Tecnologie Additive, un'opportunità da cogliere

Generalità sulle Tecnologie Additive

Fabrizio Barberis
Vice Coordinatore Commissione Ricerca & Trasferimento Tecnologico
Universita' degli Studi di Genova

Istituto Italiano della Saldatura – 5 Luglio 2018

International Relations @ Unige

- More than **30.000** students (Bachelor and Master courses)
- More than **4.000** students in postgrad courses and Ph.D Nearly **3.000** of them (~10%) are international students
- More than **1.000** Erasmus exchanges each year

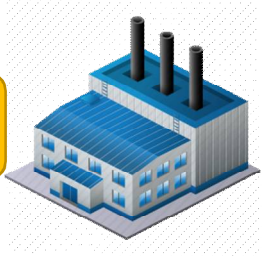
- **560** Erasmus+ agreements
- **160** academic cooperation agreements in 60 Countries
- **9** Master Science courses entirely taught in English
- More than **20** courses teaches subjects in English
- Nearly **10** double degree courses

Unige ranked second among big Italian universities (20-40.000 students) for internationalization (Censis)

University – Industry collaboration

University

Industry



Higher Education

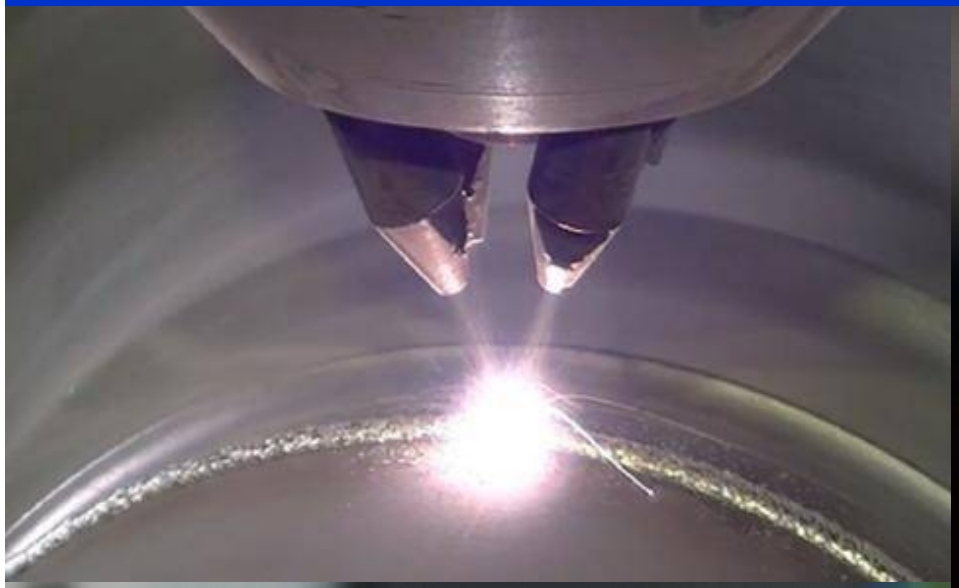
New products / processes / services

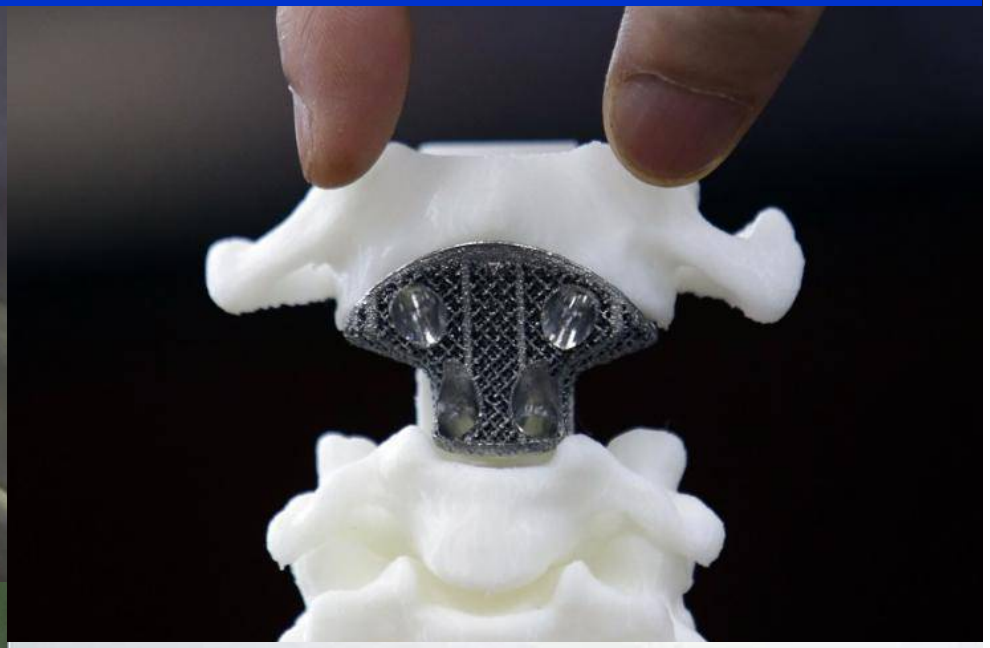
"Vertical knowledge"
Ease in exchanging information and having relationships
Global competition

