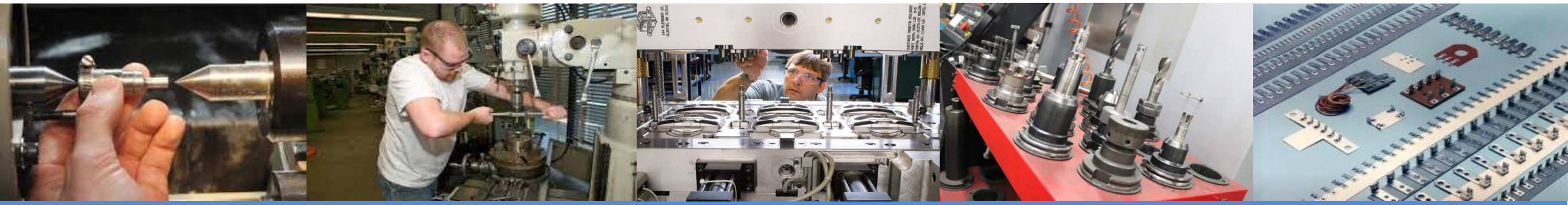
COLLABORATIVE MANUFACTURING COMMUNITIES GROWTH INITIATIVE (CMCGI)

FOR THE NORTH CENTRAL MASSACHUSETTS REGION



Final Report

October 2, 2014

***Please Note*:** This report is a good faith effort by RTI to accurately represent information available via secondary and primary sources at the time of the information capture. The report is not for publication or public disclosure.

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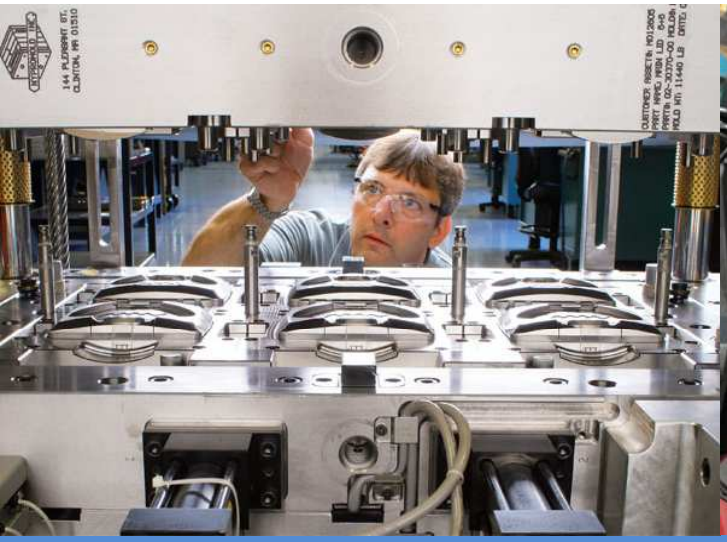

COLLABORATIVE MANUFACTURING COMMUNITIES GROWTH INITIATIVE (CMCGI) FOR THE NORTH CENTRAL MASSACHUSETTS REGION

Volume 1: Findings and Preliminary Recommendations from SME Interviews

June 16, 2014

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Volume 1

RTI INTERNATIONAL

Funding

Project Background

USDA Rural Business Opportunity Grants (RBOG) Program Objective: to promote sustainable economic development in rural communities with exceptional needs

- Grants are awarded on a competitive basis
- Grant funds must be used for projects in rural areas and can be used for the following:
  - Community economic development
  - Technology-based economic development
  - Feasibility studies and business plans
  - Leadership and entrepreneur training
  - Rural business incubators
  - Long-term business strategic planning

Goal

Project Background

CCMGI Goal: To establish a "collaborative manufacturing community“ that will enable sustained growth in the region

Massachusetts Advanced Manufacturing COLLABORATIVE

mac WORKFORCE | INNOVATION | COLLABORATIVE

aim Associated Industries of Massachusetts

NORTH CENTRAL MASSACHUSETTS MADE AFFORDABLE

MassMEP Manufacturing Extension Partnership YOUR RESOURCE FOR MANUFACTURING GREATNESS

NORTH CENTRAL MASSACHUSETTS WORKFORCE INVESTMENT BOARD

MassDevelopment

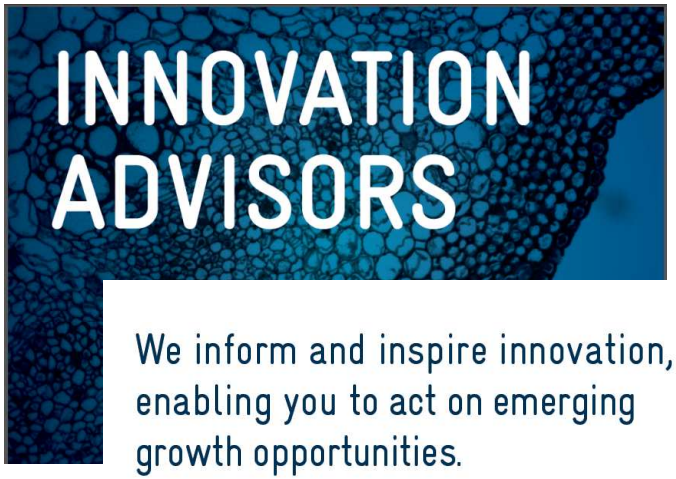
UMASS DONAHUE INSTITUTE

RTI INTERNATIONAL

Core Team

Project Background

RTI and MassMEP worked closely to interview manufacturers and develop recommendations, and continue to investigate market opportunities



We inform and inspire innovation, enabling you to act on emerging growth opportunities.

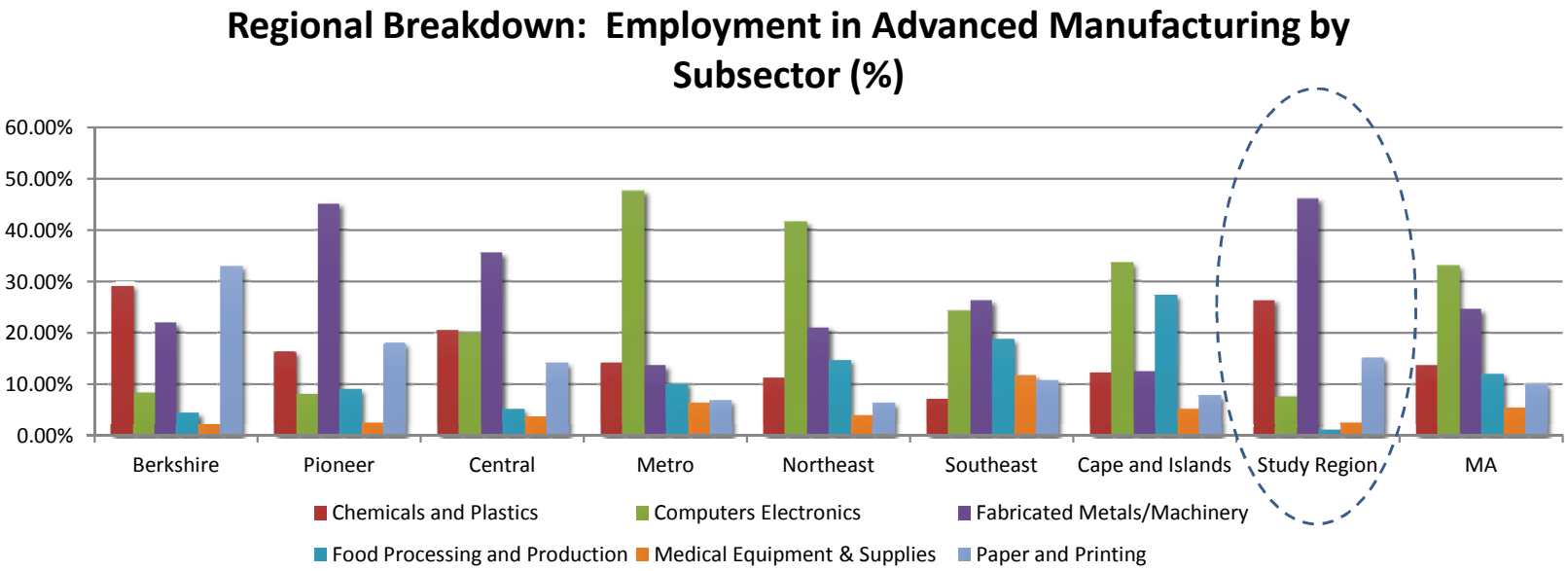
INSPIRED EXPLORED ENABLED EMPOWERED DEPLOYED

MassMEP
Manufacturing Extension Partnership
YOUR RESOURCE FOR MANUFACTURING GREATNESS

Why NCM?

Project Background

North Central is not like other regions in Massachusetts



The manufacturing profile of North Central Massachusetts is unique

- Dominated by metal fabrication, machining, and plastics molding, whereas Eastern regions are dominated by computer, electronics, and medical equipment manufacturers
- Most similar to Berkshire and Pioneer regions but fewer workers in food manufacturing

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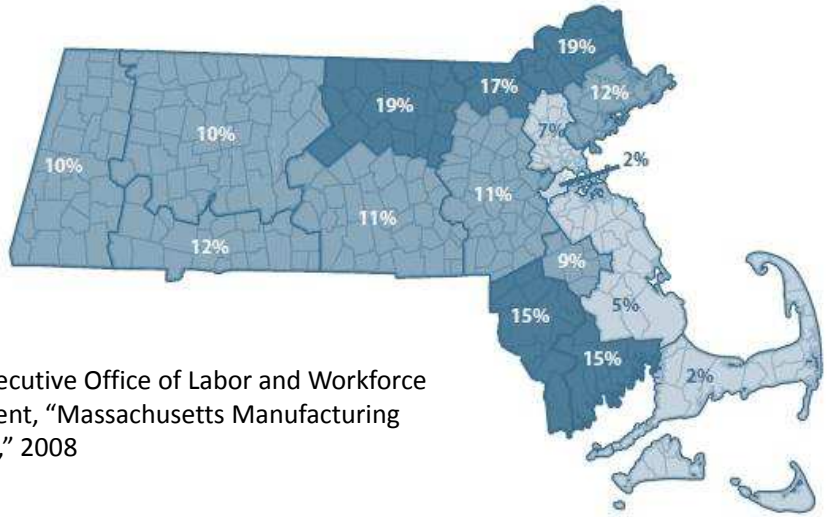
Why NCM?

Project Background

North Central is not like other regions in Massachusetts

Manufacturing Employment in Massachusetts Workforce Regions



Source: Executive Office of Labor and Workforce Development, "Massachusetts Manufacturing Chartbook," 2008

- NCM has the highest proportion of manufacturing employment in the Commonwealth, at 19.7%
- NCM's population is older than the Commonwealth
- NCM is rural
- **NCM has unique needs that must be understood to develop an effective roadmap for manufacturing growth**

Why NCM?

Project Background

North Central is losing manufacturing jobs

Sector	2011	2008	1998	change % from 1998	Change % from 2008
Fabricated Metals	5261	6122	9792	-33	-14
Computer and Peripherals	3412	3684	7932	-54	-9
Plastic & Rubber	3308	3839	6849	-44	-14
Machining	3279	3600	6078	-41	-9
Paper	2333	2722	3762	-27	-16
Total Manufacturing	31454	36217	60498	-40	-13

Source County Business Patterns

- NCM has been losing its manufacturing base as a source of employment since 1998
- Every sector has lost jobs
- **Action must be taken to preserve and grow the NCM manufacturing base, which is vital to the prosperity of the region**

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Timeline

Milestones and Tasks

Project Approach

we are here.

Interviews

Design survey instrument
Identify, categorize firms
Recruit participants
Schedule interviews

Conduct interviews
Compile, clarify, analyze results

Incorporate stakeholder feedback

Technology-Driven Market Intelligence (TDMI)

Characterize regional manufacturing capabilities

Identify opportunities

Screen and select opportunities

Conduct SWOT analyses

Develop recommendations to exploit opportunities

Collaborative (CCMGI)

Complete Talent Management surveys and share results

Organize steering committee

Complete roadmap for growth

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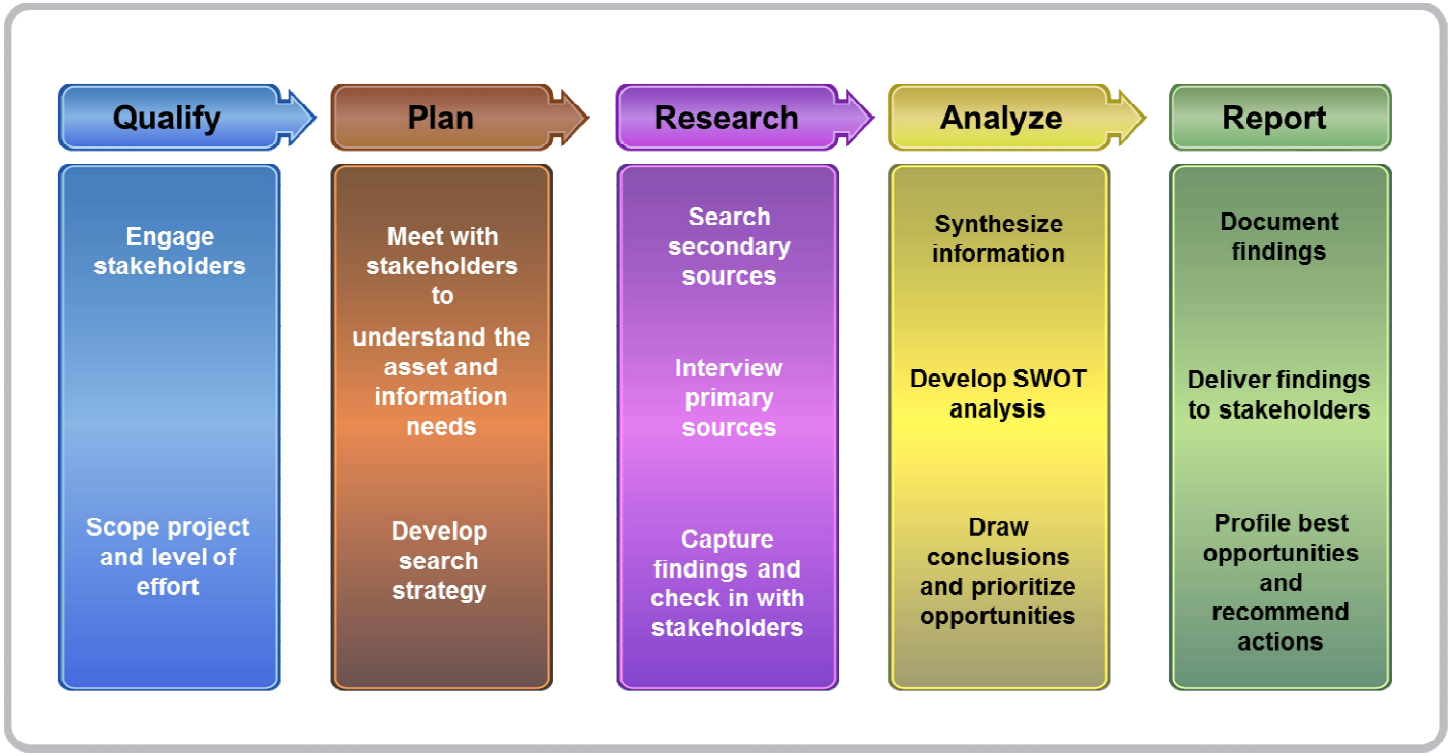
TDMI

Overview and Process

Project Approach

Technology-Driven Market Intelligence (TDMI)



- **Outcome of NASA technology transfer work (47 years)**
- **Modified for small and medium enterprise (SME) manufacturers for NIST MEP**
- **Applicable to individual firms as well as regional assets**

Tools

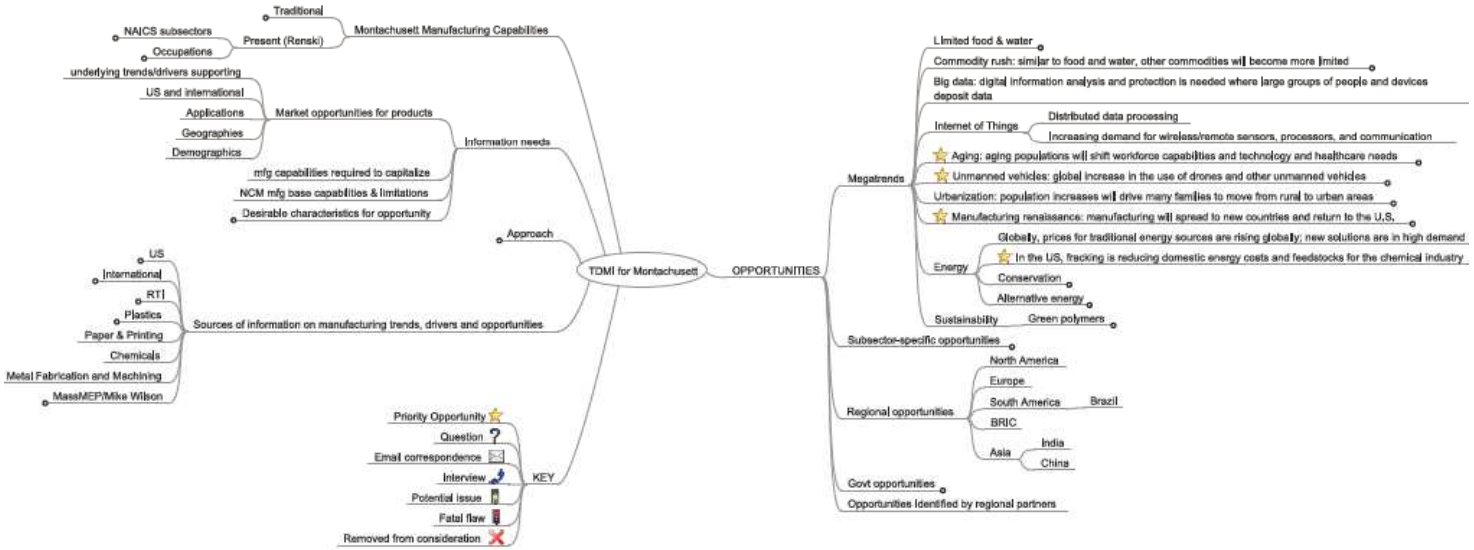
Mindmap

Project Approach

Mindmap acts as project library

Research Plan for TDMI

- **Left side: Information on NCM manufacturing capabilities**
- **Right side: Market opportunities with a need for NCM capabilities**



Tools

TDMI Opportunities

Project Approach

Example Opportunities from TDMI

Tooling sector under pressure to meet automakers' growing demand

By **Rhoda Miel**
NEWS EDITOR

OVERVIEWS OF KEY TRENDS IMPACTING THE SECTOR ...

3-D printing leaving mark on mold/tool sector

Prototype mold makers are adopting 3-D printers to make injection mold tooling capable of turning out parts in standard machines with standard resins.

The technology is giving mold makers of all sizes another weapon in their arsenal.

Manufacturers and product developers alike are using this technology to create different mechanical and physical objects with a three-dimensional printer.

ing, injection molders are going to have to adapt to the new technology," he said. "The times are changing."

While 3-D printing can be limited by the number of polymers that can be used, Miller said it is a matter of time before that issue is eliminated.

Craig W. Porter, owner and president of PlastiCert Inc., said his company has not yet seen a direct boost from the evolution of 3-D printing.

"Indirectly we have seen an improvement in time to design release," he said. "3-D

mold tooling. The company has mold making and injection molding in house, which allows it to test both molds and the final molded part.

It takes longer to add water lines and other systems to the prototype tool than it does to print the actual tool itself, Lund said, while using the printer also gives the company greater flexibility to test different cores and cavities.

About 20 percent of Diversified Plastics' business is in the medical industry. The requirements from health and safety agencies to test fully and validate medical

Tool Time for Fracking

Approach to Data Collection

Sources and Interviews

Project Approach

Approach

Compiled a database of 492 manufacturers from the following sources:

- MassMEP
- AIM
- The UMass Donahue Institute
- The North Central Massachusetts Chamber of Commerce
- Hoover's

Conducted 50 interviews (10.2% of the population)

- 46 by telephone
- 3 via e-mail
- 1 in person

Interviews consisted of 26 questions:

- Nine questions elicit information to characterize the company:
  - Size, revenue, number of employees, ownership, industry, customers
- Seventeen questions aim to understand the company's growth, attitudes to technology adoption, and barriers to growth

Subsectors

Six advanced manufacturing subsectors are best positioned for growth

The Advanced Manufacturing Regional Partnership Academy (AMRPA), part of the Massachusetts Advanced Manufacturing Collaborative, focuses on six subsectors:

- ✓ **Chemicals & Plastics (Including Pharmaceuticals)**
- ✓ **Fabricated Metal Products & Machining**
- ✓ **Computer & Electronic Products**
- **Food Manufacturing**
- ✓ **Paper & Printing**
- **Medical Equipment & Supplies**

The checked subsectors are prevalent in NCM (over half of the facilities) and will be the focus of the TDMI and roadmap.

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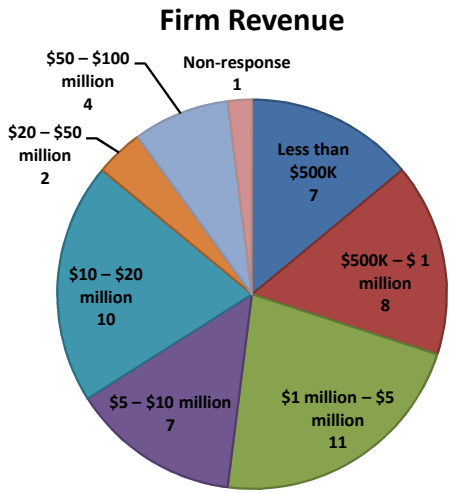
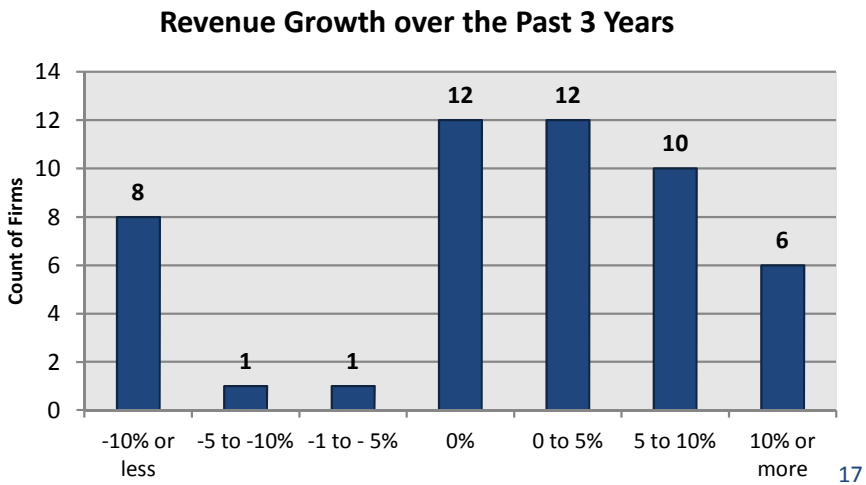
Descriptive Statistics of the Sample

Findings

- **A total of 50 firms were interviewed**
- **86 % of the firms have existed for 20 or more years**
- **The majority of firms have between 1 and 50 employees** **(34 of 50 responses)**
- **Revenues**
  - The largest category of revenues was $1 million to $5 million (22 %) and the second largest category was $10 million to $20 million (20 %)
  - Nearly one-third of the firms interviewed had less than $1 million in annual revenues over the past year.
- **Revenue Growth (over the last 3 years)**
  - 20 % of firms experienced declining revenue
  - 24 % experienced stable revenue
  - 56 % experienced growing revenue

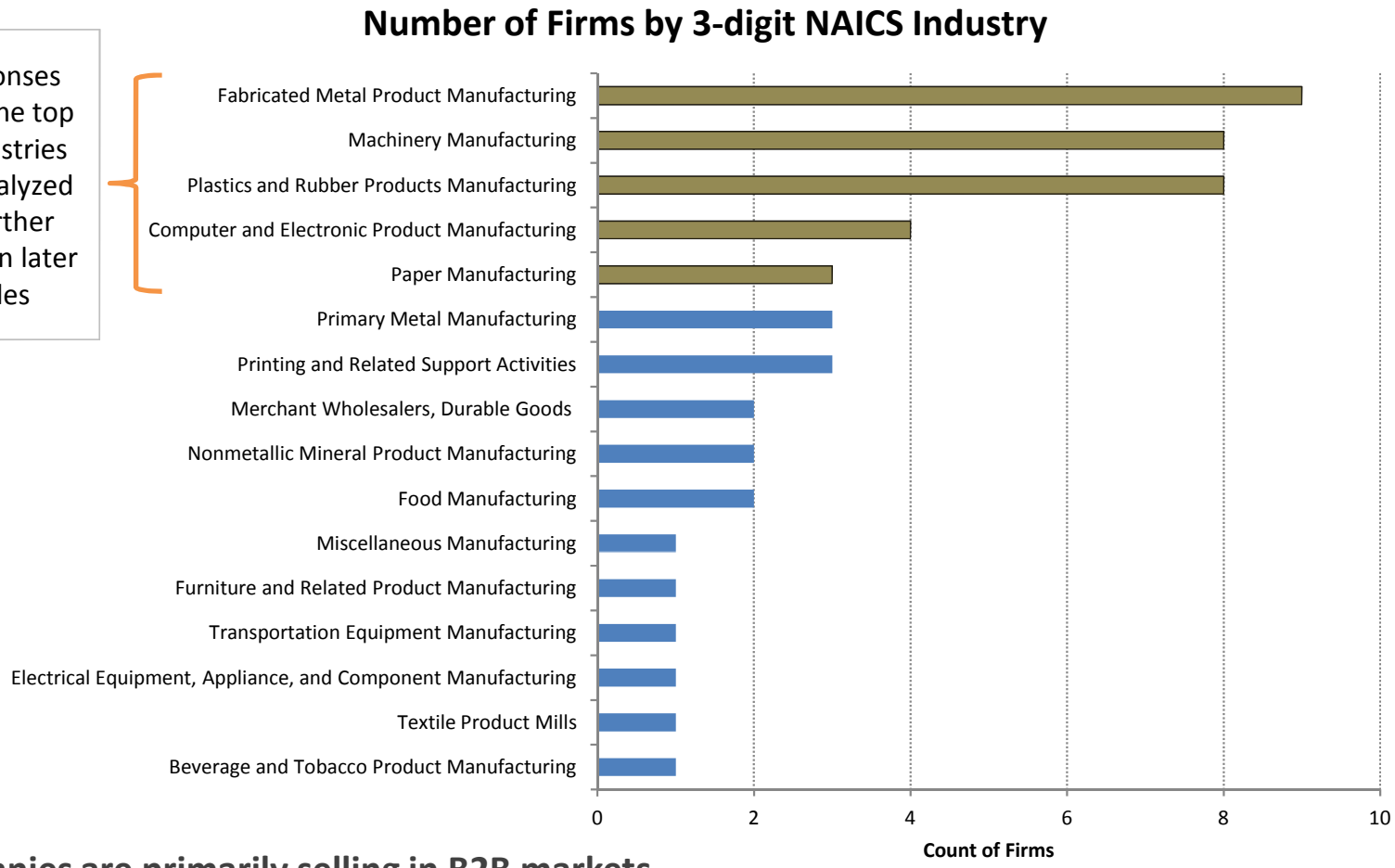




Descriptive Statistics of the Sample

Findings

Responses from the top 5 industries are analyzed in further detail in later slides



Companies are primarily selling in B2B markets.

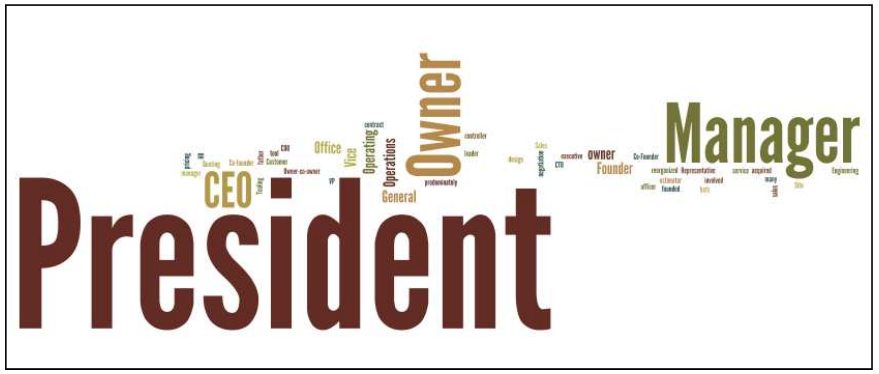
- Selling to broad industries such as medical & healthcare (17), food & beverage, electronics (6), automotive (6), military (5), consumer products (5), construction (4), aerospace & aviation (4), and utilities (4)*

*Note: the number of firms are in parentheses. Each firm was able to list multiple industries.

Interviewee Characteristics

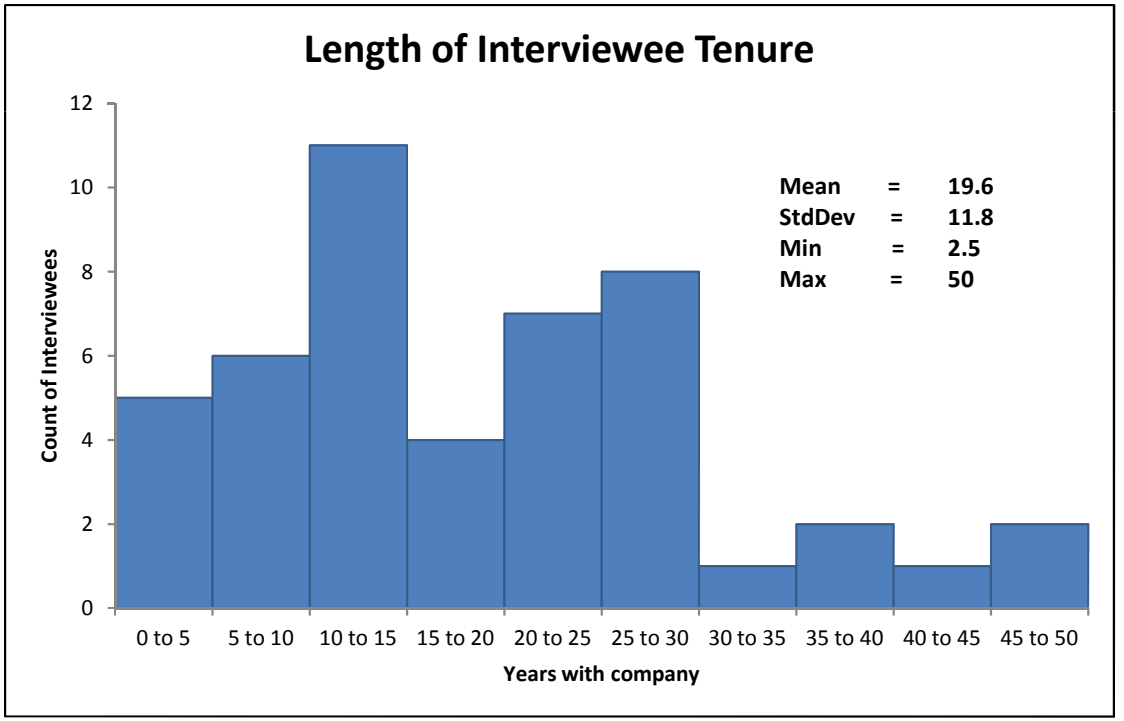
Findings

Role at the Company



Note: size of word is proportional to its relative frequency

Length of Interviewee Tenure



Sample vs. Population

The sample of interviewed firms is not substantially different from the population in terms of its industry mix

*One industry that stands out as underrepresented is NAICS 325 Chemical Manufacturing

50 Interviews vs. Population

		50 Interview Sample		Population		
NAICS	Industry	Count of Firms	% of Total Sample	Count of Firms	% of Total Population	% Difference from Population
326	Plastics and Rubber Products Manufacturing	8	16%	77	16%	0%
332	Fabricated Metal Product Manufacturing	9	18%	59	12%	6%
333	Machinery Manufacturing	8	16%	47	10%	6%
334	Computer and Electronic Product Manufacturing	4	8%	42	9%	-1%
325	Chemical Manufacturing	0	0%	30	6%	-6%
322	Paper Manufacturing	3	6%	25	5%	1%
323	Printing and Related Support Activities	3	6%	18	4%	2%
337	Furniture and Related Product Manufacturing	1	2%	11	2%	0%
327	Nonmetallic Mineral Product Manufacturing	2	4%	8	2%	2%
331	Primary Metal Manufacturing	3	6%	7	1%	5%
339	Miscellaneous Manufacturing	1	2%	7	1%	1%
335	Electrical Equipment, Appliance, and Component Manufacturing	1	2%	6	1%	1%
311	Food Manufacturing	2	4%	4	1%	3%
314	Textile Product Mills	1	2%	4	1%	1%
312	Beverage and Tobacco Product Manufacturing	1	2%	1	0%	2%
423	Merchant Wholesalers, Durable Goods	2	4%	0	0%	4%
336	Transportation Equipment Manufacturing	1	2%	0	0%	2%
321	Wood Product Manufacturing	0	0%	7	1%	-1%
n/a	Unknown	0	0%	139	28%	-28%
Total		50	100%	492	100%	

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Barriers to Growth

Top barriers to growth

1. **Workforce**
2. **Regulatory constraints**
3. **Access to new market opportunities**

Barriers to Growth

Workforce challenges

Workforce challenges

34 firms stated that quality of the area workforce poses specific challenges, including the following:

- **Lack of trained, skilled workers (18)***
  - *"Hard to find the right skills and mix results to self train. About 50% of people cannot do what they say they can do"*
  - *"There is a lack of relevant training"*
  - *"Skills are unique to us. Bulk are workforce are highly skilled crafts – so very challenging. No outside organization can help us"*
  - *"Trained technical people are hard to find, especially skilled machinists"*
  - *"Germany is a good model"*
- **Lack of interest in manufacturing careers from youth and quality of high school graduates is low (11)**
  - *"There is a stigma in the academic community against manufacturing. It shows in guidance and career counselors, who do not advise students to enter manufacturing"*
  - *"Lack of exposure middle and high school students have to manufacturing. Parents also have negative attitudes toward kids working in manufacturing. This really limits workforce they can choose from."*
  - *"Kids coming out of high school today not nearly as good as 20–30 years ago"*

*Note: the number of firms are in parentheses.

Barriers to Growth

Workforce challenges

Findings

Workforce challenges *continued*:

- **Competition for workers by larger companies and metropolitan areas (4)**
  - *"We tried to go to a temp firm but the only agencies are in Boston. Going to call the mayor's office to discuss this. There is an issue in this area. We can't hire someone from Boston—they want to live in Boston."*
  - *"We cannot hire people. We cannot find programmers in the region. We're competing with Google. Good luck!"*
  - *"Mold building is a dying trade in this area. We have one large shop that can pay much higher wages and offer more overtime than the smaller tool shops, therefore that larger shop can capture and hold the top talented tool makers."*
- **Workers lack soft skills (3)**
  - *"Need fewer but more skilled employees that can think for themselves and have basic reading and math skills."*
  - *"Big issue—quality of workforce and work ethic."*
  - *"Really hard to find good people"*
- **Aging workforce is hard to replace (1)**
  - *"Ongoing challenge. Industry is dying. Old workforce is not being replenished."*
- **Language barriers (1)**
  - *"Americans don't want to work in a factory. So he has mostly Asians (Vietnamese and Cambodians). So language problems, even though managers are bilingual."*

*Note: the number of firms are in parentheses.

