, 2011

The highest revenue generating establishments in Hamilton are largely focused in manufacturing, including: machinery and equipment, auto, and food manufacturing.

**Hamilton Top 10 Industries by Revenue Size Range \$50 million +**



Source: Statistics Canada, Canadian Business Patterns, 2011

**Major employers focused in manufacturing, healthcare, and education**

The top ten employers in Hamilton include healthcare, education and research institutions, and manufacturing based organizations, namely in the area of steel based manufacturing. Hamilton Health Sciences is the City's largest employer with 10,000 employees, followed by McMaster University with 7,400 employees, and Hamilton-Wentworth District School Board with 7,000 employees.

**Hamilton major employees**

Organization	Employees <sup>50</sup>
Hamilton Health Sciences	10,000
McMaster University	7,400
Hamilton-Wentworth District School Board	7,000
City of Hamilton	6,000
ArcelorMittal Dofasco	5,200
Hamilton Catholic District School Board	4,500
St. Joseph Healthcare Hamilton	4,000
National Steel Car	2,500
US Steel	1,100
Mohawk College	1,100

## Established manufacturing base

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In Hamilton, more than 1,000 manufacturing companies employ an estimated 13% of the local workforce. Thousands of diverse products are manufactured in Hamilton, and sold around the world<sup>51</sup>.

Industrial manufacturing within Hamilton has for many years represented the driving force of the local economy, representing a significant provincial impact with an estimated \$12 billion annual effect or the equivalent of 4% of Ontario's GDP. An estimated 85,000 jobs are attributable to this cluster, with \$5.6 billion being generated in the local economy on an annual basis through salaries and wages. One in three of all jobs in Hamilton, or 77% of the City's goods producing sector is focused in manufacturing<sup>52</sup>.

Hamilton's manufacturing sector expanded by 2.7% in 2012, as the industry continued to recover and restructure following the 2009 global recession. Although the traditional manufacturers in the City have been affected by the combination of the severe recession, energy prices and less expensive imports, many of the City's advanced manufacturing companies have addressed such challenges through investment in capital equipment, process technology and research/innovation in order to remain competitive. Results of the City's Business Retention and Expansion Program indicate that forty-four local manufacturing companies plan to expand in the next three years.

Additionally, many of the City's advanced manufacturing organizations produce specialized products for niche markets, including industrial textiles, hydraulic systems and circuit boards. With the exception of the City's large steel manufacturers, the majority of Hamilton's Advanced Manufacturers are small and medium-sized companies with less than 50 employees. Most of them are privately owned, and export a significant percentage of their product and possess a highly skilled workforce.

The City's manufacturing sector is diverse, and the composition of its manufacturing sector has started to evolve, with significant focus in a number of advanced manufacturing sub-sectors and activities.

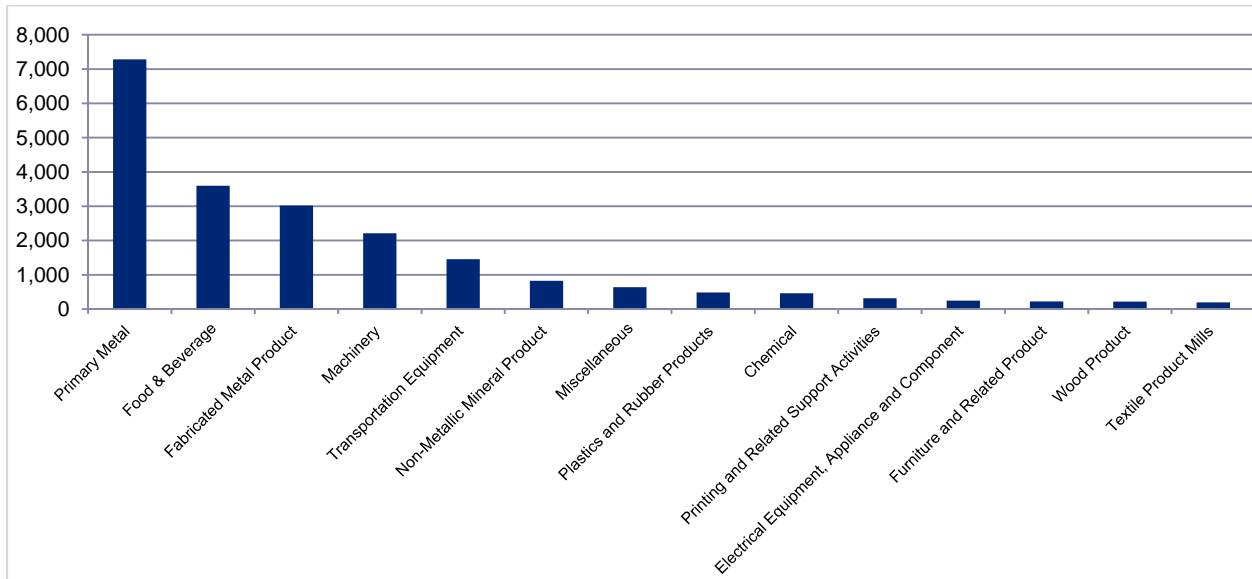
The major industries that currently dominate the City's manufacturing sector include:

- steel and steel related operations involved in fabrication and machining;
- food and beverage manufacturing;
- general and heavy manufacturing operations involved in the production of automotive parts;
- storage, warehousing and distribution;
- building products and aggregates; and
- chemicals.



According to Statistics Canada, Hamilton’s primary manufacturing based industries in terms of employment generation include primary metal, food & beverage, fabricated metal product, machinery, and transportation equipment.

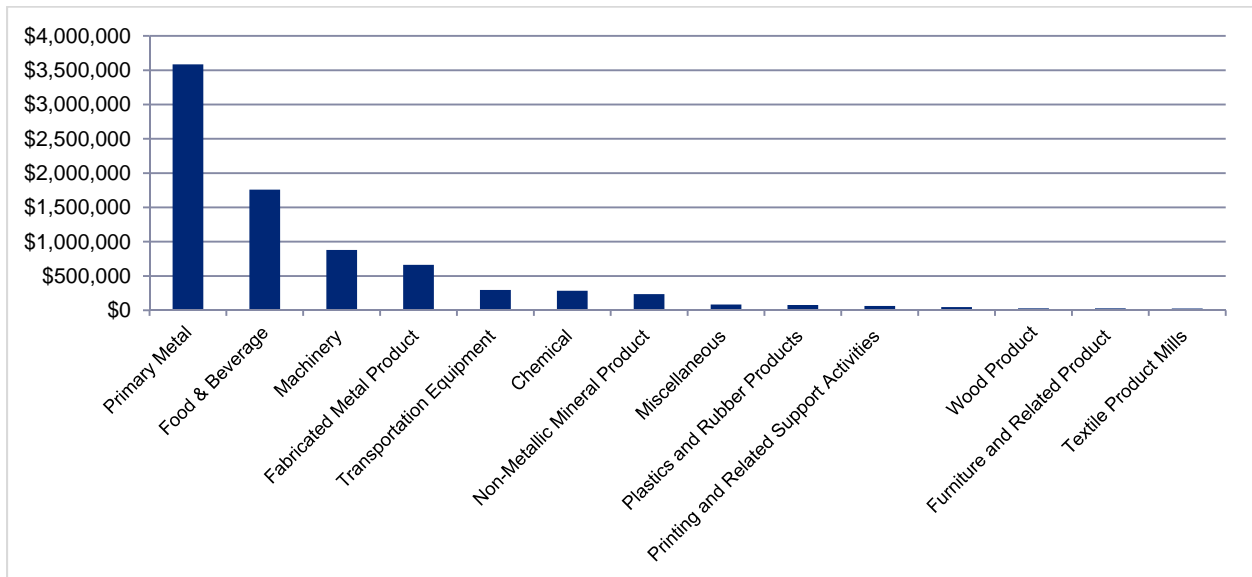
**Top Hamilton Manufacturing Industries by Employees**



Source: Statistics Canada, All Manufacturing Industries

According to Statistics Canada, Hamilton’s primary manufacturing based industries in terms of revenue generation include primary metal, food & beverage, machinery, fabricated metal product and transportation equipment.

**Top Hamilton Manufacturing Industries by Revenue (thousands)**



Source: Statistics Canada, All Manufacturing Industries

Hamilton’s manufacturing industries are explored in further detail, with respect to the City’s capabilities within advanced manufacturing, and within specific industry profiles contained within Appendices B through E.

### Strong, diverse infrastructure and transportation assets

At a global level, the infrastructure necessary to enable manufacturing to flourish and contribute to job growth will grow in importance and sophistication and be challenging for countries to develop and maintain. Reinvestment in maintaining competitive infrastructure will become critical for developed nations to keep pace. While infrastructure alone will not lead directly to best-in-class manufacturing, a serious lack of infrastructure or a steadily decaying infrastructure will negatively impact a nation’s manufacturing competitiveness and create serious obstacles for the supply chain networks of global multinationals.

The City of Hamilton is well positioned to support a robust advanced manufacturing sector, given its multifaceted infrastructure assets. Hamilton is home to a network of highways, international rail lines, the Port of Hamilton, and a top multi-modal cargo and courier airport. The Queen Elizabeth Way provides regional access to the Greater Toronto Area, and Highway 401, as well as a ring road system to move goods throughout the City quickly. Canada’s two national railways, CP and CN, provide complete rail freight services across North America for Hamilton’s industries. Hamilton’s John C. Munro International Airport is Canada’s top multi-modal cargo and courier airport and Ontario’s only 24-hour inter-modal cargo hub. The Port of Hamilton, which is situated at the western end of Lake Ontario, links Ontario’s manufacturing heartland to the St. Lawrence Seaway and has grown to be Canada’s busiest commercial Great Lakes port. The Port of Hamilton offers a full suite of state-of-the-art facilities to shippers, including terminals for dry and liquid bulk cargos, inside and outside warehousing, heavy lift cargo cranes, ro-ro berths, and container handling.

With its network of highways, international rail lines, the Port of Hamilton, and a top multi-modal cargo and courier airport, Hamilton has well-developed infrastructure which facilitates the production and movements of goods.

This network will be further well supported by the future second bridge between Windsor and Detroit, which will provide Hamilton with enhanced access to the US. This bridge is considered a much needed priority, for growing trade and traffic at the busiest Canada-US commercial border crossing, with over 8,000 trucks crossing each day. Estimates suggest the bridge could open by 2020.

From a local transportation perspective, the City has connectivity through its existing Hamilton Street Railway (“HSR”), and has plans underway for a new light rail transit (“LRT”) system, intended to provide residents with fast, accessible, reliable, and frequent service.

### Potential to provide large parcels of development land

The City of Hamilton is home to nine business parks/districts which offer a wide variety of buildings for sale or lease and vacant parcels of land for future development opportunities, totaling nearly 10,000 acres. Currently, many of these parks are largely occupied, with limited availability.

Industrial / Business Park	Gross Area (acres)
Airport Business Park/Airport Employment Growth District	735
Ancaster Business Park	660
Bayfront Industrial Area	3,700
East Hamilton Industrial Area	560
Flamborough Business Park	630
Red Hill Business Park North (formerly Mountain Business Park)	710
Red Hill Business Park South (formerly North Glanbrook Business Park)	980
Stoney Creek Business Park	1,856
West Hamilton Innovation District/McMaster Innovation Park	115

Source: City of Hamilton, Hamilton Economic Development Office

The City of Hamilton's Growth Management Division is focused on ensuring an adequate supply of "shovel ready" industrial lands, to include sites that already have the necessary designation, zoning, permits, and servicing/utility infrastructure in place. The Division is currently undertaking a comprehensive secondary and infrastructure servicing plans for the Airport Employment Growth District around the John C. Munro Hamilton International Airport.

The City also has a large supply of occupied land in its older industrial areas, some of which some consider underutilized. These areas are generally not attractive for modern industrial users but, over the long term, may become attractive to heavy industrial users, such as clean technology, chemicals or bio-fuels. The City's potential to accommodate these types of uses is a unique competitive advantage within the GTHA since many other communities actively discourage such development. .

#### Hamilton industrial business parks - Area map



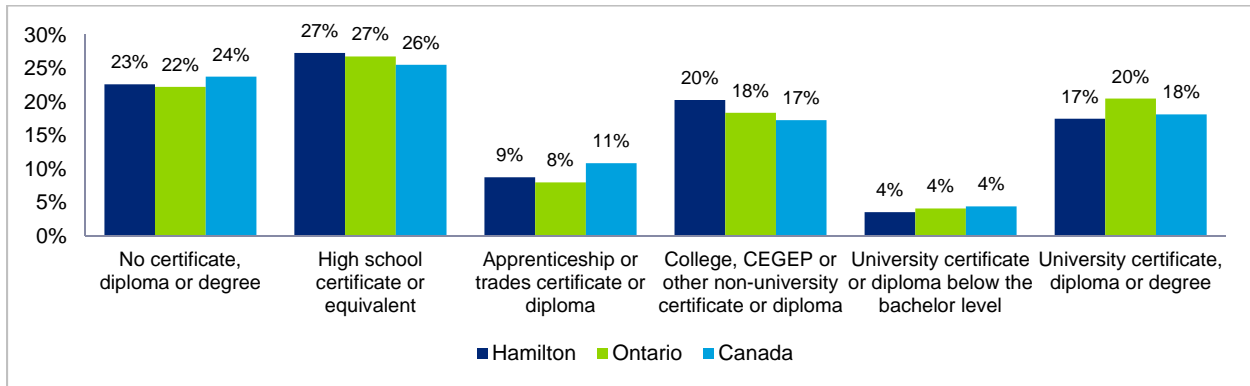
Source: City of Hamilton, Hamilton Economic Development Office

In 2012, the Real Estate Investment Network ("REIN") of Canada ranked Hamilton as the top location in which to invest in Ontario for the second consecutive year. According to REIN, "the wheels have been set in motion to create a major high-tech industrial park in conjunction with growth at McMaster University, sparking an entrepreneurial spirit in the City". "Known formerly as a hard-working steel town, the City has quickly shed this image in the eyes of potential investors – as indicated by the record breaking building permit values Hamilton has experienced in recent years."<sup>53</sup>

#### Access to talent / Strong education and research institutions

In 2010, 64% of adults in Ontario had a postsecondary credential, up from 56% in 2002 and higher than in any OECD country. The City of Hamilton has a relatively competitive educated population and workforce, with lower completion of university level education, lower levels of apprenticeship, college and university education relative to Ontario levels, but greater college or non-university level education relative to Ontario and Canada levels.

**Educational attainment – Hamilton, Ontario, Canada**



Source: Statistics Canada, 2006

Modern manufacturing is often considered to be largely based on engineering, technology, innovation and related skills, expertise and fields of study. As a result, manufacturing is critically dependent on a workforce that is trained within fields such as science, technology, engineering and math (“STEM”) <sup>54</sup>. Many experts believe that in order for Canada to remain competitive, it requires a steady pool of competent, quality employees, and the average education and performance of youth in the areas of STEM needs to improve <sup>55</sup>.

The City of Hamilton is home to a number of leading post-secondary and research institutions that have been recognized internationally for their science, technology, engineering and math related programs, research and instructional strength as well as providing local area businesses with a well-educated workforce. Such institutions include McMaster University, Mohawk College, and Redeemer University College, and these institutions form a critical support system to the City’s potential in advanced manufacturing capabilities.

**McMaster University**

Recognized among the top universities in the world <sup>56</sup>, McMaster University (“McMaster” or the “University”) provides university education to an estimated 21,000 undergraduates and 3,000 graduate students, with nearly 900 faculty members. The “McMaster Model” is a student-centred, problem-based, interdisciplinary approach to learning, and has been adopted by universities around the world. The University supports an extensive number of key STEM based faculties, departments and programs.

McMaster has a significant reputation as an innovator, and its mission is the discovery, dissemination and preservation of knowledge and is supported by its member staff and faculty.

McMaster is home to over 80 research centres, 2,000 funded research projects, and 68 Canada Research Chairs achieving research excellence in science, engineering, health sciences, humanities, and social sciences. With a total sponsored research income of \$345 million, McMaster University ranks first in the country in research intensity, a measure of research income per full-time faculty member--averaging \$308,000 per faculty member <sup>57</sup>.

In addition to its programming and research activities, the University is home to a number of institutes, parks, laboratories, etc. that are driving educational and research activities across the advanced manufacturing sector, some of which include:

- McMaster Manufacturing Research Institute** - The \$19-million McMaster Manufacturing Research Institute (“MMRI”) is one of the largest university manufacturing research institutes in Canada. The MMRI is considered one of the country’s most advanced and best equipped research laboratories, combines research excellence with state-of-the-art equipment to meet the sophisticated research and development needs of leading manufacturers. The MMRI provides a focus for high-profile research and serves as a vehicle for university-industry-government interaction.



In addition the institute promotes, encourages, and performs fundamental and applied research in cooperation with its industrial partners and provides systematic mechanisms for technology transfer and infusion of knowledge and research results.

The MMRI consists of the following six key research labs:

- Centre for Advanced Polymer Processing & Design (CAPPA-D);
- Machine Systems Research Laboratory (MSL);
- Metal Forming Laboratory (MFL);
- Micro Manufacturing Laboratory (MML);
- Robotics and Manufacturing Automation Research (RMAL); and
- Thermal Processing Laboratory (TPL).



**McMaster Innovation Park** – The McMaster Innovation Park (“MIP”) has started its development of a LEED certified research park, planned to provide over 1.7 million square feet of office, research and amenity space for the envisioned 3,000 park occupants. The McMaster Innovation Park is intended to house laboratory, office, teaching, training, and conference facilities, in support of research and development in a number of key industrial areas: advanced manufacturing and materials, nanotechnology, bio-technology, and other areas in which McMaster University has recognized research strengths. Currently, the MIP has two operating buildings - the Atrium@MIP and the CANMET Materials building, with the state of the art, world renown McMaster Automotive Resource Centre (“MARC”) building and Life Sciences building under development. As of now, the completed buildings offer an estimated 330,000 square feet of space, employing over 500 people working for the 30+ park tenants. Current tenants include a variety of public sector agencies, non-profit organizations, law firms, and start-ups.

- **CANMET Materials Technology Laboratory** – Hamilton's role as a leader in developing state-of-the-art steels, metals, alloys, and materials is well supported by the CANMET Materials Technology Laboratory (CANMET-MTL), located at McMaster Innovation Park. Materials researchers in the Faculty of Engineering at McMaster are expected to significantly increase their collaborations with CANMET-MTL, a \$40-million, 145,000 square-foot complex which includes facilities for casting, rolling and forming metal, and designing and testing new materials. Other materials related research centres at McMaster include the Brockhouse Institute for Materials Research, the Initiative for Automotive Manufacturing Innovation, the McMaster Steel Research Centre, and the McMaster Manufacturing Research Institute. According to CANMET-MTL, its "facilities are used by university researchers through CANMET-MTL's academic access program, which is supported by a grant from the Natural Sciences and Engineering Research Council. The program has supported 64 research projects from 18 universities across Canada, and its relocation to Hamilton will expand the number of students and professors who can access MTL's unique metallurgical processing facilities and gain valuable, industrially relevant experience using the centre's facilities."
- **McMaster Institute for Automotive Research and Technology** – The McMaster Institute for Automotive Research and Technology (“MacAUTO”) is the newly established coordinating body for automotive research and education at McMaster University. The University's numerous automotive-related research institutes and centres work with industry, government and academic partners in developing and commercializing new technologies and materials that will ensure the global competitiveness of Canada's auto industry. MacAUTO is also educating a new generation of professionals ideally suited to understanding real-world issues and implementing innovative solutions. Automotive research at McMaster University encompasses an expanding cluster of knowledge and expertise. More than 75 researchers in engineering, science, business and other faculties are involved in initiatives valued at over \$100 million in programs and infrastructure. Research programs range from the testing of hybrid power systems to developing corrosion- resistant coatings, from optimization of transportation and logistics systems to the impact of pollution on our environment, from creating software and simulation programs to understanding visual attention and motion perception.





- **McMaster-Mohawk Bachelor of Technology Partnership** - McMaster University's Faculty of Engineering and Mohawk College's School of Engineering Technology have partnered to establish the Bachelor of Technology degree program in response to the needs of today's innovation-based organizations. Upon graduation, students receive a Bachelor of Technology degree from McMaster University and an advanced diploma from Mohawk College. Industry partners to this program include ArcelorMittal Dofasco, GE Canada, and Linamar Corp.

**Bachelor of Technology**  
McMaster-Mohawk Partnership



- **McMaster Biointerfaces Institute** - McMaster University officially opened its Biointerfaces Institute, Canada's first and only facility for developing unique new surfaces, using high-speed robots and other leading-edge technology. This facility will enable a fresh approach to developing materials for real-world problems such as hospital doorknobs that can repel bacteria, bandages that can heal wounds, home test kits for cholesterol and contact lenses that rarely need changing.<sup>58</sup> The \$22-million Institute was funded by the Canadian Foundation for Innovation and Ontario's Ministry of Research and Innovation, with support from industry partners.

## Mohawk College

Mohawk College ("Mohawk" or the "College") provides post-secondary education in five faculties, including applied arts, business, engineering technology, health sciences, and human services and continuing education, to 11,500 full-time students, 4,000 apprentices, 400 international students and 42,000 continuing education students<sup>59</sup>.

Mohawk College offers over 100 post-secondary programs and 22 apprenticeship / skill trades programs, and based on the Mohawk's 2010 / 2011 Graduate Employment Report, there are potentially 1,250 annual graduates in STEM associated programs. Additionally, according to key performance indicators tracked by the Ministry of Training, Colleges and Universities (MTCU) and the colleges of applied arts and technology, Mohawk achieved the highest overall student satisfaction score among Greater Toronto and Hamilton Area (GTHA) colleges in 2011 and 2012.

To further improve the quality of education and overall college experience for Mohawk students, the college initiated its largest ever campus renewal project. More than \$5.7 million was donated in support of the Fennell Campus renewal project in 2011-12, exceeding the fundraising target of \$4.4 million.

In addition to its programming and research activities, Mohawk College is home to a number of key programs that are driving training activities across the advanced manufacturing sector, including:

- **iDeaWORKS** - iDeaWORKS is Mohawk College's project centre based on partnerships between Mohawk students and start-ups, small businesses and non-profit organizations. These groups work together on the design, development, testing and commercialization of new products and technologies, spanning across a range of sectors. Areas of focus include web and software development, advanced materials, energy, and robotics. iDeaWORKS also specializes in eHealth projects, that are related to developing functional prototypes and tools for electronic health record systems - and mHealth, the use of mobile technology to support healthcare delivery (more).
- **ArcelorMittal and Mohawk College Enterprise Corporation's Steel Worker for the Future Program** – ArcelorMittal and Mohawk College Enterprise Corporation's ("MCE") Steel Worker for the Future Program is based on the changes and advancements in the steel industry, and resulting need for technologically advanced training and skills. The program involves a 2½-year program, including 4 semesters of classroom training at a participating school, and 24 weeks of on-site training at ArcelorMittal, leading to an Associate of Applied Science degree as either a mechanical or an electrical technician. This program has received widespread recognition as a feeder program into the US, including recognition by Fortune Magazine and the Gates Foundation as a strong business college partnership<sup>60</sup>.



- **Mohawk College Enterprise Corporation's Advanced Manufacturing Workshop Series** – Mohawk College Enterprise Corporation ("MCE") has introduced a series of advanced manufacturing / lean manufacturing workshops, in partnership with the Excellence in Manufacturing Consortium ("EMC").

### Available networks and innovation infrastructure

In addition to McMaster University and Mohawk College, the City of Hamilton has access to a range of critical advanced manufacturing industry networks across Canada, Ontario and the City, some of which are identified below.

#### Canadian Manufacturers & Exporters (CME)

Canadian Manufacturers & Exporters (CME) is Canada's largest industry and trade association, representing businesses in all sectors of manufacturing and exporting activity across Canada. CME's mandate is to promote the competitiveness of Canadian manufacturers and the success of Canada's goods and services exporters in markets around the world. Key issues of focus include manufacturing competitiveness, US business opportunities, international markets, people and skills, energy and the environment.

CME's members are comprised of Canada's leading manufacturing and exporting businesses, accounting for an estimated 82% of Canada's manufacturing production and 90% of Canadian goods and services exports. While CME's membership includes many of Canada's largest businesses, more than 85% of members are small and mid-sized enterprises, similar to Hamilton's advanced manufacturing sector composition. Through its partnerships with other associations, CME's network extends to more than 100,000 companies engaged in manufacturing, global business and service-related industries.

#### Excellence in Manufacturing Consortium (EMC)

Excellence in Manufacturing Consortium (EMC) has grown to become Canada's largest manufacturing consortium and with over 1,000 hands-on industry events annually. EMC is a unique not-for-profit organization dedicated to helping manufacturers grow and become more competitive.

Founded in the mid-1980's and incorporated in 1997, EMC is responsible for contributing significant knowledge, expertise and industry resources towards the success of nearly 1,000 member manufacturers, employing hundreds of thousands of Canadians, in over 50 consortium regions and spanning more than 450 communities in Ontario and Atlantic Canada.

EMC offers members a broad range of services and programs to help them become more competitive, including online manufacturing networks, continuous improvement and sharing of ideas and best practices. Their investment is returned in lower costs, better opportunities to compete for business and lower stress in dealing with the day-to-day complexities of running a manufacturing operation.

#### Innovation Factory

Located in Hamilton, within McMaster University's Innovation Park and networked across North America, Innovation Factory is a not-for-profit Regional Innovation Centre ("RIC") funded by the Ontario Network of Excellence ("ONE"). Innovation Factory's mission is to strengthen Greater Hamilton's next generation of job and wealth creation by helping entrepreneurs bring new ideas to life and to market, SMEs progress to the next level and Hamilton build a dynamic culture and a community of innovation, in the areas of:

- Advanced manufacturing;
- Advanced materials and engineering;
- Cleantech;
- Information technology, communications and entertainment;
- Life sciences and health care; and
- Social innovations.

To meet the challenges of progressing SMEs, Innovation Factory has developed various acceleration programs, including LiFT, a series of programs and consulting services specifically designed for senior executives to meet the challenges of a global market. The LiFT program is designed to help identify the challenges within current growth stages and scope of growth, and then build a tailored innovation assessment. The LiFT program provides access to industry experts, programs, and other resources to overcome the obstacles you face in each stage of development. Additionally, Innovation Factory's Flight Program, was developed by entrepreneurs for new entrepreneurs, designed to accelerate the progress of start-up businesses across the various stages of design and launch.

### **Hamilton Hive**

Through a greater community effort that has involved a partnership amongst the City of Hamilton, the Chambers of Commerce, and institutional and private sector partners, a new focus has been placed on attracting and retaining the next generation of workers for Hamilton. The mission of the Hamilton Hive is to provide an all-in-one, up-to-date resource for young professionals from across the economic landscape that are looking to start or advance their career and life in Hamilton and to assist in building young professional networks in Hamilton, including creative industries, life sciences, advanced manufacturing, agriculture, etc.

### **Golden Horseshoe Manufacturing Network (GHMN)**

The Golden Horseshoe Manufacturing Network is a partnership of industry, universities, colleges, economic development offices and industry associations. The network harnesses activities and resources of all the partners to advance manufacturing in the regions of Hamilton, Halton and Niagara.

### **Quality of life factors and relatively inexpensive housing**

The City of Hamilton is a large city that is considered to be livable, relatively affordable, and safe, with strong access to transportation networks, education, healthcare, arts, culture and recreation opportunities. Physically defined by unique geographical features such as the Niagara Escarpment and Hamilton Harbour, the municipality has a broad mix of urban centres and sprawling farmland. With a wide range of museums, libraries, entertainment venues, recreational facilities, parks and conservations areas, the City of Hamilton offers residents and entrepreneurs a place to start a business, raise and family and grow within the community. Its neighbourhoods offer local shopping areas, restaurants, parks, schools, recreation, natural areas, Lake Ontario, and other amenities. The central core also offers amenities such as Copps Colliseum for performances and professional sports, the Art Gallery of Hamilton, the Convention Centre, Bayfront Park, and the Farmers' Market.

Hamilton has a variety of housing options include condominiums in the central core, to original brownstones near the Bay, townhomes and single family homes in smaller communities such as Dundas, Ancaster, Waterdown and Stoney Creek, and rural living in the rolling countryside of Flamborough and Glanbrook. On average, housing in Hamilton is more affordable than in the GTA. According to the Canada Mortgage and Housing Corporation, the average 2012 MLS price of a home was approximately \$360,000 in Hamilton, significantly lower than the average of nearly \$500,000 in Toronto. This price differential appears to be driving a growth in GTA residents relocating to Hamilton. According to a local real estate broker, in 2012 nearly one-in-five clients were from Toronto<sup>61</sup>. The quality of life drivers noted above are considered to supplement housing affordability and this potential trend of movement from Toronto to Hamilton.



### Hamilton's established position within regional advanced manufacturing cluster

Hamilton's advanced manufacturing cluster is a component of a much larger advanced manufacturing provincial and regional cluster of manufacturing sector activity and supporting service industries across southwestern Ontario. Such a regional advanced manufacturing based presence results in widespread benefits as new organizations locate in the region, and start to potentially source inputs from Hamilton.

The following table profiles some of Ontario's largest industries, including applications / sectors, revenue, employment, characteristics and the presence of significant firms.

