



TORONTO REGION RESEARCH ALLIANCE



# Ontario Manufacturing, Supply Chains and Knowledge Networks: A Report for the Toronto Region Research Alliance

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January 2010





## Introduction

The goal of the work was to understand the current state of innovation and knowledge flows in the automotive, advanced manufacturing and steel sectors in the Greater Golden Horseshoe (GGH):

Over the course of three months in 2009, 76 interviews were conducted with firms and research bodies in the GGH:

- 19 firms in the automotive sector,
- 29 firms in the advanced manufacturing sector including nine electronics firms,
- 24 firms in the steel sector, and
- 4 universities/government research bodies.

This document provides a brief overview of sector-specific findings, highlighting major trends, advantages and disadvantages of the region, global knowledge partnerships, the role of universities and colleges, the effects of the recession on these sectors and implications for researchers.

## Main Findings

The automotive, steel and advanced manufacturing sectors have been found to differ significantly in terms of how innovation and knowledge are developed, shared or used. This is chiefly determined by the structure of each industry and where a particular firm sits on the industry supply chain. Factors such as the nature of supplier relationships, the ownership pattern of the industry and the nature of the product itself play a large role in influencing how new products and services are developed and how research and development (R&D) resources are allocated.



In the **automotive** sector, the GGH boasts a number of Tier 1 and sub-Tier 1 suppliers. Higher level innovation and long term R&D in this sector are conducted by the Original Equipment Manufacturers (OEMs) who develop design specifications which are provided to the Tier 1 and parts manufacturers (note that there are no automotive OEMs in Ontario). The knowledge flow in this sector is illustrated in Figure 1. At the Tier 1 level, companies engage mainly in innovation to meet customers' design specifications and carry out incremental product improvements in areas identified by OEMs as priorities (e.g. weight reduction as a step toward fuel efficiency). When these manufacturers develop innovations independently, this is regarded as a strong competitive advantage over other parts suppliers; however, it is not customary to conduct such work outside of contract work.

“Over the last 10 years, there's been a massive shift towards commoditization of technology. The industry does not allow a single supplier to have a lock on any particular commodity. That's been the prevailing ethic in Western Europe and North America. It's unfortunate because it clearly tends to put a ceiling on innovation.”

– Tier 1 supplier on innovation in the automotive sector

Sub-Tier 1 suppliers tend to focus on delivering parts on time and within specification to their customers. They are, therefore, less likely to consider game-changing product innovation as a business strategy and are more inclined to develop process improvements only. Materials suppliers often work with both Tier 1 and parts manufacturers to carry out R&D in order to meet design specifications, deliver improvements in OEM focus areas, and allow process improvement to parts manufacturers.

