Sector Trend and Opportunities Report

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Prepared by

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1 Methodology

This report builds on the recent strategic plan, which provided data on the industry structure in Eastern Ontario and pointers to sectors that are most likely to enable sustainable growth, build sector density, and create economic prosperity. Accordingly, the identified sectors were examined utilizing, where possible, previous sector studies as indicated below.

- Advanced manufacturing (no previous studies of overall sector undertaken); sub-sectors comprise
    - Nuclear energy (initial study: 2008; updated 2010)
    - Aerospace (initial study undertaken in 2008, updated 2010)
    - Automotive (study undertaken in 2005)

- Cleantech (phase 1 & 2 studies undertaken 2009/10);
  Sub-sectors comprise:
    - Water technologies, waste management, and environmental industries:
    - Renewable energy
    - Cleantech products

- BioHealth (detailed study undertaken in late 2011)
  Sub-sectors comprise:
    - Biotechnology/pharmaceuticals
    - Medical devices
    - Bio/health informatics
    - Primary health care delivery

- Food processing (detailed study undertaken in 2011)

- Logistics (no previous sector study but directory and brochure compiled in 2011)

This work is arranged into three main components:

- Key sector trends in each sector to ascertain external opportunities and threats.
- Compilation of sector profiles through an asset audit, which built on previous work as shown above. This covered key elements of Eastern Ontario's ecosystem in each sector in terms of companies, educational institutions and programs, graduate output, research and development activities, business and professional support, and sources of capitalization.
  The company, business and professional support, and sources of capitalization work did not represent a 'deep dive' but considered the major entities as highlighted in the previous work and subsequent significant developments.
- An agglomeration of external sector trends and the asset audit synthesized into an opportunity assessment and a basis for going forward.

2 Advanced Manufacturing

No previous studies on the whole scope of advanced manufacturing in Eastern Ontario. This section therefore begins from a lower knowledge base than most of the other sectors. Current trends were assessed across the advanced manufacturing sector, which are equally applicable to manufacturing activities in sub-sectors such as aerospace and nuclear energy. The sector asset audit was compiled drawing on data from municipality websites but a complete picture will require further work. This information was brought together as an opportunity statement.

OEEDC has attended a number of advanced manufacturing events such as FABTECH (US and Canada), AME, and CMTS. All have proven challenging in investment attraction, suggesting a focus towards cutting edge technologies may prove more fruitful.

2.1 Key Trends in Advanced Manufacturing

Manufacturing in the developed world is shifting towards high-skill, high value production. With an emphasis on lean and agile manufacturing processes, there is a move towards more entrepreneurial businesses providing customized products and flexible production processes.

Operational Trends

- Ubiquitous role of information technology
- Reliance on modelling and simulation in manufacturing processes
- Acceleration of innovation in supply-chain management
- Agile manufacturing systems that respond rapidly to customer needs and external impediments
- Acceptance and support of sustainable manufacturing
- Organizational and business-model focus on process improvement
- Global demand potential for capital projects and natural resources (BRICs)

Sub-Sector Trends

Major advances in two mature areas:

- Semiconductor fabrication
- Advanced materials with a focus on integrated computational materials engineering (ICME): an emerging discipline that can accelerate materials development and unify design and manufacturing.

Emerging Technologies

- Additive manufacturing: (aka 3D printing) has the potential to change how future products are designed, sold, and delivered to customers, through mass customization and easy design. Likely to replace significant portions of traditional industrial manufacturing.

- 3-D printers are empowering entrepreneurs to design more innovative products at home, taking some mystery out of the process, and saving them time and money so they can better compete with larger companies.
- According to a recent study by Colorado-based Wohlers Associates Inc. The report forecasts sales of additive manufacturing products and services to reach $3.7-billion worldwide by 2015 and up to $6.5-billion by 2019.

- Synthetic biology, bio-manufacturing has the potential to manufacture biological substances from radically engineered biological systems for novel purposes. Could reframe common conceptions of advanced manufacturing.
- In 20 years, manufacturing is expected to advance to new frontiers, resulting in an increasingly automated and data-intensive manufacturing sector that will likely replace traditional manufacturing.

Manufacturing is entering a transformative period, with a renewed focus on product and process innovation, and unprecedented collaboration across the value chain. Innovations and Sustainable Solutions Will Accelerate as a result of three key drivers:

- The enormous volumes of high-quality engineers graduating from top academic institutions around the world (in particular in China and India);
- The eagerness to push the limits of science and find interdisciplinary breakthroughs; and
- The thirst for open innovation stimulated by the need of large companies to solve pain points in their value chains, as well as by the internet and social media.

The world is at the beginning of a new era of innovation, which will result in spectacular developments in nanoscience and new materials, biophysics, biochemistry, and very likely the arrival of commercial nuclear fusion.

Advanced Manufacturing Value Chain

The value chain chart is not an exhaustive list of companies in all categories. Rather, it is intended to illustrate the strengths of the sector with a selection of key companies. This was compiled drawing on data from municipality websites but a complete picture will require further work. The sector highlights draw out key elements of the value chain to inform the opportunity statement.

Advanced Manufacturing		
Companies		**Sector Highlights**
Advanced Manufacturing	McCloskey International, Oxy-Arc International, Laser Depth Dynamics, Sumida, Universal Seal; 3M Canada Company, Canarm, Quickmill	• 47,453 are employed in manufacturing industries in Ontario East: 10.3% of total employment • Over 3,700 engineering (Including 626 masters grads), maths, and physical science graduates supplemented by over 1500 in arts and sciences from the region's universities. • An additional pool of more than 1,400 graduates in engineering, trades and operations management disciplines, including 414 graduating in trades subjects, and a further 136 from arts & science programs out of the region's community colleges • An emerging workforce of 15,346 students enrolled in engineering, maths and science disciplines plus a further 9,232 enrolled in arts & science programs (including 1,941 masters students) • Education programming reflects industry trends Materials science programming at universities throughout the region Supported by comprehensive range of over 300 programs in general engineering, maths, science technician and trade programming from the region's universities and colleges • Considerable depth in research activities that align well with current sector trends with significant expertise in materials science, bio-materials, supported by trades and technology centres at community colleges • Diversified manufacturing base in terms of size, type, markets etc. • Cluster of plastics companies with significant support to food processing industries • High value manufacturing is driven by aerospace, and nuclear sub-sectors, some evidence of diversified manufacturing companies serving multiple markets (e.g. Oxy-Arc International, Laser Depth Dynamics) but requires further exploration • No 3D printing companies identified in region but it is possible that this technology is being deployed by companies in the region • Considerable business support deployed by local, regional, and provincial organizations
Aerospace	Kadex Aero Supply, SAFRAN Electronics Canada, L-3 Communications Canada, Arnprior Aerospace, Lockheed Martin Canada,	
Nuclear/energy	Andritz Group, GE-Hitachi Nuclear Energy, Rolls Royce (ODIM Numet Limited) Sandvik Materials Technology Canada, Andritz Group	
Automotive/transportation	HVCC Canada, Autosystems, CPK Interiors, E.T.M. Industries, Novelis, Goodyear Canada, Bombardier, Drossbach North America	
Advanced Materials	SABIC Innovative Plastics, Horizon Plastics, Berry Plastics, PolyFerm Canada (bio-plastics); Grafoid; PolyCello, Sigma Stretch Film	
Support Services		
Fabrication/machining	Kimco Steel	
Engineering & Technical Support	SGS	
Technology Support	Kingston Process Metallurgy Inc. (KPM); CMC Microsystems	
Industry Support		
Industry Associations	Society of Manufacturing Engineers, Northumberland Manufacturers Association, Kawartha Manufacturing Association	
Industry Associations - sector specific	Ontario Aerospace Council (OAC), Aerospsace Industries Association of Canada (AIAC), Automotive Parts Manufacturers Association (APMA), Organization of Canadian Nuclear Industries	
Industry Support - Local	CFDCs, Excellence in Manufacturing Consortium (7 local offices), The Small Business Centre(Quinte), Quinte Manufacturing Resource Centre, Launch Lab, The Eastern Ontario Manufacturers Network, (EOMN); Small Business Enterprise Centres (SBECs)	
Industry Support - Provincial	Canadian Manufacturers and Exporters, Colleges Ontario Network for Industry Innovation (CONII); UOIT-Commercialization office; The Ontario Partnership for Innovation and Commercialization	
Funding	Spark Angel Network, Peterborough Angels, Parteq Innovations, Capital Angel Networks; Advanced Manuafacturing Fund; The SMART Prosperity Now funding	
Education, Training and Human Resource Support		
Local	Durham College School of Skilled Trades, Apprenticeship & Renewable Technology (START); School of Science & Engineering Technology (SET); UOIT – Faculty of Engineering and Applied Science, Faculty of Science	
Specialist programs	Engineering (in all disciplines), math and science programs at all levels at the region's universities and colleges; Welding programs at the region's colleges; UOIT, Trent University, Carleton, Ottawa, RMC, Queen's: Materials science programs at all levels materials science engineering (bachelor's, masters, doctorate) Durham, St.Lawrence, Fleming, Algonquin: Operations management	
Research and Development		
Research Centres	UOIT: The Robotics and Automation Laboratory (RAL) Advanced Materials Research Group, Scanning Electron Microscope (SEM) Lab; General Motors of Canada's Canadian Engineering Centre, Automotive Centre of Excellence (ACE), Durham College: Integrated Manufacturing Centre; Trent University: Centre for Materials Research, Trent Centre for Biomaterials Research; Queen's-RMC Centre for Advanced Materials and Manufacturing; Centre for Smart Materials and Structures, Loyalist College:Sustainable Skills, Technology and Life Sciences Centre; The Kawartha Trades and Technology Centre	
Networks of Centres of Excellence - National	NRC - Security and disruptive technologies	

2.2 Advanced Manufacturing Opportunity Assessment

Key Factors	Eastern Ontario	Opportunity
	Advanced Manufacturing Technology Development	
Key game changing/transformative technologies: ▪ Additive manufacturing (3D printing); ▪ Synthetic biology; bio-manufacturing ▪ Data intensive – big data, cloud computing etc. ▪ Process innovation	● No 3D printing/additive manufacturing companies identified ● Strong research presence in bio-materials e.g. Trent U ● Advanced manufacturing customer base ● Weaknesses in ICT representation	● Develop cutting edge manufacturing sector ● Offset potential job losses: provide high value employment opportunities ● Deeper dive into activity in Eastern Ontario ● Investment attraction, business expansion initiatives to develop these aspects ● All sectors will benefit ● Eastern Ontario must not be left behind
	Diversification	
▪ Semi-conductor fabrication ▪ Advanced materials ▪ Verticals – high value added opportunities	● Extent of activity unknown in Eastern Ontario. Some evidence in Cornwall (Sigmapoint Technologies) ● Strong research presence in advanced materials e.g. Trent U, Queen's, RMC etc. ▪ Graduate specialist output in region ▪ Plastics cluster ▪ Ontario East has developed effective sector initiatives in aerospace, nuclear, cleantech ▪ Also synergies with food (materials handling etc,) and life sciences sectors (medical devices) ▪ Some evidence of companies serving multiple industries and resource based manufacturing	▪ Determine activity in Eastern Ontario ▪ Build on research base/graduate output through Investment attraction, business expansion initiatives ▪ Explore Ontario East's capabilities and potential in integrated computational materials engineering (ICME): ▪ Target diversified advanced manufacturing companies ▪ Strengthen supply chains of existing target sectors ▪ Potential to target other high value sectors e.g. resources

3 Automotive and Transportation

The findings of the study, Issues & Trends in the Automotive Industry: Implications for Eastern Ontario (DesRosiers Automotive Consultants) of 2005 concluded that there was insufficient critical mass or cohesiveness to form a growth strategy for the region. In 2008, a further sector assessment investigated commercial vehicles, which also concluded that sector was not a viable target. OEEDC has not participated in any APMA events since 2008, with the exception of a Green Car seminar in 2011.

3.1 Auto Trends

Expansion plans announced by Industry:

- Ford Motor Co. announced a near $850-million investment in its Oakville plant that will see several new global platforms built in the coming years and help secure 2,800 jobs
- GM scraps plan to close Oshawa consolidated plant line in 2014 as demand for new vehicles grows but it is now anticipated to cease production in 2016
- Chrysler is proposing a major $3.6-billion retooling of its Windsor and Brampton plants and is seeking a contribution of at least $700-million from the Provincial and Federal governments.