#### Ontario's Leading Sectors / Industries

Industry	Sample Applications / Sectors	Revenue (billions)	Employment	Key Characteristics
<b>Materials &amp; Machinery</b>	<ul style="list-style-type: none"> <li>• Materials</li> <li>• Machinery</li> <li>• Robotics</li> <li>• Automation</li> <li>• Lean manufacturing</li> </ul>	\$40.0	100,000+	<ul style="list-style-type: none"> <li>• Includes businesses that supply raw materials and components, advanced engineering capabilities, advanced materials and manufacturing processes, packaging, transportation, logistics expertise, legal and financial expertise</li> <li>• Canada's manufacturing costs, for a precision component manufacturing operation, are considered competitive, due in large part to lower energy and operating costs in Ontario</li> </ul>
<b>Automotive</b>	<ul style="list-style-type: none"> <li>• Materials and manufacturing</li> <li>• Powertrain components and systems</li> <li>• Fuels and emissions</li> <li>• Design processes</li> <li>• Intelligent systems and sensors</li> <li>• Photonics and intelligent highway systems</li> </ul>	\$68.5	100,000+	<ul style="list-style-type: none"> <li>• 12 assembly plants operated by five of the world's top automakers</li> <li>• 350+ parts manufacturers</li> <li>• 2.06 million vehicles in 2010</li> <li>• Assemblers and parts manufacturers &gt; \$10 billion in last 8-10 years</li> <li>• Toyota making \$545 million investment to make its plants in Woodstock and Cambridge more efficient and environmentally friendly</li> <li>• \$100 million+ investment by GM</li> </ul>
<b>Environment / Clean tech</b>	<ul style="list-style-type: none"> <li>• Water and wastewater treatment</li> <li>• Industrial and hazardous waste treatment</li> <li>• Solid waste management and recycling</li> <li>• Air pollution monitoring and control</li> <li>• Instrumentation and monitoring equipment</li> <li>• Environmental software and consulting services</li> <li>• Site remediation and brownfield redevelopment</li> <li>• Energy conservation</li> </ul>	n/a	50,000+	<ul style="list-style-type: none"> <li>• 2,400 companies</li> <li>• 62,000 employees</li> <li>• 40% of Canada's environment industry revenues</li> </ul>
<b>Aerospace</b>	<ul style="list-style-type: none"> <li>• Commercial, business and special-purpose aircraft;</li> <li>• Unmanned aerial vehicles;</li> <li>• Structural components</li> <li>• Satellite sub-systems</li> <li>• Flight simulators</li> <li>• Optical/visual systems</li> <li>• Electronic systems</li> <li>• Landing gear</li> <li>• Avionics</li> </ul>	\$6.5	25,000+	<ul style="list-style-type: none"> <li>• 400 firms in Ontario, 200 firms in Southwestern Ontario</li> <li>• 30 specialized research centres</li> <li>• 100 aerospace programs</li> <li>• Bombardier's Q400 series regional aircraft is assembled in Toronto</li> </ul>
<b>Food and Beverage Processing / Manufacturing</b>	<ul style="list-style-type: none"> <li>• Primary processing</li> <li>• Ingredients manufacturing</li> <li>• Specialty importers</li> <li>• Value-added processing</li> </ul>	\$32.0	100,000+	<ul style="list-style-type: none"> <li>• 200 agricultural commodities</li> <li>• 3rd largest food processing jurisdiction in North America</li> <li>• Maple Leaf Foods investing \$560 million to streamline distribution and improve efficiency</li> </ul>

Industry	Sample Applications / Sectors	Revenue (billions)	Employment	Key Characteristics
<b>Life Sciences</b>	<ul style="list-style-type: none"> <li>• Pharmaceuticals</li> <li>• Biotechnology</li> <li>• Advanced medical technologies</li> <li>• Research</li> <li>• Biomedical manufacturing.</li> </ul>	\$10.0	20,000+	<ul style="list-style-type: none"> <li>• 125+ companies</li> <li>• R&amp;D expenditures of \$1.3 billion</li> </ul>
<b>Information Technologies</b>	<ul style="list-style-type: none"> <li>• Information and communication technology</li> <li>• Software and systems developers</li> <li>• Wireless and telecommunications</li> <li>• Microelectronics</li> <li>• Digital media</li> <li>• Animation and special effects</li> <li>• E-Health</li> <li>• Security software</li> <li>• Green IT</li> </ul>	\$100.0	250,000+	<ul style="list-style-type: none"> <li>• Maryland-based Ciena investing \$900 million to expand R&amp;D operations</li> <li>• Advanced Micro Devices (AMD) investing \$375 million+</li> <li>• Gaming giant Ubisoft investing \$500+ million</li> </ul>

Source: Ontario.ca, Ministry of Economic Development & Innovation, Business Sector Strategy, Information and Communications Technology

## Capabilities

Within Ontario's leading sectors and industries, the City of Hamilton's advanced manufacturing sector plays a critical role across key advanced manufacturing industries, including the established industries of materials / metal / steel manufacturing, food and beverage manufacturing, machinery and automotive equipment. In addition, the City's has significant emerging opportunities within its advanced manufacturing capabilities, particularly within the areas of clean technology manufacturing and life science manufacturing.

## Materials / metal / steel manufacturing

### Industry trends

Steel is the most widely used metal and most recycled material worldwide, used in construction, manufacturing and automotive parts and assemblies<sup>62</sup>. Total world steel production grew by 1.2 % in 2012, with over 1.5 billion tonnes of crude steel produced. The World Steel Association notes that sector growth in 2012 is largely attributed to Asia and North America. Canada possesses a broad steel technology cluster of steel producers, customers, and suppliers, comprising an estimated 106 firms nationally, largely focused in central Canada.

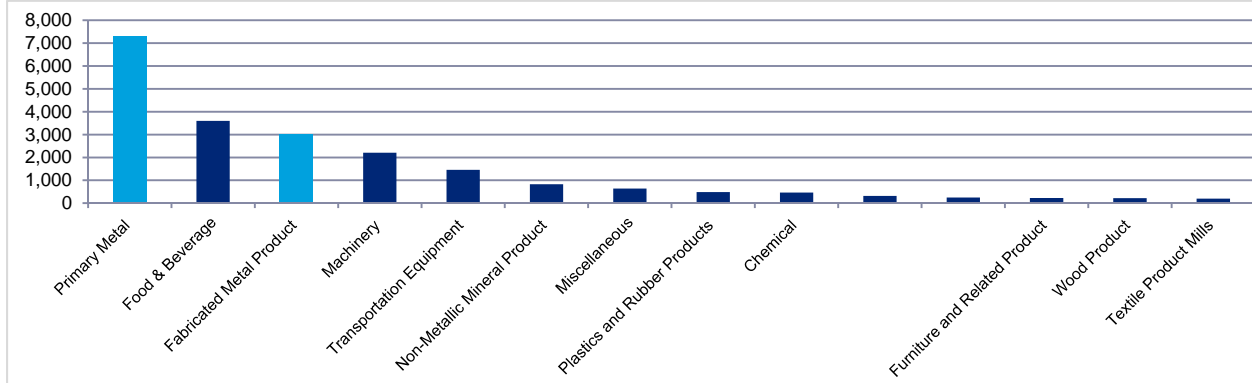
According to the Canadian Steel Producers Association, Canada produced 13 million tonnes of steel in 2010, with estimated sales of \$12 to \$14 billion, and nearly \$7 billion in exports. A 2010 study conducted by University of Toronto's Munk Centre for International Studies, finds that the Canadian industry supports over 130,000 direct and indirect jobs in Canada, and as is the case in Hamilton, forms major employers in many communities with significant local economic impacts. Canada maintained its position as the 16th largest steel producer, with total production growth of 5.9% in 2012, outpacing the US (2.5%) and Mexico (0.9%). Production in 2012 totaled 13.7 million tonnes of crude steel, and while Canada's production is up, these levels are well below the prerecession total of 15.6 million tonnes in 2007.

The Canadian primary metal industry is primarily focused in Quebec, which accounts for approximately 45% of national revenue, followed by Ontario accounting for 37% of national revenue. The Canadian fabricated metal product industry is primarily focused in Ontario which accounts for approximately 46% of national revenue.

The City of Hamilton significantly supports this broader provincial and national sector with its robust primary metal manufacturing industry, largely driven by its significant multinational steel manufacturing / producing companies (i.e. ArcelorMittal Dofasco, Max Aicher, US Steel), as well as substantial fabricated metal product manufacturing. According to Statistics Canada, Hamilton's largest manufacturing industry is primary metal manufacturing alone, with fabricated metal product manufacturing comprising the third largest manufacturing industry.

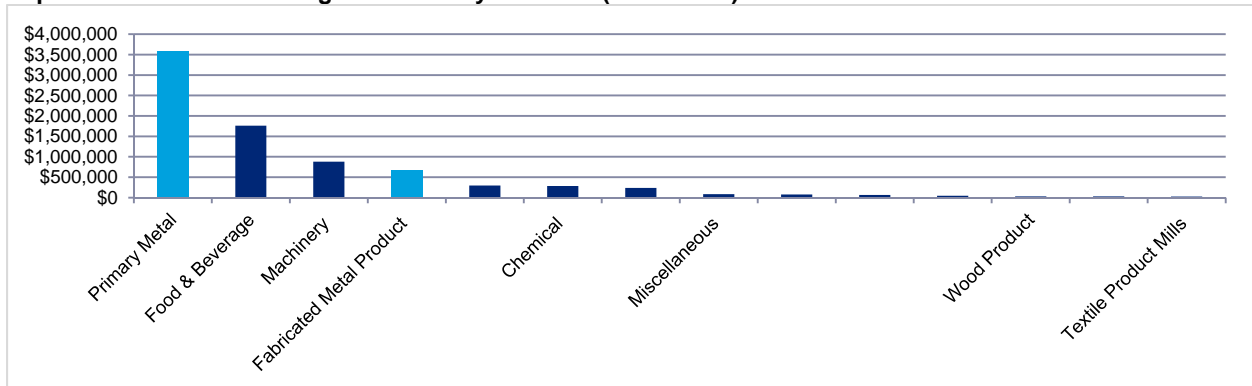
Steel is a core industry with significant impact to multiple advanced manufacturing industries and clusters, as is the case in the City of Hamilton, with significant fabricated metal, machinery and automotive equipment manufacturing industries linked to the City's significant steel industry base. Such industrial clusters have developed to minimize transportation costs and maximize collaboration, including technology and integration of supply chain relationships.

**Top Hamilton Manufacturing Industries by Employees**



Source: Statistics Canada, All Manufacturing Industries

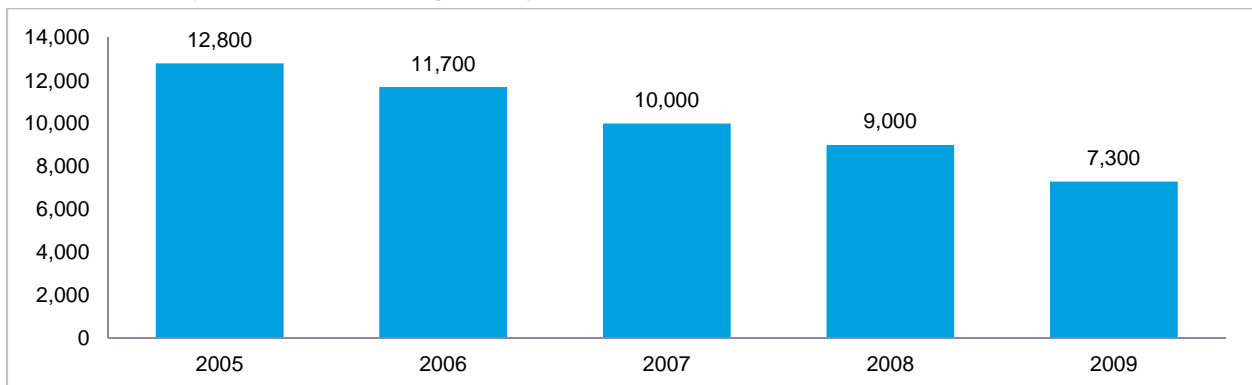
**Top Hamilton Manufacturing Industries by Revenue (thousands)**



Source: Statistics Canada, All Manufacturing Industries

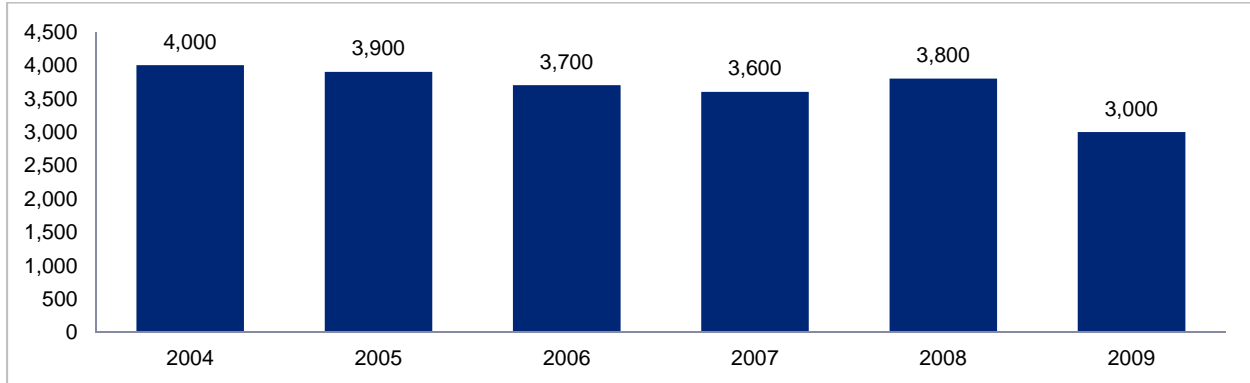
According to Statistics Canada, in 2009 the City had 10,300 employees engaged in primary and metal product manufacturing, with 7,300 employees engaged in the primary metal manufacturing and 3,000 employees engaged in fabricated metal manufacturing. This employment represented approximately 30% of Ontario's primary metal manufacturing employment, and 5% of Ontario's fabricated metal product manufacturing employment.

**Hamilton Primary Metal Manufacturing Employees**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

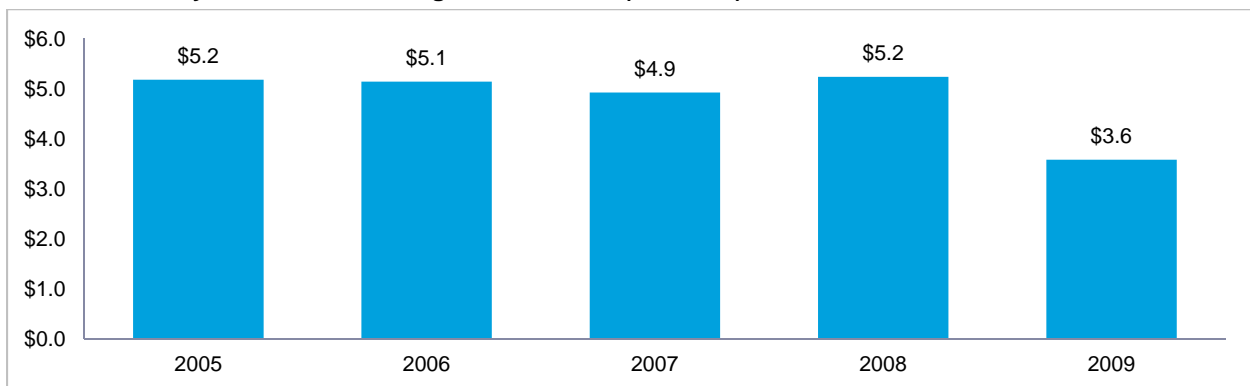
**Hamilton Fabricated Metal Product Manufacturing Employees**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

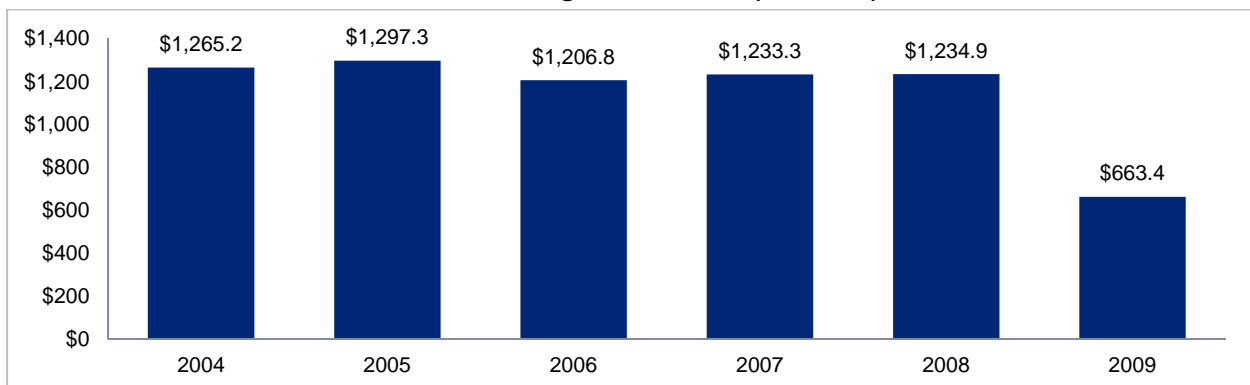
The City's primary and metal product manufacturing industries generated approximately \$3.6 billion in primary metal manufacturing, and \$663 million in fabricated metal product manufacturing. Industry revenue represented approximately 27% of Ontario's primary metal manufacturing revenue, and 5% of Ontario's fabricated metal product manufacturing revenue.

**Hamilton Primary Metal Manufacturing Total Revenue (\$ billions)**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Hamilton Fabricated Metal Product Manufacturing Total Revenue (\$ millions)**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Materials / metal / steel manufacturing fact sheet summary**

**Primary Metal Manufacturing**

Revenue (2009)	\$3.6 B
Revenue share of Ontario	27.0%
Employment (2009)	7,300
Employment share of Ontario	30.0%

**Fabricated Metal Product Manufacturing**

Revenue (2009)	\$663 M
Revenue share of Ontario	5.0%
Employment (2009)	3,000
Employment share of Ontario	5.0%

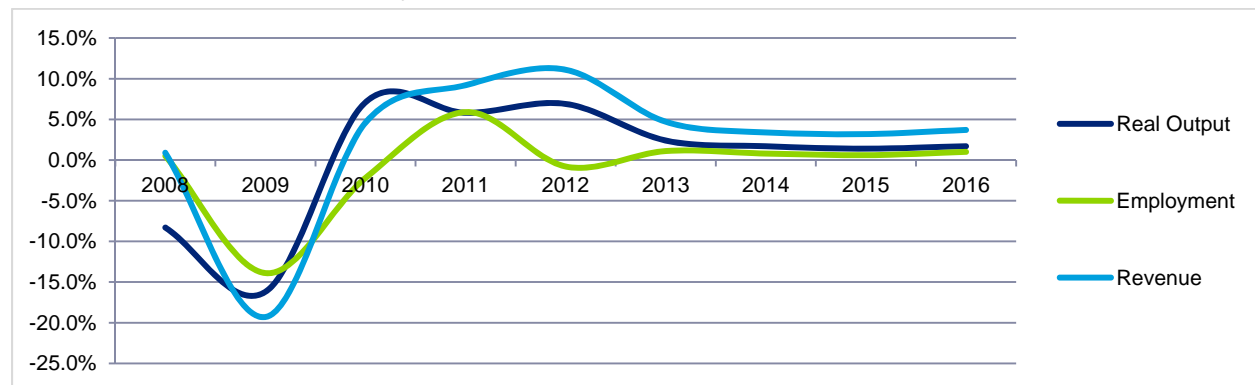
**Key Service Industries / Sectors**

- Equipment manufacturing
- Equipment operations, maintenance, repair
- Logistics
- Health and safety consultants
- Engineering consultants
- Technology providers / consultants
- Financial services
- Legal Services
- Environmental consultants

**Future outlook and opportunities**

According to the Conference Board of Canada, the economic outlook for the Canadian fabricated metal manufacturing industry is positive, including steady growth in real GDP, and modest growth in revenue, and employment through to 2016.

**Fabricated Metal Products Industry Outlook**



Source: Conference Board of Canada, Canada's Fabricated Metal Products Industry, 2012

It is projected that developing economies will require much more steel in the future, driving opportunities for Canadian steel producers. Conventional markets for steel are also anticipated to grow as Canada continues its economic recovery. This includes growth in automotive, energy and other natural resources, and construction.

The continued trend for the Canadian steel industry will also involve greater concentration to higher value-added and environmentally sustainable segments of the market. New steel products are lighter, stronger – essential for a more sustainable economy and society, including applications in automotive parts and equipment, wind and solar power towers and frames, transportation fuel efficiency, and durable construction. Growing demand for commodities worldwide is also expected to translate into higher demand for machinery and equipment used by the mining and oil and gas industries, for which fabricated metal products are key inputs.

Additionally, the industry will be required to continue to invest in continued development of employee skills, technology and innovation. Community colleges, universities and research institutions have a key role in developing needed workforce skills. Externally-oriented innovation can leverage the industry interface with key partners and customers, rather than exclusively relying on technical development.

The City of Hamilton is driving significant economic performance in steel / metal manufacturing based industries for Ontario, given that the City's industry contributes approximately 27% of Ontario's primary metal manufacturing revenue, and 5% of Ontario's fabricated metal product manufacturing revenue. Similarly, industry employment represented approximately 30% of Ontario's primary metal manufacturing employment, and 5% of Ontario's fabricated metal product manufacturing employment.

Hamilton is well positioned to grow according to future industry trends and opportunities, at it is considered a leader in steel product and process innovation and technological change. For example, the City's steel industry developed the first mini-mill in Ontario at ArcelorMittal Dofasco's Hamilton facility. The City is also leading significant research, and public / academic collaboration, such as the new CANMET Materials Technology Laboratory, a 145,000 square-foot complex includes facilities for casting, rolling and forming metal, and designing and testing new materials.

## Food and beverage manufacturing

### Industry trends

Canada enjoys a well-established agriculture and agri-food industry with significant success in the global marketplace. In 2010, there were approximately 8,000 food and beverage processing establishments in Canada, with over 230,000 employees.

The food and beverage processing industry is among the largest manufacturing industries in most Canadian provinces. Ontario accounts for most national production, with approximately 40% of national food and beverage manufacturing revenue, with Quebec accounting for 24%, the Prairie Region for 22%, British Columbia for 8% and the Atlantic Provinces for the remaining 7%. More than 200 agricultural commodities are grown on Ontario's farms, many of which are processed within the province, and there are estimated to be at least 2,500 food and beverage manufacturing firms in the province. Ontario has a well-developed supply chain network of primary processors, ingredients manufacturers, specialty importers and further value-added processors.

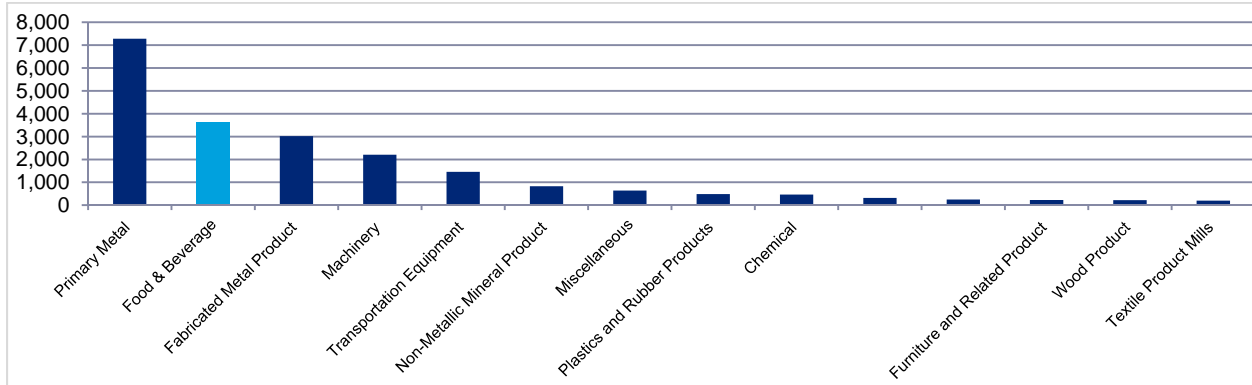
The City of Hamilton is home to a strong agricultural land base, as the majority of the 227,000 acres within the Hamilton boundaries qualify as prime agricultural lands. Considering that only 5% of the Canadian land mass constitutes prime land, the importance of this resource in Hamilton is significant. The majority of land within the City of Hamilton qualifies as prime agricultural land. According to Statistics Canada, Hamilton agricultural land generated cash receipts of nearly \$1,700 per acre in 2006, the fourth highest per acre revenue yield in Ontario. This base forms a significant driver of the City's food and beverage manufacturing industry. Local food and beverage manufacturing is concentrated in sugar and confectionery product manufacturing, meat product manufacturing, bakeries and tortilla manufacturing, beverage manufacturing, fruit and vegetable preserving and specialty food manufacturing.

The City of Hamilton recently attracted significant food and beverage processing based investment, with Maple Leaf Foods investing nearly \$400 million in a new 500,000 square foot protein plant facility in Hamilton's Red Hill Industrial Park, which is anticipated to support nearly 700 employees. Construction on the protein production plant began in 2012, with completion estimated for 2014.

This deal represents the single largest investment in the food industry in Canada. In 2009, Maple Leaf also invested \$100 million in a Canada Bread this 400,000 square foot facility bakery, also located in the Red Hill Industrial Park, which opened in 2011.

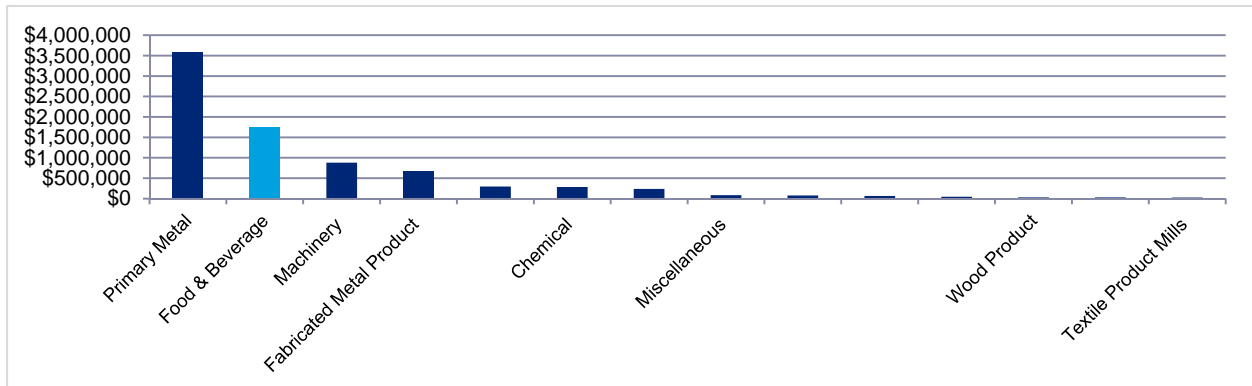
Hamilton' food manufacturing sector generates approximately \$1.8 billion in total revenue, with approximately 70 establishments and 3,600 employees in 2009.

**Top Hamilton Manufacturing Industries by Employees**



Source: Statistics Canada, All Manufacturing Industries

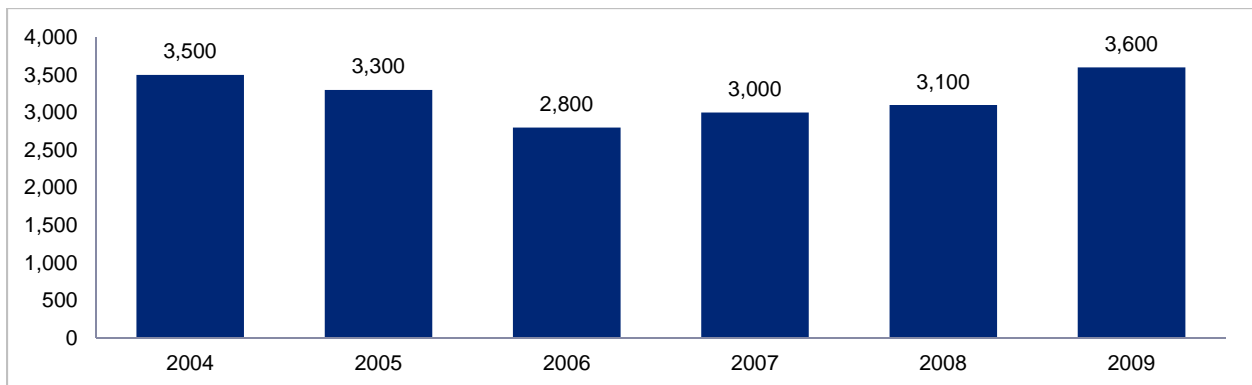
**Top Hamilton Manufacturing Industries by Revenue (thousands)**



Source: Statistics Canada, All Manufacturing Industries

The Hamilton food and beverage manufacturing industry has grown significantly, reaching 3,600 employees in 2009, and generating approximately \$1.8 billion in 2009, representing a 38% increase from 2004 levels.