## KNOWLEDGE FLOW IN THE AUTOMOTIVE SECTOR

 Material Flow  
 Information/Knowledge Flow

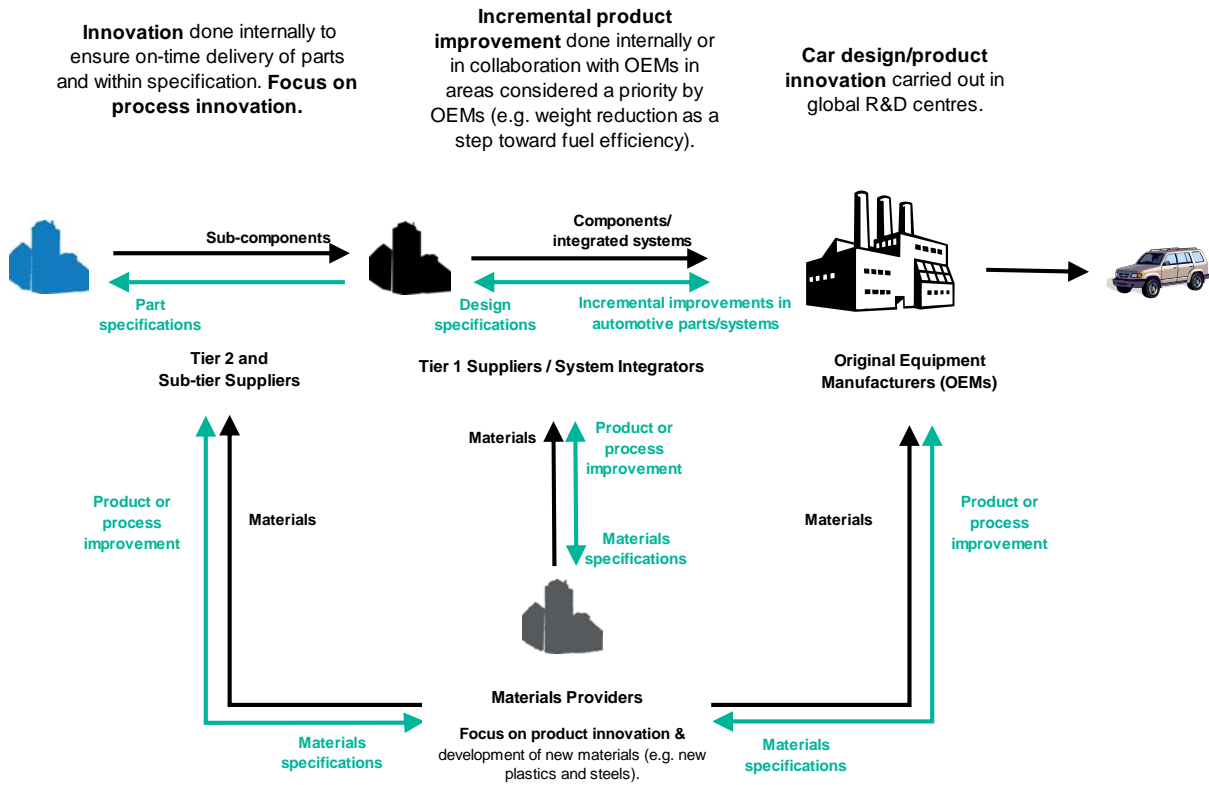
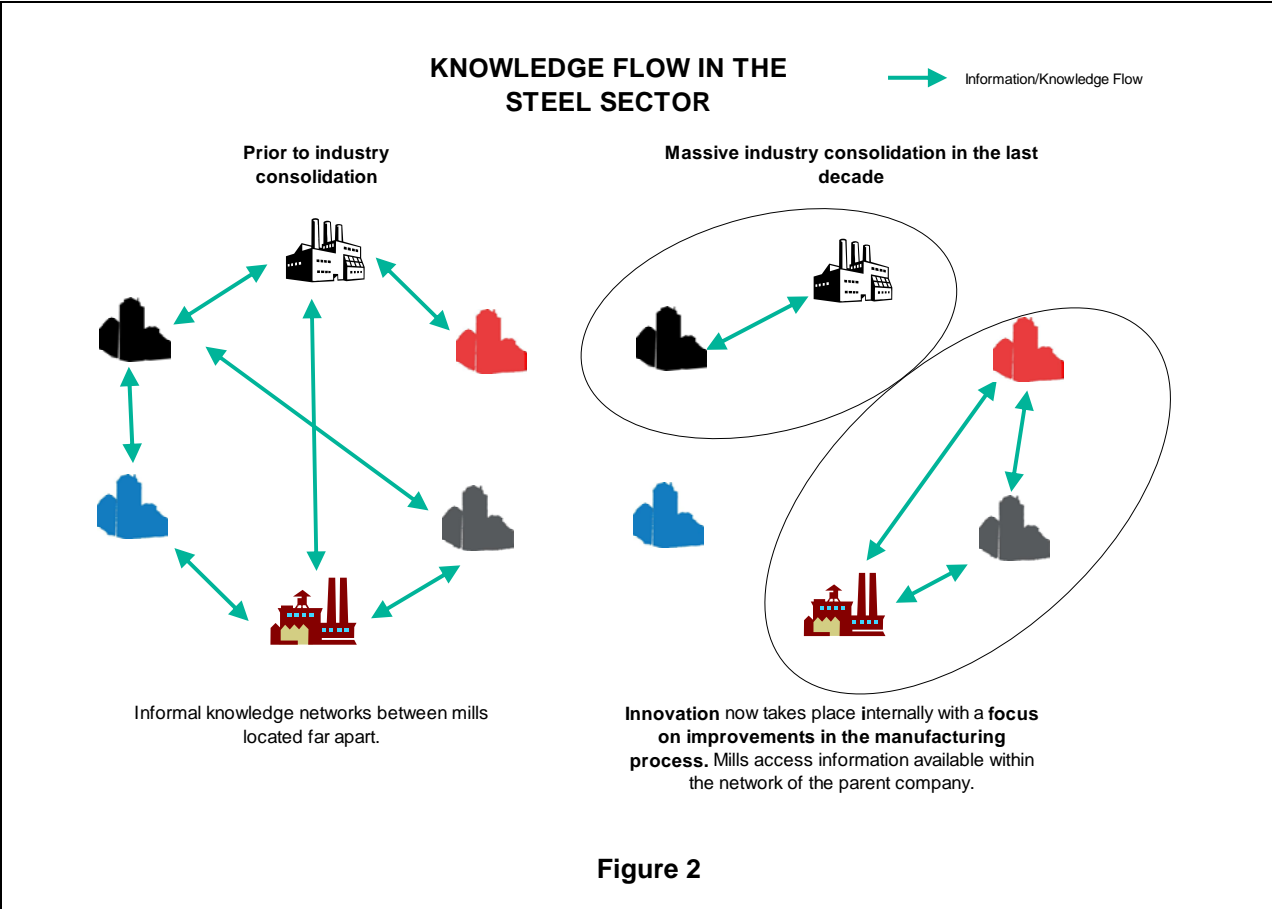


