

# Advanced Manufacturing Technologies How Communities Can Capitalize

# Location Strategies

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- Established 2004
- Economic Development Consultants
- Large and small communities across Canada
- Urban and rural communities
- International: Enterprise Florida Business Birmingham (U.K.) Welsh Government

# Overview

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- The Opportunity
- Key technology themes changing the face of manufacturing
- Ontario East Economic Development Commission Advanced Manufacturing Technology Study
- How your community can align its assets with these technologies
- How to leverage attributes and take advantage of technology trends
- Provide a foundation for a roadmap to a successful and sustainable advanced manufacturing strategy
- Case study examples

# The Opportunity



# The Opportunity

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## Technology is a Growth Driver

- New technologies provide higher quality jobs
- Potential to disrupt existing markets and to create billions of dollars of economic value
- Best potential to support innovative, inclusive, and sustainable growth

# The Opportunity

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- Early days of the Internet era
- Lower barriers to entry: access to better, cheaper manufacturing equipment, development and design tools
- One-person startups can create market-shaking innovations
- Small, nimble manufacturing operations
- Highly specialized, highly advanced micro-factories, niche products
- Making traditional products in new ways, new products, and custom-made items
- Clearpath Robotics (Waterloo) was launched in a basement eight years ago with just \$50
- Manufacturing as an incubator of innovation

# Collaborative Connected Communities

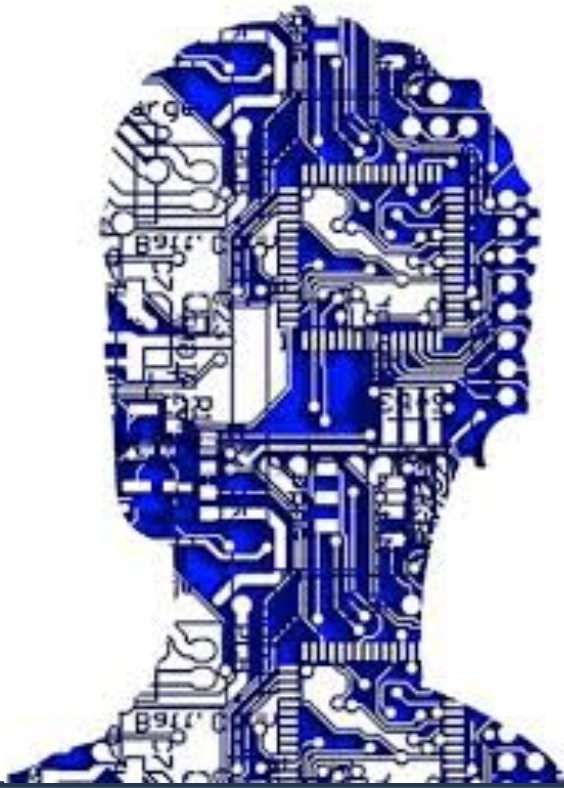
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## Smaller Communities Can Capitalize

- Opportunities are accessible
- Remote commercialization, design, configuration, and delivery of products and services
- Lifestyle opportunities
- Sense of community builds synergies
- Human capital: talent attraction and retention

# Technology Themes

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# Key Manufacturing Technology Themes



Four key manufacturing themes

- Sustainable manufacturing
  - High performance manufacturing
  - ICT enabled intelligent manufacturing
  - New materials in manufacturing
- European Union's 'Factories of the Future Initiative'

# Key Disruptive Technologies



- Additive manufacturing - 3D printing
- Nanotechnology -Atomically Precise Manufacturing (APM)
- The Internet of Things (Advanced Sensors)
- Next Generation Robotics
- Automation of knowledge work (Artificial Intelligence)

(McKinsey Global Institute)

Increased speed, customization, precision, and efficiency

# Leveraging the Opportunity

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**Case study:** Ontario East  
Economic Development  
Commission Advanced  
Manufacturing  
Technology Roadmap

# Leveraging the Opportunity

Advanced Manufacturing Technologies

What assets do we have in our community?