At Ford growth is accounted for by emerging markets and robust resource driven domestic economies. The Ford plant in Oakville has sold 6,000 of its Edge crossovers to China, and 4,000 to Brazil, with record sales in Canada are coming in large part from resource-producing Saskatchewan and Alberta.

Strong government support for the industry continues

- $250M Auto Innovation Fund renewed

- Awards focus on energy efficiency, research and cutting edge manufacturing:
    - $80 million to Ford to establish a flexible engine assembly plant and an advanced power train research centre in Windsor, Ont.
    - $54.8 million to Linamar Corporation, to develop advanced components for transmissions, engines and drivelines.
    - $70.8 million to Toyota Canada to develop more fuel-efficient vehicles, including electric vehicles.
    - $21.7 million to Magna International to develop energy-efficient components for vehicles and power train components for next-generation vehicles.

Ottawa still has nearly $180-million left in previously announced funding for the auto industry with about $680-million available for companies to tap. Repayment terms on previous federal contributions have often been generous, allowing for up to 20 years for reimbursement.

Chrysler is seeking $700 million from the Provincial and Federal Governments before it goes ahead with its plant retooling plans.

National/Provincial Competitive disadvantages on incentives

- Canada still faces competition from Mexico and from some U.S. states that benefit from generous government subsidies.

- General Motors announced in late December that it will move production of the Chevrolet Camaro from Oshawa to a plant in Michigan in 2015.

Consolidation looms large around the globe

- In Canada, there have been nine assembly plants close since the auto pact was signed in 1965
- Since 2000, Canada has lost more than 51,000 assembly plants and parts-sector jobs (DesRosiers Automotive Consultants)
- GM Oshawa's consolidated plant line will cease production in 2016
- Toyota announced it would close its manufacturing plant in Australia, shutting down car production in the country after 50 years. Ford and GM have made similar moves, and by 2017 Australia will no longer have cars produced on home soil.

Electric vehicles are moving into the fast lane: Battery-powered electric vehicles (EV) are poised to change the social, political and economic landscape – while also transforming existing vehicle manufacturers and creating new enterprises and business models.

3.2 Automotive Value Chain

Information from the DesRosiers study undertaken in 2005, the commercial vehicles sector assessment in 2008, the APMA, and municipal websites was utilized to complete this exercise. It should be pointed out that a number of the companies identified in the 2005 are either no longer in business or in Eastern Ontario. The value chain chart is not an exhaustive list of companies in all categories since it is intended to illustrate the strengths of the sector with a selection of key companies, support organizations and institutions. This sector assessment also covers other modes of the transportation sector in Eastern Ontario (rail, air and ship/boat) to provide a comparative perspective. The sector highlights draw out elements of the value chain showing strengths and weaknesses to inform the opportunity statement.

Advanced Manufacturing - Automotive & Transportation		
Companies		**Sector Highlights**
Automotive parts	HVCC Canada, Autosystems, CPK Interiors, E.T.M. Industries, Novelis, Goodyear Canada, Belden; Sumida; Prysmian Power Cables and Systems Canada	• Employment in automotive industries declined by 22.4%: loss of 670 jobs - just under 3,000 in 2006 to 2,288 in 2012 • Some recovery with 11.4% growth in auto industries predicted between 2013 and 2020 • Employment in other transportation industries (railroad, aerospace and ship/boat) declined by 12.9%, half rate of auto, but fewer employed (around 950) 72% are employed in aerospace industries (2012) • 7.4% improvement expected in transportation industries between 2013 and 2020 • 12 Specialist automotive education programs available at UOIT, Loyalist, La Cite, Durham, and Algonquin Colleges at all levels • Materials science programming at universities throughout the region. Supported by comprehensive range of over 300 programs in general engineering, maths, science technician and trade programming from the region's universities and colleges • Over 250 programs in engineering, science, math, trades, and technical disciplines. • Over 2,700 engineering, maths and science graduates (including 626 masters grads) with a pool of over 1500 arts and sciences graduates • An additional pool of more than 1,400 graduates in engineering, trades, operations management disciplines, and further 136 from arts & science programs from the region's community colleges • An emerging workforce of 15,346 students enrolled in engineering, maths and science disciplines plus a further 9,232 enrolled in arts & science programs (including 1,941 masters students) • Considerable research depth: • Specialist automotive centres: Autoplex and Canadian Engineering Centre of General Motors (GM) Canada Ltd. • Materials science at Trent University: Centre for Materials Research, RMC, Queen's, UIOT • Potential to capitalize on Green Car initiatives through: • Trent Centre for Biomaterials Research but Ontario bio-auto council appears to have lost momentum • Fuel cells at RMC/Queen's • Low industry density in automotive parts (LQ 0.39), in which 75% are employed • Appears to support conclusions of Des Rosiers study in 2005 (Issues & Trends in the Automotive Industry: Implications for Eastern Ontario):companies manufacturing auto components in Eastern Ontario do not appear to have significant common grounds that could form the basis for a future industry growth strategy for the region • Adjacent to major centre in Oshawa but the long term prognosis is not good: GM is now anticipated to close Oshawa consolidated plant line in 2016
Transportation (OEM/parts)	Bombardier, Drossbach North America, Flying Colours Corporation, Cascade	
Supply Chain		
Fabrication/machining/metal finishing	FisherCast Global/Dynacast, CONCEPT 2 REALITY, ABC Electro Powdercoating, Merit Precision Moulding	
Engineering & Technical Support	Nexum Research Corporation	
Industry Support		
Industry Associations - Regional	Automotive Parts Manufacturers Association (APMA), Society of Manufacturing Engineers; The Ontario BioAuto Council	
Industry Support	Canadian Manufacturers and Exporters, Colleges Ontario Network for Industry Innovation (CONII); UOIT-Commercialization office; The Ontario Partnership for Innovation and Commercialization	
Funding	Automotive Partnership Canada (APC), Advanced Manufacturing Fund; The Automotive Innovation Fund (AIF)	
Education, Training and Human Resource Support		
Specialist programs	UOIT: Bachelor/masters automotive engineering, including management options Loyalist College, St. Lawrence, Durham College, Algonquin College, La Cite: Motive Power Technician Loyalist College, St. Lawrence, Durham College, Algonquin College: parts, service and management	
Other relevant programs	Electrical, mechanical engineering programs at all levels at region's universities and colleges UOIT, Trent University, Carleton, Ottawa, RMC: Materials science programs at all levels	
Research and Development		
Research Centres and Laboratories - Automotive	UOIT: Autoplex and Canadian Engineering Centre of General Motors (GM) Canada; Automotive Centre of Excellence (ACE) , Queen's-RMC Fuel Cell Research Centre (FCRC)	
Research Centres and Laboratories - Advanced Manufacturing	UOIT:The Robotics and Automation Laboratory (RAL) Advanced Materials Research Group, Scanning Electron Microscope (SEM) Lab; Integrated Manufacturing Centre at Durham College; Trent University: Centre for Materials Research, Trent Centre for Biomaterials Research; Queen's-RMC Centre for Advanced Materials and Manufacturin, Centre for Smart Materials and Structures; Loyalist College, Sustainable Skills, Technology and Life Sciences Centre; The Kawartha Trades and Technology Centre	
Networks of Centres of Excellence - National	Automotive Partnership Canada (APC), AUTO21 Network of Centres of Excellence; NRC Automotive and Surface Transportation - Surface transportation facilities, Wind tunnel testing facilities (Ottawa)	

3.3 Automotive Opportunity Assessment

Key Factors	Eastern Ontario	Opportunity
	Advanced Manufacturing - Automotive	
▪ Auto Innovation Fund: Financial support leans towards energy efficiency, research and cutting edge manufacturing ▪ Federal/Provincial government support ▪ Defensive position/Declining industry: contraction, incentive driven; NAFTA cost pressures ▪ Advanced/bio materials, energy saving, green car initiatives	● Eastern Ontario can pursue these opportunities through advanced manufacturing and cleantech initiatives ● Companies in Ontario East have weathered the storm ● Ontario East is not dependent on sector ● External factors, geographical proximity and very small company concentration mean limited ability to capitalize on any opportunities ● Eastern Ontario has a more compelling value proposition in other transportation sectors, particularly aerospace ● Ontario East has strengths in these areas that can be deployed in this sector	● Ontario East can strengthen this sector through a focus on new technologies and processes as part of an overall advanced manufacturing initiative (recommended) ● This sector could be part of a broader transportation sector focus

4 Nuclear Energy

A nuclear sector profile was first compiled in 2008, with an update in 2010. There has been consistent activity on the part of Ontario East to capitalize on the nuclear revival and attract investment. While refurbishment programs at Bruce Power and Darlington have materialized, new build has been postponed until the next review of Ontario's Long Term Energy Plan in 2016. An election victory by the Conservative Party could change this scenario. Sector trends in overall energy generation together with a cursory review of Ontario East's activity in these areas are provided, as these could also present potential opportunities.

4.1 Energy Sector Trends in Canada[1]

Electricity supply is forecast to increase to record levels, as new generating capacity is built to meet steadily increasing demand.

Total generation capacity is projected to increase by 27% to 2035, with natural gas-fired and renewable-based capacity showing the largest increases. Energy from fossil fuels will remain the dominant supply

[1] Adapted in part from Canada's Energy Future: Energy Supply and Demand Projections 2010 to 2035, National Energy Board

source. Sustainable energies and smart grid technologies will be a key feature.

Nuclear is expected to continue to play a key role in providing base load generation in Ontario. Annual nuclear generation is projected to increase slightly rising from 82 TW.h in 2010 to 83 TW.h in 2035. As a result of higher growth in other types of generation, such as wind and gas-fired, the share of nuclear in total electricity generation declines to 11% by 2035, compared to 14% in 2010.

Nonetheless, nuclear energy remains is a key sector in Ontario. According to data in Ontario's Long Term Energy Plan Review 2013:

- 45,600 people are employed in the nuclear sector in Ontario
- $2.5 billion is generated by the nuclear industry in direct and secondary economic activity in Ontario every year
- Nuclear power contributed 56 per cent to the province's electricity supply mix in 2012
- The nuclear refurbishment will begin to renew 8,500 megawatts over 16 years from 2016
- 9,000 jobs will be created as a result of refurbishment activities at Darlington and Bruce Power nuclear plants

Natural gas power capacity in Canada is expected to increase from 18 GW in 2010 to 28 GW by 2035 driven by lower GHG emissions than coal-fired power plants; shorter construction time; lower investment costs than coal or nuclear power plants; the ability to be built in smaller increments to better match load growth; and well-developed gas supply infrastructure in Canada. The recent low price of natural gas has also enhanced the attractiveness of this form of generation. Annual gas-fired generation will more than double rising from 50 TW.h in 2010 to 114 TW.h in 2035. The share of gas-fired generation will increase from 9% in 2010 to 15% in 2035.

As a result of projected hydro-based capacity expansion, annual hydroelectricity production increases from 346 TW.h in 2010 to 420 TW.h in 2035. Due to faster growth in other forms of generation, such as wind-based and gas-fired generation, the share of hydroelectricity declines from 59 per cent of total generation in 2010 to 56 per cent in 2035.

Factors which could impact may influence the choice of generation options and the generation mix in the future include:

- Technological developments, new policies, and changing prospects of fuel supply and fuel prices
- Social and local acceptability of electricity infrastructure projects
- The relative economics of new power plant projects depend on fuel and overall capital costs
- Non-hydro renewables, such as wind and solar power deployment is supported in some markets by financial incentives such as feed-in-tariffs.
- Reliability concerns for how much variable renewable-based generation may be integrated into a power system.
- Reduction or elimination of incentives without a corresponding cost reduction due to technological improvement, or grid integration issues, may constrain growth of these generation sources.
- Government regulation and policies impacting investments and operations of power plants continue to evolve.

Global Demand

International Atomic Energy Agency (IAEA) report, released September 2013 - Energy, Electricity and Nuclear Power Estimates for the Period up to 2050 - contains high and low projections of energy, electricity and nuclear power trends over the coming years. Under the low scenario, installed nuclear capacity is predicted to grow 373 GWe in 2012 to reach 435 GWe by 2030. The high scenario predicts nuclear capacity reaching 722 GWe by 2030.

Growth is expected in all regions of the world under the high scenario, although total Western European nuclear capacity could decline from 114 GWe in 2012 to 68 GWe in 2030 under the low scenario. The low scenario also sees a slight decrease for nuclear capacity in North America. IAEA expects nuclear to be important in the energy mix due to growth in population and in demand for electricity in the developing world.