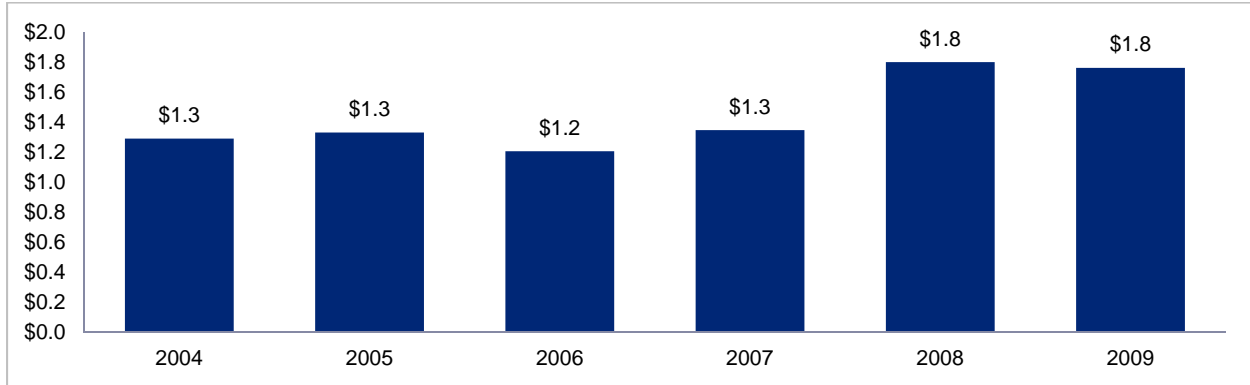
**Food & Beverage Manufacturing Total Employment – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System



**Food & Beverage Manufacturing Total Revenue (\$ billions) – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Food & beverage manufacturing fact sheet summary**

Revenue (2009)	\$1.8 B
Revenue share of Ontario	5.0%
Employment (2009)	3,600
Employment share of Ontario	5.0%

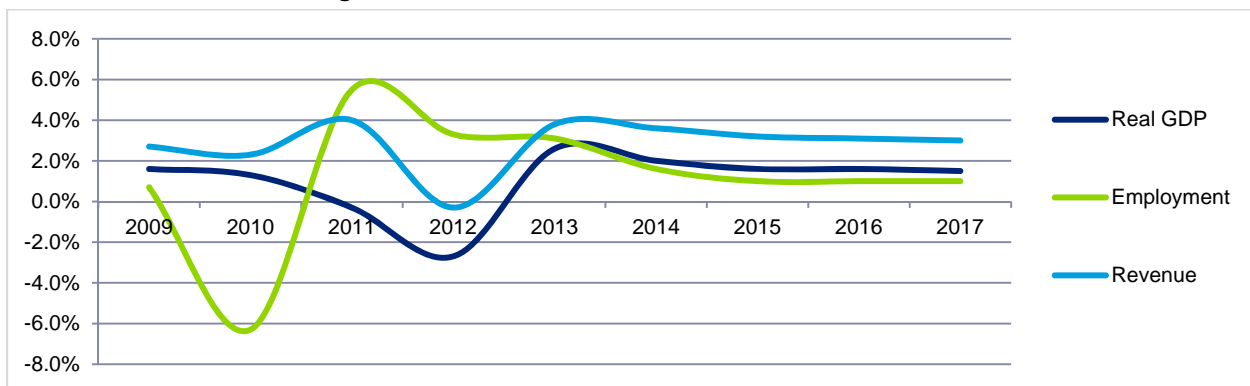
**Key Service Industries / Sectors**

- Other food & beverage producers / processors
- Equipment manufacturing
- Equipment operations, maintenance, repair
- Logistics
- Health and safety consultants
- Engineering consultants
- Food safety consultants
- Technology providers / consultants
- Financial services
- Legal Services
- Environmental consultants

**Future outlook and opportunities**

According to the Conference Board of Canada, the economic outlook for the Canadian food manufacturing industry is positive, including steady growth in real GDP, revenue, and employment through to 2017<sup>63</sup>.

**Canadian Food Manufacturing Outlook**



Source: Conference Board of Canada, Canada's Food Manufacturing Industry, 2012

Global economic uncertainty and a fragile domestic economy have caused consumers to reduce their spending, impacting food and beverage. Although the outlook for 2013 is more positive, it is anticipated to be another challenging year for the industry. Modest domestic demand growth is anticipated for the industry, given rising commodity prices, fuelled by the lingering effects from last year's record droughts in the US, South America and Russia as well. However, growing demand from emerging markets for Canadian food products suggests that exports will continue, and bolster the industry's production in 2013.

The market power of health-conscious Canadians is also on the rise. The food manufacturing industry recognizes this growing trend, and it is creating more items that resonate with these consumers. As a result, specialty food items that provide some health benefits comprise a growing share of the industry's product offerings. This desire for healthier, specialty products means that consumers are willing to pay a premium price, and potentially generate higher profit margins. Hamilton industry stakeholders noted the City's strength across specialty product manufacturing, enabling the ability to benefit from such a trend.

Industry exports continue to grow as more opportunities are found in emerging markets. The growing middle class in emerging markets such as China and India has attracted the attention of Canadian food manufacturers. Increasing exports to these countries are a sign that Canadian food manufacturers are successfully penetrating these markets. Canadian companies tend to expand into these markets through strategic acquisitions, joint ventures, or by using partnerships.

Through the adoption of new technologies, superior products and innovative methods of production, agricultural growth has outperformed many manufacturing and business sectors over recent periods. There continue to be new and growing agricultural production opportunities beyond food production in such areas as bio-products, bio-energy, bio-fuels, pharmaceuticals, nutraceuticals and bio-fibers. In view of the above the industry needs to work with educational institutions at all levels to include agricultural programming in the curriculum and to encourage the provision of education and support programs for farmers. Post-secondary education programs in agri-business, biomedical, other bioproducts, etc. will continue to play a critical role in such development opportunities.

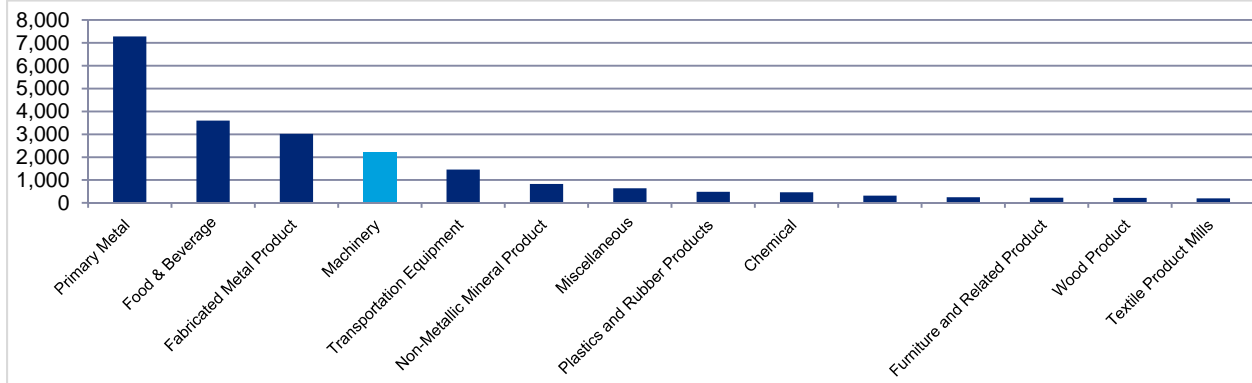
Hamilton is well positioned within Ontario's food and beverage manufacturing industry, with a number of key strengths including its prime farming lands, proximity to water and the City's port, good climate, a multi-modal transportation network, and access to markets. Primary agriculture, affordable real-estate and strategic location have also created a diverse and productive agri-business cluster in Hamilton. Additionally, local businesses currently experience significant export activity, largely focused in Europe, and continue to develop specialty market offerings, in line with growing demand trends. While the local industry is not without its challenges, such factors place Hamilton in a significant position to experience future growth in its food and business manufacturing and related industries.

## Machinery manufacturing

### Industry trends

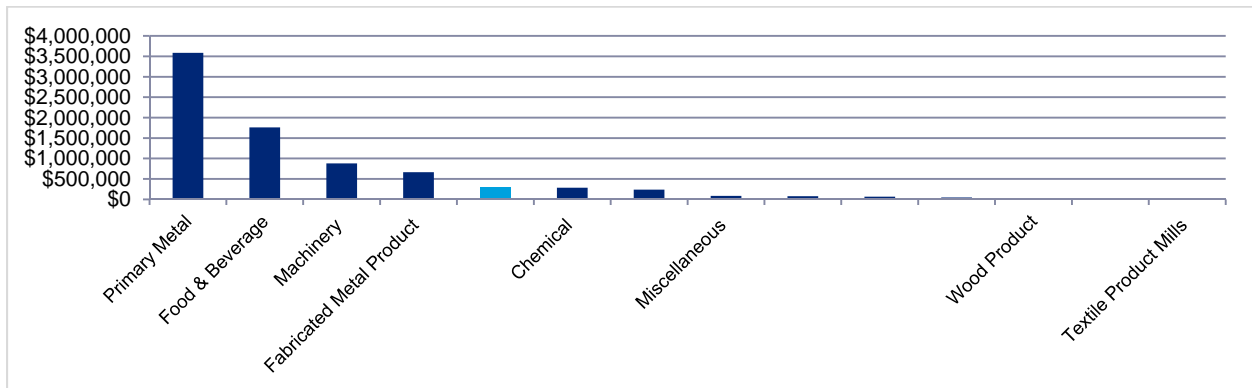
With respect to Canada's machinery manufacturing sector, Ontario accounts for 43% of national machinery manufacturing revenue, followed by the Prairie Region with 31%, and Quebec with 19% of national machinery manufacturing revenue. With respect to machinery manufacturing based employment, Ontario accounts for approximately 44% of national levels, with 54,600 employees in 2010. Machinery manufacturing is Hamilton's fourth largest manufacturing industry, generating \$880 million in total revenue, and supporting 2,200 employees.

**Top Hamilton Manufacturing Industries by Employees**



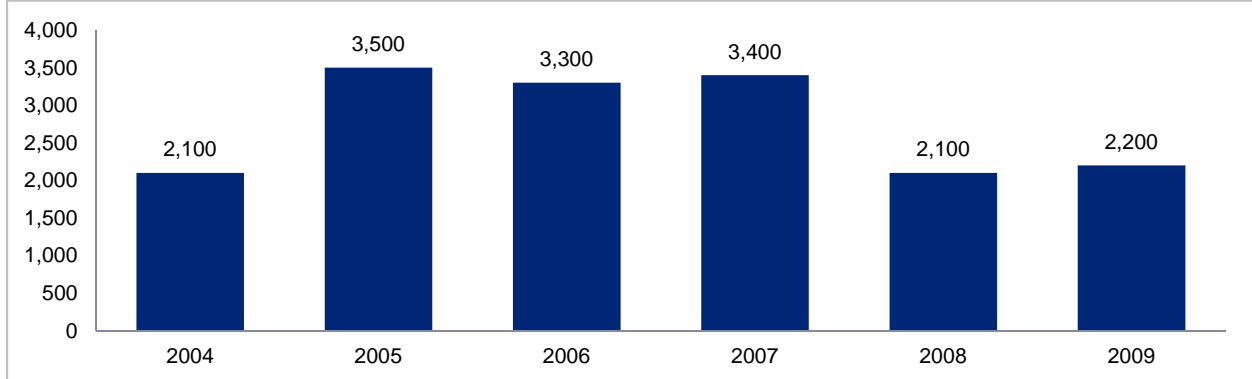
Source: Statistics Canada, All Manufacturing Industries

**Top Hamilton Manufacturing Industries by Revenue (thousands)**



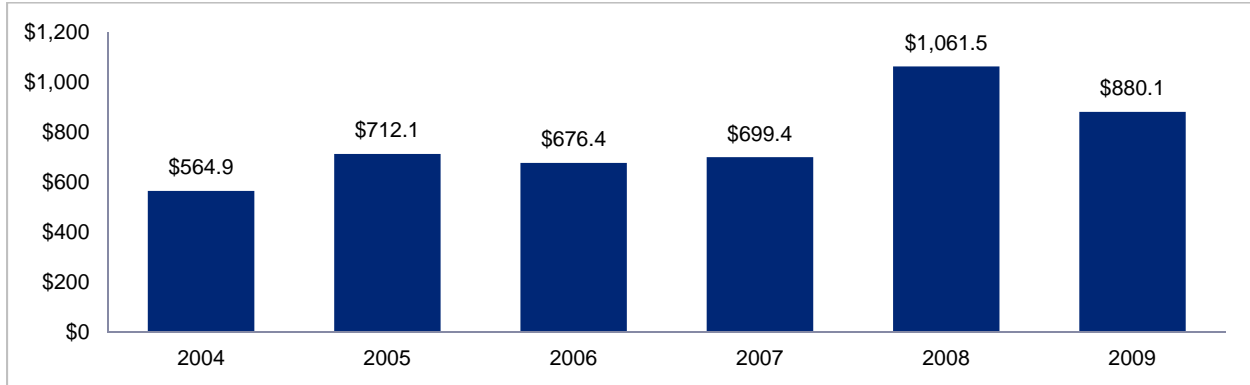
Source: Statistics Canada, All Manufacturing Industries

**Machinery Manufacturing Total Employment – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Machinery Manufacturing Total Revenue (\$ millions) – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Machinery manufacturing fact sheet summary**

Revenue (2009)	\$880 M
Revenue share of Ontario	7.0%
Employment (2009)	2,200
Employment share of Ontario	4.0%

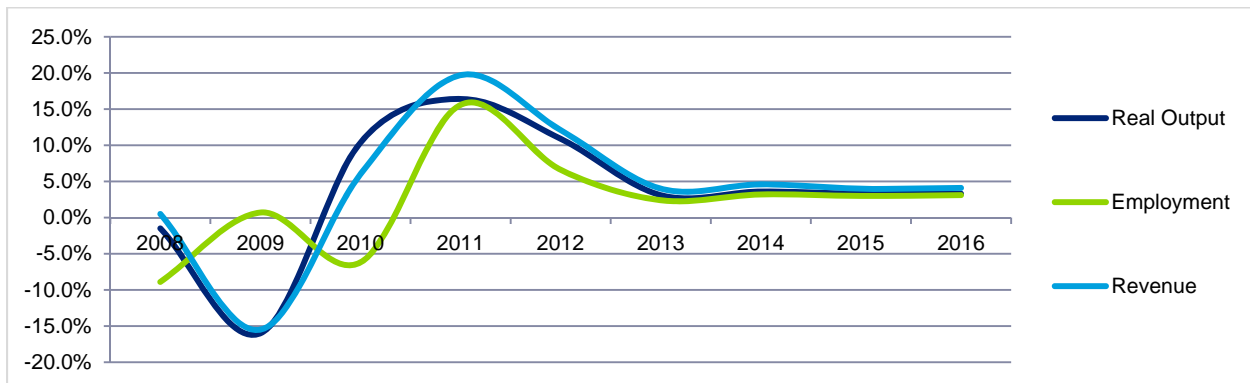
**Key Service Industries / Sectors**

- Materials / metal / steel manufacturing
- Equipment manufacturing
- Equipment operations, maintenance, repair
- Logistics
- Health and safety consultants
- Engineering consultants
- Technology providers / consultants
- Financial services
- Legal Services
- Environmental consultants

**Future outlook and opportunities**

According to the Conference Board of Canada, the economic outlook for the Canadian machinery manufacturing industry is positive, including steady growth in real output, revenue, and employment through to 2016.

**Canadian Machinery Manufacturing Outlook**



Source: Conference Board of Canada, Canada's Machinery Manufacturing Industry, 2012

As the baby boomers retire, all sectors of the economy are expected to face labour shortages, which is expected to potentially boost domestic demand for labour-saving machinery. Additionally, exports of agricultural, construction, and mining machinery could benefit from rising populations and energy demands in emerging markets, all of which are areas of Hamilton's machinery manufacturing activities.

### Automotive equipment manufacturing

#### Industry trends

Canada is the ninth largest vehicle producer in the world, and the Canadian automotive industry accounts for approximately 14% of manufacturing GDP and 24% of manufacturing trade. Canadian vehicle assemblers account for roughly 4% of total world production of 68.6 million units.

According to Industry Canada, the Canadian automotive equipment industry directly supports over 550,000 jobs across the country in 11 light duty and 3 heavy-duty assembly plants, over 540 parts manufacturers, 4,000 dealerships and many other directly related industries. For every job in auto assembly and parts manufacturing, seven others are potentially created in related industries, including the steel, plastic and transportation industries.

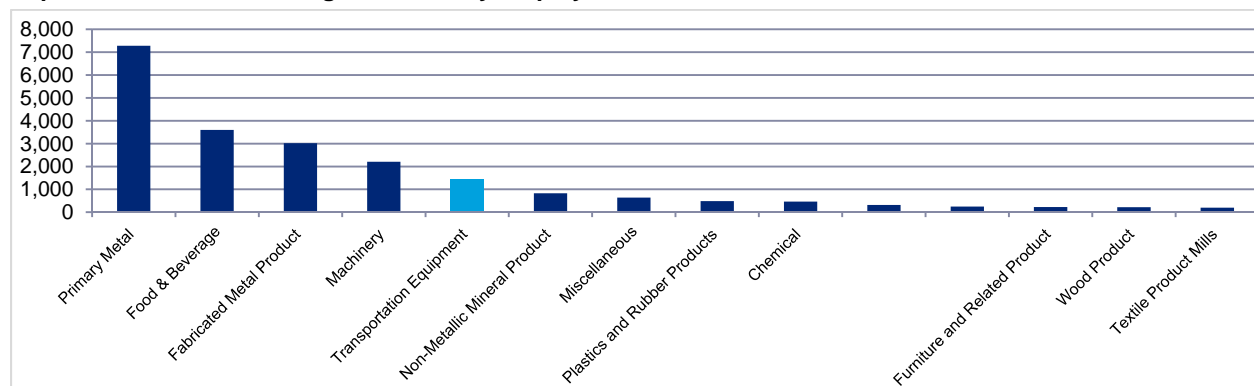
Canada is home to numerous auto manufacturing plants, including GM, Ford, Chrysler, Toyota and Honda. Parts suppliers including Magna International, Tesma, TRW Automotive and Ventra Group also have assembly facilities in Canada<sup>64</sup>.

A significant portion of Canadian automotive economic activity is concentrated in Ontario, as the Province is home to 11 assembly plants operated by Chrysler, Ford, General Motors, Honda, and Toyota, and over 300 parts manufacturers. The industry employs an estimated 88,000 highly skilled workers who produced over 2.1 million vehicles in 2011, more than any other North American sub-national jurisdiction<sup>65</sup>.

Ontario currently averages over 600,000 motor vehicle units annually in sales, or one fourth of total Canadian motor vehicle sales. Similar to Canadian averages, Ontario's motor vehicle sales are anticipated to experience limited growth in the near future, ranging from 0.3% to 0.5% in annual from in 2013 and 2014.

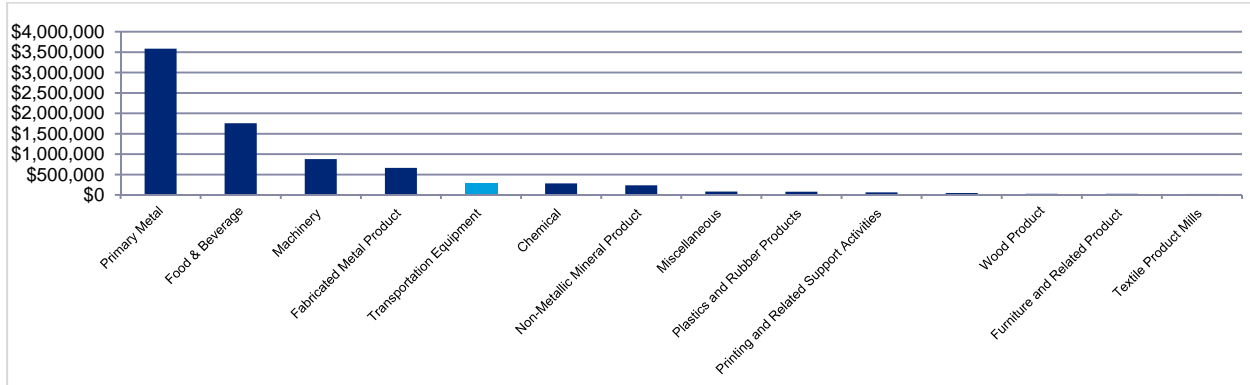
Transportation equipment manufacturing, specifically automotive equipment manufacturing, is Hamilton's fifth largest manufacturing industry, with \$296 million in total revenue, and approximately 35 establishments supporting 1,500 employees.

#### Top Hamilton Manufacturing Industries by Employees



Source: Statistics Canada, All Manufacturing Industries

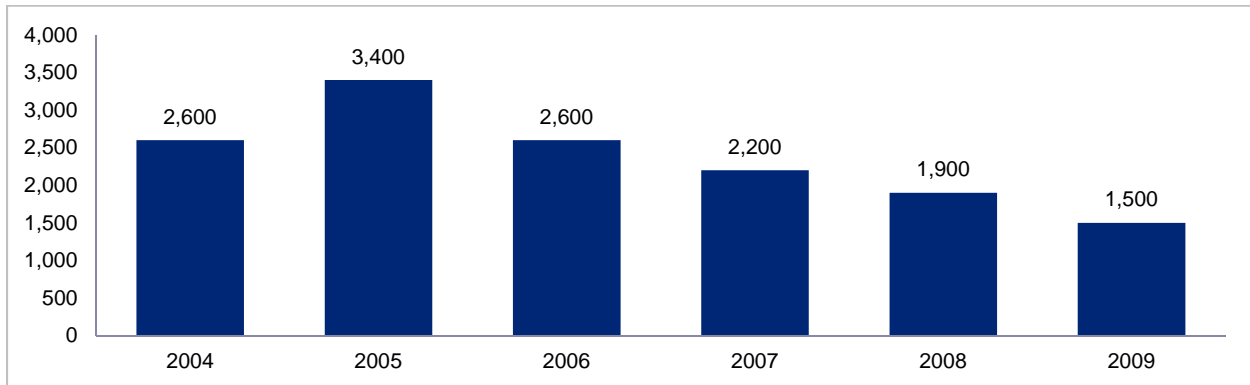
**Top Hamilton Manufacturing Industries by Revenue (thousands)**



Source: Statistics Canada, All Manufacturing Industries

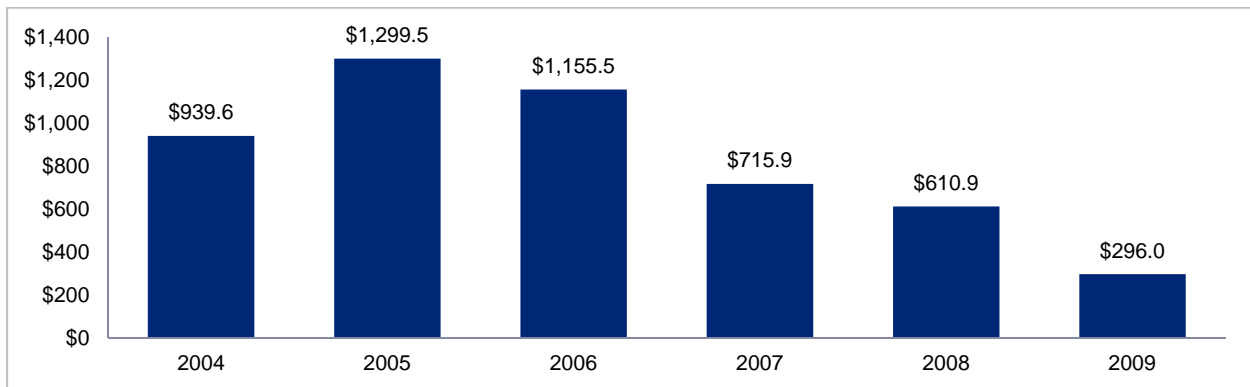
The Hamilton automotive equipment manufacturing industry has been challenged in recent periods, decreasing in employment from 2005 to 2009, reaching 1,500 employees in 2009, and decreasing in revenue from 2005 to 2009, reaching \$296 million in 2009.

**Automotive Equipment Manufacturing Total Employment – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Automotive Equipment Manufacturing Total Revenue (\$ millions) – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Transportation / Automotive manufacturing fact sheet summary**

Revenue (2009)	\$296 M
Revenue share of Ontario	<1%
Employment (2009)	1,500
Employment share of Ontario	1.5%
Number of establishments	35

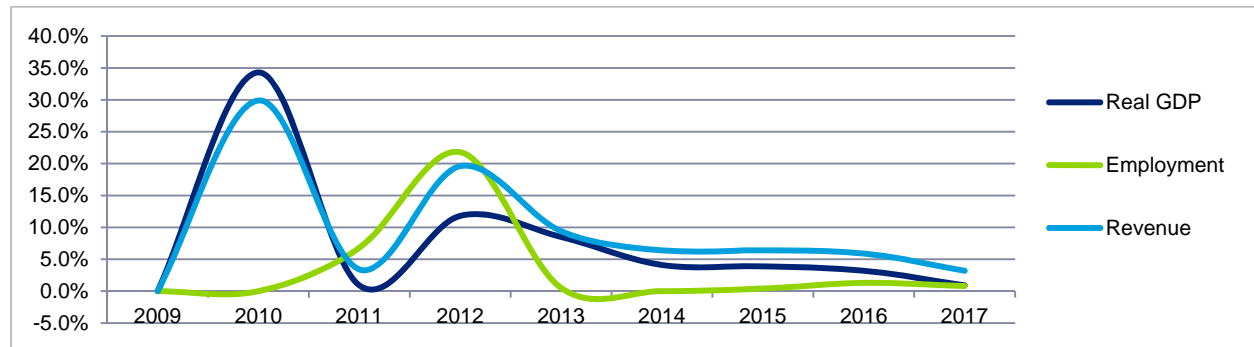
**Key Service Industries / Sectors**

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- Equipment manufacturing
- Equipment operations, maintenance, repair
- Logistics
- Health and safety consultants
- Engineering consultants
- Technology providers / consultants
- Financial services
- Legal Services
- Environmental consultants

**Future opportunities**

In Canada, motor vehicle production and sales are expected to continue to remain fairly flat, totalling 2.5 million units of production and 1.7 million units in sales in 2012, representing limited growth in the short term. Such production and sales levels translates into a modest economic outlook for the Canadian automotive sector, including projected decreases in real GDP, employment and revenue, and flat growth through to 2017, according to the Conference Board of Canada.

**Canadian Automotive Outlook**



Source: Conference Board of Canada, Canada's Motor Vehicle Manufacturing Industry, 2012

Hamilton is home to a number of assets which support its automotive equipment manufacturing industry, including its primary, fabricated metal and machinery manufacturing industries, as well a number of sizeable businesses operating within this space.

The future of higher value add production trends across materials / metal / steel production will translate to automotive equipment manufacturing, and serve as a significant opportunity to Hamilton. Areas of innovation include high strength and electrical steels, which have significant use in energy applications and hybrid and electrical vehicles. Additional trends in terms of lighter structure and automotive safety requirements are also expected to lead to future opportunities within the industry.



McMaster University is a key contributor to local research, innovation and development of skills across the local automotive equipment manufacturing sector. MacAUTO is the newly established coordinating body for automotive research and education at McMaster University. Automotive research at McMaster University encompasses an expanding cluster of knowledge and expertise. More than 75 researchers in engineering, science, business and other faculties are involved in initiatives valued at over \$100 million in programs and infrastructure.

Research programs range from the testing of hybrid power systems to developing corrosion-resistant coatings, from optimization of transportation and logistics systems to the impact of pollution on our environment, from creating software and simulation programs to understanding visual attention and motion perception. The University's numerous automotive-related research institutes and centres work with industry, government and academic partners in developing and commercializing new technologies and materials that will ensure the global competitiveness of Canada's auto industry.

The automotive sector is a key component of Canada's economy and advanced manufacturing in Canada. As the sector continues to recover and adapt to future trends, it is expected that there will be continued public sector and private sector support towards its growth. For example, the federal government has commissioned a \$2.1 million study of the auto industry that will assess policies affecting the sector, and McMaster University will establish the Canadian Automotive Policy Partnership, a five-year project that will be assisted by Toyota Motor Manufacturing Canada Inc., Ford Motor Co. of Canada Ltd. and the Canadian Auto Workers union<sup>66</sup>.

### Clean technology manufacturing

The term "clean energy" spans energy production, infrastructure and conservation, and involves technologies and services that promote, enhance or advance: diversity of supply sources and distribution/transmission, efficiency in use, and reduced negative environmental effects such as greenhouse gas emissions<sup>67</sup>. Clean technology ("clean tech") industries are companies which design, develop or manufacture products or services that reduce negative environmental impacts. Clean tech companies represent a wide spectrum of industries including alternative energy generation, energy efficiency, manufacturing, water and wastewater, waste and recycling and materials<sup>68</sup>.

Clean tech industries are often connected to the development of advanced manufacturing. For example, the production of renewable energy systems requires and relies on various elements of an advanced manufacturing industry. Clean tech industries cover a broad spectrum of goods and services production including solar, wind, geothermal, fuel cell and hydro power; light-rail equipment and services, cogeneration, biomass products and the recycling of one product to produce another.

### Canadian clean tech market landscape

The demand for clean technologies is rising globally and in Canada. To keep pace with this demand, investment towards clean technology has grown significantly. In 2008, global venture capital investments towards clean technologies were approximately \$8.4 billion USD, up 38% from \$6.1 billion USD in 2007. These numbers represent the seventh consecutive year of growth in global venture capital investment towards clean technology. Although still a small and emerging market in Canada, VC investment towards clean technology follows the global trend, totaling \$379 million CDN in 2007, more than doubled the \$155 million CDN invested in 2004. With an estimated 700 companies, the Canadian clean tech sector is estimated to have invested almost \$2 billion in research and development between 2008 and 2010, and saw an 11% growth in employment over this period<sup>69</sup>.

The Ontario Environment Industry Association (ONEIA) estimates the Province's energy and environment sectors are worth \$8 billion in annual revenues and \$1 billion in export activity. Ontario's Green Energy Act (the "Act") is a key element of the provincial government's environmental strategy. The Act helps to address climate change and the environment by facilitating the development of a sustainable-energy economy. This legislation is supported by other initiatives, including the Feed-in Tariff (FIT) program and the province's plan to phase out coal fired generation. The province's economic landscape is changing, moving from traditional strengths in environmental and energy technologies into a field of convergence in clean technology – or "clean tech / green tech".

Before 2009, strong environmental and energy sectors were built using technologies from both within and outside the province, with greater involvement from international companies. Significant strength also exists in the water sector, with leadership in water-treatment technologies.

