

4 Vaughan's Value Proposition & Strategic Focus

The City of Vaughan has identified seven (7) target sectors to serve as areas of focus for the City's economic development activities through the recently completed Employment Sectors Strategy. These target sectors, which are discussed in detail in the Background Economic Analysis and Appendices report, include:

- Advanced manufacturing
- Professional, scientific and technical services
- Transportation, logistics, warehousing and distribution
- Corporate headquarters
- Building products
- Cultural industries and tourism
- Educational services, health care and social assistance

However, there are two areas of concern surrounding these target sectors. The first lies in the number of sectors involved. There are seven areas of focus, each of them quite broad in nature, begging the question if indeed there is sufficient 'focus' to the target sectors. The second concern is, perhaps, closely related to the first. In and of themselves, these targets are not necessarily remarkable or unique, as many other communities in the province or country have identified similar target sectors.

In the GTA alone, 10 communities have targeted advanced manufacturing, as well as three regional municipalities. Reflecting this common approach, both the Greater Toronto Marketing Alliance (GTMA) and the Toronto Region Research Alliance (TRRA) have made advanced manufacturing a priority action area in their regional activities. This is in addition to several other communities in the GTA that have targeted traditional manufacturing as well.

As the ESS makes clear, each of these target areas has a certain logic and strength in the context of Vaughan's economy. The

challenge lies in the ability to understand the local context in creating a value proposition that is unique and compelling, allowing Vaughan to build its competitive advantage over other communities while differentiating itself in marketing the city to potential investors. In doing so, the City will have a clearer, more focused set of targets for future economic development activities.

The very notion of pursuing investment in "target sectors" of the economy is based upon the economic development concept of "cluster development," the idea that industry groups together in nodes of concentration. These nodes arise where resources are thickest – where concentrations of talent, of infrastructure and amenities, of financial capital, etc., are present and available to participants within the cluster. Vaughan, for example has identified building products as a target sector. This might be based on the presence of, or ability to, develop a thickness of building products related resources located in Vaughan. Or perhaps the development of the sector can be linked to a set of external forces, interconnected to provide a network of support that is unmatched by other communities, i.e. land use policies that encourage the use of green construction materials and sustainable techniques in development. In part, the collective set of these support structures are often included in the consideration of an economic "cluster".

Economic development practitioners have long embraced the concept of cluster development as a key component of their strategic activities. Introduced by Harvard University's Michael Porter in 1990, cluster theory describes the interactions of concentrations of interconnected businesses, suppliers and associated institutions within particular sectors of business and industry. Clusters may be defined in four ways:

- Geographically (i.e. interactions within a specific region)
- Horizontally (i.e. interactions between businesses to share resources)

- Vertically (i.e. interactions based on supply chain management)
- Sectorally (i.e. interactions between businesses in a given business field)

4.1 Sector Based Clusters

4.1.1 Defining Vaughan’s areas of Cluster Convergence

Initially, the term “cluster” was applied only to large and significantly resourced industry concentrations, particularly the world leaders in given fields (such as Silicon Valley for ICT or Zurich for pharmaceuticals). More recently, economic development practitioners have taken to employing the phrase in a less grand sense, and more as a “short hand” for explaining the potential to grow local economies by building on areas of concentration and interconnectedness within their own community. In most cases, the clusters identified are geographic and sectoral in nature.

Most communities will have several business sectors where there is evidence of a concentration of business activities and opportunities. These are often referred to as areas of local competitive advantage, and form the basis of strategic targeting exercises in economic development activity. Vaughan’s seven target areas represent, in this sense, the community’s belief that seven geographically concentrated sector clusters are present within its local economy, or at least that they may be developed over time. However, as noted above, the challenge lies in a community’s ability to differentiate itself from other communities with similarly identified business sectors. What Vaughan’s value proposition should seek to do is to differentiate the community by identifying aspects or facets of its clusters that are rare or even unique.

The solution to this challenge lies in understanding the interactions between a community’s sector-based clusters. Many communities have a strong building products sector. Many have a strong

advanced manufacturing sector. However, far fewer have strength in both. From this perspective, each time an additional cluster is identified, the community’s value proposition to a certain segment of potential investors is strengthened.

This approach to the value proposition allows communities to identify those specific areas of strength that are complimentary to each other, and thus identify the point or points at which the community has a regional, national or global competitive advantage. These advantages may then form a key part of the larger value proposition that may be used to lure or attract external investment to the community, or to anchor increased internal investment.

At a practical level, this approach suggests that Vaughan’s area of greatest competitive advantage lies in activities that incorporate more than one element of activity from different cluster strengths. For example, unique competitive advantages begin to emerge at the point of overlap between advanced manufacturing and the building products sector, where the fringes of these sectors begin to merge. Few communities, like Vaughan, are strong in both the advanced manufacturing and building products sector. Vaughan should be able to significantly out-compete many other communities for investments that rely on or are linked to both of these sectors.

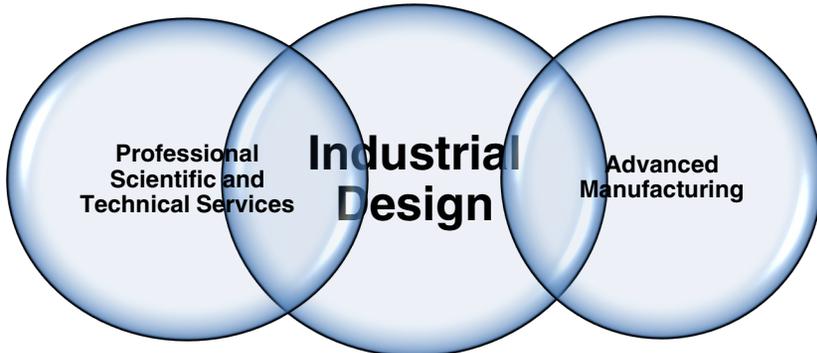
Following this idea of convergence, it is possible to begin to map out a model of how multiple sectors relate to and support other target sectors. These relationships and areas of convergence generate an optimal value proposition for Vaughan on the basis of a particular configuration of cluster activity in the community.

Where two circles show overlapping interests and activities, the community has an area of competitive advantage at a regional or national level. In Vaughan’s case the ESS discussed each sector in detail including subsector activities by North American Industry Codes (NAICS). This work was expanded on in the Background Economic Analysis report. Reviewing this research paints a picture of

how these activities in various sub-sectors may be related to each other.