How can we translate our assets into opportunity?

Asset Analysis

Reconfiguration

Roadmap

Reconfigure



Realign



Reinvent



# Aligning Community Assets - Technology Audit

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## Asset audit of advanced manufacturing technologies

- Companies investing in technological innovation, productivity-enhancing technologies and skilled technical workforce
- Business and professional support ecosystem: assistance to growing companies and technology companies
- Research and development activities around key technologies
- Talent: Education programming and graduate output, skills inventory

# Objectives

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- Identify key technology strengths from asset compilation
- Identify technology gaps
- Sector re-configuration and re-alignment
- Facilitate sector presentation and value proposition
- Foundation for advanced manufacturing technology sector roadmap
- Capitalize on the new age of manufacturing

# Companies

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- Entrepreneurial activity
- New product development
- In-house company R&D
- Technologies deployed
- Collaboration: leading edge companies, research institutes, post-secondary education
- Grants/incentives for innovation

# Advanced Materials Technologies Example

Technology Theme	Companies	Technology Theme	Companies
Lightweight materials and structures, including composites and hybrids	Sabic Innovative Plastics, Horizon Plastics, Universal Fan & Blower, VN Instruments	Natural and bio-based materials	PolyFerm Canada, DuPont, 3M
Materials to withstand more aggressive environments (e.g. high temperature, corrosive, erosive)	ADL Insulflex, Canadian Wear Technologies, Universal Fan & Blower, Kennametal Stellite, Impacto Protective Products, DuPont, Milex	Joining technologies	Protoplast, Limpact
Electronic and optical functional materials	OZ Optics, Evonik	Materials for portable power sources (batteries/fuel cells)	Evonik Industries, DuPont
Smart and multifunctional materials, devices and structures	They Innovate Inc	Nanomaterials (including graphene)	Grafoid, ALCERECO
Surface engineering and coating technologies	Berry Plastics, DuPont, Valspar Corporation, Safran Electronics Canada, CPK Interiors	Materials with reduced environmental impact through life	Limpact, Arclin, AkzoNobel, PolyFerm Canada, DuPont, 3M
Particulate engineering; near-net shape manufacturing	Arnprior Aerospace	Materials designed for reuse/recycle/remanufacture	PolyFerm Canada, DuPont, 3M
Fibre and textile-based technologies	Palziv, Canadian Wear Technologies, Miltex, INVISTA, DuPont, 3M, Coviden (Medtronic)	Nondestructive Evaluation (NDE/) structural health monitoring (SHM)/condition monitoring	VN Instruments, Canadian Nuclear Laboratories (CNL), Kingston Process Metallurgy Inc. (KPM)
Bioresorbable, bioactive and biocompatible materials	PolyFerm Canada, DuPont, 3M	Predictive modelling through the full life cycle, including lifetime prediction	I.S.I. Controls, Siemens, Milltronics Process Instruments, Armada Tool Works, SigmaPoint Technologies, Kingston Process Metallurgy Inc. (KPM)



# Incubator and Commercialization Networks Models

Significant in spawning cutting edge companies in Eastern Ontario

**Canadian Hybrid Incubator Resource Platform (CHIRP)** Canada's first and only Soft Landings International Incubator



**Fast Start**, Trent and Fleming College, University of Ontario Institute of Technology (UOIT), Durham College, working with the Greater Peterborough Innovation Cluster (GPIC) Spark Center