The growing numbers of organizations, emerging companies and research institutes involved in research and development (R&D) in the environmental, energy, water and wastewater management sectors in the province have gradually established Ontario as a clean tech hub.

### **Hamilton clean tech market landscape**

In the City of Hamilton, the clean technology industry is considered to be a rapidly growing and emerging sector, and as a result, is among the City's key sectors / industries.

A combination of increased public concern towards environmental issues, resource depletion and policy and regulations has catalyzed the recent growth of the industry. Many regions tout the development of clean-tech industry as an emerging industry sector that will support existing industries, provide high quality employment and improve the environment. National and provincial policies and incentives are helping to create a favourable environment for the clean-tech industry. It is now an opportune time for Hamilton to capitalize on the growth of this industry and the economic, environmental and community benefits that will follow<sup>70</sup>.

The City of Hamilton's transition into the "green" economy and growth potential of the City's clean tech sector is evident in the existing base of clean tech focused companies and growing number of new clean tech investment inquiries that have been received by Hamilton's Planning & Economic Development Department in more recent years. Currently, nearly one in four new business investment opportunities being considered by the City of Hamilton have a clean tech focus. As a result of the City of Hamilton's extensive corporate calling program, the City has uncovered an emerging manufacturing focus on the green economy and clean tech activities.

Currently, the City of Hamilton's clean tech focus is predominately in two key areas, power generation and water and waste water:

#### **Power generation**

The City's power generation companies are engaged in the development and sale or the development and use of proprietary technologies to generate power from renewable resources, such as wind, solar, hydro, geothermal, co-generation or fuel cells.

There are strong centres of activity developing in and around the Golden Horseshoe, which includes Hamilton, with companies who are involved in the development of materials and components used in integrated power generation systems. There is strong institutional support from universities like McMaster as well as new technical training programs that have evolved in several colleges including Mohawk College.

#### **Water and wastewater**

According to the City of Hamilton, clean tech companies that operate within the Water and Wastewater sector are predominantly engaged in the following activities:

- Advanced water purification technologies (e.g. membrane technologies involving micro-filtration, ultra-filtration and reverse osmosis and other related separation technologies);
- Wastewater treatment technologies that treat grey water or wastewater from residential and industrial consumers;
- Water resources management technologies that include automated systems and instrumentation that can monitor and control non-point source pollution, point-source discharges, spills of hazardous materials, biotoxins and contamination of water supplies and products that optimize the management and operation of water and wastewater treatment and conveyance infrastructure.

The potential for water and wastewater in Hamilton is further strengthened by strong institutional expertise at the National Water Research Institute, Wastewater Technology Centre, Canadian Water Network and Great Lakes Institute for Environmental Research, which all have presence within Hamilton.

The City of Hamilton has an emerging presence in various areas across the clean-tech sector, including those identified in the table below.

Clean tech company focus areas
• Agriculture - Bio-based materials; farm efficiency technologies, microirrigation, systems, bio-remediation; non-toxic cleaners and natural pesticides
• Air and Environment - air purification products and filtration systems, energy efficient HVAC and gas detectors
• Alternative Energy Equipment and Systems Manufacturers
• Alternative Energy from Recycling Industries
• Energy Conservation and Demand Management
• Energy Generation, Wind, Solar, Hydro/Marine, Biofuels
• Environmental Software and Consulting Services
• Industrial Waste Treatment
• Instrumentation and Monitoring Equipment
• Manufacturing - Advanced Packaging, Monitoring and Control, Smart
• Production
• Power Generation
• Recycling and Waste Management
• Research and Development Water Technologies
• Site and Brownfield Remediation
• Transportation - Vehicles, Logistics and Structures
• Water and Wastewater Treatment

Source: City of Hamilton Economic Development Strategy 2010-2015

### Investment activity

Recent and potential future investments within, or supporting the City's clean tech sector include the following:

- Anderson Water Systems currently has plans to invest in Hamilton,;
- Environmental Remediation and Site Enhancement (ERASE) Brownfield Redevelopment Program - through the efforts of City staff and the Economic Development Office, the City has benefited significantly from our Environmental Remediation and Site Enhancement (ERASE) Brownfield Redevelopment Program - three significant re-development ERASE grant applications were approved last year along with a value of \$76 million in construction expenditures were received. Not only has Hamilton been recognized as a leading community on Brownfields but has recently developed further offerings in way of financial incentives that encourages Leadership in Energy and Environmental Design (LEED) building designs on all future development within the City's designated Industrial Business Parks.;
- The short-term goal of introducing a light-rail transit system, supporting the growth of existing environmental business; and
- The short-term goal of attracting a major solar or wind power manufacturing facility<sup>71</sup>.

## Life sciences / healthcare manufacturing

### Canadian life sciences / healthcare market landscape

The Canadian life sciences sector is an important contributor to Canada's innovation economy, engaging in creating the medical innovations that will improve health-care delivery and patient care in Canada and abroad. The Canadian industry spans the research, development and manufacturing continuum. Industry players include small and medium-sized companies developing diagnostics, biopharmaceuticals, pharmaceuticals and medical devices, as well as global companies with research, development and manufacturing operations in Canada, serving both domestic and international markets. Contract service providers in Canada provide industry support for research and development, clinical trials and manufacturing. Canada's world-class health research institutions and research networks are integral partners in research and knowledge translation<sup>72</sup>.

According to BIOTECANADA and PricewaterhouseCoopers', 2013 Canadian Life Sciences Industry Forecast, the Canadian life sciences sector continues to show determination and resiliency, although, similar to other sectors of the Canadian economy; it's faced significant challenges as a result of the global economic slowdown. Nevertheless, the sector's fundamentals remain strong. According to business respondents to the survey component of the study, approximately 50% of global pharmaceutical and life sciences CEOs are found to be very confident that their organizations will be able to generate higher revenues over the short term, and 46% are very confident of being able to do so over the next three years.

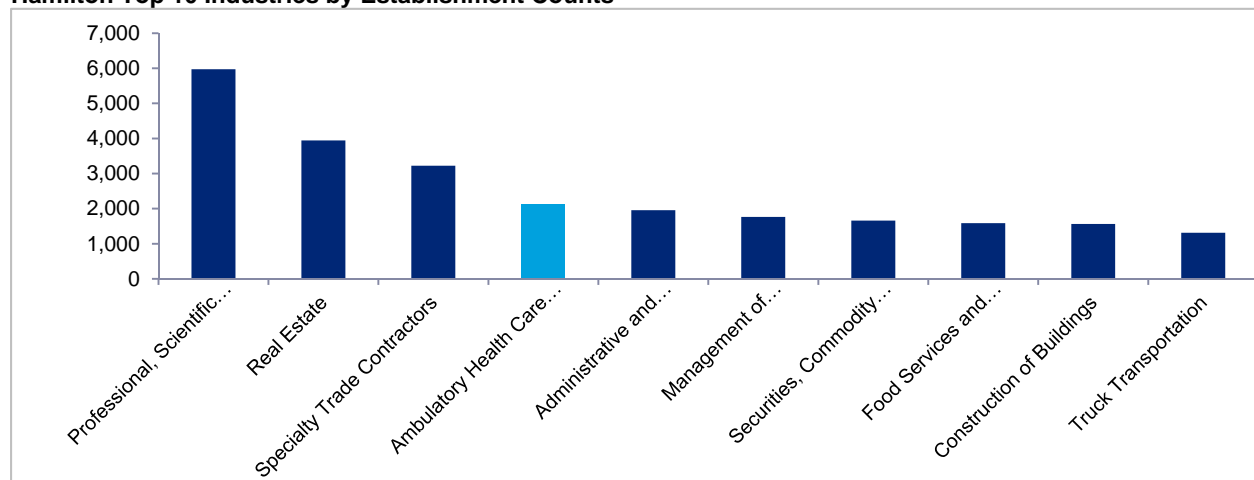
### Hamilton life sciences / healthcare market landscape

In the City of Hamilton, life sciences is considered to be among the City's top sectors / industries. The City of Hamilton is the home of an intellectual and physical environment for a thriving life sciences cluster that connects researchers, business, healthcare providers and education. The City is globally recognized for its biotechnology strengths in the health sector including drug discovery and validation, gene therapy and clinical trials.

Research in these areas is producing lifesaving drugs and vaccines, medical devices, and solutions to current health issues. With a focus on the commercialization of research and development, Hamilton is poised for growth in this knowledge-based cluster. The City together with its community partners Hamilton Health Sciences, St. Joseph's Healthcare, McMaster University and Mohawk College is supporting the life sciences sector to achieve its innovative potential by building a supportive business environment, connecting research and business communities, and marketing its world-class strengths in the global marketplace.

With respect to top industries by establishment counts, healthcare based services ranks fourth in the City.

#### Hamilton Top 10 Industries by Establishment Counts



Source: Statistics Canada, Canadian Business Patterns, 2011

While various sectors / industries in the City of Hamilton have been challenged in recent periods, areas such as healthcare have been very supportive to the local economy<sup>73</sup>. Healthcare also comprises a significant portion of the City's employment. Hamilton Health Sciences is the City's largest employer with 10,000 employees, and comprised of six unique hospitals and a cancer centre. Hamilton Health Sciences was recently selected by GE Healthcare to be the first site in the world to receive new prototype technologies for use in a molecular breast imaging research program.

Additional organizations with significant focus in healthcare based activities include McMaster University with 7,400 employees, St. Joseph Healthcare Hamilton with 4,000 employees and Mohawk College with 1,100 employees.

#### Hamilton major employees

Organization	Employees <sup>74</sup>
Hamilton Health Sciences	10,000
McMaster University	7,400
St. Joseph Healthcare Hamilton	4,000
Mohawk College	1,100

The City's life sciences sector is leveraging Hamilton's strong health care sector, institutions and talent, to develop a significant base of life sciences manufacturing activity. According to Statistics Canada data, there are approximately 35 medical / health care equipment and supply manufacturing firms in Hamilton, captured under miscellaneous manufacturing.

#### Local life science / healthcare / medical manufacturers

- Advance Dental Ceramics Inc
- Advanced Foot Care and Orthotics
- Alternate Solutions Inc.
- Aurum Prosthetics
- B A Hall and Associates
- Barthmann Denture Clinic
- Battell Denture Clinic
- Bert Rufenach Denture Clinic
- Bio Sculpture Nails
- Bowland Dental Laboratory Ltd
- Canadian Dental Laboratory
- Can-dan Rehatec Ltd.
- Dental Technicians Inc
- DiNardo Pino Dundas Denture Clinic
- DTI Dental Laboratory Ltd
- Gilmour Peter & Tim
- Healthcare Water Services
- Home Health Care Centre
- Horst Dental Laboratories Limited
- International Bandage Company
- Just Feet Shoe Clinic
- KMR
- Limeridge Medical Supplies
- Meyer Service & Supply
- National Orthotic Centre
- Orthopaedic Services
- Pensafe

**Local life science / healthcare / medical manufacturers**

- Precision Lens Crafters
- R & R Optical Laboratory
- Regional Dental Inc
- Rj Smith Dental Laboratory Ltd.
- Rotsaert Peter Denturist
- Take Control Cosmedix Inc.
- Technical Systems 2002 Inc

Source: Statistics Canada, Canadian Business Patterns, 2011

**Advanced manufacturing FDI and export opportunities**

**FDI driven by advanced manufacturing**

In 2012, the top sectors for FDI Projects were largely driven by advanced manufacturing based activity, including information and communication technology, followed by business and financial services, transportation equipment, engines, turbines and industrial machinery and chemicals, plastics and rubber. Ontario ranked third overall with respect to attracting such FDI projects in 2012<sup>4</sup>. Such areas of FDI align well with the City of Hamilton’s advanced manufacturing sector, and represent a potential future growth opportunity for the City, through strategic FDI attraction initiatives.

**US markets and auto continue to drive Ontario exports**

With respect to top export destinations for goods, the US accounts for 77% of all Ontario exports, followed by the UK (9.3%), Norway (1.5%), China (1.4%), Hong Kong (1.1%) and Mexico (1.0%). Within the US, Michigan receives 24.1% of all US exports, followed by California (8.8%), and New York (6.2%).

**Top 10 Export Destinations, 2011**

By Country	(% of All Ontario Exports)	By US State	(% of All Ontario Exports)
United States	77.0%	Michigan	24.1%
United Kingdom	9.3%	California	8.8%
Norway	1.5%	New York	6.2%
China	1.4%	Ohio	4.3%
Hong Kong	1.1%	Illinois	3.3%
Mexico	1.0%	Pennsylvania	3.3%
Germany	0.8%	Texas	3.1%
Japan	0.8%	Indiana	2.6%
Netherlands	0.6%	Massachusetts	2.4%
Switzerland	0.5%	New Jersey	1.9%

Source: Statistics Canada, International Trade Division, March 2012

<sup>4</sup> Refers to greenfield investment projects, and does not include mergers and acquisitions, or other equity-based or non-equity investments.

Ontario's exported goods are primarily comprised of automobiles (24.9%), followed by gold (10.7%), motor vehicle parts (5.1%) and nickel (5.1%).

**Top 10 Goods Exported, 2011**

Export	% of Exports
Autos	24.9%
Gold – unwrought	10.7%
Motor vehicle parts	5.1%
Nickel mattes	2.1%
Medications – packaged for retail use	1.6%
Engines	1.6%
Coins	1.1%
Uranium and other radioactive elements	1.0%
Non-crude petroleum oil	1.0%
Nickel – unwrought	0.9%

*Source: Statistics Canada, International Trade Division, March 2012*

Currently, the economic wealth generated from the City of Hamilton's manufacturing activity is driven by exports (tradable goods) with over 96% consumed by the United States. Approximately 80% of Hamilton manufacturers are exporting their products to US markets. As with FDI potential, the City currently supports Ontario's primary export products, largely through its extensive automotive manufacturing industry. Such international trade potential is also well supported by the City of Hamilton's market access, diverse infrastructure assets and transportation linkages, including the future Detroit Windsor bridge, which will further enhance connections with the US.

**Summary**

The City of Hamilton possesses a number of market strengths, assets and capabilities that contribute to the City's historical and existing strengths in the advanced manufacturing sector, and are considered to be critical to the future of advanced manufacturing growth in Hamilton.

Advanced manufacturing increasingly involves processes involving new techniques, machinery, information technology and organizational practices. Such manufacturers are shifting from labour intensive and mass production processes to highly skilled and technologically enhanced environments. Thus, these organizations are potentially attracted to communities such as Hamilton, which has a growing population, employment and capacity for industrial growth, competitive economic growth and diverse economy, established advanced manufacturing base with leading industries in steel / materials, food and beverage, machinery and automotive equipment manufacturing, market access, infrastructure assets and available land and real estate at competitive costs. Hamilton potentially has the opportunity to leverage these market strengths, assets and capabilities further, given the ability to adapt to and address some of the challenges and vulnerabilities also facing advanced manufacturing locally.

# City of Hamilton Market Challenges and Vulnerabilities

The City of Hamilton’s advanced manufacturing sector is facing a number of challenges and vulnerabilities, which may potentially impact the City’s ability to realize future growth.

## Global, low cost competition

As previously discussed, manufacturing businesses across the country are faced with the challenge of developing business strategies that enable them to compete in fundamentally different markets against competitors from both low cost countries and developed economies. Hamilton and its North American based companies are currently challenged to compete directly with low cost countries in traditional manufacturing.

### Country Manufacturing Labor costs, 2011 US\$/hour

Competitiveness Ranking	1	2	3	4	5	6	7	8	9	10
Country	China	Germany	US	India	South Korea	Taiwan	Canada	Brazil	Singapore	Japan
Labor costs (US\$/hour) (2011)	2.8	46.4	35.4	0.9	17.7	9.2	38.3	12	21.9	35.4

Source: Deloitte Touche Tohmatsu & US Council on Competitiveness Council, “2013 Global Manufacturing Competitiveness Index”.

In general, Canadian manufacturers are responding to this challenge by designing their operations to deliver a suite of capabilities via increased agility, mass customization capacity, capitalizing on market niches and innovation. Companies that build flexibility into their manufacturing operations can respond more quickly and outperform their less agile competitors. Manufacturers have started to respond by adapting production volumes efficiently based on changes in customer demand and profitability, varying their production mixes, and adjusting the location of certain production within their production footprints.

The ability to expand mass customization capabilities creates a competitive advantage by enabling firms to deliver unique products based on customer specifications or needs while maintaining the general cost efficiency of large scale production. Manufacturers are also motivated to capitalize on market niches through a range of offerings including specialized products, or through their ability to provide a customer solution that can focus on products and services. These emerging drivers are among the key motivators for new investment in manufacturing facilities in Canada.



## Increasing competition for FDI

Competition between nations to attract foreign direct investment is expected to increase dramatically raising the stakes for countries and in turn complicating the decision processes for foreign companies. Annual foreign direct investment inflows for manufacturing more than doubled to average US\$ 350 billion from 2006 through 2009, and manufacturing accounted for 26% of global FDI projects in 2010, generating 1.1 million jobs. FDI is a means to bring manufacturing and research facilities to a country, building infrastructure in public-private partnerships and leveraging the multiplier effect of manufacturing on service jobs across the nation. As public funding challenges mount, the competition between nations for FDI will increase dramatically. Membership in the World Association of Investment Promotion Associations has increased by 2.5 times over the past ten years. For companies, the multitude of potential investment options will be increasingly hard to differentiate and navigate.

## Regulatory hurdles and labour union challenges

While Ontario is one of North America's most competitive jurisdictions for corporate taxes, its employers face a burdensome regulatory regime with approximately 386,250 requirements placed on individuals and businesses. Ontario's Ministry of Labour and the Workplace Safety and Insurance Board (WSIB) are considered two of the primary sources of this challenge, and the Province's environmental regulations are some of the nation's strictest. Ontario ranked 6<sup>th</sup> among provinces and territories in the latest Canadian Federation of Independent Business Red Tape Report Card. The Province's B- rating reflected an improvement over 2011 as a result of renewed commitments to remove two regulations for every new regulation instated; however, many business owners feel that cost of compliance is still too high.

Numerous local stakeholders noted labour union challenges to be among key concerns pertaining to the local manufacturing sector. Southern Ontario's unionized environment may pose challenges to businesses during periods of slow economic growth, and given the significantly less costly labour options available in the US, it's an increasing trend that is potentially reshaping the American manufacturing landscape, pushing the country's auto belt south from Michigan and Ohio into areas such as Alabama and Mississippi in search of cheaper labour and fewer costly union battles.

While it's not the first time the industry has seen a shift to the US for cheaper labour, some analysts believe the current shift appears more profound and longer lasting. It's a shift that now potentially threatens the future of high-paying manufacturing jobs in Canada, and specifically Southern Ontario and maybe even the future of unionized workplaces<sup>5</sup>. For example, in recent years Siemen's gas turbine Hamilton plant was closed and relocated to Charlotte, North Carolina, eliminating approximately 550 local jobs.

## Demographic shifts and challenges

Ontario currently has a population of approximately 13 million people. The arrival of baby boomers into the 65+ age group began in 2011, with a current senior population of 1.8 million. This figure is projected to more than double, increasing from 1.8 million in 2009 to 3.7 million by 2030. Currently in Canada approximately 6% of workers continue to work full-time after age 65, and the average retirement age in Canada is 62.

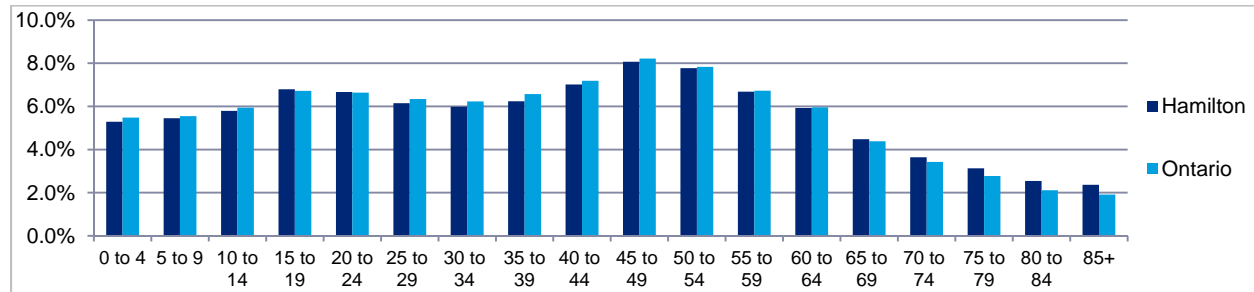
Since 2001, the pace of growth of Ontario's core working-age population (aged 15 to 64) has slowed, which reflects relatively low birthrates in Ontario from 1980 to 1990, and the passage of baby boomers into the 65+ age group. Over the next 20 years, it is projected that the working-age population will increase by 13.5%. As such, the total population's share of working-age population is expected to decrease from 69.4% in 2009 to 61.5% by 2030.

Hamilton has a slightly older population than Ontario and Canada on average, with a median age of 41. Approximately 20% of the City's population is between the ages of 35 and 49. Approximately 16% of Hamilton's population is aged 65 or older Hamilton, a ratio slightly higher than the national average of 14.8% and the provincial average of 14.6%.

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<sup>5</sup> Macleans, "State of the anti-union". April 5, 2012.

**2011 Age Demographics – Hamilton vs. Ontario**



Source: Statistics Canada, 2011

**Future talent and skill shortages**

Globally, talented human capital will be the most critical resource differentiating the prosperity of countries and companies. An estimated 10 million jobs with manufacturing organizations cannot be filled today due to a growing skills gap. Despite the high unemployment rate in many developed economies, companies are struggling to fill manufacturing jobs with the right talent, while emerging economies cannot fuel their growth without more talent. Thus, access to talent will become increasingly important and more competitive. Today’s skills gap will not close in the near future. Companies and countries that can attract develop and retain the highest skilled talent – from scientists, researchers and engineers to technicians and skilled production workers – will essentially come out on top. In the race to future prosperity, talent will remain a primary driver.

According to a Conference Board of Canada study, in 2025 Ontario could face a shortage of approximately 364,000 workers. A significant and growing skills mismatch is impacting Ontario’s growth, and without a concerted effort, Ontario’s unskilled workers may potentially see their opportunities decline, while employers have even more difficulty in attracting and retaining the talent they need. There are various industries and sectors in Ontario for which specific skill shortages have been projected. These are identified in the table below:

**Potential Skill Shortages in Ontario**

Industry / Sector	Potential Need / Shortage	Reason
Manufacturing	100,000	Retirement
Automotive	14,500	Retirement
Food services	200,000	Retirement, rising disposable income, aging population will increase household spending on food service
Retail	n/a	Shortage of workers, skills, knowledge
Financial services	25,000	Retirement
Health care	n/a	Retirement
Construction	50,000	Retirement
Environment	n/a	Shortage of workers, skills, knowledge
Electric power	17,000	Retirement

Source: Conference Board of Canada, Ontario’s Workforce Shortage Coalition

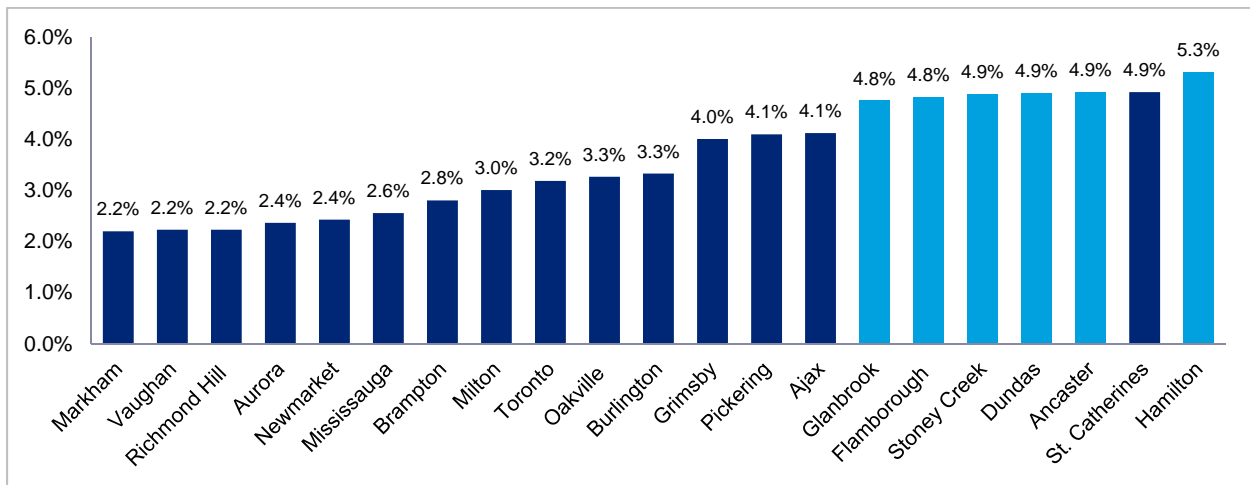
Such potential skill shortages, coupled with the future slow growth of workforce population, will potentially lead to a significant labour challenge for Ontario. Incentives for higher education and training, and being able to effectively engage skilled immigrants will potentially be a critical focus for the province.

### Municipal industrial property taxes

The City of Hamilton's industrial property tax rates are notably higher than a number of other municipalities across the Greater Toronto Area and surrounding region. The City's 2012 urban industrial property tax rate was 5.32%, the highest relative to Markham, Vaughan, Richmond Hill, Mississauga, Toronto, Oakville and Burlington, among various other municipalities, which range as low as 2.2% in Markham. Similarly, the City's 2012 urban industrial property tax rate for new construction was 5.17%, whereas the rates of these samples municipalities range as low as 2.2% in Markham.

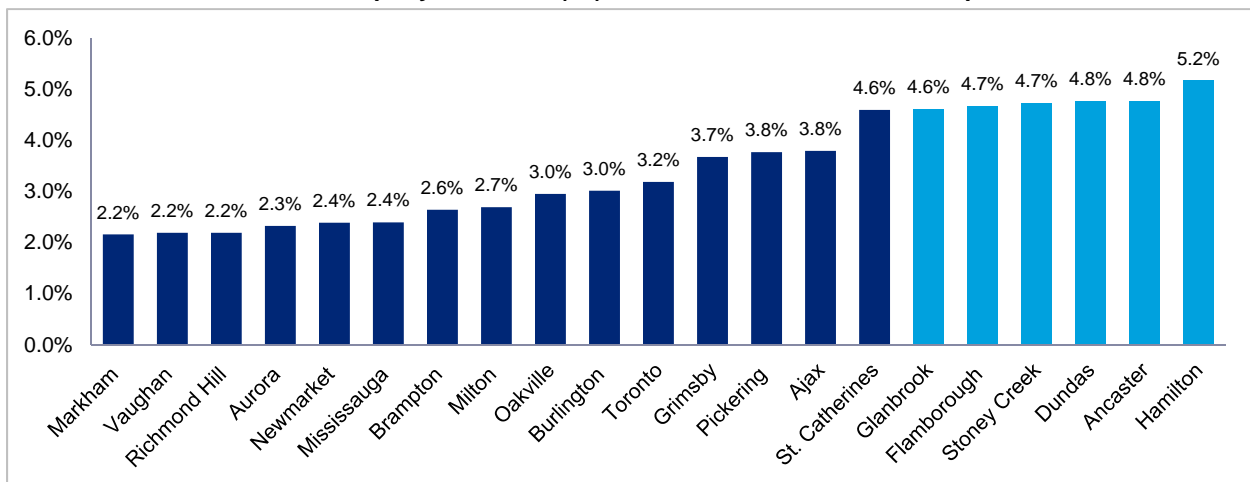
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**Industrial Property Tax Rates (IT) – Various Ontario / GTA municipalities**



2012 / 2013 Municipal, Regional and Board of Education Industrial Property Tax Rates, Applied to Assessment Value

**New Construction Industrial Property Tax Rates (JT) – Various Ontario / GTA municipalities**



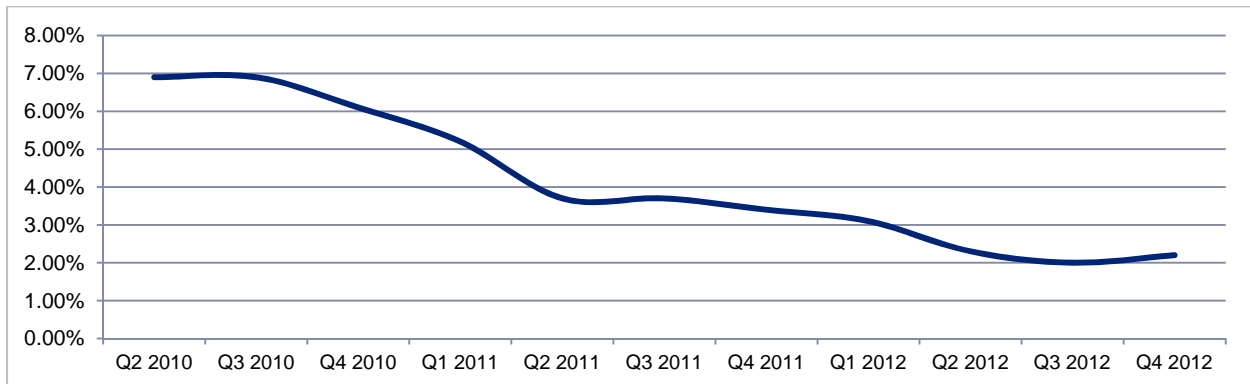
2012 / 2013 Municipal, Regional and Board of Education Industrial Property Tax Rates, Applied to Assessment Value

## Industrial market steadily tightening

Hamilton's industrial real estate market is currently very tight, and has seen a substantial reduction in the amount of industrial space available on the market. The City's vacancy rate for industrial space was 2.2% at Q4 2012, a significant decrease from 2010 and 2011 levels, where vacancy ranged from 3.4% to nearly 7%.

