



ADDITIVE MANUFACTURING RESOURCE GUIDE

For additional information, please contact:
Tim Fahey, Vice President, Industry and Innovation
tfahey@teamneo.org | 216.363.5425

Additive manufacturing (AM) represents the future of the manufacturing industry and Northeast Ohio is at the center of AM innovation. Home to America Makes, the national accelerator for additive manufacturing and 3D printing, Northeast Ohio is uniquely-positioned to help your business adopt and leverage AM technologies. With a strong manufacturing base, a variety of university and institutional resources, as well as connections to end-user markets already using 3D printing technology (like biomedical and aerospace), Northeast Ohio continues to build a thriving AM cluster that is progressively turning the region into an additive manufacturing hub.

A recent study conducted by the Youngstown Business Incubator, MAGNET (the Manufacturing Advocacy and Growth Network), America Makes and Team NEO looked at the opportunities additive manufacturing presents. What follows is a summarized version of the study's findings.

This guide will highlight how you can leverage Northeast Ohio's additive manufacturing strengths to become more competitive in the global economy. To learn more about the region's AM strengths, please visit: neohioamcluster.org.

Global Additive Manufacturing Landscape and Market Opportunities:

Additive manufacturing is forecasted to remain on a sizeable global growth trajectory over the next several years:

- Industry analysts, Wohlers Associates estimated in 2015 a global market of more than \$5.2 billion for direct products and services, with an additional \$1.8 billion in indirect revenue from in-house production, for a total market of \$7 billion.
- This represents a 25% compound annual growth rate (CAGR), with most analysts predicting similar growth through 2020.



The **tooling industry** is projected to reap the greatest economic benefits:

- A recent study sized the U.S. AM tooling opportunity at **\$8.8 billion** by 2020.
- Ohio is 2nd in the U.S. in tool, die & mold output with a 12% share, meaning that AM tooling production could represent a **\$1 billion sector in Ohio by 2020**.

The Northeast Ohio Advantage:

- High concentration of universities training three-dimensional printing (3DP) design talent
- Historically strong manufacturing base and associated workforce
- World-class materials and biomedical assets
- Growing presence of innovators and innovation service providers



Northeast Ohio AM Organizations & Assets:

Organizations & Institutions:

Northeast Ohio is progressively developing an additive manufacturing network that is helping to position the region as the epicenter for AM innovation. Below are many of the organizations and institutions that are fueling Northeast Ohio's expertise and growth:

Regional Economic Development and Entrepreneurial Support Organizations:

- o **America Makes** provides a linking network of public and private entities committed to advancing the technology and industry for Additive manufacturing.
- o **BioEnterprise** provides entrepreneurial support to high-technology companies which specialize in bio-science.
- o **JumpStart** is a connected network of public, private and nonprofit entities throughout Northeast Ohio focused on providing support to entrepreneurs and fostering environments to facilitate their growth.
- o **MAGNET (Manufacturing Advocacy and Growth Network)** educates, supports, and champions manufacturing in Northeast Ohio.
- o **Team NEO** is an economic development organization focused on creating jobs and helping businesses thrive in Northeast Ohio.
- o **Youngstown Business Incubator** facilitates the creation of high-value businesses through collaborative partnerships, assisting with commercialization process, counseling on go-to market strategies, and facilitating networking and funding opportunities.

Higher Education Institutions:

- o **Lorain County Community College** - Smart Center
- o **Cuyahoga Community College** - Digital Design and Manufacturing Curriculum
- o **Case Western Reserve University** – Additive Manufacturing Studio in think[box]
- o **Youngstown State University** – Center for Innovation in Advanced Manufacturing (CIAM)

Private Sector Organizations and National Associations:

- o **ASM International** - World's largest association of metals-centric materials, engineers and scientists
- o **SME** – Dedicated to advancing and educating the manufacturing industry
- o **Alliance for Working Together (AWT)** – A consortium of 75+ manufacturing companies working on the sustainability of manufacturing in the community

Northeast Ohio – The Right Location, Offering the Right Resources at the Right Time

ENTREPRENEURIAL SUPPORT

- **The Jumpstart Entrepreneurial Network:** A whole host of interconnected business incubators which have additive manufacturing programs – these include Youngstown Business Incubator, Akron Global Business Incubator, the Tech Belt Energy Innovation Center, The Incubator at MAGNET, Braintree Business Development Center, Austen BioInnovation Institute and BioEnterprise.
- **State supported investment programs**, such as Valley Growth Ventures, GLIDE Innovation Fund, North Coast Angel Fund, and the Akron ARCHAngels
- **SBA Program** run by Team NEO



Central Location - Northeast Ohio's central location among the loose clustering of additive manufacturing assets in the Midwest help make the region ground zero for AM innovation.