Barriers to Growth

Regulatory challenges

Regulatory challenges

39 firms provided desired changes to the regulatory environment, including the following:

- **Costs like healthcare mandate, unemployment insurance, environmental regulations are burdensome in terms of time and money (15)**
  - *"Regulations themselves (environmental) are not the problem, it's the bureaucracy that goes along with it. The effort to comply is a heavy burden. You have to pay the State to file reports, after you've done the work. Thousands of dollars for fees alone. But the US EPA doesn't charge fees. We must pay consultants who must approve. The fee is not based on production, but number of employees. Even if you don't pollute. That needs to change. Requirements need to match actual pollution rates.*
  - *"Time you have to put into it, not necessarily the regulations themselves. Opportunity costs of time spent."*
  - *"Regulation needs to be more site appropriate"*
- **International trade regulations (13)**
  - *"We lose millions in export license responsiveness, so time lags make us less competitive."*
  - *"Need to harmonize the approval agencies so we do not have to recertify and requalify the products in each new market or new country. Approvals can take up to a year and $1 million or more."*
  - *"International compliance, lead-free initiatives are burdens. I get 12–14 questions from US Dept. of Commerce that are ridiculous. Huge waste of time but legally required to do it. In Mass there is extra stuff.*

*Note: the number of firms are in parentheses.

Barriers to Growth

Regulatory challenges

Regulatory challenges *continued*:

- **Massachusetts is not a "business friendly state" (4)**
  - *"To enable growth easier it would be important to ease the state's unemployment constraints. Have run into issues even when hiring workers thru a temp agency."*
  - *"Politics overburden any small business. You can't fire people and the employees have all the rights. The political environment is unfriendly and slanted to bigger companies. I would not recommend for anyone to open company in MASS. Tax structure, health insurance have been huge issues since 2006."*
- **Tax structure (6)**
  - *"Death tax is very high 16% — my company wouldn't survive if I died."*
  - *"Towns are coming to companies/manufacturers to pay for city services."*
  - *"Need more incentive to invest in capital expenditures. Tax credits. Reduce unemployment withholding."*
- **Workforce training grant applications are burdensome and grants are restrictive (2)**

*Note: the number of firms are in parentheses.

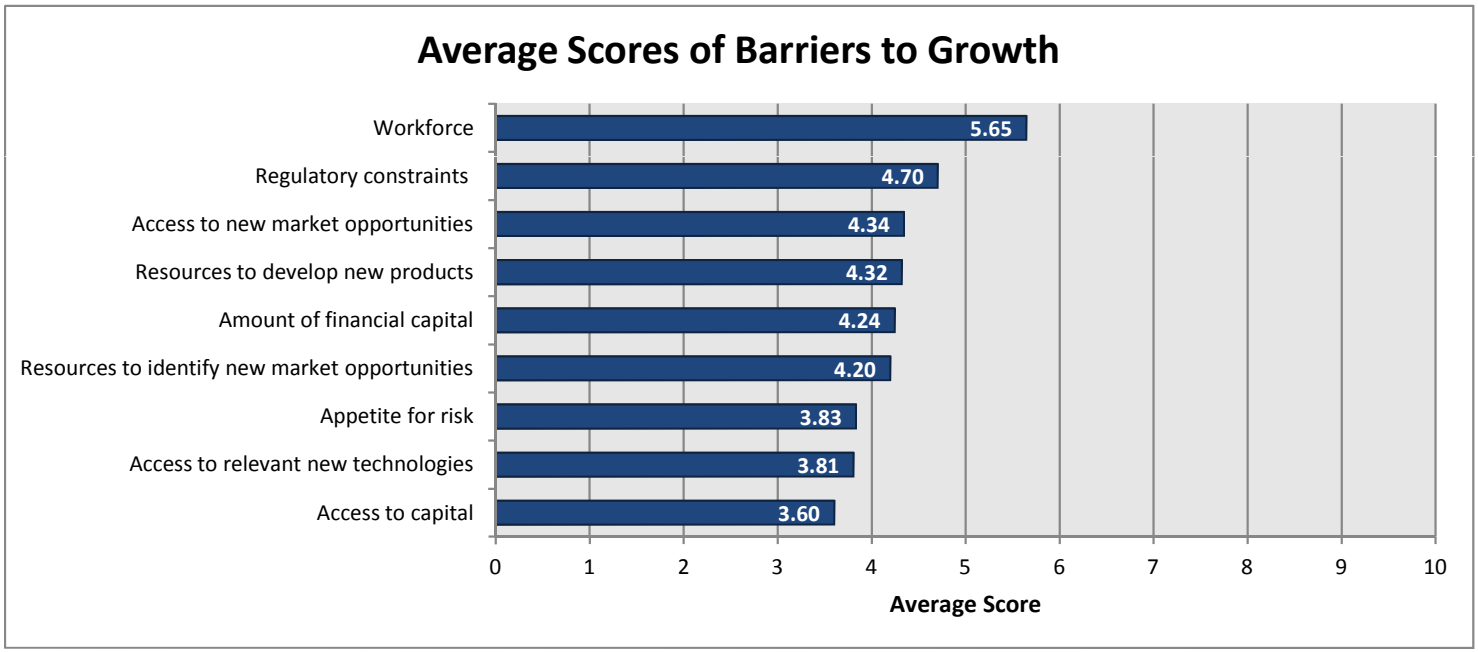
Barriers to Growth

Other barriers

Findings

"Access to capital" was the lowest barrier to growth (ranked 9th)

- However, the "amount of financial capital" is ranked 5th
- Could be a sequential issue
  - Since "access to new market opportunities" was ranked 3rd, it may be that *once* new market opportunities are identified by these firms, *then* "access to capital" starts to become more of a barrier to growth.



*Each factor could receive a score from 1 to 10.
1 = "this is not a factor for my company"
10 = "this is a very significant barrier to the growth of my company."

Facilitators of Growth

Most Desired Changes

Most desired changes to create growth

- Workforce and regulatory issues are at the top of mind
- 12 firms named increased effort in marketing & business development activities

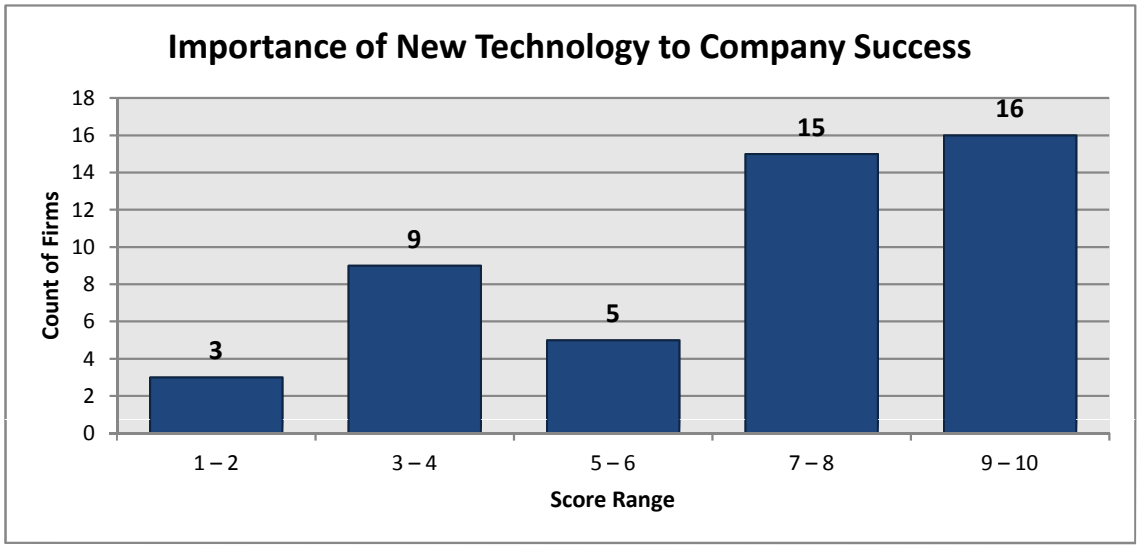
Change about business to create new growth	Count of Firms	%
Workforce quality	8	16%
Marketing & Sales	7	14%
Regulation	6	12%
New products/markets	5	10%
Invest in new technology	3	6%
Move location	3	6%
Competition	3	6%
Reduce costs	3	6%
Market stability	2	4%
Leadership	1	2%
Financial capacity	1	2%
Obtain certifications	1	2%
Non-response	7	14%
Total	50	100%

Facilitators of Growth

Technology Adoption

Findings

On a scale from 1 to 10, firms rated at 6.9 the importance of new technology and technology adoption to their companies' success



What have firms done in terms of exploring and/or adopting new technologies over the last year?

- 84 % of firms searched for technologies to improve their competitiveness
- 70 % of firms identified specific technologies to implement
- 58 % of firms implemented new technologies

Facilitators of Growth

Technology Adoption

Younger firms tend to state that new technology is more important to their success

	Count of Firms	Importance of New Technology and Technology Adoption to Company Success
All Firms	48	6.9
By Firm Age		
0 - 20 years	5	9.0
Greater than 20 years	41	6.7
Non-response	2	6.0

**Note: 2 firms did not answer this question*

Facilitators of Growth

Technology Adoption

Findings

There is substantial variation in the stated importance of technology across firms and industries

NAICS	Industry	Count of Firms	Importance of New Technology and Technology Adoption to Company Success
Top 5 industries			
332	Fabricated Metal Product Manufacturing	9	5.8
333	Machinery Manufacturing	8	7.9
326	Plastics and Rubber Products Manufacturing	7	8.7
334	Computer and Electronic Product Manufacturing	4	8.3
322	Paper Manufacturing	3	6.8
	Top 5 industries (combined)	**31**	**7.4**
	All other industries	17	5.9
	Overall average	48	6.9

**Note: 2 firms did not answer this question*

Facilitators of Growth

Technology Adoption

When investing and/or considering investing in new technologies, firms are concerned with the following:

- Cost, return on investment (ROI), and will the new technology work (21)
  - *"Recently purchased a new laser technology and concerned about recouping costs."*
  - *"If new technology doesn't deliver, your costs have just gone up and you are less competitive."*
- Cost of capital (6)
  - *"Don't have the money. Access to capital."*
  - *"Difficulty in finding capital to purchase and risk of not getting the ROI."*
- Business decline/uncertainty (4)
  - *"Business is terrible so he can't invest in anything"*
  - *"No technology will help. Competitors adapted and competitors drove us out of business in 2008."*

Facilitators of Growth

Technology Adoption

When investing and/or considering investing in new technologies, firms are concerned with the following: ***continued***

- Rapid development of new technologies (4)
  - *"Higher technologies tend to have shorter life span. Technology changes so fast.*
  - *"Investing in technologies that become old fast. It took him 8 months to research a technology."*
- Implementation (2)
  - *"Having the resources to implement the new technologies. It costs more to implement the technologies than purchase technology. "*

Facilitators of Growth

Interaction with Regional Manufacturing Support Entities

23 firms listed support entities that they have worked with in the past year

- 11 firms had interacted with MassMEP (22%), consistent with statewide involvement
- 11 firms had interacted with AIM (Associated Industries of Massachusetts)
- 6 of the 11 firms that interacted with MassMEP also received support from AIM

Services are relatively helpful to firms that have used them in the last year

- Firms that interacted with MassMEP rated services as a 6.1 on a 10-point scale*
- Firms that interacted with AIM rated services as a 7.6 on a 10-point scale*

*Note: when a firm interacted with both MassMEP and AIM, the score was NOT reported separately for both organizations

Facilitators of Growth

What Companies Would Change About Regional Support Entities

What companies would change about regional support entities

- Outreach and information about service offerings (7)
  - *"Need to increase awareness of offerings and existence."*
  - *"Don't know what they provide. More outreach so people are more aware of the help that is available."*
- Workforce issues (7)
  - *"Workforce training grants are very limited for some businesses like hers. They are too specific and too restrictive for a small business (100 or fewer employees)."*
  - *"Employment services, replacing retiring workers."*
  - *"A lot of emphasis on worker training, but no real cleaning house after workers are done. So they can tap into this potential later pool. Should be a central clearing house."*
- Tailored advice and services rather than program-based (6)
  - *"Do a good job and have valid directions for solving problems currently. Could do better if they could break down to company level, visit company, see work environment, understand the business environment. Ask the people on the floor what skills they want/need."*
- Increased assistance for small businesses (5)
  - *"Would love to have a forum for small businesses to exchange ideas"*
  - *"Been in business for a long time and some of the programs don't qualify for them, because they are too small."*
- Less administrative burden attached to support (3)
- Coordination of services across entities (2)

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General

Recommendations

General

- Increase collaboration and coordination among providers
  - Existing resources are in place to address most of the needs stated in the interviews
- Create Steering Committee of AIM, SBDC, MassDEV, Chambers, MassMEP, community colleges, et al. to focus resources on needs
  - Customize offerings to address specific regional needs identified in the interviews
  - Increase awareness of manufacturing support services
  - Reduce administrative burden to engage in manufacturing support services

Workforce

Recommendations

Workforce

- Conduct Critical Skills Audits to understand company-specific training needs
  - 10 will be conducted under this study
  - Identify funding source(s) for additional assessments
- Create a CEO Roundtable similar to the SouthCoast CEO Roundtable
  - CEOs set the agenda
  - No competitors
  - Facilitated
- Utilize Collaboratives
  - ISO 9000 and ISO 13485-2003 and ISO 9000 series
  - Continuous Improvement
- Add training in additional manufacturing skills identified by Critical Skills Audits to MACWIC offerings (e.g., tool & diemaking, molding, moldmaking) based on demand
- Expand availability of the simulator technology at Worcester Polytechnic Institute and create new simulations based on employers' machinery

Workforce

Recommendations

Workforce *continued*

- To attract young workers, establish 5S Collaboratives to modernize the workplace environment
  - AMP IT UP could underwrite
  - 5–8 companies each give up one employee
  - Duration: 1–2-day events every 2 weeks times number of participants
    - Each company would lose one employee every other week for 1 day and get the team 1 or 2 days in return
    - Facilitate 5S Blitzes, each lasting 1 or 2 days at each of the collaborating companies
    - Team cleans up shops, shares expertise, improves productivity
    - Employees return with new skills and benchmarks
- Reimburse employers for participating in recognized certification programs
  - Require potential employee to have first-level certification
  - Employer must commit to bring the employee to level 3 or 4 within 12 months
  - MEP would administer the tests and proctor exams
  - Upon achievement of prescribed level, employer would be reimbursed a %age of salary

Workforce

Recommendations

Workforce *continued*

- Increase awareness & interest in manufacturing through activities similar to AMP IT UP that focus on the positive attributes of the NCM region
- Possible additional target audiences:
  - Young married Boston area residents who want to settle down — train service impact has made the area a bedroom community but has not attracted Boston residents to work
  - "Inside the beltway" commuters or downtown residents (commute opposite traffic, takes the same amount of time as a commute from suburban Boston to downtown Boston)
- Offer employer bus service – Picks up employees at the station and drives to various local employers
- To address language barriers, offer training simulators
  - Simulators that train in thousands of languages are now available
  - An area company has video capability with language translation, which could complement Training Within Industry (TWI) offered by MEP
  - Do TWI and leave behind a video with language "switchability" and use a local company
- Create a promotional video similar to Amp It Up! Western Mass:
  - https://vimeo.com/82401695

Access to Market Opportunities

Recommendations

Access to Market Opportunities

- Create CEO roundtable group in North Central and provide access to original equipment manufacturers (OEMs)

  (AIM's CEO Connection can serve as a platform)

- Maintain and grow "Leadership" position in medical device components
  - Utilize MassMedic Resources
  - Rethink sub-assemblies and regional "combined services"
  - Improve higher education relationships
  - Set up a Prototyping and Design Regional Center to provide access to advanced technologies:
    - 3D printing
    - Virtual prototyping software
    - CAD/CAM interface software

Access to Market Opportunities

Recommendations

Access to Market Opportunities

The Massachusetts Medical Device Industry

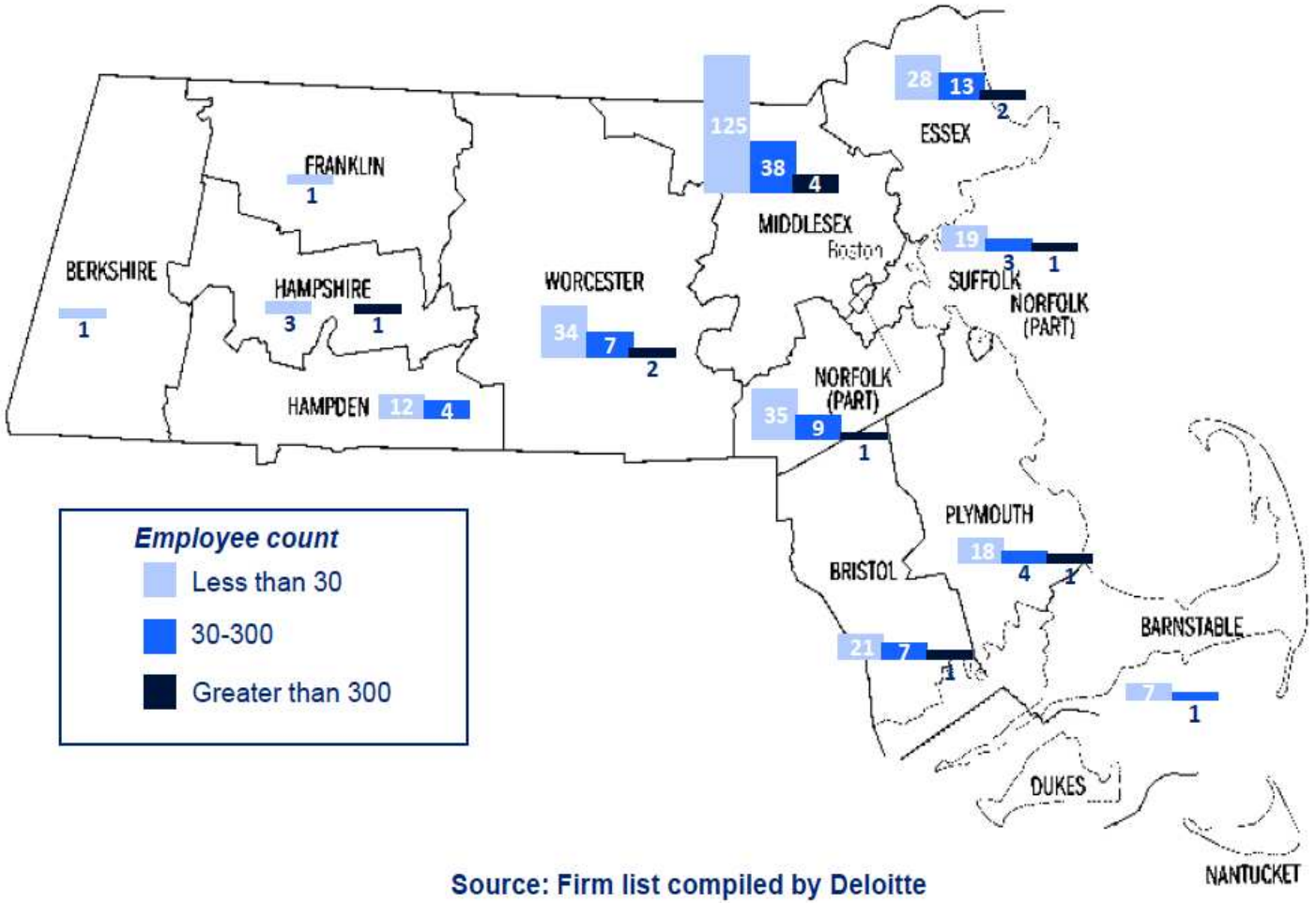
- Massachusetts is home to more than 400 medical device companies, with surgical and medical instrument manufacturers leading the pack
- The Bay State is the second largest employer of people in the medical device industry behind only California, employing 24,268 within seven medical device manufacturing categories. Furthermore, the Massachusetts medical device industry is responsible for creating more than 80,000 jobs in related industries in the state
- While heavily concentrated in Eastern Massachusetts, medical device firms are present in almost all regions of the state
- Massachusetts medical device firms received $286 million, or 12 % of national medical device venture funds in 2010
- Over the past decade Massachusetts medical device exports have been growing at more than twice the rate of the state's exports as a whole
- Medical devices are more than 10 % of the state's total exports and represent $1 out of every $10 of U.S. medical device exports

From the Deloitte study, *The Medical Device Industry in Massachusetts*

Access to Market Opportunities

Recommendations

Medical Device Manufacturers in and around the North Central Region by Size



Source: Firm list compiled by Deloitte

Access to Market Opportunities

Recommendations

Access to Market Opportunities

- Initiate outbound efforts
  - Examples: Fracking, Automotive, Bicycle
  - This effort will provide market intelligence and contacts for target capabilities
- Re-create industry clusters around served markets vs. current industry
  - Would reinvigorate clusters
  - Reduces concerns about meeting with competitors
  - Creates market focus and collaboration along the value chain
  - AIM's Sustainability Roundtable is an example
  - Potential market clusters:
    - Biomedical/Pharma
    - Aerospace/Defense
    - Electronics
    - Packaging

Access to Market Opportunities

Recommendations

Access to Market Opportunities

- Offer Value Opportunity Profile (VOP) services
  - At a reduced rate either individually or as a group with individual follow-up
  - Provides a quality and risk profile for the company's ability to grow
- Increase availability of Technology-Driven Market Intelligence to SMEs
  - Use the Innovation Readiness Profile to determine readiness on the Innovation Scale
  - Selected companies obtain access to RTI TDMI services to conduct focused TDMI projects at a reduced cost to be determined
- Marketing
  - Marketing plan creation and/or evaluation
  - SWOT analysis
  - Market feasibility and competitive analysis
  - Packaging and labeling
  - Market outreach as directed by steering committee

Access to Market Opportunities

Recommendations

Access to Market Opportunities

- Collaborate with MIT to teach Design for Manufacturing concepts to University students/budding technology start-up entrepreneurs (a recommendation from the recent AMP 2.0 meeting at MIT)
  - This expertise is lacking, according to AMP 2.0 participants
  - Opportunity exists to establish relationships and awareness of NCM capabilities
- New Product Exploration
  - Brainstorming: product, process, & use opportunities
  - Proof of concept validation assistance
- New Product Development
  - General design review
  - Engineering and prototyping
  - Design for manufacturing guidance
  - Patent & trademark & legal assistance
- Promote AIM Matchmaking Portal (BuyMass.org)

Access to Technology

Recommendations

Access to Advanced Manufacturing Technology

- Precision Machining
  - Access Eric Hagopian (CEO of Massachusetts Center for Advanced Design and Manufacturing [MCADM]) as an expert in advanced manufacturing issues and opportunities
  - With MCADM no longer in operation, Eric is a great resource and can get involved with the North Central effort
- CAD/CAM Interface
  - MSC Software has offered their CAD/CAM system interface solution
  - Place a seat in Devens for use by SMEs
- 3D Printing
  - Leverage Nypro/Nypromold/Nypro University to teach local molders about the advantages of 3D printing in injection molding

Access to Technology

Recommendations

Access to Advanced Manufacturing Technology

- Seek “Block Grant” type funds from MassDevelopment for appropriate projects
- Establish Life Science Fund Grants as appropriate
- Engage with Greentown to keep start-ups in Massachusetts
- Engage existing collaboratives and technology acceleration centers
  - Advanced Manufacturing Collaborative
  - Green Plastics Initiative
  - UMass Lowell
    - FIBERS – Composites AMTECH Grant (NIST)
    - Plastics Center
    - BioManufacturing Center
    - Emerging Technologies & Innovation Center (ETIC)

Government

Recommendations

Government

- Review taxes and regulations, reduce burden where possible
- Benchmark New York, the only state with an economy that has made the top 20 growing manufacturing states in the US that is not
  - energy related (Southwest),
  - reshoring related (Southeast), or
  - auto related (Michigan/Ohio)

Acknowledgements

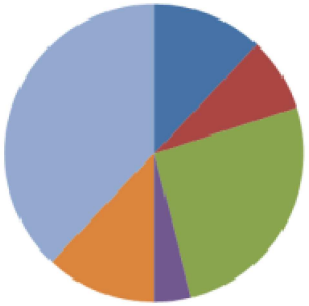
RTI and MassMEP would like to thank the stakeholders whose participation made it possible to complete 50 interviews in a timely manner and who continue to support this effort by contributing their insights to the TDMI.

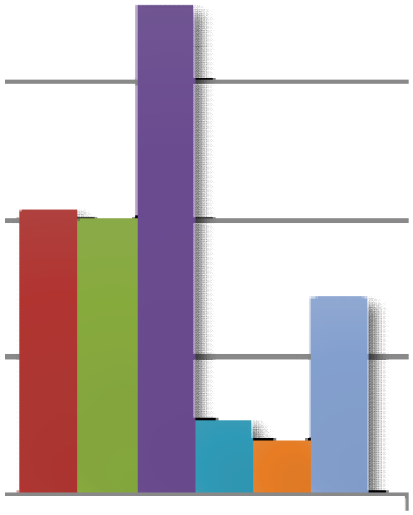
Appendix

COMPLETE SURVEY RESULTS

Appendix Table of Contents

Question-by-question descriptive statistics



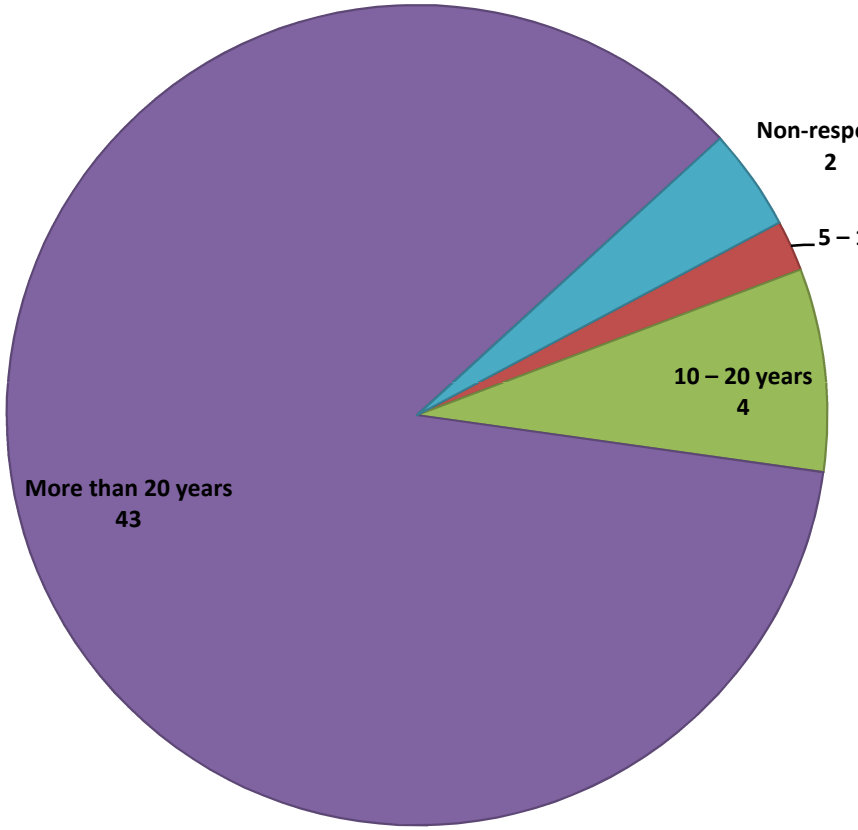


Company Characteristics

Q1

How long have you been in business?

Firm Age



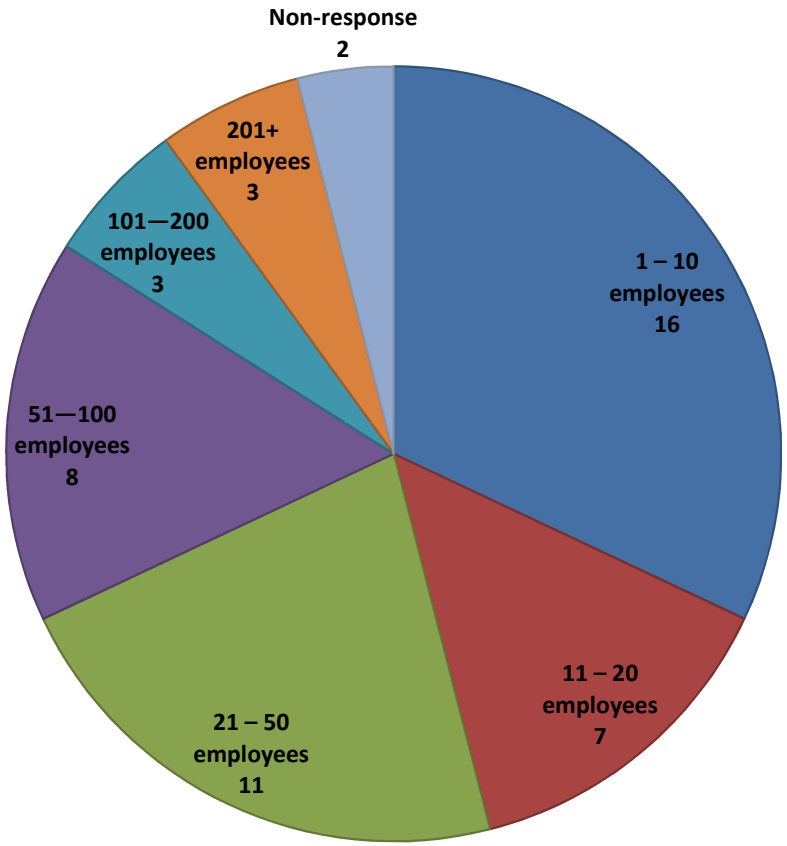
Age	Count of Firms	%
< 5 years	0	0%
5-10 years	1	2%
10-20 years	4	8%
> 20 years	43	86%
Non-reponses	2	4%
Total firms interviewed	50	100%

Company Characteristics

Q2

How many employees do you have?

Firm Size



Number of employees	Count of Firms	%
1 – 10	16	32%
11 – 20	7	14%
21 – 50	11	22%
51—100	8	16%
101—200	3	6%
201+	3	6%
Non-response	2	4%
Total firms interviewed	50	100%

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Company Characteristics

Q3

What types of products do you manufacture? (insert products from website and/or NAICS codes and verify with interviewee)

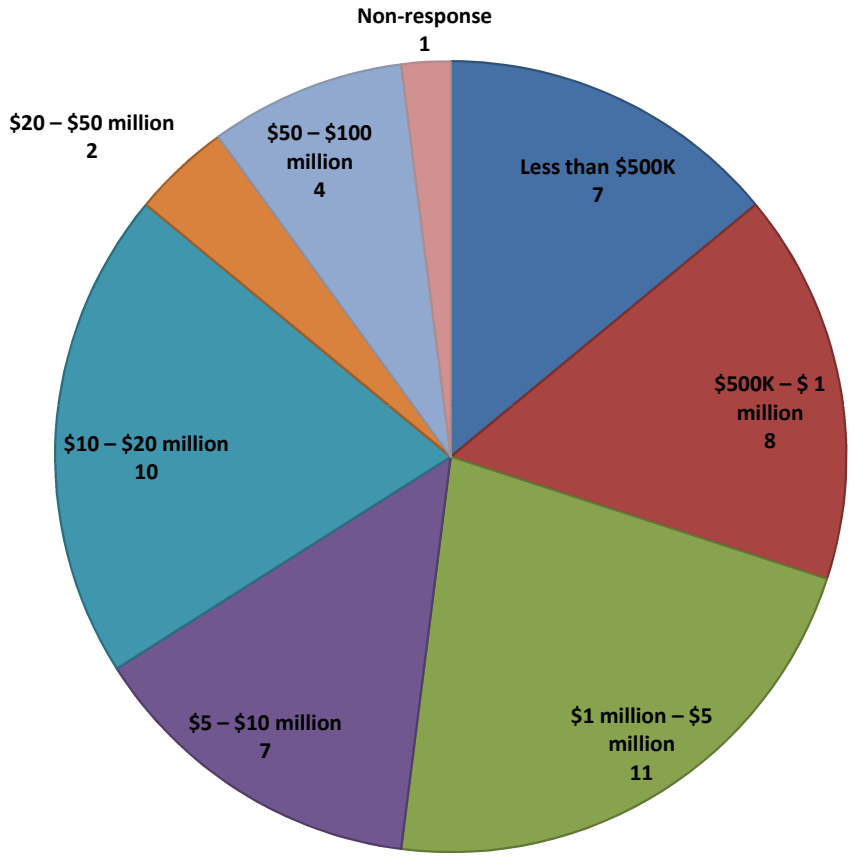
NAICS	Industry	Count of Firms	%
332	Fabricated Metal Product Manufacturing	9	18%
326	Plastics and Rubber Products Manufacturing	8	16%
333	Machinery Manufacturing	8	16%
334	Computer and Electronic Product Manufacturing	4	8%
323	Printing and Related Support Activities	3	6%
331	Primary Metal Manufacturing	3	6%
322	Paper Manufacturing	3	6%
311	Food Manufacturing	2	4%
327	Nonmetallic Mineral Product Manufacturing	2	4%
423	Merchant Wholesalers, Durable Goods	2	4%
312	Beverage and Tobacco Product Manufacturing	1	2%
314	Textile Product Mills	1	2%
335	Electrical Equipment, Appliance, and Component Manufacturing	1	2%
336	Transportation Equipment Manufacturing	1	2%
337	Furniture and Related Product Manufacturing	1	2%
339	Miscellaneous Manufacturing	1	2%
Total		**50**	**100%**

Company Characteristics

Q4

Which range best describes your annual revenues in the last year?

Firm Revenue



Annual Revenue	Count of Firms	%
Less than $500K	7	14%
$500K - $ 1 million	8	16%
$1 million - $5 million	11	22%
$5-$10 million	7	14%
$10-$20 million	10	20%
$20-$50 million	2	4%
$50-$100 million	4	8%
Non-response	1	2%
Total firms interviewed	50	100%

Company Characteristics

Q5

Which phrase best describes your company's ownership?

Company Ownership	Count of Firms	%
Division or wholly owned- subsidiary of a large company	6	12%
Employee stock-owned company	1	2%
Family Owned	13	26%
Limited Liability Company	3	6%
Other	14	28%
Partnership	2	4%
Sole-proprietor	11	22%
Total Firms Interviewed	50	100%

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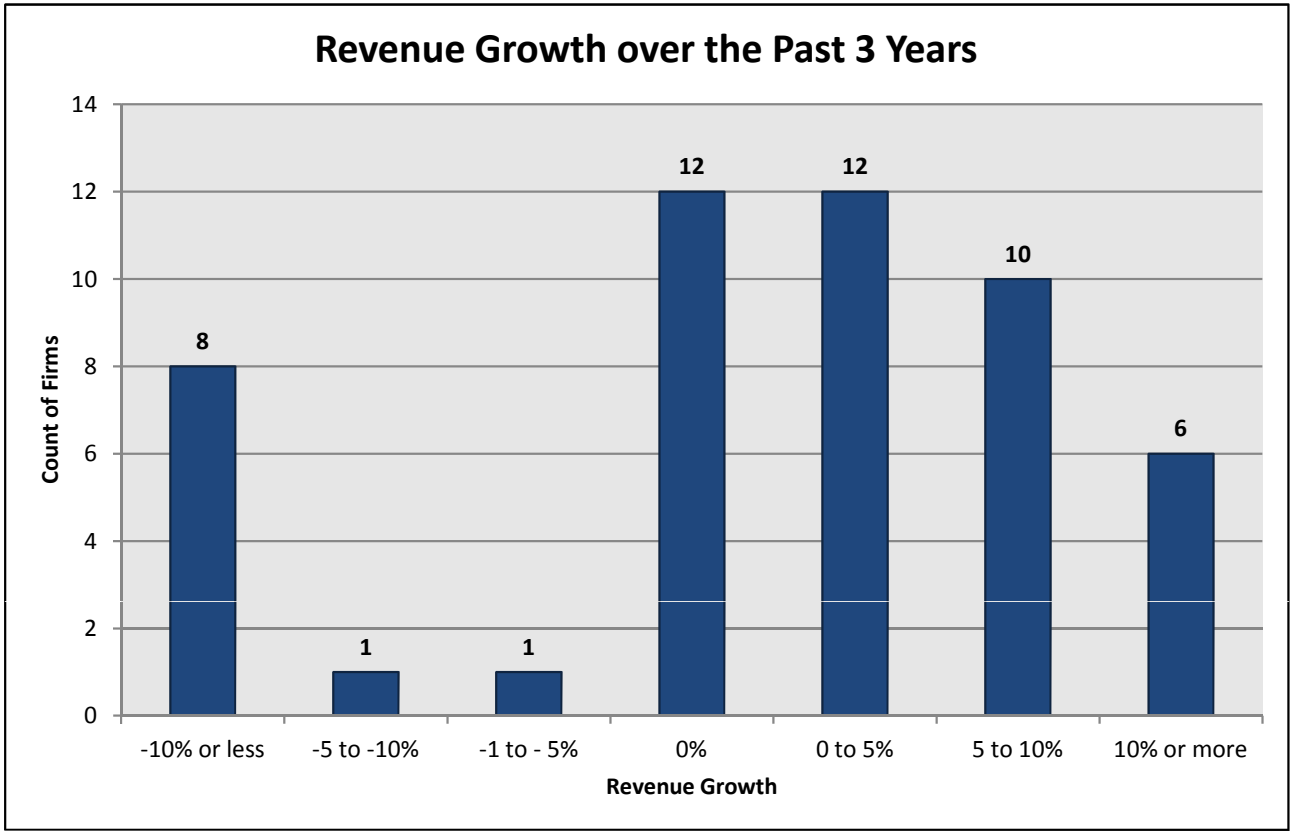
Company Characteristics

Q6

How would you describe your company's revenue growth over the past 3 years?