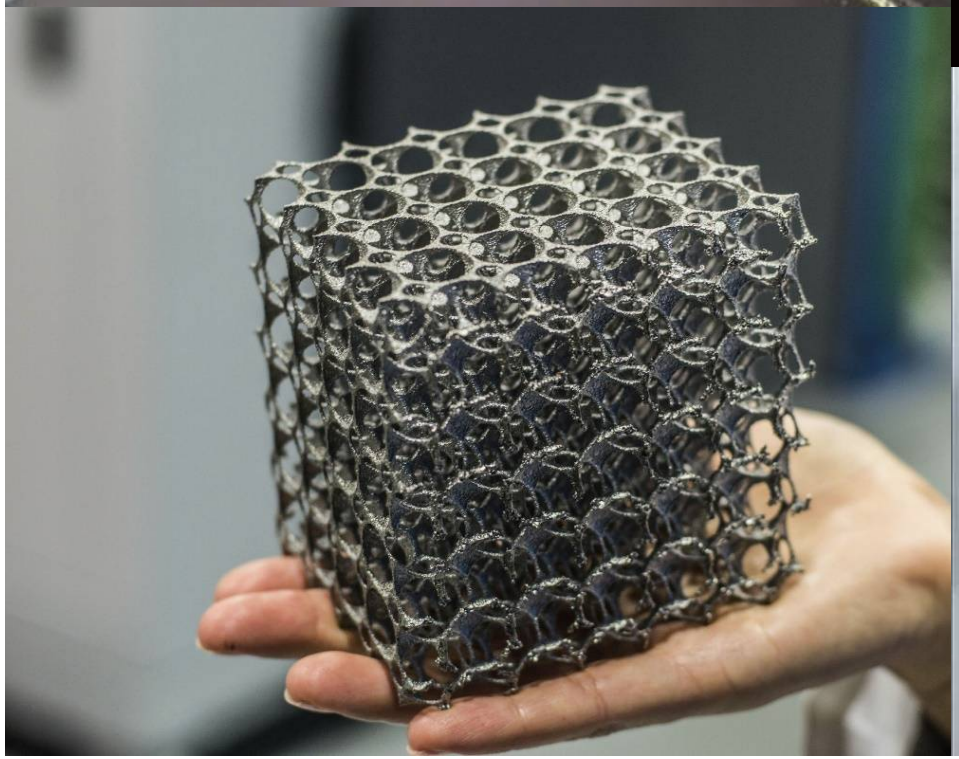
Research

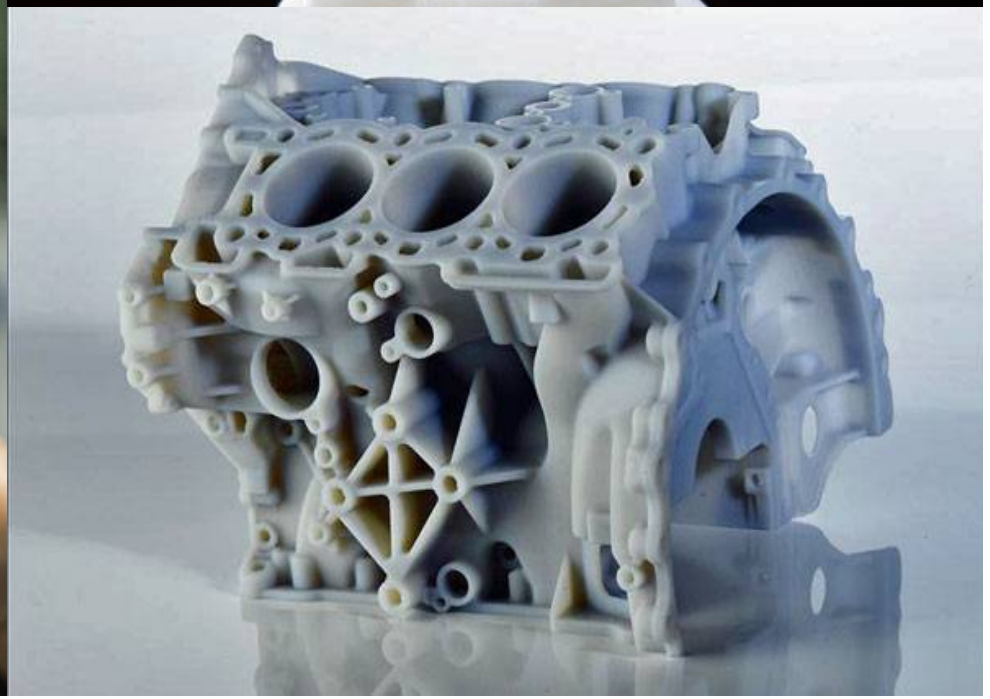
Competitiveness and incomes

Tecnologie Additive: un opportunita' da cogliere









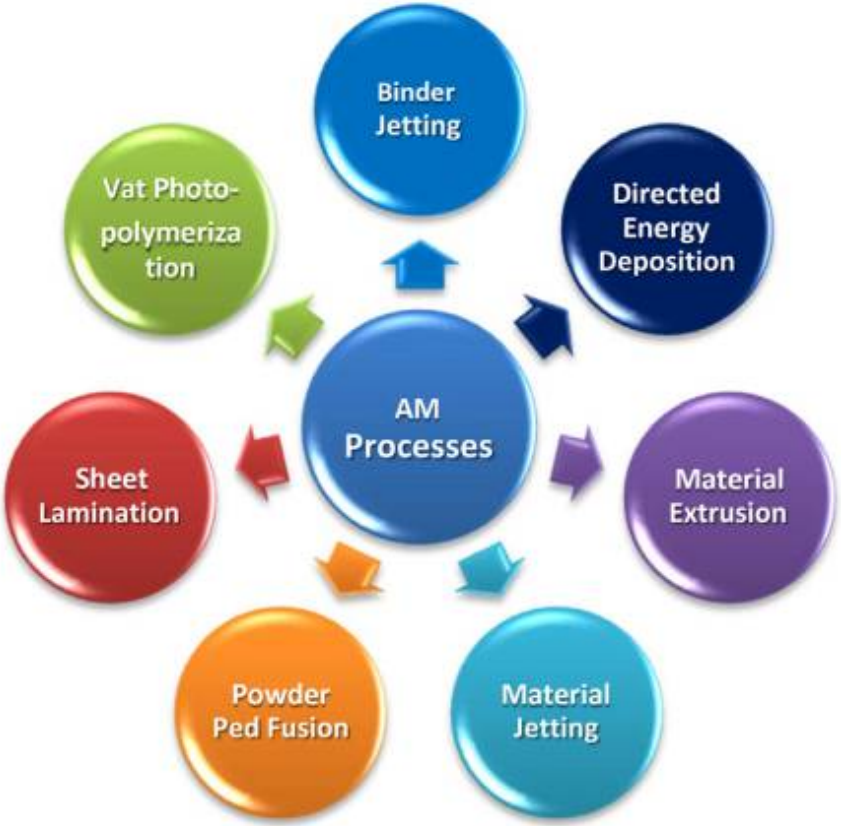


Fig. 1. Classification of AM processes based on ISO/ASTM 529000:2015.

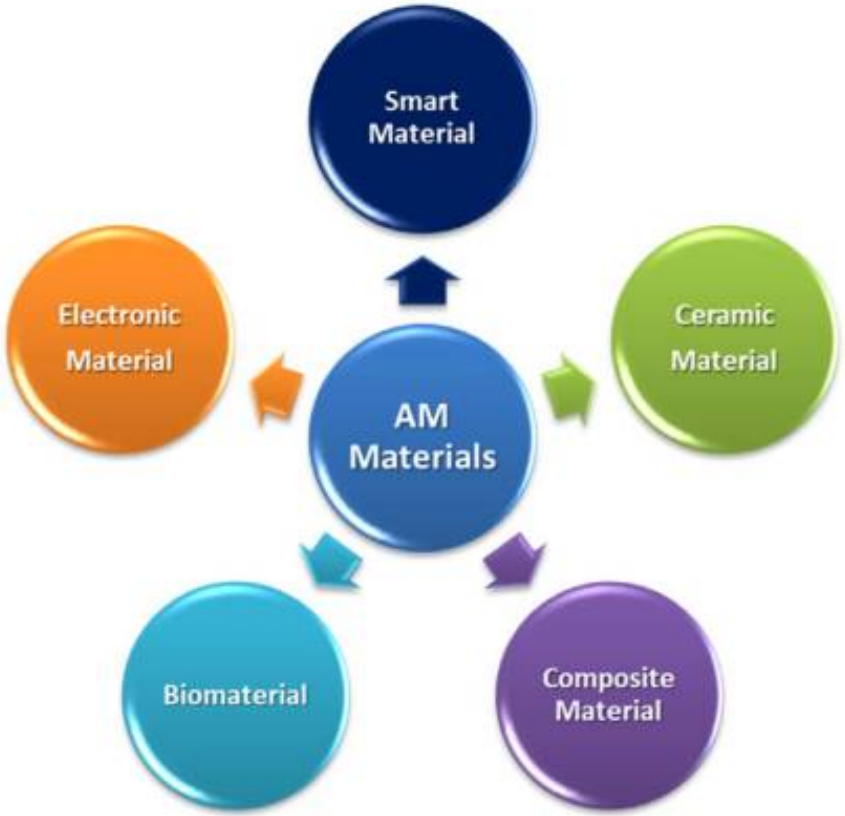
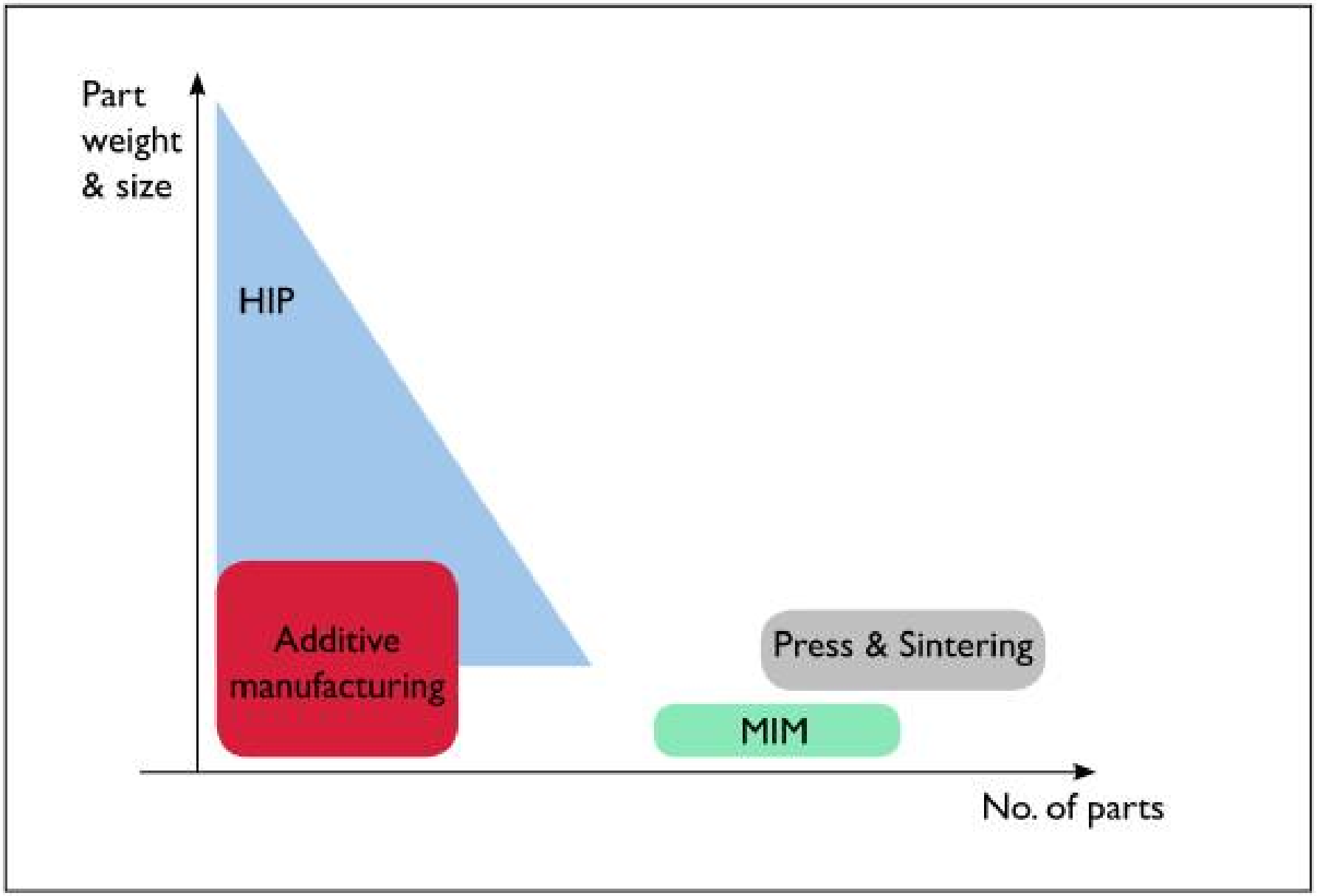


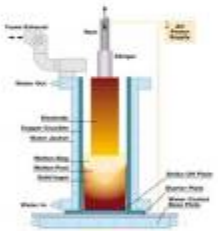
Fig. 3. Classification of AM materials.