**GreenCentre Canada (Kingston)**  
New online portal promotes green chemistry collaboration



**Haliburton Creative Business Incubator**



**N100** Start-ups compete for a \$100,000 convertible note

**Kawartha Trades and Technology Centre**  
Sustainable Skills, Technology and Life Sciences Centre, Loyalist College



# Research: Advanced Manufacturing and Materials Technologies

UOIT	Queen's University
Distributed and Mobile Systems Laboratory (DaMSeL) the Robotics and Automation Laboratory The Ontario Power Generation Engineering building Rapid prototyping and manufacturing lab Combustion and engines lab Mechatronics lab Integrated Manufacturing Centre Durham College/UOIT Advanced Materials Research Group	The Robotics Laboratory Manufacturing and Dynamic Systems Group: Rapid Laminated Tooling Laboratory Advanced Design and Manufacturing Institute (ADMI) Queen's-RMC Centre for Advanced Materials and Manufacturing Energy and Power Electronics Applied Research Laboratory (ePEARL)  The Advanced Polymeric Materials Characterization facility Center for Manufacturing of Advanced Ceramics and Nanomaterials Materials Characterization Laboratory
<b>University of Trent:</b> Trent Biomaterials Research Program Centre for Materials Research	
<b>Community Colleges</b> The Kawartha Trades and Technology Centre Fleming College Sustainable Skills and Technology and Life Sciences Centre. Loyalist College	<b>Royal Military College – research groups</b> Electrochemical Power Sources Environmental Remote Sensing Lab Chemical Thermodynamics of Materials, Nanocomposites, Organometallic Chemistry Polymer Characterization, Chitosan Fiber Spinning Group, Chemical Protective Clothing Test Facility



# Education Programming

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- Materials science programs at UOIT, Trent University, Carleton, Ottawa, RMC, Queen's
- Supported by a comprehensive range of over 300 programs (Eastern Ontario) in general engineering, maths, science, technician and trades from the region's universities and colleges
- Engineering (all disciplines), math, and science programs at all levels at the region's universities and colleges

# Opportunity Assessment



# Technology Themes

Technology	Eastern Ontario	Opportunity
High performance manufacturing Productivity/efficiency gains	<ul style="list-style-type: none"> <li>▪ Advanced manufacturing/materials company base</li> <li>▪ Technology driven companies</li> <li>▪ In-house R &amp; D in companies; established centre of excellence</li> <li>▪ Strathcona, Grafoid, DuPont</li> </ul>	<ul style="list-style-type: none"> <li>▪ Eastern Ontario manufacturing base is a potential market</li> <li>▪ GAP Semi-conductor fabrication – MEMs,</li> </ul>
ICT enabled intelligent manufacturing	<ul style="list-style-type: none"> <li>▪ Small number of companies involved in Predictive modelling, Geospatial, data driven applications</li> </ul>	<ul style="list-style-type: none"> <li>▪ Build on company base</li> </ul>
New materials in manufacturing	<p>Prevalence in:</p> <ul style="list-style-type: none"> <li>▪ Lightweight materials and structures</li> <li>▪ Materials to withstand more aggressive environments</li> <li>▪ Surface engineering and coating technologies</li> <li>▪ Fibre and textile-based technologies</li> </ul>	<ul style="list-style-type: none"> <li>▪ Use areas to identify niches in advanced materials; e.g. Transportation</li> <li>▪ Energy, Defence, security, manufacturing sectors</li> <li>▪ Broad range of manufacturing products and services</li> <li>▪ Technical textiles</li> </ul>
Sustainable manufacturing (including bio-manufacturing)	<ul style="list-style-type: none"> <li>▪ Companies producing materials with reduced environmental impact</li> <li>▪ Bio-plastics manufacturer</li> <li>▪ Plastics and packaging clusters</li> <li>▪ Other bio-products around packaging</li> <li>▪ Companies adopting sustainable practices</li> </ul>	<ul style="list-style-type: none"> <li>▪ Leverage plastics and packaging cluster as part of advanced materials strategy</li> <li>▪ Bio-materials opportunity through research base and synergies with plastics and packaging companies</li> </ul>

Modelled on European Union's 'Factories of the Future Initiative'