## The City's vacancy rate for industrial space was 2.2% at Q4 2012

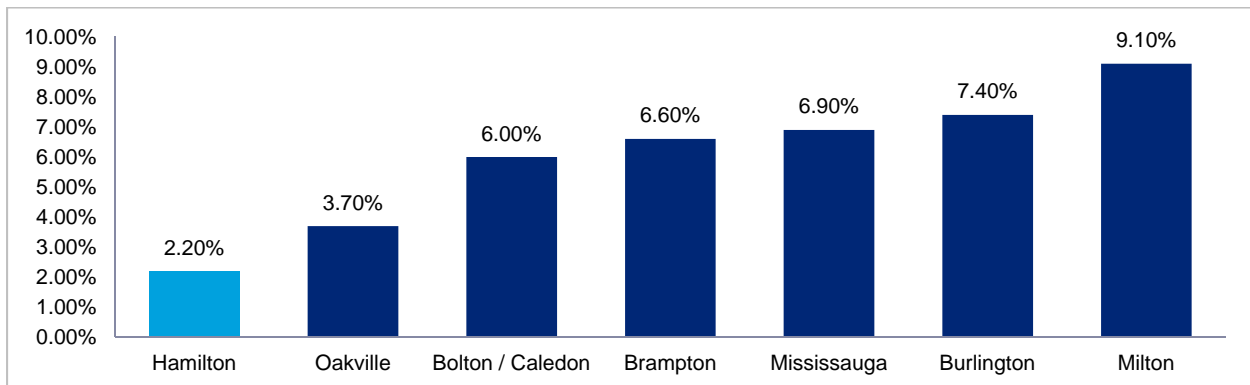
### Hamilton Historical Industrial Vacancy Rates



Source: Colliers International

Hamilton's vacancy represents a tight rate relative to various markets in the west GTA area, including Oakville (3.7%), Bolton / Caledon (6%), Brampton (6.6%), Mississauga (6.9%), Burlington (7.4%), and Milton (9.1%).

### Q4 2012 Hamilton vs. GTA West Industrial Vacancy Rates



Source: Colliers International, Cushman & Wakefield, 2012

## Manufacturing and Hamilton perception challenges

One of the most critical challenges that continues to face the growth of Hamilton's advanced manufacturing sector, is the local and regional perception of manufacturing itself, as well as the perception of the City of Hamilton, as a traditional industrial / manufacturing centre. This challenge of perception was particularly evident through stakeholder interview feedback, as this topic was widely noted as a top issue to the future growth of the sector.

As noted earlier, manufacturing oriented production and enterprise increasingly involves some form of advanced process, technology and innovation. Members of Hamilton's manufacturing community support such a view, but recognize that there is a lack of awareness around this shift among the general public, and particularly among youth, with respect to their views and choices on viable career paths.

Some students are likely lacking the understanding of science, technology, engineering and mathematics based subjects that drive advanced manufacturing careers, and view manufacturing to involve more traditional, factory, and assembly type activities.

Additionally, given Hamilton's association with manufacturing, there is also some degree of negative perception / misconception associated with the City itself. As noted by the Globe and Mail "when non-residents hear Hamilton, Ontario there's a good chance scarred landscapes and tall smokestacks come to mind"<sup>75</sup>. Stakeholders note that as a result of misperceptions of manufacturing, Hamilton is often considered to be "dirty", "industrial", "boring", etc.

### Images, Views and Perceptions of Hamilton



Source: Global News, Stephen C. Host, Canadian Press Images, Globe and Mail

As noted by the Hamilton Jobs Prosperity Collaborative ("JPC"), "a strong, creative brand for Hamilton will help to change attitudes and build a positive sense of momentum for the City"<sup>76</sup>. While the City has been actively working towards rebranding / reimagining Hamilton, it appears that there remains work to be done in this area. Hamilton's manufacturing community would like for the City to be positively recognized, for its advanced manufacturing strengths and assets, as a community that embraces the advanced manufacturing sector, and with a focus on its technological, innovative and sophisticated aspects.





## Attracting and retaining talent

Given potential skill shortages facing the province, and in addition to the perception challenge facing the City of Hamilton and its manufacturing sector the City also has a related challenge of attracting and retaining talent to the City, to potentially work within manufacturing sectors.

For example, McMaster University students are potentially not incented to work and live in Hamilton after graduation, according to a survey conducted by the students' union. Based on a poll of 800 students, 40% said that they would not consider living in Hamilton after completing their studies, 24% said they would not look for employment in the City, and 34% would live in Hamilton only as a last resort.

"McMaster is known as a top-rated institution, but everyone hears that Hamilton is the steel city of 50 years ago," according to McMaster University's student vice-president. Students are also sceptical of Hamilton as a result of a lack of awareness of cultural activities that take place in the city<sup>77</sup>.

While Hamilton is considered a location that offers a positive quality of life, including access to dynamic communities, affordable housing, strong transportation network, as well as education, healthcare, arts, culture and recreation opportunities, stakeholder feedback identified a lack of key amenities that would attract top talent of the future.

For example, Hamilton stakeholders identified a current lack of modern, urban living development, potentially in the form of new, well located condominiums in the City. Such development is considered to be critical to incent the younger demographic, new graduate or new entrepreneur to view Hamilton as a viable location to live and work.

Additionally, a lack of entertainment and recreational opportunities, particularly within walking distance of growing business areas / parks was noted to be a hindrance to the growth of these areas. For example, the McMaster Innovation Park (MIP) is located in a largely industrial area, and is considered to be in need of accessible dining options for area employees, in order to attract talent, and develop into a vibrant centre for collaboration. Such space would support the collaborative and interactive nature of the MIP's vision for effective innovation to occur.

The GTA is considered a key competitor in terms of offering a more attractive lifestyle to potential graduates given its urban lifestyle and mix of recreational, entertainment and other amenities.

## Summary

The City of Hamilton's advanced manufacturing sector is facing a number of challenges and vulnerabilities, which may potentially impact the City's ability to realize future growth. Such challenges include global, low cost competition, relatively high municipal industrial property taxes, a tight industrial market with limited availability, increasing global and national competition for FDI, regulatory hurdles, demographic shifts and challenges, future labour and skill shortages and manufacturing and Hamilton perception challenges.

While some of these challenges cannot be addressed or assisted at the municipal level (i.e. global low cost competition, provincial level regulations, etc.), other challenges are specific to Hamilton, or can be potentially addressed by the City, including municipal tax rates, the lack of availability within the local real estate market, perceptions challenges, and attracting and retaining talent to address current and future skill requirements. In order to address such challenges, and leverage the City's strengths, assets, and capabilities in a shifting global and North American landscape, the City will be required to act as a champion for the local advanced manufacturing sector, and strategize how it can effectively support this important sector towards future growth.

# Strategic Directions and Action Plan

## Overview

Advanced manufacturing is critical contributor to the Canadian economy, with significant economic impact, and ability to drive the prosperity of the nation, across regions and municipalities. Historically, industrial manufacturing has represented the driving force of the City of Hamilton's local economy.

The City of Hamilton's location, growing population and labor profile, established advanced manufacturing base with leading industries in steel / materials with the presence of Canada's largest integrated steel mills, food and beverage, machinery and automotive equipment manufacturing, market access, and developed infrastructure represent some of the drivers that have typically served as a foundation for attracting and expanding the region's manufacturing based industries.

In more recent periods, the City of Hamilton's manufacturing sector has faced a number of challenges, largely due to factors such as significant global economic turbulence, and fluctuating costs of doing business. The City's manufacturing sector has been traditionally focused in industrial based manufacturing and the steel industry, which was especially challenged in the recent recession, and resulting in a previous downturn in the autos and parts industry, followed by a recent positive shift and some expansion. Such challenges continue to test the City's manufacturing sector, to respond, diversify and capitalize on new opportunities.

## Strategic Directions

Today's Hamilton manufacturing based firms, associations, academic institutions and public sector leaders are concerned with issues such as increasing global competition, attracting, retaining and advancing talent, improving productivity and leading collaboration and innovation in order to remain competitive in a shifting global environment.

In order to effectively strategize to address such issues and truly prosper as an advanced manufacturing sector and local economy, the effective support and critical engagement across industry, academia, research, public sector and other key community groups is required. The City of Hamilton is well positioned to effectively champion such engagement, support local advanced manufacturing sector growth and ultimately establish Hamilton as a destination for new business investment. The following five strategic directions are recommended to ensure that the city of Hamilton is in the best possible position to meet the needs of the market and capitalize on future opportunities in the sector, with specific recommended action items to follow.

### Continue to Make Advanced Manufacturing a High Economic Development Priority

Raising the awareness of advanced manufacturing is important, as the sector plays a key role in wealth creation and has the ability to drive economic prosperity and productivity growth in the City, Provincial and National economy.



A focus on the top sub-sectors and emerging sub-sectors identified in this study is recommended, including:

- Materials / metal / steel manufacturing;
- Food & beverage manufacturing;
- Machinery manufacturing;
- Transportation / automotive manufacturing;
- Life sciences / healthcare manufacturing;
- Clean technology manufacturing; and
- Emerging technologies such as additive manufacturing, nanotechnology and synthetic biology and genetic engineering.

The City has many competitive advantages that will allow it to capitalize on future opportunities, in particular the potential re-shoring of more specialized manufacturing to North America. Hamilton's strategic location, access to transportation infrastructure and land supply will be major advantages.

### **Ensure Existing Firms Remain Competitive**

It is critical to ensure that the existing base of firms in the City's advanced manufacturing sector remains as competitive as possible. It is clear that manufacturing firms in Canada and Ontario are under measurable cost pressures. The City should seek to ensure that existing firms are able to adapt to these pressures and remain competitive. Of particular importance will be small and medium size enterprises, whose continued growth will play a major role in closing the productivity gap between Canada and the US.

### **Continue to Expand Innovation Infrastructure and Other Enabling Factors**

The City should seek to create an environment in which a wide range of breakthrough advances can be made and commercialized in the form of new materials, products and manufacturing processes. To this end it is important to maintain and expand the infrastructure and other enabling factors that supports advanced manufacturing, including: higher education and training; innovation, research and development capabilities; information and communications systems; availability of skilled labour; access to capital and incentives; and a stable, competitive business cost environment.

### **Aggressively Pursue High-Profile Advanced Manufacturing Investments**

Although Hamilton will experience a certain amount of investment in the normal course of growth, this may not reflect the City's full economic potential. To fully capitalize on future opportunities, the City should aggressively pursue advanced manufacturing investments, in particular high profile users, to raise the profile of the sector and set the tone for the future. An aggressive approach is also necessary to keep pace with competing communities, for which advanced manufacturing is also a high priority and, in some cases, where direct incentives are being offered to attract investment.

### **Monitor and Report on the State of the Industry**

Fundamentally, the City's advanced manufacturing strategy must focus on putting in place the business conditions, infrastructure and other enabling factors that will make Hamilton an attractive location for new investment, combined with an active pursuit of high profile users. Since this strategy cannot be followed without relevant market intelligence, the final initiative is to regularly monitor and report on the state of the industry. The information and insights gathered will be required for several purposes, including the communication of success stories, identifying the requirements of existing and future advanced manufacturing firms and tracking trends and changes in the industry.



## Action Plan

In order to implement this strategy, it is recommended that specific actions be taken within the following five categories.

- Marketing and Branding;
- Business Retention
- Investment Attraction ;
- Talent and Skills Development; and
- Local Industry Engagement.

## Marketing and Branding

### 1) Continue to position Hamilton as part of Ontario and the broader GTAH and beyond

Given the City of Hamilton's strategic position within the broader regional, provincial and national advanced manufacturing sector, it is recommended that the City continue to work with other municipalities and industry partners to market the broader Greater Toronto and Hamilton Area (GTAH), Ontario and national advanced manufacturing industry.

The City should seek to service or partner with new advanced manufacturing businesses that may choose to locate in other municipalities in close proximity to Hamilton. The City's ability to build its reputation, relationships and partnerships with members of the broader regional advanced manufacturing sector will be critical to realizing such opportunities.

### 2) Showcase the City of Hamilton's advanced manufacturing sector

A strategic marketing plan for the City of Hamilton's advanced manufacturing sector should be prepared to address the broader challenges associated with the traditional perceptions of manufacturing in Hamilton. The sector needs to be showcased as technologically advanced and sophisticated and one that represents a substantial economic opportunity for the City, the Province and Canada. A focus on the top sub-sectors and emerging sub-sectors identified in this study is recommended, including:

- Materials / metal / steel manufacturing;
- Food & beverage manufacturing;
- Machinery manufacturing;
- Transportation / automotive manufacturing;
- Life sciences / healthcare manufacturing;
- Clean technology manufacturing; and
- Emerging technologies such as additive manufacturing, nanotechnology and synthetic biology and genetic engineering.

### 3) Update City's advanced manufacturing sector's marketing material / industry profiles

The City of Hamilton's advanced manufacturing sector requires marketing material with information for the industry as a whole, as well as specific targeted sub-sectors and industries. Historical marketing materials should be updated to address current and emerging opportunities such as the rise of lightweight materials, new production processes, and the changing needs of the automotive industry. Hamilton's entire advanced manufacturing sector is well positioned to support all these activities. Key marketing channels to be updated include:

- Hardcopy and electronic marketing materials;
- Industry research;
- Website content; and
- Social media communication.

#### **4) Market Hamilton as a top location to work, live and play**

It is recommended that Hamilton undertake further marketing initiatives to challenge and continue shifting the perception of the City of Hamilton as a location for traditional industrial based manufacturing, smoke stacks and other “old economy” activities. The City should instead be positioned as a rapidly growing, technologically advanced and cost-effective location to live and conduct business. A “brand enhancement” program is recommended to articulate the quality of life opportunities in the Hamilton region.

#### **5) Leverage trade show opportunities**

While the specific trade shows that the City of Hamilton might choose to target and attend will vary by sub-sector and the City’s priorities with respect to target sub-sectors, it is recommended that advanced manufacturing trade shows be utilized to leverage marketing and branding and investment attraction opportunities in accordance with these strategies that the City will develop, including both domestic and foreign exposure. Participation focus should be given to the largest and emerging advanced manufacturing sub-sectors in Hamilton, and include shows catering to small to medium sized businesses, as well as larger, high profile advanced manufacturing firms. Potential trade shows for consideration may include those supported by key manufacturing associations such as Canadian Manufacturers and Exporters (CME), Excellence in Manufacturing Consortium (EMC), etc., national and international economic development trade shows, and corporate real estate trade shows where numerous site selectors are in attendance, such as CoreNet. A sample of potential advanced manufacturing oriented trade shows or conferences for additional consideration are provided in Appendix F.

### **Business Retention**

#### **6) Understand the needs of large and strategic advanced manufacturing firms**

The City of Hamilton currently maintains a detailed business listing across advanced manufacturing, as well as various other data sets and information gathering tools such as its corporate calling initiative. These tools should continue to be used to properly understand and potentially predict the requirements and growth opportunities of large or potentially high-growth firms.

#### **7) Identify key service providers and supply chain linkages**

Local stakeholders consistently noted the importance of understanding the availability and access to critical suppliers following the choice to locate in Hamilton. Stakeholders noted that the clear identification of such suppliers at the site selection and business development stage is important for understanding how to effectively locate and source necessary services. The City should take steps to ensure that existing firms are aware of key providers and supply chain linkages.

#### **8) Identify opportunities to assist existing businesses**

Providing a cost competitive environment is important to assist local established businesses, and plays a key role to the ability of these organizations to expand and experience future growth. The City currently offers a range of incentive programs for property owners and developers to help offset the costs of development including: reductions in property tax rates, grants for brownfields, heritage properties, core area properties, and LEED certified buildings. The City should seek to ensure that existing firms are aware of the various available incentive programs.

#### **9) Maintain regular contact with key industry leaders and foster community collaboration**

The City should maintain regular contact with key industry leaders to ensure a thorough understanding of the needs of local businesses and be well positioned to respond. Given Canada’s challenge of realizing growth across its more maturing organizations, and closing the productivity gap, there is an important role for the City to play in supporting advanced manufacturing industries and organizations. Similarly, the City should seek opportunities to foster collaboration and further develop the local manufacturing community through events, trade shows, etc.

## Investment Attraction

### 10) Assess the opportunity for targeted financial incentives

Financial incentives can play an important role in influencing business location decisions, and are particularly relevant given that many of Hamilton's competitors offer financial incentives. The City currently offers a range of incentive programs for property owners and developers, but none specifically able to target the advanced manufacturing sector. It is recommended that the City consider options for developing a targeted incentive program, similar to the Imagination, Manufacturing, Innovation Technology (IMIT) Financial Incentive Program in the City of Toronto.

### 11) Continue to lead tours of the City's advanced manufacturing facilities

The City should highlight potential opportunities within its entrepreneurial, innovation, and collaboration spaces by leading more frequent tours of the City's major assets and state of the art manufacturing facilities, such as the McMaster Innovation Park. Such tours could enable prospective organizations to better understand and envision the investment opportunity in Hamilton, and enable Hamilton's existing advanced manufacturing organizations to gain further exposure to the broader regional, national and international community. The local commercial real estate community should be leveraged further to strategically market and lease available space, and target advanced manufacturing investment.

### 12) Regularly monitor foreign direct investment (FDI) opportunities

Given that advanced manufacturing activities figure prominently in FDI, it is recommended that the City regularly monitor these opportunities. Such monitoring should include such issues as the site selection drivers for various foreign markets, foreign views of Hamilton as a potential location for investment and what investments could potentially be attracted. The results would be used to identify the top target countries, industries and organizations to pursue as part of a formal FDI strategy led by the City of Hamilton.

### 13) Aggressively pursue high profile investments with the appropriate tools

The City should continue to aggressively pursue high profile advanced manufacturing users in its key industry sectors, notably steel and fabricated metal products, food and beverage, automotive equipment and manufacturing. These are also sectors that figure prominently in the broader GTHA economy. The "full sales team" should be brought to the table including municipal experts in business development, economic development and planning. Steps should also be taken to provide greater clarity on the regulatory and union environment as well as options to streamline the approvals process.

## Talent and Skills Development

### 14) Identify gaps in the local demand and supply of advanced manufacturing talent

It is critical to connect industry directly with training to effectively match the supply and demand for employment opportunities in Hamilton's advanced manufacturing market. Through its workforce planning research, studies, analysis, and surveys, the City should seek to strengthen the alignment of local businesses and institutions by specific program area. Areas of focus could include identifying local growing firms to contribute to future post-secondary education program advisory, identification of future skill needs / gaps, and support and encouragement of job training / retraining across industries.

### 15) Support and expand education and technical training programs

The City should seek to support and expand education and training, given the projected shortage of manufacturing skills in Ontario, the importance of science, technology, engineering and mathematics (STEM) based education programs and the presence of such specialized programming and research at McMaster University and Mohawk College. The City should also promote the positive graduation employment statistics in these programs and need for skills in STEM areas, in order to inform high school students on the technical and strong future career opportunities in advanced manufacturing.

### **16) Encourage local entrepreneurship**

The City should continue to support and encourage innovation and entrepreneurship at the local level, including high school and post-secondary education events and talent competitions around advanced manufacturing to drive positive, and identify key sources of local talent, innovation and future entrepreneurs. One option would be for the City to host a “Dragon’s Den” type series, among local high schools and colleges to foster innovation and entrepreneurial activities, and feature innovative businesses in support of Hamilton entrepreneurial economy.

## **Local Industry Engagement**

### **17) Identify advanced manufacturing champions for the City**

Given the various actions required to lead expansion in the City’s advanced manufacturing sector, it is recommended that “champions” be identified. This could be through a permanent fulltime position, complemented by an advisory board. The position should be filled by an individual with experience in the advanced manufacturing sector and also knowledge of the municipal decision making process. As such, the champions could comprise representatives from the local manufacturing private sector, with a significant relationship with the City of Hamilton, or a public sector representative from the City of Hamilton with extensive relationships across the private sector manufacturing community. A similar approach has been taken by the City of Pittsburgh: a specific strategy was developed for senior industry leaders to actively engage in the attraction, recruitment and retention of high profile businesses to the Pittsburgh area.

### **18) Leverage regional expertise**

The City should continue to engage, consult and leverage the expertise of local industry, innovation, and academic organizations such as:

- McMaster University;
- Mohawk College
- Excellence in Manufacturing Consortium (EMC);
- Innovation Factory;
- Canadian Manufacturers and Exporters (CME);
- Business Development Bank of Canada (BDC);
- Export Development Canada (EDC); and
- local manufacturing firms, among other groups.

These organizations will continue to provide critical insight into future manufacturing growth opportunities for the City of Hamilton, and additional recommendations for realizing future growth.

### **19) Improve local sector collaboration to drive partnership, innovation and productivity**

Hamilton’s manufacturing based firms, associations, academic institutions and public sector leaders share common interests and concerns around productivity, effective collaboration, locating critical talent and investing in innovation, among others. While the City has a breadth of local expertise across the manufacturing sector, there are clear benefits to improving collaboration across these groups, to effectively support partnership and drive innovation. For example one issue identified by stakeholders is a lack of identified venue / space and means for such collaboration to take place. The City should consider options to supply space to accommodate regular manufacturing specific events, such as a “Productivity / Innovation Series”, across key industries, as well as hold other regular meetings with industry leaders to discuss key issues and facilitate development when opportunities arise.

# Appendix A – Stakeholder Interviews

## Interviewees

Hamilton Organizations	Genre	First Name	Last Name	Position
ArcelorMittal Dofasco Inc.	Manufacturing	Tony	Valeri	Vice President Public Affairs and Communications
Canadian Manufacturers & Exporters	Non-Profit	Paul	Clipsham	Vice President
CareGo Group of Companies	Manufacturing	Demetrius	Tsafaridis	President and CEO
CareGo Group of Companies	Manufacturing	David	Jenkins	Chief Operating Officer
Excellence in Manufacturing Consortium	Non-Profit	Al	Diggins	President & General Manager
Excellence in Manufacturing Consortium	Non-Profit	Scott	McNeil-Smith	Director of Marketing & Development
Felton Brushes	Manufacturing	Tony	Ponikvar	President
Fibracast	Clean tech	John	Tomescu	CEO
Hamilton Port Authority	Non-Profit	Bruce	Wood	President and CEO
Innovation Factory	Non-Profit	Ron	Neumann	Executive Director
Innovation Factory	Non-Profit	Tyler	Wright	Business Development Coordinator
Maple Leaf	Food & Beverage	Anne	Tennier	Vice President of Environmental Affairs and Food Safety
McMaster University	Education & Research	Nick	Marketos	Assistant Vice-President, Research Partnerships
McMaster University	Education & Research	Stephen	Veldhuis	Associate Professor and Director, McMaster Manufacturing Research Institute (MMRI)
Mohawk College	Education & Research	Cheryl	Jensen	Vice President, Academic
Ministry of Economic Development, Trade, and Employment	Advanced Manufacturing	Marc	Sharrett	Director, MEDTE, Advanced Manufacturing Branch
Ministry of Economic Development, Trade, and Employment	Advanced Manufacturing	Carrie	Manchuk	Manager, MEDTE, Advanced Manufacturing Branch
Parrish & Heimbecker	Food & Beverage	Robert	Bryson	Director of Eastern Canadian Grain Operations
VicWest	Manufacturing	Doug	Mackinnon	General Manager

## Stakeholder Consultation Guide

The following section outlines the content shared with key stakeholders and identifies key discussion topics and questions posed to participants.

### Overview

The City of Hamilton is one of Canada's major cities, and one of Ontario's most economically diverse. Hamilton's major economic sectors include manufacturing, agriculture/food processing, creative industries, clean technology, life sciences and transportation/goods movement. Situated at the western end of Ontario's Golden Horseshoe region, Hamilton is centrally located in Canada and Ontario's manufacturing heartland. The City's location, market access, and presence of Canada's largest integrated steel mills, have served as a foundation for attracting and expanding the region's manufacturing based sectors.

While the City's diverse economy and advanced manufacturing sector possess many strengths and opportunities, its key sub-sectors have also faced numerous challenges and threats, including an economic recession, low-cost competition on an international scale, and increasing costly regulatory constraints imposed by North American governing agencies.

The City's companies have continued to adapt and respond to such challenges, and the City of Hamilton continues to seek ways in which to effectively support and facilitate long-term growth for its manufacturing sector. As such, the City has retained Deloitte & Touche LLP ("Deloitte") to undertake the following study regarding the City's advanced manufacturing sector (the "Study").

Through the proposed Study, the City of Hamilton's Planning & Economic Development Department is looking to define the current state of Hamilton's advanced manufacturing cluster, and identify key realistic and implementable recommendations to formulate strategic objectives and initiatives that will assist the City and its economic development partners to establish Hamilton as a destination for investment and a supportive environment for industrial growth.

### Purpose

The purpose of the stakeholder consultation process is to assist the City of Hamilton:

- Identify, clarify and prioritize potential strengths, weaknesses, opportunities and threats facing the City's advanced manufacturing sector and local businesses operating within this sector; and
- Obtain critical input towards potential recommendations to be considered and included within our analysis for this Study for the City of Hamilton.

### Structure of market consultations

Stakeholder consultations are being conducted on a confidential, non-attributable basis. Background information on the Study and stakeholder consultation questions are contained in this presentation. These questions represent a guideline for interviews, from which to frame the discussion.

Each market sounding consultation will involve representatives from Deloitte and the City of Hamilton, meeting with individuals from a single stakeholder organization. The meetings will run approximately one hour, and will be conducted in person or via teleconference.

Deloitte has developed the stakeholder consultation process in consultation with the City of Hamilton and we have been instructed to schedule, facilitate and provide high level feedback on the stakeholder consultations.

## Topics for discussion and stakeholder consultations questions

### Overview

- Overview of nature of your organization and mandate?
- How would you describe the state of the current advanced manufacturing cluster in Hamilton?
- What are the key elements of this cluster, for example critical mass of sector / businesses, academic and research institutions, supply chain framework, etc.?
- How would you describe the nature of current export activity in Hamilton? Is Hamilton competitive in advanced manufacturing exports relative to other municipalities?
- How would you describe the nature of current FDI Hamilton? Is Hamilton competitive in advanced manufacturing oriented FDI relative to other municipalities?

### Strengths and opportunities

- How do you view the City of Hamilton's value-added proposition relative to other locations (i.e. across Canada, U.S. or internationally)?
- Where do you believe local advanced manufacturing businesses have observed significant growth / opportunities? (i.e. domestic activity, exports, etc.)
- What potential business growth opportunities (i.e. domestic, exports, etc.) do you envision for local advanced manufacturing businesses in the future?
- What tools would be critical to realizing such opportunities?
- Do you think local advanced manufacturing businesses prioritize and invest in capital equipment, talent, technology and innovation related initiatives appropriately?
- How does existing local / regional infrastructure currently support local manufacturing based businesses?
- What is the potential role for local / regional government in assisting local advanced manufacturing businesses to realize such opportunities?
- Other strengths and opportunities?

### Challenges, threats and gaps

- What challenges face local advanced manufacturing businesses? (i.e. economy, talent shortage, customer base shifts, increasing domestic competition, increasing international competition, etc.)
- How would you rank the greatest challenges, what issues are most critical?
- What potential challenges to local advanced manufacturing businesses might you envision in the future? Why?
- What are some of the potential key tools required or current gaps within the sector, local economy, local / regional governance, etc. that need to be addressed, in order to effectively manage these challenges?
- How could existing infrastructure potentially be strengthened to better support the operations of local advanced manufacturing businesses?
- What is the potential role for local / regional government in assisting / addressing such challenges?
- Other challenges, threats and gaps?



# Appendix B - Industry 1: Steel / Metal Manufacturing Trends

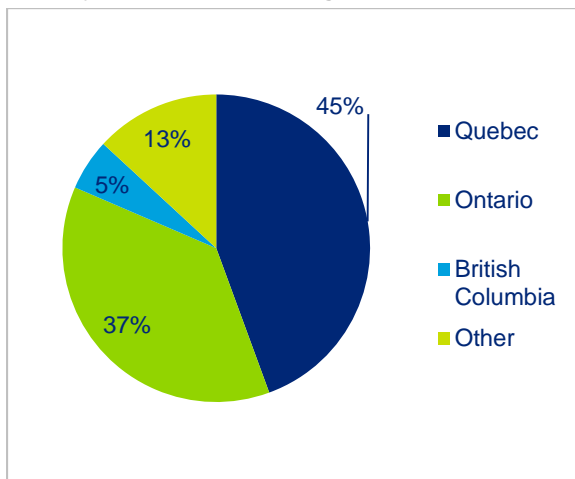
## Canadian metal / steel industry market landscape

Steel is the most widely used metal and most recycled material worldwide, used in construction, manufacturing and automotive parts and assemblies<sup>78</sup>. Canada has a steel technology cluster of steel producers, customers, and suppliers, comprising an estimated 106 firms nationally, largely focused in central Canada. Total world steel production grew by 1.2 % in 2012, with over 1.5 billion tonnes of crude steel produced. The World Steel Association notes that sector growth in 2012 is largely attributed to Asia and North America.