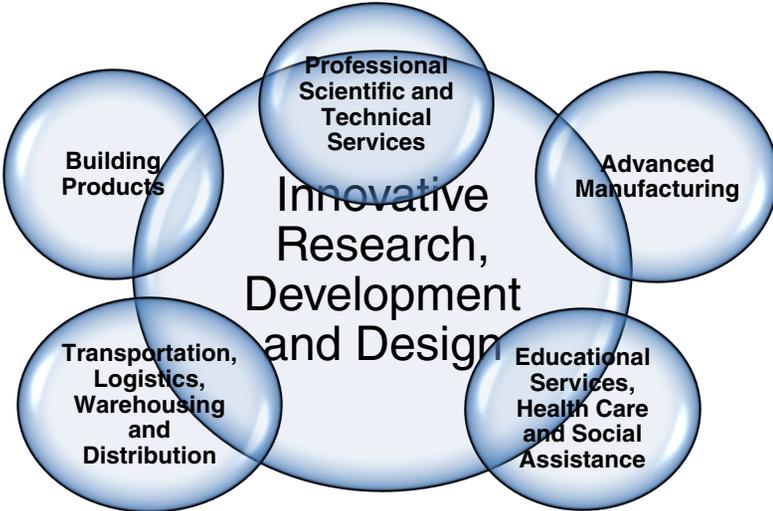
The figure below notes this convergence concept at the two-sector level. Where the professional, scientific, and technical services (PSTS); and advanced manufacturing sectors converge, there is an innovative sector focused on the design of products and processes. The sector draws specializations from the PSTS sector in computer systems and design, as well as manufacturing process expertise to create innovative new high-value products with excellent design or efficient manufacturing methods for use in advanced manufacturing companies.

Figure 1: Sector Convergence - Industrial design



As additional clusters are added to the convergence model, the narrower the focus or specialization of the convergence cluster, and the stronger Vaughan’s value proposition becomes.

Figure 2: Convergence - Innovative research, development and design



The model presented in the figure above suggests that in Vaughan’s case, five of the target sectors or clusters have a concept in common: innovative research, development and design. Figure 18 describes the activities related to innovative research, development and design in each of the five sectors.

The Organization for Economic Co-operation and Development defines research and development as, “creative work undertaken on a systemic basis in order to increase the stock of knowledge...and the use of this stock of knowledge to devise new applications”². Design is a broad based concept that may apply to a product, system or structure. The unifying theme is creativity and application to products, systems and structures.

² OECD Factbook 2008: Economic, environmental and social statistics
<http://puck.sourceoecd.org/vl=789024/cl=16/nw=1/rpsv/factbook/070101.htm>

As a convergence sector, there are a few broad categories of activities within Vaughan’s innovative research, development and design cluster:

- Industrial design and prototyping including product and equipment design and application;
- Systems design including computer, record management, manufacturing and logistical systems;
- Engineered materials for manufacturing, transportation and building applications
- The design of space and buildings including research and application of green technologies and concepts
- Medical and pharmaceutical research.

Educational Services, Health Care and Social Assistance	<ul style="list-style-type: none"> • Electronic records management • Advanced medical equipment design and development • Computer systems design services
Professional, Scientific, and Technical Services	<ul style="list-style-type: none"> • Architectural and engineering design • Computer systems design • Industrial design and prototyping

Figure 3: Innovative research, development and design activities

Target Sector	Innovative Research, Development and Design Activities
Advanced Manufacturing	<ul style="list-style-type: none"> • Robotics and automation systems • Advanced control systems • Innovations in processing
Transportation, Logistics, Warehousing and Distribution	<ul style="list-style-type: none"> • Tracking and GPS systems • Efficiency modelling
Building Products	<ul style="list-style-type: none"> • Green product development and prototyping • Green building modeling

Returning to the idea of the value proposition and investment attraction, Vaughan should direct attraction and growth strategies at companies actively engaged or interested in the activities discussed here. The strength in the value proposition is that companies that are focused on or have activities in any area of innovative research, development and design will be attracted to Vaughan for the diversity and depth of activities already in Vaughan. This diversity and depth offers companies the opportunity to perhaps expand their own activities, collaborate with others, or seek opportunity in the value chain through securing suppliers or customers in Vaughan.

As the convergence sector profile will demonstrate though, some of this development will be dependent on additional external forces. For example, the creative people that are engaged in innovative research and design activities require a certain type of firm in an area, but also a set of inter-connected services and qualities that combine to make an area an attractive place to live.

Similar to the model presented above, advanced manufacturing shows evidence of convergence with transportation, logistics, warehousing and distribution (TLWD) as well as building products.

As a convergence sector there are three broad categories of activities where advanced manufacturing, TLWD and building products exhibit overlap:

- Composites including the development and application of paints, coatings, resins, auto parts, wood products and other transportation and building product parts, components and materials.
- Green technologies including the development, manufacture and application of energy (power and heating/cooling) and waste management systems.
- Development and application of robotics and automated and advance control systems in building, construction and warehousing and logistics applications.

Figure 4: Convergence – Advanced goods production and movement



Figure 5: Advanced goods production and movement activities

Target Sector	Advanced Goods Production and Movement
Advanced Manufacturing	<ul style="list-style-type: none"> • Development and applications in waste reduction and energy conservation • Development and use of robotics, automation and advanced control systems
Transportation, Logistics, Warehousing and Distribution	<ul style="list-style-type: none"> • Application of products and concepts to reduce waste and conserve energy • Use of robotics, automation and advanced control systems • Plastic product manufacturing • Chemical manufacturing • Transportation equipment manufacturing
Building Products	<ul style="list-style-type: none"> • Application of energy efficient heating, cooling and electrical systems • Chemical manufacturing • Engineered wood products manufacturing • Cement and concrete product manufacturing

Like innovative research, development and design, the development of the advanced goods movement and production sector will rely on external forces as well as the strength of the component clusters. These will be outlined in the sector profile.

4.1.2 Targeted Areas of Convergence and “Incubation”

While the convergence sectors represent areas where activities in each of the traditional target sectors intersect, they also represent some of the core activities within each of these sectors. For example, due to the complexity of modern goods movement and the pressures to reduce negative environmental impacts from those activities, the transportation, logistics, warehousing, and distribution sector relies heavily on advancements in green technologies, composites, and automation, all segments of advanced goods movement and production. As well, advancements in education, health care and social assistance rely heavily on the development of a strong innovative research, development, and design sector, with creative people and firms at the core. By looking at each of these convergent sectors as the area of activities fundamental to the growth of each of the component sectors, two important benefits emerge.

First, these convergent sectors provide a focal point for the City, the local community, and local businesses when considering economic and community development services. These areas are the foundational framework upon which elements of economic and community development in the city, such as business assistance programs, international partnerships, investment attraction and retention, marketing, and development approvals can be based. Similar to the way an incubator would align services based on the sector it serves, the larger community can develop its business assistance and incubation services and efforts focused on discrete areas where important local economic sectors can benefit.

Accordingly, services delivered to grow these core activities will inherently benefit the component sectors – the convergent sectors represent an innovative way to support the growth of a diverse range

of sectors in the local economy. By focusing services in this way, the City (and community and business leaders) is leveraging limited assets to benefit the larger economy.

Consider the Vaughan Business Enterprise Centre (VBEC) as an element of the “Vaughan as an incubator” theme. By focusing on these discrete areas in addition to their existing support for small business across the economy, their services potentially extend much further than just the entrepreneur or small business they are assisting. By supporting that creative entrepreneur with a new product or process in the innovative research, development, and design sector today, their services could in turn be supporting the development of the local (or national, or even global) advanced manufacturing sector, tomorrow. Expansion of their services to larger businesses will extend this potential. The same can be said for all service delivery and business stakeholders in the city. By focusing on these areas, there is certainly potential for broader, spin-off effects in different areas of the local economy.