Figure 1

The **steel** sector has undergone extensive consolidation in the last decade, which has significantly impacted how knowledge flows within the industry and the type of research conducted. The status of steel as a commodity has shifted the innovation focus on making the product faster and cheaper. These cost-cutting measures, which give companies a competitive edge in outbidding competitors, have, unfortunately, also accelerated the commoditization of steel thus driving down prices further. Little product improvement research is conducted and its commodity status with the automotive and construction sectors results in few new product developments or offerings to customers. Innovation now takes place internally with a focus on improvements in the manufacturing process. As illustrated in Figure 2, mills that have been consolidated can access the information available within the network of the parent company and participate in global knowledge transfer.

“Selling a patented steel product in the automotive sector is not necessarily a great thing. The automotive industry doesn’t want a single source buyer of any steel product because they want multiple suppliers of the product so that they can feed off against each other to lower the price. This is not necessarily true for the process side because the ability to make steel for \$20.00 a ton cheaper is a huge advantage.”

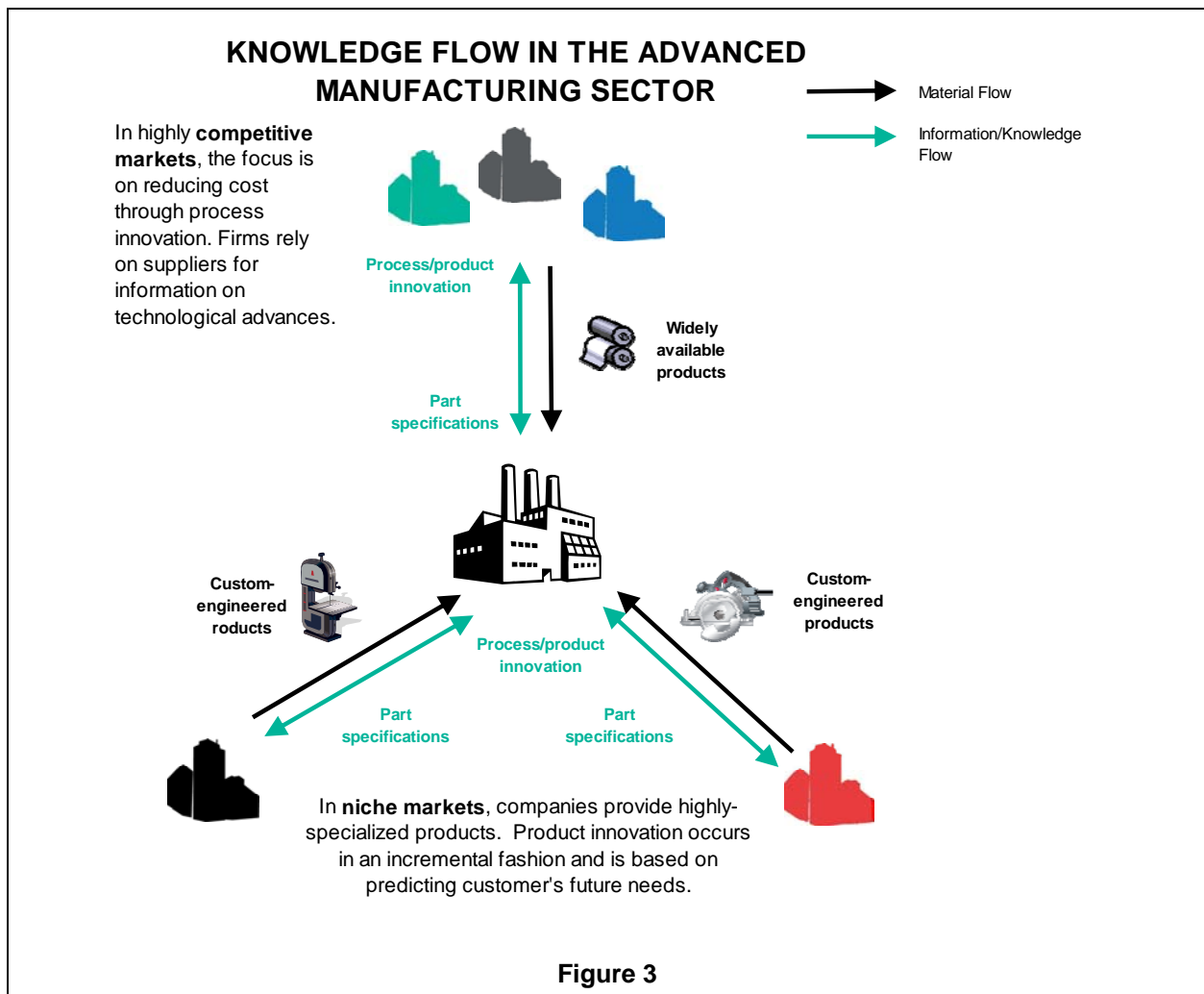
– Steel mill



**Advanced manufacturing** is a far broader sector than the latter two because of the diverse nature of its industries. However, from an innovation point of view, the companies in this sector can be grouped into either those serving niche or highly-competitive markets (refer to Figure 3). Niche market advanced manufacturers tend to create custom-engineered products for heavy industry, or specialty products used in manufacturing processes. In this case, the firms fabricate very specialized products and conduct little highly-innovative research, focusing on incremental product improvements through internal R&D. Highly-competitive firms are far more affected by economic factors and price is a competitive advantage over engineering excellence. For these companies, the focus is on overhead cost reduction, with little or no internal research and most information and technological advances being provided by suppliers to the firms.