Revenue growth over past 3 years	Count of Firms	%
-10% or less	8	16%
-5 to -10%	1	2%
-1 to - 5%	1	2%
0%	12	24%
0 to 5%	12	24%
5 to 10%	10	20%
10% or more	6	12%
Total Firms Interviewed	50	100%

Company Characteristics

Q7

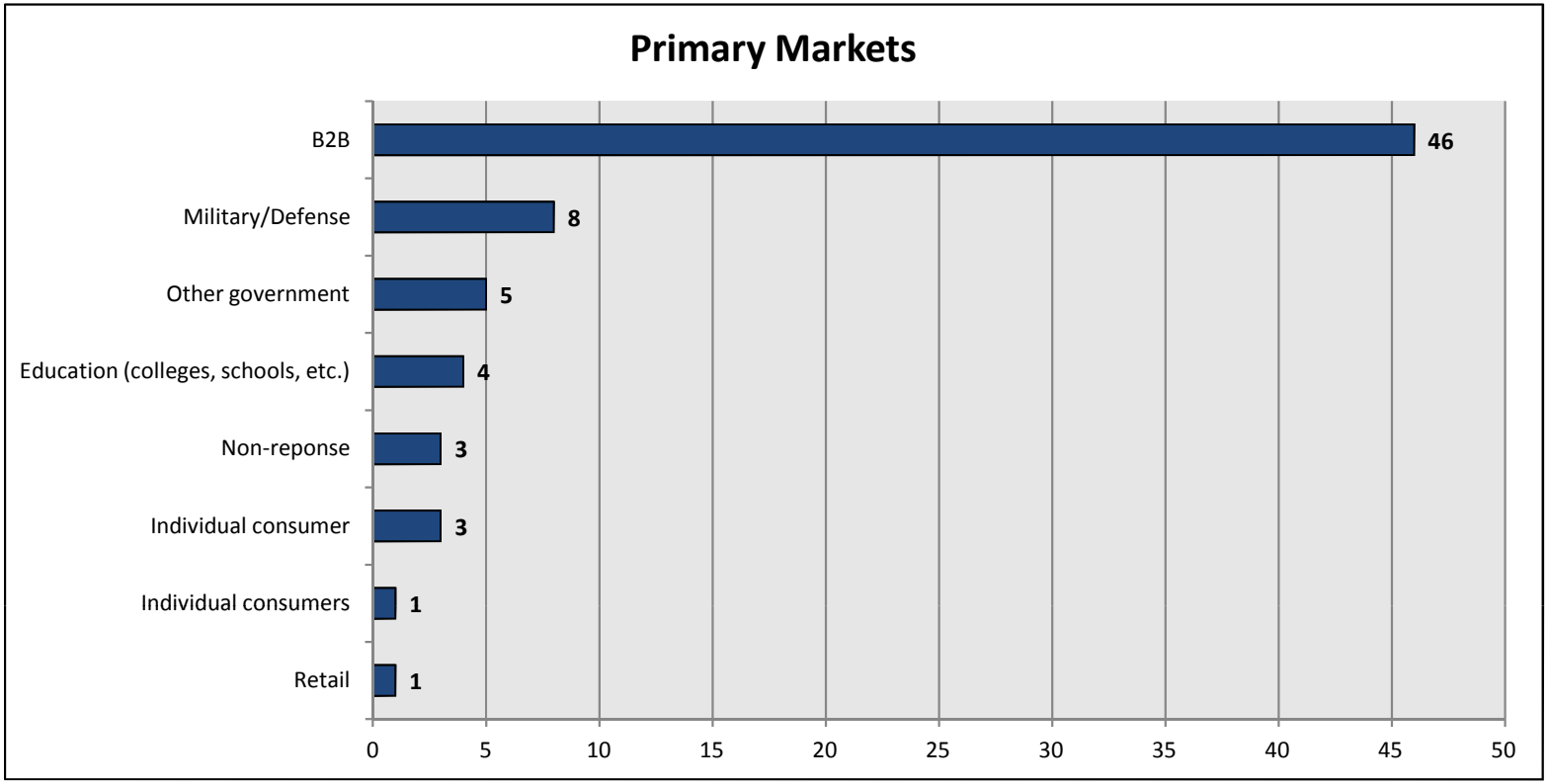
What have been the main factors driving this decline/growth/steady state?

Main Factor Driving Growth/Steady State/Decline	Count of firms
Decline/steady state over the past 3 years	
Recession	7
Globalization	6
Industry trends	3
New ownership	1
Business model	1
Government policy	1
Location	1
Workforce	1
Lack of new products	1
International expansion	1
Subtotal	*23*
Growth over the past 3 years	
Increased demand	5
New / unique products	5
Recession / recovery	3
International expansion / other expansion	2
Leadership	2
Globalization	1
Marketing	1
Industry trends	1
Government policy	1
Quality	1
Higher margin focus	1
Leaner	1
Reputation	1
Investments in technology	1
Expansion	1
Subtotal	*27*
Total firms	50

Company Characteristics

Q8

What are your primary markets? For example, is it military, other government, b2b, or individual consumers?



Market	Total Firms Listing as one of Primary Markets
B2B	46
Military/Defense	8
Other government	5
Education (colleges, schools, etc.)	4
Individual consumer	3
Retail	1
Individual consumers	1
Non-reponse	3

**Note: numbers do not sum to 50 because some firms listed multiple primary markets*

Company Characteristics

Q9

What industries do you serve?

Top 5 industries served by interviewed firms

- Medical and Healthcare (16 firms)
- Electronics (6 firms)
- Military (5 firms)
- Automotive (5 firms)
- Construction (4 firms)

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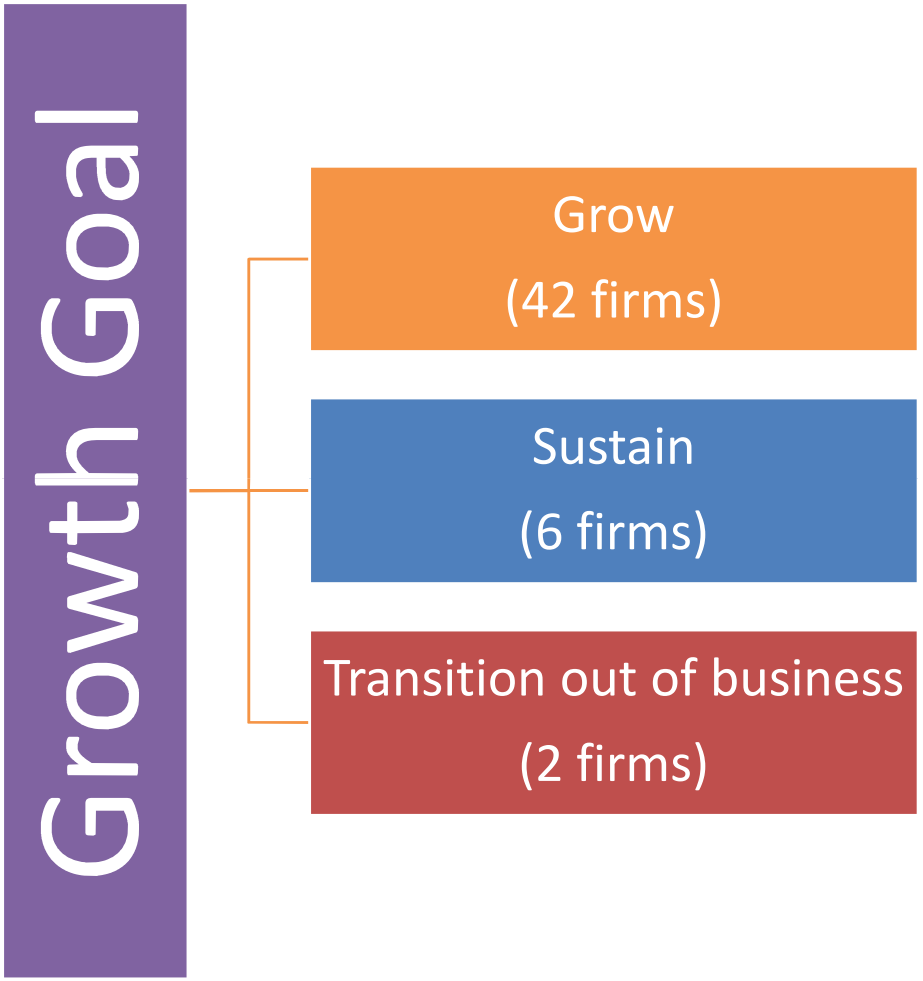
Q10

Which choice best describes your growth goal for your company?



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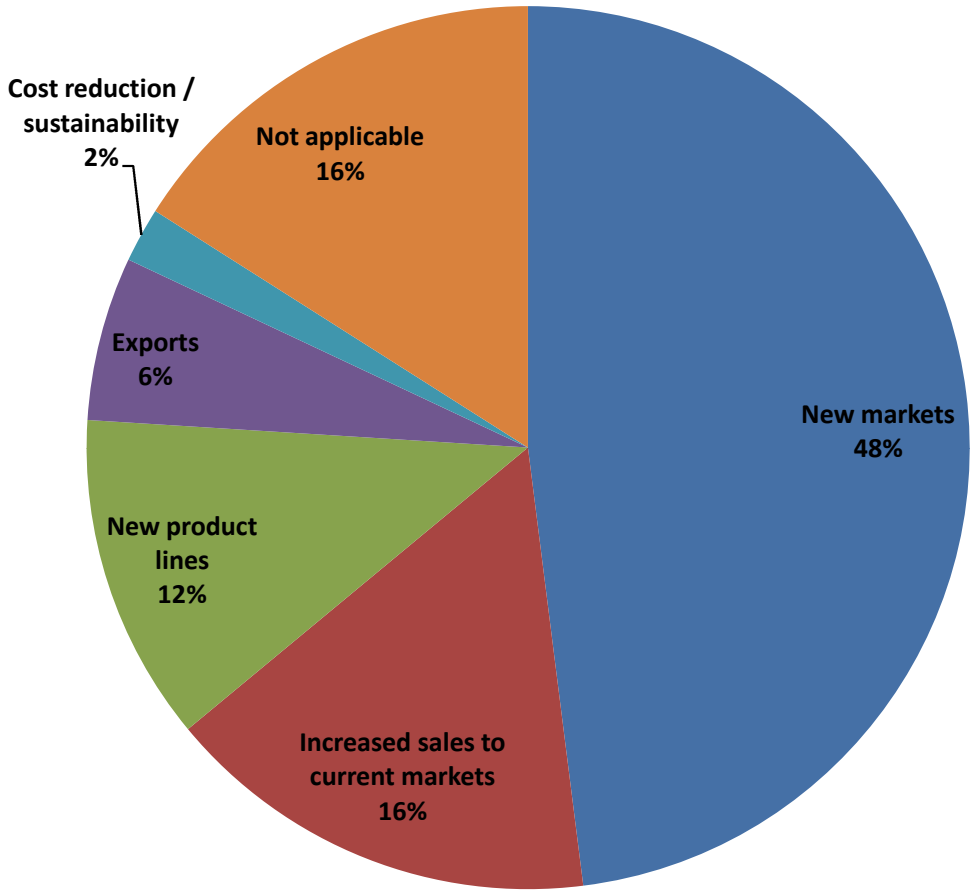
Q12

What is the main way you expect to grow (or add value)?



Expected means of future growth	Count of Firms	%
New markets	24	48%
Increased sales to current markets	8	16%
New product lines	6	12%
Exports	3	6%
Cost reduction / sustainability	1	2%
Not applicable	8	16%
Grand Total	50	100%

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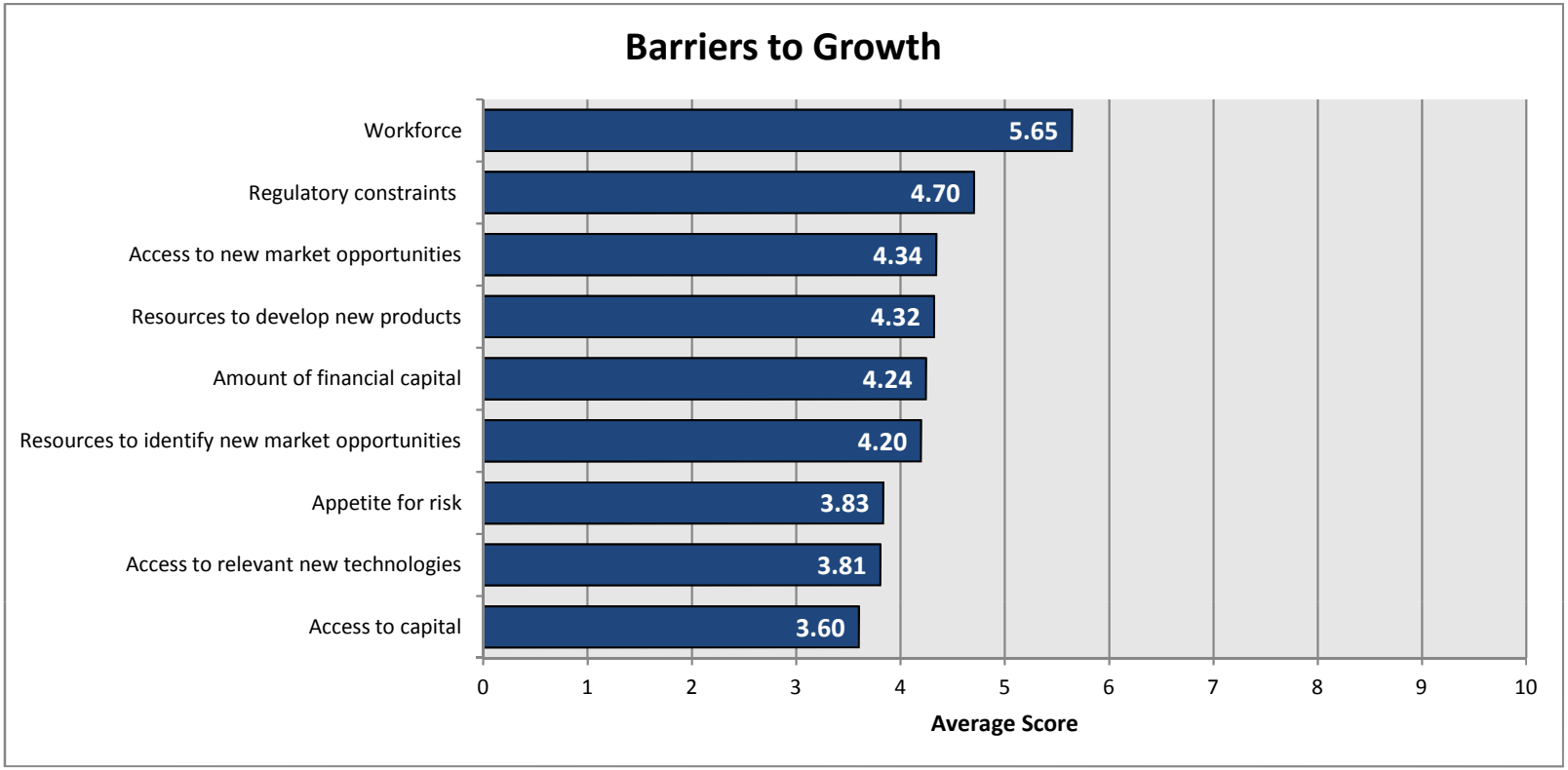
Q13 - Detailed

I will now ask you a question that lists factors that may hinder your ability to grow or add value.

Please respond to each factor with a number on a scale of 1 to 10.

1 = this is not a factor for my company, and

10 = this is a very significant barrier to the growth of my company.



Factor hindering ability to grow or add value	Average	Rank
Workforce	5.65	1
Regulatory constraints	4.70	2
Access to new market opportunities	4.34	3
Resources to develop new products	4.32	4
Amount of financial capital	4.24	5
Resources to identify new market opportunities	4.20	6
Appetite for risk	3.83	7
Access to relevant new technologies	3.81	8
Access to capital	3.60	9

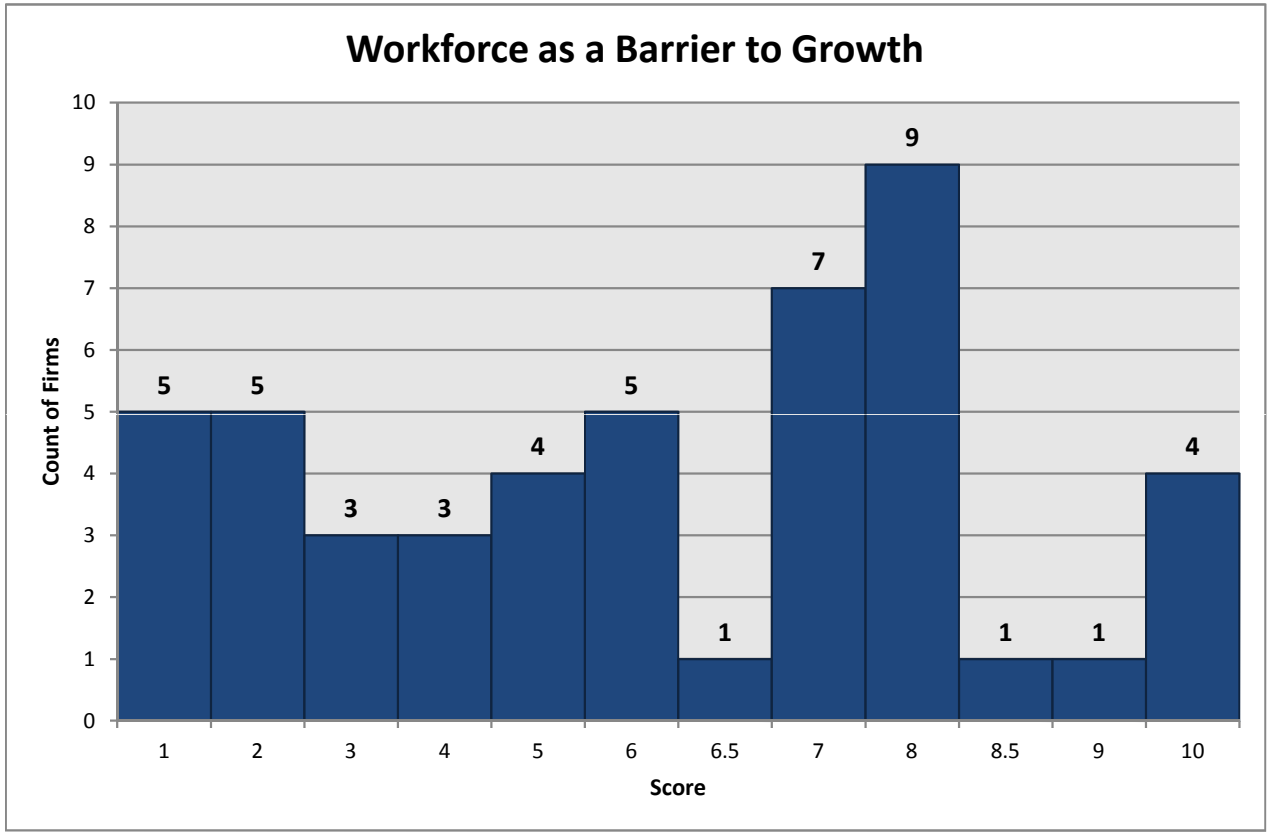
Q13

Workforce as a barrier to growth

Please respond to each factor with a number on a scale of 1 to 10.

1 = this is not a factor for my company, and

10 = this is a very significant barrier to the growth of my company.



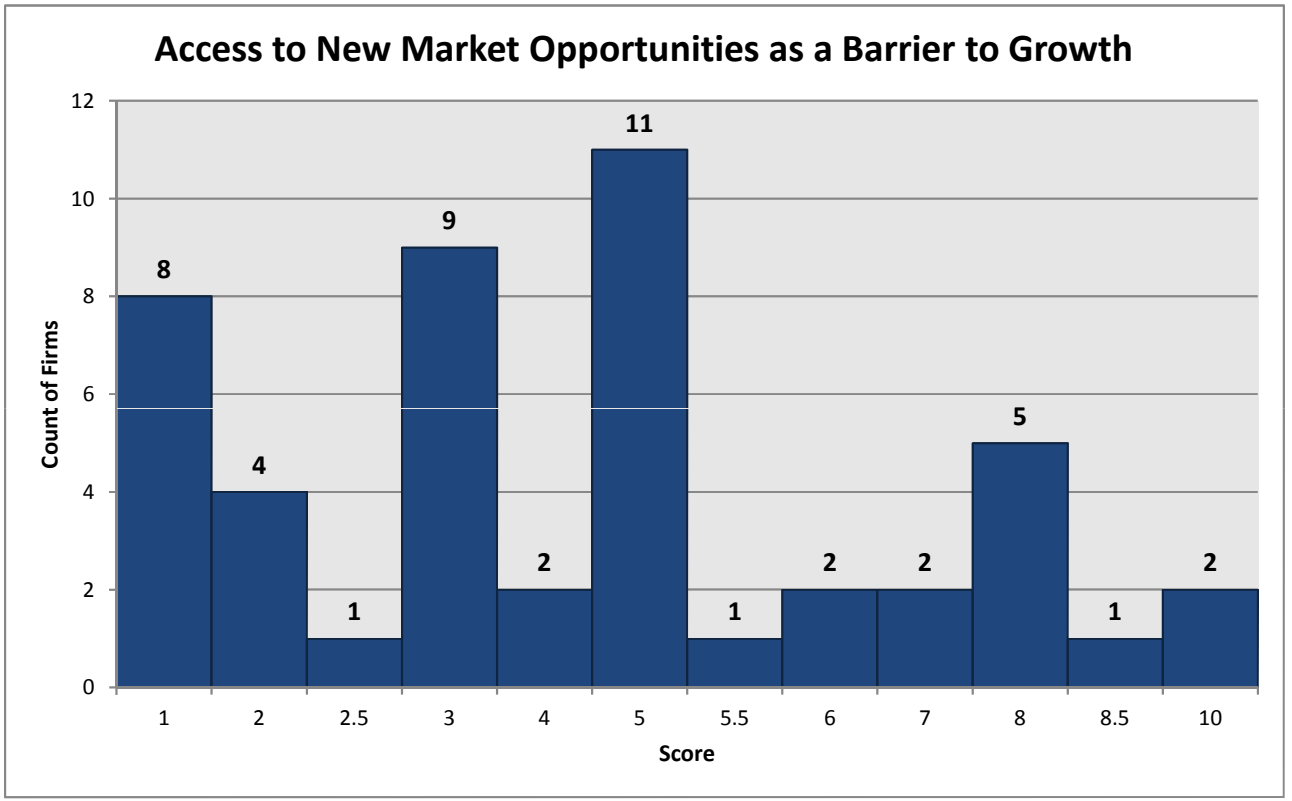
Q13 – Access to new market opportunities

Access to new market opportunities as a barrier to growth

Please respond to each factor with a number on a scale of 1 to 10.

1 = this is not a factor for my company, and

10 = this is a very significant barrier to the growth of my company.



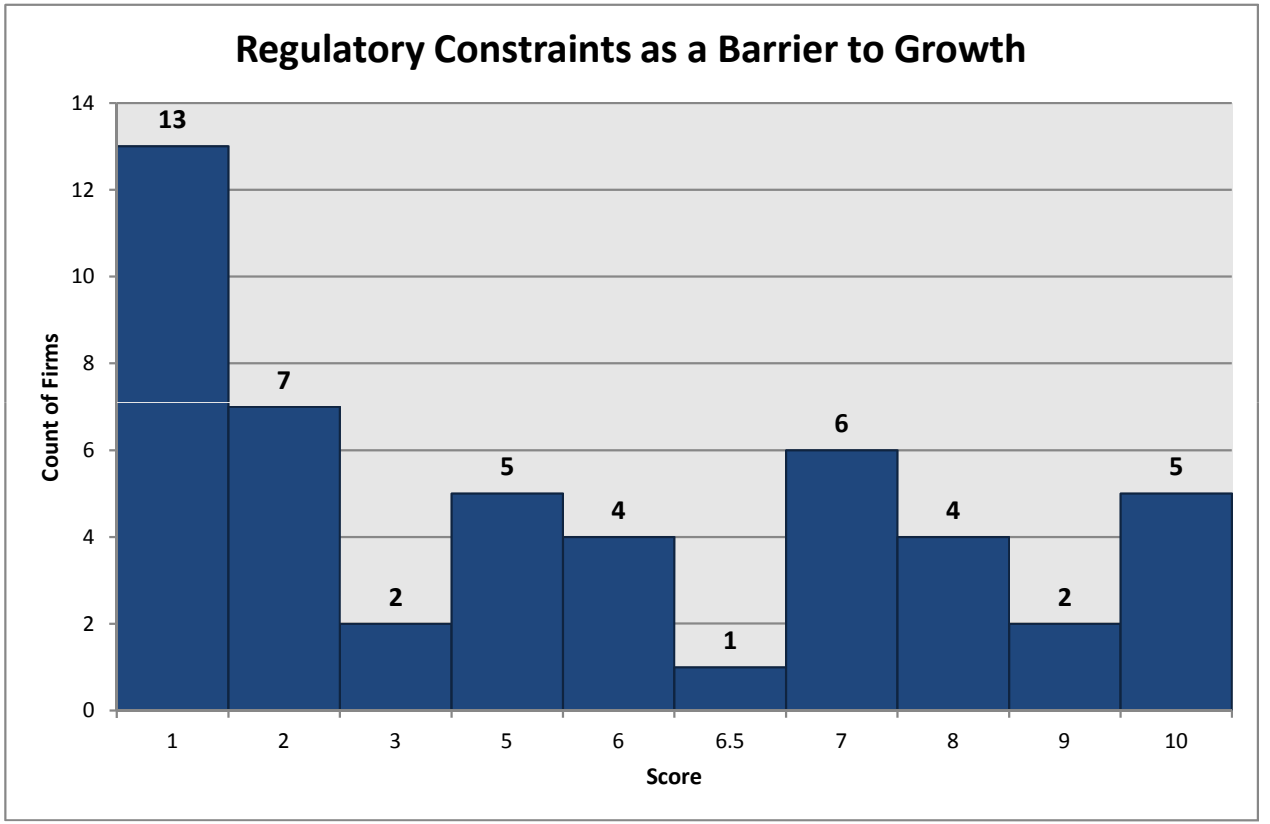
Q13

Regulatory constraints as a barrier to growth

Please respond to each factor with a number on a scale of 1 to 10.

1 = this is not a factor for my company, and

10 = this is a very significant barrier to the growth of my company.



Q14

If you could change one thing about your business that would help create new growth (add value), what would that be?

Change about business to create new growth	Count of Firms	%
Workforce quality	8	16%
Marketing & Sales	7	14%
Regulation	6	12%
New products/markets	5	10%
Invest in new technology	3	6%
Move location	3	6%
Competition	3	6%
Reduce costs	3	6%
Market stability	2	4%
Leadership	1	2%
Financial capacity	1	2%
Obtain certifications	1	2%
Non-response	7	14%
Total	50	100%

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Q15

If you could change one thing about the business environment that you think would help you be more competitive in global markets, what would that be?

Change about the business environment	Count of Firms
Costs like healthcare, unemployment insurance, minimum wage, etc. are burdensome	15
Trade regulation	13
Tax structure	6
Other	5
MA not "business friendly" state	4
Energy costs	1
Cuts in gov't funding	1
Site appropriate regulation	1
Would not change anything	11

**Numbers do not sum to 50 because some firms gave multiple answers*

Q16

Does the quality of the area workforce pose any specific challenges for hiring and/or worker performance at your company? If so, please describe.

Area workforce challenges	Count of Firms
Lack of skilled labor	18
High school grad. quality, lack of interest, stigma	11
Competition for labor	4
Lack of soft skills	3
Other	3
Aging workforce	1
Language barriers	1
No workforce challenges	16

**Numbers do not sum to 50 because some firms gave multiple answers*

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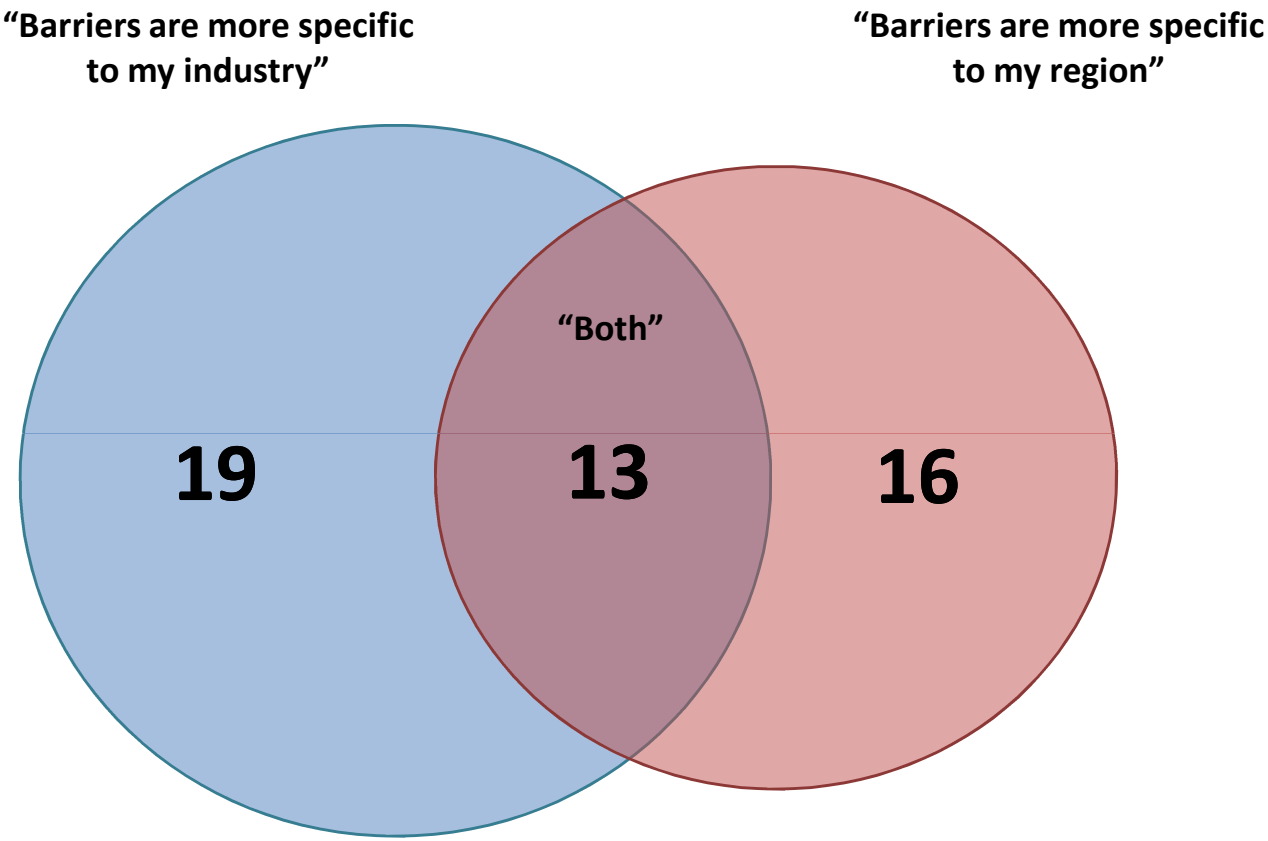
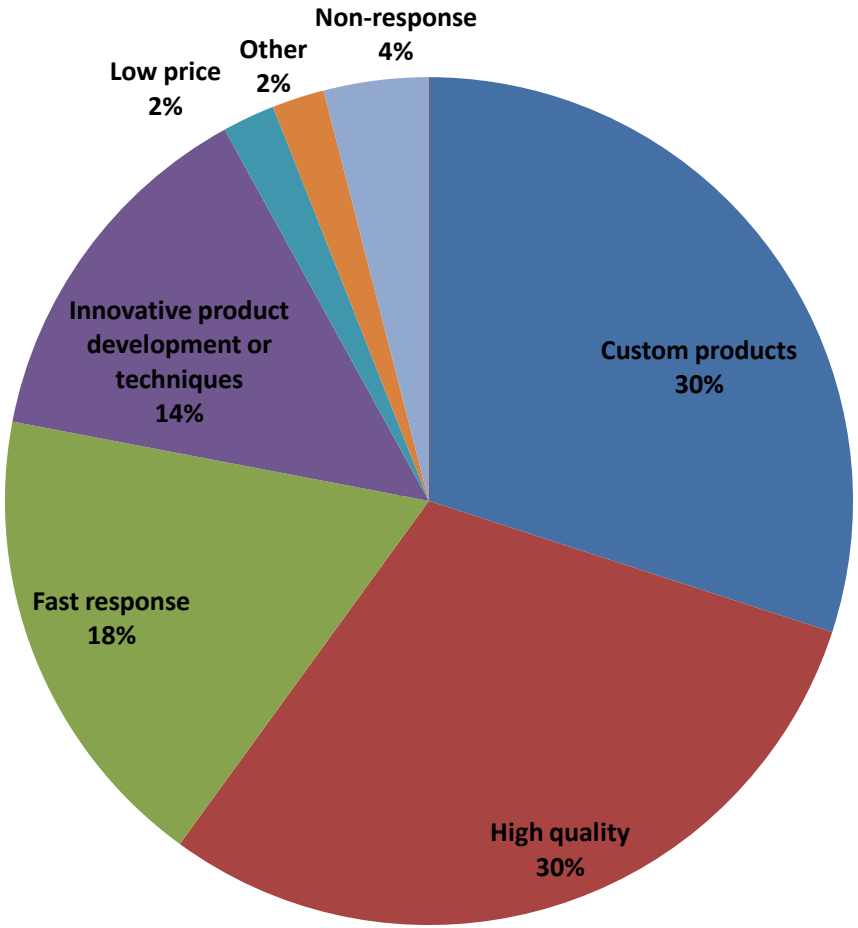
Q17

Do you find that barriers to growth are more specific to your industry? Or to the region where you are operating? Or both?



Q18

Which of these phrases best describes your business strategy?