4.1.3 Vaughan’s ‘Pyramid of Support’

The development of a value proposition and genuine cluster-growth and strategy, however, is not merely an exercise in identifying areas of convergence. It is a more nuanced approach that attempts to articulate core messages about how the configuration of the cluster strengths may be deployed to meet the needs of business in a way that drives economic growth and increased employment. It is about identifying specific and tangible reasons why an existing local business, a new entrepreneur or an external investor would choose to invest or reinvest funds within the community.

This shift is discussed at length in a range of specialist literature, including Per Lundequist and Dominic Power’s 2002 paper *Putting Porter into Practice? Practices of Regional Cluster Building: Evidence from Sweden*³. They suggest that economic developers

³ European Planning Studies, Volume 10, Issue 6 September 2002 , pages 685 - 704

“use the term ‘cluster’ as something of a buzz word that represents a shift away from narrowly focused firm-based strategies to more holistic regional economic development approaches...”

They also argue that this activity, while not clustering in the traditional sense, has proven highly effective in a range of jurisdictions. This revised cluster theory represents a significant shift in economic development thinking, as it suggests that a range of local actors – not just businesses – can play an important role in driving economic growth. As the US Department of Commerce has argued, “Cluster theory also describes how factors external to the firm impact competitiveness and innovation. It is not just the characteristics of firms that create a truly competitive cluster; there are regional factors external to the firm that matter as well.” As alluded to above, success within many knowledge-based industries depends on the product or service produced, largely related to the creative talent that a firm has access to. The quality of infrastructure and amenities in a place is increasingly responsible for attracting people, rather than the types of jobs or companies present in an area. Attractive, sustainable, and liveable places, with a range of services that support both the population and business ventures have been proven to appeal to the most coveted creative talent.

This connects back to the notion that clusters arise where resources are thickest, where concentrations of talent, of infrastructure and amenities, of financial capital, etc., - all factors external to the firm - are present and available to participants within the cluster.

The process of mobilizing these external factors is still not entirely understood. However, in 2004 Maryann Feldman and Johanna Francis argued that there are three basic stages of cluster formation. They describe these in *Homegrown Solutions: Fostering Cluster Formation* as:

- The movement from latent entrepreneurship to active entrepreneurship

- The initial formation of the cluster
- The development of a fully functioning entrepreneurial environment within an innovative and adaptable industrial cluster

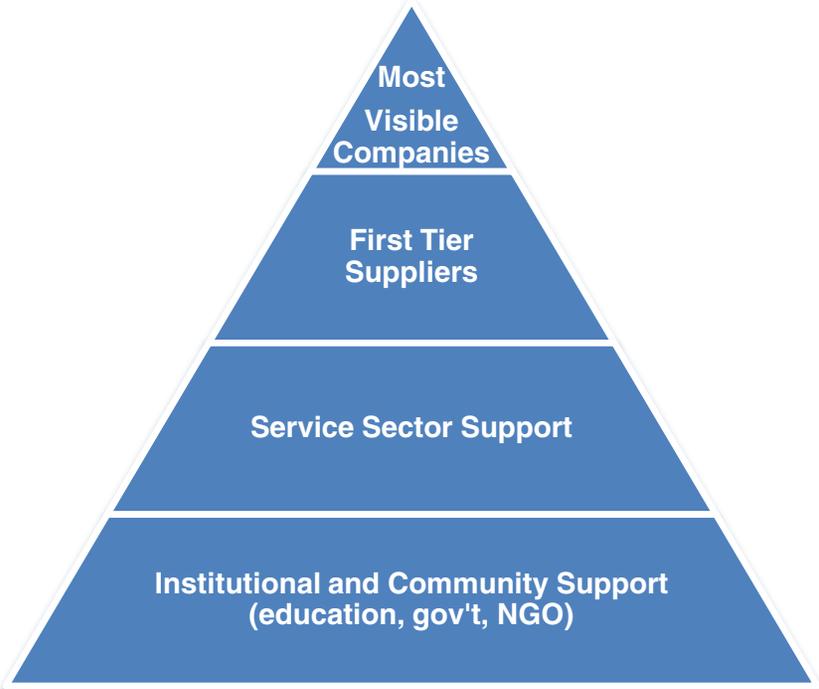
By linking the early stages of cluster development directly to this latter factor, the “entrepreneurial environment”, Feldman and Francis are rooting the cluster in a specific operational environment or business climate of a given community – which for entrepreneurial development means an area rich with opportunity, commercial and industrial interconnectedness, support structures, and human and financial capital.

In the previous section of the chapter, two areas of industrial connectedness emerged that are of particular interest to Vaughan: Innovative research, development and design, as well as advanced goods production and movement. The following section of the chapter demonstrates that this interconnectedness needs to be embedded in a broader network of community and institutional support. Millier Dickinson Blais uses a pyramid model (seen in Figure 6 below) to visualize this broader network of support systems required for a fully functioning, innovative and adaptable industrial cluster to thrive.

The top of the pyramid is represented by companies operating in the areas of convergence. The next layer is composed of first tier suppliers – those companies that supply the immediate inputs to the companies in the targeted area. In populating this layer of the pyramid, the question to ask is, “what are the inputs required by the target firms and what, if any, of those goods are supplied locally?” The subsequent layer is composed of services required of businesses including financial and professional services. However, recall the focus is not on services required of all businesses but by those businesses operating in the convergence areas. Finally, the

bottom layer of the pyramid is composed of a broader set of institutional support.

Figure 6: Pyramid of Support



To further understand the lower tiers in the pyramid, Millier Dickinson Blais employs a value chain assessment using a methodology developed by Dr. Edward Feser, the head of the Department for Urban and Regional Planning at the University of Illinois at Urbana-Champaign (UIUC). In the course of his work on regional economic analysis and supply chains, Dr. Feser has done detailed analysis on national level US statistical data related to input/output of sales, in order to develop a measurement of the relative strength of inter-industry linkages. Feser’s work shows the connection between ‘Core’ and ‘Linked’ Industries. The average propagation length (APL) is

used to note the strength of the industry connection, both forwards (linked industries that ‘purchase’ from the core industry), and backwards (linked industries that ‘supply’ the core industry). Generally speaking, the average propagation length is the average number of steps or time it takes a stimulus in one industry to propagate and affect another industry⁴. The lower the APL value, the tighter the linkage between a specific industry and the core industry. The relationship is noted by the figure below.

Figure 7: Conceptual Diagram of Industry Linkages



For Vaughan, this type of analysis offers a unique way of exploring the broad set of agencies and institutions supporting a convergence cluster. This can then be compared to the actual agencies and institutions in place in Vaughan to fully describe the value proposition and drive investment attraction.

Data in a Canadian context was obtained at a June 2009 workshop with Dr. Feser, supported by the Ontario Ministry of Agriculture, Food, and Rural Affairs. This data was used as a basis for the industry linkage analysis in this project. The methodology that was employed for this analysis was as follows:

⁴ Dietzenbacher, E. and Romero, I. Production Chains in an Interregional Framework: Identification by Means of Average Propagation Lengths. *International Regional Sciences Review*, 2007

1. The industry clusters were first defined by four digit NAICS codes for the purposes of data analysis and sector characterization, as noted in the ESS. These select NAICS codes were then used as the NAICS definition of each of the target sectors.
2. Dr. Feser’s analysis relies on 180 generalized industry groupings containing one or more 4 digit NAICS code. The NAICS codes within the target sectors were then attributed to their respective ‘industries’ in order to undertake the linkage analysis. These became the ‘core’ industries; of which there were multiple for each target sector.
3. A list was then produced of the top 20 backwards linked industries (suppliers) for each of the core industries. In order to undertake further analysis, each of the backwards linked industries was related back to the four-digit NAICS code(s) that defined it.