Part
weight
& size
HIP
Additive
manufacturing
Press & Sintering
MIM
No. of parts

AM is more than manufacturing!

AM machines create a unique material product form – typically, the purview of the foundry or mill and guaranteed through CoCs based on proprietary process controls and commercially-available specifications (e.g. ASME, SAE, ANSI, ASTM, AWS, MIL specs).

Subtractive Forging Process

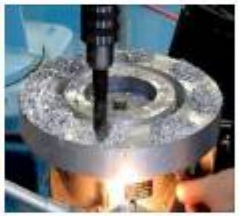

1. Ingot Making


2. Cutting


3. Heating


4. Forging

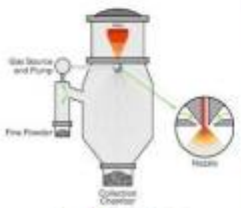

5. Heat Treating


6. Machining


7. Inspection


8. Delivery with CoCs

Additive SLM Process


1. Powder Making


2. Printing

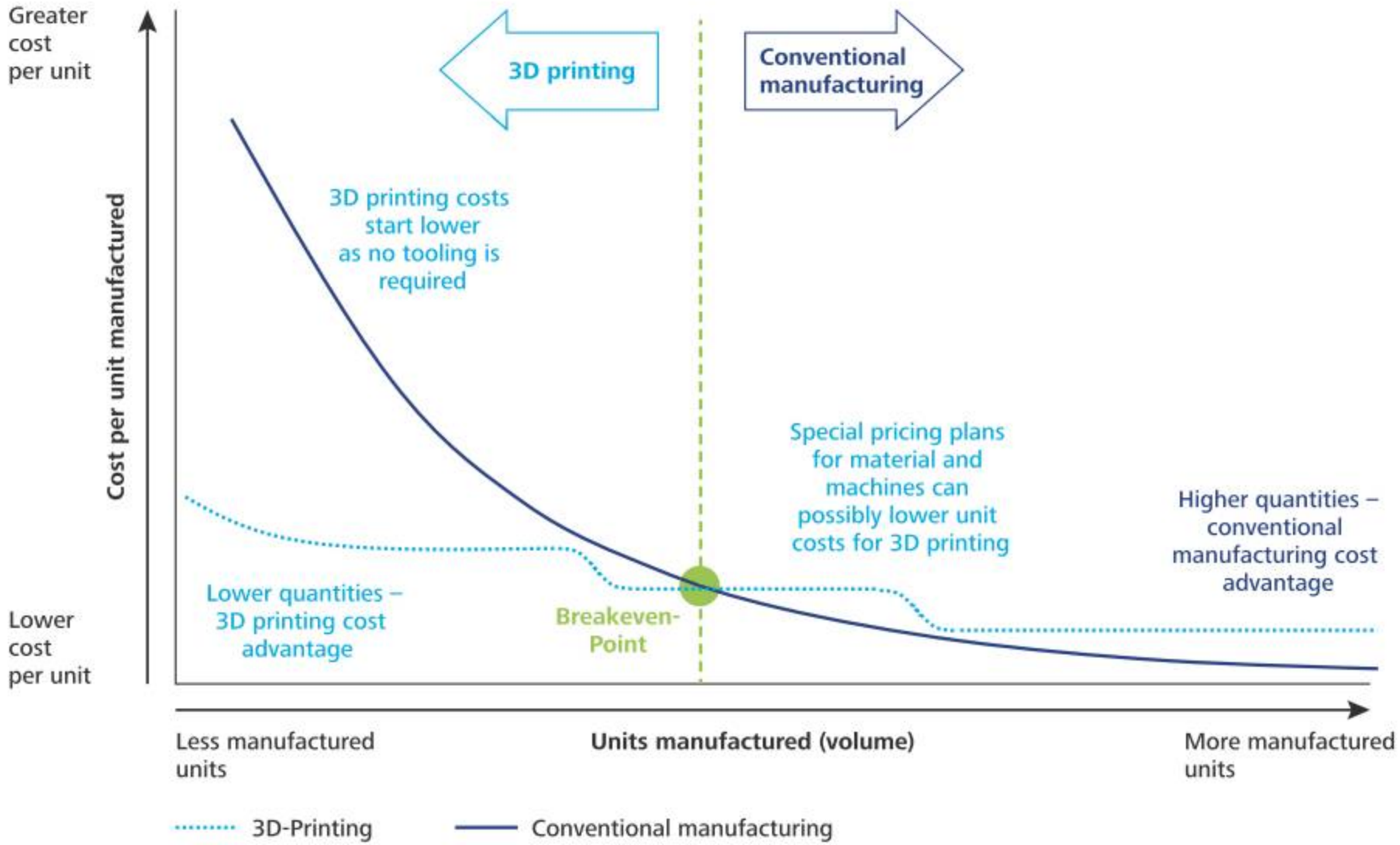

3. HIPing


4. Heat Treating


5. Machining


6. Inspection


7. Final Part


Greater cost per unit
Lower cost per unit
Cost per unit manufactured
3D printing
Conventional manufacturing
3D printing costs start lower as no tooling is required
Special pricing plans for material and machines can possibly lower unit costs for 3D printing
Higher quantities – conventional manufacturing cost advantage
Lower quantities – 3D printing cost advantage
Breakeven-Point
Less manufactured units
Units manufactured (volume)
More manufactured units
3D-Printing
Conventional manufacturing

Snapshot of the future in 3D

3D printing could revolutionise customisable products and their supply chains.

Business benefits of a 3D-printing supply chain

1 Factory is closer to home
Designs are sent to production centres that are closer to consumers. Logistics for these products become local business.

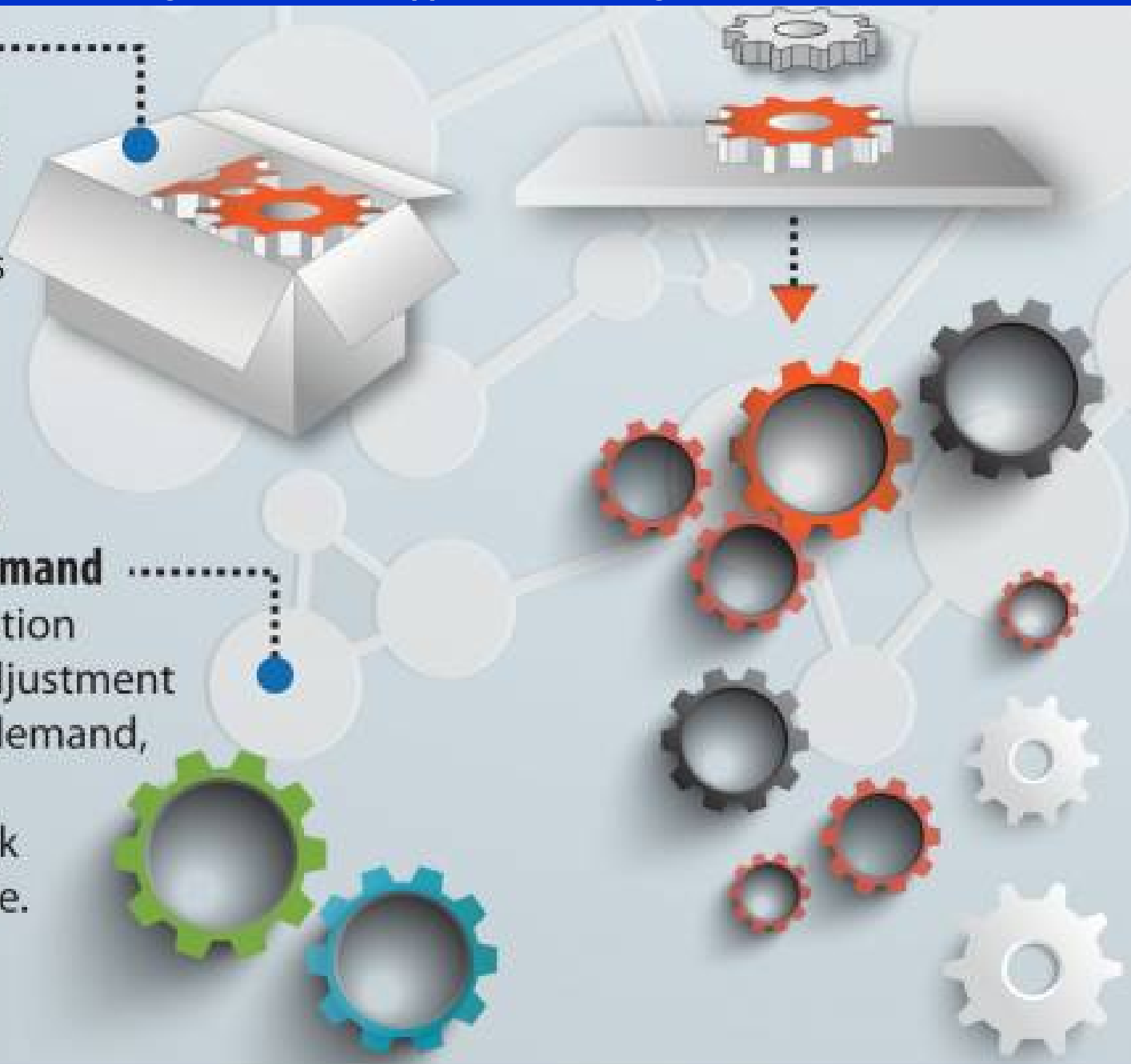
2 No more intermediaries
Consumers download designs directly—some open source—then customise and print. A printing center may be all that's needed.