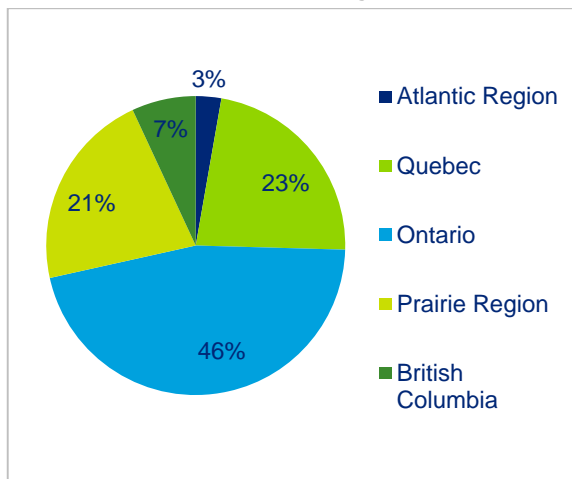
According to the Canadian Steel Producers Association, Canada produced 13 million tonnes of steel in 2010, with estimated sales of \$12 to \$14 billion, and nearly \$7 billion in exports. A 2010 study conducted by University of Toronto's Munk Centre for International Studies, finds that the Canadian industry supports over 130,000 direct and indirect jobs in Canada, and as is the case in Hamilton, forms major employers in many communities with significant local economic impacts. Canada maintained its position as the 16th largest steel producer, with total production growth of 5.9% in 2012, outpacing the U.S. (2.5%) and Mexico (0.9%). Production in 2012 totaled 13.7 million tonnes of crude steel, and while Canada's production is up, these levels are well below the prerecession total of 15.6 million tonnes in 2007.

The Canadian primary metal industry is primarily focused in Quebec, which accounts for approximately 45% of national revenue, with Ontario accounting for 37%, British Columbia accounting for 5%, and the remaining regions collectively accounting for 13% of primary metal industry revenue. The Canadian fabricated metal product industry is primarily focused in Ontario which accounts for approximately 46% of national revenue, followed by Quebec (23%), the Prairie Region (21%), and the remaining regions accounting for the remaining 10% of primary metal industry revenue.

**Primary Metal Manufacturing Total Revenue**



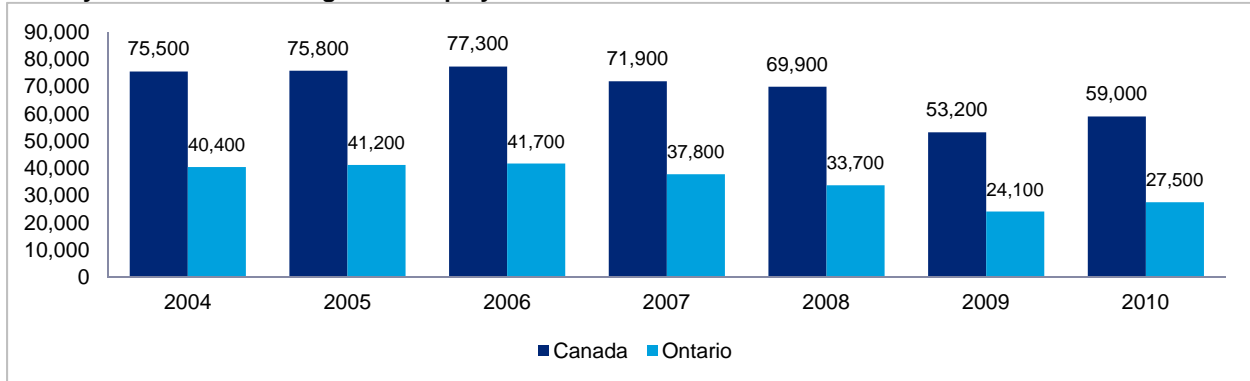
**Fabricated Metal Manufacturing Total Revenue**



Source: Statistics Canada, *Principal statistics for manufacturing industries, by North American Industry Classification*

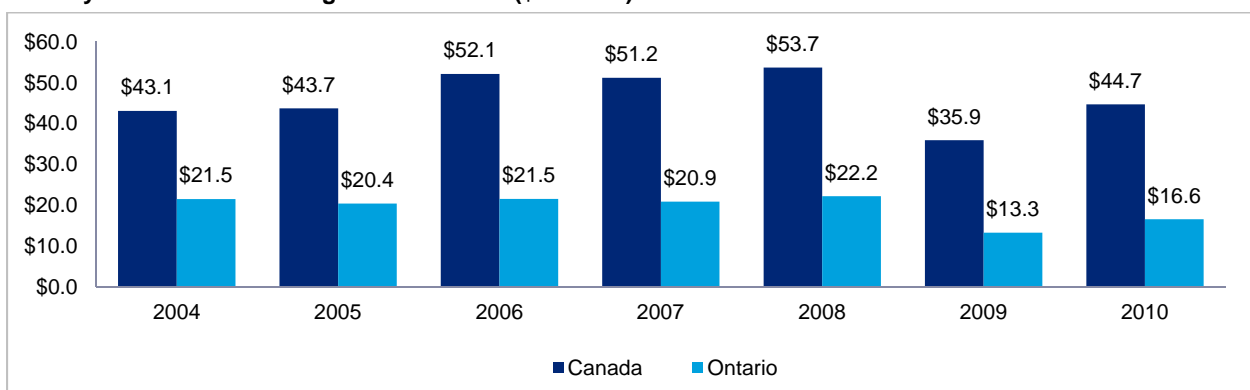
Ontario's steel industry is a major economic driver in the province, supporting an estimated 27,500 employees in 2010 and total revenue of \$16.6 billion. According to the Ministry of Economic Development, Trade, and Employment, the province's steel industry accounts for exports of \$6 billion a year and is forecast to experience between 20% to 30% growth over the next decade. Ontario's steel industry spends an estimated \$500 million annually on R&D.

**Primary Metal Manufacturing Total Employment – Canada and Ontario**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Primary Metal Manufacturing Total Revenue (\$ billions) – Canada and Ontario**



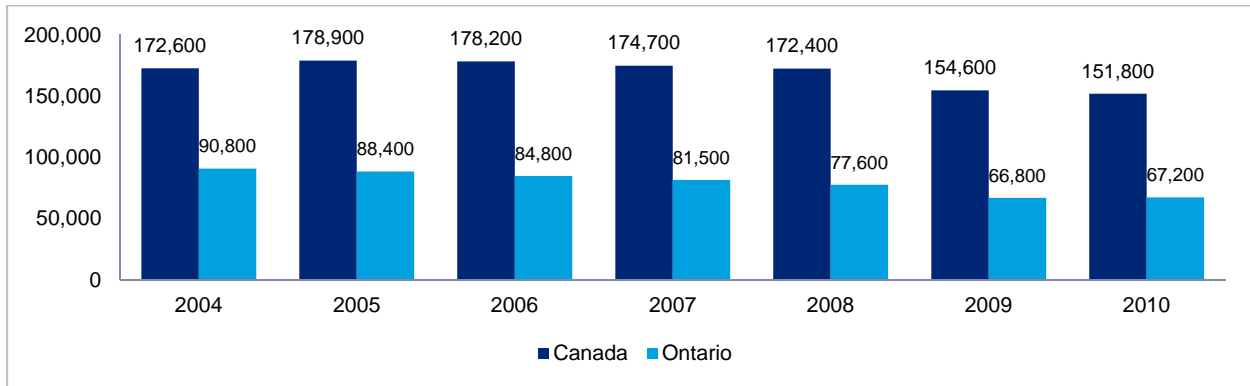
Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

Fabricated metal product manufacturing is also a key element of the Ontario's manufacturing economy. This sector is defined to include the following activities:

- Forging and stamping;
- Architectural and structural metals manufacturing;
- Boiler, tank and shipping container manufacturing;
- Spring and wire product manufacturing;
- Machine shops, turned product, and screw, nut and bolt manufacturing; and
- Other fabricated metal product manufacturing.

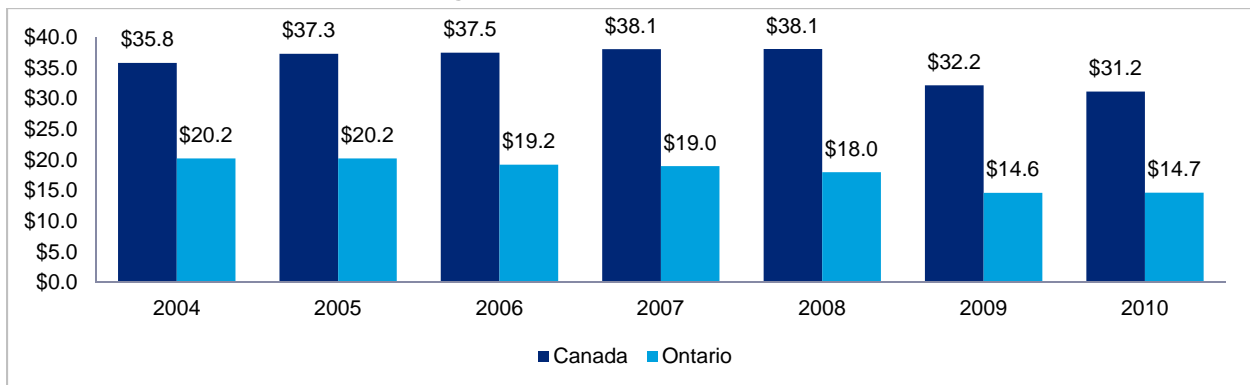
In 2010, Ontario's fabricated metal product manufacturing industry supported an estimated 67,200 employees in 2010, and generated total revenue of \$14.7 billion.

**Fabricated Metal Product Manufacturing Total Employment – Canada and Ontario**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Fabricated Metal Product Manufacturing Total Revenue (\$ billions) – Canada and Ontario**

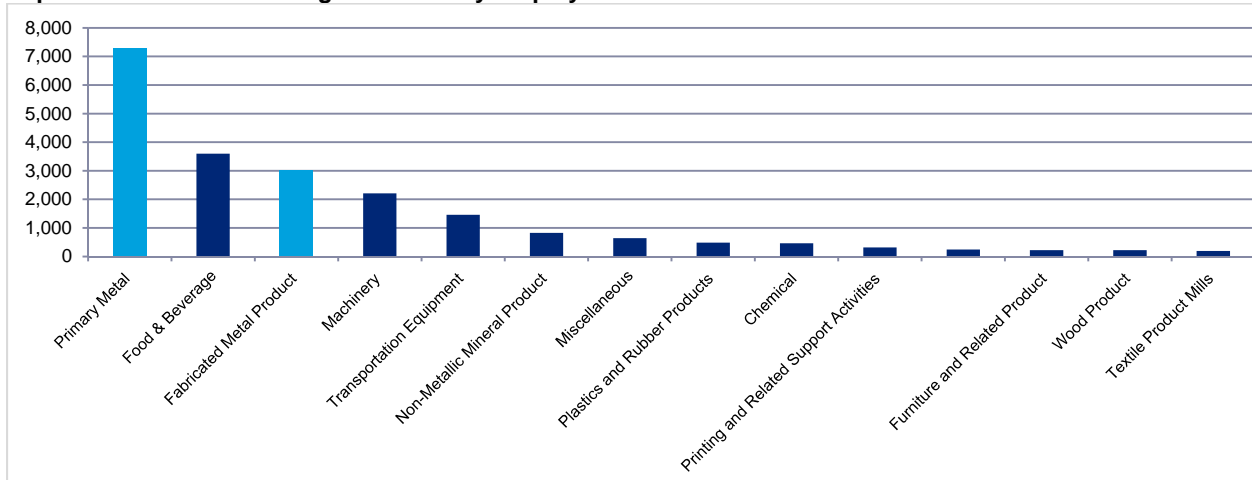


Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Hamilton metal / steel industry market landscape**

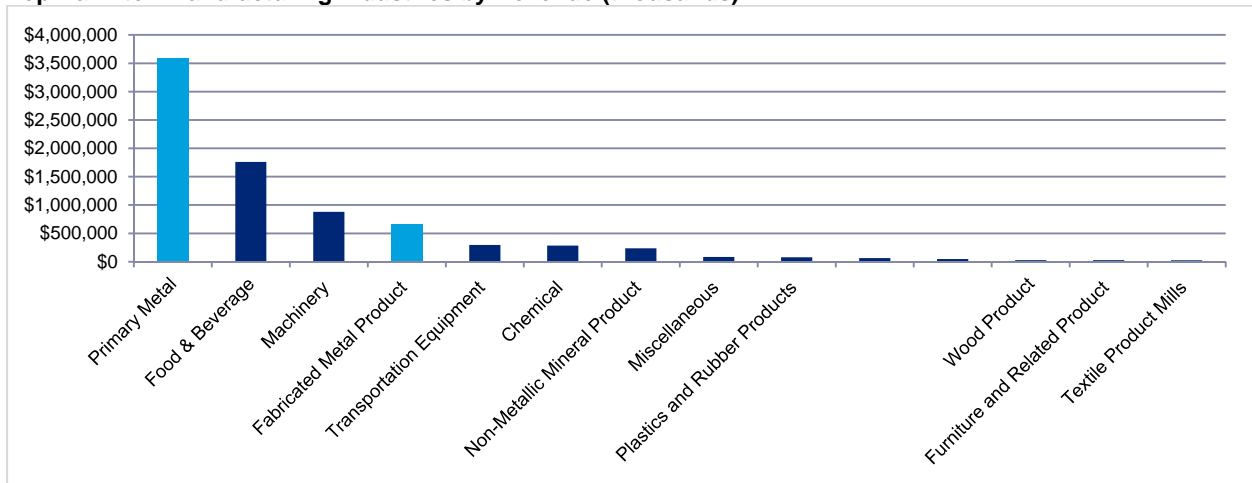
The City of Hamilton supports a robust primary metal manufacturing industry, largely driven by its significant multinational steel companies (i.e. ArcelorMittal Dofasco, National Steel Car, US Steel), as well as substantial fabricated metal product manufacturing. According to Statistics Canada, Hamilton's largest manufacturing industry is primary metal manufacturing alone, with fabricated metal product manufacturing comprising the third largest manufacturing industry.

**Top Hamilton Manufacturing Industries by Employees**



Source: Statistics Canada, All Manufacturing Industries

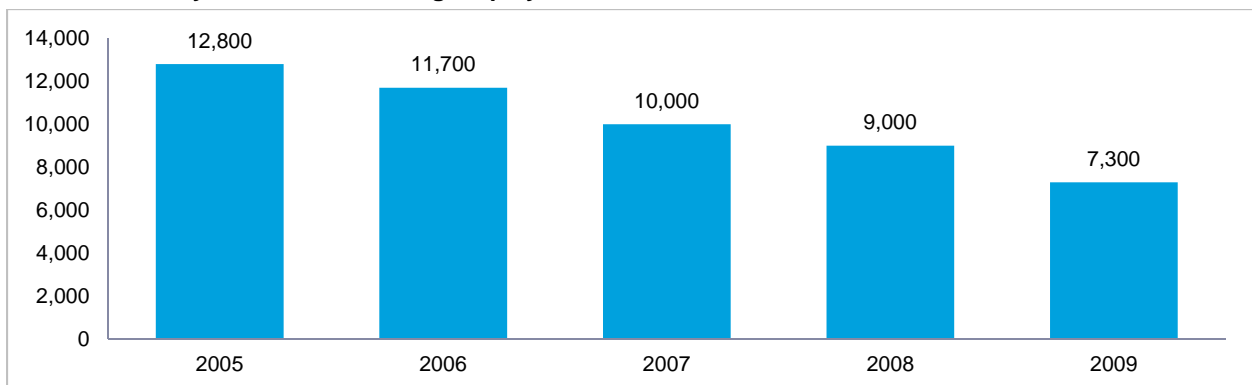
**Top Hamilton Manufacturing Industries by Revenue (thousands)**



Source: Statistics Canada, All Manufacturing Industries

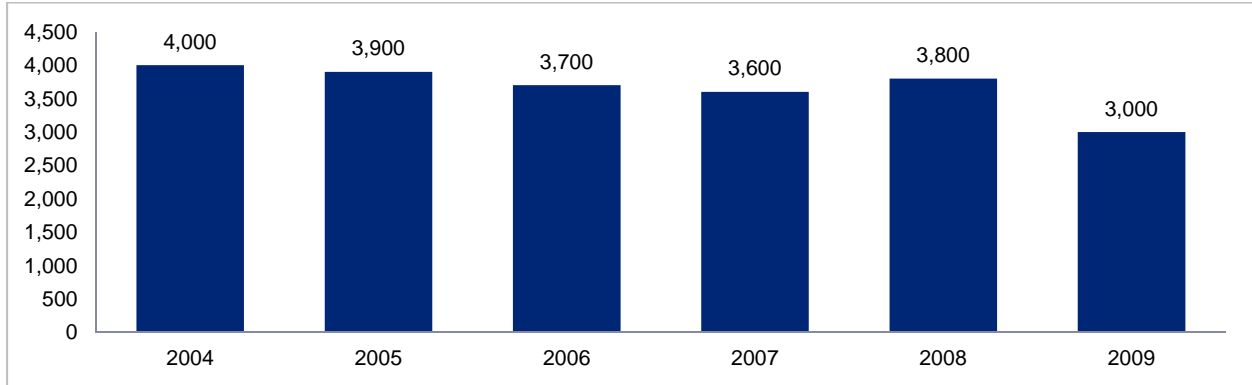
According to Statistics Canada's 2010 Annual Survey of Manufacturers and Logging, in 2009 the City had 10,300 employees engaged in primary and metal product manufacturing, with 7,300 employees engaged in the primary metal manufacturing and 3,000 employees engaged in fabricated metal manufacturing. Industry employment represented approximately 30% of Ontario's primary metal manufacturing employment, and 5% of Ontario's fabricated metal product manufacturing employment.

**Hamilton Primary Metal Manufacturing Employees**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

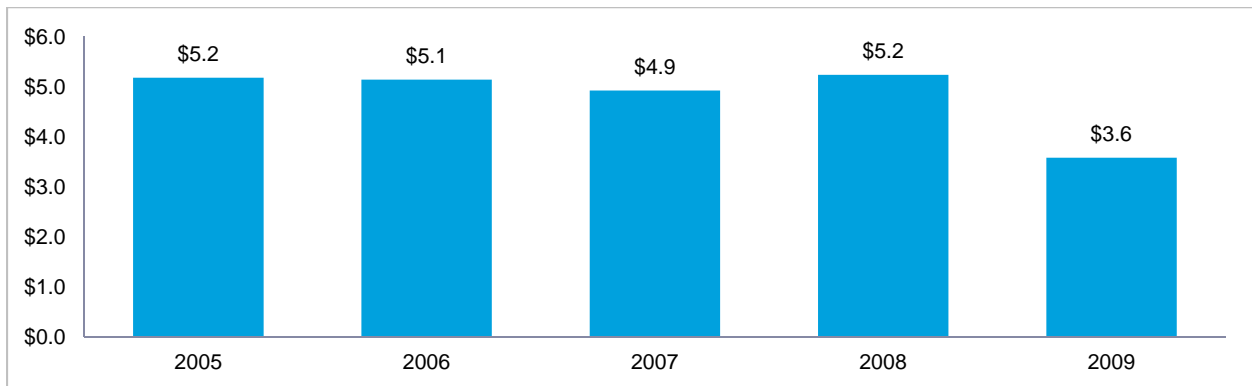
**Hamilton Fabricated Metal Product Manufacturing Employees**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

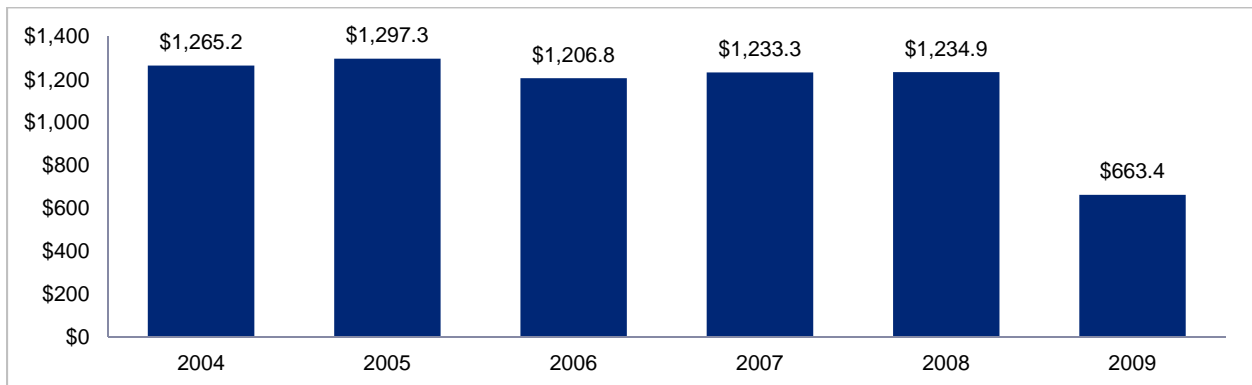
These industries generated approximately \$3.6 billion in primary metal manufacturing, and \$663 million in fabricated metal product manufacturing. Industry revenue represented approximately 27% of Ontario's primary metal manufacturing revenue, and 5% of Ontario's fabricated metal product manufacturing revenue.

**Hamilton Primary Metal Manufacturing Total Revenue (\$ billions)**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Hamilton Fabricated Metal Product Manufacturing Total Revenue (\$ millions)**

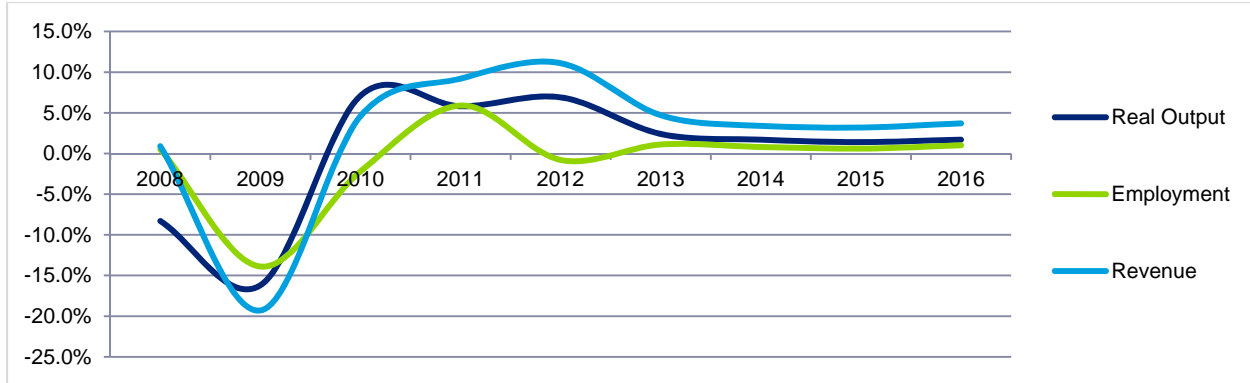


Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

### Future outlook and opportunities

According to the Conference Board of Canada, the economic outlook for the Canadian fabricated metal manufacturing industry is positive, including steady growth in real GDP, and modest growth in revenue, and employment through to 2016.

#### Fabricated Metal Products Industry Outlook



Source: Conference Board of Canada, *Canada's Fabricated Metal Products Industry, 2012*

It is projected that developing economies will require much more steel in the future, driving opportunities for Canadian steel producers. Conventional markets for steel are also anticipated to grow as Canada continues its economic recovery. This includes growth in automotive, energy and other natural resources, and construction.

The continued trend for the Canadian steel industry will also involve greater concentration to higher value-added and environmentally sustainable segments of the market. New steel products are lighter, stronger – essential for a more sustainable economy and society, including applications in automotive parts and equipment, wind and solar power towers and frames, transportation fuel efficiency, and durable construction. Growing demand for commodities worldwide is also expected to translate into higher demand for machinery and equipment used by the mining and oil and gas industries, for which fabricated metal products are key inputs.

Additionally, the industry will be required to continue to invest in continued development of employee skills, technology and innovation. Community colleges, universities and research institutions have a key role in developing needed workforce skills. Externally-oriented innovation can leverage the industry interface with key partners and customers, rather than exclusively relying on technical development.

The City of Hamilton is driving significant economic performance in steel / metal manufacturing based industries for Ontario, given that the City's industry contributes approximately 27% of Ontario's primary metal manufacturing revenue, and 5% of Ontario's fabricated metal product manufacturing revenue. Similarly, industry employment represented approximately 30% of Ontario's primary metal manufacturing employment, and 5% of Ontario's fabricated metal product manufacturing employment.

Hamilton is well positioned to grow according to future industry trends and opportunities, at it is considered a leader in steel product and process innovation and technological change. For example, the City's steel industry developed the first mini-mill in Ontario at ArcelorMittal Dofasco's Hamilton facility. The City is also leading significant research, and public / private collaboration, such as the new CANMET Materials Technology Laboratory, a 145,000 square-foot complex includes facilities for casting, rolling and forming metal, and designing and testing new materials.

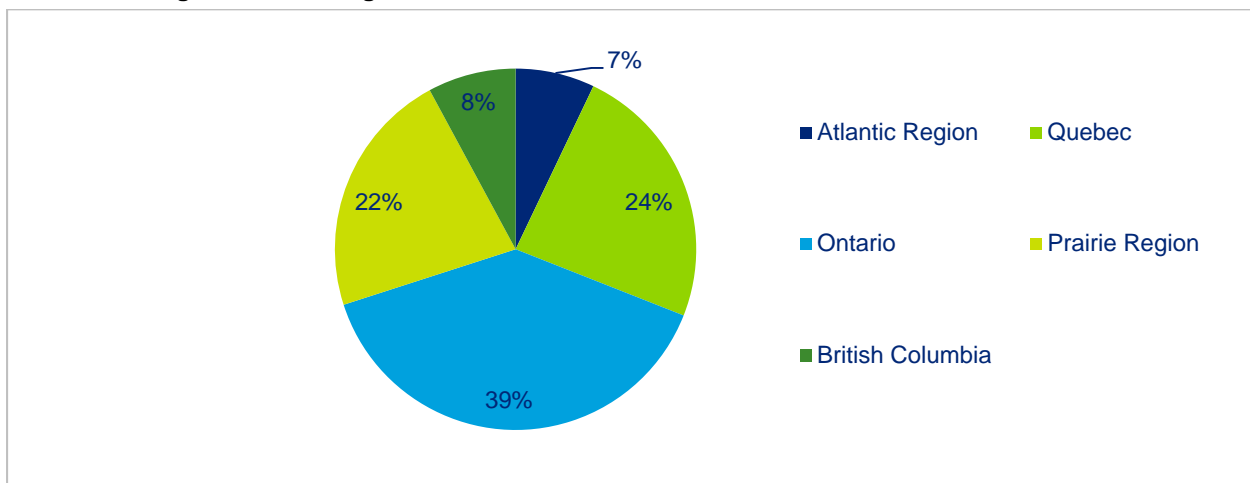
# Appendix C - Industry 2: Food and Beverage Manufacturing Trends

## Canadian food and beverage manufacturing market landscape

Canada enjoys a well-established agriculture and agri-food industry with significant success in the global marketplace. In 2010, there were approximately 8,000 food and beverage processing establishments in Canada, with over 230,000 employees. Food and beverage manufacturing includes industries such as animal food manufacturing, dairy product manufacturing, meat product manufacturing and bread and bakery product manufacturing.

The food and beverage processing industry is among the largest manufacturing industries in most Canadian provinces. Ontario accounts for most national production, with approximately 40% of national food and beverage manufacturing revenue, with Quebec accounting for 24%, the Prairie Region for 22%, British Columbia for 8% and the Atlantic Provinces for the remaining 7%.

### Food & Beverage Manufacturing Total Revenue – Canada



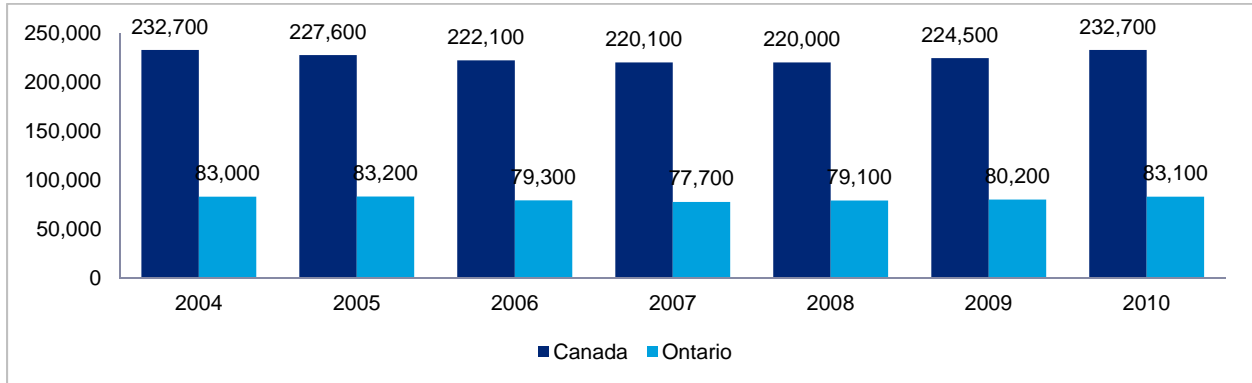
Source: Statistics Canada, *Principal statistics for manufacturing industries, by North American Industry Classification*

Ontario is one of the largest and most competitive food processing clusters in North America, ranking as the third largest food processing jurisdiction with annual sales of more than \$34.3 billion. Approximately one-third of sales are generated by exports, mainly to the US, and virtually every country in the world.

More than 200 agricultural commodities are grown on Ontario's farms, many of which are processed within the province, and there are estimated to be at least 2,500 food and beverage manufacturing firms in the province. Ontario has a well-developed supply chain network of primary processors, ingredients manufacturers, specialty importers and further value-added processors.

With respect to food and beverage manufacturing employment, Ontario accounts for approximately 36% of national levels at 83,100, and has remained steady, growing approximately 4% from 2009 to 2010.