Industry	Count of Firms	%
Custom products	15	30%
High quality	15	30%
Fast response	9	18%
Innovative product development or techniques	7	14%
Low price	1	2%
Other	1	2%
Non-response	2	4%
Total	50	100%

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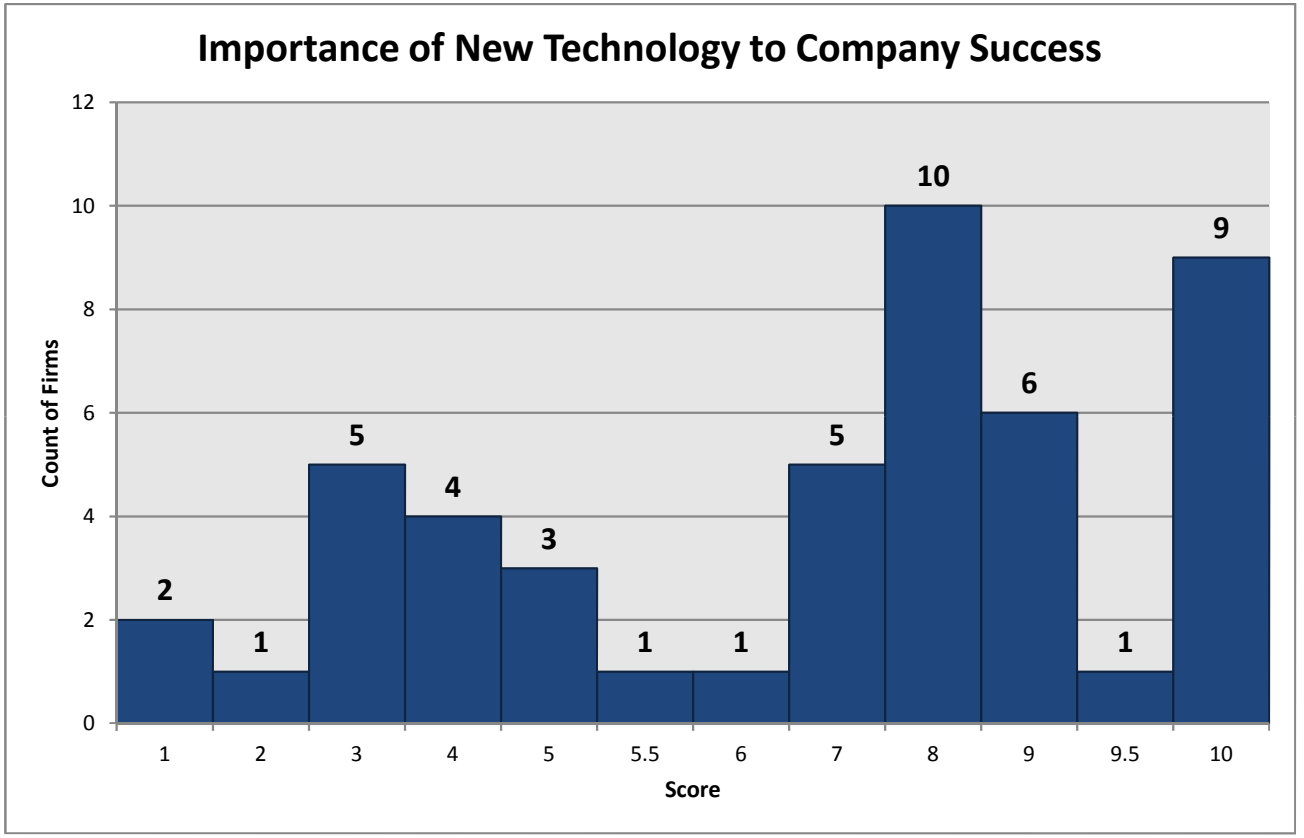
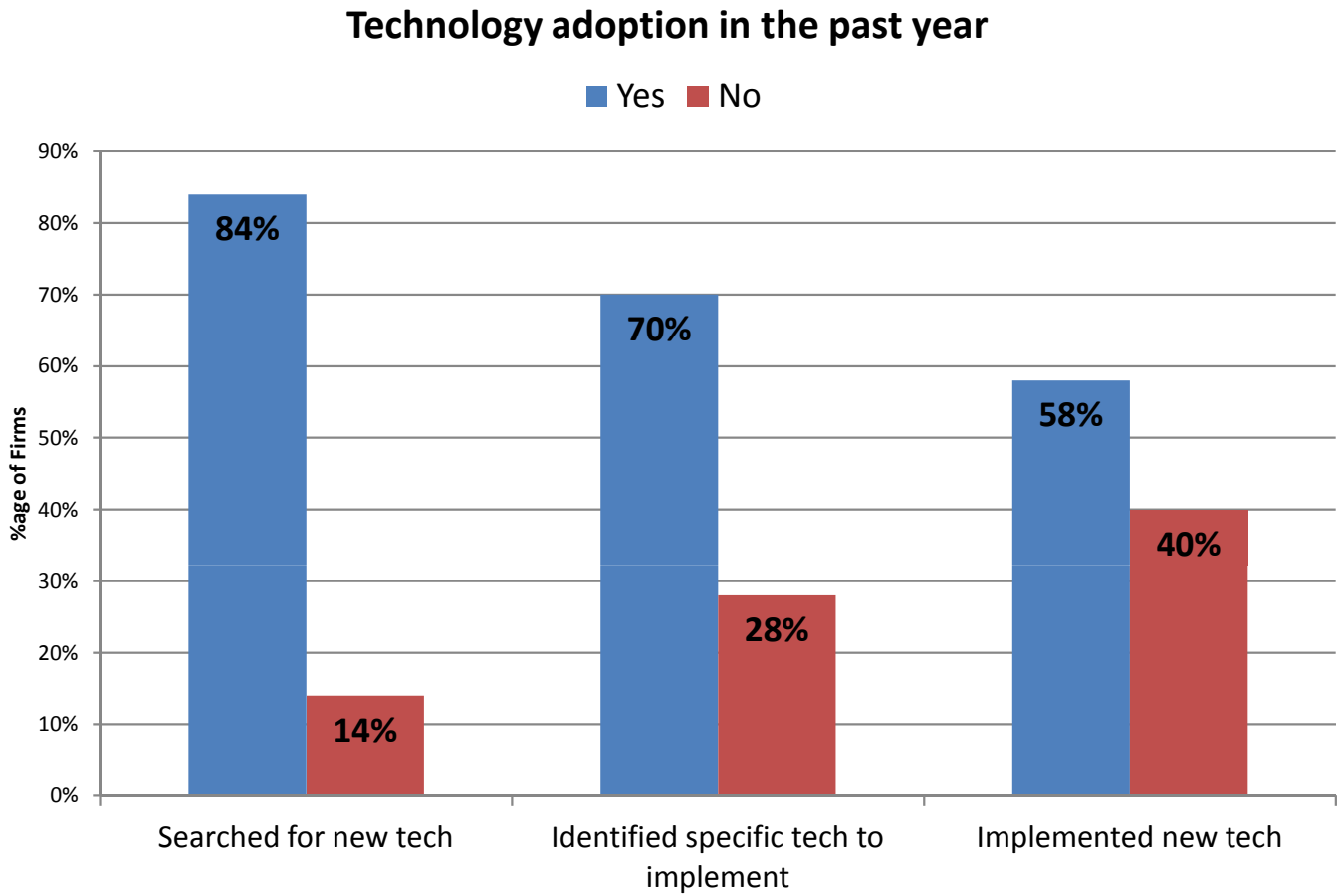
Q19

On a scale of 1 to 10 with 1 being not important at all and 10 being extremely important, how important is new technology and technology adoption to your company's success?



Q20

In the past year have you …



	Yes	No	N/A
Searched for new tech	84%	14%	2%
Identified specific tech to implement	70%	28%	2%
Implemented new tech	58%	40%	2%

Q21

What concerns do you have in investing in new technologies?

Concern	Count of Firms	%
Cost and ROI	12	24%
Will it work	9	18%
None	5	10%
Cost of capital	6	12%
Rapid development	4	8%
N/A	4	8%
Business decline/uncertainty	4	8%
Implementation	2	4%
Other	4	8%
Total	50	100%

Q22

Have you accessed services from regional manufacturing support entities in the past year?

If yes, what organizations did you work with? What services did you receive?

Please rate these services on a scale from 1 to 10.

Accessed regional manufacturing support services in the last year	Count of Firms	%
No	26	52%
Yes	18	36%
N/A	6	12%
Total	50	100%

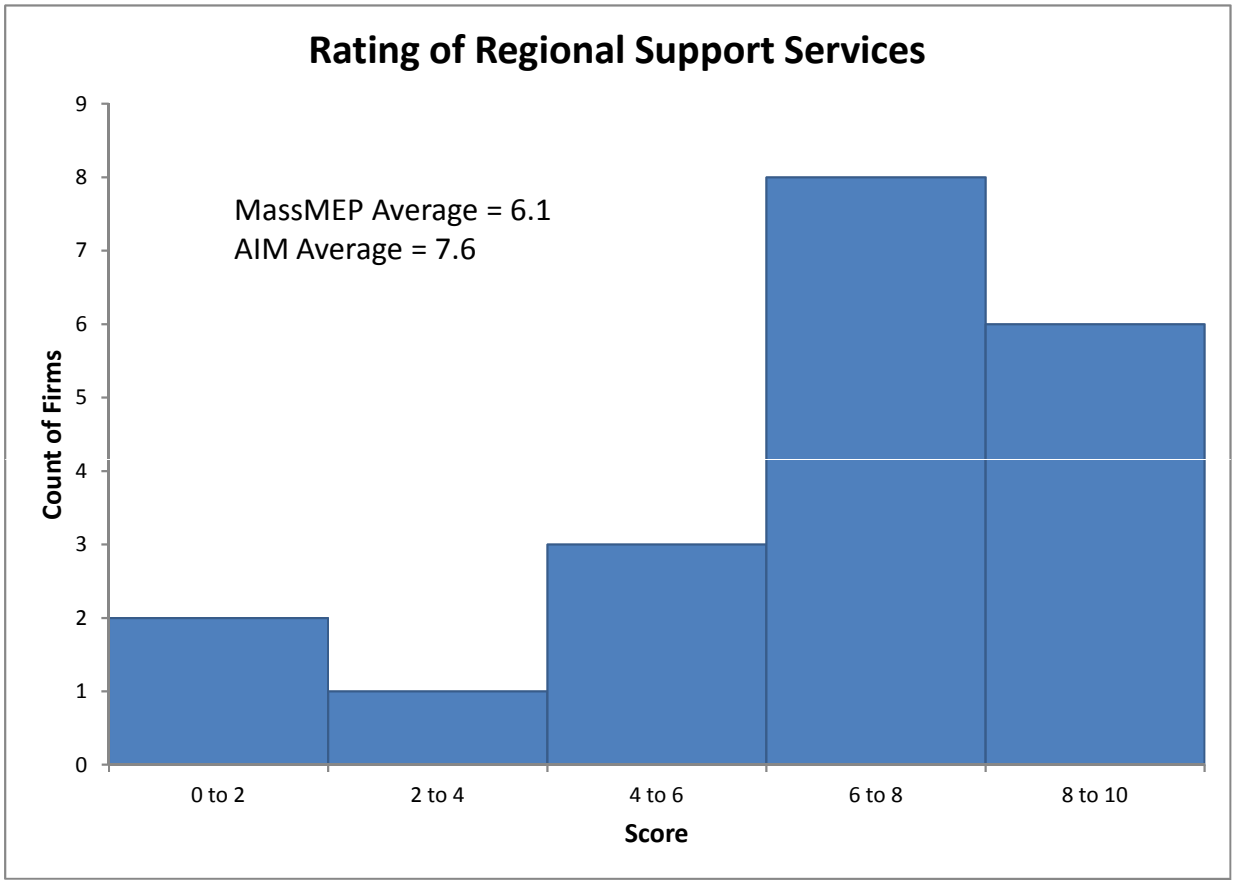
	Worked with Mass MEP	Did not work with Mass MEP
Worked with AIM	6	5
Did not work with AIM	5	34

Q22 Cnt'd

Have you accessed services from regional manufacturing support entities in the past year?

If yes, what organizations did you work with? What services did you receive?

Please rate these services on a scale from 1 to 10.



Q23

If you could change 1 to 3 things about these kinds of support organizations and the services they provide, what would they be?

Change about regional support entities	Count of Firms
More outreach about service offerings	7
Workforce / training / employment services	7
Tailored advice / personalized interactions	6
More assistance for small businesses	5
Change nothing	4
More funding	3
Decreased administrative burden attached to using services	3
Better coordination among regional manufacturing support entitie	2
Lobbying	1

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Q24

Are there support services critical to your business that are NOT currently being provided in your area? If so, what are they?

Services NOT being offered	Count of Firms
Workforce training / education	5
No additional services needed	5
Advocacy/Policy	3
Regulatory assistance	3
Employment services	2
Technology advice/implementation	2
B2B services	1
Niche tailored advice	2
Services offered, but too cumbersome to use	2
Quality implementation	1
Language training	1
Certification support (AS91000)	1
Marketing assistance	1

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Q25

What is your greatest concern regarding the future of your company?

Greatest concern about future of company	Count of Firms
Workforce	16
Growth	4
Healthcare	4
Economy	4
Technology	4
Competition	3
Demand	3
Survival	3
Financial stability	2
Tax	2
Input supply	2
New products	2
None	2
Succession plan	2
Policy	1
International trade	1
Business climate	1
Risk	1
Potential closure	1
New markets	1
Safety	1
Costs	1
Wastewater	1
Regulation	1

**Numbers do not sum to 50 because some firms gave multiple answers*

Cross-tabulations

	Count of Firms	Access to new market opportunities	Access to relevant new technologies
All Firms	50	4.3	3.7
By Firm Revenue			
Less than $500K	7	3.9	5.1
$500K - $ 1 million	8	5.8	3.6
$1 million - $5 million	11	4.2	3.0
$5-$10 million	7	2.7	3.1
$10-$20 million	10	5.2	4.8
$20-$50 million	2	4.0	3.0
$50-$100 million	4	2.7	2.8
Non-response	1	2.0	2.0

Q6 & Q7

Companies who had steady or declining revenues cited the following as the main factors

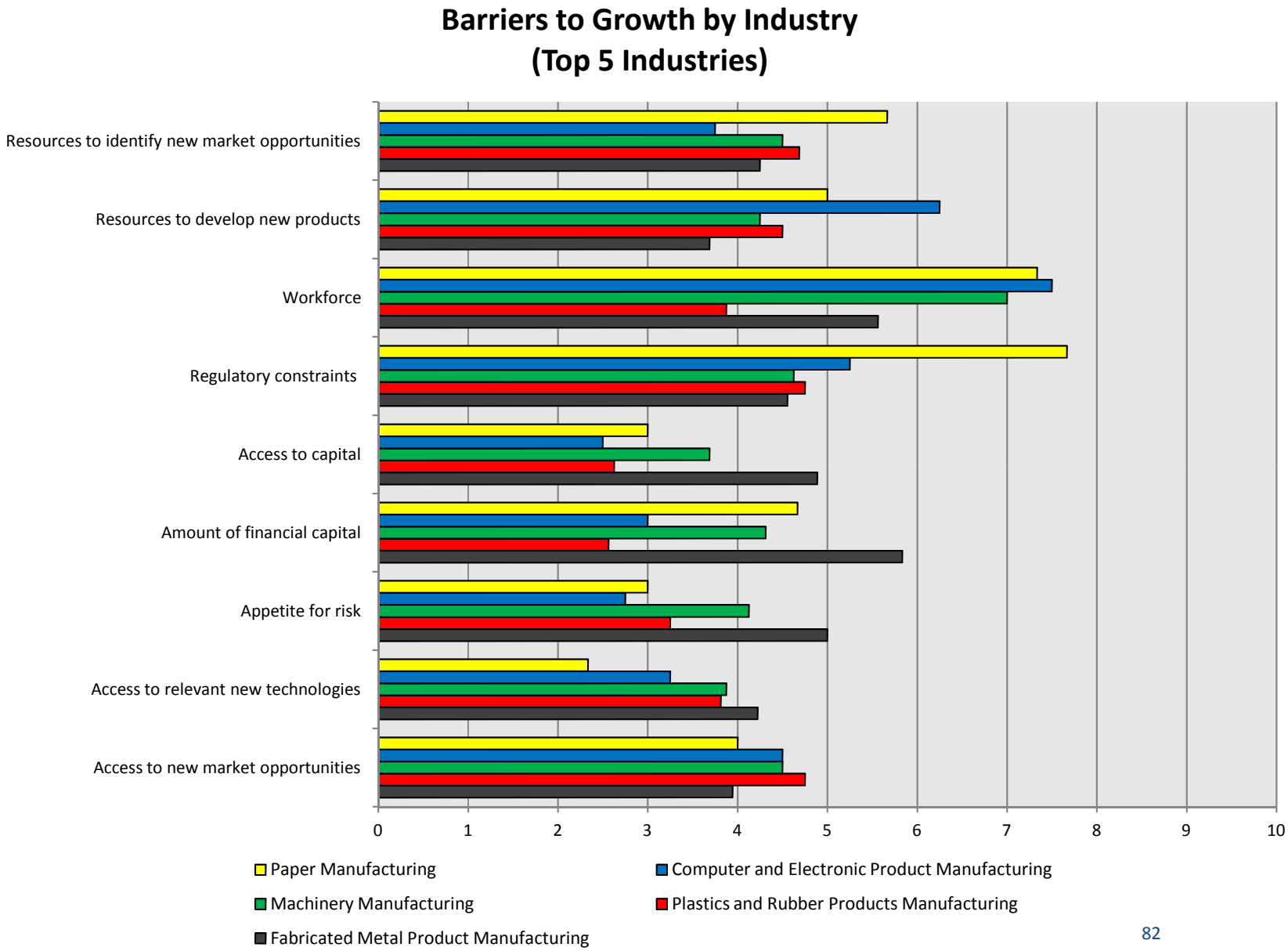
- The recession (7)
- Globalization (6)
- Industry trends (3)

Companies who experienced revenue growth over the last three years cited the following as the main factors

- Increased demand and a recovering economy (8)
- New and unique products (5)
- International expansion (2)

Q13 by industry

On a scale of 1 to 10 with 1 being not important at all and 10 being extremely important, how important is new technology and technology adoption to your company's success?



Q13 – by firm size

I will now ask you a question that lists factors that may hinder your ability to grow or add value.

Please respond to each factor with a number on a scale of 1 to 10.

1 = this is not a factor for my company, and

10 = this is a very significant barrier to the growth of my company.

		Factors that may hinder ability to grow or add value								
	Count of Firms	Access to new market opportunities	Access to relevant new technologies	Appetite for risk	Amount of financial capital	Access to capital	Regulatory constraints	Workforce	Resources to develop new products	Resources to identify new market opportunities
All Firms	50	4.3	3.7	3.7	4.2	3.5	4.6	5.4	4.2	4.0
By Firm Size										
1 – 10	16	4.8	4.5	4.2	4.8	4.1	4.1	4.8	4.3	4.8
11 – 20	7	3.3	2.1	2.4	3.9	3.2	3.4	4.3	2.2	2.7
21 – 50	11	4.1	2.8	3.7	4.1	3.7	6.1	6.4	5.0	3.8
51—100	8	4.9	5.8	3.9	3.9	3.0	3.9	5.4	4.4	3.5
101—200	3	3.7	3.3	4.7	1.7	3.0	4.0	4.7	3.7	4.0
201+	3	2.5	2.3	2.7	4.7	3.0	6.3	7.3	4.0	3.7
Non-response	2	4.5	2.5	3.0	4.0	2.5	5.5	7.0	5.0	6.5

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Q13 – by firm age

I will now ask you a question that lists factors that may hinder your ability to grow or add value.

Please respond to each factor with a number on a scale of 1 to 10.

1 = this is not a factor for my company, and

10 = this is a very significant barrier to the growth of my company.

		Factors that may hinder ability to grow or add value								
	Count of Firms	**Access to new market opportunities**	**Access to relevant new technologies**	**Appetite for risk**	**Amount of financial capital**	**Access to capital**	**Regulatory constraints**	**Workforce**	**Resources to develop new products**	**Resources to identify new market opportunities**
All Firms	50	4.3	3.7	3.7	4.2	3.5	4.6	5.4	4.2	4.0
By Firm Age										
< than 5 years	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-10 years	1	5.0	2.0	8.0	5.0	2.0	1.0	8.0	1.0	7.0
10-20 years	4	3.3	3.5	4.3	3.0	2.8	5.0	5.3	3.0	2.0
> 20 years	43	4.4	3.9	3.7	4.4	3.8	4.6	5.4	4.3	4.3
Non-response	2	2.5	0.5	0.5	0.5	0.5	5.0	5.0	5.0	1.0

RTI INTERNATIONAL

Q13 – by firm revenue

I will now ask you a question that lists factors that may hinder your ability to grow or add value.

Please respond to each factor with a number on a scale of 1 to 10.

1 = this is not a factor for my company, and

10 = this is a very significant barrier to the growth of my company.

		Factors that may hinder ability to grow or add value								
	Count of Firms	Access to new market opportunities	Access to relevant new technologies	Appetite for risk	Amount of financial capital	Access to capital	Regulatory constraints	Workforce	Resources to develop new products	Resources to identify new market opportunities
All Firms	50	4.3	3.7	3.7	4.2	3.5	4.6	5.4	4.2	4.0
By Firm Revenue										
Less than $500K	7	3.9	5.1	4.9	6.5	5.3	4.3	4.4	4.5	4.4
$500K - $ 1 million	8	5.8	3.6	3.9	4.3	3.8	4.1	4.8	3.6	4.4
$1 million - $5 million	11	4.2	3.0	2.7	4.5	3.8	4.2	5.8	2.9	3.6
$5-$10 million	7	2.7	3.1	3.0	3.6	2.6	5.1	6.5	5.7	4.0
$10-$20 million	10	5.2	4.8	4.5	3.3	3.1	5.3	5.3	5.0	4.2
$20-$50 million	2	4.0	3.0	3.0	2.0	4.0	2.0	6.0	5.0	5.5
$50-$100 million	4	2.7	2.8	4.0	3.8	2.5	6.8	6.0	3.3	3.0
Non-response	1	2.0	2.0	1.0	1.0	1.0	2.0	4.0	3.0	2.0

RTI INTERNATIONAL

Q21

On a scale of 1 to 10 with 1 being not important at all and 10 being extremely important, how important is new technology and technology adoption to your company's success?

	Count of Firms	Importance of New Technology and Technology Adoption to Company Success
All Firms	48	6.9
By Firm Size		
1 – 10	16	7.1
11 – 20	7	5.4
21 – 50	11	7.0
51—100	8	7.4
101—200	3	8.3
201+	3	4.7
Non-response	2	9.3
By Firm Age		
< 5 years	0	n/a
5-10 years	1	10.0
10-20 years	4	8.8
> 20 years	41	6.7
Non-response	2	6
By Firm Revenue		
Less than $500K	7	5.7
$500K - $ 1 million	8	8.1
$1 million - $5 million	11	5.2
$5-$10 million	7	8.7
$10-$20 million	10	7.5
$20-$50 million	2	8.5
$50-$100 million	4	5.5
Non-response	1	10.0

Q21 – by industry

On a scale of 1 to 10 with 1 being not important at all and 10 being extremely important, how important is new technology and technology adoption to your company's success?

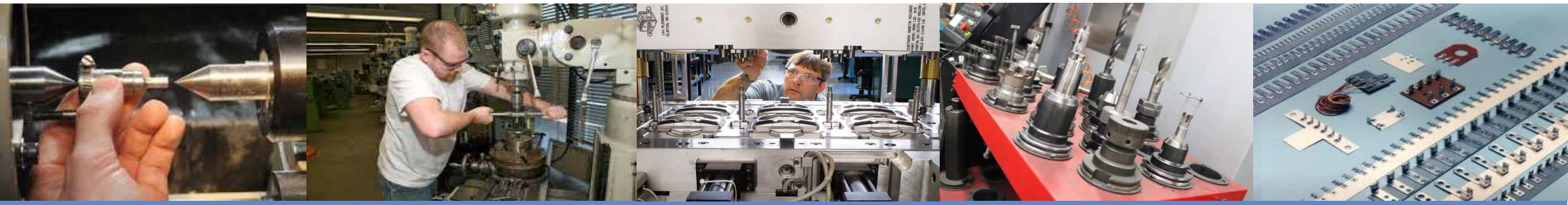
NAICS	Industry	Count of Firms	Importance of New Technology and Technology Adoption to Company Success
Top 5 industries			
332	Fabricated Metal Product Manufacturing	9	5.8
333	Machinery Manufacturing	8	7.9
326	Plastics and Rubber Products Manufacturing	7	8.7
334	Computer and Electronic Product Manufacturing	4	8.3
322	Paper Manufacturing	3	6.8
	Top 5 industries (combined)	**31**	**7.4**
	All other industries	17	5.9
	Overall average	48	6.9

**Note: 2 firms did not answer this question*

END VOLUME 1

COLLABORATIVE MANUFACTURING COMMUNITIES GROWTH INITIATIVE (CMCGI)

FOR THE NORTH CENTRAL MASSACHUSETTS REGION



Volume 2: Technology-Driven Market Intelligence Report

January 5, 2015

***Please Note*:** This report is a good faith effort by RTI to accurately represent information available via secondary and primary sources at the time of the information capture. The report is not for publication or public disclosure.

Table of Contents

Volume 2

Funding

Project Background

USDA Rural Business Opportunity Grants (RBOG) Program Objective: to promote sustainable economic development in rural communities with exceptional needs

- Grants are awarded on a competitive basis
- Grant funds must be used for projects in rural areas and can be used for the following:
  - Community economic development
  - Technology-based economic development
  - Feasibility studies and business plans
  - Leadership and entrepreneur training
  - Rural business incubators
  - Long-term business strategic planning

Goal

Project Background

CCMGI Goal: To establish a "collaborative manufacturing community“ that will enable sustained growth in the region

Massachusetts Advanced Manufacturing COLLABORATIVE

mac WORKFORCE | INNOVATION | COLLABORATIVE

aim Associated Industries of Massachusetts

NORTH CENTRAL MASSACHUSETTS MADE AFFORDABLE

MassMEP Manufacturing Extension Partnership YOUR RESOURCE FOR MANUFACTURING GREATNESS

NORTH CENTRAL MASSACHUSETTS WORKFORCE INVESTMENT BOARD

MassDevelopment

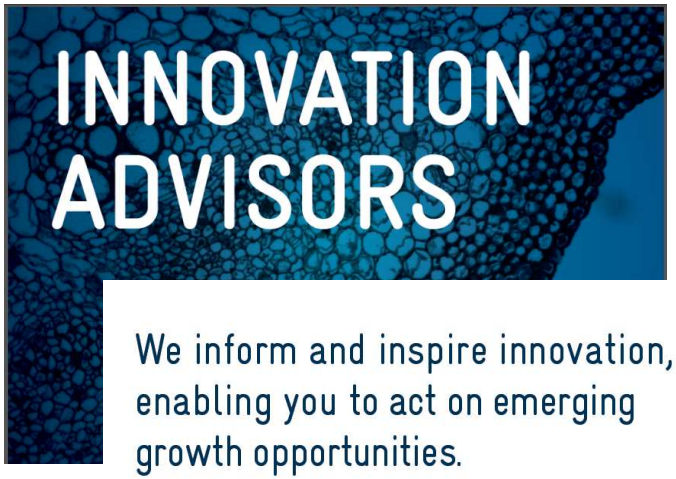
UMASS DONAHUE INSTITUTE

RTI INTERNATIONAL

Core Team

Project Background

RTI and MassMEP worked closely to interview manufacturers and develop recommendations, and continue to investigate market opportunities



We inform and inspire innovation, enabling you to act on emerging growth opportunities.

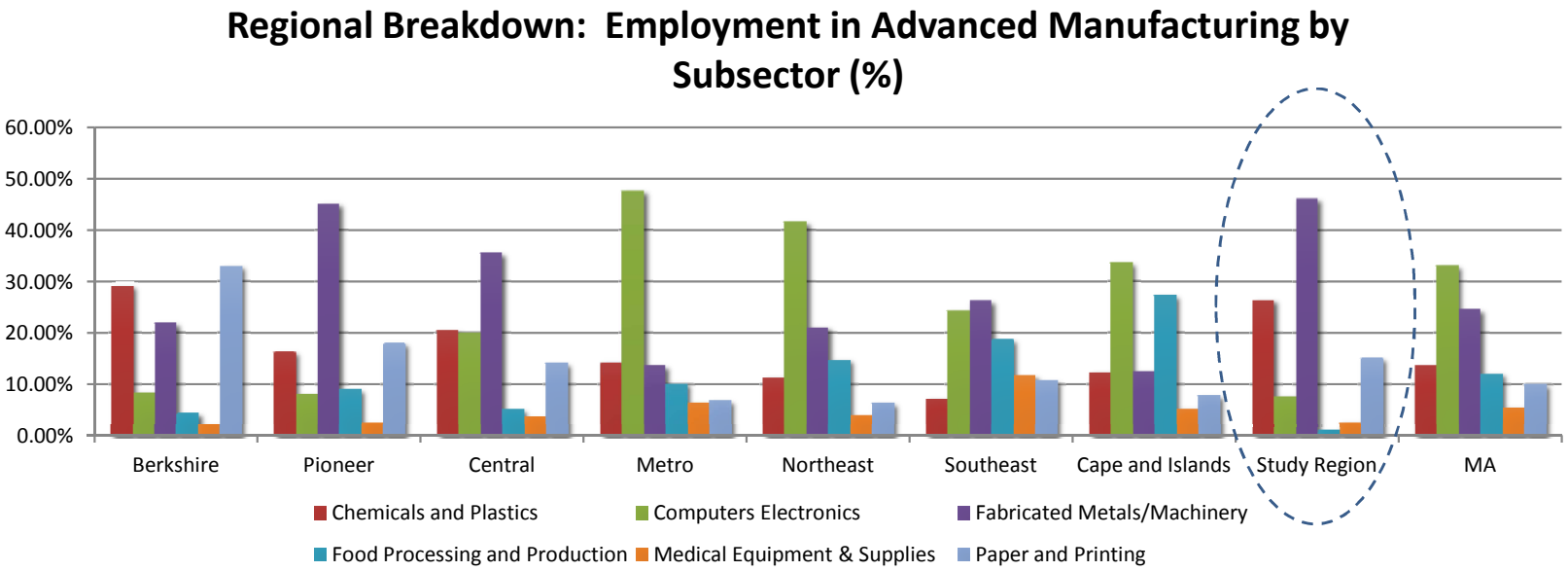
INSPIRED EXPLORED ENABLED EMPOWERED DEPLOYED

MassMEP
Manufacturing Extension Partnership
YOUR RESOURCE FOR MANUFACTURING GREATNESS

Why NCM?

Project Background

North Central is not like other regions in Massachusetts



The manufacturing profile of North Central Massachusetts is unique

- Dominated by metal fabrication, machining, and plastics molding, whereas Eastern regions are dominated by computer, electronics, and medical equipment manufacturers
- Most similar to Berkshire and Pioneer regions but fewer workers in food manufacturing

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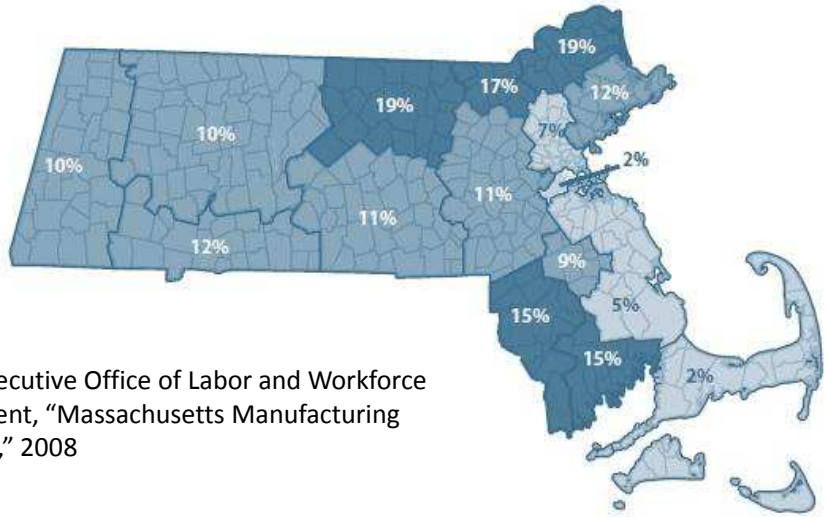
Why NCM?

Project Background

North Central is not like other regions in Massachusetts

Manufacturing Employment in Massachusetts Workforce Regions



Source: Executive Office of Labor and Workforce Development, "Massachusetts Manufacturing Chartbook," 2008

- NCM has the highest proportion of manufacturing employment in the Commonwealth, at 19.7%
- NCM's population is older than the Commonwealth
- NCM is rural
- **NCM has unique needs that must be understood to develop an effective roadmap for manufacturing growth**

Why NCM?

Project Background

North Central is losing manufacturing jobs

Sector	2011	2008	1998	change % from 1998	Change % from 2008
Fabricated Metals	5261	6122	9792	-33	-14
Computer and Peripherals	3412	3684	7932	-54	-9
Plastic & Rubber	3308	3839	6849	-44	-14
Machining	3279	3600	6078	-41	-9
Paper	2333	2722	3762	-27	-16
Total Manufacturing	31454	36217	60498	-40	-13

Source County Business Patterns

- NCM has been losing its manufacturing base as a source of employment since 1998
- Every sector has lost jobs
- **Action must be taken to preserve and grow the NCM manufacturing base, which is vital to the prosperity of the region**

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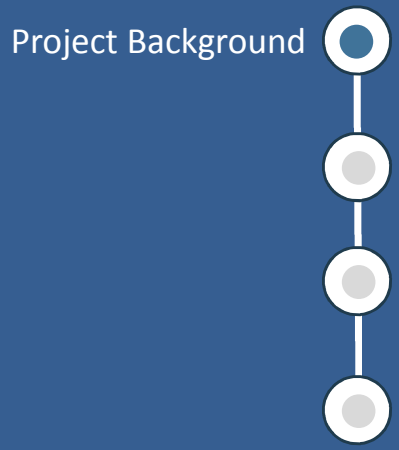
Timeline

Project Background



January 2014

Internal kickoff

February

Stakeholder kickoff

March

April

May

Present preliminary interview findings, recommendations

June

Present final interview findings, recommendations

July

August

September

Present Market Analysis findings, recommendations

January 2015

Phase 1: Survey Manufacturers

Design survey instrument
Identify, categorize firms
Recruit participants
Schedule interviews

Conduct interviews
Compile, clarify, analyze results

Incorporate stakeholder feedback

Phase 2: Market Analysis

Characterize regional manufacturing capabilities

Identify opportunities

Screen and select opportunities

Conduct SWOT analyses

Develop recommendations to exploit opportunities

Phase 3: Roadmap for Growth

Propose roadmap

Organize steering committee

Initiate partnership collaborations

Complete roadmap for growth

we are here.