Nuclear technologies

Commercial nuclear fusion
Canada is the only major country not involved in a national program of fusion research at an internationally competitive level, after dropping support in the 1990s and there are fears Canada will be left behind. General Fusion in Burnaby, BC is involved in this area.

Small nuclear reactors
Partly to the high capital cost of large power reactors generating electricity via the steam cycle and partly to the need to service small electricity grids under about 4 GWe,bhttp://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Power-Reactors/Small-Nuclear-Power-Reactors/ there is a move to develop smaller units.

A 2009 assessment by the IAEA under its Innovative Nuclear Power Reactors & Fuel Cycle (INPRO) program concluded that there could be 96 small modular reactors (SMRs) in operation around the world by 2030 in its 'high' case, and 43 units in the 'low' case.

The US federal government is funding an additional $226 million to help advance small nuclear reactors. The Department of Energy and NuScale are entering a cost-sharing arrangement to build 100-megawatt modules. This is in addition to another agreement with Babcock & Wilcox and Bechtel to develop small modular reactors for the Tennessee Valley Authority.

Toshiba Corporation has developed a small nuclear reactor to power oil sands extraction in Alberta and hopes to have it operational by 2020, according to Japan's The Daily Yomiuri.

4.2 Nuclear Energy Value Chain

The nuclear sector profiles compiled in 2008 and 2010 were considered as a basis of to the value chain chart shown below. This is not an exhaustive list of companies and organizations in all categories. It is intended to illustrate the strengths of the sector with a selection of key companies, support organizations and institutions. This sector assessment also considers other energy generation sources to provide a comparative perspective and identify any opportunities. The sector highlights draw out elements of the value chain showing strengths and weaknesses to inform the opportunity statement.

Advanced Manufacturing - Nuclear & Energy		
Companies		**Sector Highlights**
Nuclear	GE-Hitachi Nuclear Energy, Rolls Royce (ODIM Numet Limited) Sandvik Materials Technology Canada, Bubble Technology Industries, Nu-Tech Precision Metals Inc. Cameco Corporation	• In 2012 17,169 people were employed in the energy sector in Eastern Ontario, representing 3.7% of total employment in Ontario East. • Over 240 programs in engineering, science, math, trades, and technical disciplines with 19 specialist nuclear programs available from RMC and UOIT • Over 2,700 engineering, maths and science graduates (including 626 masters grads) with a pool of over 1500 arts and sciences graduates • 74 graduates from specialist energy programs at community colleges • An additional pool of more than 1,400 graduates in engineering, trades, operations management disciplines, and further 136 from arts & science programs from the region's community colleges • An emerging workforce of 15,346 students enrolled in engineering, maths and science disciplines plus a further 9,232 enrolled in arts & science programs (including 1,941 masters students) • Adjacent to key nuclear installations at Darlington & Pickering and Durham region energy generation cluster • Significant research capacity through Chalk River, RMC, UOIT, and the University of Ottawa • Ontario East's profile in the industry is established with regular presence at industry events and relationship with Organization of Canadian Nuclear Industries • Port Hope Area Initiative attracting professional services companies e.g. AMEC; Maxaam Analytics • Strong company representation at all stages of the nuclear cycle • A number of companies identified that serve the broader energy generation sector • Strong presence of renewable energy generating capacity (as covered in cleantech)
Energy	Andritz Group, NORCAN Hydraulic Turbine; Canadian Hydro Components; Prysmian Power Cables and Systems Canada	
Supply Chain		
Manufacturing support	Quickmill, Nefab,	
Engineering & Technical Support	Amec, MMM Group, Conestoga Rovers, Crew Systems Solutions, Wadrop Engineering, SGS, Measuremax, WSP Group (Genivar),Dominis Engineering; Maxxam Analytics; Siemens	
Technology Support		
Industry Support		
Industry Associations	Candian Nuclear Association, Organization of Canadian Nuclear Industries, Canadian Nuclear Society	
Industry Support	Canadian Manufacturers and Exporters, Colleges Ontario Network for Industry Innovation (CONII); UOIT-Commercialization office; The Ontario Partnership for Innovation and Commercialization	
Funding - Angel Networks	Advanced Manufacturing Fund; Spark Angel Network, Peterborough Angels, Parteq Innovations, Capital Angel Networks;	
Education, Training and Human Resource Support		
Education Institutions	Durham College School of Skilled Trades, Apprenticeship & Renewable Technology (START); School of Science & Engineering Technology (SET); UOIT – Faculty of Energy Systems and Nuclear Science, Faculty of Science; RMC: Mechanical Engineering, Physics Departments	
Specialist programs	Fleming College:Electrical power generation diploma; Durham College: power engineering technician diploma; Algonquin College: Powerline technician; RMC/UOIT Doctor, Masters, Bachelors in nuclear engineering and nuclear science (English and French at RMC); UOIT Graduate diplomas in nuclear design and nuclear technology; Deep River Science Academy	
Other relevant programs	Electrical, mechanical engineering programs at all levels at the region's universities and colleges UOIT, Trent University, Carleton, Ottawa, RMC: Materials science programs at all levels	
Research and Development		
Research Centres and Laboratories - Nuclear	Queen's University: The Nuclear Materials Group; RMC Nuclear Research Groups Emergency Response, Isotope Safety and Compliance Laboratory, Reactor Simulation and Fuel Management, H.W. Bonin and M. Pierre" University of Ottawa: NSERC/NRCan/AECL Generation IV Energy Technologies Program (NNAPJ)	
Research Centres and Laboratories - Energy	UOIT: Energy Systems and Nuclear Science Research Centre (ERC): facilities in geothermal, hydraulic, hydrogen, natural gas, nuclear, radiation, solar and wind energy technologies; Clean Energy Research Laboratory (CERL)	
Research Centres and Laboratories - Advanced Manufacturing	Advanced Materials Research Group, Scanning Electron Microscope (SEM) Lab; Integrated Manufacturing Centre at Durham College; Trent University: Centre for Materials Research, Queen's-RMC Centre for Advanced Materials and Manufacturing, Centre for Smart Materials and Structures; Loyalist College, Sustainable Skills, Technology and Life Sciences Centre; The Kawartha Trades and Technology Centre	
Networks of Centres of Excellence - National	The University Network of Excellence in Nuclear Engineering (UNENE); TRUMPF (Queen's); Chalk River Laboratories; NRC Energy, Mining and Environment	

4.3 Nuclear Energy Opportunity Assessment

Key Factors	Eastern Ontario	Opportunity
	Advanced Manufacturing - Nuclear Energy	
▪ Refurbishment program at Darlington	● Eastern Ontario proximity; favourable incentives in comparison to Clarington	● Supply chains in place on the part of major contractors: opportunities might be limited ● Investigate supply chain opportunities through major contractors
▪ Overseas nuclear demand/OCI missions to developing world	● Strong cluster in EO with export markets	● Capitalize on global markets
▪ Environmental initiatives	● Port Hope Area Initiative (PHAI)	● Increase technical/professional services presence in region
▪ Larger regional nuclear cluster initiatives being advocated by Organization of Canadian Nuclear Industries (OCI) – includes Eastern Ontario	● Good relationship with OCI	● OEEDC collaborative opportunity with OCI ● Collaborative cluster initiatives
▪ Nuclear technologies: small nuclear; nuclear fusion	● Strong research capabilities at universities and Chalk River could spin off more companies (e.g. Bubble Technologies)	● Investigate potential for Eastern Ontario ● Capitalize on new technologies
▪ Energy generation capacity growth from other sources	● Some evidence of manufacturing support to other energy sectors e.g. hydro, oil & gas ● Good representation of renewable energy generation especially solar and biofuels	● Possible energy generation initiative that includes nuclear, possibly renewable energies

5 Aerospace

An aerospace sector profile was initially compiled in 2008, and updated in 2010. This sector assessment also considers defence, which is a potentially important value-add.

OEEDC has undertaken significant sector development programs since the initial study. Relationships with sector organizations have been developed at all geographical levels: provincial (Ontario Aerospace Council – OAC), national (Aerospace Industries Association of Canada - AIAC), and international (National Business Aviation Association – NBAA - USA). With consistent attendance at major industry events, and activities at a local level, Eastern Ontario's profile in the sector is now established.

5.1 Aerospace and Defence Sector Trends

5.1.1 Aerospace Sector Trends[2]

The global commercial aerospace sector is expected to sustain its significant revenue and earnings growth in 2014, underlined by extended record-setting production levels both at the platform and supplier base. This will be driven primarily by the accelerated replacement cycle of obsolete aircraft with next generation fuel-efficient aircraft, as well as the continued increases in passenger travel demand, especially in the Middle East and the Asia Pacific regions.

On the other hand, continued declines in revenue and earnings are expected for the global defence sector. This is primarily due to the cessation of a prolonged period of armed conflict in Iraq and Afghanistan, leading to lower budgets for traditional purchasers of military equipment. However, with regional tensions continuing to simmer for example in the Middle East, North Korea, and the East and South China Seas, it is expected that affected governments will continue to increase purchases of next generation military equipment.

For the overall global aerospace and defence (A&D) industry, revenue growth in the 5 percent range is expected for 2014. This would be similar to the growth experienced in 2012 and likely in 2013, all of it and more due to the rising fortunes of the commercial aerospace sector.

5.1.2 Defence Sector Trends

The government's Canada First Defence Strategy (CFDS) called for an investment of $240 billion to re-equip the CF between 2008 and 2027.

The CFDS has committed to a total investment of $490 billion in personnel, equipment, readiness and infrastructure, of which, $240 billion is allocated to procurement in the latter three categories. The government has stated that it intends to use the unique opportunity created by this exceptional investment to support the competitiveness of Canadian industry.

[2] Deloitte 2014 Global Aerospace and Defence Industry Outlook

Canada's defence-related industries represent more than two thousand companies, with more than 70,000 employees and an estimated $12.6 billion in annual revenues (2011), almost equally split between domestic and export sales.

5.2 Aerospace and Defence Value Chain

The aerospace sector profiles of 2008 and 2010 formed the basis of the value chain chart shown below. This is not an exhaustive list of companies and organizations in all categories as it is intended to illustrate the strengths of the sector with a selection of key companies, support organizations and institutions.