3 Less inventory

Ability to print what you need when you need it reduces excess inventory.

4 Rapid response to consumer demand

Easy customisation allows quick adjustment to changes in demand, reducing the inventory at risk of obsolescence.



Best suited to small-scale structures with fine details, direct write has been used to print miniature sensors inside jet engines and gas turbines.

Traditional 3D printing

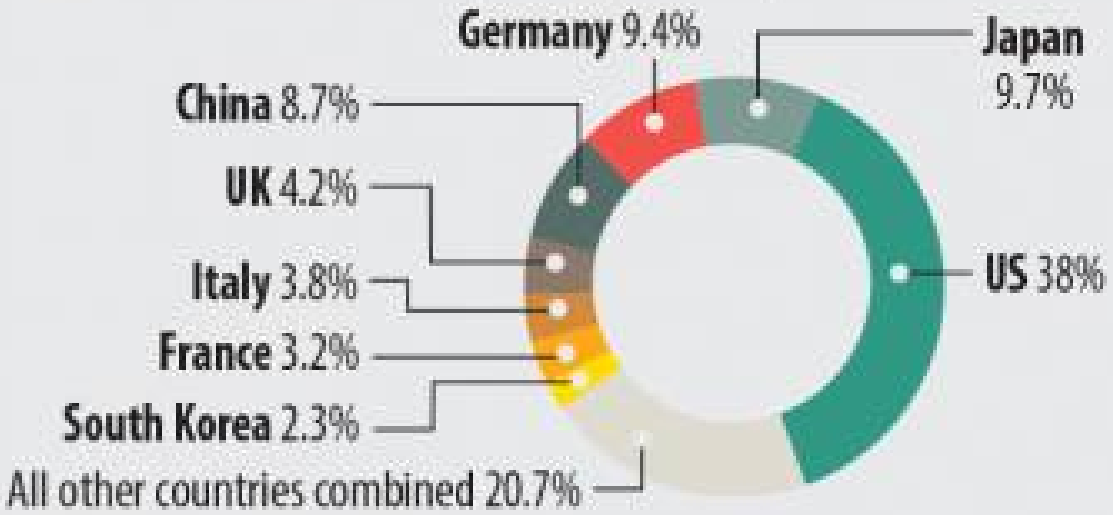
Material is added layer by layer to create an object. Suitable for consumer goods, industrial parts and lots more.

The ADDITIVE INDUSTRY

Robot hand built from 3d-printed parts

Global distribution:

Percent of worldwide 3D printing industry market



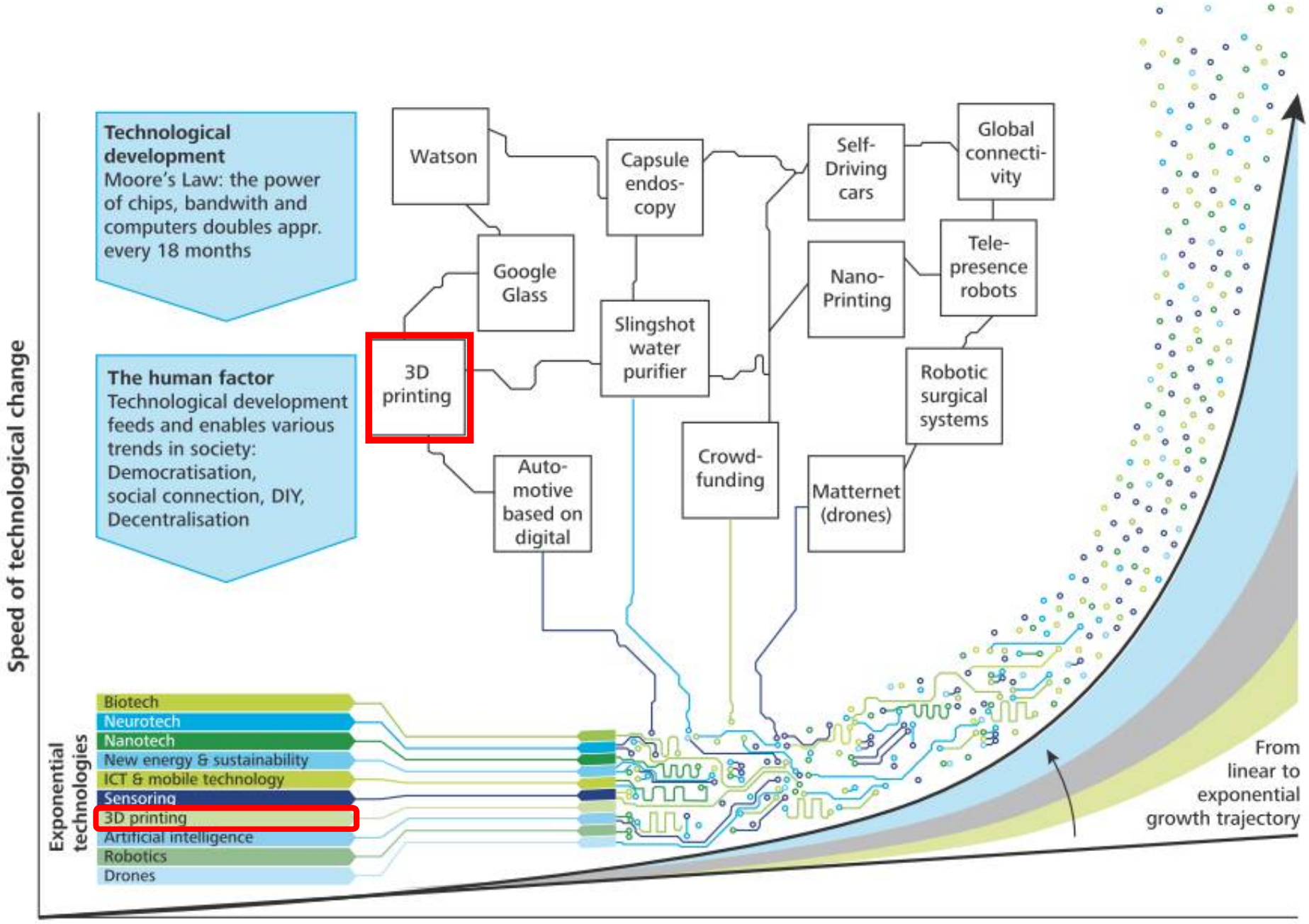
Projected global value

Industrie 4.0

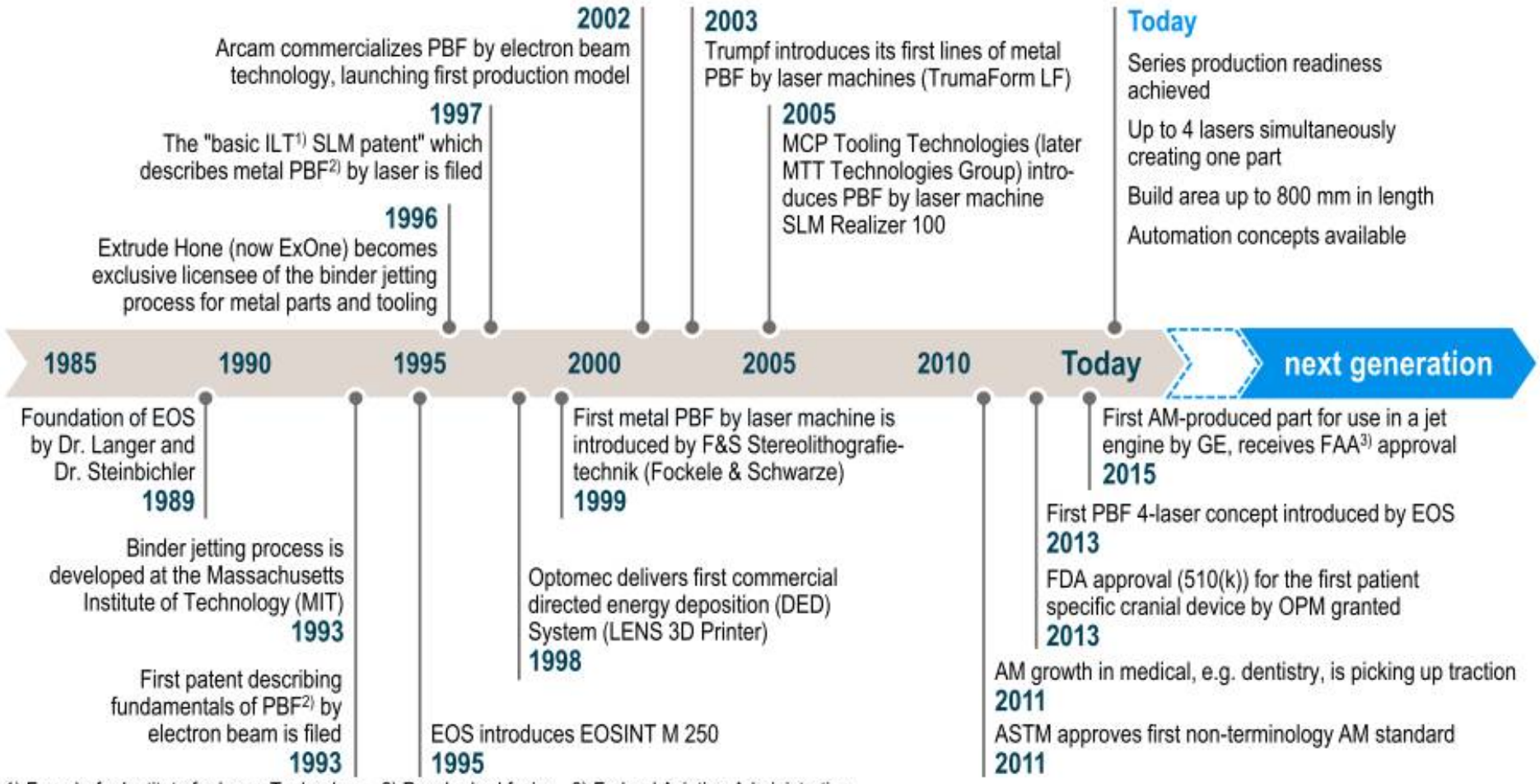
*The term **Industrie 4.0** was first used in 2011 at the Hanover Fair.[8] In October 2012 the Working Group on Industry 4.0 chaired by Siegfried Dais (Robert Bosch GmbH) and Kagermann (acatech) presented a set of Industry 4.0 implementation recommendations to the German federal government. On 8 April 2013 at the Hanover Fair the final report of the Working Group Industry 4.0 was presented.[9]*

Industrie 4.0

To encourage companies **to drive common standards**, the government has established the Industry 4.0 platform at the Ministry for Economics and Energy, **to promote dialogue and collaboration among industry, government and other stakeholders.**


Technological development
Moore's Law: the power of chips, bandwith and computers doubles appr. every 18 months
The human factor
Technological development feeds and enables various trends in society: Democratisation, social connection, DIY, Decentralisation
Watson
Capsule endos-copy
Self-Driving cars
Global connecti-vity
Google Glass
Nano-Printing
Tele-presence robots
3D printing
Slingshot water purifier
Robotic surgical systems
Auto-motive based on digital
Crowd-funding
Matternet (drones)
Speed of technological change
Exponential technologies
Biotech
Neurotech
Nanotech
New energy & sustainability
ICT & mobile technology
Sensoring
3D printing
Artificial intelligence
Robotics
Drones
From linear to exponential growth trajectory

Emergence of Additive Manufacturing



1) Fraunhofer Institute for Laser Technology 2) Powder bed fusion 3) Federal Aviation Administration

Source: Company websites; European Patent Office; Wohlers Associates; Roland Berger

The White House

Office of the Press Secretary

For Immediate Release

June 24, 2011

President Obama Launches Advanced Manufacturing Partnership

Today, at Carnegie Mellon University, President Obama launched the Advanced Manufacturing Partnership (AMP), a national effort bringing together industry, universities, and the federal government to invest in the emerging technologies that will create high quality manufacturing jobs and enhance our global competitiveness. Investing in technologies, such as information technology,