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Objective

Identify best-fit market opportunities for key NCM industry groups

Project Approach

SCOPE OF WORK

STEPS

- Understand the manufacturing capabilities of the NCM region
- Select manufacturing capabilities for TDMI focus
- For each manufacturing industry/capability:
  - Identify strengths and weaknesses
  - Complete preliminary analysis of potential markets & applications
  - Consider emerging and future needs of market sectors
  - Identify, profile target markets and applications
  - Conduct SWOT and other analysis
  - Provide recommendations for next step(s)

PROCESS

- Consult local stakeholders to identify key industries and manufacturing capabilities
- Select 4 industries with significant presence and prospects for growth
- Use secondary resources to gain foundational application/market information
- Use primary research (primarily phone interviews) to gain insight around these questions:
  - Who are potential, users, adopters, and clients?
  - What are their needs and preferences?
  - Who are the players, and what are the trends and drivers?
  - What are the barriers or threats in these markets?
  - Engage with stakeholders throughout the project

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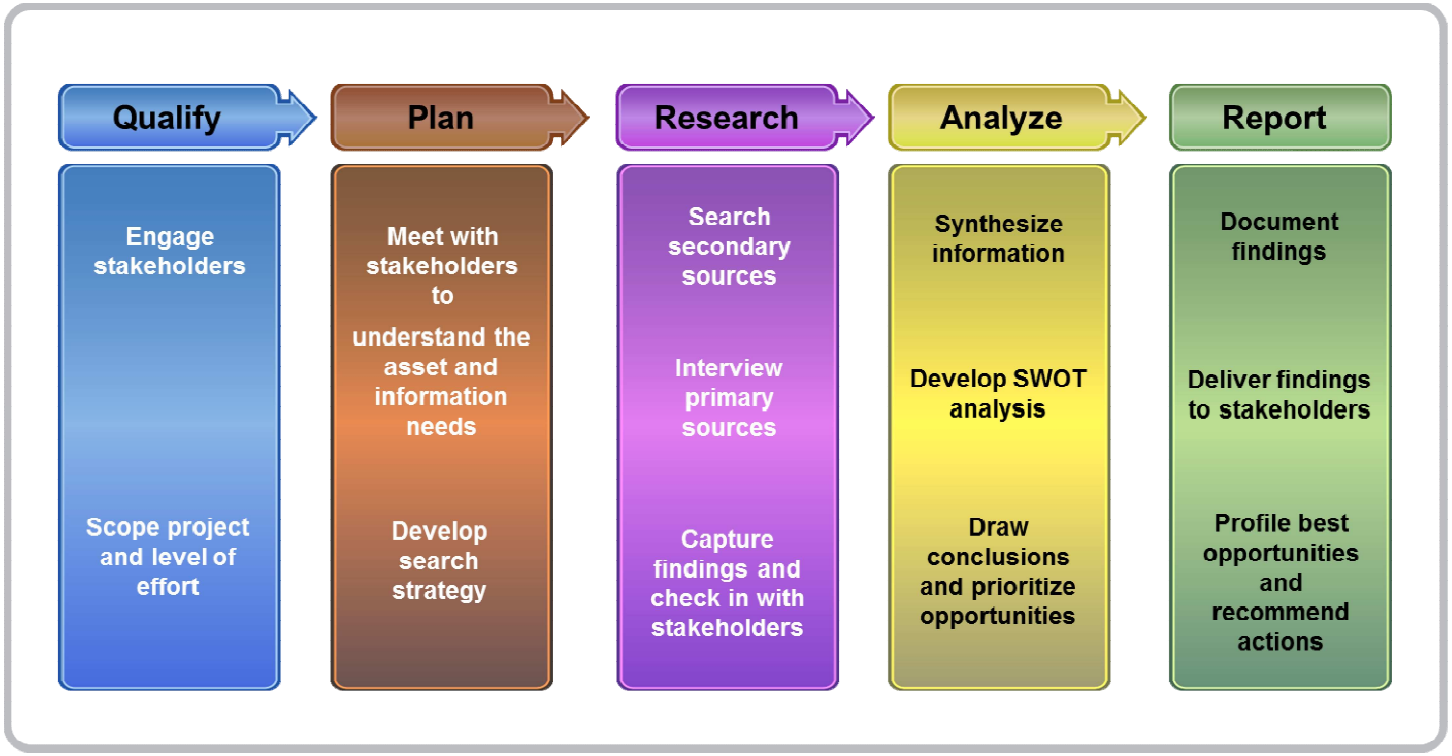
TDMI

Process

Project Approach

Technology-Driven Market Intelligence (TDMI)



- **Outcome of NASA technology transfer work (47 years)**
- **Modified for small and medium enterprise (SME) manufacturers for NIST MEP**
- **Applicable to individual firms as well as regional assets**

TDMI

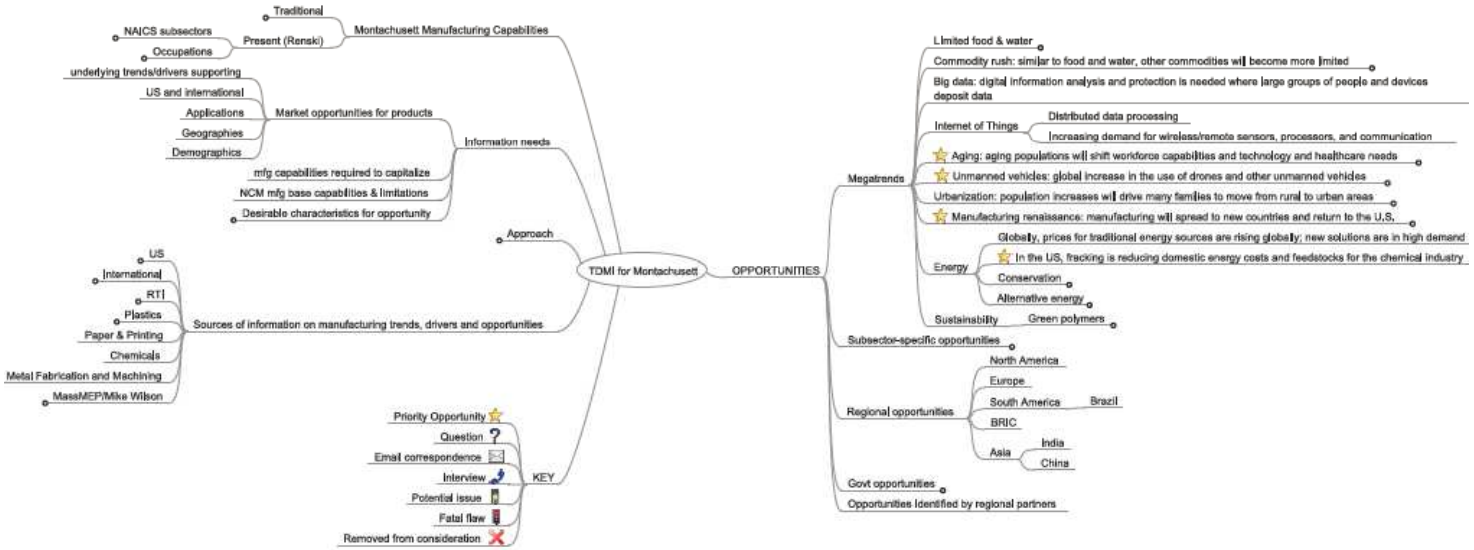
Mindmap

Project Approach

Mindmap acts as project library

Research Plan for TDMI

- **Left side: Information on NCM manufacturing capabilities**
- **Right side: Market opportunities with a need for NCM capabilities**

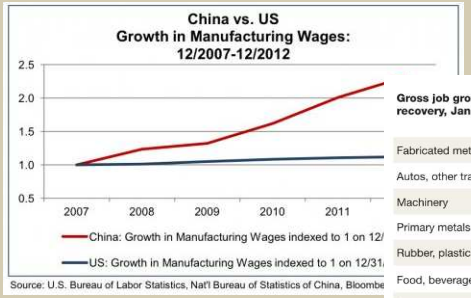


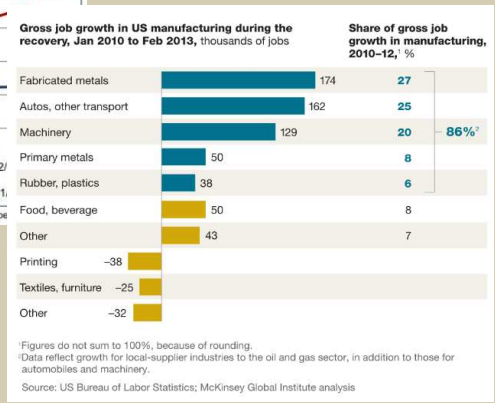
TDMI

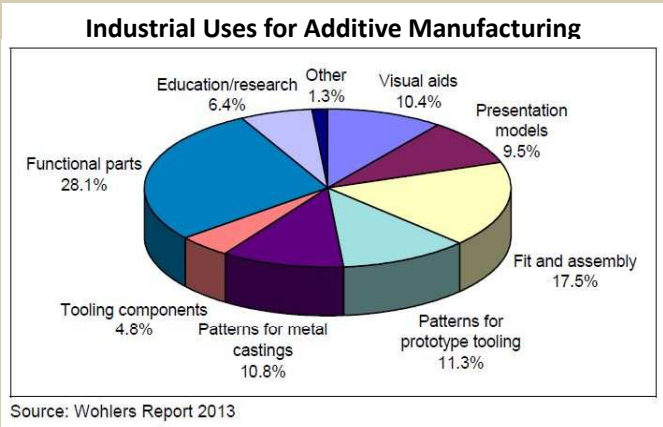
Secondary Research

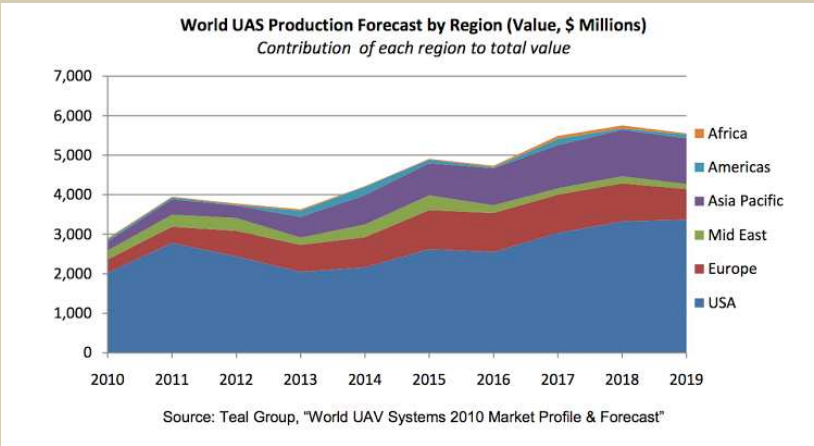
Project Approach

RTI used secondary sources to gain knowledge, determine possible markets









Secondary sources included market research reports, news releases, trade journals, and company information

TDMI

Primary Research

Project Approach

RTI and MassMEP conducted primary research to confirm hypotheses and uncover new, current insights

Experts were chosen from different markets, industries, value chain positions and organization functions

TDMI

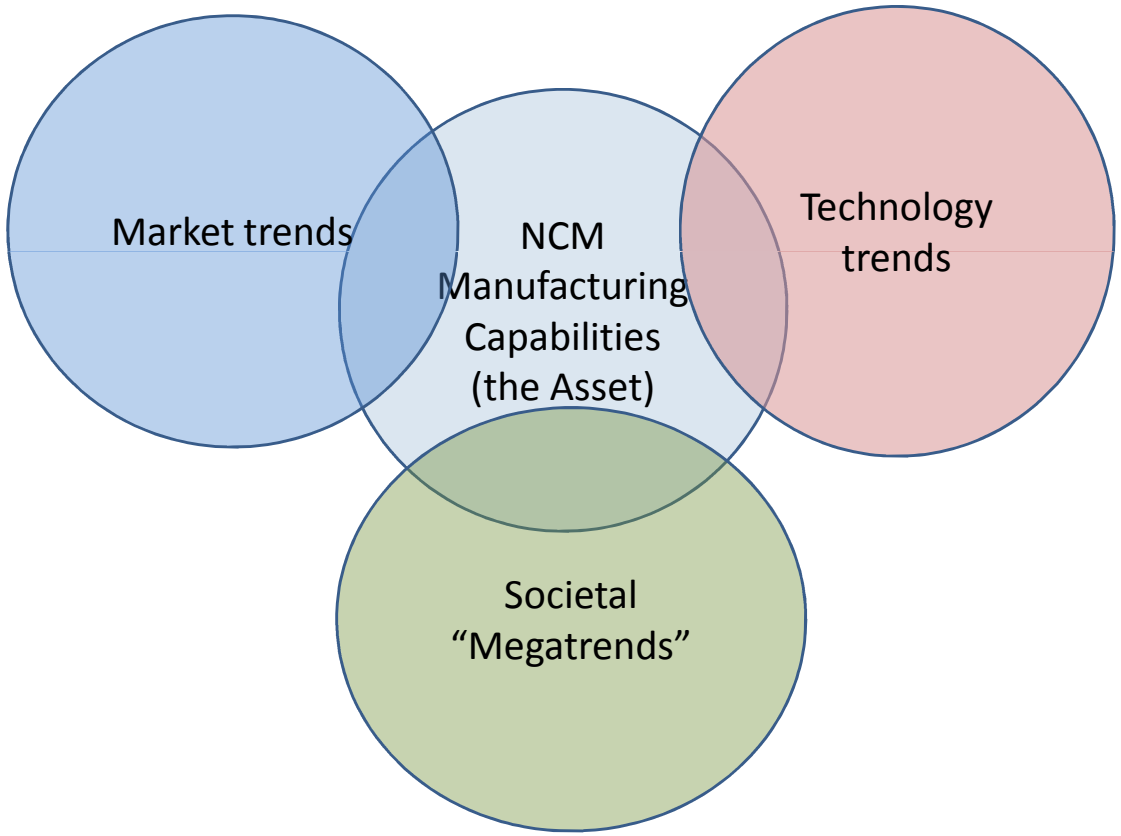
Linking NCM capabilities to opportunities

Project Approach

Sources Of Opportunity

Opportunities exist where:

- NCM capabilities match emerging needs of society and industrial markets
- New high-impact technologies can be adopted



NCM Industry Profile

Advanced Manufacturing

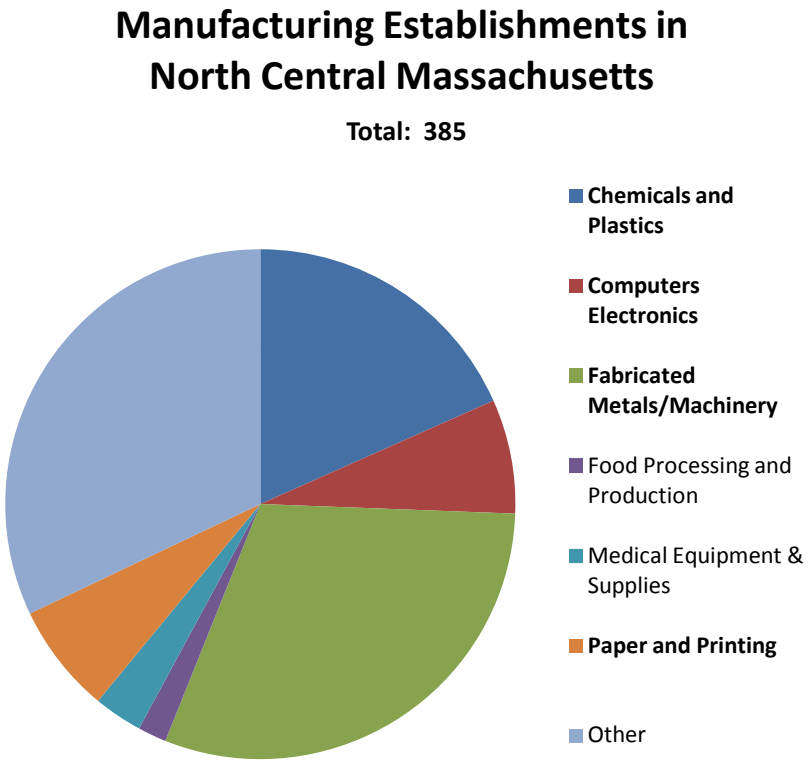
Project Approach

Four advanced manufacturing subsectors in NCM are best positioned for growth

The Collaborative Manufacturing Communities Growth Initiative has selected 4 subsectors characterized by advanced processes or products, that are significant to the NCM economy, **and have good prospects for growth:**

- **Chemicals & Plastics (Including Pharmaceuticals)**
- **Fabricated Metal Products & Machining**
- **Computer & Electronic Products**
- **Paper & Printing**

These subsectors are the 4 largest manufacturing groups in NCM, representing over 62% of establishments in the region.

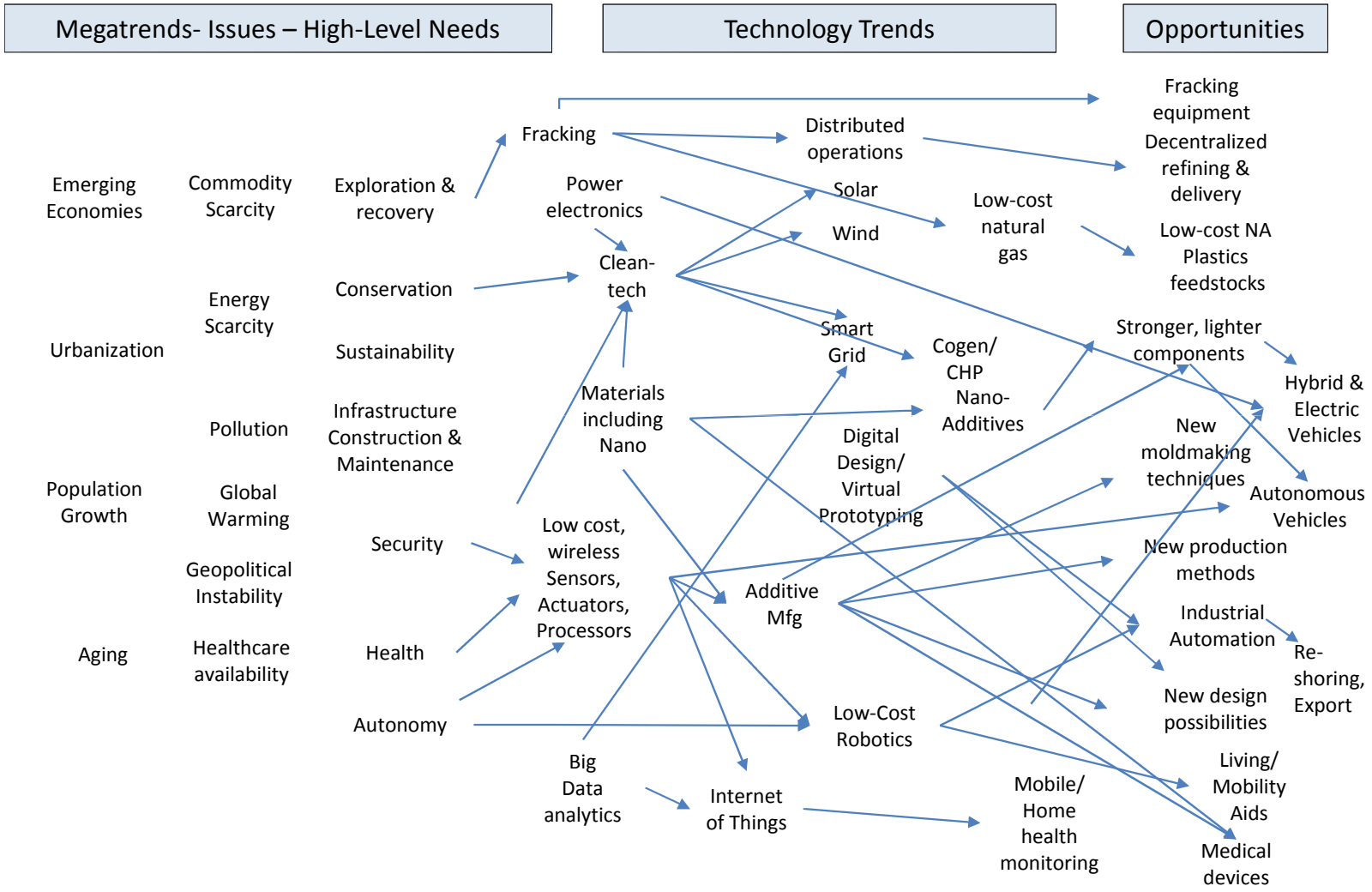


Trends

Sources of opportunities

Project Approach

Needs drive disruptive innovation, creating opportunity for NCM

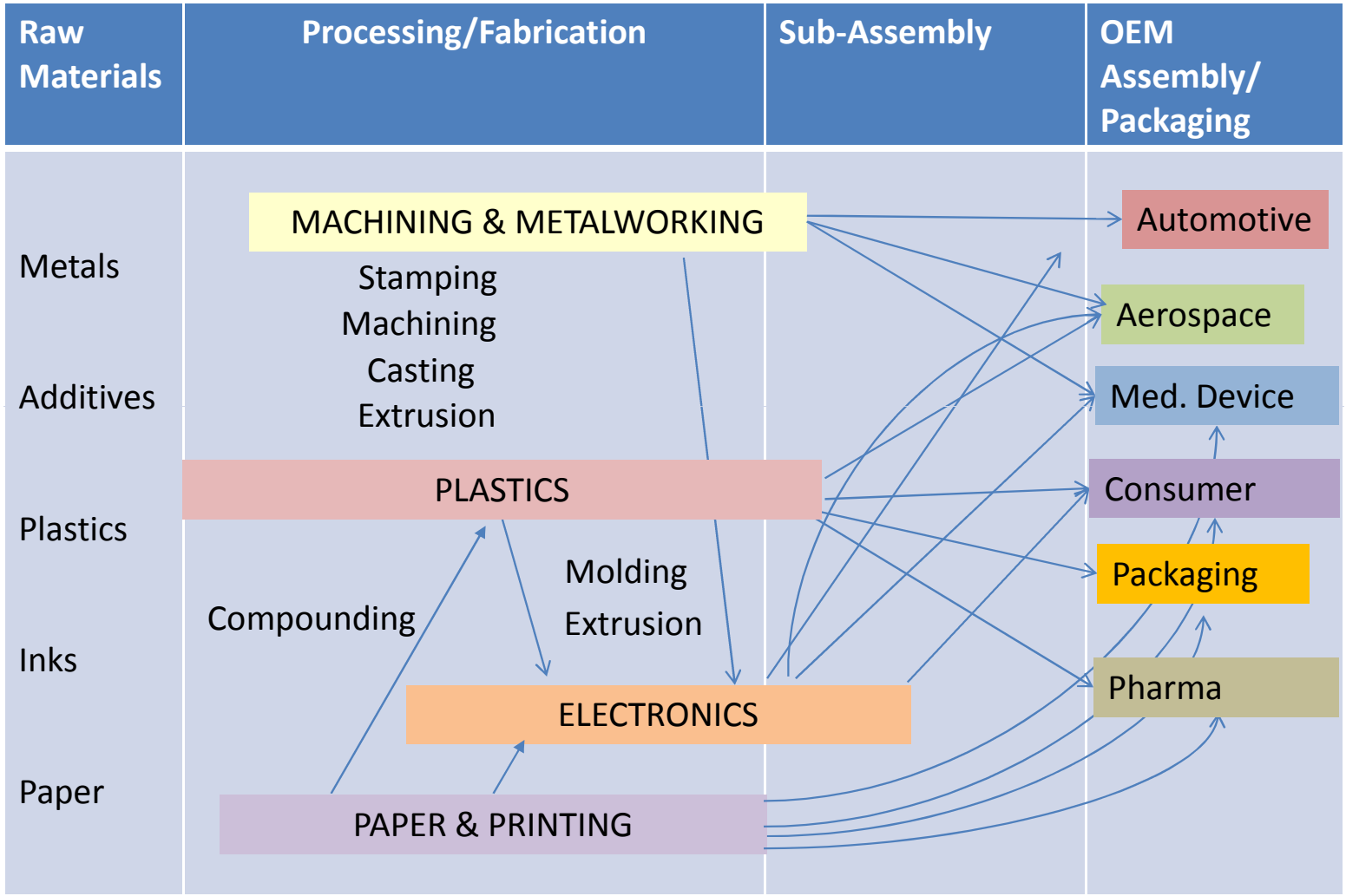


Subsectors

Subsector Relationships

Project Approach

Opportunities can impact multiple industries



Subsectors

Plastics Manufacturing

Project Approach

Plastics Industry - Manufacturing Capabilities

- Compounding
- Product Design and Development
- Rapid Prototype Development
- Product Engineering
- Injection Molding
  - Custom
  - Single and Multi Shot
- Blow Molding
- Micro Molding
- Extrusions
- Insert Molding
- Bio Absorbable Molding
- Ultrasonic Welding
- Microscopic Welding
- CNC/EDM Machining
- Secondary Operations
- White Space
- Atmospheric Controls
- Class 10,000 Clean Rooms
- Class 100,000 Clean Rooms
- High Speed Automation
- Dedicated Medical Production
- Optical Inspection
- Quality Assurance Equipment

"North Central Massachusetts is home to the largest plastics cluster in the Northeast."

-North Central Massachusetts Chamber of Commerce

Medical devices *Source: Nypro*

Consumer products

Source: Mar-Lee

Subsectors

Machining & Metalworking

Project Approach

Machining & Metalworking subsector - Manufacturing Capabilities

- Fabricated metal product manufacturing
  - Machining: EDM, 5-Axis CNC, CAD/CAM
  - Stamping
  - Forging
  - Welding
- Metalworking machinery manufacturing
  - Moldmaking for Injection Molding & Blow Molding
  - Tooling, Dies, Jigs
- Architectural and Structural Metals Manufacturing
  - Structural Steel Manufacturing
  - Sheet Metal Manufacturing
- Machinery manufacturing
- Turbines

Injection molds

Source: Nypromold

Deep-drawn stamped metal parts

Source: Herfco

Subsectors

Paper & Printing

Project Approach

Paper & Printing subsector - Manufacturing Capabilities

- Paper manufacturing
- Corrugated box and paperboard manufacturing

- Converting and printing operations
  - Full-color
  - Digital
  - Offset
  - Paper and polymer substrates
- Products
  - Business cards
  - Gift tissue
  - Bumper stickers
  - Greeting cards
  - Flyers

Custom corrugated box

Source: Crocker Technical Papers

High-end gift tissue

Source: Seaman Paper

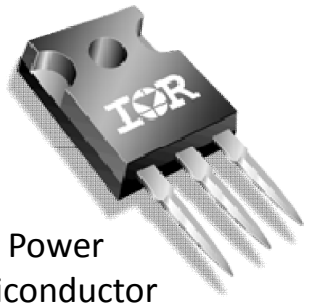
Subsectors

Electronics

Project Approach

Electronics subsector - Manufacturing Capabilities

- Products
  - Diagnostics
  - Instrumentation
  - Electronic components
  - PCBs
  - Security systems, controls
- Markets
  - Industrial
  - Military
  - Commercial
  - Medical



IGBT Power Semiconductor Component

Source: International Rectifier

Millimeter-wave point-to-point radio

Source: HXI LLC

Opportunities

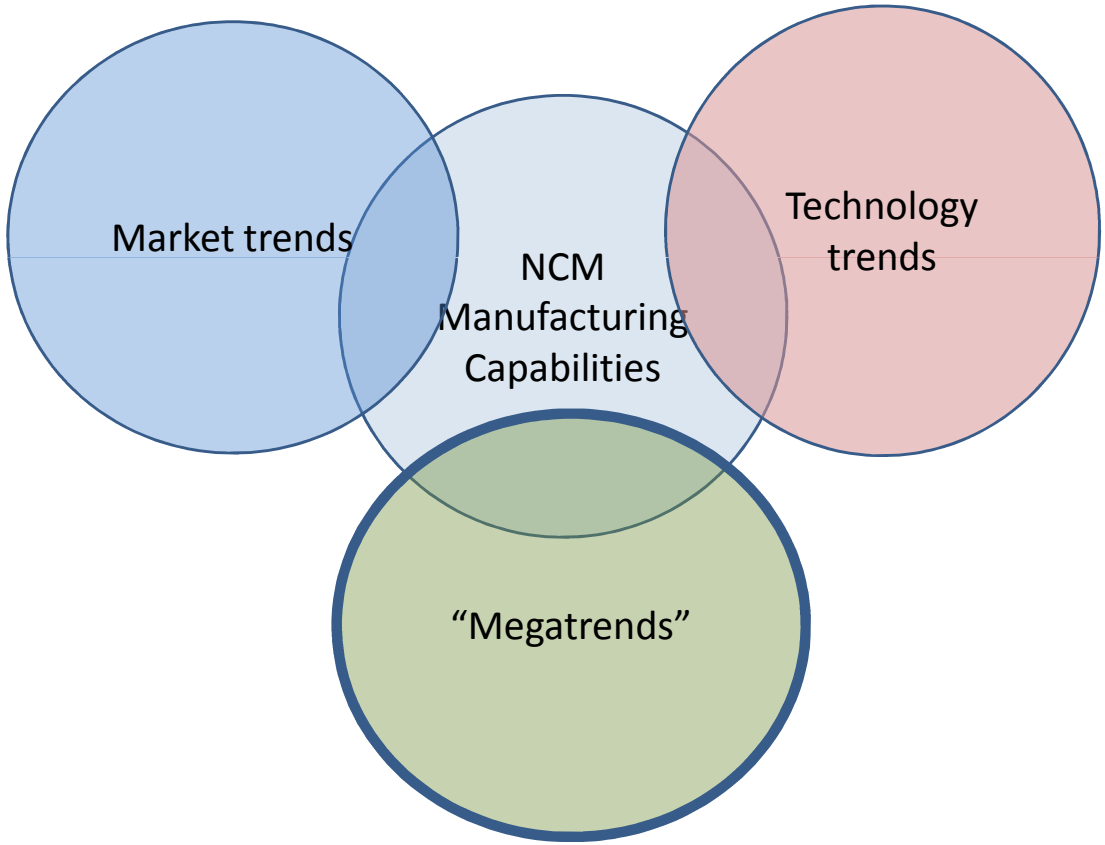
Megatrends

Opportunities

Megatrend Opportunities

Opportunities exist where:

- NCM capabilities match emerging needs of society and industrial markets
- New high-impact technologies can be adopted



Reshoring

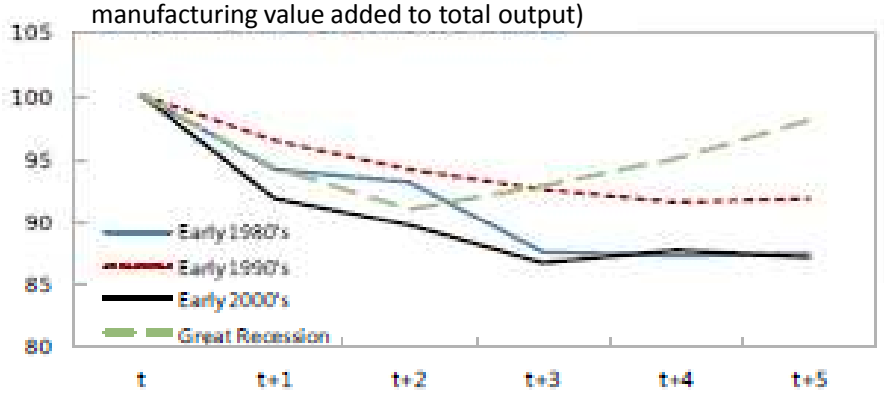
Megatrends

Opportunities

Reshoring: It's Real

- As the US Economy has recovered from the Great Recession, manufacturing has rebounded more strongly than in past recessions:

Manufacturing Rebound by Recession
(Index, 100 = year before recession, index of the share of manufacturing value added to total output)



sources: IMF, Haver Analytics

- This rebound is attributed to four main factors:
  - A weaker dollar relative to emerging economies
  - Automation
  - Lower US labor costs relative to emerging economies due to:
    - Increasing labor costs in China
    - Downward pressure on wages in the US due to high unemployment
  - Lower domestic energy prices due to hydraulic fracturing (fracking) technology
- These factors are causing manufacturers to bring operations back to the US, a phenomenon known as "reshoring"

Reshoring

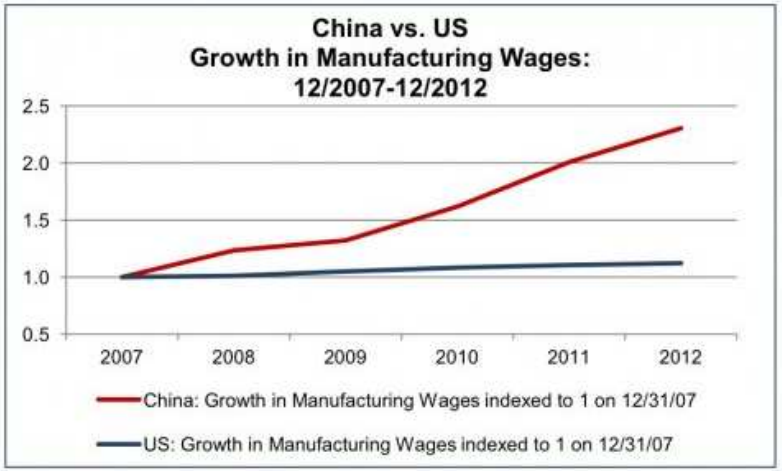
Megatrends

Opportunities

The Shrinking Wage Gap

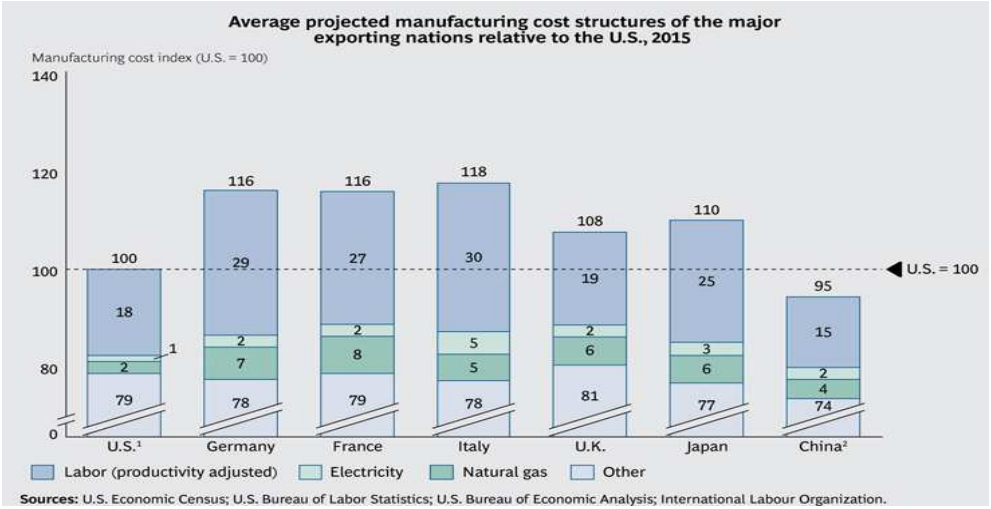
Wages:

- Chinas' wages have more than doubled since 2007, whereas US wages have remained relatively flat
- China's wage growth is expected to persist at the current rate through 2030



Source: U.S. Bureau of Labor Statistics, Nat'l Bureau of Statistics of China, Bloomberg

China's overall cost advantage vs. the US will shrink to less than 5% by 2015



Reshoring

Megatrends

Opportunities

Walmart Commitment Drives Reshoring

- The company has committed to buying **$250 billion** in US-made products over the next 10 years
- According to the company, in a recent Open Call event, one-third of companies (US manufacturers) won supply contracts
- Mississippi has engaged Walmart on a regional level to get Mississippi-made products in regional stores—those that are successful have a chance to supply Walmart nationally

Walmart's New Mantra: Made in the USA

Steve Minter | *IndustryWeek*

Reshoring

Megatrends

Opportunities

Reshoring vs. Next-Shoring

- Whereas re-shoring refers to returning outsourced manufacturing back to the market it serves, McKinsey defines next-shoring as locating manufacturing in proximity to *demand* and proximity to *innovation* (an innovative base of suppliers) – so, for example, a US manufacturer would set up manufacturing in China to serve the Chinese market.
- As emerging economies such as China develop, domestic manufacturers are shifting focus to supplying domestic markets, increasing the risk associated with offshoring.
- Manufacturers are realizing locating manufacturing close to demand makes it easier and faster to identify and respond to local needs, while reducing supply risk.
- Proximity to clusters of innovative suppliers ensures that manufacturers can meet local needs and facilitates leveraging of new manufacturing technologies such as additive manufacturing, digital manufacturing, and robotics.