Despite the analysis being based on statistical evidence of industry relationships, there are several notes that must be made regarding the limitations of the analysis. Ideally, each of the convergence zones would correspond with a major NAICS industry sector or four-digit NAICS industry group.

- Industries included in the target sector NAICS definition may include industries with a very weak connection to the core activities of the target sectors.
- The analysis provides the strength of the industry linkage, but little information about how the industries are linked, or through what products. An explicit indication of what products or services link different industries could be useful when looking at industries with weak relationships.

Through the Feser-style analysis outlined above, the pyramid of support can be developed for both convergence sectors identified in

Vaughan. The contents of these pyramids are represented in the figures below.

Figure 8: Support for Vaughan’s Innovative Research, Design and Development Convergence Sector

First Tier Suppliers	Architectural, engineering and related services (5413), , management, scientific and technical consulting services (5416), computer systems design and related services (5415), specialized design services (5416)
Service Sector Support	Employment services (5613), office administrative services (5611), facilities support services (5612)
Institutional and Community Support (education, government, NGO)	Civic, social, professional and other similar organisations (8134), other personal services (8129), food services and drinking places (7221-7224), accommodations (7211-7213), amusement parks, arcades and gambling industries (7131/7132), child day-care services (6244), community, food and other relief services (6242/6243), individual family services (6241), elementary and secondary schools (6111)

Figure 9: Support for Vaughan’s Advanced Goods Production and Movement Convergence Sector

First Tier Suppliers	Paint, coating and adhesive manufacturing (3255), Coating, engraving, heat treating and allied activities (3328), Resin, synthetic rubber, and artificial and synthetic fibres and filaments manufacturing (3252), Plastic product manufacturing (3261), Rail transportation (4821), Electric power generation, transmission and distribution (2211), Veneer, plywood and
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	engineered wood product manufacturing (3212), Basic chemical manufacturing (3251), Other chemical product manufacturing (3259), Rubber product manufacturing (3262), Glass and glass product manufacturing (3272), Architectural and structural metals manufacturing (3323), Petroleum product wholesaler-distributors (4121), Ventilation, heating, air-conditioning and commercial refrigeration equipment manufacturing (3334), Engine, turbine and power transmission equipment manufacturing (3336), Other general-purpose machinery manufacturing (3339), Electrical equipment manufacturing (3353), Other miscellaneous manufacturing (3399)
Service Sector Support	Wholesaler-distributors including Electrical, plumbing, heating and air-conditioning equipment (4161), Metal service centres (4162), Lumber, millwork, hardware and other building supplies (4163), Construction, forestry, mining and industrial machinery, equipment and supplies (4172), Computer and communications equipment and supplies (4173), Chemical (except agricultural) and allied product (4184) and Management of companies and enterprises (5511), Air transportation (4811 and 4812), Automotive equipment rental and leasing (5321), Administrative services (5611), Employment services (5613)
Institutional and Community Support	Transit and ground passenger transportation (4851 through 4855), Accommodations (7211 through 7213), Other amusement and recreation industries (7139)

4.2 Convergence Sector Highlights and Implications

This analysis provides for a targeted approach to investment attraction, uncovering linkages between detailed industries and noting where industries occupy the areas of convergence between the target sectors. It is important to understand that it does not necessarily eliminate the work associated with the sectors that were identified in the ESS and the strategy that form each of these convergent sectors.

Instead, it complements the activity by indicating what activities within the sectors are most closely associated with Vaughan’s value proposition and which supplier industries will provide the necessary support to businesses within the target industries (building local supply capacity). Theoretically, the value proposition for these suppliers is the presence of a strong local marketplace for their goods and services.

Local economies are typically divided into the export-oriented activities and local provision activities. Innovative research, development and design offers the potential to link with the targeting of corporate headquarters for firms providing these services to export throughout Ontario, Canada and around the globe. However, there is also potential to expand the activities of existing firms to capture a greater degree of the local market. Given the diversity and convergence of five significant local industries and the growth projections for the city, there is a great deal of potential in the local market for local firms engaged in these activities. Further:

- Innovation, notes Richard Florida, is a central theme in city regions that dominate the world’s economic landscapes.
- Design is becoming the new mantra in corporate survival. Design is no longer just about creating the ‘next’ product but rather creating a design driven culture, where firms learn and apply understandings of how to connect with their customers

on a deeper level⁵. The most common example of this today is Apple which combines the diversity of basic functions with interface, appearance and applications making their products 'the' products to have.

- Research and development (R&D) is an essential component to innovative design, and spending on R&D is increasing. Both the American House Committee on Science and Technology and the European Commission recognize the importance of research in maintaining a thriving economy. According to Statistics Canada, domestic spending on research and development has increased from \$24.7 billion in 2003 to \$29.2 billion in 2007⁶; an increase of 18% in 4 years.

Vaughan is in a unique position to capitalize on this growth by creating a design oriented culture within the city and the approach to economic development. This will include not just the growth and attraction of firms engaged in these activities, but also fostering or "incubating" these activities in other firms in Vaughan. Vaughan should also be concerned with creating a place that is desired by design-oriented firms and their employees.

Vaughan's cluster convergence in advanced goods production and movement puts the city in a unique position to address these global trends. One of the clear opportunities for Vaughan is to develop the composites sector in the local area. Earlier identified as one of the activity segments in this convergence sector; composites stand out as an opportunity for Vaughan.

Composite materials can be lighter, stronger and more energy efficient with the added benefit of being partially or completely biodegradable. Transportation equipment and parts, paints, coatings,

⁵ Do you matter: How design will make people love your company. Robert Brunner and Stewart Emery 2008

⁶ <http://www40.statcan.ca/l01/cst01/scte01a-eng.htm>

resins, engineered wood products, glue laminated timber and fibre cement can all potentially be made from composite material. The materials can reduce waste and carbon emissions in both their manufacture and end use and as such are becoming increasingly popular in the manufacturing of vehicles and parts as well as the building products sector. Within this convergence cluster, Vaughan has an incredible concentration and strength in plastics manufacturing. This, coupled with the Magna NRC Composites Centre of Excellence, places composites and the associated manufacture of plastics, resins and other chemical products firmly in the centre of advanced goods production and movement cluster and set it as a clear target for the City's economic development efforts.

In addition, the following trends provide a preliminary rationale for investment into the rest of the convergent sector:

- As manufacturing, construction and distribution all move to improving efficiencies and cost competitiveness, the use of robotics, automation and advanced control systems is increasing.
- The global environmental movement is having a significant impact on manufacturing processes and product development; distribution systems and energy use; as well as building construction as all seek to lower overall carbon emissions and waste throughout product lifecycles.

A more detailed description of each of these convergent sectors as well as an analysis of global and national trends that affect them follows.