The White House

Office of the Press Secretary

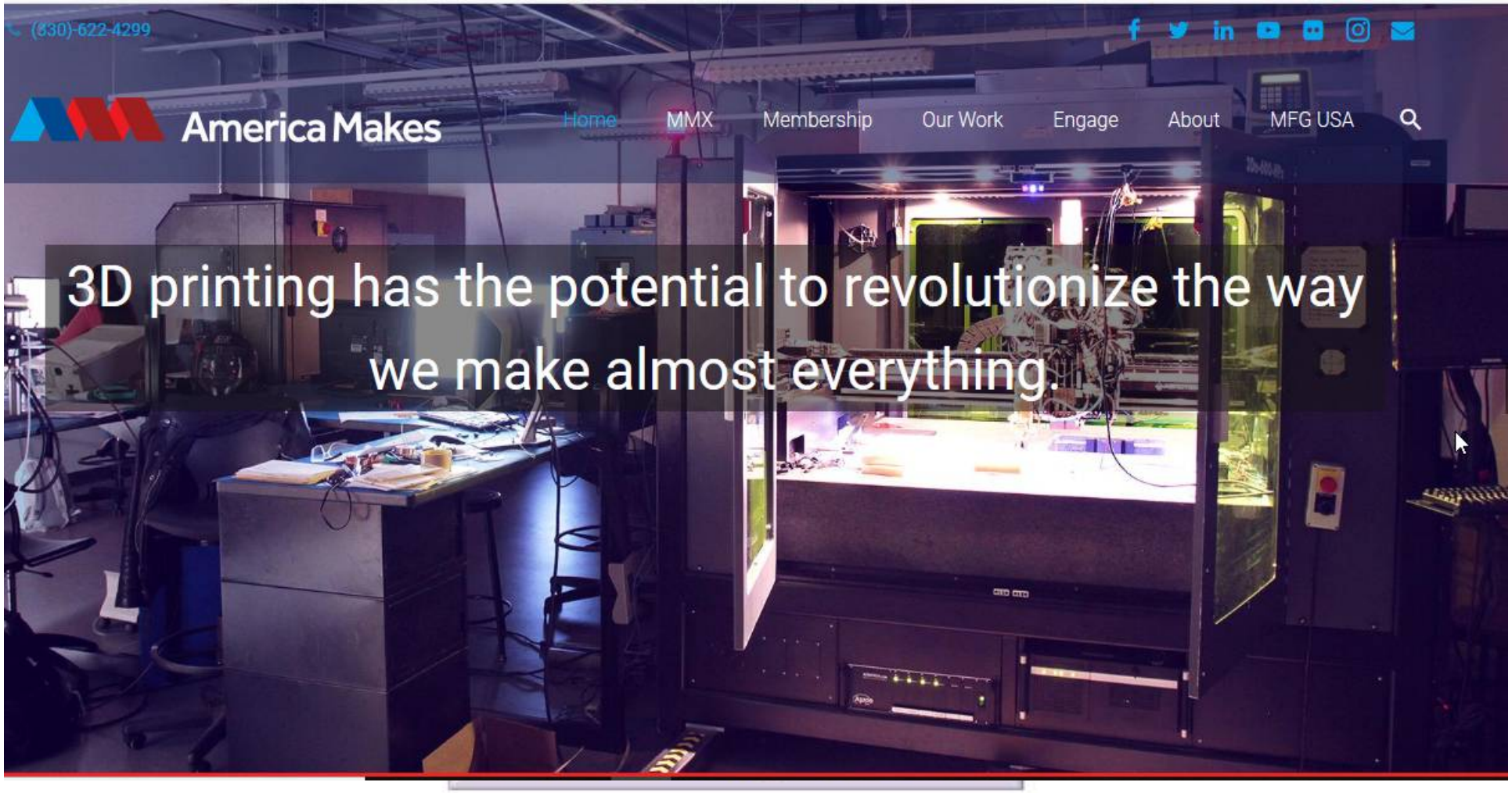
For Immediate Release

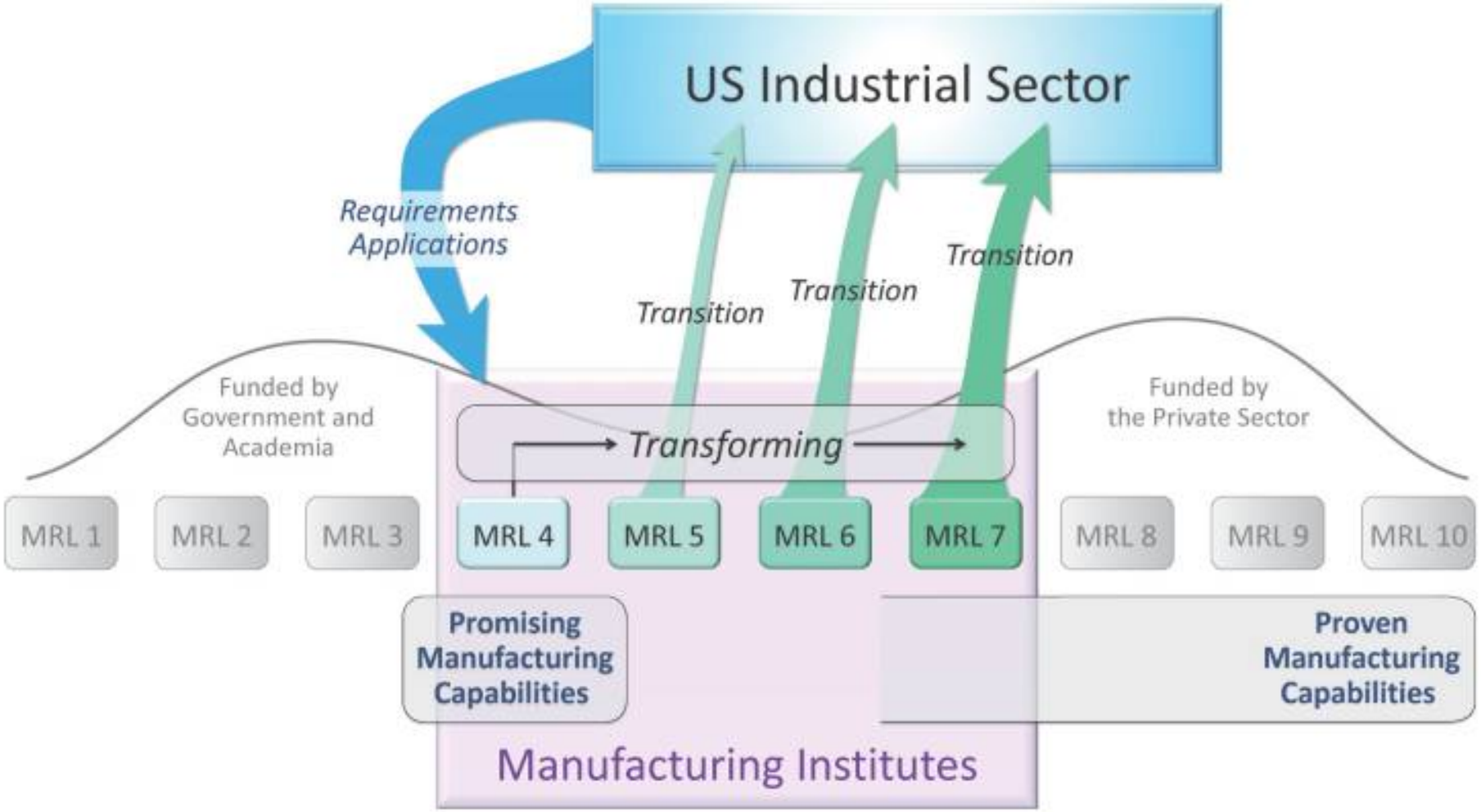
March 09, 2012

President Obama to Announce New Efforts to Support Manufacturing Innovation, Encourage Insourcing

Administration Proposes New National Network to Support Manufacturing, Takes Immediate Action to Create a Pilot Manufacturing Institute

On Friday, President Obama will continue to highlight the successful trend of insourcing – companies from around the world bringing jobs back and making new investments here in the United States – at the Rolls-Royce Crosspointe jet engine disc manufacturing facility in Prince George County, Virginia. The President's Blueprint for An Economy Built to Last lays out a number of ways we can encourage insourcing, support investment in our manufacturing sector, and create good jobs here in the United States, and today's announcements build on


(630)-622-4299
America Makes
Home
MMX
Membership
Our Work
Engage
About
MFG USA
3D printing has the potential to revolutionize the way we make almost everything.


US Industrial Sector
Requirements
Applications
Transition
Transition
Transition
Funded by
Government and
Academia
Transforming
Funded by
the Private Sector
MRL 1
MRL 2
MRL 3
MRL 4
MRL 5
MRL 6
MRL 7
MRL 8
MRL 9
MRL 10
Promising
Manufacturing
Capabilities
Proven
Manufacturing
Capabilities
Manufacturing Institutes

The Institute Ecosystem Process Flows

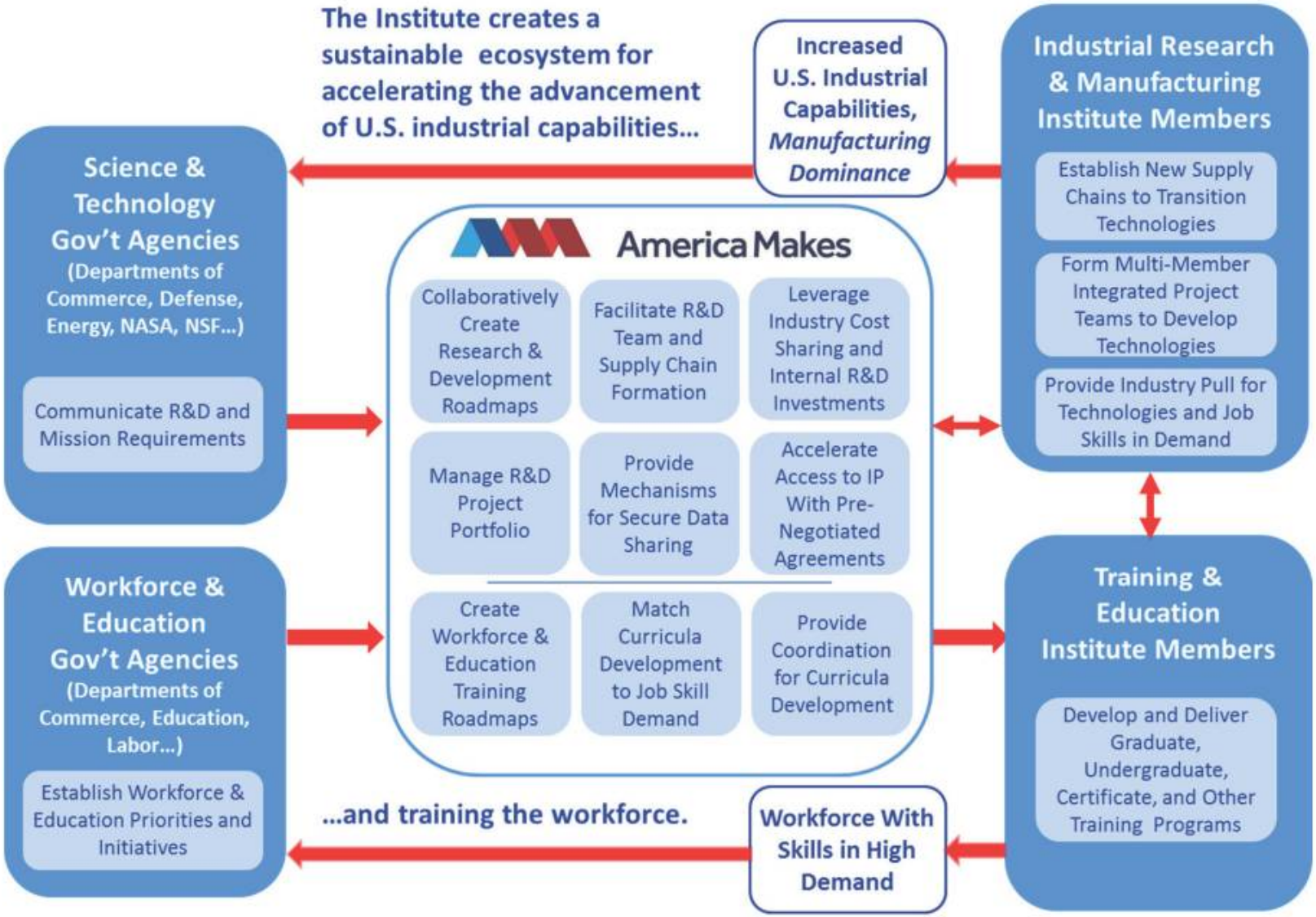


Figure 6. Institute Ecosystem Process Flows Generate Benefits that Incentivize Ongoing Participation

NISTIR 8059

Materials Testing Standards for Additive Manufacturing of Polymer Materials: State of the Art and Standards Applicability

Aaron M. Forster
Materials and Structural Systems Division
Engineering Laboratory