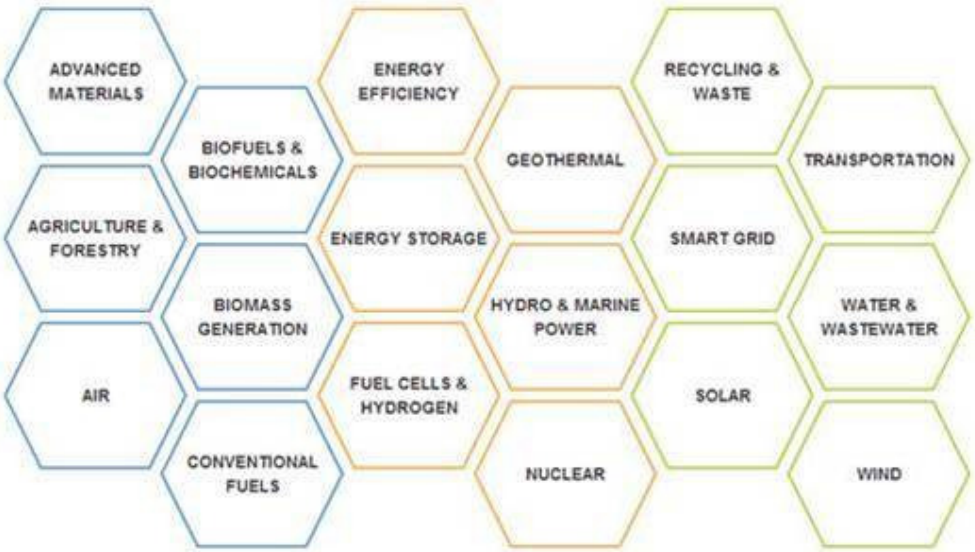
Advanced Manufacturing - Aerospace		
Companies		**Sector Highlights**
Equipment manufacturers & distributors	Kadex Aero Supply, SAFRAN Electronics Canada, L-3 Communications Canada, Arnprior Aerospace, Lockheed Martin Canada,	• 27,514 employed in aerospace and defence with just under 16,000 people employed in aerospace industries in Ontario East, 3.5% of total employment in the Region. A further 12,137 are employed in defence services • Ontario East sits at the heart of Canada's, Aerospace cluster, the fifth largest in the world. 75% of Canada's aerospace employees are in close proximity – in Ontario East, other parts of Ontario and in neighbouring Quebec. • Highly developed education and training infrastructure • Key development in education programming: Seneca College - Peterborough Campus established. • 22 aerospace programs provided by Carleton University, Royal Military College (RMC) Queen's University, Seneca College – Peterborough Campus • Seneca College – Peterborough Campus Bachelor of Aviation Technology program is the only aviation technology-based degree program in Canada. Supplemented by specialist training • Carleton University has one of Canada's largest programs of graduate studies and research in mechanical and aerospace engineering • Over 250 programs in engineering, science, math, trades, and technical disciplines. • Over 2,700 engineering, maths and science graduates (including 626 masters grads) with a pool of over 1500 arts and sciences graduates • 62 graduates from specialist aerospace programs at community colleges • An additional pool of more than 1,400 graduates in engineering, trades, operations management disciplines, and further 136 from arts & science programs from the region's community colleges • An emerging workforce of 15,346 students enrolled in engineering, maths and science disciplines plus a further 9,232 enrolled in arts & science programs (including 1,941 masters students) • Significant research and development capacity at RMC, Ottawa-Carleton • Infrastructure expansion: regional airports and bases • Kingston Airport is in the final stages of concept development for the potential expansion of the runway and terminal. • City of Peterborough has completed a $28.6 million dollar Peterborough Airport Expansion Project, • CFB Trenton - $1-billion program in upgrades continues • Eastern Ontario has a significant presence of leading global aerospace suppliers as well as tier 2 and 3 suppliers in all major subsectors - Aerostructures, Avionics/Electrical Systems, Electric Power Management & Environmental Conditioning Systems, and MRO plus capabilities • Prominent location for defence bases • Engineering support and major OEMs and Tier 1 office locations in Ottawa • Strong relationship with Ontario Aerospace Council
MRO	Flying Colours Corporation, L3 Communications - CMRO (CFB Trenton), Cascade (CFB Trenton), IMP Group (CFB Trenton),	
Defence	CFB Trenton, CFB Kingston, CFB Petawawa, Thales Canada, Defence & Security	
Security and Rescue	Ottawa: MMIST, Scintrex Trace Corporation, Allen Vanguard, Pacific Safety Products, ATCO Structures & Logistics	
Infrastructure	Peterborough Airport & Business Park, Kingston Airport, Ottawa International Airport	
Operators	Vector Air, JAZZ Air, Central Airways, NAV Canada	
Support Services		
Engineering & Technical Support	GasTOPS	
Industry Support		
Industry Associations - Regional	Ontario Aerospace Council (OAC), Aerospsace Industries Association of Canada (AIAC), Canadian Council for Aviation & Aerospace (CCAA)	
Industry Support	Canadian Manufacturers and Exporters, Colleges Ontario Network for Industry Innovation (CONII); UOIT-Commercialization office; The Ontario Partnership for Innovation and Commercialization	
Funding	Spark Angel Network, Peterborough Angels, Parteq Innovations, Capital Angel Networks; Strategic Aerospace and Defence Initiative (SADI); Advanced Manufacturing Fund	
Education, Training and Human Resource Support		
Local	Durham College School of Skilled Trades, Apprenticeship & Renewable Technology (START); School of Science & Engineering Technology (SET); UOIT – Faculty of Engineering and Applied Science, Faculty of Science; Algonquin College, School of Advanced Technology; Seneca College - Peterborough Campus	
Specialist training	Algonquin College: Corporate Training - aerospace, aviation, and defence; Angels of Flight Canada, WM Aero Flight, Aviation Maintenance Orientation Program (AMOP), Air and Medical Studies: Exodus Academy;	
Specialist programs	Seneca - Peterborough Campus: Bachelor of Aviation Technology; Fleming College CO-OP Program: Flying Colours Corp. Aircraft Interiors Fundamentals; Carleton University, Ottawa, RMC: Bachelor's, Masters, Doctorate Aerospace Engineering Queen's Mechanical engineering program with aerospace specialty; Algonquin College, Aviation Management and aircraft maintenance; First Nations Technical Institute with Canadore College: Aviation Pilot - Fixed Wing diploma.	
Research and Development		
Research Centres and Laboratories	The Ottawa-Carleton Institute of Mechanical and Aerospace Engineering (OCIMAE) Queen's-RMC Centre for Advanced Materials and Manufacturing. Advanced Design and Manufacturing Institute (ADMI) (Queen's) UOIT: Advanced Materials Research Group; Durham College – Integrated Manufacturing Centre; Scanning Electron Microscope (SEM) Lab; Trent University: Centre for Materials Research, Trent Centre for Biomaterials Research, Loyalist College:Sustainable Skills, Technology and Life Sciences Centre; The Kawartha Trades and Technology Centre	
Networks of Centres of Excellence - National	NRC Aerospace research and technology development facilities (Ottawa, Montreal and Thompson, MB), Canadian Forces Aerospace Warfare Centre (CFAWC); The David Florida Laboratory (DFL)	
Commercialization & Innovation Support	The Greater Peterborough Innovation Cluster, Durham College: Office of Research Services and Innovation (ORSI); UOIT The Office of Technology Transfer and Commercialization (OTTC), Colleges Ontario Network for Industry Innovation (CONII); The Ontario Partnership for Innovation and Commercialization, Ontario Network of Entrepreneurs: Eastern Ontario locations, Ontario Centres of Excellence (Ottawa), MITACS Accelerate, The Industrial Research Assistance Program (IRAP)	

5.3 Aerospace and Defence Opportunity Assessment

Key Factors	Eastern Ontario	Opportunity
	Advanced Manufacturing - Aerospace	
▪ Business aviation sector predicted growth ▪ Global commercial passenger growth ▪ Obsolete aircraft replacement Fuel efficiency, new materials etc.	▪ Infrastructure improvements: Kingston, Peterborough ● Strong cluster/value proposition in EO ● Companies with export markets ● Advanced materials research capacity in region	● Attraction of aviation service companies ● Possible expansion of passenger services at EO's regional airports ● Supply chain partnership opportunities ● Increase technical/professional services presence in region
▪ Eastern Ontario profile growing in sector	● Good relationships with OAC, AIAC, NBAA	● Continue collaborative work with OAC ● Collaborative cluster initiatives
▪ Defence sector investment to support Canadian industry	● Three significant Canadian bases; CFB Trenton expansion	● Investigate defence industry opportunities

6 Cleantech

According to the Cleantech Group, the concept of cleantech embraces a diverse range of products, services, and processes across industry verticals that are inherently designed to (a) Provide superior performance at lower costs, (b) Greatly reduce or eliminate negative ecological impact, and (c) Improve the productive and responsible use of natural resources as illustrated in the diagram below.



Source: Cleantech Group's i3 Platform

OEEDC conducted a two phase sector study in 2008 and 2009 covering renewable energies (wind, solar, bio-energies, geothermal, fuel cells, small hydro), water technologies, waste management, and environmental. The work provided an insight into cleantech activity in Eastern Ontario. It should also be noted that cleantech products were touched upon but not to the extent of the other areas. These studies were in the wake of the newly launched Ontario FIT program. As a result, initial sector activities focused on wind and solar, with the latter attracting more investment due to Eastern Ontario's inherent climatic advantages. The initial euphoria around the FIT program began to die down around 2011, which was reflected in declining investment inquiries. In the meantime, other cleantech areas have continued to grow rapidly, which is where Eastern Ontario should turn its attention.

6.1 Cleantech Sector Trends

Innovative sustainable technologies have started to mature and are getting closer to mainstream acceptance. Cleantech Group reported clean technology venture investment during 2013 totalled USD308 million in Canada.

Favourable government funding climate; for example

- $1,503,600 in funding from the Ontario Research Fund - Research Excellence program for the Energy Storage and Recovery Ontario (ESARO) project, which will develop technologies to help in managing the variability of solar and wind power generation. Queen's-RMC are involved

- The federal government is launching a biomaterials program to accelerate the development of green vehicles and buildings. Minister of State (Science and Technology) the five-year, $55-million program is aimed at turning agricultural and forestry by-products into new, more environmentally-friendly materials

Renewable Energies

Key changes to feed in tariff:

- Domestic content requirements eliminated confirming the Ontario government's intention to comply with a recent World Trade Organization (WTO) ruling, which held that these requirements violate Canada's trading obligations
- Feed-in tariffs for large projects cancelled to be replaced by bidding system
- Renewed Commitment to Small-Scale Renewable Energy Projects
- Refocus attention on small-scale projects less than 500 kW in size to continue. Contracts will be offered for up to 900 MW of additional capacity through 2018
- Recognition of the importance of municipalities with increased involvement and local control

Wind power is expected to make the largest contribution to non-hydro renewable growth with capacity quintupling over the projection period, to 23 GW in 2035. The largest capacity additions will be in Quebec, Ontario and Alberta. The share of wind-based generation triples from less than 2% of total generation to 6% by 2035. Wind energy added a record 1.6 GW of new capacity in 2013 and bringing total installed capacity to 7.8 GW on a path to 12 GW total installed capacity by 2016. (CanWEA)

Total combined capacity of biomass, solar and geothermal is also expected to grow, with net capacity additions over the projection period of over 5 400 MW, accounting for nearly 6% of total generation by 2035. The addition of more renewable-based capacity, such as wind, hydro and biomass, as well as the application of carbon capture and storage (CCS) technology, reduce the emissions intensity of the electricity sector.

Solar Makes a Comeback
The cost of solar has come down by 20 percent each year for the past four years, while efficiencies have continued to rise. There was a successful IPO of SolarCity earlier in 2013. Cleantech Canada expects this trend to pick up further steam in 2014.

Work is underway on all kinds of new technologies for energy storage, such as very large flow batteries and compressed air for the utility market but the quest for large-scale energy storage continues.

Cleantech products

- Solar will play a big role in industrial innovation. For example, GlassPoint uses solar to generate steam for the process industry. The company's first application is replacing expensive natural gas for enhanced oil recovery in the Middle East with a significantly cheaper solar solution. Today, Shell and Petroleum Development Oman are already benefiting from this technology

- Big Data and Smart Grid are Stepping Up to the Plate
  The application of the industrial Internet and big data is an exciting area with the potential for radical innovation in energy-intensive industries, enabling them to make more cost-effective decisions, as well as process optimization and efficiency gains. According to EY Canada, smart grids and smart metering are high on the list of company priorities

Water technologies are in demand
In both emerging and western geographies, the demand for water is increasing at rates that cannot be satisfied with existing systems and sources – globally, the demand for potable water is expected to double in the next 20 years. From investors to global corporations, new technologies and businesses are being created to address this global opportunity.

A huge surge in water investments is just beginning, particularly in the domain of wastewater treatment and desalination, as well as water savings and conservation technologies. The energy industry requires huge amounts of water — for example, electricity generation is the second-largest consumer of water globally — yet there are water shortages in many areas of the world. This is also impacting the oil & gas and mining industries, in which a lot of water is required to produce oil: two gallons of water for every gallon of oil. The mining industry is highly water-intensive and also produces significant wastewater contamination.