Source: McKinsey

Reshoring

Megatrends

Opportunities

Reshoring & Next Shoring in NCM

- Local plastics industry executives report that companies that survived the Great Recession are seeing increased sales and are hiring
  - Nypro Healthcare recently expanded in Devens, plans to hire 165 employees
  - Sterling Manufacturing has invested in state of the art technology and is aggressively pursuing reshoring opportunities
  - Toner Plastics has won new business from Walmart:
    - Wonder Loom
    - Component in flat-screen TV assembled in the US

Nov 5, 2013, 7:01am EST

Nypro is moving into the old Evergreen Solar plant, plans to hire 165

BOSTON BUSINESS JOURNAL

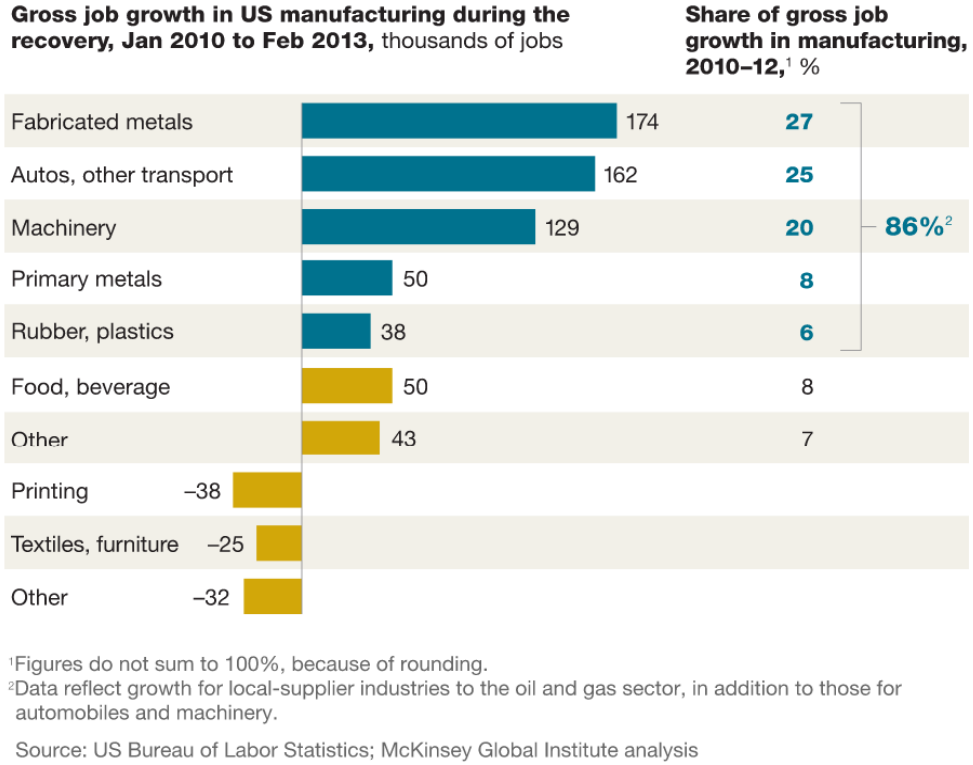
Reshoring

Megatrends

Opportunities

The reshoring/next-shoring opportunity in NCM

- Fabricated metals and machinery accounted for almost half of US manufacturing job growth between 2010 and 2013
- The plastics & rubber industry also saw significant job growth in the period
- Boston Consulting Group estimates that reshoring has the potential to create up to **1 million new manufacturing jobs in the US by 2020**



- Potential Impacts:
  - **27,100 jobs** in Massachusetts based on its share of US manufacturing output (2.7%)
  - **1,500 jobs** for North Central Massachusetts (5.6% of manufacturing jobs in Massachusetts)

Reshoring

Megatrends

Opportunities

Pennsylvania is actively recruiting OEMs to reshore components and products

Goal: Reshore 18 items to Pennsylvania by October 2015

Plan:

- ✓ Use Datamyne to identify items imported into Pennsylvania
- ✓ Identify five "reshore ready" industries based on imports and other factors
- ✓ Use Datamyne to identify "reshore ready" companies in Pennsylvania that are importing in the industries
- ❑ Invite "reshore ready" companies to attend a reshoring seminar
- ❑ Engage with companies and identify "reshore ready" items by using Total Cost of Ownership Estimator™
- ❑ Post "reshore ready" opportunity to PA Reshoring website
- ❑ Scout suppliers (performed by NIST MEP, EDA and WIB partners)
- ❑ Facilitate buyer / supplier connection for successful reshoring!

Status: Started in January 2014

NEPIRC

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Opportunities

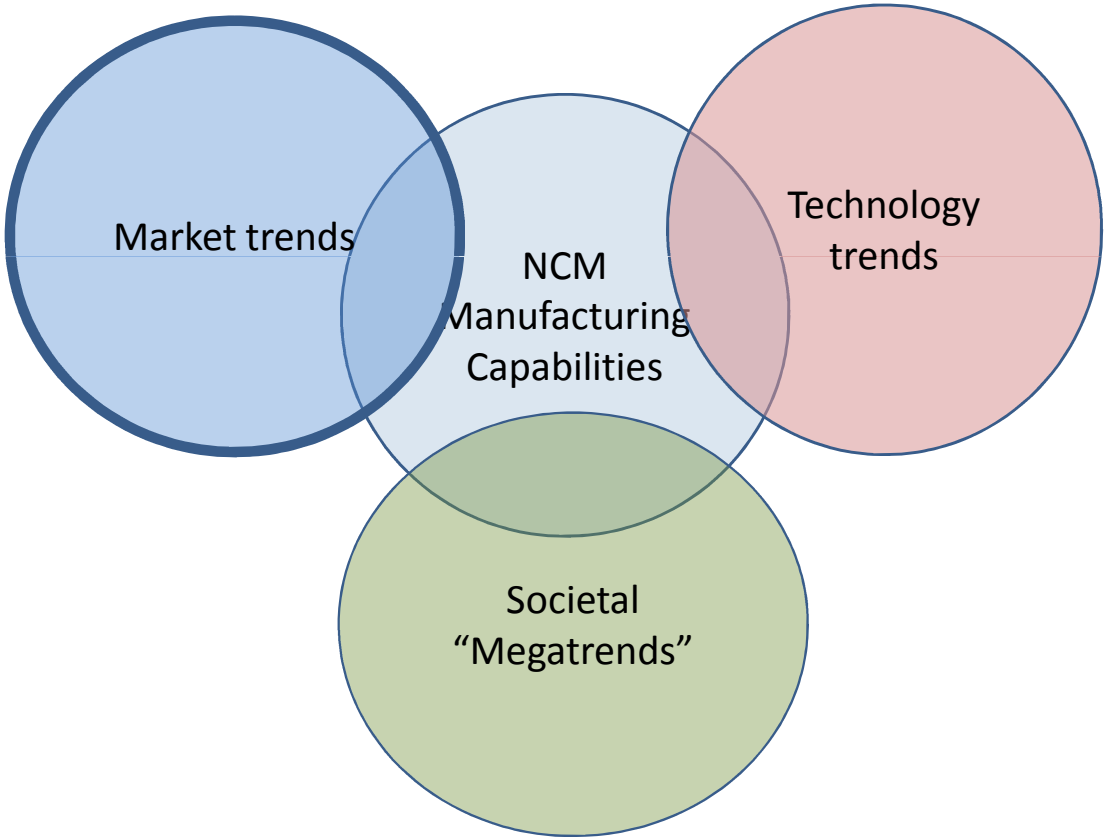
Market trends

Opportunities

Market Trend Opportunities

Opportunities exist where:

- NCM capabilities match emerging needs of society and industrial markets
- New high-impact technologies can be adopted



Opportunities

Market trends

Market Opportunities for NCM

Medical Devices

UAV's

Smart Packaging

Tooling

Opportunities

Market trends

Market Opportunities for NCM

- **Medical Devices**
- UAV's
- Smart Packaging
- Tooling

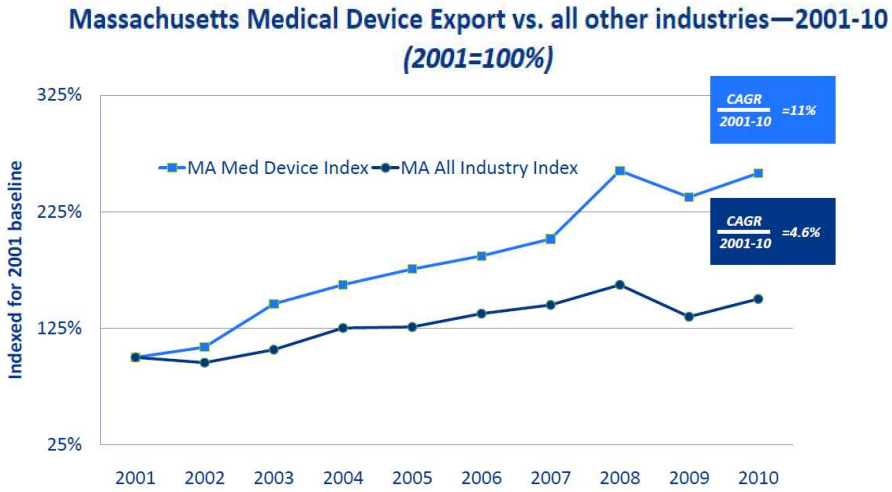
Medical Devices

Market trends

Opportunities

Medical Devices: NCM is well-positioned for further growth

- Massachusetts is one of the top 3 states in Medical Device employment with over 20,000 employees
- Medical devices account for 10% of the value of Massachusetts exports
- Medical device exports are outpacing all other industries (see chart below)
- Boston is home to the second largest venture capital market in the US, focused on commercializing medical technology
- The University of Massachusetts supports Medical Device startups through the Massachusetts Medical Device Development Center (M2D2)
- NCM manufacturers already supply the industry
  - Nypro Healthcare, Sterling Mfg., Mar-Lee Companies



Source: UMass Donahue Institute

Medical Devices

Market trends

Opportunities

Medical Devices: Huge Market, Steady Growth

- Market Size: *(Source: BCC Research)*
  - Global: $411 Billion, CAGR 5.5%
    - Europe flat; high growth in Asia due to rapid economic growth
  - North America: $187 Billion, CAGR 3.7%
    - Modest growth due primarily to the Affordable Care Act (Excise tax, increased transparency, focus on cost-effectiveness)
- Technology Trends
  - Interoperability of devices
  - Big Data
  - Low-cost innovation
  - Multifunctionality
  - Nanotechnology
  - 3D Printing

Medical Devices

Market trends

Opportunities

Medical Device Market Driven by Demand for Reduced Cost

- Growth Sectors
  - Structural Heart – new products are poised to expand access of care to high-risk patients who previously had no options.
  - Robotic Assistance - robot-assisted technologies for surgery and treatment planning.
  - Infection Control Tools - hospital acquired infections (HAI) remain one of the top risks to patients
  - Home Care – Driven by wellness initiatives, availability of remote monitoring tools, and a push to extend care outside of hospitals
  - Neuro-devices –new external and implantable technologies to treat brain disorders will advance care beyond current standards.

Opportunities

Market trends

Market Opportunities for NCM

Medical Devices

UAV's

Smart Packaging

Tooling

Autonomous Aerial Vehicles (UAVs)

UAVs

Market trends

Opportunities

- Large, rapidly growing market
- Domestic Production is driven by ITAR, precluding foreign competition
- Fit with local capabilities:
  - Light weight means Medical Device types of metals and part sizes
  - MIT has significant R&D capabilities and relationships
  - Attractive market for multiple NCM industries:
    - Metal fabrication
    - Composites
    - Computer & Electronics
    - Plastics

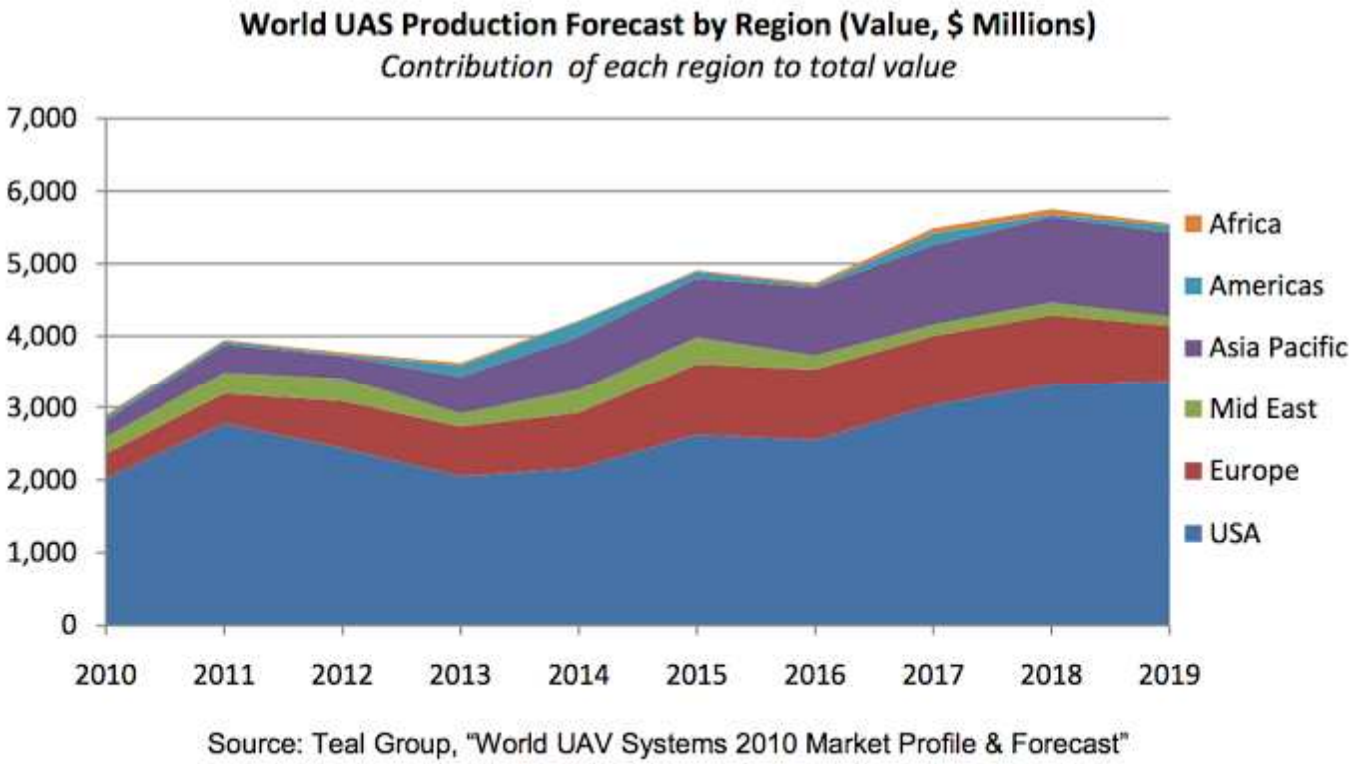
Source: Processindustryforum.com

UAVs

Market trends

Opportunities

The UAV market is a growing domestic and export market



Source: Teal Group, "World UAV Systems 2010 Market Profile & Forecast"

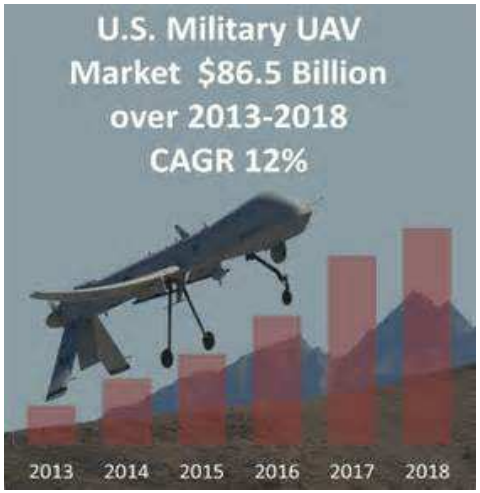
UAVs

Market trends

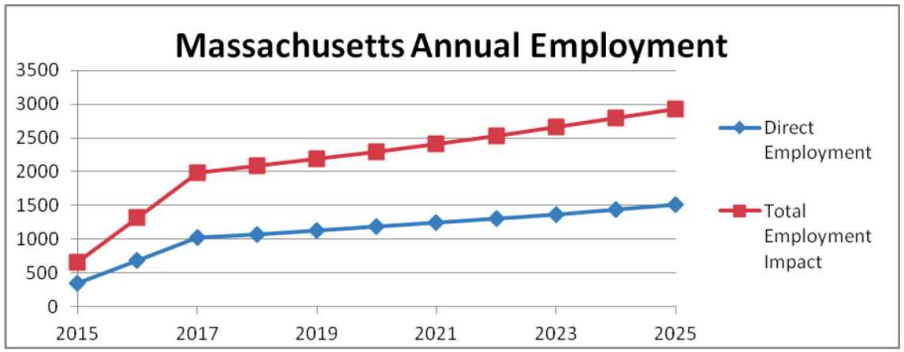
Opportunities

The UAV market is expected to have a significant impact on Massachusetts

- The U.S. UAV market will triple in size over the next five years, growing from $5 billion in 2013 to $15 billion in 2020.
- Civilian uses are expanding to include vehicles for facility security, agriculture, filming, energy infrastructure security and maintenance, and package delivery
- Potential impact to Massachusetts:
  - Direct employment: 1000 jobs by 2017
  - Total employment impact: 2000 jobs by 2017
  - $ 386 million impact (2015-2017)
- Current MA Companies serving the UAV market:
  - Hydroid (Pocasset, MA)
  - Maxon Motor (Fall River, MA)
  - Protonex (Southborough, MA)
  - Boston Engineering (Waltham, MA) (underwater vehicle)



Source: Marketresearchmedia.com



Source: UAVSI Economic Report 2013

UAVs

Market trends

Opportunities

Massachusetts has the assets to exploit the UAV market but must ensure a conducive environment for development

Comments and recommendations from The Association for Unmanned Vehicle Systems International (UAVSI):

- States with an already thriving aerospace industry are projected to reap the most economic gains
- Massachusetts is ranked 11th in expected economic impact of the UAV market in dollars and jobs
- A variety of factors—state laws, tax incentives, regulations, the establishment of test sites and the adoption of UAS technology by end users—will ultimately determine where jobs flow.

> While we project more than 100,000 new jobs by 2025, states that create favorable regulatory and business environments for the industry and the technology will likely siphon jobs away from states that do not.

Source: UAVSI Economic Report 2013

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Opportunities

Market trends

Market Opportunities for NCM

Medical Devices

UAV's

Smart Packaging

Tooling

Smart Packaging

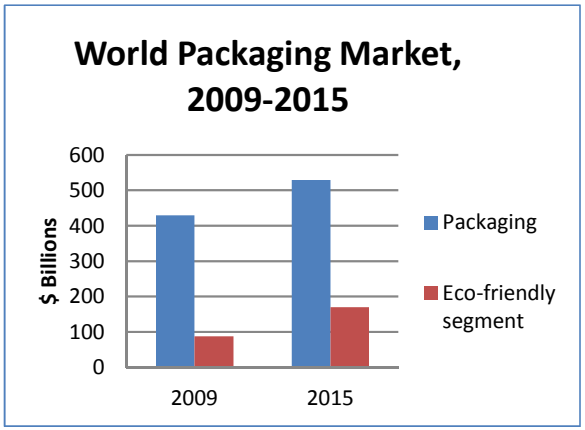
Market trends

Opportunities

Opportunities for Paper and Packaging manufacturers: Smart Packaging & Eco-Friendly Packaging

Significance:

- Overall Packaging market is very large with Growth Rate close to that of the global economy: revenues growing from $429 B in 2009 to $530B by 2015
- High-growth segments exist:
  - "Eco Friendly": $88B to $170B growth from 2009 to 2015 (11.7% CAGR)
  - Controlled/Active/Intelligent: $31.4B in 2011, to $44.3B by 2017 (5.8% CAGR)
- Some high-growth opportunities are accessible to manufacturers with minimum capital expense
  - Current papermaking, converting & printing equipment may need minor modification
  - Does not trigger a relocation decision
- Megatrend of increasing safety concerns in packaged goods (Medical, Food)
  - Tamper-proof/Tamper-evident
  - Cold Chain
- Reshoring is occurring due to concerns about the safety of the Chinese food supply
- Eco friendly and sustainable Megatrend
  - Eco friendly feedstocks available
  - Fits state focus



Sources: Pike Research, Freedonia

Smart Packaging

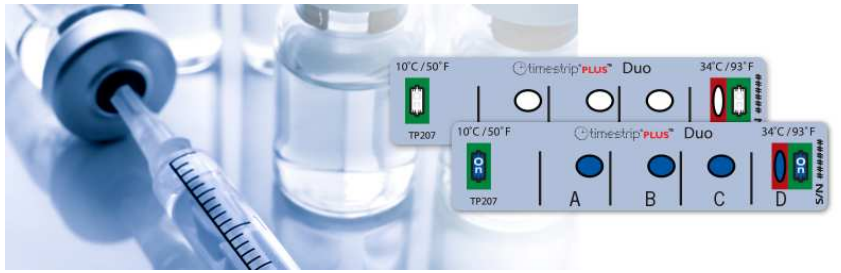
Market trends

Opportunities

Smart Packaging Examples

RipeSense label changes color when fruit is ripe

Corrugated packaging with ethylene absorber to delay ripening



Cold chain indicator label

Sources: RipeSense, Timestrip, Food Production Daily

Opportunities

Market trends

Market Opportunities for NCM

Medical Devices

UAV's

Smart Packaging

Tooling

Tooling

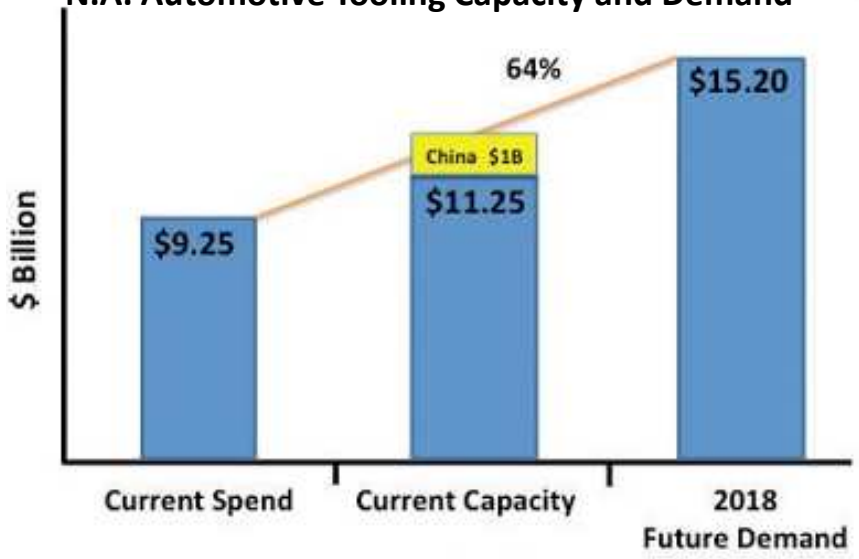
Market trends

Opportunities

A Severe Domestic Tooling Shortage is Expected

- The North American tooling manufacturing base is not adequate to meet expected demand from the North American automotive industry
  - A $6 billion gap in tooling production capacity is expected by 2018 (source: Harbour Associates, 2013).
- Demand from the domestic automotive sector is straining tooling capacity in other industries such as appliances and toys that may be more attractive to NCM suppliers.

N.A. Automotive Tooling Capacity and Demand



Source: Harbour Associates

Tooling

Market trends

Opportunities

A Severe Domestic Tooling Shortage is Expected

- Next-shoring: More OEMs moving to the Toyota model of "buy it where you build it" or a "regional sourcing" model:
  - There is a trend - particularly in the automotive industry - to build the high-tech, more complex molds in the U.S.
  - The market for tooling is not as dependent on location as for parts, because quantities are low – the tooling manufacturer does not need to be near Detroit or other automotive hubs.

Honda water pump test fixture

Source: Quality Inspection Technologies

Opportunities

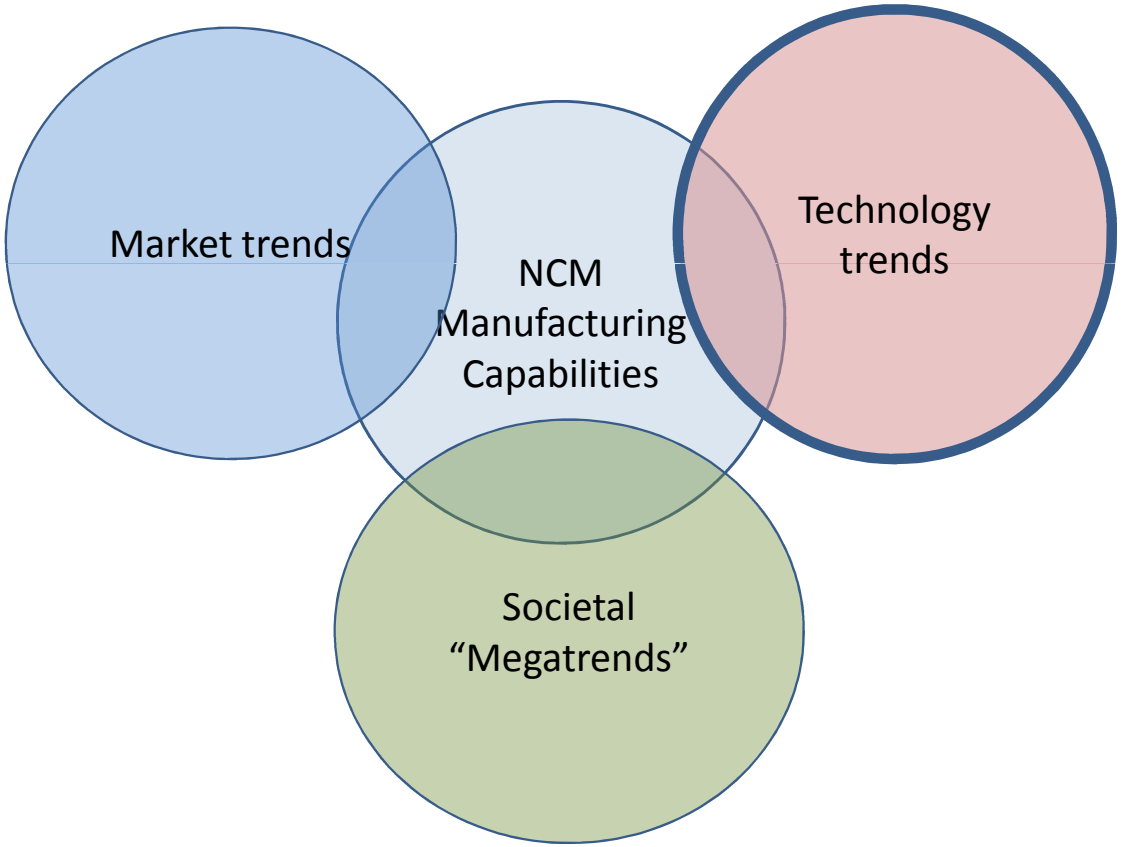
Technology trends

Opportunities

Technology Trend Opportunities

Opportunities exist where:

- NCM capabilities match emerging needs of society and industrial markets
- New high-impact technologies can be adopted



Advanced Manufacturing Technology

Technology trends

Opportunities

National Network for Manufacturing Innovation (NNMI) – a Federal initiative to maintain US leadership in advanced manufacturing

- In 2013 President Obama initiated the **National Network for Manufacturing Innovation -** an initial network of up to 15 Institutes for Manufacturing Innovation (IMIs)

- Intent: create up to 45 IMIs over the next 10 years, each with a different technology focus

- 4 IMIs have been established to date:
  - America Makes (Additive Manufacturing) – Youngstown, OH
  - Digital Manufacturing & Design - Chicago
  - Lightweight & Modern Metals Manufacturing - Detroit
  - Next Generation Power Electronics Manufacturing – Raleigh, NC

- The selection of **Additive Manufacturing** as the focus of the first IMI reflects the impact this technology is already having and its potential to further transform manufacturing

- Digital Manufacturing and Lightweight Metals are technologies that will impact both Additive and Subtractive (e.g., CNC) manufacturing

Advanced Manufacturing Technology

Technology trends

Opportunities

NNMI mission includes SME growth

Relevance of Institutes for Manufacturing Innovation (IMIs) to SMEs:

"IMIs will offer facilities comprising an 'industrial commons' (the R&D, engineering, and manufacturing capabilities needed to turn inventions into competitive, manufacturable commercial products) **to accelerate the formation and growth of small- and medium-sized enterprises (SMEs)**, and **will integrate education and workforce training functions into their operations**. IMIs will **engage with many types of corporations, with particular emphasis on engaging small and medium-sized manufacturing enterprises**. They will provide shared-use facilities with the goal of scaling up laboratory demonstrations and maturing technologies for manufacture. American companies and international corporations with significant holdings in the United States are envisioned as participants in these Institutes. "

-from "National Network for Manufacturing Innovation: A Preliminary Design" (Executive Office of the President)

MEP Centers will be the primary interface between the NNMIs and the SME community

Advanced Manufacturing Technology

Technology trends

Opportunities

Advanced Manufacturing Technology's Impact in NCM

- Local plastics manufacturers that have survived the recent recession invested in CNC machining and automation to improve productivity and expand capabilities - these companies are now growing
- Additive manufacturing is already having a significant impact on the plastics, machining and metalworking industries
- Nypro and Sterling have invested in additive manufacturing but smaller companies are lagging in adoption
- There is an opportunity for NCM to become a center of excellence in additive manufacturing
- Conversely, failure to develop these skills could result in a future decline in NCM manufacturing

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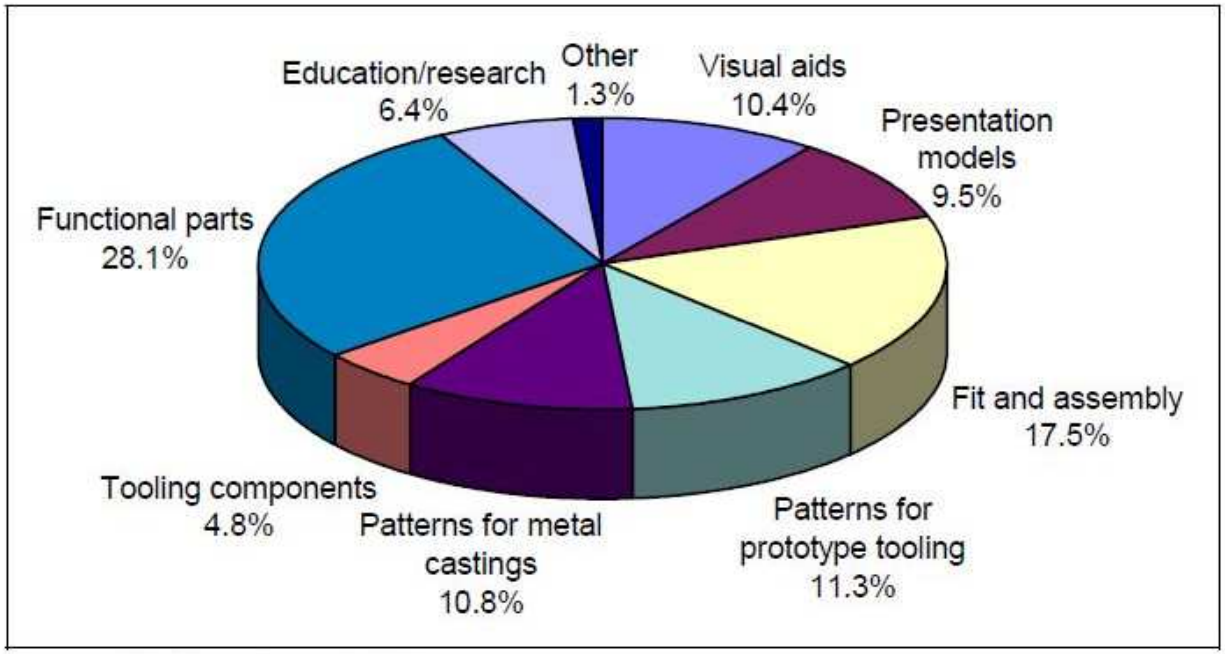
Additive Manufacturing

Technology trends

Opportunities

Industrial Applications of Additive Manufacturing



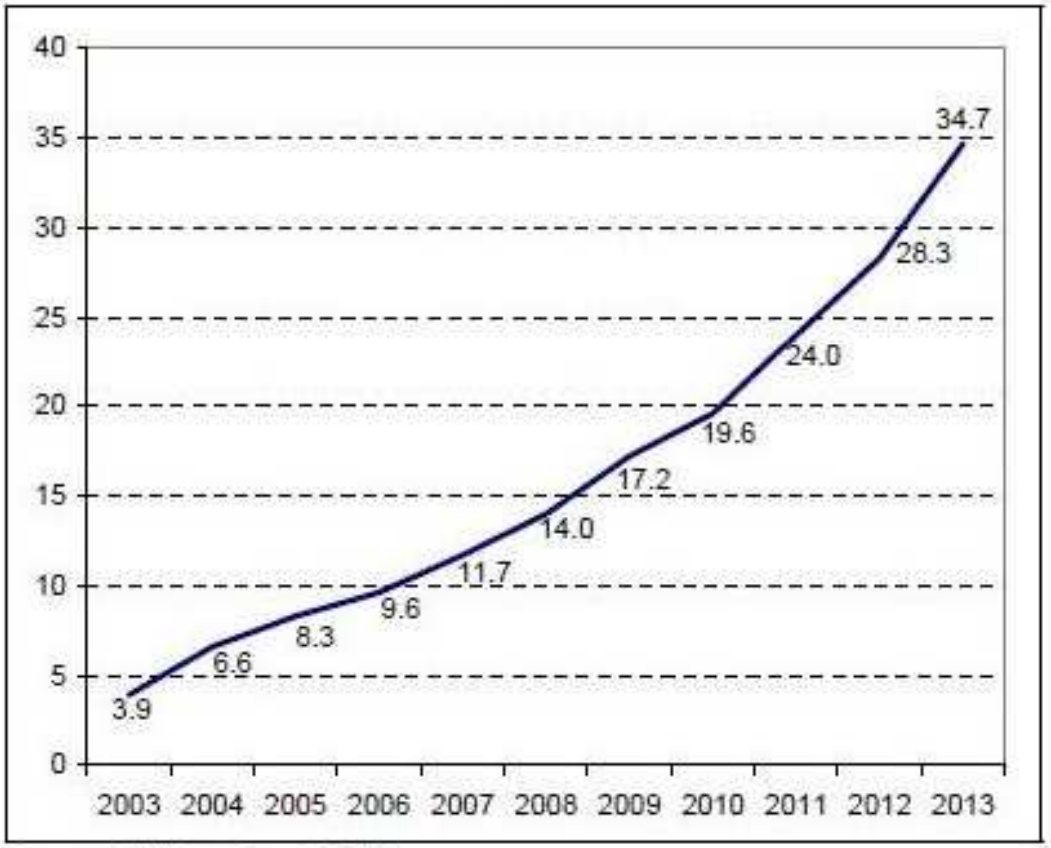
Source: Wohlers Report 2013

Additive Manufacturing

Technology trends

Opportunities

Production of Parts for Final Products is Now 34.7% of the Market



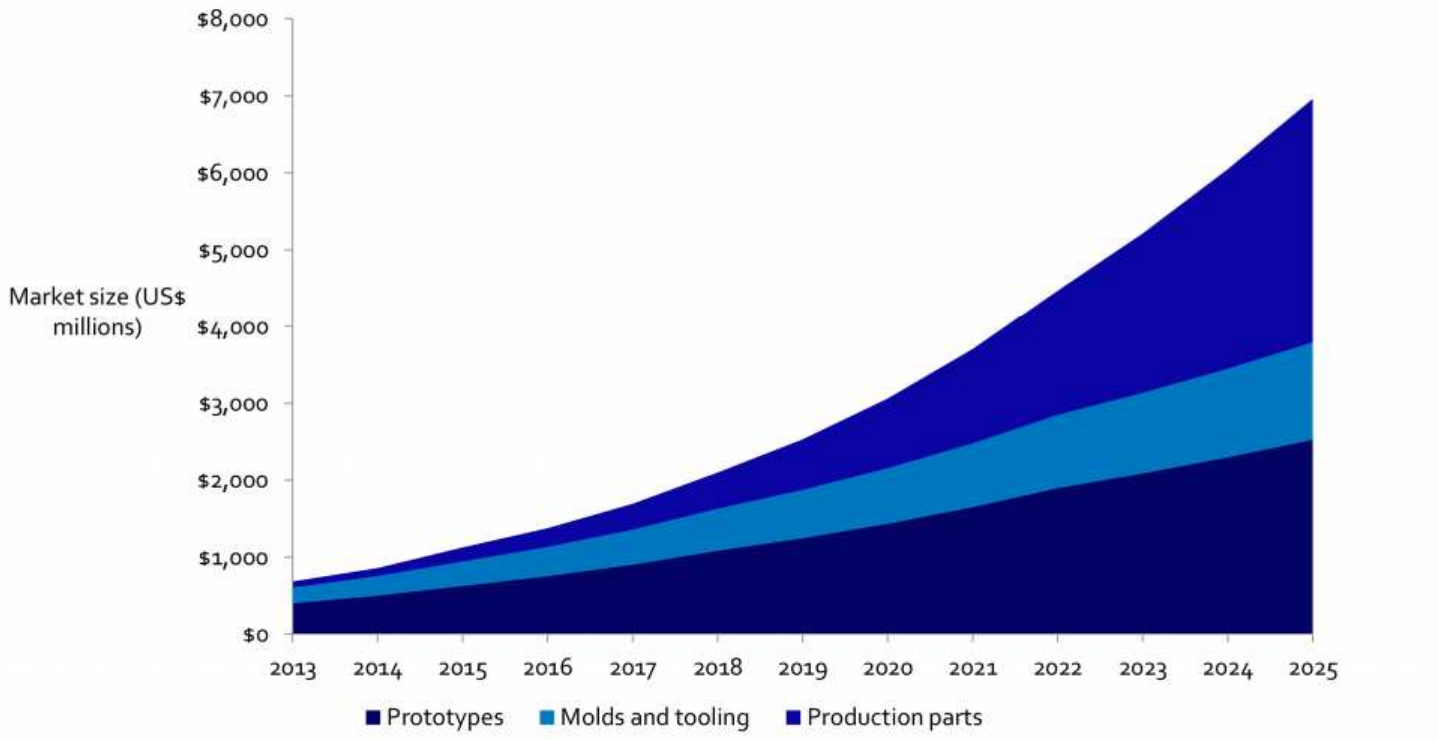
Source: Wohlers Report 2014

Additive Manufacturing

Technology trends

Opportunities

The 3D Printed Part Market Will Reach $7 Billion in 2025



Source: Lux Research, Inc.
www.luxresearchinc.com

Additive Manufacturing

Technology trends

Opportunities

Advantages of 3D Printing

- Mold cost reduction
  - Design cost
  - Labor cost
  - Material cost
- Lead time reduction
  - Hours or days vs. weeks to produce prototypes or final parts
- New design possibilities:
  - Fewer parts required for an assembly
  - "Free" complexity: complex molds, jigs and parts are no more expensive to print than simple designs

Part numbers and hardware pocket integrated in a 3D-printed fixture made from ABS

Source: Stratasys

Sources: Stratasys, 3D Printing Industry, Jabil, Plastics News, EOS

Additive Manufacturing

Technology trends

Opportunities

Advantages of 3D Printing

- Geometries can be produced with 3D printing that cannot be produced with subtractive methods
  - Internal features, trapped geometries, voids
  - "Conformal" or contoured cooling channels can be designed into in molds, which can reduce molding cycle time by 30 percent or more and improve part quality
- Reduced material usage
  - Lighter, more efficient designs are possible
  - Significantly less scrap produced
  - Multiple materials can be used (e.g., gradient materials) for more efficient usage

3D-printed injection-molding tool insert with conformal cooling channels

Source: EOS

Sources: 3D Printing Industry, Jabil, Plastics News, EOS

Additive Manufacturing

Technology trends

Opportunities

3D Printing Opportunities for Plastics Manufacturers

Case study: Whale Industries, mold manufacturer

Stratasys & Whale Create 97% Lead Time Reduction with 3D Printing

BY SHANE TAYLOR ON THU, JUNE 5, 2014 · 3D PRINTING, 3DP APPLICATIONS, INDUSTRIAL, PROTOTYPING

"This is hugely revolutionary for our business. We have already seen the technology take months off of our product development process and that in turn minimizes risk. In fact, I estimate that we've shortened our R&D process by up to 35% with 3D printing. Add that on top of the 20% we're already saving in terms of our design work – well for me, it's fantastic." *Patrick Hurst, Managing Director, Whale*

3D-printed injection-molding tools (material: ABS)

Sources: 3D Printing Industry, Stratasys

Additive Manufacturing

Technology trends

Opportunities

3D Printing Opportunities for Plastics Manufacturers

Case study: Nypro Healthcare (Ireland)

Stratasys along with Nypro Healthcare conducted a series of tests to assess the performance of rapid prototyped cores and cavities with critical features that included:

- Gears
- Ratchets
- Interlocking legs
- Catch features

Upon completion of the tests,

- Molds were deemed to be stable
- the quality of the injection molded prototypes was deemed by Nypro to be "good."