# Disruptive Technologies

Technology	Eastern Ontario	Opportunity
Additive manufacturing (3D Printing)	<ul style="list-style-type: none"> <li>Limited specialist company base</li> <li>Plastics companies deploying this technology</li> </ul>	<ul style="list-style-type: none"> <li>Plastics cluster could provide entry route into this space</li> <li>Deployment expected to be widespread</li> </ul>
Nanomaterials	<ul style="list-style-type: none"> <li>Nanomaterials – graphene, Grafoid outstanding, high profile company</li> <li>Centre of excellence</li> <li>Graphite mine</li> </ul>	<ul style="list-style-type: none"> <li>Build on company and R&amp;D presence</li> <li>Next generation technologies facilitated across many sectors</li> </ul>
Next Generation Robotics	<ul style="list-style-type: none"> <li>Small robotics company base</li> <li>Main customer – automotive: supply chain</li> <li>No auto OEMs, aerospace assembly companies</li> <li>Strong research base</li> <li>Extensive lab facilities at post-secondary education institutions</li> </ul>	<ul style="list-style-type: none"> <li>Develop technology base</li> <li>Route to sector is through research and lab capacity</li> <li>Collaboration could spawn new specialist technology companies</li> <li>Extension of applications in Aerospace</li> </ul>
The Internet of Things	<ul style="list-style-type: none"> <li>Small but innovative company base</li> <li>Industry leaders – media interest</li> <li>Electronics company base</li> <li>Embryonic group of geospatial companies</li> </ul>	<ul style="list-style-type: none"> <li>Target opportunities around manufacturing</li> <li>Diversification opportunities for electronics companies</li> <li>Ubiquitous deployment of geospatial technologies</li> </ul>
Automation of knowledge work (Artificial Intelligence)	<ul style="list-style-type: none"> <li>Initiatives will come from research base</li> <li>Lack of pure play ICT companies compared to other regions could be an impediment</li> </ul>	<ul style="list-style-type: none"> <li>Early stage – not a priority</li> <li>Limited ability to capitalize</li> <li>Limited payback for effort involved</li> </ul>

Modelled on McKinsey Global Institute disruptive technologies



# Opportunity Assessment

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## Things to consider

- Leverage leading edge technology opportunities and strengths identified
- Key sector strengths in verticals
- Supply chain depth
- Acknowledge external factors: competitive positioning, sub-sector growth potential

# Technology Opportunities

**Key target opportunities:** technology strengths, significant concentration, leading edge companies showcases, research and labour force capacity

Medium  
Term

**Potential opportunities:** some presence (handful of growing companies with leading edge technologies), synergies with existing clusters, research

Long  
Term

**Embryonic opportunities:** very small number of important companies, some research capacity, technology has significant upside/growth potential

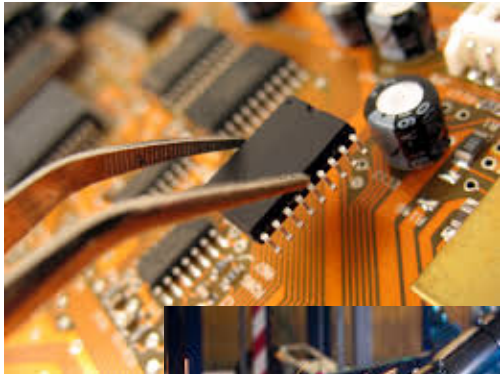


# Technology Opportunities

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- New company formation
- Nurturing early stage companies
- Reinvention – integrating technology into non-tech companies
- Attraction – gazelles, education, R&D
- Partnerships

# Reconfigure Realign Reinvent



# Build Ecosystem Platform

## Moving from traditional physical assets to knowledge assets

- Develop strategies to support the technology opportunities
- Capture value from synergies with research and development, higher education
- Leverage funding sources
- Engage universities/colleges, industry, entrepreneurs, and Investors aligned with technology strengths
- Build an entrepreneurial culture
- Form collaborative networks to develop innovation networks
- Engage schools: 21st Century apprentice models: Germany: 60% young people enter "dual" education system combines practical on-the-job training and education
- Engage a core group of committed individuals
- Develop vision and value proposition