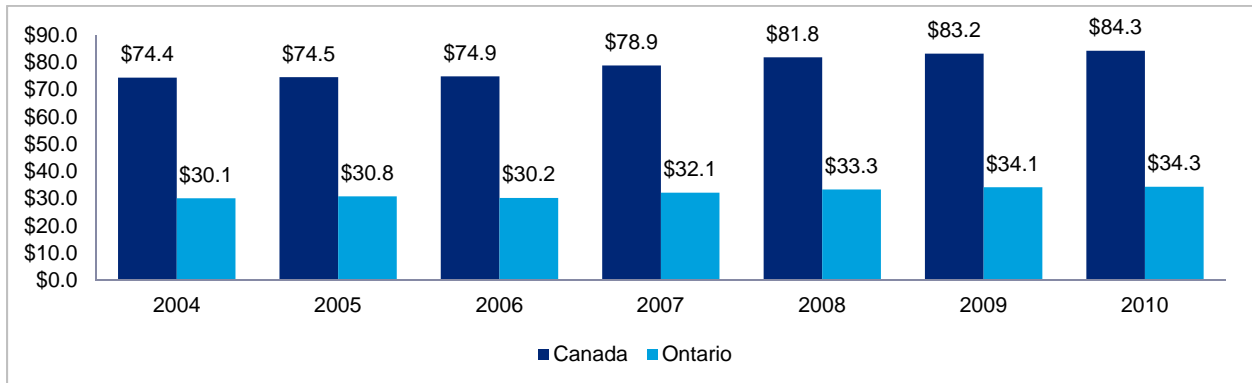
**Food & Beverage Manufacturing Total Employment – Canada and Ontario**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

Ontario accounts for approximately 41% of national food and beverage manufacturing revenue at \$34.3 billion, and has remained steady, with positive growth from 2007 to 2010.

**Food & Beverage Manufacturing Total Revenue (\$ billions) – Canada and Ontario**



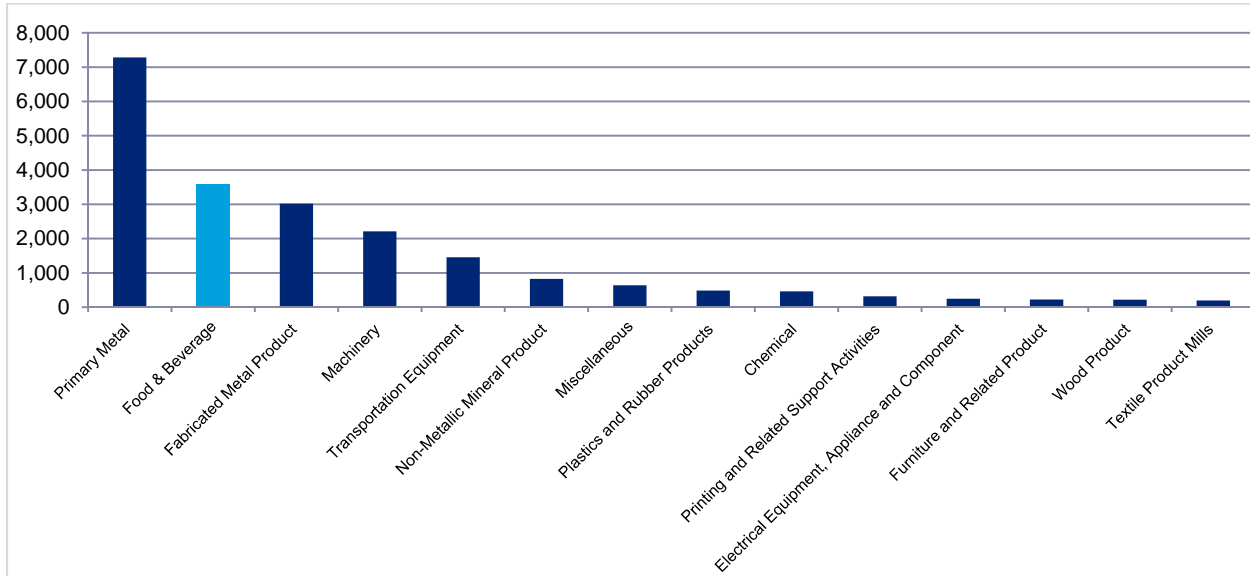
Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System



## Hamilton food and beverage manufacturing market landscape

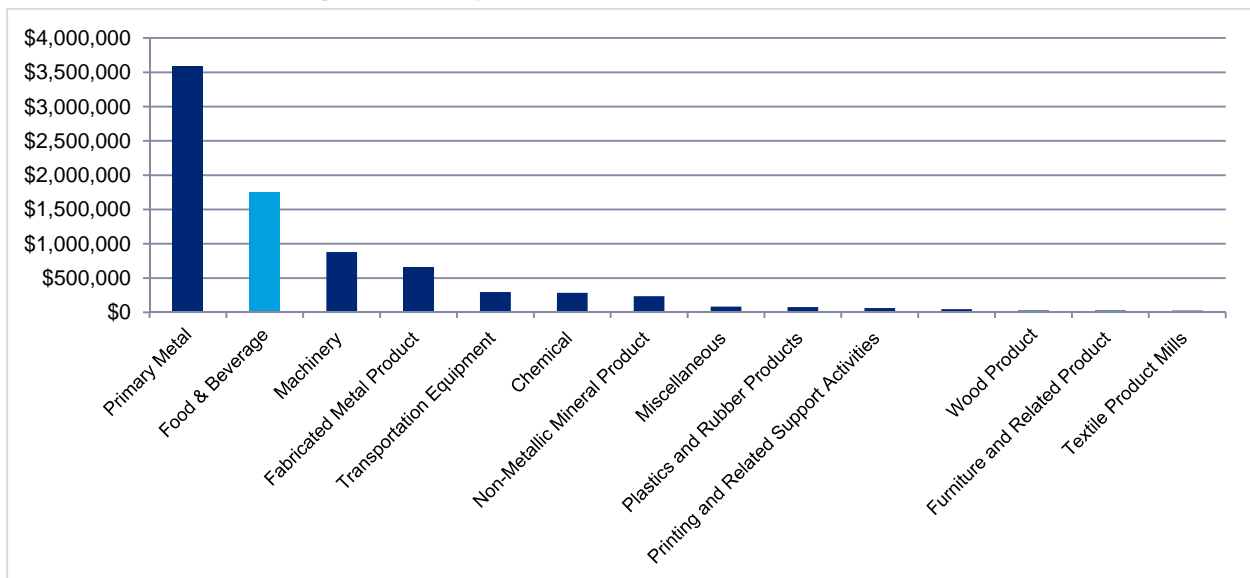
Food and beverage manufacturing in Hamilton's second largest manufacturing industry, with \$1.8 billion in total revenue, and approximately 70 establishments and 3,600 employees.

### Top Hamilton Manufacturing Industries by Employees



Source: Statistics Canada, All Manufacturing Industries

### Top Hamilton Manufacturing Industries by Revenue (thousands)

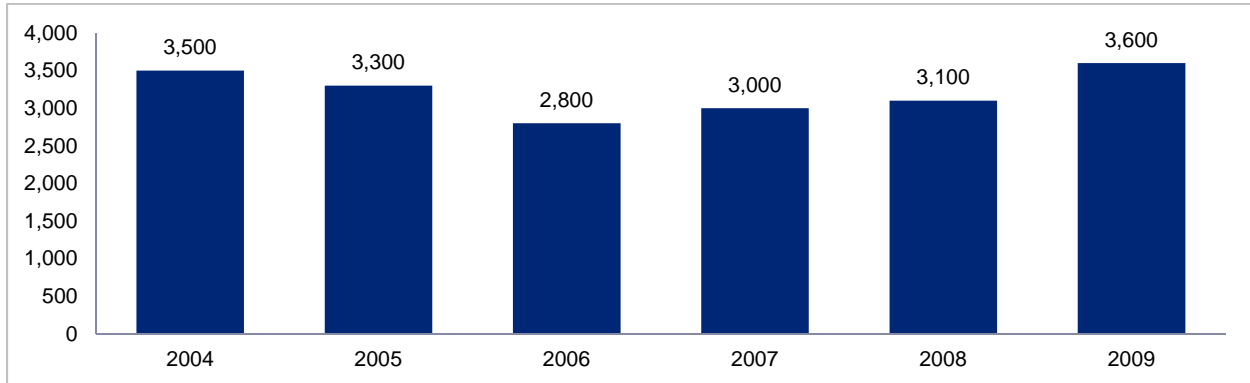


Source: Statistics Canada, All Manufacturing Industries

The City of Hamilton is home to a strong agricultural land base, the majority of the 227,000 acres within the Hamilton boundaries qualify as prime agricultural lands. Considering only 5% of the Canadian land mass constitutes prime land, the importance of this resource in Hamilton is significant. The majority of land within the City of Hamilton qualifies as prime agricultural land. According to Statistics Canada Hamilton agricultural land generated cash receipts in 2006 equal to \$1,687 per acre, the fourth highest per acre revenue yield in Ontario.

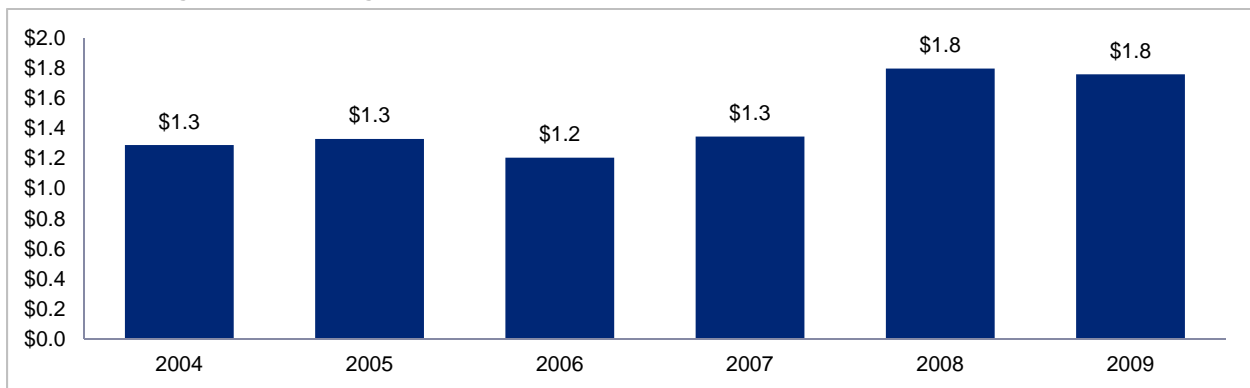
The Hamilton food and beverage manufacturing industry has grown significantly, reaching 3,600 employees in 2009, and revenue of \$1.8 billion in 2009, a 38% increase from 2004 levels.

**Food & Beverage Manufacturing Total Employment – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Food & Beverage Manufacturing Total Revenue (\$ billions) – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

Local employment is concentrated in sugar and confectionery product manufacturing, meat product manufacturing, bakeries and tortilla manufacturing, beverage manufacturing, fruit and vegetable preserving and specialty food manufacturing.

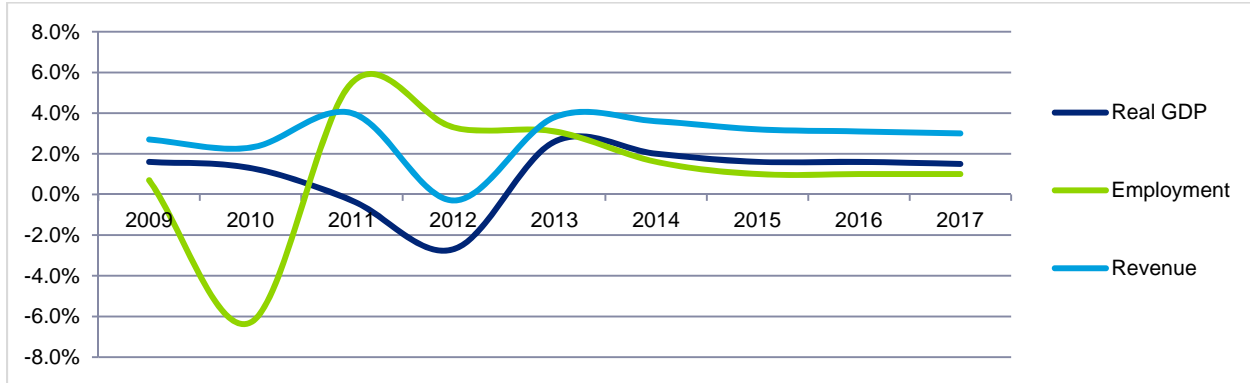
The City of Hamilton recently attracted significant major investment within its food and beverage processing sector. Maple Leaf Foods is investing nearly \$400 million in a new 500,000 square foot protein plant facility in Hamilton's Red Hill Industrial Park, anticipated to house nearly 700 employees. Construction on the protein production plant begins in 2012, with completion estimated for 2014. This deal represents the single largest investment in the food industry in Canada.

In 2009, Maple Leaf also invested \$100 million in a Canada Bread this 400,000 square foot facility bakery, also located in in Red Hill Industrial Park, which opened in 2011.

**Future outlook and opportunities**

According to the Conference Board of Canada, the economic outlook for the Canadian food manufacturing industry is positive, including steady growth in real GDP, revenue, and employment through to 2017<sup>79</sup>.

**Canadian Food Manufacturing Outlook**



Source: Conference Board of Canada, *Canada's Food Manufacturing Industry*, 2012

Global economic uncertainty and a fragile domestic economy have caused consumers to reduce their spending, impacting food and beverage. Although the outlook for 2013 is more positive, it is anticipated to be another challenging year for the industry. Modest domestic demand growth is anticipated for the industry, given rising commodity prices, fuelled by the lingering effects from last year's record droughts in the US, South America and Russia as well. However, growing demand from emerging markets for Canadian food products suggests that exports will continue, and bolster the industry's production in 2013.

The market power of health-conscious Canadians is also on the rise. The food manufacturing industry recognizes this growing trend, and it is creating more items that resonate with these consumers. As a result, specialty food items that provide some health benefits comprise a growing share of the industry's product offerings. This desire for healthier, specialty products means that consumers are willing to pay a premium price, and potentially generate higher profit margins. Hamilton industry stakeholders noted the City's strength across specialty product manufacturing, enabling the ability to benefit from such a trend.

Industry exports continue to grow as more opportunities are found in emerging markets. The growing middle class in emerging markets such as China and India has attracted the attention of Canadian food manufacturers. Increasing exports to these countries are a sign that Canadian food manufacturers are successfully penetrating these markets. Canadian companies tend to expand into these markets through strategic acquisitions, joint ventures, or by using partnerships.

Through the adoption of new technologies, superior products and innovative methods of production, agricultural growth has outperformed many manufacturing and business sectors over recent periods. There continue to be new and growing agricultural production opportunities beyond food production in such areas as bio-products, bio-energy, bio-fuels, pharmaceuticals, nutraceuticals and bio-fibers. In view of the above the industry needs to work with educational institutions at all levels to include agricultural programming in the curriculum and to encourage the provision of education and support programs for farmers. Post-secondary education programs in agri-business, biomedical, other bioproducts, etc. will continue to play a critical role in such development opportunities.

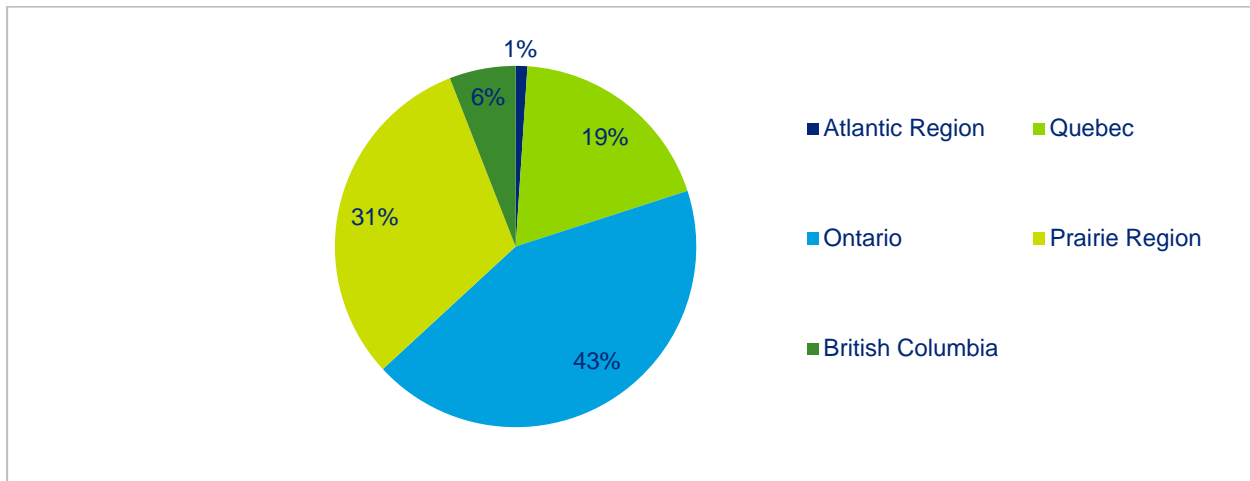
Hamilton is well positioned within Ontario's food and beverage manufacturing industry, with a number of key strengths including its prime farming lands, proximity to water and the City's port, good climate, a multi-modal transportation network, and access to markets. Primary agriculture, affordable real-estate and strategic location have also created a diverse and productive agri-business cluster in Hamilton. Additionally, local businesses currently experience significant export activity, largely focused in Europe, and continue to develop specialty market offerings, in line with growing demand trends. While the local industry is not without its challenges, such factors place Hamilton in a significant position to experience future growth in its food and business manufacturing and related industries.

# Appendix D - Industry 4: Machinery Manufacturing Trends

## Canadian machinery manufacturing market landscape

With respect to Canada's machinery manufacturing sector, Ontario accounts for 43% of national machinery manufacturing revenue, followed by the Prairie Region with 31%, and Quebec with 19% of national machinery manufacturing revenue.

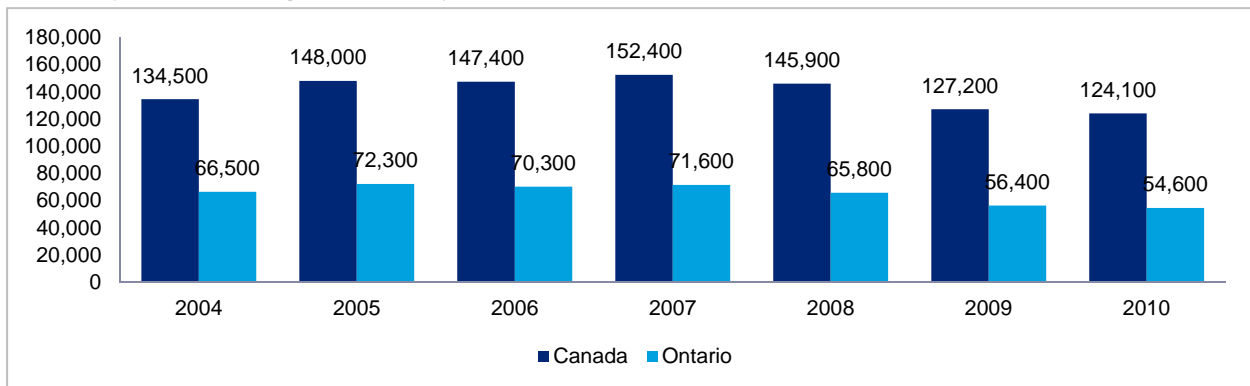
### Machinery Manufacturing Total Revenue – Canada



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

With respect to machinery manufacturing based employment, Ontario accounts for approximately 44% of national levels, with 54,600 employees in 2010.

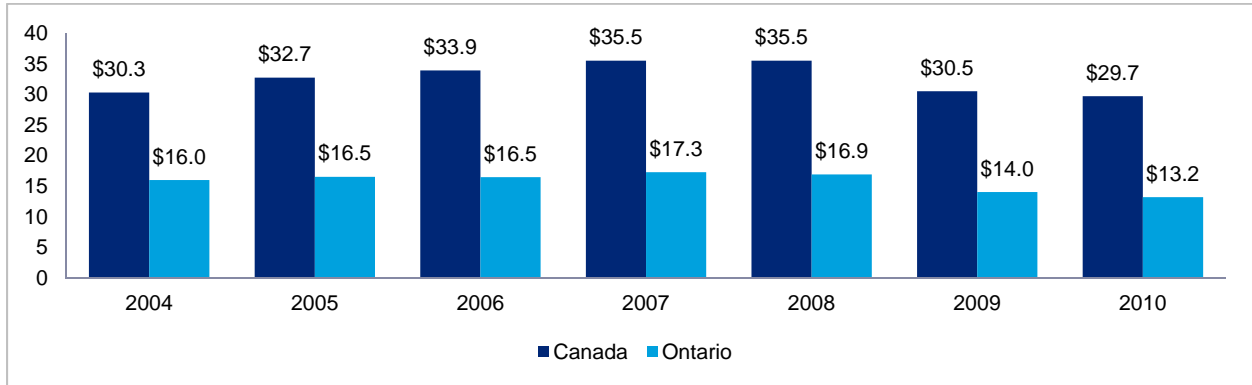
### Machinery Manufacturing Total Employment – Canada and Ontario



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

Ontario accounts for approximately 45% of national automotive equipment manufacturing levels at \$13.2 billion in 2010.

**Machinery Manufacturing Total Revenue (\$ billions) – Canada and Ontario**

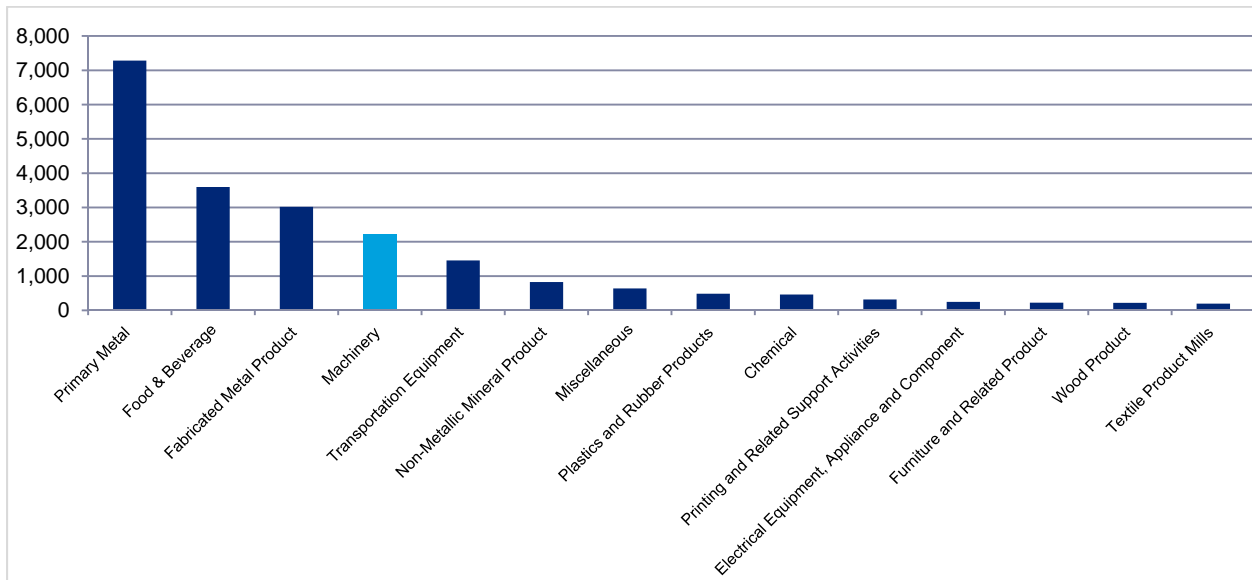


Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Hamilton machinery manufacturing market landscape**

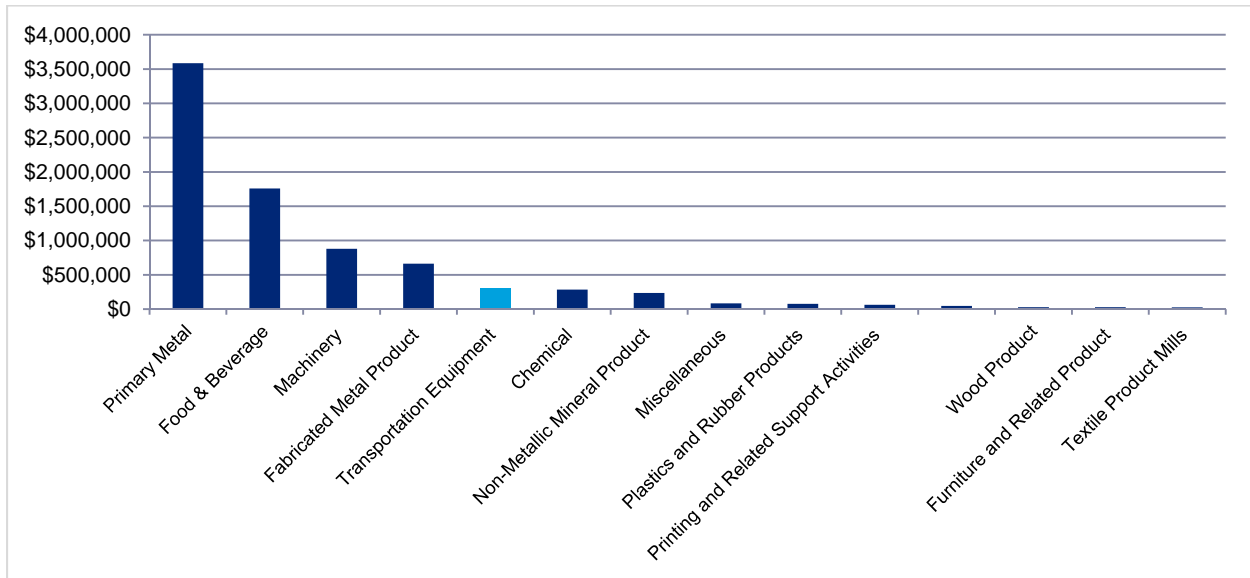
Machinery manufacturing is Hamilton’s fourth largest manufacturing industry, generating \$880 million in total revenue, and supporting 2,200 employees.

**Top Hamilton Manufacturing Industries by Employees**



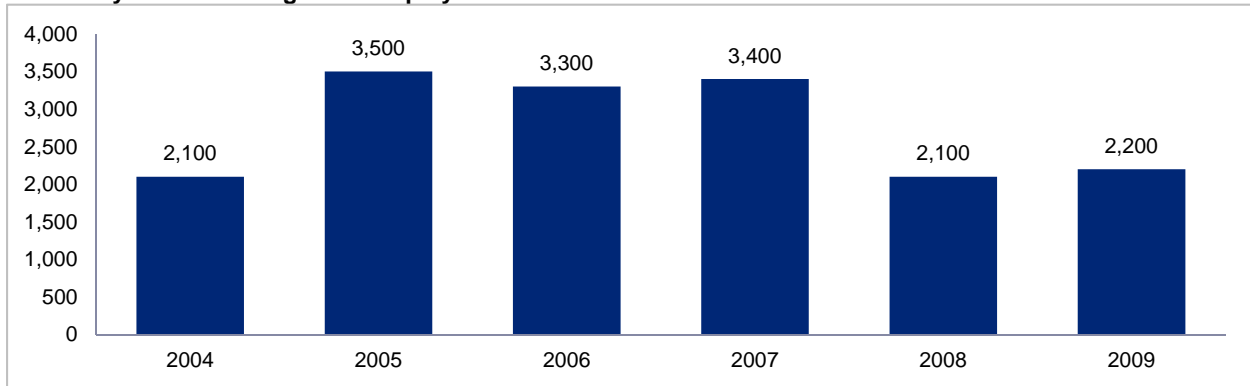
Source: Statistics Canada, All Manufacturing Industries

**Top Hamilton Manufacturing Industries by Revenue (thousands)**



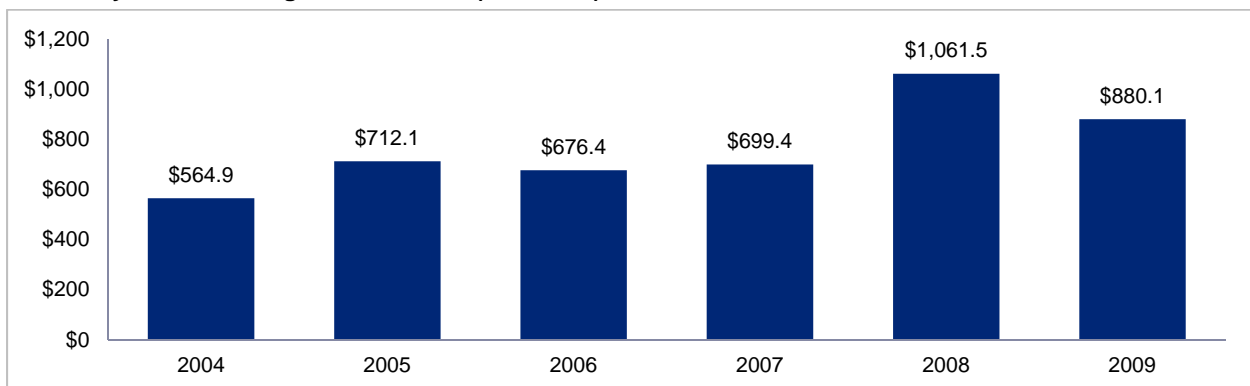
Source: Statistics Canada, All Manufacturing Industries

**Machinery Manufacturing Total Employment – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Machinery Manufacturing Total Revenue (\$ millions) – Hamilton**

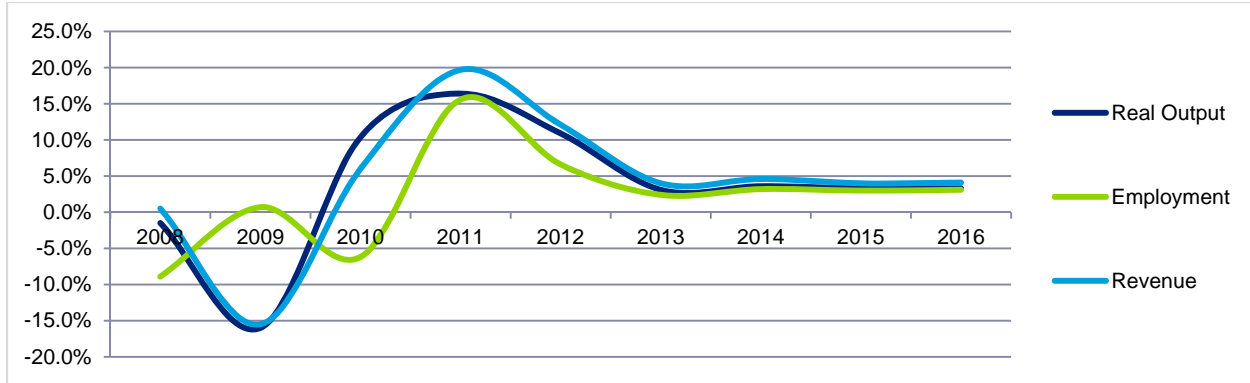


Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

### Future outlook and opportunities

According to the Conference Board of Canada, the economic outlook for the Canadian machinery manufacturing industry is positive, including steady growth in real output, revenue, and employment through to 2016.