This publication is available free of charge from:
http://dx.doi.org/10.6028/NIST.IR.8059

May 2015

U.S. Department of Commerce
Penny Pritzker, Secretary

National Institute of Standards and Technology
Willie May, Under Secretary of Commerce for Standards and Technology and Director

NIST Advanced Manufacturing Series 100-5

Measurement Science Roadmap for Polymer-Based Additive Manufacturing

Prepared for

Material Measurement Laboratory
National Institute of Standards and Technology
Gaithersburg MD 20899

Division of Civil Mechanical and Manufacturing Innovation
National Science Foundation
Arlington, VA 22230

Prepared by

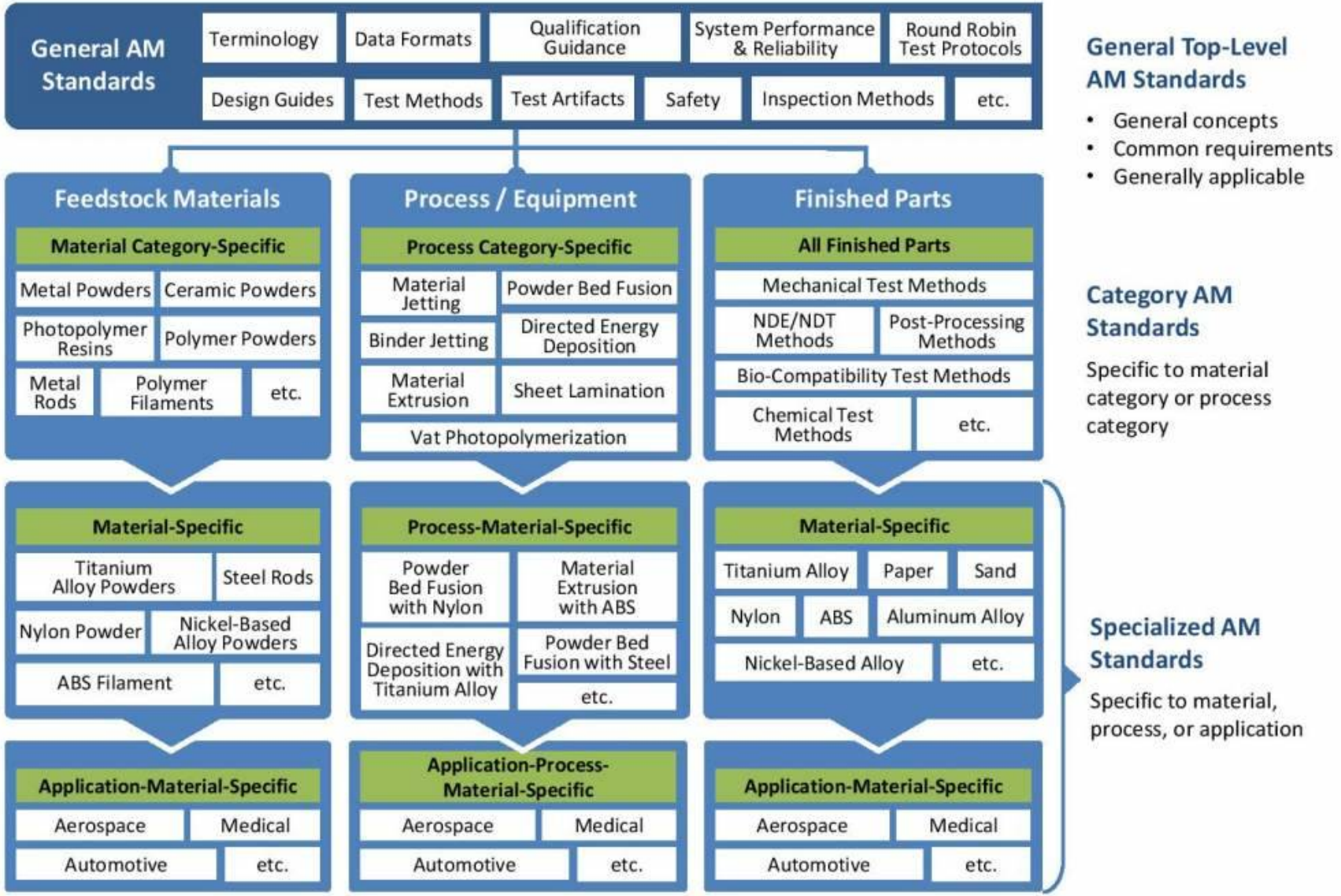
Joan Pellegrino
Tommi Makila
Shawna McQueen
Emmanuel Taylor
Energetics Incorporated
Columbia MD 21046

This publication is available free of charge from:
https://doi.org/10.6028/NIST.AMS.100-5

December 2016

U.S. Department of Commerce
Penny Pritzker, Secretary
National Institute of Standards and Technology
Willie May, Under Secretary of Commerce for Standards and Technology and Director

Additive Manufacturing Standards Structure



Final Report

Department of Defense Additive Manufacturing Roadmap

Report Released 30 November 2016

Dr. Jennifer Fielding, Technical Advisor, Structures, Propulsion and Manufacturing Enterprise Branch, Air Force Research Laboratory

Mr. Andy Davis, Program Manager, Manufacturing Technology, U.S. Army

Mr. Ben Bouffard, Additive Manufacturing Lead, Research, Development, Test, and Evaluation, Department of the Navy

Dr. Mary Kinsella, Additive Manufacturing IPT Lead, Air Force Research Laboratory

Mr. Tony Delgado, R&D Additive Manufacturing Program Manager Defense Logistics Agency

Mr. John Wilczynski, Director of Technology Development, America Makes

Kelly Marchese, Principal, Deloitte Consulting, LLP

Ian Wing, Manager, Deloitte Consulting, LLP

America Makes

NCDMM
NATIONAL CENTER FOR DEFENSE MANUFACTURING AND MACHINING

Deloitte.

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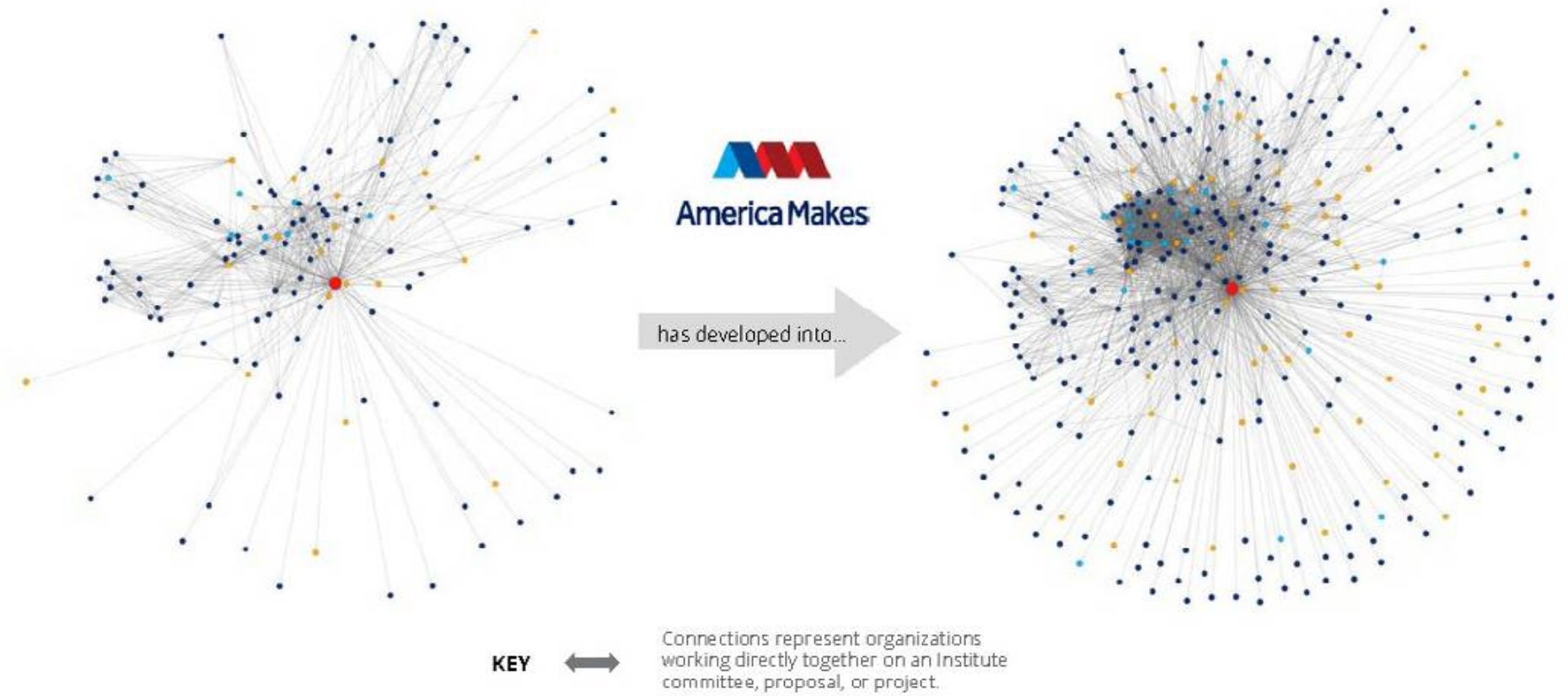
America Makes
has developed into...
KEY
Connections represent organizations working directly together on an Institute committee, proposal, or project.
2013
135 organizations connected through
652 relationships
2016
345 organizations connected through
3,634 relationships