**Advantages of the Golden Horseshoe Region**

The GGH region was acknowledged by many of those interviewed to be the heartland of manufacturing in Canada and many firms highlighted the advantages of the Southern Ontario region. In particular, they mentioned the transportation infrastructure and the presence of a critical mass of suppliers and support services such as machine shops. Although many respondents mentioned that manufacturing in Southern Ontario did have a reputation for quality that helped them competitively, many noted that Germany has a similar cluster that not only has the manufacturing excellence but also strong R&D. Southern Ontario offers a competitive edge in its international airport and proximity to the U.S. border. Companies located in Windsor felt that the latter was a particular asset.



The findings suggest that Southern Ontario also has an advantage when it comes to the support infrastructure that allows manufacturing to thrive. However, when compared to other global manufacturing regions Ontario lags in key areas such as a critical mass of researchers in manufacturing or a cheap labour pool. The recent economic downturn and resulting lay-offs have resulted in an over-supply of skilled and experienced technical labour. The formal and informal networks these individuals possess along with the willingness of firms in the automotive and advanced manufacturing sectors to hire individuals from other sectors is an advantage to the sectors. These networks allow access to the knowledge possessed by individuals who are hired, as well as the pooled knowledge of their extended technical network. The steel sector tends to hire from within and, therefore, does not fully benefit from these knowledge networks.

“The advantage from our perspective is that Canada and, Ontario in particular, has a good reputation for manufacturing quality that helps us compete. Southern Ontario is really the manufacturing heartland in Canada.”

– Advanced manufacturing firm on the benefits of Southern Ontario

“I would say Hamilton is probably the best place to be for servicing the steel industry because of existing mills such as Dofasco. It is definitely a steel town.”

– Steel consulting firm

## Global Knowledge Flows

Firms in Southern Ontario are heavily involved in global networks of knowledge transfer. This is true for firms of all sizes. While large manufacturing firms prefer to work with a local partner, they also search around the globe for the required expertise, often partnering with universities deemed to have superior expertise. For small and medium sized firms, especially engineering firms and advanced manufacturing firms in niche markets, their global customer base meant that their engineers are interacting with others around the globe to solve problems and are tapped into an international network. Most firms stated a preference towards working with local universities and firms where the local expertise was equivalent to that available internationally.

“With developing products, you really have to look at more fundamental research to come up with that next breakthrough idea and that’s not something we generally have the resources in-house to pursue. It’s very important that the universities are working further ahead in areas that we wouldn’t typically support and take it to a point where we can start investigating how to apply it in our facilities.”

– Steel mill on the role of universities in creating industry breakthroughs

The reliance on global knowledge flows is especially true for the steel sector which is driven by the consolidation of the steel industry. Global knowledge flows span the entire sector, from large multinationals to smaller steel firms located in the GGH that work around the globe and are connected to global networks.

“One of the biggest competitive advantages we have is the network. We have a lot of plants worldwide and any problems that we may encounter have likely been solved somewhere else.”

– Steel mill

## The Significance of the Auto Industry to Ontario Manufacturing

Although the research covered three distinct sectors, both steel and advanced manufacturing are very reliant upon the automotive sector in Ontario in several ways. Firstly, large steel mills in the region produce a good portion of their steel for the automotive industry. Thus, downturns that affect automotive companies also deeply affect the steel industry. The automotive sector also provides a lynchpin for several other manufacturing industries in the GGH as the customer for advanced manufacturing firms, even those working across multiple sectors. The three sectors benefit from a shared labour pool and supplier base for other firms to draw upon. Most heavy industry firms in the GGH rely upon machine shops that serve the automotive industry and, if those machine shops disappeared, it would greatly affect the ability of those non-automotive firms to conduct business.

“Southern Ontario is an automotive region. When the industry is booming and hiring, we – as a smaller firm – must fight to get skilled people because we’re competing with the Big 3. When they’re laying off, it’s easier for us to pick and choose labour. We have certainly gained from the availability of resources because of the downturn in Southern Ontario.”

– Advanced manufacturing firm

## **Universities and Colleges as a Source of Talent and Expertise**

All three sectors acknowledge that the most important asset universities provide for the industry is a talented workforce. Most firms interviewed suggested that the talent pool in the Greater Golden Horseshoe was excellent, particularly due to the presence of good universities.