6.2 Cleantech Value Chain

Cleantech		
Companies		**Sector Highlights**
Sustainable Energy	Components; NORCAN Hydraulic Turbine; GreenField Ethanol; Centennial Global Technology; Kawartha Ethanol; SunRise Power; SPARQ' Senreq; QSBR; **Numerous smaller local/regional developer/integrators/distributors** e.g. Strathcona Solar Initiatives; Evergreen Power, Cleave Energy, EcoGen Energy, Enersmart, GAIA Power. **Ottawa:** Enfinity Canada; 3G Energy; Plasco Energy; Ensyn Technologies; Iogen Corporation; Canadian Solar – Sales Office	• 289 programs in energy and environment and related disciplines at the region's universities and colleges • Just over 5,000 graduates in energy and environment and related disciplines from the region's universities and colleges, including 526 masters graduates and an additional 1,519 arts & science graduates • Nearly 21,000 students enrolled in energy and environment and related disciplines, including 2,118 masters students • Eastern Ontario continues to make its mark in solar energy generation with two very large installations (Arnprior, First Light, Napanee) and 48 approved applications in the pipeline • Eastern Ontario is less dominant in wind energy generation with 4 approved applications, Westerm Ontario leads the way in terms of installations and approved applications • Continued activity in bio-energy but one company has left the region (Advanced Biorefinery) and Canadian Bio-pellets appears to have lost momentum • Representation in minor renewables – geothermal and small hydro through network of smaller local and regional energy integrators • Fuel cells companies appear to have been acquired, gone out of business, or left the region diluting the company base. Strength from Queen's-RMC Fuel Cell Research Centre • Substantial research depth in renewable energies of all kinds across the region. Advanced manufacturing, materials science, and bio-materials research provides a basis for cleantech product and process development • Further work required in cleantech products such as energy management (smart grid etc.) and green products and buildings • Cursory examination shows signs of activity across a number of cleantech product areas • UOIT hosted IEEE International Conference on Smart Energy Grid Engineering (SEGE'13) • Water technologies has a strong research base R&D in all key areas but at a disadvantage with National Centre of Excellence at Waterloo but region's universities are partners. • Newterra (Brockville), an important company that is among Cleantech Group™ The 2013 Global Cleantech 100 Companies (Water & Wastewater category) one of five ranked Canadian companies • Global waste management companies are in Ottawa but there specialist companies plus small composting cluster in the region • The National Networks of Excellence Waste to Energy initiative at Carleton University appears to have fizzled out.
Sustainable products	PolyFerm Canada (bio-plastics); Solar Signals (advanced traffic mangement); Aztech Associates; Switchable Solutions; Triacta Power Technologies; Bag to Earth; XACT Systems; Robinson Solutions; Energate (Ottawa);	
Water	ENDETEC; Newterra; Greyline Instruments; BASF Canada; Forward Water Technologies; Bishop Water Technologies; Seprotech Systems(Ottawa);	
Environment	Pinchin Environmental, Malroz Engineering, Scott Environmental Group, Newterra; Ottawa: ESSA Technologies; 3M Canada Company	
Waste Management	Waste Management of Canada, BFI Canada, Waste Services Inc.; Miller Waste Management; Quinte Waste Solutions; La Fleche Environmental	
Support Services		
Engineering & Technical Support	Clark Consulting Services; Caduceon Enterprises; WSP Group (Genivar); AECOM; CRM Trilogix, SGS	
Installations - existing and pending	First Light Solar Park, Napanee; Arnprior Solar Project; GreenField Ethanol, Johnstown; Kawartha Ethanol, Havelock; plus approved applications 48 solar, 4 wind farms & 3 bio-energy plants	
Manufacturing Support	Centennial Global Technology; Kimco Steel	
Industry Support		
Industry Associations - Regional	The Canadian Clean Technology Coalition; CanWEA, CanSIA; Canadian Hydropower Association; Canadian Renewable Fuels; BIOTECanada CANBIO; Canadian Earth Energy Association; The Biogas Association; Ontario Sustainable Energy Association (OSEA)	
Industry Support	SWITCH Kingston, Sustainable Development Technology Canada (SDTC); GreenCentre Canada; CleantechNorth; Small Business Enterprise Centres (SBECs); MaRS; The Ontario Clean Water Agency (OCWA)	
Funding	Spark Angel Network, Peterborough Angels, Parteq Innovations, Capital Angel Networks; Sustainable Development Technology Canada (SDTC); GreenCentre Canada; Sustainable Ventures; Investment Accelerator Fund (IAF)	
Education, Training and Human Resource Support		
Specialist programs	Renewable energy programs at Durham,S.;Lawrence ; Specialist sustainability programs at Trent and Queen's; Earth sciences programs at Trent, University of Ottawa, Carleton and Queen's. Graduate/undergraduate programs Math, Science, Environmental programs in all disciplines at region's universities and colleges.	
Research and Development		
Research Centres and Laboratories - sustainable energy	UOIT: Energy Systems and Nuclear Science Research Centre (ERC): facilities in geothermal, hydrogen,solar and wind energy technologies; Clean Energy Research Laboratory (CERL); St. Lawrence College: Sustainable Energy Applied Research Centre; Carleton:Sustainable Energy Research Centre (CSERC); Queen's Institute for Energy and Environmental Policy; The Queen's-RMC Fuel Cell Research Centre (FCRC;)Queen's-RMC: Energy Storage and Recovery Ontario (ESARO)project	
Research Centres and Laboratories - environment	Queen's University: The Sustainable Bioeconomy Centre (SBC); The Ottawa-Carleton Institute for Environmental Engineering (OCIENE); Sustainable Energy Research Centre (CSERC); University of Ottawa: Institute of the Environment; RMC Institute for the Environment;Trent University: Canadian Environmental Modelling Centre, James McLean Oliver Ecological Centre University of Guelph @ Kemptville: The Ontario Rural Wastewater Centre; Trent University: Worsfold Water Quality Centre, Institute for Watershed Science; Trent Centre for Biomaterials Research; Fleming College: The Centre for Alternative Wastewater Treatment (CAWT); Loyalist College: Sustainable Skills, Technology and Life Sciences Centre; GreenCentre Canada	
Networks of Centres of Excellence - National	The NSERC Hydrogen Canada (H_2CAN) Strategic Research Network; NRC Energy, Mining and Environment; Natural Resources Canada - CanmetENERGY; NRC Ocean, Coastal and River Engineering (NRC OCRE)	

6.3 Cleantech Opportunity Assessment

Key Factors	Eastern Ontario	Opportunity
Advanced Manufacturing - Cleantech		
Renewable Energy		
▪ FIT program for developers eliminated	● Strong project pipeline; particularly in solar	● Momentum in large installations will be through existing or proposed projects
▪ Revised FIT program supporting small projects/municipality involvement	● Good SME base of integrators/developers	● Strengthen local company base through increased opportunities
▪ New solar powered technologies for industrial energy generation	● Strong solar energy base through installations and research	● Can be leveraged to attract companies in these technologies
▪ Emergence of 2nd/3rd generation bio-product technologies		
Water Technologies		
▪ Expected surge in water investments, ▪ Wastewater treatment and desalination, ▪ Water savings and conservation technologies.	▪ Significant research capacity in these areas e.g. Trent U ▪ Flagship company Newterra ▪ Growing technical/professional services sector	▪ Capitalize on sector strengths and momentum
Waste Management		
▪ Proposed Provincial Waste Diversion Act	▪ Waste management companies in region ▪ Waste to energy synergies with food processing cluster ▪ State of the art waste facility for Port Hope	▪ Responsibilities of Industrial Commercial Institutional (ICI) will result in expansion of sector
Environmental		
▪ Government driven initiatives will continue	▪ Strength in professional services sector is in Ottawa	▪ Attract more satellite offices from Ottawa/Toronto ▪ Entrepreneur initiatives
Sustainable Products		
▪ Huge growth potential driven by government and consumer expectations	▪ Some evidence of companies involved	▪ Determine activity in Eastern Ontario

7 BioHealth (Life Sciences)

A detailed study on bio-health activities in Eastern Ontario was undertaken in Fall 2011. The work encompassed Biotechnology/pharmaceuticals, medical devices, bio/health informatics and major health care delivery institutions. Prior to the study, OEEDC as a group had undertaken no previous initiatives in this sector. Therefore, the objective of this study was to understand the nature of opportunities available, and provide the initial steps required to lay the foundations for the development of the sector in Eastern Ontario. Subsequently, meetings were held with Life Sciences Ontario, with attendance at their events and an IT Health show.

The sector trends, a value chain, an opportunity assessment, and initial action plan from this study are included in this section.

7.1 Life Sciences Sector Trends

Government cost management initiatives are having an effect[3]:
Total health care spending in Canada is expected to reach $207 billion in 2012, which shows the rate of growth is slowing. The proportion of Canada's gross domestic product (GDP) spent on health care will reach 11.6% this year: down from 11.7% in 2011 and the all--time high of 11.9% in 2010.

- Growth rate for drug spending will fall to 3.3% in 2012, down from 4% last year
- Provincial governments are focused on controlling health care costs
- Cost management initiatives such as Lean projects to improve efficiencies in delivering care and changes to generic drug pricing policies are central

Health system decision makers will face the challenge of finding appropriate care for older Canadians that balances access, quality and appropriateness of care on the one hand and cost on the other.

Soaring chronic disease burden fuelled by demographics and medical advances:

- Blurring boundaries in healthcare: clinical advances are rendering previously fatal diseases chronic
- Self-medication sector is expanding
- Governments focus on prevention rather than treatment
- Regulators more cautious about approving innovative medicines

Technology will drive healthcare productivity and the need to get products to market faster

- The virtualization of R&D
- Semantic technologies and computer-aided molecule design
- Wider availability and accuracy of biomarkers for diagnosis and treatment: The number and size of the clinical studies will contract
- Pervasive monitoring will enable real-time tracking of patients irrespective of their location
- Big data impacting health and bio-informatics in data collection and analysis
- Approval of new medicines will be a cumulative process, based on the gradual accretion of data

[3] Canadian Institute for Health Information

The need for new business models to succeed:

- Collaboration to bring treatments to the market
- Pay for performance
- Research base is shifting to Asia

Canadian Life Sciences Industry Forecast 2013 (PWC/BioteCanada)

Short-term confidence has declined slightly due to the difficulty of raising capital

7.2 Life Sciences Value Chain

Life Sciences		
Companies and Institutions		**Sector Highlights**
Health Care Delivery	Kingston General, Hotel Dieu Hospital, Providence Care, Royal Ottawa Hospital, The Children's Hospital of Eastern Ontario, L'hopital Montfort, Bruyere Continuing Care, The Ottawa Hospital Research Institute	• Nearly 59,000 are employed in life sciences activity in some form in Ontario East, with 7,769 involved in industry employment. • The sector is an important employer in all regions and accounts for 12.8% of total employment. • The Region's education institutions provide 300 programs in life sciences disciplines at all levels • 17,149 students enrolled in life science disciplines (biotechnology, primary health care delivery, and community health care delivery) at the Region's universities with a further 9,232 arts & science students and over 1,600 masters students. • The region produces over 4,400 graduates in life sciences disciplines, (3,230 university graduates and 1,234 college graduates) and includes over 500 masters graduates. Supplemented by 1,700 graduates in arts & science subjects. • Bio-Health Education Resources • Extensive Research Capacity: Seven academic hospitals are a key part of deep and comprehensive bio-health research activities in Eastern Ontario covering every aspect of life sciences, concentrated in Ottawa and Queen's with bioinformatics interests also present at UOIT, and Health Sciences at Trent. • Applied research facilities at Loyalist College, Algonquin College • Research activities cover key areas in leading edge science and technology: Translational Medicine: Medical Devices Innovation; Systems Biology and Bioinformatics • The region is home to 51 Research Chairs in life sciences disciplines • Base of innovative companies throughout the bio Health value chain in pharmaceuticals, biotechnology, advanced medical technologies, research and biomedical manufacturing. • Eastern Ontario's companies are involved in pharmaceuticals, biotechnology, advanced medical technologies, research, bioinformatics, diagnostics, biomedical manufacturing and medical devices, which can form a base of further sector development • Eastern Ontario has leaders in the field of Animal Health, which synergizes with the agri-food sector
Medical Devices	GlobalMed, Advanced Mobility Systems, eSight Corporation, Brytech, Epocal, and Vocantis; Medizone International, Covidien , 3M Canada Company	
Biotechnology/Life Sciences	Bionome Life Sciences (biopharmaceuticals/animal health), Kalgene Pharmaceuticals; Nometics ; Octane Medical Group (Regenerative Medicine) Fate Therapeutics, Chemaphor (Stem Cells) Pillar 5 Pharma; Octane OEM, Trillium Health Care Products (Contract Manufacturing) and CSL Behring (Biotherapeutics), Allphase Clinical Research, MTrials (Contract Research), Abbott Labs (closure 2014)	
Bioinformatics	Improved Outcomes Software Inc., Protein Simple and TrialStat, (Bioinformatics).IGO technologies; High Performance Computing Virtual Laboratory	
Diagnostics	MJS BioLynx Inc., Canadian Life Sciences; Qubit Systems Inc., Avestin, and Luzchem Research. Ottawa: Fischer Scientific, Spartan Bioscience (Ottawa)	
Industry Support		
Industry Associations	Life Sciences Ontario, BioteCanada, IEEE Engineering in Medicine and Biology Society, MEDEC, COACH	
Industry Support	UOIT-Commercialization office; The Ontario Partnership for Innovation and Commercialization, Ontario Centres of Excellence (OCE), MaRS, Health Technology Exchange	
Funding	Spark Angel Network; Peterborough Angels, Parteq Innovations, Capital Angel Networks; Health Technology Exchange (HTX); Ontario Centres of Excellence; BioDiscovery Toronto; Canada Health Infoway (bio-informatics); Investment Accelerator Fund (IAF)	
Education, Training and Human Resource Support		
Specialist programs	The Region's education institutions provide 300 programs at all levels in biotechnology, pharma, health care delivery. Important strategic emerging areas of bioinformatics and bio-engineering programs at Queen's, Carleton, and Ottawa universities,with informatics options at UOIT and bio-engineering technologist at Durham College. Algonquin College offers a medical devices reprocessing program	
Research and Development		
Research Centres and Laboratories-general	Children's Hospital of Eastern Ontario Research Institute, the Élizabeth Bruyère Research Institute, The Royal Ottawa Mental Health Centre, Ottawa Hospital Health Research Institute, UOIT: Loyalist College: Sustainable Skills, Technology and Life Sciences Centre; Algonquin College: design centre; 51 Research Chairs	
Life Sciences	University of Ottawa: Centre for Research in Biopharmaceuticals and Biotechnology; Emerging Pathogens Research Centre; The University of Ottawa Heart Institute; Ottawa Center for Neural Dynamics; Brain and Mind Institute Cancer Research Institute at Queen's University (QCRI); Centre for Neuroscience Studies (CNS); Centre for Applied Urological Research; Ottawa Medical Physics Institute (OMPI) Trent University: Centre for Health Studies	
Medical Devices	University of Ottawa:Medical Devices Innovation Institute; The School of Human Kinetics; University of Ottawa Eye Institute; Gastrointestinal Disease Research Unit (GIDRU); Queen's: Musculosketal - Human Mobility Research Centre (HMRC)	
Bio/healthinformatics	Health Education Technology Research Unit (HETRU); University of Ottawa:: Institute of Systems Biology; IBM Centre for Business Analytics and Performance, Tefler School of Management, Healthcare operations Queen's University: Botterell Hall, Bioinformatics Centre;	
Networks of Centres of Excellence - National	Ontario Genomics Institute: Genome Canada;; Centre of Excellence in Personalized Medicine - Cepmed; Institute for Research in Immunology and Cancer – Commercialization of Research – IRICoR; NRC Human Health Therapeutics (HHT); NRC Medical Devices	