Nypro offered the following analysis of the tests: **"It can be concluded that the injection molding trials were very successful… the process of printing cores and cavities can be considered an advantage in terms of time, initial functionality evaluations and reduced tooling cost."**

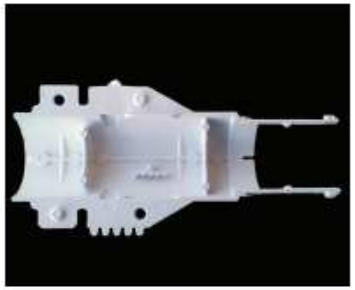


Figure 5 : Component part created by Nypro to test injection molded parts using a PolyJet mold.

Source: Stratasys

Additive Manufacturing

Technology trends

Opportunities

3D Printing Opportunities for Plastics Manufacturers

"The study concluded that, with this technique, molds are unique in that they perform in the same way as metal molds but are much cheaper, easier and faster to make. Of course there is still much to learn, but the study underscores the potential beyond the traditional uses of additive manufacturing to enable production." *-Jabil blog*

Nypro Healthcare

Source: Jabil

"Manufacturers are already seeing significant economic benefits from customized additive manufacturing solutions. We're working toward a future where the optimal combination of materials, machines and methods yield disruptive innovations in real-time."
-Scott Gebicke, Jabil Vice President of Global Business Units

Figure 6 : Finished sample part.

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Additive Manufacturing

Technology trends

Opportunities

Implications of 3D Printing for Plastics Molding & Moldmaking

3D printed cores and cavities … will further reduce the number of man-hours it takes to build a mold, and further reduce both time and cost. **Moldmakers who say they don't want to invest in 3D printing may not have a choice** because their customers are certainly adopting additive manufacturing in a number of ways.

Engineering teams at OEMs have 3D printers on their desks and in their labs. They are doing new-product iterations faster and cheaper than moldmakers can with even a single cavity "prototype" mold that can be built in a week.

Parts with complex geometries - and larger in size - can now be built in a matter of hours in the chosen material. **Not only parts, but actual cores and cavities can be built at the OEM's company** through the use of Direct Metal Laser Sintering (DMLS) and Selected Laser Melting (SLM), two technologies whose time has come.

This has two implications: **moldmakers will build fewer conventional "prototype" molds to produce "prototype" parts, and molders will do fewer pre-production "sample" runs.** With the continued evolution of materials - both polymers and metals - the ease and quickness of producing new-products and molds will improve time-to-market even more.

-Plastics Today

Additive Manufacturing

Technology trends

Opportunities

Implications of 3D Printing for Plastics Molding & Moldmaking

Secondly, these same material advancements are making it possible **to do small runs of actual end-use components that go from 3D printer to the vehicles or aircraft without a mold.** That has major implications for mold manufacturers who specialize in one- and two-cavity molds for low-volume parts requirements.

Additionally, molders will see this disruptive technology with respect to metal injection molding (MIM) as DMLS and SLM become dominant in the market, **and small volume plastic parts production, which can be quite profitable, will be a thing of the past.**

The second trend is human resources. If OEMs continue the trend of reducing the number of engineering staff and depending on their suppliers such as moldmakers, to supply the engineering expertise required, **more mold companies will be forced to hire skilled, degreed design and mechanical engineers.** We're already seeing that in want ads as moldmakers look for engineering personnel with varying educational and skill levels to meet the greater demands of their customers.

-Plastics Today

Additive Manufacturing

Technology trends

Opportunities

Implications of 3D Printing for Plastics Molding & Moldmaking

Third, **mold companies will have to bulk up financially to serve the major OEMs.** Over the past year, I've read dozens of reports and surveys that focus on suppliers and what OEMs want from their supply chain, and financial stability is near the top. These global OEMs can no longer afford to have suppliers who do not have the financial wherewithal to support their customers in their strategic growth plans. **That means the ability to hire the best people, and to invest in high-tech software and machine tool equipment to increase capabilities and capacity.**

Finally, to compete, moldmakers must establish a strategic business plan that includes a good marketing/sales plan to target, obtain and retain their optimum customer base. Perhaps that is the most difficult aspect of business for moldmakers to wrap their heads around because it's more ambiguous than buying another machine tool to increase capacity. But it's vital to the success of your business if you expect to be a long-term player with the big dogs.

-Clare Goldberry, Plastics Today

Additive Manufacturing

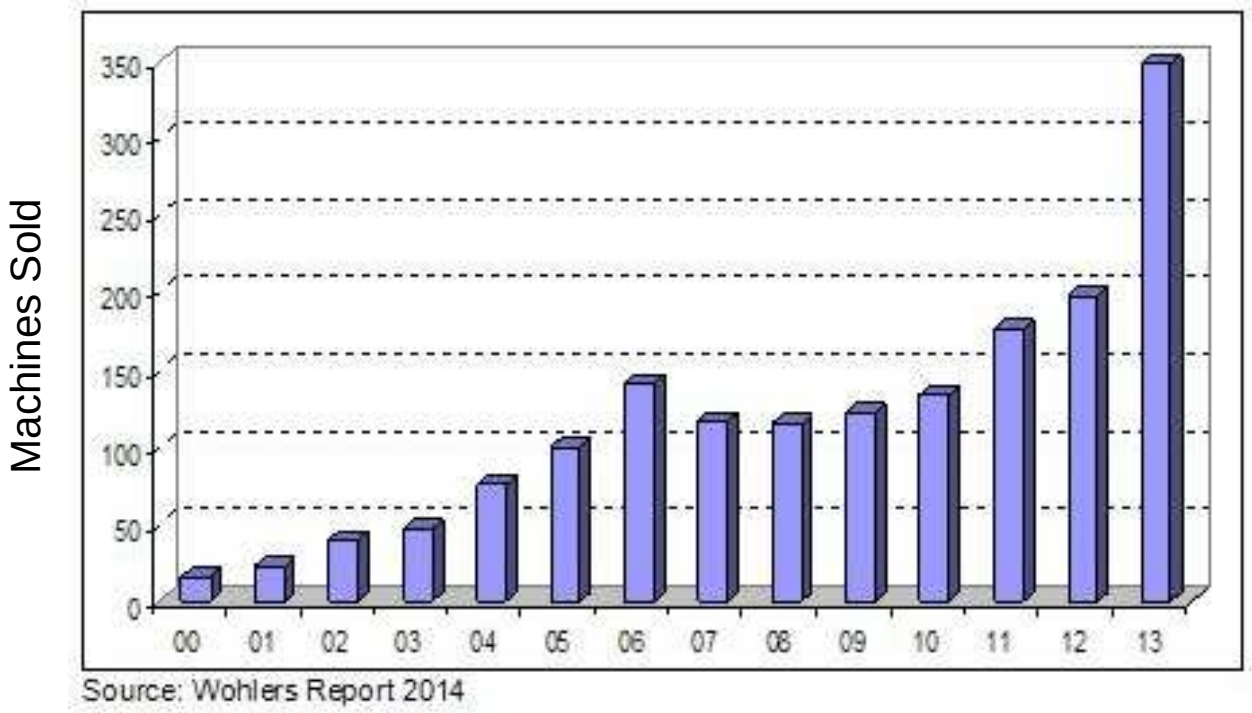
Technology trends

Opportunities

3D Printing is Also Impacting Machining & Metalworking

- Metal Additive Manufacturing grew by 76% from 2012-2013
- Major Markets:
  - Aerospace
  - Medical

Growth in Metal Additive Manufacturing



Source: Wohlers Report 2014

Additive Manufacturing

Technology trends

Opportunities

3D Printing is Changing the Aerospace Industry

GE is focusing on metal additive manufacturing for aerospace applications:

- By 2020, GE Aviation will produce more than 100,000 additive manufactured components for its LEAP and GE9X engines
- GE will install 19 additive manufactured fuel nozzles on every LEAP engine, which has amassed more than 4,500 orders.
- Why? Because parts are **25% lighter** and **5 times more durable** than their predecessors
- As part of a $3.5 billion investment in its aerospace supply chain, GE says it will spend tens of millions of dollars to invest in new technology and, over the next five years, **triple the size of its 70-person 3D-printing staff** and expand its factory floor fourfold.

GE 3D printed fuel nozzle

Source: GE

Sources: Bloomberg, SparPoint Group, The Economist

Additive Manufacturing

Technology trends

Opportunities

3D Printing is Changing the Aerospace Industry

The 3D printed bracket above (right), used on Airbus A320 aircraft, demonstrates the weight saving opportunities enabled by additive manufacturing techniques

Source: EADS

Additive Manufacturing

Technology trends

Opportunities

Metal Additive Manufacturing Enables Improvement in Customized Medical Devices

- Custom parts printed from patients' medical imaging data
- Compared to machining:
  - Lighter weight designs
  - More efficient use of costly medical materials (e.g., titanium)
  - No tooling

Replacement hip socket

Replacement for damaged portion of skull

Source: Renishaw

Additive Manufacturing

Technology trends

Opportunities

Design for Additive Manufacturing (DFAM) – an unmet workforce need and an opportunity for NCM

- Experienced designers learned how to design using subtractive methods, e.g., machining and may not see the possibilities of AM without specific training in DFAM
- Entry-level designers have the opportunity learn DFAM from the start as part of a holistic approach that includes subtractive techniques - they will understand all design options up-front and be able to select the best process for a given design problem
- DFAM is essential to future competitiveness in plastics and metals industries and presents an opportunity for regional competitive advantage

"Current design education is inadequate for additive manufacturing. Re-training of existing designers should be attempted. More importantly, a significant push to educate the next generation of engineers and designers to utilize additive manufacturing must become a part of related technical training, community college courses, and university degrees."

-Terry Wohlers, Wohlers & Associates (2013)

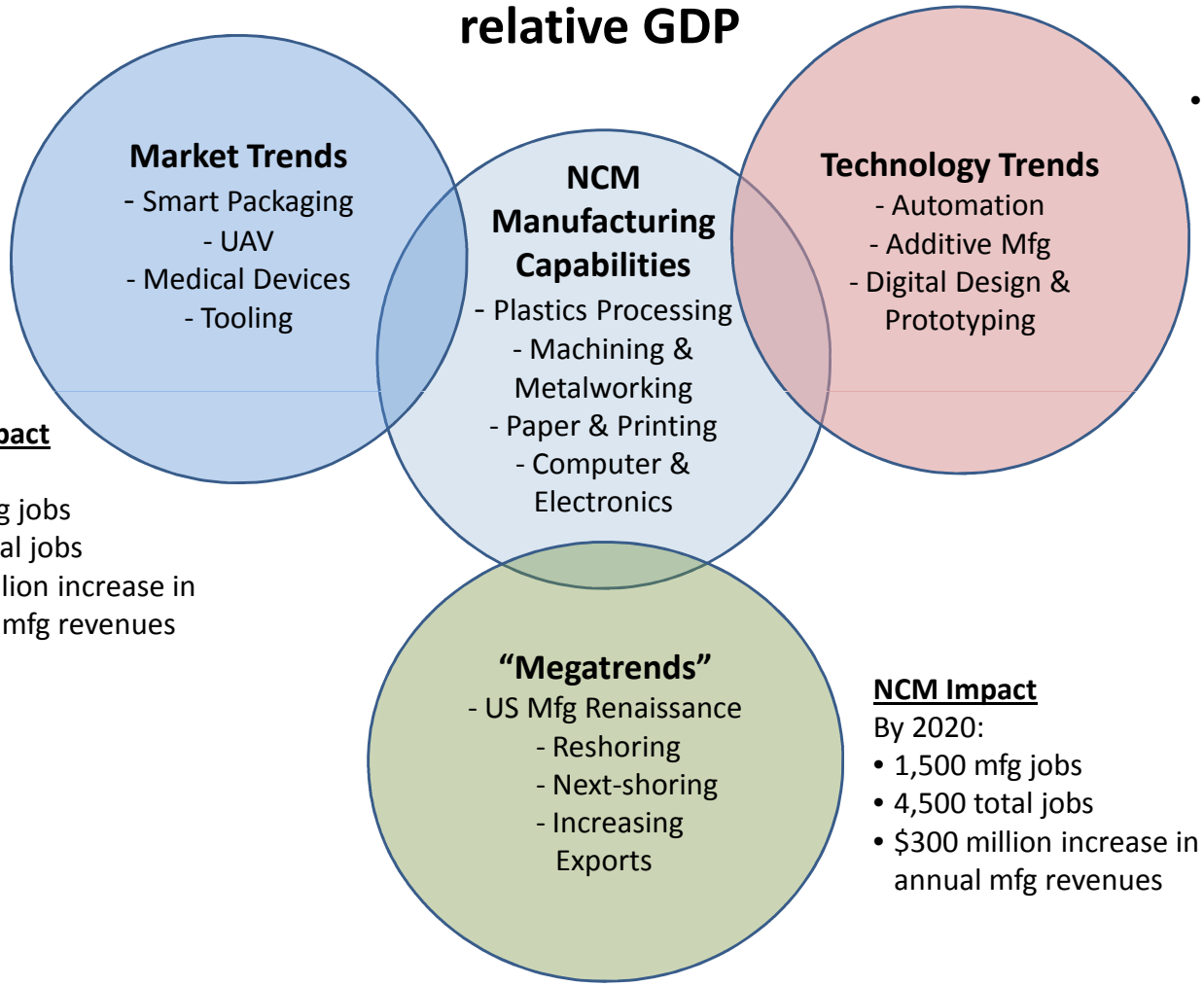
Impacts

NCM Impacts

Opportunities

POTENTIAL NCM IMPACTS

"Fair share" of expected market growth based on relative GDP



NCM Impact
By 2025:
- 300 mfg jobs
- 900 total jobs
- $60 million increase in annual mfg revenues

NCM Impact
By 2025:
- $7 billion global market for 3D printed parts
- Highest growth in medical device and aerospace, 2 key NCM industries

NCM Impact
By 2020:
- 1,500 mfg jobs
- 4,500 total jobs
- $300 million increase in annual mfg revenues

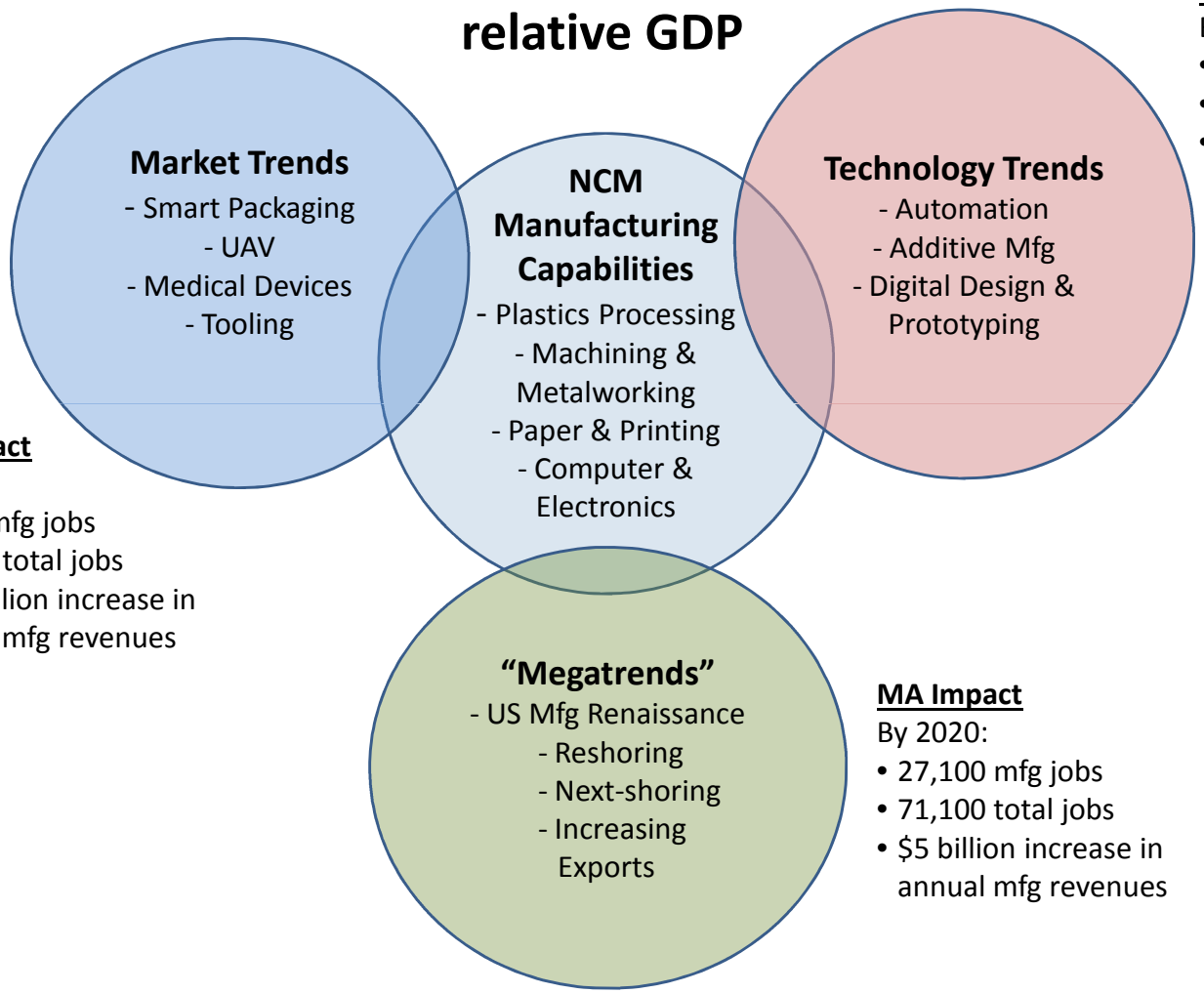
Impacts

MA Impacts

Opportunities

POTENTIAL MASSACHUSETTS IMPACTS

"Fair share" of expected market growth based on relative GDP



MA Impact
By 2025:
- 5,000 mfg jobs
- 15,000 total jobs
- $2.1 billion increase in annual mfg revenues

MA Impact
By 2025:
- 250–500 mfg jobs
- 750–1500 total jobs
- $50–100 million increase in annual mfg revenues

MA Impact
By 2020:
- 27,100 mfg jobs
- 71,100 total jobs
- $5 billion increase in annual mfg revenues

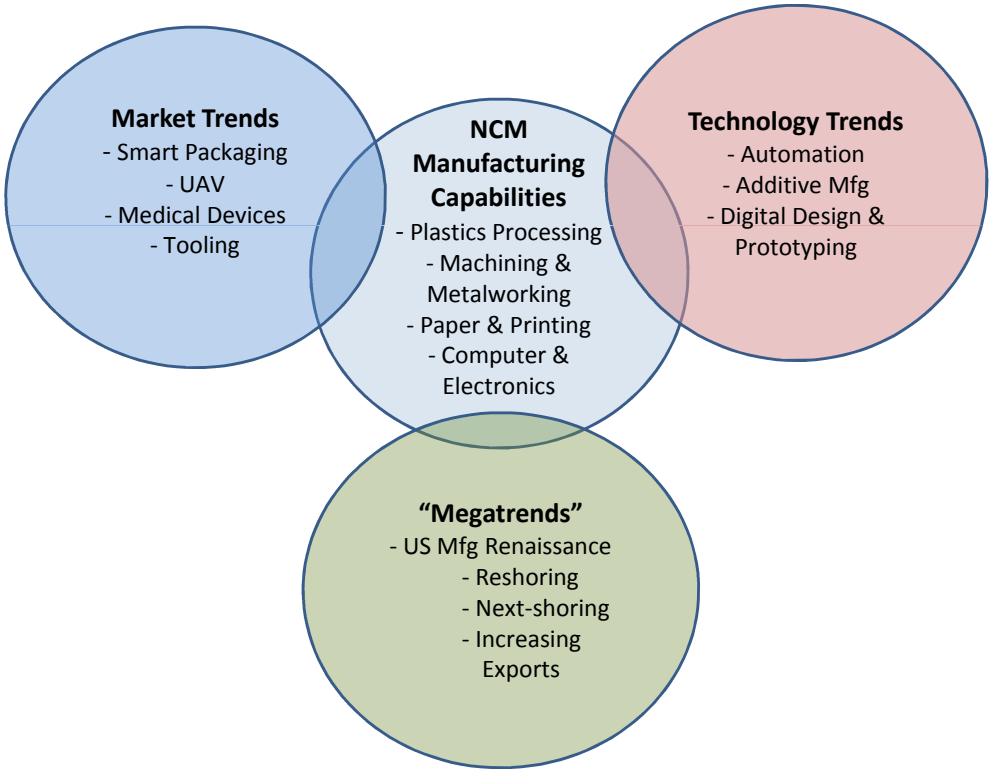
Impacts

Need for collaboration

Opportunities

POTENTIAL MASSACHUSETTS IMPACTS

To get its "fair share," the NCM collaborative must *actively* pursue relevant opportunities



Recommendations

High-Level

Recommendations

High-Level Recommendations for the NCM Collaborative

- **Actively assist SMEs in identifying and pursuing reshoring, export and market-specific opportunities through matchmaking and outreach**

- **Create a regional Center of Excellence in advanced manufacturing technology**
  - CNC
  - Additive Manufacturing
  - Digital Design
  - Lightweight Metals
  - Automation

Active Matchmaking

Recommendations

Active Matchmaking can help SMEs overcome barriers

- **Matchmaking** includes any activities designed to connect companies with needs to companies with relevant offerings to stimulate economic activity
- Matchmaking can include passive techniques (e.g. online databases) and active techniques driven by business professionals:
  - One-one-one connections
  - Matchmaking events
- There is a growing consensus that **active** matchmaking is required to achieve significant impacts:
  - NIST MEP is funding 10 pilot active matchmaking programs among MEP centers nationwide (MassMEP is one of the awardees)
  - The **Enterprise Europe Network (EEN)**, an EU-funded network of 600 business support organizations across 60 countries in the European Union and around the globe, has offered active matchmaking services since 2008
- Since 2008, the EEN has helped more than **11,000 companies** to sign business, technology, and research partnerships
- Average impact per company engaged: **$285,000 annual turnover**

MEP • MANUFACTURING EXTENSION PARTNERSHIP
NIST NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

enterprise europe network
Business Support on Your Doorstep

Active Matchmaking

Recommendations

MassMEP is implementing Active Matchmaking

- MassMEP has won a 2-year, $200,000 grant from NIST to establish a pilot active matchmaking program called the **Enterprise Massachusetts Network (EMN):**
  - MassMEP will build a database of regional technologies, capabilities, needs, and opportunities with assistance from the Collaborative and provide active matchmaking services similar to the EEN
  - RTI International, a member of the US-EU Match consortium, will connect the EMN to the EEN, opening a new path to export opportunities
- The NCM Collaborative can facilitate matchmaking by:
  - Creating awareness of matchmaking resources and promoting activities to SMEs/members
  - Encouraging SMEs/members to work with MassMEP to provide profiles of capabilities and descriptions of needs
  - Helping to identify matchmaking opportunities and supporting matchmaking events

enterprise europe network

Business Support on Your Doorstep

EEN reach (participant countries in blue)

Active Matchmaking

Recommendations

Pursue Matchmaking Outreach Opportunities

The Collaborative should consider the following options for marketing regional capabilities:

- Trade missions
  - Regional (e.g., Boston for medical device industry)
  - Industry-specific (Medical device, UAV)
  - Market-specific (e.g. Tooling)
  - Company-specific (e.g., Wal-Mart)
  - Domestic (e.g., for tooling opportunities in the Midwest)
  - International (the US Commerce Department, the Enterprise Europe Network and other groups sponsor these)
- International matchmaking events
  - US Commerce Department's Gold Key Matching Service
  - EEN events
- Regional participation at industry trade shows
- Reshoring-focused regional OEM outreach events

enterprise europe network

Business Support on Your Doorstep

EEN reach (participant countries in blue)

Active Matchmaking

Recommendations

Enterprise Massachusetts Network

Universities (UMass/ M2D2)

SMEs

Start-ups (Greentown Labs)

OEMs

Solutions
- Technologies
- Suppliers/ Capabilities

Needs
- Technology Requests
- Business Opportunities

Regional CMCGI
Outreach, Resources, TDMI

Active Matchmaking
- Build/maintain database
- Search for matches
- Connect providers and seekers
- Host matchmaking events
- Facilitate reshoring opportunities
- Provide business support to facilitate successful matches

Reshoring Initiative®
Bringing Manufacturing Back Home

Reshoring Initiative
- Database of purchasing contacts at OEMs sourcing inputs offshore
- Total Cost of Ownership calculator

MassMEP
Manufacturing Extension Partnership

Impacts:
- Higher employment
- Higher wages
- Economic growth

RTI INTERNATIONAL

RTI International
- US/EU Match member
- Upload opportunities to EEN matchmaking database
- Facilitate inquiries from EEN clients

us eu match

enterprise europe network
Business Support on Your Doorstep

Enterprise Europe Network
- Technologies
- Technology requests
- Export opportunities
- Partnership opportunities

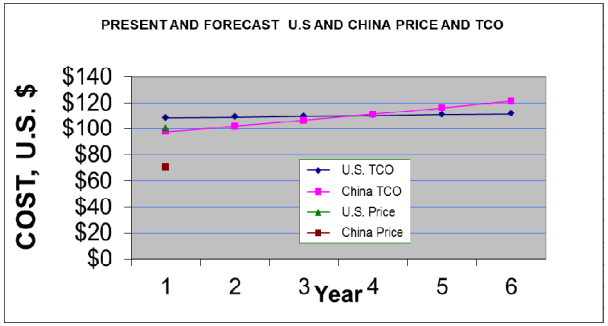
Active Matchmaking

Recommendations

Reshoring will be included in active matchmaking efforts

- MassMEP will adopt the process developed by the Reshoring Initiative (currently being implemented by several MEPs):
  - Identify regional OEMs with reshoring opportunities using Datamyne database
  - Engage SMEs with OEMs to help the OEM understand, calculate, and compare the Total Cost of Ownership (TCO) of the SME's components or products and those of Chinese manufacturers
    - Some elements of TCO that buyers often overlook: insurance during shipment, larger buys, delays in delivery, quality issues, use of unacceptable materials, travel costs
  - If the SME's costs are still high, MassMEP will work with them to drive down cost using Lean Manufacturing principles

Reshoring Initiative®
Bringing Manufacturing Back Home



Sample OEM TCO calculation

Source: Reshoring Initiative

Active Matchmaking

Recommendations

Target market-specific opportunities through the EMN

- Through the Enterprise Massachusetts Network (EMN), MassMEP will seek matches to connect NCM manufacturers with relevant capabilities to market opportunities in the high-growth markets identified:
  - Medical Device
  - UAV
  - Packaging & Printing
  - Tooling
- Matches will first be pursued regionally, then domestically, then internationally (through the Enterprise Europe Network)
- The Collaborative can support this effort by:
  - Promoting SME participation in matchmaking and hosting regional matchmaking events focused on the targeted markets to connect established OEMs and startups with NCM manufacturers
  - Organizing a working group to develop a strategy to maximize the UAV opportunity

Advanced Manufacturing

Recommendations

Create an Advanced Manufacturing Center of Excellence in NCM

Many of the pieces are already in place:

- **CNC:**
  - Training courses are currently offered by MACWIC
    - Applied Manufacturing Technology Pathway Certification Program is a "curriculum in a box" that has been widely adopted by vocational schools and community colleges throughout Massachusetts
    - The LearnCNC Virtual Training System increases access to low-cost training

- **Digital Manufacturing:**
  - Siemens recently announced $660 million of in-kind software grants for manufacturing programs at vocational high schools, technical community colleges and universities throughout Massachusetts - students will now have access to Siemens' product lifecycle management (PLM) software
  - Siemens is also a Tier One partner in the Digital Manufacturing Lab NNMI and a Platinum Member of America Makes (Additive Manufacturing NNMI)

Advanced Manufacturing

Recommendations

Create an Advanced Manufacturing Center of Excellence in NCM

Many of the pieces are already in place:

- **Additive Manufacturing**:
  - Polymer 3D printing capability is in place at WPI, UMass Lowell, and Quinsigamond CC
  - The Connecticut Center for Advanced Technology (CCAT) already considers working with Massachusetts companies part of its mission and is actively working with several companies in the western part of the State
  - CCAT assets include an aerospace-grade metal 3D printer that prints large parts in a range of metals and a multi-material polymer 3D printer

- **Lightweight & Modern Metals:**
  - WPI is a member of the Lightweight & Modern Metals NNMI, responsible for conducting research in casting and heat treating

Advanced Manufacturing

Recommendations

Create an Advanced Manufacturing Center of Excellence in NCM

Training

- Incorporate Design for Additive Manufacturing (DFAM) into regional Advanced Manufacturing workforce training curricula as a required element to build regional competency
  - Engage recognized DFAM experts and manufacturers to build the curriculum
    - Nypromold
    - University of Texas
    - CCAT
    - Equipment vendors
  - Fund or subsidize the cost of DFAM training for a critical mass of workers to establish an additive manufacturing (AM) community

Equipment

- Provide access to additive manufacturing assets to SMEs:
  - Plastic AM
    - Utilize existing assets at educational institutions or set up a separate entity similar to CCAT if access to existing assets is not feasible
    - Offer incentives for SMEs to purchase systems
    - Promote CCAT for designs requiring multiple materials
  - Metal AM
    - Promote CCAT

Advanced Manufacturing

Recommendations

RTI INTERNATIONAL

Create an Advanced Manufacturing Center of Excellence in NCM

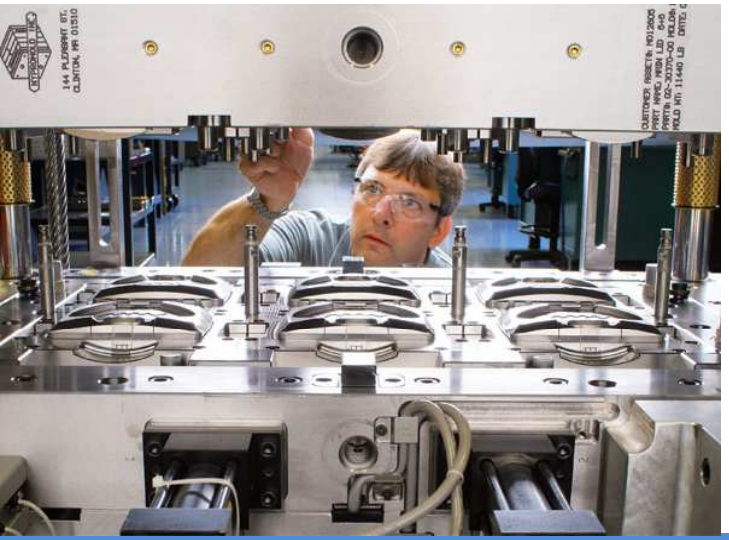
Collaboration

- Establish and promote practitioner communities for CNC, Additive Manufacturing, and Digital Manufacturing for NCM to promote sharing of knowledge and best practices
- Require practitioner communities to engage the NNMI Institutes for Manufacturing Innovation (IMIs), by joining them or leveraging local IMI partners, to monitor activities and learn about opportunities to participate in funded projects and other SME assistance efforts:
  - America Makes (partner: Siemens)
  - Digital Manufacturing Lab (partner: Siemens)
  - Lightweight & Modern Metals (partner: WPI)

Outreach

- Conduct outreach events and marketing to inform NCM manufacturers of training opportunities and practitioner community activities, promote employee participation in communities, and promote adoption of advanced manufacturing technologies

END VOLUME 2



COLLABORATIVE MANUFACTURING COMMUNITIES GROWTH INITIATIVE (CMCGI) FOR THE NORTH CENTRAL MASSACHUSETTS REGION

Volume 3: Executive Summary and Final Recommendations from SME Interviews and Technology-Driven Market Intelligence

January 16, 2015

***Please Note*:** This report is a good faith effort by RTI to accurately represent information available via secondary and primary sources at the time of the information capture. The report is not for publication or public disclosure.

Funding

USDA Rural Business Opportunity Grants (RBOG) Program Objective: to promote sustainable economic development in rural communities with exceptional needs

- Grants are awarded on a competitive basis
- Grant funds must be used for projects in rural areas and can be used for the following:
  - Community economic development
  - Technology-based economic development
  - Feasibility studies and business plans
  - Leadership and entrepreneur training
  - Rural business incubators
  - Long-term business strategic planning

Timeline

we are here.