Respondents were especially supportive of university co-op programs which are a major source of new employees across all the investigated sectors. These programs are also a valuable way for firms to understand the quality of potential employees in the local labour pool. Co-op programs and their students were generally regarded very highly and are often the preferred method of employing new labour. Co-op programs leave students with specialized skills before they are hired permanently. Some larger firms have even created and funded co-op programs at local universities specifically to ensure that an appropriately-trained pool of talent is available to them.

Most firms, however, are less involved in the shaping the curriculum to ensure that graduates of local schools are properly trained for their needs. There was a good deal of lament in all three sectors as to the lack of specific training offered. While there appeared to be willingness to change, there was confusion on how to accomplish this. Firms in the advanced manufacturing sector often complained that local colleges insufficiently prepare graduates for skilled trades because they are trained using old equipment and outdated techniques. Another concern is that the programs do not adequately emphasize the practical aspects and leave graduates unable to begin work without further training.

Universities are less highly-regarded when it comes to their research capacity. Although the sophisticated facilities and expensive machinery in universities are considered important assets, there are barriers to collaboration. Most notably, is the concern over the protection of intellectual property. Universities are not viewed as trustworthy partners and companies are afraid that any findings would be not protected. Many respondents also stated that they would like to engage in collaboration with universities but do not how to access the academic network. The confusion about access is another barrier to industry partnerships.

## **Impact of the Recession**

All three sectors were significantly affected by the recession. Manufacturing in the GGH is currently undergoing an extremely difficult time, especially in the steel and automotive sectors. The financial troubles of the American auto manufacturers and the idling of local mills have had spin-off affects for all people involved in the industry. However, some automotive companies which are more involved with the Japanese OEMs have been relatively protected. Due to the downturn, some companies that we attempted to contact could not be interviewed because they had either gone under or were working with minimal staff.

The firms that outperformed others are those that serve niche markets in the advanced manufacturing sector. This is largely because the products they provide are essential and cannot be replaced with cheaper imitations. Other products fabricated by advanced manufacturing firms in the GGH, which have relied on quality rather than cost reduction in the past to differentiate themselves from the competition, have felt the crunch of buying policies which have focused on cost.

Overall, the GGH's manufacturing firms have been greatly affected by the economic downturn. The decline of North American automotive manufacturers has had a ripple effect that has caused unprecedented economic troubles for many businesses across the industry.

## Implications for Researchers

Ontario must consider itself as a manufacturing heartland competing on a global stage. This research has underpinned the already accepted fact that GGH is competing with other regions not only in labour cost but also in expertise. Similar regions in Germany and Japan were consistently mentioned as being more advanced in research than the GGH and, if Ontario is to compete on quality, this is an area that needs to be addressed.

The barriers currently dividing academia and industry need to be bridged. While many businesses acknowledge that programs such as Auto21 and the Ontario Centres of Excellence have helped, there is still a sense that these programs are not yet creating the deeply embedded contacts between academia and industry that exist in other regions. The main concern expressed by industry members in working with academics centres around the handling of intellectual property and ensuring appropriate project timelines or quick turnarounds to meet industry needs. This concern needs to be addressed prior to meetings with industry.

A second area of concern is that much of the manufacturing that exists in Southern Ontario will have to thrive by serving larger markets rather than through specialization. While existing in niche markets allows for superior engineering to provide a competitive advantage, this is not the reality for most firms in the area who are doing business in highly-competitive arenas where products are sold in a manner similar to commodities. These firms require more help to make process improvements to ensure the competitiveness of their products. Firms in the region are now developing ways to formally manage their innovation and research-related data by forming internal innovation councils as well as partnering with universities to examine their own processes. In addition to the support granted to product R&D, the development of knowledge management systems must also be encouraged. The loss of firms that exist in these large competitive markets would be an enormous drain on the region's economy.

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