# Value Proposition

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- The ability to present a compelling value proposition
- Convey the right messages to appeal to leading edge companies and their intermediaries
- Building awareness of capabilities and potential in advanced manufacturing technologies
- Position as a location of choice for target companies considering expansion and/or relocation
- Focus of investment attraction and business retention for leading edge companies is now more holistic
- 'Soft' variables embedded in the notion of 'quality of place'

# Case Study Examples



Bend, Oregon, Population: 79,000



The New Economy Initiative,  
Southeast Michigan



Motorsport Valley, U.K.

# Case Study Examples: Bend, Oregon

- **Third reincarnation:** forestry roots, attracting aviation and retirees, recession 2008
- Focused on quality of life: repositioned as outdoor recreational destination
- Remediated contaminated buildings as Old Mill District: economic engine for the region employing 1,700 people one year after opening
- Creation of supportive environment to attract and nurture entrepreneurs rather than financial incentives
- [Bend Venture Conference](#), Bend Economic Development Advisory Board, [BendTECH](#) - Entrepreneurial and Coworking Hub, [Start-up Bend](#)
- Focus on microbrewing, biosciences, recreation equipment manufacturing, and technology companies.
- Entrepreneurs in these fields have flexibility to choose where they locate
- Recreation driven manufacturing: Hydro flask, Ruff Wear, Kialoa Paddles
- 2014 the city had 95 startups across multiple technology sectors
- Top job growth rate in U.S. last year at 6.6% *Entrepreneur Magazine* “the most entrepreneurial city in America” No. 1 on Forbes’ Best Small Places for Business and Careers



## Case Study Examples: The New Economy Initiative, Southeast Michigan

- Largest philanthropy-led economic development initiative in the U.S.
- Support network for entrepreneurs and small businesses organized around key elements: Ideas, Tools, Talents, Places, Money (50 NEI-funded programs)
- **Impact based guiding principles:** incentivizing collaboration, highly localized program delivery, social inclusion, thinking differently, motivational stories, industry agnostic, assessing what works
- 20% support recipients are manufacturers, many are former autoworkers
- **Reconfiguring Detroit's legacy:** next-generation manufacturers, industrial robots, nanotechnology materials, biotech pharmaceuticals
- **TechTown, nonprofit innovation hub and incubator** facility provided by General Motors
- Since launch (2007), invested \$96.2 million, direct assistance to over 4,400 companies, launch of over 1,600 companies, creation of 17,490 jobs, generation of nearly \$3 billion in real economic output
- Investment in technology entrepreneurship helped region enhance image and grow a workforce



## Case Study Examples Motorsport Valley® U.K. Niche Sector

- Innovation led by sector interest group Motorsport Industry Association (MIA)
- Emerged out of small sheds, garages and factories servicing motorsports across two counties in central U.K.
- Now global centre for world-class automotive products, services facilities
- 4,300 businesses employing 41,000 staff, including 25,000 highly skilled engineers, \$14.5bn worldwide sales, design & builds 75% of the world's single-seat racing cars
- 15% of all firms spend over 30% of annual sales on R&D, strong international focus: 87% of firms export
- Partnerships between global OEMs and UK motorsport companies for R&D and prototyping: seeking brand association with Grand Prix racing
- Collaborations between the Motorsport Valley cluster, government, and universities delivers specialist training: motorsport academy to draw young students through brand association
- **Key value added:** broaden core activity into other technology intensive industries. aerospace, marine, automotive, defence, pit-stop process applied to new-born baby resuscitation





# Thank you

Gillian Hatton  
ghatton@locstrategies.com  
416-277-5269