7.3 Life Sciences Opportunity Assessment

Opportunity Area	Eastern Ontario
High Priority – Short term initiatives	
Medical devices	Company base, technology driven companies, medical device research centres, technicians/engineering graduate output.
Big pharma consolidation	Greenfield sites, relative lack of labour competition, research base, graduate output.
Generic drug manufacturers	As per big pharma.
Contract manufacturing organizations (CMO)	Good company representation, as per big pharma
Medical Logistics - Supply chain: Specialist healthcare logistics distributors – pharma distribution centres	Established logistics base, bio-health company base, at the heart of ON-QC life sciences corridor
High Priority – medium term initiatives	
Health informatics	Ottawa presence, fledgling, early stage company base, research centres, graduates
Bioinformatics	As per health informatics
Biopharmaceuticals	One large company plus a few spin-offs, research base can be a catalyst, graduate output
Therapeutics/diagnostics companies	A few companies, research base can be a catalyst
Contract research organizations (CRO)	One university spin-off, research base can be a catalyst
Professional services: testing	Potential to leverage other professional services firms in the region and Ottawa presence.
Low Priority	
Nutraceuticals	Ottawa base, but food sector overlap is a strength.
Support services: packaging	Good representation of companies. More companies will not add significant value to the sector - Opportunistic
Support services: professional services	Ottawa presence.

7.4 Action items

Action Plan Items	Stakeholders	Priority
Overarching goal: The creation of a 'collaborative ready cluster'		
Creation of bio-health directory ■ Online, interactive - include all bio-health stakeholders ■ Identify partnership ready companies ■ R&D collaboration opportunities in conjunction with university research institutions **Develop an interconnected regional network of companies (**education and research institutions, enabler organizations such as RINs etc, major healthcare institutions, and industry stakeholders.) **Process initiation:** 1. Examine best practice examples – Boston, Raleigh-Durham, Minneapolis-St.Paul, OCRI **2.** Initiate discussions with OCRI	OEEDC OEEDC, region's universities & colleges ONE, RINs etc. OEEDC	High Immediate
Develop relationships with key sector stakeholders ■ Build relationships with Life Sciences Ontario (LSO) ■ Collaborate with Québec-Ontario Life Sciences Corridor initiative (MRI) ■ Liaise with MEDTI/DFAIT ■ Extend liaison to site selection consultants, applicable consulates etc.	OEEDC LSO MEDTI/DFAIT OEEDC	High Immediate
Extend existing bio-health sector development resources ■ Extend assistance to bio-health SMEs and entrepreneurs ■ Community colleges: Collaboration opportunities with local companies ■ Develop bio-health sector expertise at Regional Innovation Networks, Community Futures Development Corporations ■ Ensure companies maximize the use of research, development, training and other incentives.	OEEDC, region's universities & colleges ONE, RINs, CFDCs, MITAC, IRAP	Medium Medium term
Leverage research resources ■ Align with the target sub-sector opportunities ■ Explore the possibility of a region wide BioDiscovery Toronto model which links nine of Toronto's internationally recognized biomedical research institutions for the commercialization of research.	OEEDC MITAC, IRAP	Medium Medium term
Labour Force Development ■ **Consult with community colleges** to introduce bio-informatics and bioengineering programming: examples at Seneca College, Centennial College ■ Determine labour force capacity and capabilities in Eastern Ontario. ■ Subject to labour force capacity findings: ■ **Talent retention:** promote employment opportunities in bio-health in Eastern Ontario to graduates of local educational institutions ■ Investigate medical devices re-skilling through community colleges	OEEDC Workforce Development Boards	High Immediate

Action Plan Items	Stakeholders	Priority
Communications ▪ Build positioning and selling messages ▪ Develop awareness of the bio-health sector in Eastern Ontario	OEEDC	High Immediate

8 Agri-Food

A comprehensive research study: Food Processing in Eastern Ontario: (Location Strategies and Millier Dickinson Blais) was released in September 2011. This work included sector trends, a value chain, an opportunity assessment, and an action plan. Since it is relatively recent, these pieces are included in this section with applicable updates. Agriculture aspects have been incorporated, as this sector was not part of the 2011 study's remit.

OEEDC has undertaken a consistent investment attraction program through a comprehensive trade show program in Canada, and the US. With participation in the Ontario Food Corridor Initiative this year the geographical scope will be extended to Europe and South America – Brazil.

8.1 Agri-food Sector Trends[4]

Globalization and Competition in the Food Sector

While a number of broad supply and demand-related trends are affecting the food sector, perhaps the greatest factor underlying most if not all of these trends is the globalization and integration of global food systems.

Food companies are investing globally to extend their supply chains and get closer to their markets; outbound foreign direct investment by the Canadian food sector has risen from just under $3B in 1999 to $6B in 2009.[5]

Consolidation is a key trend in the food processing industry resulting in large multi-nationals and smaller companies providing niche products.

Global food demand is rising, raising concerns about the security and availability of food supply.

There has been a significant shift in consumer demand preferences for food, specifically related to food security and transparency (and an accompanying rise in organic and local food); and public health and safety.

Demand driven market trends

There are a variety of demand-driven and market-driven trends likely to affect that food industry in Canada in coming years:

- Local Food The 'local food' movement is increasingly seen as more of a trend than a passing fad
- Cultural Diversity. Canada has the highest net immigration rate of any G8 country, leading to shifting consumption patterns in the food industry, affecting everything from specialized grocery retail to import and distribution, especially in high-population centres

[4] Adapted from Food Processing in Eastern Ontario, September 2011. Location Strategies and Millier Dickinson Blais

[5] The Conference Board of Canada - Centre for Food in Canada. June 2011. Valuing Food: The Economic Contribution of Canada's Food Sector.

- Demography Ontario, like the rest of Canada and much of the developed world, has an aging population with the 'baby boomer generation' entering retirement age. Demand will rise for nutritionally enriched foods. In addition, health condition-driven purchases (cardiovascular, diabetes, blood pressure, osteoporosis) will rise, growing the market for health foods and 'nutraceuticals'
- Health and 'Calorie Awareness. Arguably, Canadians are more aware of the nutritional content of food than ever before, while continuing to put a premium on convenience and safety

Supply driven trends:

- Increasing use of technology is reshaping the industry e.g. precision agriculture; biologics, robotics to increase yields, facilitate specialization, improve traceability, and expand variety
- Food processors create new foods to address specific lifestyle and dietary needs
- Distributors use process improvements to reduce the cost of getting food from the farmer to the consumer
- The demographic aging of the workforce – while having important repercussions for consumption trends – also affects labour availability for the food processing industry in Ontario

8.2 Agri-food Value Chain

Agri-Food		
Companies		**Sector Highlights**
Agriculture	Ingredion Canada (Casco) ; Performance Plants	• Just over 18,500 people are employed in the agri-food industry in Ontario East or 4% of total employment in the Region. 11,351 accounts for food processing employment. • Just over 4,000 graduates in agri-food and related disciplines; including 526 masters graduates plus 1,519 arts & science graduates at the Region's universities and colleges • Nearly 21,000 students enrolled in agri-food and related disciplines, including 2,118 masters students • Considerable strength in agricultural research at Kemptville, Campus d'Alfred and Trent University - Centre for The Centre for Dairy Goat Research. • Key areas of food systems sustainability at the University of Ottawa and Trent University, and health and wellness at Queen's university and the University of Ottawa • Expansion of agriculture research capacity at University of Guelph – Kemptville Campus: new Agricultural Research Stations at Emo, New Liskard, and Winchester • Increased industry support though Ontario Agri-food Venture Centre Announcement • Specialty food companies are making headway e.g. Sprucewood Handmade Cookie Co – international markets – Harrods food hall • A deep supply chain with primary producers, meat, dairy, ingredients to support multiple phases of the food value chain – from production (e.g. dairy, grain, egg farms) to processing to distribution • Significant presence of global companies – e.g. Weetabix Canada, Nestle, Pepsi-Quaker Oats, Parmalat, Kelloggs • Specialist support services in the region e.g. Specialist Logistics and cold storage providers, packaging • Distribution hub with mixed retailers including food and food service: Target Shoppers Drug, Jean Cortu, Farm Boy and Giant Tiger with Tim Horton's and Sysco.
Dry Goods	Kellogg Canada; Weetabix of Canada; Nestle Professional, Pepsi-QTG - Quaker Oats; Weston Bakeries; Blommer Chocolate Canada; Burnbrae Farms; Leclerc	
Processed Dairy	Parmalat Canada; Saputo Foods; Ivanhoe Cheese (GayLea), Agropur Cooperative - Natrel Division	
Ingredients	Casco; Quality Custom Blending; Sensient Colors Canada	
Specialty	Redhead Pantry; Sprucewood Handmade Cookie Co.; The Algonquin Tea Company; Harvest Food Works	
Beverages	Coca-Cola Ltd. - Minute Maid ;Quaker Tropicana Gatorade; Wineries - 32 including Harwood Estates Vineyards Huffs Estate The Grange of Prince Edward County; Waupoos Estate Winery	
Industry Support		
Manufacturing Support	Oxy-Arc International	
Distributors	Findlay Foods; Calico Food Ingredients	
Technical & Professional Services	SGS Canada; Maxxam Analytics; Flowmetrix Technical Services; Endetech; Bioniche Food Safety Division; University of Guelph - Kemptville	
Specialist Logistics and Warehousing	Trenton Cold Storage, ALL-CAN DISTRIBUTION CENTRES, DHL Express, Ryder Canada, Wills Transfer Limited	
Industry Support	The Investeco Sustainable Food Fund; Eastern Ontario Agri-food network, Ontario Agri-food Venture Centre	
Industry Associations	Ontario Food Processors Association, Ontario Dairy Council; Food Processors of Canada; Canadian Restaurant and Foodservices Association, Baking Association of Canada, plus numerous Ontario associations in produce categories	
Education, Training and Human Resource Support		
Speciallist Programs	Carleton University: BSc in Food Science & Nutrition (honours); College d'Alfred:Food Science & Nutrition diploma; University of Guelph - Kemptville Campus: food science and quality management diploma; Durham College: pharmaceutical and food science technology advanced diploma; Algonquin College: food and nutrition management graduate certificate College d'Alfred: Agricultural technologies diploma	
Customized programs	Loyalist Training and Knowledge Centre (LTKC) The Process Operator - Food Manufacturing Apprenticeship Program	
Research and Development		
Corporate	Animal Health and Food Safety Vaccine Manufacturing Centre (Bioniche)	
Food Processing	University of Guelph - Kemptville Campus:,Laboratories: Food Processing, Fraser Hall Food Lab, Engineering, Rorke Hall Sensory Lab; Durham College: The Centre for Food (CFF)	
Agriculture	**University of Guelph - Kemptville Campus:** Field Crop Unit, Agroforestry Education Centre, Dairy Education & Innovation Centre; Laboratories: Animal Science Research. Agricultural Research Stations at Emo, New Liskard and Winchester **College d"Alfred:** le Centre de recherche en production laitière biologique - Centre for Organic Dairy Research; **Trent University**: Natural Resources DNA Profilingand Forensic Centre; Centre for Dairy Goat Research, Partnership	
Health	University of Ottawa: MONET Research Group;The Institute of Population Health Queen's: Centre for Obesity Research and Education (CORE	
Networks of Centres of Excellence - National	NRC - Aquatic and crop resource development	