4.3 Convergence Sector: Innovative Research, Development, and Design

The innovative research, development, and design cluster, being at the convergence of several other sectors, is not about what Vaughan makes, it is about what Vaughan does. While the old economy was

concerned with mass manufacturing and economies of scale, the new economy is concerned with improving experiences and promoting the innovative concepts that emerge through smart design. Innovative research and development are key components of intelligent design.

Traditional industry sectors can be assessed and quantified using NAICS codes and data derived from Statistics Canada. However, a similar approach to innovative research, development, and design is more difficult, undermined by the fact that the NAIC system does not comprehensively cover all of the activities found within this convergence sector in an existing NAICS category. As with advanced manufacturing, this sector is as much about tools and processes as it is about the product produced. For the purposes of this strategy, the activities in this sector include:

- Research and development
- Industrial research and prototyping
- Medical equipment research and prototyping
- Development and incorporation of advanced control, robotics, and automation systems
- Innovations in processes (manufacturing, logistics/supply chain, and customer satisfaction)
- Efficiency modeling
- Engineering design
- Architectural, interior, and landscape design
- Green product development and prototyping
- Green building modeling
- Computer systems design
- Graphic and other specialized design

As such, the cluster has implications on economic prosperity in a city through business activity alone, but also through place-making and sustainable design, which contribute to the building of a great city

capable of attracting and supporting innovate firms and creative people.

4.3.1 Global Trends and Context

The advanced manufacturing discussion alluded to the changes taking place in the patterns of production and consumption. Mass production has been shifting to lower cost locations, while the remaining production facilities in North America turn to producing higher value products. However, there is evidence to suggest that the shifts taking place in the economy run deeper than this.

Low cost manufacturing jurisdictions will not be content to stay low cost. As product process and manufacturing knowledge increases, the products from China and India will move up the value chain. Firms in Canada and the Western World will soon see the BRIC nations closing in on the manufacture of those high end goods seen as the ‘safe haven’ for North American manufacturers. The lesson here is that firms in Canada need to be continually focused on research, development, and design. Canadian firms need to become design leaders.

Design is not just about drawing, it is about thinking. It is not just about form, it is about innovation. Products and services need to be developed and delivered with customer experience in mind. Design is becoming the new mantra in corporate survival. Design is no longer just about creating the ‘next’ product but rather creating a design driven culture, where firms learn and apply understandings of how to connect with their customers on a deeper level⁷. The quintessential example is Apple. Apple’s iPod and iPhone products became a huge consumer hit not simply because of form or even purpose. Both form and purpose are important, but even more important is how the customer interacts with the product. Richard Martin, Dean of the Rotman School of Business at the University of

⁷ Brunner, R. And Emery, S. (2008). Do you matter: How design will make people love your company.

Toronto offers the following understanding about design, “design is about refusing to accept apparent trade-offs and instead innovating around them to produce creative resolutions.”⁸

How exactly are firms responding to this new world order? The advertising industry in London can offer an example.⁹ The industry is composed of a set of professionals that come together to work on individual projects; similar to the structure of a jazz band. The pieces are mixed and matched according to the project, and individual members have a highly improvisational role. The approach is similar to what others refer to as flexible specialization,¹⁰ whereby smaller firms or clusters of firms are specialized on specific products; however, each output is unique and tailored to customers’ needs. The final good or service competes on qualitative attributes rather than cost.

The convergence discussion at the outset of this chapter explained that clusters are defined when there is a certain density or thickness of opportunity, of commercial and industrial interconnectedness, of support structure, and of human and financial capital. The discussion here is leading to a similar conclusion; that a design oriented economy will result in sets of smaller, interconnected firms operating within close proximity of one another. This proximity or cluster of activity offers a number of positive spin offs to participating firms:

- The development of interpretive communities that can advance product design and development
- Transferability of skills between the area where they were gained and a related area
- Flexible/short notice for procurement of product inputs enabled by density of firms

⁸ Martin, R. (2006). What innovation advantage? *Business Week*. January 16, 2006

⁹ Grabher, G. (2002). The project ecology of advertising: Task, talents and teams. *Regional Studies* 36 (3). Pp 245-262

¹⁰ Scott, A. (2006). Creative cities: Conceptual issues and policy questions. *Journal of Urban Affairs* 28 (1). Pp. 1-17

- Increasing ability to handle global rather than regional clients based on the high degree of specialization of firms
- Highly fluid and competitive labour markets develop, allowing each firm the possibility to attract the very best

The immediate advantage for Vaughan is that it need not attempt to create this cluster, but rather to understand the existing components of the cluster, and strengthen them to encourage further development.

Labour markets that appear around industry agglomerations are of particular importance to cities and city regions. In a design economy, labour (skill and talent) is the most important input for a firm. It is the agglomeration of skills and talent that leads Richard Florida’s argument that cities and inter-connected “mega regions” are the economic engine of the new economy. Only in those urban areas, he argues, will there be a sufficient pool of skills and talent for leading innovation, creativity, and design to take place.

In part, this insight is reflected in a similar work that describes four global trends relevant to the design city and the design economy¹¹:

- The role of urban agglomerations and the city region is intensifying. Cities need to recognize their positioning within North America’s primary city regions
- Places compete in a world of imperfect competition, each needs to understand its niche and differentiating features
- Dynamic firms are globally interconnected; this increases opportunities for cities to interact with other cities
- Routine tasks can be outsourced, while design tasks cannot

Why should a city care about its design and the design economy? In ‘The place of design: Exploring Ontario’s design economy’, Tara

¹¹ Grabher, G. (2002). The project ecology of advertising: Task, talents and teams. *Regional Studies* 36 (3).

Vinodrai suggests that cities and regions can realize a design dividend¹² and realize and strengthen the local economy by:

- Generating revenue and employment through their own work
- Generating revenue and employment for others through collaborative project work and local sourcing
- Adding value to the products and services of others
- Contributing to innovation across sectors
- Participating in and enhancing community engagement and identity
- Developing quality of place

Citing a report produced by the New Zealand Institute for Economic Research which found there is a strong, positive correlation between competitiveness and the use of design, Vinodrai makes a strong argument for the value of design in the economy (see figure below). Other studies have shown that design indeed raises productivity and contributes to national competitiveness. In attempting to capture the design dividend, several nations have embarked on national and regional design policies. These policies typically have the following goals and objectives¹³:

- Increasing the adoption of design among business
- Strengthening the design workforce through education
- Raising public awareness of design
- Improving the built environment
- Creating a strong cultural identity or brand

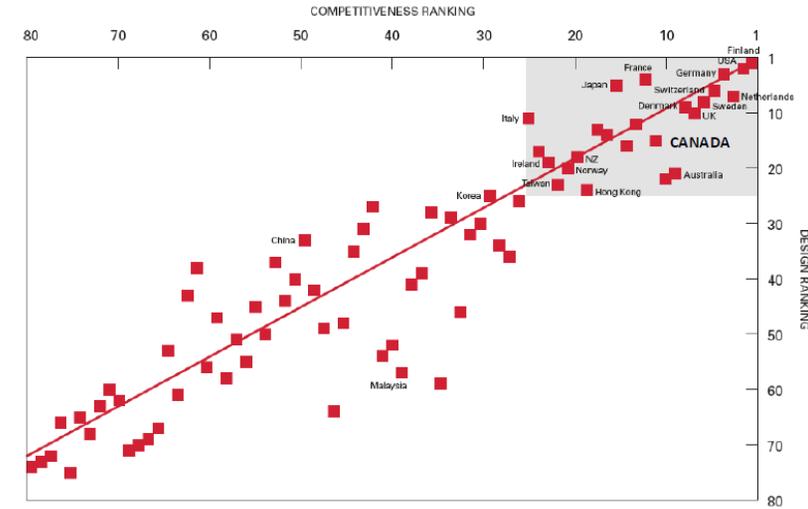
Nordic countries have some of the longest and most in-depth experience in building a design culture. Norway hosts national awards and sponsors seminars and educational programs for design.