Phase 1: Survey Manufacturers

Design survey instrument
Identify, categorize firms
Recruit participants
Schedule interviews

Conduct interviews
Compile, clarify, analyze results

Incorporate stakeholder feedback

Phase 2: Market Analysis

Characterize regional manufacturing capabilities

Identify opportunities

Screen and select opportunities

Conduct SWOT analyses

Develop recommendations to exploit opportunities

Phase 3: Roadmap for Growth

Propose roadmap

Organize steering committee

Initiate partnership collaborations

Complete roadmap for growth

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Barriers to Growth

Interviews of NCM SME manufacturers identified top barriers to growth:

(Sample size: 25% of 214 SMEs of five employees or greater)

1. **Workforce – lack of workers with appropriate skills ("middle skills")**
   - Lack of interest in manufacturing among high-school students
   - Lack of workers with basic professional skills (metrology, math, blueprint reading, work readiness)
   - Lack of workers with relevant manufacturing skills (mill, lathe, programming)
2. **Regulatory constraints**
   - Companies must submit duplication of paperwork to demonstrate compliance with varying State and Federal regulations
   - Regulations are not flexible enough to account for a site's particular situation
   - Costly regulations that provide no economic benefit
3. **Access to new market opportunities**
   - Lack of resources to identify opportunities
   - Lack of resources to pursue new markets

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Facilitators of Growth

What companies would change about regional support entities

- Outreach and information about service offerings (7)
  - *"Need to increase awareness of offerings and existence."*
  - *"Don't know what they provide. More outreach so people are more aware of the help that is available."*
- Workforce issues (7)
  - *"Workforce training grants are very limited for some businesses like hers. They are too specific and too restrictive for a small business (100 or fewer employees)."*
  - *"Employment services, replacing retiring workers."*
  - *"A lot of emphasis on worker training, but no real cleaning house after workers are done. So they can tap into this potential later pool. Should be a central clearing house."*
- Tailored advice and services rather than program-based (6)
  - *"Do a good job and have valid directions for solving problems currently. Could do better if they could break down to company level, visit company, see work environment, understand the business environment. Ask the people on the floor what skills they want/need."*
- Increased assistance for small businesses (5)
  - *"Would love to have a forum for small businesses to exchange ideas"*
  - *"Been in business for a long time and some of the programs don't qualify for them, because they are too small."*
- Less administrative burden attached to support (3)
- Coordination of services across entities (2)

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Recommendations

Recommendations: General

- Increase collaboration and coordination among providers
  - Existing resources are in place to address most of the needs stated in the interviews
- Create Steering Committee of AIM, SBDC, MassDEV, Chambers, MassMEP, community colleges, et al. to focus resources on needs
  - Customize offerings to address specific regional needs identified in the interviews
  - Increase awareness of manufacturing support services
  - Reduce administrative burden to engage in manufacturing support services

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Recommendations

Recommendations: Workforce

Barrier	Solution	Rationale

• Lack of trained, skilled workers
• Lack of interest in manufacturing careers from youth, and quality of high school graduates
• Workers lack soft skills
	• Recruiting
	  • MassDevelopment/AMP It Up
	  • Local Chambers of Commerce
	  • Vocational schools
	• Training
	  • MACWIC Regional Training Initiative
	  • Workforce investment boards/career centers
	  • MWCC
	  • Distance learning
		• Building a pipeline
		• Survey tells us skills are needed/the manufacturing base is not providing
		• WIBs are a captive area for job seekers
		• Distance learning provides credentialing

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Recommendations

Recommendations: Workforce

Barrier	Solution	Rationale

• Lack of trained, skilled workers
• Lack of interest in manufacturing careers from youth, and quality of high school graduates
• Workers lack soft skills
	• Facilitate OJT and Apprenticeships
	• Leverage Federal resources [National Networks for Manufacturing Innovation (NNMI), NIST MEP] to help NCM manufacturers implement advanced manufacturing technologies beyond CNC:
	  • 3D/Additive Mfg
	  • Digital Design
	  • Lightweight Metals
		• Provide workplace learning
		• Additive manufacturing is already impacting key NCM industries
		• NNMI participation will guide development of advanced manufacturing capabilities
		• Serving SMEs is a key part of the NNMI and NIST MEP missions

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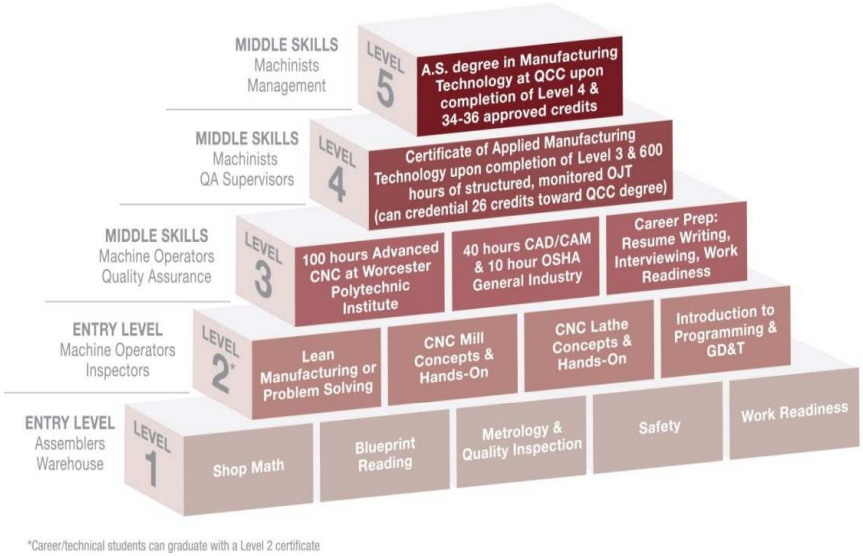
Recommendations

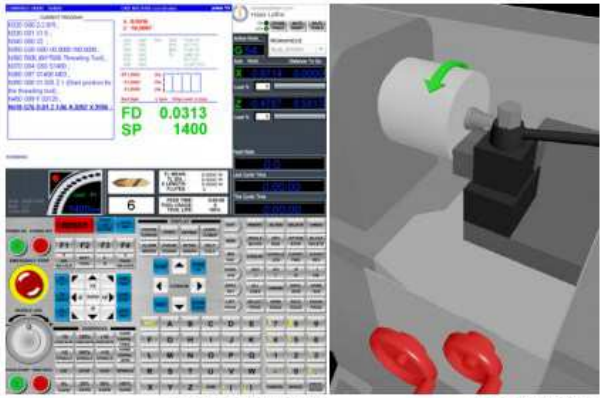
Workforce Development Partners & Programs



Applied Manufacturing Technology Pathway Certification

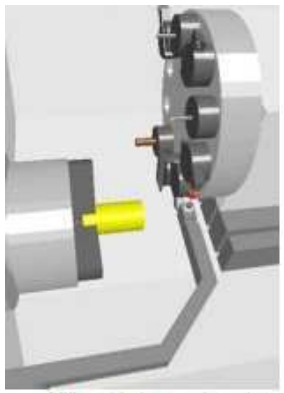
mac
WORKFORCE | INNOVATION | COLLABORATIVE

WPI

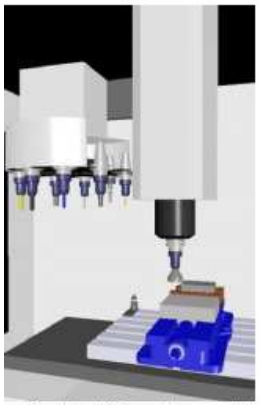


Popular control panels

Lathe applications



Mill and lathe touch probes



Simulated 3D machine models

LearnCNC™ Virtual Training System

RTI INTERNATIONAL

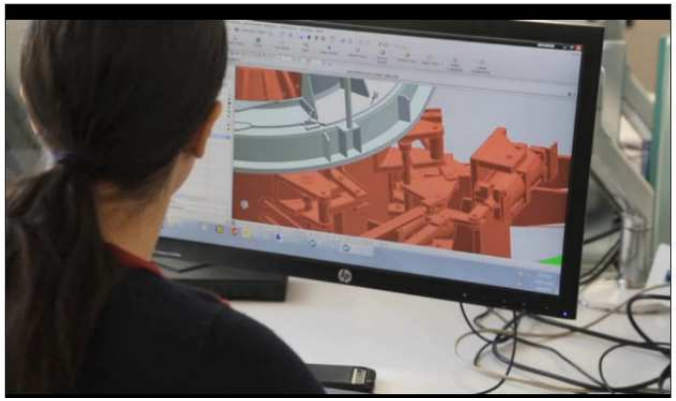
Recommendations

Workforce Development Partners & Programs

AMP IT UP! MATCHING GRANTS TOTAL NEARLY $100,000 FOR 10 INNOVATIVE PROGRAMS ACROSS MASSACHUSETTS

AMP it up! Manufacturing Promotional Campaign

MassDevelopment



Siemens Makes Nearly $660M Investment in Software Grants for Massachusetts Schools to Educate and Train Workers for Manufacturing Industry

SIEMENS

SMARTalent
STRATEGIC MANAGEMENT ACQUISITION & RETENTION OF TALENT

NIST MEP develops workforce programs like SMARTalent and facilitates systemwide sharing of best practices

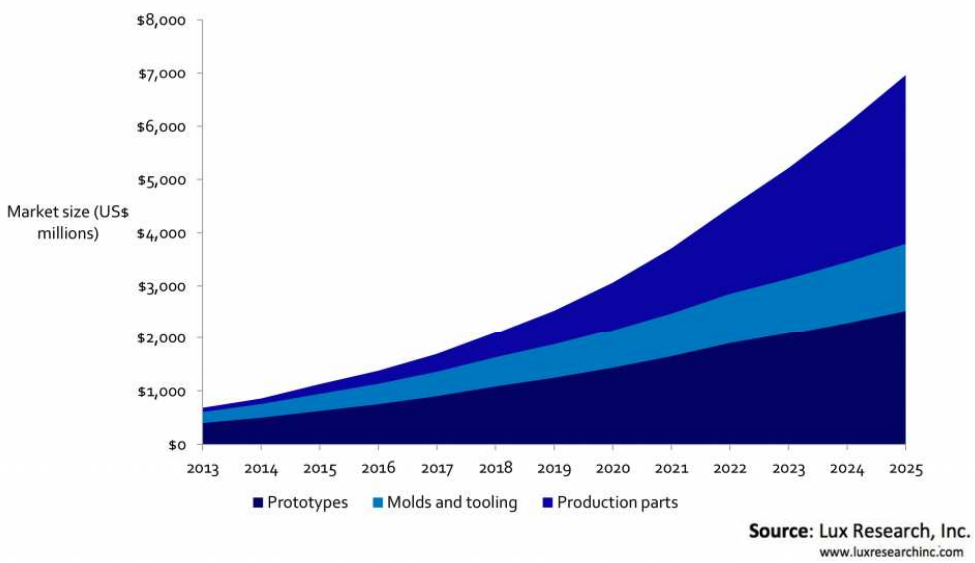
NIST | MEP

RTI INTERNATIONAL

Recommendations

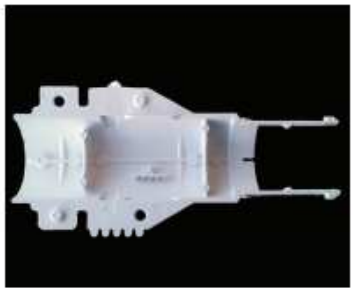
3D Printing Opportunity

The 3D Printed Part Market Will Reach $7 Billion in 2025



Source: Lux Research, Inc.
www.luxresearchinc.com

Nypro Healthcare



Nypro and others are producing prototypes and finished parts from 3D-printed molds

"Current design education is inadequate for Additive Manufacturing (AM). Retraining of existing designers should be attempted. More importantly, a significant push to educate the next generation of engineers and designers to utilize AM must become a part of related technical training, community college courses, and university degrees."

-Wohlers & Associates

Initiatives are under way at Lowell, Quinsigamond, WPI

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Recommendations

Recommendations: Regulatory constraints

Barrier	Solution	Rationale
Burdensome regulation (environmental, tax, workforce training application, import/export)	• Establish Services from state and federal resources that will: – Provide education to lessen compliance costs – Ensure interaction to determine cost of compliance – Legislate against burdensome regulations – Assist regulators in compliance reform with a sensitivity to the size of the enterprise	• Regulatory Compliance weighs heavily on the minds of manufacturers with 78% of the respondents, and is the major contributor to Unfavorable Business Climate response • Growth in the cost of regulations grew at an annualized rate of 7.6% (1998–2011 vs 0.4% growth in physical manufacturing growth for the same period

RTI INTERNATIONAL

Recommendations

Recommendations: Regulatory constraints

Barrier	Solution	Rationale
Burdensome regulation (environmental, tax, workforce training application, import/export)	• Establish Services from state and federal resources that will: – Seek to harmonize State and Federal Regulations – Educate SMEs relative to Government Grants/Credits such as R&D tax credits that can offset the uncompetitive US tax barrier	• Reduction in output is projected to cost manufacturers $200 billion in 2012, representing approximately 34% of the 2010 pretax profit for the industry • Two-thirds of the world's purchasing power is offshore, representing the biggest growth opportunity for Small Manufacturing enterprises • Small Manufacturers under 20 employees, the most in need, are significantly underrepresented in the Workforce Training Grant awards

RTI INTERNATIONAL

Recommendations

North Central Resources

Associated Industries of Massachusetts (AIM) improves your company's financial performance through a unique combination of lobbying, management, and human-resource services that allow you to control the environment both inside and outside your business. AIM is a community of Massachusetts employers working together to improve the business climate and create economic opportunity by

- reducing the cost of health care, taxes, unemployment insurance, and other business expenses;
- shaping state and federal business regulation; and
- ensuring a skilled and highly educated work force.

AIM provides management and HR services that increase workforce productivity and improve the recruitment, retention, and training of talented people. We keep members compliant with complex employment laws and regulations so they avoid fines, lawsuits, and adverse impacts to their reputations as employers. AIM also allows employers to access high-quality workers compensation and other insurance products.

- 75% of clients surveyed credit the Massachusetts Export Center (Massexport) with helping them to achieve specific export sales.
- Overall, companies assisted by Massexport generated well over $2 billion in export sales in 2011.
- Between 2010 and 2011, Export Center clients increased their export sales by over 27%, compared to an increase of just 5% for Massachusetts' export performance during the same time period.
- 100% of clients found the services of the Massachusetts Export Center to be beneficial and 81% indicated that the Export Center’s services exceeded their expectations.
- The Massachusetts Export Center's impact translates to over 1,000 new/retained jobs in Massachusetts (based on the U.S. Commerce Department's exports-to-jobs formula).

Recommendations

North Central Resources

The Smaller Business Association of New England, Inc. (SBANE), founded in 1938, is a private not-for-profit Association of approximately 600 member companies located throughout the six-state region. SBANE was established to provide a legislative voice for small business at the state and federal levels and to make practical information available to help business owners grow their companies. The membership is characterized by a high degree of participation, reflected in a large and dynamic committee structure, addressing a range of topics from international trade to human resources. SBANE services include:

Educational and Networking Events
Member Marketplace
Marketing Opportunities
Capital Connections

SBANE has the expertise to identify non-traditional, non-bank capital solutions for the small business owner to finance its growth or sustainability.

Manufacturing Matching Grant Program
New England Innovation Awards
Raytheon Integrated Defense Systems (IDS) Supplier Matchmaking

SBANE can facilitate an introduction to seek an evaluation from Raytheon as to whether your competencies and capabilities meet Raytheon's supplier requirements.

Massachusetts SBDC

Regulations and compliance

The SBDC connects SMEs to resources to provide starting points for learning about regulations that apply to their manufacturing business, and how to comply with them.

Environmental Regulations

Environmental Compliance: Industry Sector Guides
Compliance Assistance Centers (link is external)
State-by-State Resource Locator (link is external)
Statues and Regulations by Business Sector
Environmental Regulations Guide

OSHA Regulations

OSHA eTools
Compliance Assistance Publications
OSHA Recordkeeping Handbook
Onsite Consultations
Workplace Safety and Health Guide

Tax Regulations

Tax Guide for Manufacturing

Marketing Regulations

Made in the USA Labels: Information for Manufacturers, Retailers, and Consumers

Recommendations

Recommendations: Business Development

Barrier	Solution	Rationale
Lack of business development resources	• Establish **Active** Matchmaking services for SMEs similar to the European Union's Enterprise Europe Network (EEN), to focus on the opportunities below • Pursue exports: – Participate in the EEN through US/EU Match – Connect SMEs to Massexport, facilitate use of their export training program • Work with UMass Lowell/ M2D2 on SME outreach • Resurrect the NCM Chamber medical device collaborative	• Active human matchmaking is essential for significant impact on SME growth – NIST has reached the conclusion that passive supplier databases alone are not effective—matchmaking needs to be driven by people – The EEN's active matchmaking services have made significant impacts on EU SMEs • Once export opportunities are found, SMEs will need to learn the export process • NCM serves the medical device industry, which leads MA in exports • NCM Chamber medical device collaborative was successful but was discontinued due to lack of funding

Recommendations

Recommendations: Business Development

Barrier	Solution	Rationale
Lack of business development resources	• Pursue market opportunities identified in TDMI market analysis • Pursue reshoring opportunities: – Utilize Reshore Initiative's database to ID regional OEMS sourcing offshore – Engage OEMs in Total Cost of Ownership discussion – Link OEMs to NCM suppliers	• Billion-dollar markets, growing faster than GDP • NCM industry is serving or can serve with capabilities • US is near cost parity with China • An estimated 25% of goods outsourced to China could be made in the US at a lower total cost

RTI INTERNATIONAL

Recommendations

Active Matchmaking

- Active matchmaking (business professionals connecting solution seekers with solution suppliers and facilitating relationships) has been effective in the European Union
- The **Enterprise Europe Network**, an EU-funded network of 600 business support organizations across 60 countries in the European Union and around the globe, has offered active matchmaking services since 2008
- The EEN maintains a database of SME capabilities and needs, actively mines the database to identify potential matches, facilitates introductions and provides support to partners as needed to realize opportunities
- Since 2008, the EEN has helped more than 11,000 companies to sign business, technology, or research partnerships
- Average impact per company engaged: $285,000 annual turnover
- We propose establishing an **Enterprise Massachusetts Network (EMN):**
  - MassMEP will build a database of regional technologies, capabilities, needs, and opportunities with assistance from the Collaborative and provide active matchmaking services similar to the EEN
  - RTI International, a member of the US-EU Match consortium, will connect the EMN to the EEN, opening a new path to export opportunities

enterprise europe network

Business Support on Your Doorstep

RTI INTERNATIONAL

Recommendations

Enterprise Massachusetts Network

Universities (UMass/ M2D2)

SMEs

Start-ups (Greentown Labs)

OEMs

Solutions
- Technologies
- Suppliers/ Capabilities

Needs
- Technology Requests
- Business Opportunities

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- Database of purchasing contacts at OEMs sourcing inputs offshore
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Impacts:
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RTI International
- US/EU Match member
- Upload opportunities to EEN matchmaking database
- Facilitate inquiries from EEN clients

enterprise europe network
Business Support on Your Doorstep

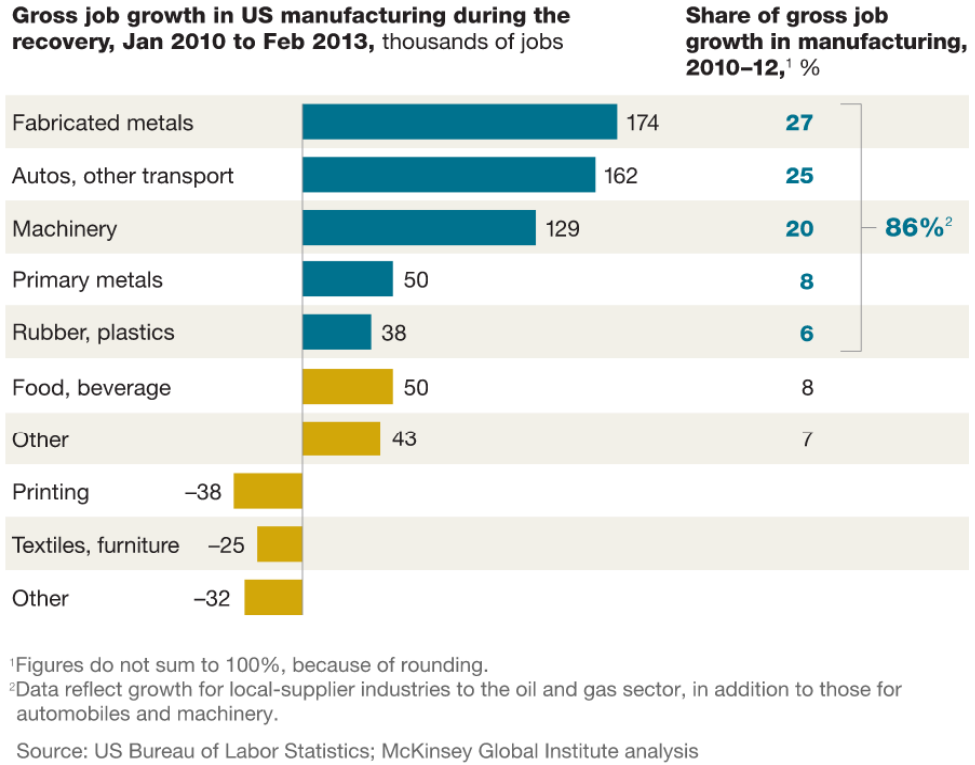
us eu match

Enterprise Europe Network
- Technologies
- Technology requests
- Export opportunities
- Partnership opportunities

Recommendations

The reshoring/next-shoring opportunity in NCM

- Fabricated metals and machinery accounted for almost half of US manufacturing job growth between 2010 and 2013
- The plastics & rubber industry also saw significant job growth in the period
- Boston Consulting Group estimates that reshoring has the potential to create up to **1 million new manufacturing jobs in the US by 2020**



- Potential Impacts:
  - 27,100 jobs in Massachusetts based on its share of US manufacturing output (2.7%)
  - 1,500 jobs for North Central Massachusetts (5.6% of manufacturing jobs in Massachusetts)

Recommendations

Matchmaking for reshoring opportunities

Reshoring strategy:

- Adopt the process developed by the Reshoring Initiative (currently being implemented by several MEPs):
  - Engage SMEs with regional OEMs to help the OEM understand, calculate, and compare the Total Cost of Ownership (TCO) of the SME's components or products and those of Chinese manufacturers
    - Some elements of TCO that buyers often overlook: insurance during shipment, larger buys, delays in delivery, quality issues, use of unacceptable materials, travel costs
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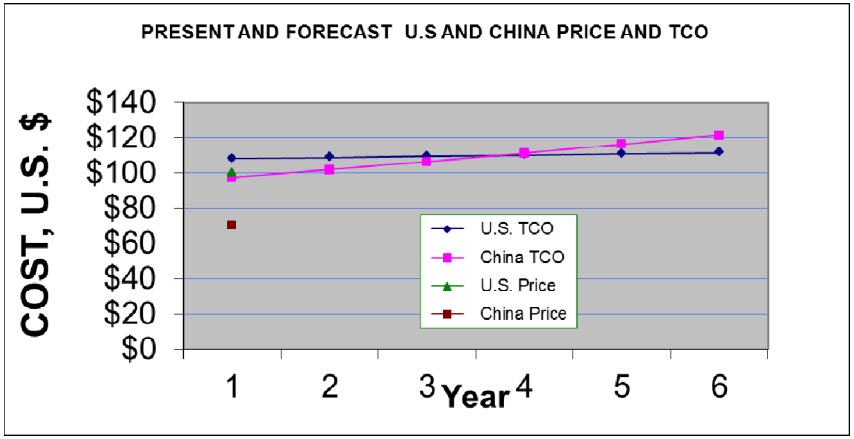
Reshoring Initiative®
Bringing Manufacturing Back Home

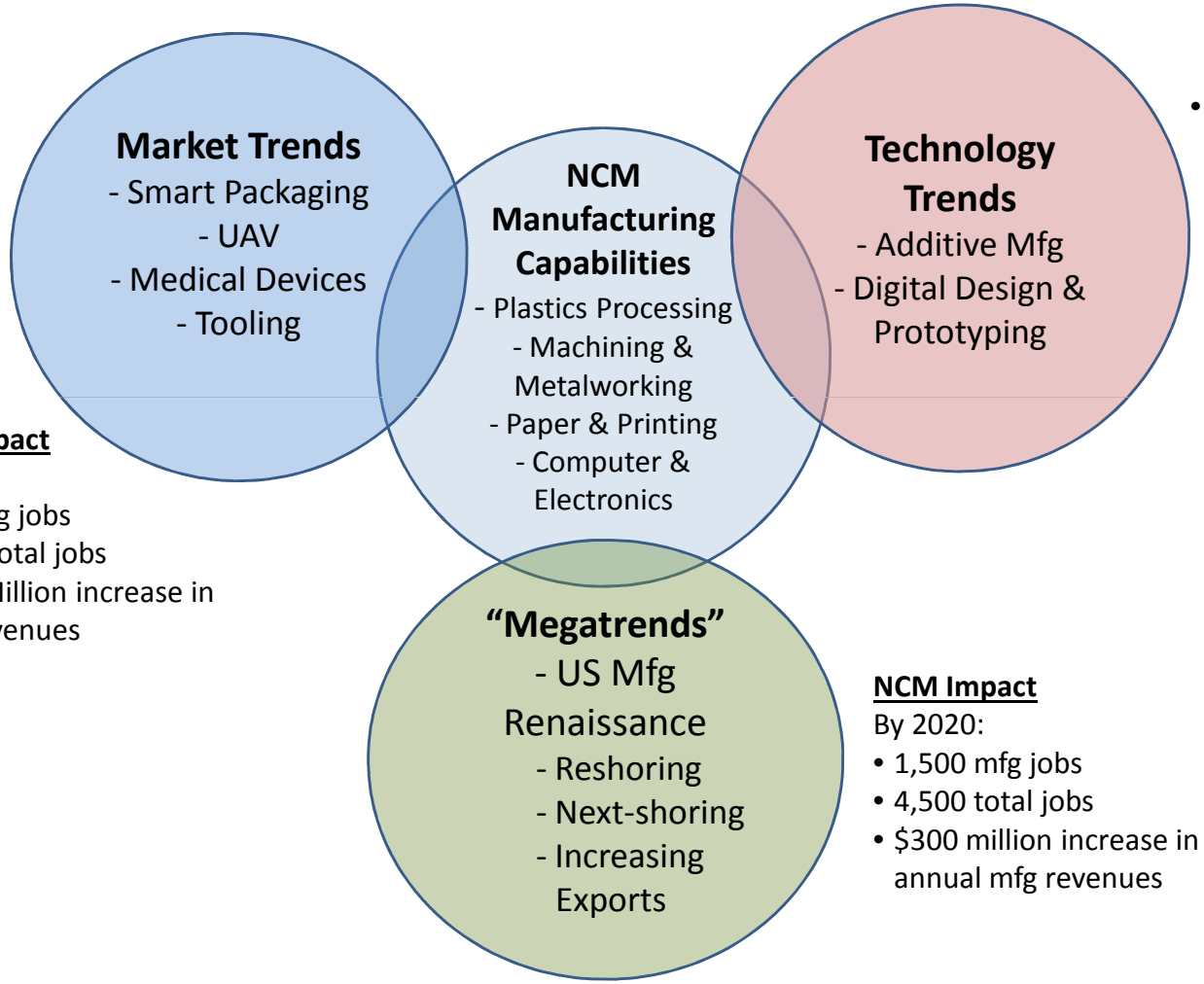


Source: Reshoring Initiative

Opportunities

North Central Massachusetts

OPPORTUNITIES



NCM Impact
By 2025:
- 560 mfg jobs
- 1,680 total jobs
- $117 Million increase in mfg revenues

NCM Impact
By 2025:
- $7 billion global market for 3D printed parts
- Highest growth in medical device and aerospace, 2 key NCM industries

NCM Impact
By 2020:
- 1,500 mfg jobs
- 4,500 total jobs
- $300 million increase in annual mfg revenues

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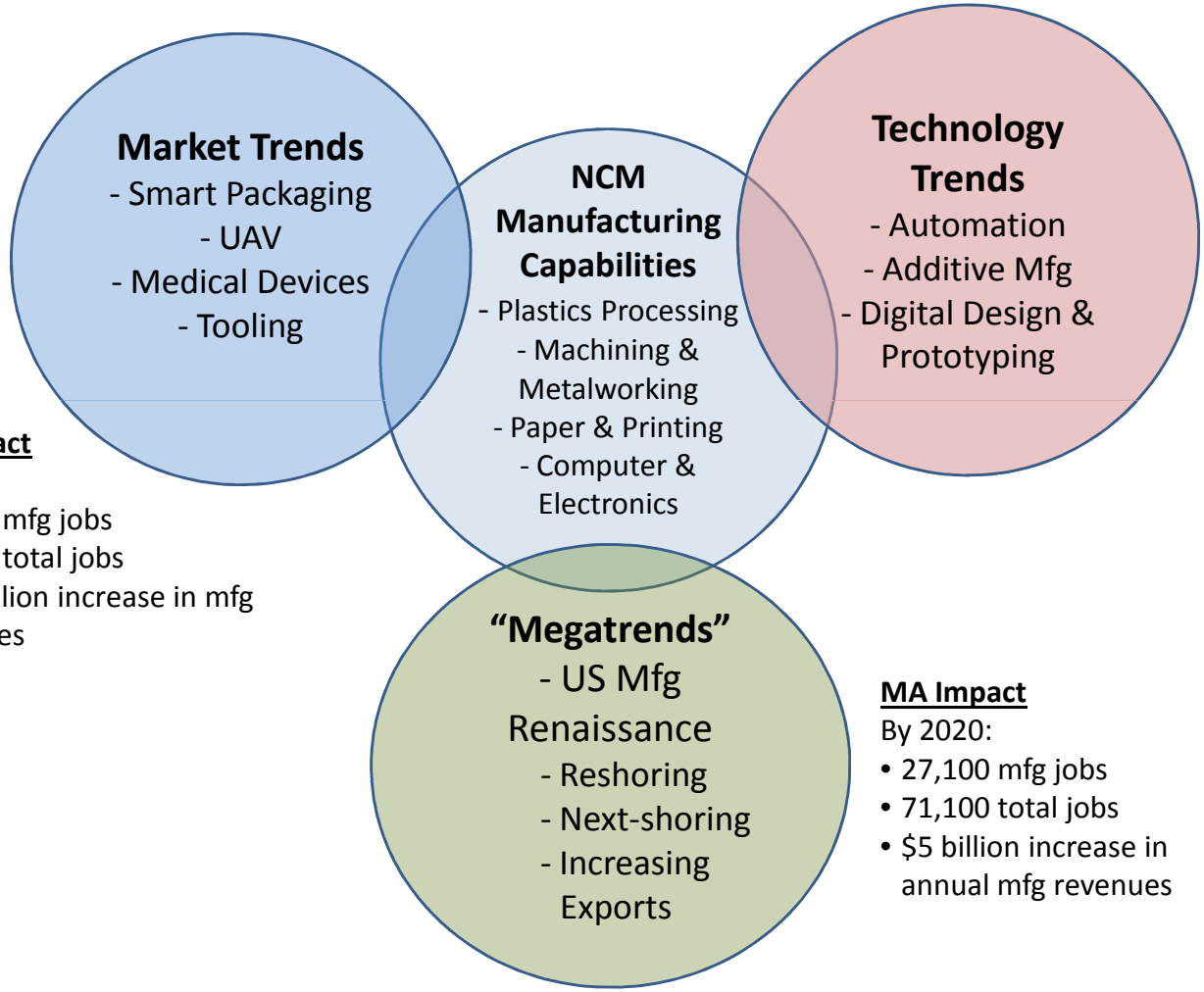
Opportunities

Massachusetts

OPPORTUNITIES



MA Impact
By 2025:
- 10,000 mfg jobs
- 30,000 total jobs
- $2.1 billion increase in mfg revenues

MA Impact
By 2025:
- 250–500 mfg jobs
- 750–1500 total jobs
- $50–100 million increase in mfg revenues

MA Impact
By 2020:
- 27,100 mfg jobs
- 71,100 total jobs
- $5 billion increase in annual mfg revenues

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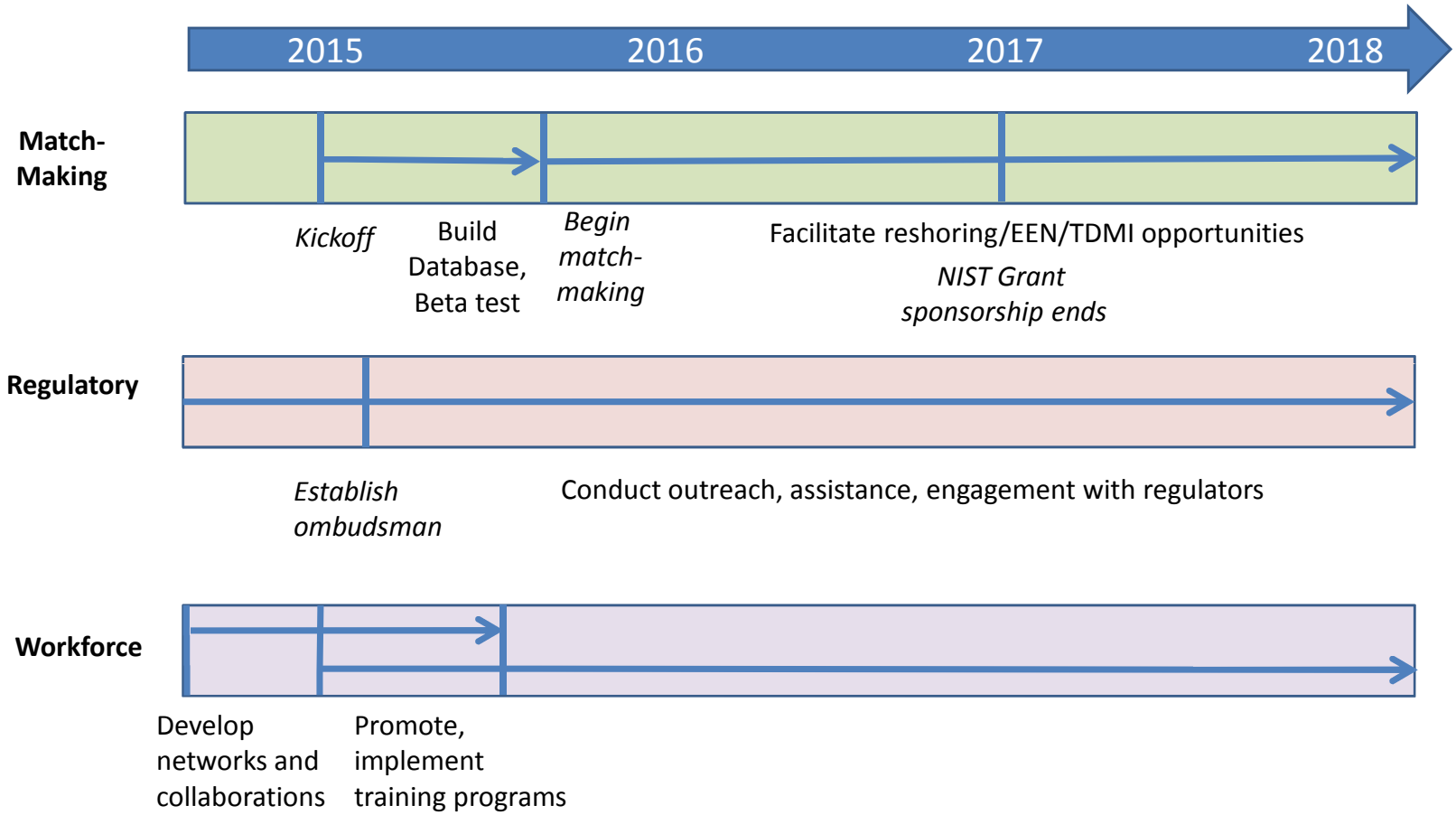
Timeline

TIMELINE



END VOLUME 3

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