8.3 Agri-food Opportunity Assessment

8.3.1 Build on these Strengths

Key Factors	Eastern Ontario	Opportunity
	Fresh Food	
▪ Increased interest in local food, farm-to table ▪ Increasing demand for fresh and organic produce ▪ New and growing companies in frozen vegetables sector oriented towards healthy eating ▪ Growth in freshly prepared convenience foods ▪ Provincial Local Food Act, 2013	▪ Extensive primary producer activities ▪ Trent University/ Fleming College: established foothold in sustainable food systems. The university has a strong sustainability theme in many programs, research and facilities. ▪ Prevalence of farmers' markets ▪ Rural character of the region ▪ Success of municipal/sub-regional gastro-marketing efforts Eastern Ontario locations ▪ Ontario Agri-food Venture Centre ▪ (Bakkavor closure)	▪ Freshly prepared convenience foods (note: Bakkavor closure) ▪ Agglomerate into an Eastern Ontario brand ▪ Wholesale, importers – exotic fruits ▪ Leverage fresh fruit & vegetables for frozen produce supply ▪ Funding for local food initiatives
	Organic Foods	
▪ Rise of niche producers ▪ Niche product aggregation in organics, distributors: SunOpta, Tree of Life ▪ More 'convenience organic' foods ▪ Artisan, organic, and gluten free produce is a growing sub-set of breakfast/snack foods ▪ Uptake of produce among mainstream grocers	▪ Prevalence of organics throughout value chain ▪ Centre for Organic Dairy Research (le Centre de recherché en production laitière biologique), Campus d'Alfred, University of Guelph	**Address Market Gaps** ▪ Major aggregator distributors – SunOpta, Tree of Life ▪ Importer, wholesale, and brokerage companies **Small scale opportunities.** ▪ Dairy substitutes – products based on Soy milk, rice, almonds etc. ▪ Snack foods and breakfast cereals. ▪ Ambitious bakers to grow beyond their local markets e.g. larger artisan bakers such as ACE Bakery

Key Factors	Eastern Ontario	Opportunity
	Meat Products	
■ Importance in the supply chain with many finished products derived from meats ■ Supply-managed commodities/import controls means partnership or setting up a facility is the only way to market entry ■ Comprehensive Economic and Trade Agreement (CETA) proposed free trade agreement between Canada and the European Union	■ Federally certified plants combined with a solid base of primary producers, wide product range. ■ Specialist training at Seaway Valley Meat Cutting Institute and Canadian Meat Council ■ Eastern Ontario is well placed to capitalize on potential expansion projects in meat products ■ Vantage Foods case ready products	■ **Markets**: food service, co-manufacturing, private label ■ **Products**: freshly prepared foods, finished products – sausages, etc. ■ Foreign producers seeking market entry ■ European producers seeking partnerships/distributors
	Warehousing/Distribution	
■ Access to markets, transportation networks, materials is a key location consideration ■ Emergence of joint distribution, between domestic (Canadian) and international food companies ■ Import/distribution of specialty food products. ■ Comprehensive Economic and Trade Agreement (CETA) proposed free trade agreement between Canada and the European Union	■ Well established 'big box' distribution sector in all consumer categories ■ Specialist providers ■ Supporting logistics operators ■ SME specialist food distributors much less developed – Findlay Foods in Kingston ■ Most robust employment growth food sector – added over 800 jobs 2001-2006.	■ Develop categories and market gaps i.e. organic; ethnic foods, non-alcoholic beverages, etc. ■ European producers seeking distributors ■ Capacity to attract major distribution centres – groceries etc ■ Target companies - mission critical to reduce the costs of inputs, storage and distribution
	Nutraceuticals	
■ Increased public awareness of healthy lifestyle choices ■ Preventative medicine ■ Demographics driving demand	■ Nutrition research and development at Kemptville College and University of Ottawa ■ Small but cohesive company representation in all aspects of the value chain	■ Build on sector strengths ■ Increase regional product research and development capacity
	Packaging companies	
■ New technology innovations are driving growth. ■ New packaging around freshly prepared foods ■ Eco-packaging /bio-materials are key growth areas	■ Specialist food processing service providers, including Cascades and Strathcona, recyclables leaders ■ Global companies providing all purpose packaging ■ Bio-materials research expertise at Trent University, education programming	■ Capitalize on growing market segments through company presence, local demand and research expertise
	Large company Expansion – Retention and Attraction	
■ Continued growth of largest companies in food production and distribution/retail	■ Weston Bakeries, Kellogg's	■ Highlights importance of continued retention and expansion activities

Key Factors	Eastern Ontario	Opportunity
		▪ Add more segments of existing businesses e.g. distributing for international companies, poultry and livestock slaughtering for larger companies, etc. ▪ Larger companies with no presence in North America/Canada, particularly opportunity markets such as Brazil
▪ Industry consolidation	▪ Closures – PepsiCo (Trenton), Kraft, Hershey's, Bakkavor	▪ Major companies already in Canada
	Supply Chain	
▪ Access to markets, transportation networks, materials key in business location ▪ Rising operating costs ▪ Increasing importance of sustainable practice. ▪ Technology pushing companies to de-value labour considerations ▪ Supply chain – just in time ▪ Focus on low-cost areas close to supply chain (both inputs and markets).	▪ Presence of high quality companies – primary producers, meat, dairy, ingredients ▪ Advantage in skills and capabilities to support multiple phases of the food value chain – from production (e.g. dairy, grain, egg farms) to processing to distribution	▪ Focus on attracting businesses that are complementary existing operations, to strengthen the local food sector value chain ▪ Promote Eastern Ontario's supply strengths

8.3.2 Further Sector Development

Key Factors	Eastern Ontario	Opportunity
	Agriculture	
▪ Provincial Local Food Act, 2013 ▪ Increasing use of technology	▪ Extensive primary producer activities ▪ EO third largest corn producing region in ON ▪ Trent University/ Fleming College: established foothold in sustainable food systems. The university has a strong sustainability theme in many programs, research and facilities ▪ University of Guelph Kemptville campus – expansion of agriculture research capacity ▪ Ontario Agri-food Venture Centre	▪ Attract new businesses in geoinformatics, precision agriculture, training etc. ▪ Augment existing food sector and creative rural economy activities

Key Factors	Eastern Ontario	Opportunity
	Private Label	
▪ Increasing cost-consciousness ▪ Food prices and supply - Rise in discount shopping ▪ Private labels account for 36% of total dollars spent in Ontario	▪ Comprehensive supply chain ▪ Presence of Blommer Chocolate, Vantage Foods, Streamline Foods ▪ Bakkavor closure	▪ Extend presence of private label companies
	Co-packing/Manufacturing	
▪ Emergence of joint distribution, packing, production other JVs between domestic and international food companies ▪ Increasing globalization of food sector ▪ Low-cost/low-risk market entry as alternative to large-scale foreign direct investment	▪ Comprehensive supply chain ▪ Presence of Streamline Foods	▪ Better representation of companies providing co-packing, co-manufacturing, import, distribution and wholesale ▪ Opportunities/job creation through JVs ▪ Help companies establish a foothold in Eastern Ontario
	Professional Support Services – Testing	
▪ Consumers want information and assurance ▪ Concerns about food security and transparency, public health and safety ▪	▪ Low private sector company representation outside Ottawa ▪ SGS (Peterborough) ▪ Testing facilities at Kemptville	▪ Food Testing Facilities appear to be concentrated on East side of the Region ▪ Towns further west such as Kingston, Belleville/Trenton, Port Hope and Cobourg could have potential to attract small scale food testing laboratories ▪ Satellite branches of Ottawa consultants such as, Exova ▪ Extend capabilities of existing professional services consultants e.g. Maxaam Analytics now in Port Hope, environmental
	Food Science Research and Development	
▪ Increased research & development and innovation in processing, product development, supply chain (distribution), crop production ▪ More food companies looking to collaborate with post-secondary institutions ▪ Product innovations identified as lrevenue growth driver in next 1-3 years ▪ Some major food processing companies in consultations have recruited food scientists for product development, research & development. ▪ Ontario is seen as innovative in speciality crop production and research-based products (omega-3 eggs, DNA-enhanced milk, lycopene from tomatoes, etc.) ▪ Health/nutrition driving product development ▪ 2014 federal budget –plans on investing $390 million over five years to strengthen Canada's food safety system	▪ Research activities covers key areas affecting global and national industry, consumer and product trends ▪ Food science programs at Carleton University and Durham College. room for expansion ▪ Canadian Institute of Food Science & Technology (CIFST) representation now in Peterborough ▪ Bioniche Food Safety division	▪ Increase regional food processing research capacity ▪ New food science education programming ▪ Greater involvement by Ontario Networks of Excellence ▪ Develop interest among highly educated individuals ▪ Encourage collaboration between companies and education institutions

Key Factors	Eastern Ontario	Opportunity
	Labour Force	
▪ Higher levels of older workers and due to retire in next five years ▪ Higher proportion of immigrant workers ▪ Employees have 'transferable' skills focused on production - competition from other sectors for labour ▪ Lower educational attainment among labour force ▪ Food industry pays below-average wages ▪ Upskilling of sector: Potential skills gap as technology demands increase	▪ Good education and training provision in English and French. ▪ Flexible programming - Customized training, continuing education ▪ Process Operator - Food Manufacturing Apprenticeship Program at Loyalist College ▪ Skilled labour supply ▪ Loyal workforce	▪ Extend food science education provision in region ▪ Improve image of industry ▪ Generate awareness among youth of food processing careers

8.3.3 Address Market Gaps

Key Factors	Eastern Ontario	Opportunity
	Food Processing Product Categories	
▪ Many emerging companies in non-alcoholic beverages – water, tea, energy drinks, etc. ▪ Projected growth in fish consumption and exotic seafoods ▪ Product areas – cakes/desserts, frozen desserts	▪ Small representation in non-alcoholic beverage categories – tea, water - plenty of room for growth ▪ Absence of significant companies in cakes/desserts, frozen desserts ▪ Cakes/desserts, Frozen desserts: – good supply chain company representation – dairy, Blommer Chocolate	▪ Distribution, importer, manufacturing – non-alcoholic beverages ▪ Proximity to large markets could present opportunities in fish processing. ▪ Opportunistic expansion in desserts
	Ethnic Foods	
▪ Purchasing power of ethnic groups is projected to double in 10 years ($65B to $128B) ▪ Spread of immigrant communities to suburbs due to cost of living pressures ▪ Increased demand in wider population; more 'variety-seeking' among domestic consumers, awareness and appetite for 'flavour'	▪ Visible minority groups make up a tiny proportion of Eastern Ontario's population ▪ Ability to capitalize on this trend is not without challenges	▪ Capitalize on the growth of Durham Region ▪ Out migration from the GTA into Eastern Ontario. ▪ Growth in 'domestic' consumer demand ▪ Wholesale distributor importer broker opportunities ▪ Note: Business Immigration program eliminated 2014
	Wholesalers, Importers, Brokers	
▪ Canadian companies cite international sourcing as key growth driver ▪ Import/distribution – of new specialty food products ▪ China/Brazil increasing share of	▪ Very low representation in Eastern Ontario	▪ Utilize to develop categories and market gaps i.e. organic; ethnic foods, non-alcoholic beverages, exotic fruits ▪ European opportunity