¹² Vinodrai, T. (2009). The place of design: Exploring Ontario's design economy retrieved from http://martinprosperity.org/media/pdfs/The_Place_of_Design-TVinodrai.pdf

¹³ Ibid.

They are also using industrial design in their approach to development assistance through 'Design without frontiers'¹⁴. Sweden also supports design led initiatives and promotes energy reduction and environmental sustainability through design projects. Both Sweden and Finland use public procurement to showcase and promote local design. These programs have shown to increase employment and the design economy in their respective countries, while contributing to important city-building and unique place branding as well.

Figure 10: Relationship between national competitiveness and design



Source: New Zealand Design Taskforce, 2003.

4.3.2 National/Provincial Trends and Context

While other countries are realizing that design is critical to international competitiveness, Canada has been slow to adopt a design culture. Perhaps the most notable inclusion of design in the provincial economy is in the case of Quebec, which has introduced

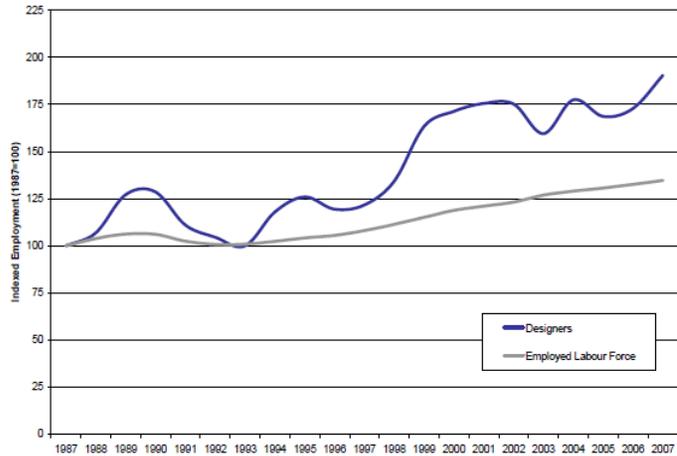
¹⁴ www.norskform.no and www.doga.no

several policies and initiatives to develop design-led value added products. The re-location of the offices of the International Council of Societies of Industrial Design and the International Council of Graphic Design Associations to Montreal is testament to Quebec’s success in the design economy.

Ontario, by contrast has been less embracing of the design economy than Quebec. Still, Vinodrai’s research shows that while growth in Ontario’s design industry and workforce has been volatile, it has also been outpacing the broader provincial economy.

Figure 11: Growth of Ontario’s Design Workforce, 1987-2007¹⁵

Figure 3: Growth of Ontario’s Design Workforce, 1987-2007



Source: The Place of design: Exploring Ontario’s Design Economy

The research also shows that while there are similar patterns in the growth between the design workforce and the design industry, the growth in the design workforce has outpaced the growth of the design industry. This is consistent with the fact that those employed

¹⁵ Vinodrai, T. (2009). The place of design: Exploring Ontario’s design economy retrieved from http://martinprosperity.org/media/pdfs/The_Place_of_Design-TVinodrai.pdf

in design occupations work in a variety of industries. Within the design occupations (as defined by Vinodrai), industrial design has been showing the fastest rate of growth.

Figure 12: Employment Growth by Design Occupation in Ontario, 1991-2006¹⁶

	1991	1996	2001	2006	Average Annual Growth (%)
Architects	3,415	3,375	5,135	5,200	2.8
Landscape architects	580	560	1,095	765	1.9
Industrial designers	1,625	2,795	4,505	4,630	7.2
Graphic designers	12,880	15,880	20,230	24,290	4.3
Interior designers	3,700	3,510	5,515	5,990	3.3
Other designers [†]	3,350	3,535	3,570	4,275	1.6
All Design Occupations	25,550	29,655	40,050	45,150	3.9
All Occupations	5,435,845	5,401,395	5,992,765	6,473,730	1.2

[†] Includes theatre, fashion, exhibit and other creative designers. Note: Numbers may not add due to rounding; Growth is calculated as annual compound average growth rate.

Source: The Place of design: Exploring Ontario’s Design Economy

The research in Ontario confirms the findings of the research conducted in other jurisdictions. Those engaged in design occupations are more likely to:

- Be self-employed or working for small firms
- Work from home
- Be engaged in short-term contracts
- Participate in social and professional networks
- Work and live in urban centres (around agglomerations of other designers and the design industry)

Some other findings about the design industry in Ontario are relevant for understanding of design and its importance for a city:

- Institutions help create an ecology of design
- Designers draw from other sectors of the economy

¹⁶ Ibid.

- Clusters of designers breed more designers

4.3.3 Local Trends and Context

Section nine of the City’s new Official Plan outlines the priorities for Vaughan in “Building a Great City.” Primarily, the policies revolve around:

- creating high-quality spaces within the public realm
- ensuring excellent and contextually significant design for the built environment
- Promoting developments and buildings that use energy and resources in a sustainable manner

As noted previously, Vaughan’s local innovative research, development, and design cluster is difficult to define by traditional sector profiling activity. A number of the assets and trends will have positive influences on the growth of the cluster, including:

- A strong base of advanced manufacturing firms that provide a local market poised to utilize the innovations of a design cluster for improved products and processes
- Transportation connections already exist to the City of Toronto, and the coming subway connection will provide a more direct link to the downtown core, and the workforce and market that exists there
- The Magna-NRC Composite Centre of Excellence is an important venue for composite product innovations and developments in the city
- A strong and growing base of professional, scientific, and technical services workers in the city, which includes a number of research and design fields
- The Vaughan Metropolitan Centre should focus on providing both a location for design firms, and the opportunity to produce a high-quality public and private landscape that

appeals to creative workers within the design cluster, including live-work opportunities

- Positioning within one of the densest urban agglomerations in North America, which contains a concentration of both professional and financial services supported by a network of skilled individuals and post-secondary institutions
- New prestige employment areas and downtown developments that offer opportunities to showcase design excellence and sustainability in city-building, supported by land use policies in the new Official Plan
- Green construction demonstration projects through the Kortright Centre already showcase Vaughan’s design capabilities in sustainable construction
- Concentrated population of individuals with post-secondary educations – a strong local creative capacity

4.3.4 Considerations for Vaughan

As a city leading innovative research, development and design, Vaughan must create a policy and regulatory environment that encourages design and innovation. There are several opportunities for Vaughan to do so, most notably the VMC and the Enterprise Zone. Through creative implementation of municipal zoning and collaboration with third party stakeholders, the City can encourage:

- Green building design principles
- Architecturally iconic buildings
- Cultural and design communities
- Flexible and adaptable live and work spaces
- Liveable spaces that attract cultural and design workers

Design workers have highly transferable skills, so a strong cluster of design workers has positive implications for the development of a wide range of sectors. Therefore, labour force is the primary asset for this cluster. A city needs to be the place to attract creative, knowledge, and/or design workers - in part, this is accomplished by ensuring that sustainability and high-quality private and public spaces are top of mind in City-building activities

4.4 Convergence Sector: Advanced Goods Production and Movement

The advanced goods production and movement sector in the city of Vaughan encompasses elements of the advanced manufacturing; transportation, logistics, warehousing, and distribution; and building products sectors. Primarily, there are three broad activity categories where those three sectors overlap to produce the advanced goods production and movement sector:

- Composite materials
- Green technologies
- Industry-specific robotics and advanced control systems

The rationale for the identification of this convergence sector is rooted in the strengths of the city in the context of each of those larger sectors as well - the role of the Greater Golden Horseshoe in goods movement, the available land resources in the city, the city's transportation connections, and the ability to access a number of large markets from within the city. To understand the opportunities associated with the sector, it is necessary to understand the national and international context in which it exists. A discussion of these trends and opportunities follows.

4.4.1 Global Trends and Context

Composite materials consist of two or more materials combined in a way that maintains the unique characteristics of each component material. For example, concrete is a composite consisting of cement and gravel. The two constituents of a composite material are basically binders or matrices, and reinforcements. The reinforcement material is stronger and stiffer than the matrix, but the matrix binds the typically discontinuous fibres of the reinforcement together to form the material. Demand for the materials in the marketplace has traditionally been driven by cost reduction and improved performance

of the materials over “traditional” materials, but they have numerous other advantages over traditional materials:

- High strength to weight ratio
- Ability to be formed and moulded
- Inherent durability
- Low capital investments required for manufacturing facility conversion

Several larger trends illustrate the strength of the composites industry, which is considered to be a \$19 Billion (USD) industry based somewhat on healthy growth of wind energy, aerospace manufacturing, and pipe & tank manufacturing segments.

- The BRIC¹⁷ market has been the fastest global growth segment over the past five years, with the market increasing a combined rate of 10% - growth is projected at 9% over the next five years
- The Asian market, primarily buoyed by demand in China and India, became the largest regional composite market by shipments in 2008, with demand slowing through the onset of the global economic downturn
- Some of the strongest industry growth has been in the aerospace segment - the aerospace industry is forecasted to demand \$57 Billion in composite materials from 2007-2026
- Global sales for carbon fibre reinforced plastics is forecasted to grow from \$15 Billion in 2008 to \$28 Billion in 2014, and further to \$50 Billion by 2025

Low relative investment in undertaking composite material production, especially in equipment, has led to one primary trend

¹⁷ Brazil, Russia, India, and China

associated with composite material manufacturers. Many of the manufacturers and composite moulding companies with the largest market share are smaller, more entrepreneurial ventures. As well, since the introduction of composite materials is still occurring in many fields, and many new materials are still being developed, the door is open for these small ventures to develop highly innovative and specialized products or new processes for developing materials.

The green technologies sector is incredibly broad and contains a number of different industry segments. Within the context of the advanced goods production and movement sector of convergence, the green technologies sector primarily includes the development, construction, application, and installation of energy and waste management systems. This has specific relevance to the sector as more traditional industrial activities like manufacturing, transportation, building, and construction are looking for ways to enhance the sustainability of their current practices by framing every operational or locational decision within a “green” perspective.

Broadly speaking, several trends are globally, or universally, impacting the green technologies sector. Primarily though, many developments and innovations are a result of increasing concern of a potential future climate crisis, which is driving the exchange of traditional avenues of economic growth with more sustainable solutions that can accomplish the same economic development goals. Further:

- Global levels of new investment in sustainable energy projects increased six-fold (605%) between 2002 and 2008, and 67% between 2006 and 2008 alone
- Between 2007 and 2008, the fastest growing alternative energy segments by investment were Geothermal (149%) and Solar (49%), with Wind and Solar accounting for the highest levels of investment in 2008

- Emerging markets, primarily China and India, are increasingly turning to more green building products and processes to accommodate their explosive population growth and urbanization in more sustainable ways

The green construction applications market, which remains one of the largest markets for composite materials, is estimated to reach \$6.1 Billion by 2013 in North America, which represents an average growth rate of 5% per year from current levels. Primarily, this includes composite materials used in residential components like windows, doors, bath tubs, and swimming pools, but also rebar, utility poles, and cooling towers for industrial applications.

The integration of robotics, automation, and advanced control systems remain an effective way to implement productivity and efficiency gains in industrial activities. This segment could include a range of processes or products, such as the design of automated packaging systems for building components, robotic systems for cross-docking of freight, or the manufacturing of precision machinery. Primarily, many of the advancements in the segment are being driven by advancements in other related areas, such as Information Technology.

Several trends with regards to technology integration and advancements in industrial applications are emerging, and have a potential impact within the robotics, automation, and advanced control systems segment:

- Wireless communications and smart phone technology are increasingly being integrated into industrial practices and machinery/asset management, showing advancements in areas like monitoring and quality control, planning, safety, and employee-to-employee communication
- Security is a growing concern as control systems are integrated with a company's business networks, and are thus

threatened by the same cyber attacks - security strategies for industrial software and hardware, to maintain the integrity of the automated industrial systems against cyber threats, is an emerging area of activity

- Software and hardware advancements in areas like virtualization/cloud computing, visualization, and software as a service (SaaS) are having profound impacts on cost-reduction, planning, robotic accuracy and measurement, predictive equipment monitoring, and the integration of advanced industrial systems

4.4.2 National/Provincial Trends and Context

The positioning of the advanced goods production and movement sector in Canada reflects the positioning of its component sectors. Productivity and efficiency gains are driving developments in the sector, and many advances are being made within the context of “greening” the industry. In the three relevant areas of focus for Vaughan, there are several trends of note at the national/provincial level.

For composite materials, Canada benefits from being next to a large customer:

- The U.S. market for reinforced plastics is forecasted to grow 2.8% annually, reaching 2.3 Billion pounds of resin and 1.3 Billion pounds of reinforcements by 2013.
- Reinforced thermoplastics are forecasted to exhibit similar performance, increasing 2.9% per year to 1.5 Billion pounds in 2013 in the U.S., with reinforced polypropylene and nylon composites also exhibiting above average growth.

With 75% of Canadian exporting activity in the sector aimed at the U.S. market, Canadian firms are well positioned to take advantage of that demand, especially given strengths in plastics and resins in Ontario.

Though growth comes from several different industry sectors, much of the demand in the U.S., and also in Canada, has been in the automotive, alternative energy, and utilities sectors. The automotive industry, a primary component of the advanced manufacturing landscape in Canada, but especially Ontario, is particularly drawn to composite materials based on the strength to weight advantages over other materials. The alternative energy sector is likewise drawn by the weight to strength ratio, with the wind industry's interest in composite materials for wind turbine blades, being just one example.