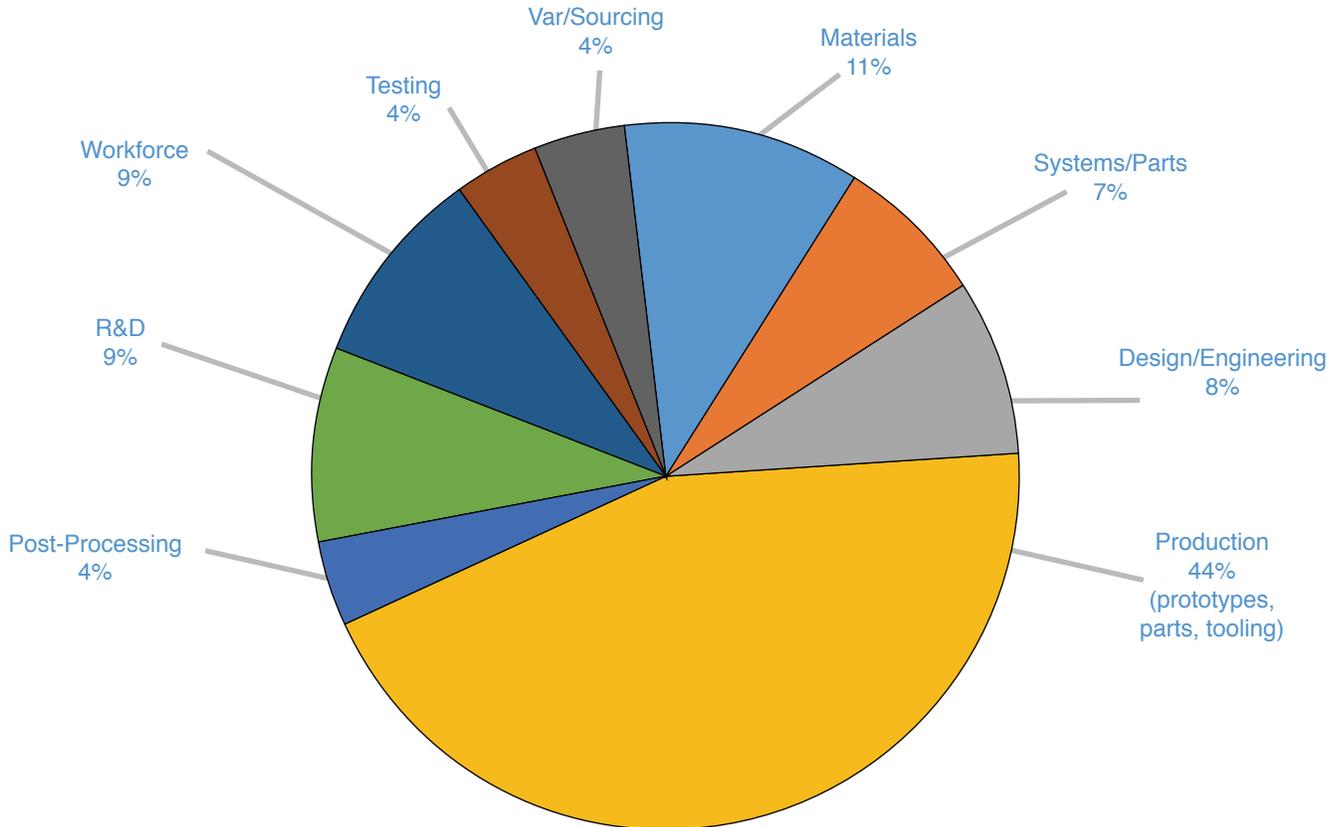
TECHNOLOGY ADOPTION

- **ATAP** – Advanced Tooling Acceleration Program – Provides demonstrations on how to implement additive into low volume tooling
- **P3N (Precision Printed Parts Network)** – Educating business owners in the metal casting industry on the value of additive and how to implement it into their business
- **SANDCORE** – Champion the technology adoption of 3D printing for the metal casting industry.
- **MAGNET MEP** - Working to promote advanced industry and offer growth opportunities to inventive businesses and individuals through a team of expert engineers and growth advisers who help clients better understand additive manufacturing methods and how they can be applied practically.

Value Chain

With a robust value chain already in place, there is great opportunity for companies who decide to pursue additive manufacturing in Northeast Ohio. As such, the study identified 165 distinct companies and organizations directly involved in the AM supply chain. These assets were catalogued as having direct involvement in specific sectors of the AM supply chain; 35 companies were identified as having involvement in more than one sector. The following is a breakdown of the value chain segments identified in the study:

Supply Chain	# of Companies
Production	85
Materials	19
Workforce	19
Third Party Research & Development	18
Systems/System Parts	15
Design/Engineering	14
Third Party Testing	9
Post Processing	7
Sourcing	6
Value Added	3



End-Users

Two industries core to Northeast Ohio – biomedical and aerospace – represent the leading end-user markets for direct part production via AM. NEO is home to aerospace AM leaders such as Parker Hannifin and Arconic; regional adoption of AM for medical devices and implants continues to grow in companies like SLICE and QED. Advanced uses in tissue modeling for surgical planning are occurring at The Cleveland Clinic.

In addition, AM is now experiencing rapid adoption for use in tooling, molds, jigs and fixtures – an industry at the heart of the Ohio economy. This has opened up the opportunity for manufacturers to produce components cost effectively at much lower production volumes than previously possible. The automotive industry has become the early adopter of this use of AM, with Honda, Ford, Delphi and many supply chain participants using AM tooling to reduce production cost and enhance quality & productivity. This also has significant implications for increasing innovation through lower fixed capital costs and shorter design iteration cycles. It is estimated that the opportunity for AM tooling production in Ohio will reach \$1 billion by 2020.

Interested in learning more about the benefits of adopting AM technologies to grow your business? Please contact:

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