Key Factors	Eastern Ontario	Opportunity
imports from 14% in 1992 to 21% of processed food purchases (2010) ▪ CETA proposed free trade agreement between Canada and the European Union (2015)		
	Professional Support Services – IT Engineering Testing	
▪ Technology trends driving 'just-in-time' ▪ Cost and sustainability pressures on manufacturing and distribution ▪ Technological improvements in business processes	▪ Appears to be little or no representation of specialist IT/Engineering support for food processing ▪ SGS testing	▪ Extend capabilities of existing professional services companies

8.3.4 Marketing Activities

Key Factors	Eastern Ontario	Opportunity
	Opportunity Markets	
▪ Quebec and the United States are seen as the key locations for attracting investment in the food sector into Ontario ▪ Canada's largest trading partner for food products. 57% of imports into Canada are from the US ▪ Ontario Provincial Population forecasts Durham Region to be one of the fastest growing GTA regions ▪ Brazil is emerging as a key market, especially for proteins and secondary processing ▪ Evidence of increased activity by emerging food processing nations – Asia, Middle East, Turkey, etc. in previous trade show campaigns	▪ Proximity of Quebec to Eastern Ontario is sometimes problematic as companies want to be in GTA or West of GTA ▪ Track record of US trade show activity ▪ Efficient access to NE USA ▪ Proximity of Northumberland, Kawartha Lakes and Peterborough to Durham Region and to a lesser extent, Bay of Quinte	▪ Growth in Durham region - Expanded distribution networks will be required to meet growing population in this market ▪ Brazil potential – partnerships with DEFAIT/OMAFRA/Ontario Food Corridor ▪ Re-evaluate previous US/Quebec campaigns ▪ Investigate emerging markets
	Awareness Generation	
▪ Ontario Food Corridor from provincial and federal governments is a competitive advantage ▪ Density of research and development activity in the Ontario Food Corridor will likely make it more attractive to potential investors that	▪ Lack of awareness and profile of the advantages of Eastern Ontario as a food sector destination, even among some government representatives ▪ Ontario Food Corridor partnership ▪ Though the area has competitive cost factors such as electricity	▪ Raise the profile of local successes and internationally recognized food companies in Region (i.e. community ambassadors) to give credibility as an investment destination ▪ Enhance communications with site selectors and investment agencies to ensure they have detailed

Key Factors	Eastern Ontario	Opportunity
incorporate research and technology-intensive product development and processing into their activities, as compared to Eastern Ontario	rates and development charges, it is perceived that other jurisdictions are more effective at promoting these advantages	regional and local information ▪ Integrate key strengths into Ontario East food processing cluster identity

8.3.5 Advanced Manufacturing Sector Team Initiatives

There a number of opportunities that are more applicable to the Advanced Manufacturing Sector team which are briefly described below

Key Factors	Eastern Ontario	Opportunity
	Machining	
▪ Rise in automation and technology in food production and rising production costs in (transportation and commodity prices)	▪ Automation/technology – good base of machinery support services but weak on technology	▪ Eastern Ontario can leverage its tradition in manufacturing to develop and attract higher value added advanced manufacturing applications that serve this sector
	Water Treatment/Technologies	
▪ Issues around Greater support for waste and wastewater management and treatment arose during the consultations ▪ This is a critical area in the food processing industry with water supply and sewage treatment capacity, and to a lesser extent water treatment capacity cited as important in potential investment decisions.	▪ Research expertise at Trent University, Campus d'Alfred, UOIT and Queen's University ▪ University and community college programming ▪ Company and professional support base	▪ Capabilities in this area can be enhanced through initiatives to attract support services in this sector ▪ Municipality water capacity assessment matrices

8.4 Action Plan

Action Plan Items	Timescale	Priority
Build on Strengths - Capitalize on Current Trends		
Leverage presence of large MNEs.	Immediate	High
Capitalize on supply chain strengths	Immediate	High
Leverage recent logistics and distribution successes	Immediate	High
Build on strength in fresh produce	Immediate	High
Capitalize on strong presence of supply managed products	Immediate	High
Build on success of Organics/Artisan Producers and Manufacturers	Immediate	Medium
Capitalize on growth potential in packaging	Immediate	Medium
Build JV/partnership Opportunities	Immediate	High
Target Product Category Gaps	Medium term	Low
Ethnic Foods Sector Development	Long term	Low/Medium
Increase Research and Development Capacity in the Eastern Ontario	Long term	High
Develop Research and Technology driven sub-sectors		
Build on small number of Nutraceuticals companies: Increase representation in OEEDC member communities	Medium term	Low
Develop Technical and Professional Services and Food Testing Capabilities in OEEDC member communities (outside Ottawa)	Medium term	Medium
Enable the Development of SMEs		
Develop Online Resource through food processing directory	Immediate	High
Food Processing Facilities to Assist SMEs	Long term	High
Labour Force Development Initiatives		
Generate awareness among youth of food processing careers.	Long term	High
Extend food processing and food science programming	Long term	High
Increase pool of higher-skilled employees	Long term	High
Increase Awareness of Ontario East's Food Processing Sector		
Augment Existing Relationships with Multipliers	Long term	High
Communications Campaign	Long term	High
Develop Ontario East Branding and Positioning: Sector Selling Messages	Long term	High
Trade Show Program	Immediate	High

9 Logistics

While no recent studies have been undertaken of the logistics and warehousing sector, the directories, as compiled in 2010, and material for a brochure update in 2012 were utilized as part of the information gathering exercise. The logistics sector team has developed strong relationships with Supply Chain Management Canada and H2O, through consistent participation at events and annual conferences. With the advent of increased interest in Canada on the part of US retailers and the attraction of Target, this reach has been extended to the Retail Leaders Industry conference in the US.

9.1 Logistics and Warehousing Sector Trends

- **Changing parameters** in manufacturing, global sourcing, investment, technology and security are driving new distribution investment strategies.
- **Accelerating Globalization** has resulted in structural shifts in supply chain management. Manufacturers, retailers and natural resources industries are relying on their logistics networks to deliver seamless, integrated, secure, reliable and efficient solutions to leverage their global value chains through the allocation of different parts of the production process across different countries.

- **The sharp increase in international trade:** Innovations in logistics and changes in policies in countries around the world have led to a reduction in the costs of shipping goods and services across borders. The ratio of trade to GDP for the world as a whole (commonly-used measure of economy openness – has increased from 39% in 1990 to 59% in 2011. The total value of global trade today exceeds US$ 20 trillion.

- **Investment in distribution facilities in Canada increased dramatically** between 2005 and 2010, when total annual investment grew by106% from $674 million to $1.39 billion; (69% adjusted growth using price index of non-residential commercial building construction), and by 123% in Ontario during the same period. In 2010 Ontario has the largest share (32%) of total distribution facility investment.
- **Cost Pressures:** Firms are seeking to establish dynamic, responsive, automated and low-cost distribution centres (DCs) that will support their logistics global business strategies. Control of transportation costs is a key focus for all players in the supply chain.
- **The Importance of technology**. Supply chain technology has been one of the fastest-growing segments in the information technology field. Sophisticated global logistics strategies have resulted in significant efficiencies with performance measurement metrics, information technology system standards and supplier relationship management practices.

- **Strategic mix of in-house and outsourced resources.** Growth trend in logistics outsourcing in non-asset based logistics services 4/5PL, customs clearance, brokerage services, and rail services. Consolidation among logistics intermediaries.
- **Environmental sustainability** driven by the need for regulatory compliance and satisfaction of customer demand.
- **Growth in Intermodal transportation;** intermodal business, made up 25 % of CN's company's overall business in 2012.

- **Short Sea Shipping** is significant component in goods movement throughout Europe. Identified by HWYH2O as providing long-term sustainability for the Great Lakes / Seaway System through bypassing congested surface routes and reducing stress on urban infrastructure.

9.2 Logistics and Warehousing Value Chain

Logistics and Warehousing Value Chain		
Companies		**Sector Highlights**
Distribution Centres	Lyreco Office Supplies, Sears, National Grocers, Tim Horton's, Walmart, Black & Decker, Giant Tiger, Shoppers Drug Mart, McKesson, Sysco, The Benson Group, Target, Sysco	[illegible] in Ontario East; 1.8% of total employment • Specialist education provision in the region is improving. Latest addition is Graduate certificate logistics and supply chain management at St. Lawrence College - Cornwall campus, strengthening a major hub in the Region. Other specialist programs available at Algonquin College, Fleming College (Trade) and Carleton University • Multi-modal location but has to rely on provision outside the region for significant deep water Port facilities (Montreal, Toronto) • Fast border crossings provide competitive advantage • Significant existing and potential improvements to modal infrastructure • 407 extension • City of Peterborough has completed a $28.6 million dollar Peterborough Airport Expansion Project • Kingston Airport is in the final stages of concept development for the potential expansion of the runway and terminal • Proposed major airport at Pickering on eastern side of GTA • Port of Johnstown is nearing completion of a new $34.76 million expansion including a new 465 meter (1,525 feet) berth, 7.7 hectares (19 acres) wharf area and new storage area • Cornwall and the Harbour Revitalization Project provide small commercial spaces • Potential improvements a result of The Eastern Ontario Transportation Needs Analysis project, an assessment of the competitiveness of eastern Ontario's transportation infrastructure and services with recommendations • Established distribution hub with major companies throughout the Region • Strong representation of national and international 3PL carriers • Supporting infrastructure – warehousing, truck service/repair, customs brokers etc. • Strong relationships with key industry interest groups: Supply Chain Management Canada, and H2O
Mulit-modal Logistics	Con-way, DHL, TST Overland Express, YRC Reimer, All-Can Distribution, Seaway Express, SLH Transport, Ryder, Wills Transfer, Trenton Cold Storage; Kriska	
Air	Peterborough Airport, Kingston Airport, Ottawa International Airport	
Port	Cornwall Harbour, Port of Johnstown, Taylor Kidd Industrial Park	
Rail	CP, CN, Via Rail	
Support Services		
Support Services - logistics	Customs brokers, freight forwarders,regional courier hubs, and warehousing . FedEx Trade Networks, Crossborder Solutions, Nefab, Canada Distribution centres	
Support Services - trucking	Tallman Truck Centre, Hasuik Storage Trailers, Benson Truck & Trailer	
Industry Support		
Industry Interest Groups/Assoications	HwyH2O, Canadian Supply Chain Sector Council, Supply Chain and Logistics Association of Canada	
	Canadian International Freight Forwarders Association – CIFFA (Toronto) The Logistics Institute (Toronto), Canadian Society of Customs Brokers (Ottawa) Ontario Trucking Association (Toronto), Canada Border Services Agency (CBSA) The Association of Operations Management	
Education, Training and Human Resource Support		
Speciallist programs	UOIT MBA program - Marketing and Logistics and Supply Chain Management.option; St. Lawrence College - Cornwall campus: Graduate certificate logistics and supply chain management; Algonquin College: Bachelor of Applied Business e-business supply chain management, Durham College: Operations Management; Fleming College: Advanced Diploma in International Trade; Carleton Sprott School of Management: Bachelor of Commerce: supply chain management	
Specialist training - regional	Canadian Institute of Traffic and Transportation (CITT) - Toronto FITT (Forum for International Trade Training) (Ottawa); UOIT, Durham College, Corporate Training Services (CTS), Sprott School of Business, Teffler School of Management, Queen's School of Business	
Recruitment	StaffPlus, Adecco, Labor Ready, Kelly Services	
Research and Development		
Research Institutions	UOIT Faculty of Business and Information Technology - published research on supply chain topics	

9.3 Logistics and Warehousing Opportunity Assessment

Key Factors	Eastern Ontario	Opportunity
	Logistics	
■ Global logistics expansion ■ Interposal transportation growth	■ Infrastructure improvements: ■ Air Kingston, Peterborough; ■ Port of Johnstown, Cornwall ■ Transportation study	■ Strengthen product offering ■ Increased potential to attract investment
■ Distribution facility investment ■ Increasing competition in retailing ■ Interest from US retailers	■ Strong representation of distribution companies ■ Region established as a logistics/warehousing hub ■ Synergies with food processing, medical logistics	■ Continued investment attraction ■ Strengthen other target sectors
■ Supply chain technology	■ Not well placed to capitalize due to weal ICT base but must address this issue	■ Leverage strong sector to attract ICT supply chain tech providers