#### Canadian Machinery Manufacturing Outlook



Source: Conference Board of Canada, *Canada's Machinery Manufacturing Industry, 2012*

As the baby boomers retire, all sectors of the economy are expected to face labour shortages, which is expected to potentially boost domestic demand for labour-saving machinery. Additionally, exports of agricultural, construction, and mining machinery could benefit from rising populations and energy demands in emerging markets, all of which are areas of Hamilton's machinery manufacturing activities.

# Appendix E - Industry 3: Automotive Equipment Manufacturing Trends

## Canadian automotive equipment manufacturing market landscape

Canada is the ninth largest vehicle producer in the world, and the Canadian automotive industry accounts for 14% of manufacturing GDP and 24% of manufacturing trade. Canadian vehicle assemblers account for roughly 4% of total world production of 68.6 million units.

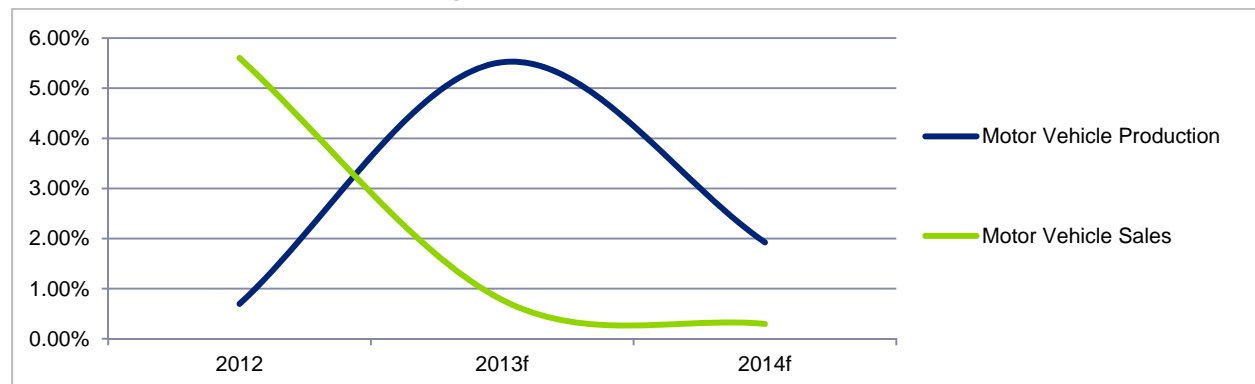
According to Industry Canada, the Canadian automotive equipment industry directly supports over 550,000 jobs across the country in 11 light duty and 3 heavy-duty assembly plants, over 540 parts manufacturers, 4,000 dealerships and many other directly related industries. For every job in auto assembly and parts manufacturing, seven others are potentially created in related industries, including the steel, plastic and transportation industries.

Canada is home to numerous auto manufacturing plants, including GM, Ford, Chrysler, Toyota and Honda. Parts suppliers including Magna International, Tesma, TRW Automotive and Venra Group also have assembly facilities in Canada<sup>80</sup>.

## Motor vehicle production and sales expected to remain flat in Canada

Overall, motor vehicle production and sales are expected to continue to remain fairly flat in Canada, totalling 2.5 million units of production, and 1.7 million units in sales in 2012, representing limited growth in the short term.

### Motor vehicle production and sales % growth, Canada



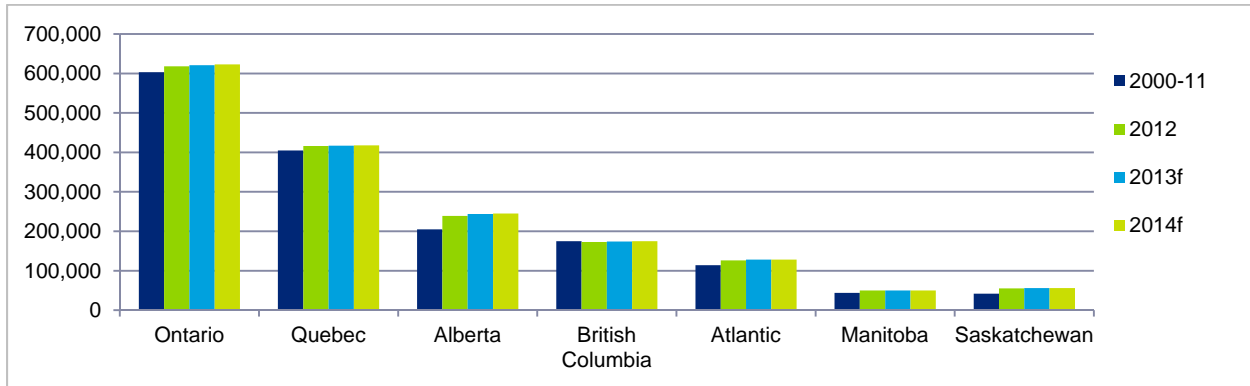
Source: Scotiabank, Global Economic Research, 2013



A significant portion of Canadian automotive economic activity is concentrated in Ontario, as the Province is home to 11 assembly plants operated by Chrysler, Ford, General Motors, Honda, and Toyota, and over 300 parts manufacturers. The industry employs an estimated 88,000 highly skilled workers who produced over 2.1 million vehicles in 2011, more than any other North American sub-national jurisdiction<sup>81</sup>.

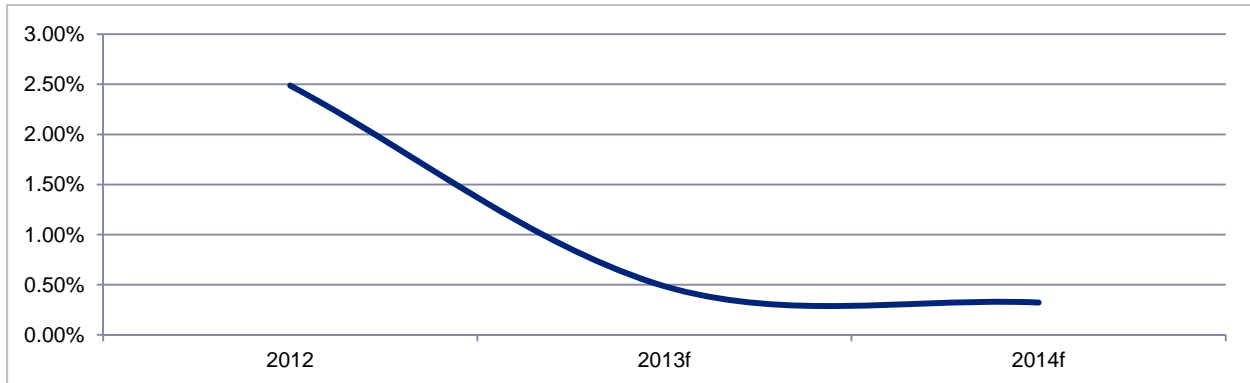
Ontario currently averages over 600,000 motor vehicle units annually in sales, or one fourth of total Canadian motor vehicle sales. Similar to Canadian averages, Ontario's motor vehicle sales are anticipated to experience limited growth in the near future, ranging from 0.3% to 0.5% in annual from in 2013 and 2014.

**Motor vehicle sales, by Canadian region**



Source: Scotiabank, Global Economic Research, 2013

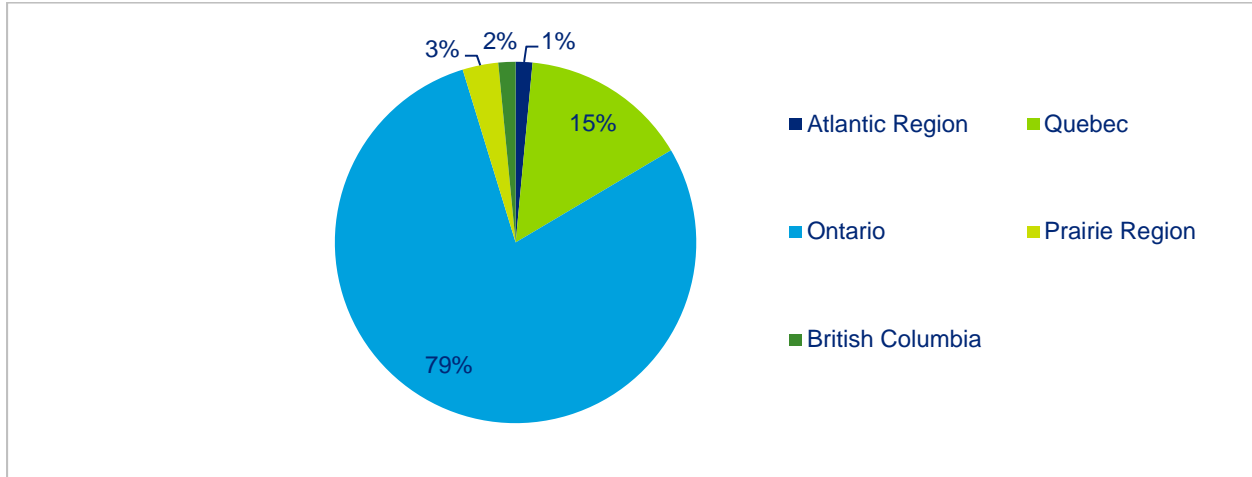
**Motor vehicle sales % growth, Ontario**



Source: Scotiabank, Global Economic Research, 2013

In terms of the Canadian transportation equipment manufacturing sector, Ontario accounts for most national production, with nearly 80% of national revenue, followed by Quebec accounting for 15%, the Prairie Region (3%), British Columbia (2%) and Atlantic Region (1%).

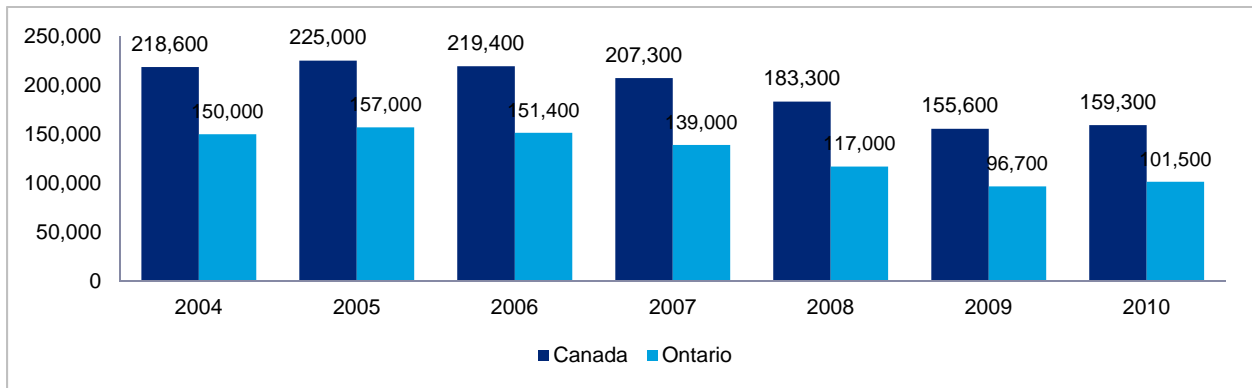
**Automotive Equipment Manufacturing Total Revenue – Canada**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification

With respect to automotive equipment manufacturing employment, Ontario accounts for approximately 64% of national levels, supporting 101,500 employees in 2010.

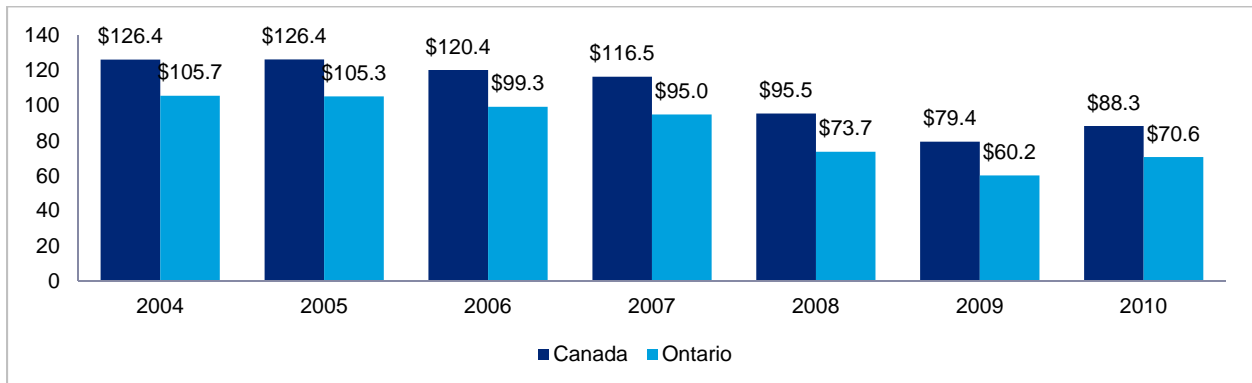
**Automotive Equipment Manufacturing Total Employment – Canada and Ontario**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

Ontario accounts for approximately 80% of national automotive equipment manufacturing levels at \$71 billion, and has generally decreased from 2004 to 2009, and then increasing in 2010.

**Automotive Equipment Manufacturing Total Revenue (\$ billions) – Canada and Ontario**

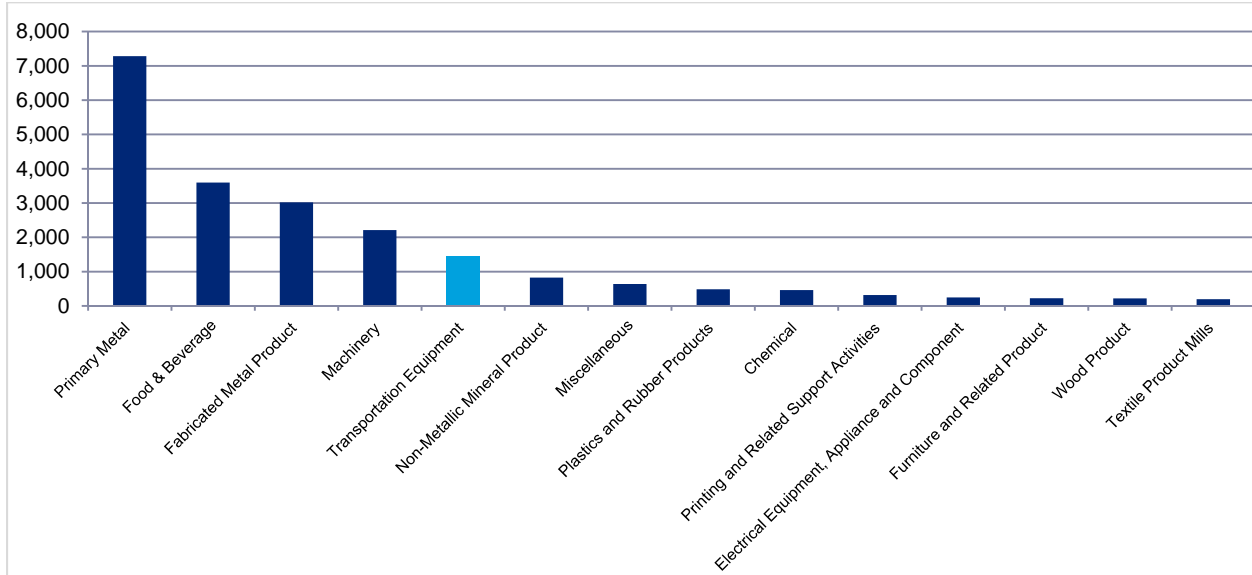


Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

### Hamilton automotive equipment manufacturing market landscape

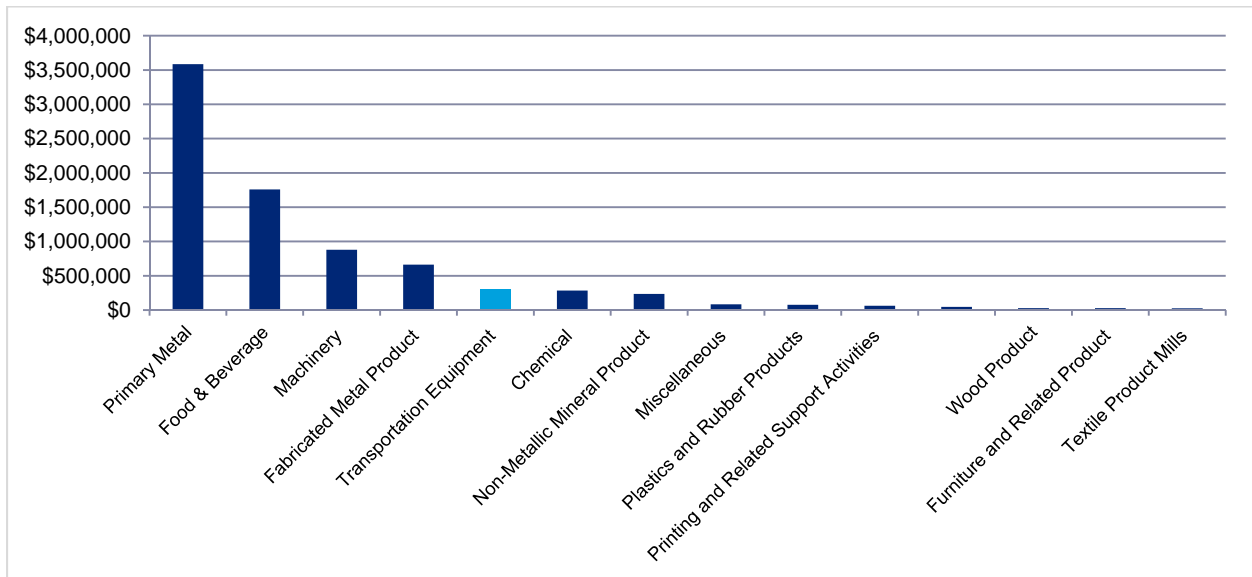
Transportation equipment manufacturing, specifically automotive equipment manufacturing, is Hamilton's fifth largest manufacturing industry, with \$296 million in total revenue, and approximately 35 establishments supporting 1,500 employees.

#### Top Hamilton Manufacturing Industries by Employees



Source: Statistics Canada, All Manufacturing Industries

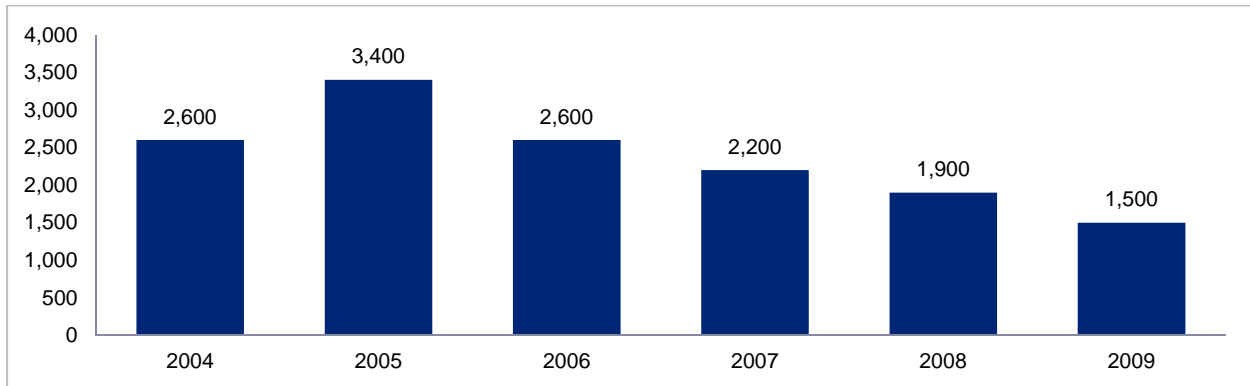
#### Top Hamilton Manufacturing Industries by Revenue (thousands)



Source: Statistics Canada, All Manufacturing Industries

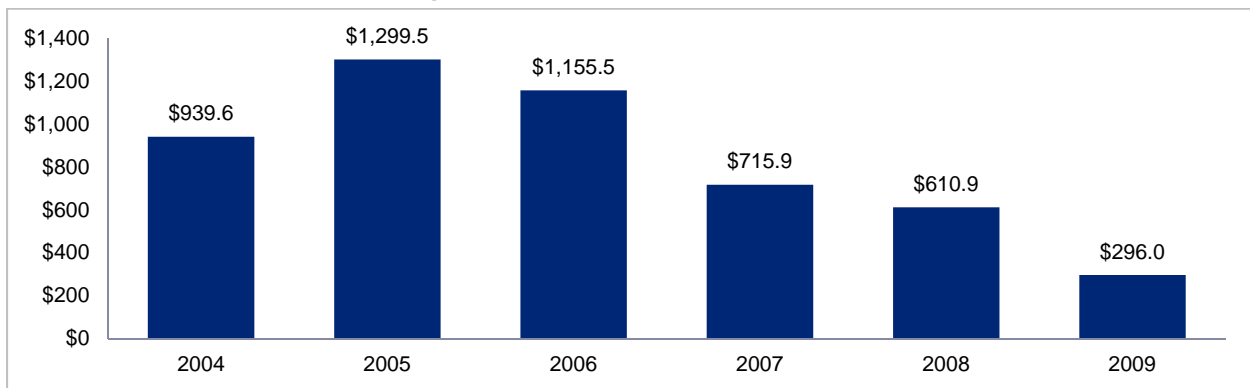
The Hamilton automotive equipment manufacturing industry has been challenged in recent periods, decreasing in employment from 2005 to 2009, reaching 1,500 employees in 2009, and decreasing in revenue from 2005 to 2009, reaching \$296 million in 2009.

**Automotive Equipment Manufacturing Total Employment – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Automotive Equipment Manufacturing Total Revenue (\$ millions) – Hamilton**



Source: Statistics Canada, Principal statistics for manufacturing industries, by North American Industry Classification System

**Transportation / Automotive manufacturing**

Revenue (2009)	\$296 M
Revenue share of Ontario	<1%
Employment (2009)	1,500
Employment share of Ontario	1.5%

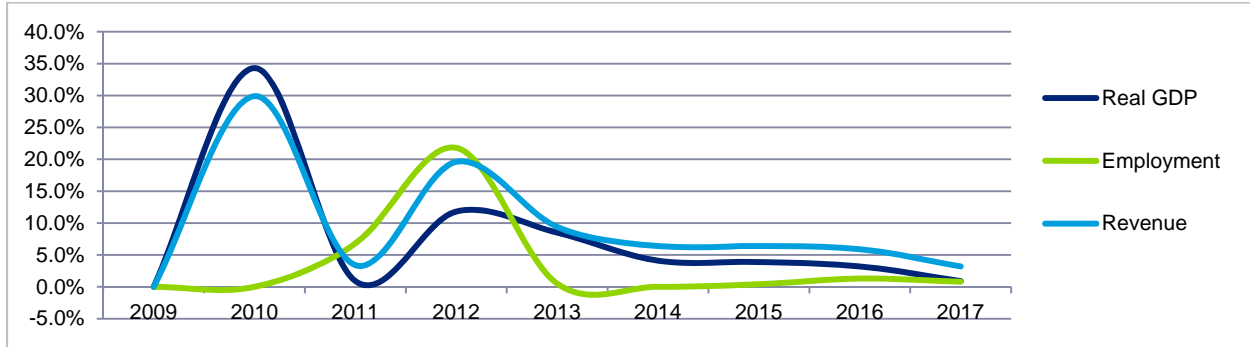
**Key Service Industries / Sectors**

- Materials / metal / steel manufacturing
- Machinery manufacturing
- Equipment manufacturing
- Equipment operations
- Health and safety consultants
- Financial services
- Legal Services

**Future opportunities**

In Canada, motor vehicle production and sales are expected to continue to remain fairly flat, totalling 2.5 million units of production, and 1.7 million units in sales in 2012, representing limited growth in the short term. Such production and sales levels translates into a modest economic outlook for the Canadian automotive sector, including projected decreases in real GDP, employment and revenue, and flat growth through to 2017, according to the Conference Board of Canada.

Canadian Automotive Outlook



Source: Conference Board of Canada, *Canada's Motor Vehicle Manufacturing Industry*, 2012

Hamilton is home to a number of assets which support its automotive equipment manufacturing industry, including its primary, fabricated metal and machinery manufacturing industries, as well a number of sizeable businesses operating within this space.

The future of higher value add production trends across materials / metal / steel production will translate to automotive equipment manufacturing, and serve as a significant opportunity to Hamilton. Areas of innovation include high strength and electrical steels, which have significant use in energy applications and hybrid and electrical vehicles. Additional trends in terms of lighter structure and automotive safety requirements are also expected to lead to future opportunities within the industry.

McMaster University is a key contributor to local research, innovation and development of skills across the local automotive equipment manufacturing sector. MacAUTO is the newly established coordinating body for automotive research and education at McMaster University. Automotive research at McMaster University encompasses an expanding cluster of knowledge and expertise. More than 75 researchers in engineering, science, business and other faculties are involved in initiatives valued at over \$100 million in programs and infrastructure. Research programs range from the testing of hybrid power systems to developing corrosion-resistant coatings, from optimization of transportation and logistics systems to the impact of pollution on our environment, from creating software and simulation programs to understanding visual attention and motion perception. The University's numerous automotive-related research institutes and centres work with industry, government and academic partners in developing and commercializing new technologies and materials that will ensure the global competitiveness of Canada's auto industry.

The automotive sector is a key component of Canada's economy and advanced manufacturing in Canada. As the sector continues to recover and adapt to future trends, it is expected that there will be continued public sector and private sector support towards its growth. For example, the federal government has commissioned a \$2.1 million study of the auto industry that will assess policies affecting the sector, and McMaster University will establish the Canadian Automotive Policy Partnership, a five-year project that will be assisted by Toyota Motor Manufacturing Canada Inc., Ford Motor Co. of Canada Ltd. and the Canadian Auto Workers union<sup>82</sup>.

# Appendix F – Potential Trade Show Considerations

## Association Conferences / Trade Shows

Advanced Manufacturing Expo
Association of Equipment Manufacturers (AEM)
Association for Manufacturing Excellence (AME)
Automation Technology Expo Canada (ATX)
Automotive Industries Association of Canada
Automotive Parts Manufacturer's Association
Canadian Manufacturers & Exporters (CME)
Canadian Manufacturing Technology Show (CMTS)
Design & Manufacturing Canada
Design Engineering Expo (DEX)
Excellence in Manufacturing Consortium (EMC)
FabTech Canada
Global Automakers of Canada
Grocery Innovations Canada (GIC)
I.E.Canada
International Manufacturing Technology Show (IMTS)
NASCC: The Steel Conference
Western Manufacturing Technology Trade Show (WMTS)

# Appendix G - Endnotes

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- <sup>1</sup> Deloitte Touche Tohmatsu Limited (DTTL)'s Global Manufacturing Industry group and The U.S. Council on Competitiveness (Council). "2013 Global Manufacturing Competitiveness Index".
- <sup>2</sup> Institute for Defense Analyses, "Emerging Global Trends in Advanced Manufacturing". March 2012.
- <sup>3</sup> Institute for Defense Analyses, "Emerging Global Trends in Advanced Manufacturing". March 2012.
- <sup>4</sup> The Economist "The third industrial revolution". April 2012.
- <sup>5</sup> The Economist "The third industrial revolution". April 2012.
- <sup>6</sup> Massachusetts Institute of Technology News, "New virus-built battery could power cars, electronic devices". April 2009.
- <sup>7</sup> Industry Canada, Canadian Manufacturers & Exporters, McMaster University, "State of Advanced Manufacturing: A Canadian Perspective".
- <sup>8</sup> Executive Office of the President of the US- President's Council of Advisors on Science and Technology. June 2011
- <sup>9</sup> Institute for Defense Analyses, "Emerging Global Trends in Advanced Manufacturing". March 2012.
- <sup>10</sup> World Economic Forum in Collaboration with Deloitte, "The Future of Manufacturing Opportunities to drive economic growth". April 2012.
- <sup>11</sup> Cushman & Wakefield Inc., New Age of Trade: the Americas. January 2009.
- <sup>12</sup> Industry Canada, Canadian Manufacturers & Exporters, McMaster University, "State of Advanced Manufacturing: A Canadian Perspective".
- <sup>13</sup> Industry Canada, Canadian Manufacturers & Exporters, McMaster University, "State of Advanced Manufacturing: A Canadian Perspective".
- <sup>14</sup> Ibid. 2.
- <sup>15</sup> The Economist, "The boomerang effect", [www.economist.com/node/21552898](http://www.economist.com/node/21552898), April 21, 2012.
- <sup>16</sup> Ibid. 2.
- <sup>17</sup> Ibid. 2.
- <sup>18</sup> Berlin's School of Economics, Professor Bernd Venohr.
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