The integration of alternative energy technologies into the public grid could represent a major opportunity for composite material growth as well. The emergence of the Smart Grid, which will enable the two-way information and energy flow required for both time-of-use pricing and smaller-scale energy generation, provides opportunities for a number of composite materials to be used in cables, power electronics, cable insulators, or energy storage devices.

As noted in the building components profile, the *Green Energy Act* (GEA) provides a primary driver for the development and implementation of green technologies in Ontario. Within the advanced goods production and movement sector, the act has implications on the types of energy used to power sector activities, the types of materials manufactured, and the ways in which those goods are moved, all with an emphasis on environmentally sustainable methods and products. Primarily though, the GEA mandates that a high level of activity associated with the initiatives under the act, must be performed in Ontario. This includes construction and labour, but also the manufacturing of a large portion of the materials used in those projects.

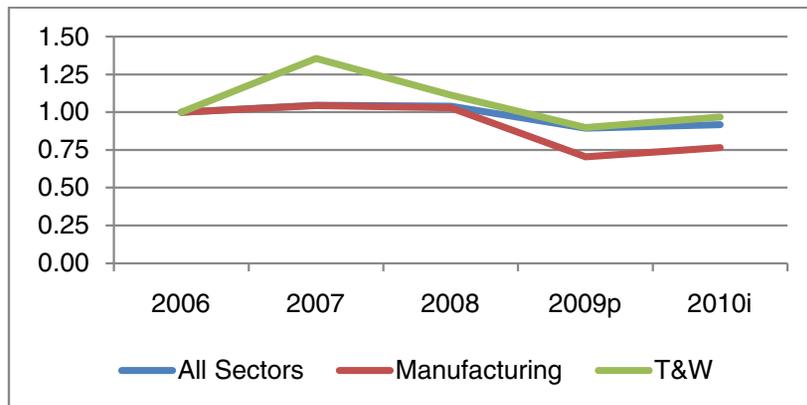
For example, once the GEA and the associated Feed-In Tariff (FIT) program came into effect, more than 1,000 applications were received by OPA during the first phase of the program, resulting in the approval of large- and small-scale projects that will generate over 2,600 MW of green energy. With the stipulations that require a

portion of goods and labour to come from Ontario, these projects are well positioned to offer numerous opportunities to businesses within the advanced manufacturing and building components sectors in Ontario.

Underlying these developments and drivers is the third segment: advanced control systems, automation and robotics; which has an influence on the design, manufacture, transportation, and application of industrial products including composite materials and green technologies. By far, the most prevalent trend within this segment is the integration of technology to reduce costs and improve productivity. Though some of this may be process-based improvements, a large portion of these improvements are based on capital investments in machinery and equipment that allows for higher productivity. In order to compete globally, investment in high-tech equipment is paramount.

The downturn has somewhat affected spending on machinery and equipment in some sectors across Canada and Ontario, but that appears to be rebounding moderately into 2010, as illustrated on the next page.

Figure 13: Capital Expenses for Machinery and Equipment, Indexed to 2006 Levels, Canada

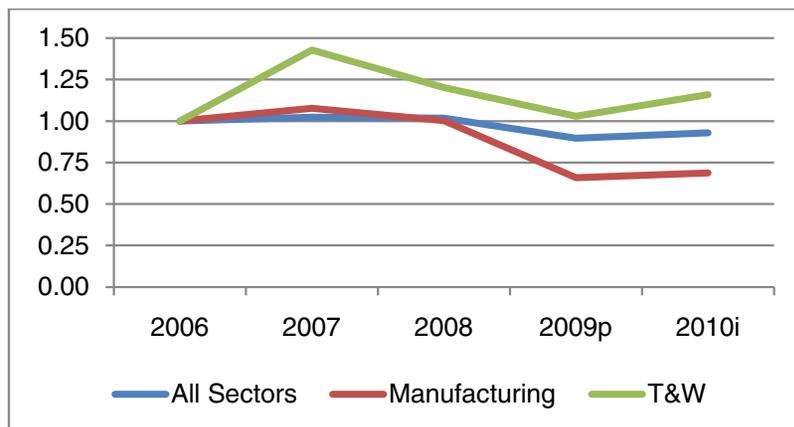


p = preliminary 2009, i = intentions for 2010

T&W = Transportation and Warehousing

Source: Derived from Statistics Canada Private and Public Investment in Canada, Intentions Survey by Millier Dickinson Blais, 2010

Figure 14: Capital Expenses for Machinery and Equipment, Indexed to 2006 Levels, Ontario



Source: Derived from Statistics Canada Private and Public Investment in Canada, Intentions Survey by Millier Dickinson Blais, 2010

4.4.3 Local Trends and Context

Vaughan’s local advanced goods production and movement sector is difficult to define by employment, as it is composed of a range of different industrial subsectors. A number of the assets and trends illustrated in the Background Economic Analysis and Appendices report will have positive influences on the growth of the advanced goods production and movement sector, including:

- Large motor vehicle parts manufacturing, plastic product manufacturing, furniture and cabinet manufacturing, and architectural and steel building components manufacturing sectors
- Concentrated employment in furniture, plastics, structural metals, resins, synthetic fibres, motor vehicle parts, navigational, measuring, medical, and control instruments, and metalworking machinery
- A manufacturing sector dominated by firms with fewer than 20 employees, suggesting ability to integrate technology easily or occupy specialized niche areas of the market
- Highway 427 expansion further into the City, as well as transit improvements to ease congestion
- Presence of the Magna-NRC Composite Centre of Excellence in Vaughan
- Strong support through the new Official Plan for green industries and environmentally responsible green products, as well as eco-districts that use district energy, recycle industrial by- or co-products, and share resources or facilities; strong policies focused on promoting efficient movement of goods through transit expansions; and strong policies regarding energy efficient residential construction
- Strong industrial presence in computer systems design and related services

- Large contiguous parcels of land capable of accommodating large-scale and high-tech, integrated production/transportation/warehousing facilities
- Existing or emerging strengths in both transportation of goods, and the logistical support structures for transporting or storing goods
- Presence of some of the largest residential developers in the Greater Toronto Area, supportive of environmental building policies
- Presence of green-building projects, as well as supportive residential building education programs
- The Vaughan Business Enterprise Centre is an assets within the sector, where new entrepreneurial and small-business ventures will likely account for much of the development

4.4.4 Considerations for Vaughan

Innovation in the sector is just as likely to come from small firms and entrepreneurs as it is from large companies, highlighting the need for the VBEC to support entrepreneurial and small-medium sized businesses with more industry-specific services.

The sustainability-related priorities of a city can fit well with both the industrial practices of the cluster, and the possibility of a robust local market for products and processes supplied by the cluster. With Vaughan's strong commitment to land use policies that encourage sustainability and green building, it is naturally a good fit for the cluster.

A local concentration of computer and industrial design skills will likely produce a strong base for development of advanced products and processes within the cluster, especially given increased automation and computerization to achieve efficiency and productivity. Like business and incubation services directed at firms, regard should be given to developing training programs and attracting skilled workers within these transferrable fields. This in part highlights the importance of quality of place, even in an industrial context.

Though capital and operational investments are paramount to being globally competitive within a private sector context, government regulations, incentives, and support are driving a large portion of development in the cluster and providing an immediate business case in some respects – the momentum that the GEA has generated is an example.