Creating the workforce of tomorrow

NIST

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NIST OFFICE OF ADVANCED MANUFACTURING (OAM)

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- Programs +
- National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL)
- Funding Opportunities
- Staff Directory
- National Strategic Plan for Advanced Manufacturing

National Strategic Plan for Advanced Manufacturing

Background Information

On February 5, 2018, the National Science and Technology Council, Committee on Technology, Subcommittee on Advanced Manufacturing published a Request for Information – National Strategic Plan for Advanced Manufacturing (https://www.federalregister.gov/d/2018-02160). This RFI solicits input from the public on ways to improve government coordination and on long-term guidance for federal programs and activities in support of United States manufacturing competitiveness, including advanced manufacturing research and development that will create jobs, grow the economy across multiple industrial sectors, strengthen national security, and improve health care.

America Makes

ANSI
American National Standards Institute

Standardization Roadmap for Additive Manufacturing

VERSION 2.0

PREPARED BY THE

America Makes & ANSI Additive Manufacturing Standardization Collaborative (AMSC)

JUNE 2018

EUROPEAN COMMISSION

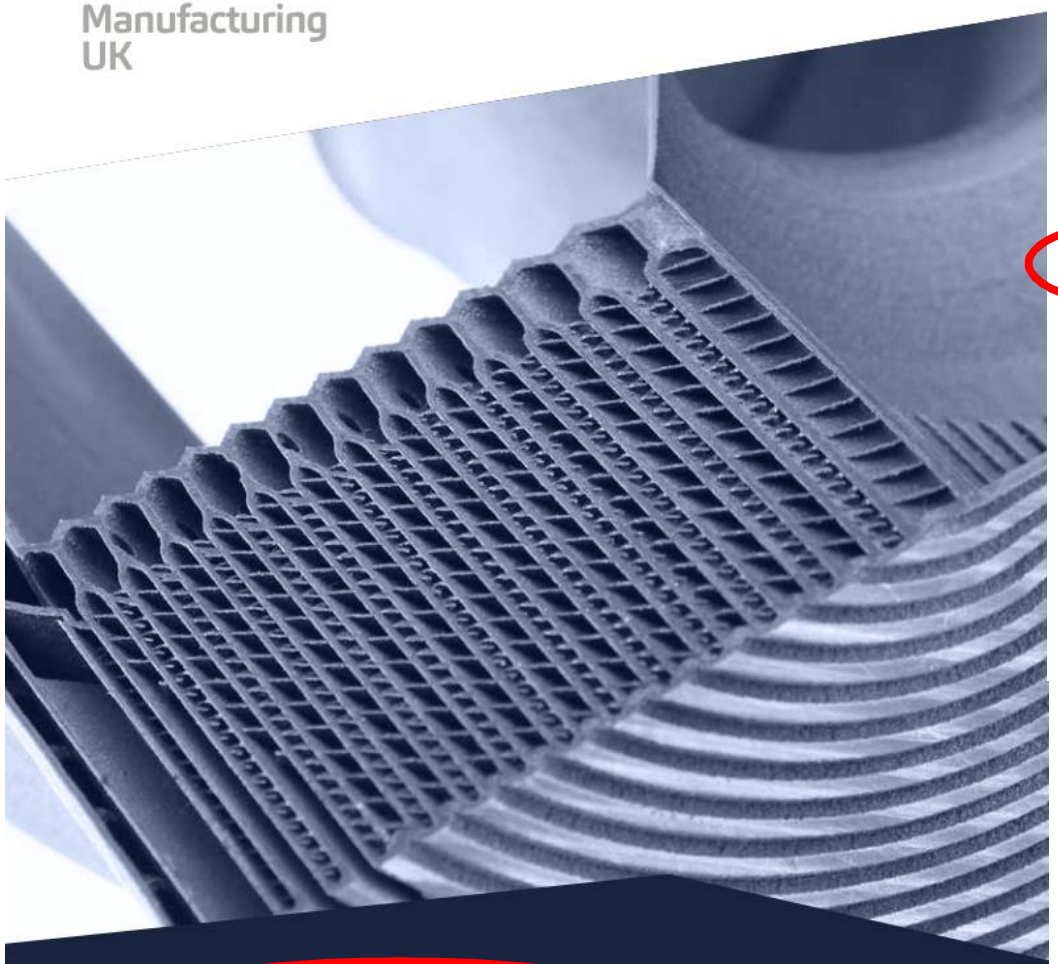
EXECUTIVE AGENCY FOR SMALL AND MEDIUM-SIZED ENTERPRISES

Identifying current and future application areas, existing industrial value chains and missing competences in the EU, in the area of additive manufacturing (3D-printing)

Final Report

Brussels, 15th of July, 2016

Additive Manufacturing UK



Additive Manufacturing UK

National Strategy 2018 - 25

Leading Additive Manufacturing in the UK

European Parliament
2014-2019

Committee on Legal Affairs

23.11.2017

WORKING DOCUMENT

on three-dimensional printing, a challenge in the fields of intellectual property rights and civil liability

Committee on Legal Affairs

UK publishes Digital Strategy outlining plans for Makerspaces, IP protection for 3D printing, and internationally connected Tech Hubs

cecimo
European Association of the Machine Tool Industries

CECIMO
Voice of the European Additive Manufacturing Industry

Activities Report
2017

Imperial College London

Institute for Molecular Science and Engineering

Briefing Paper No 2
September 2017

The value of additive manufacturing: future opportunities

Billy Wu, Connor Myant and Shoshana Z. Weider

Genova Additive Manufacturing

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ENTE MORALE

UNIVERSITÀ DEGLI STUDI
DI GENOVA

GeAM

In 2017 it has been signed a joint Program between University of Genoa (Polytechnic School, Dime and Dicca Departments) and Italian Institute of Welding (IIS) to create a Scientific and Industrial center dedicated to Additive Manufacturing on Metals: Genova Additive Manufacturing - GeAM

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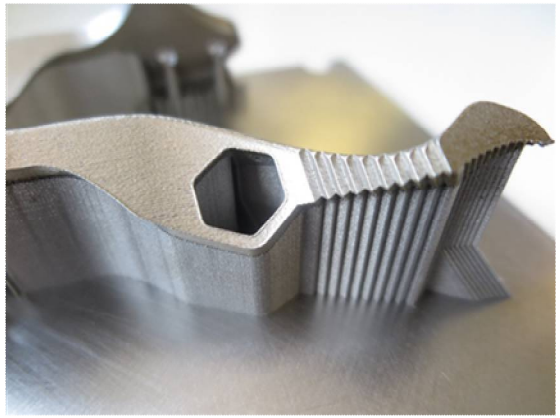
ENTE MORALE

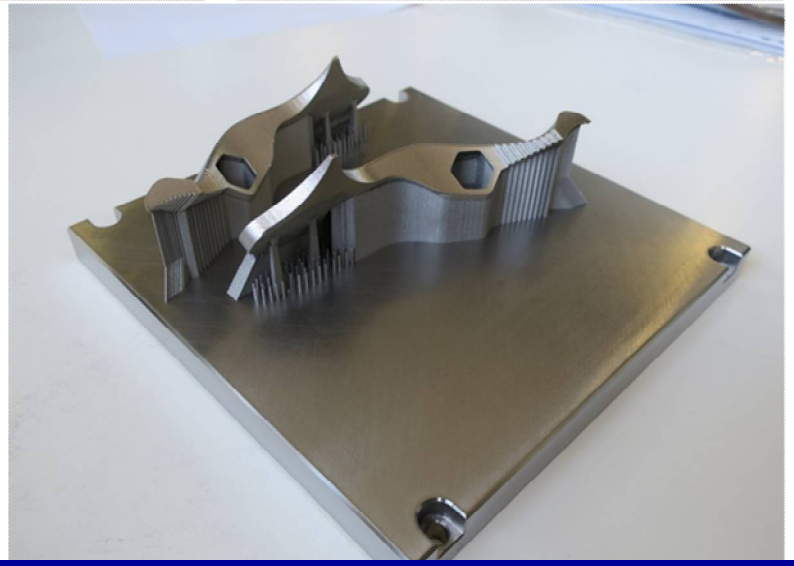
UNIVERSITÀ DEGLI STUDI
DI GENOVA

Ge AM
laser per costruire, a Genova

Genova Additive Manufacturing



IIS Genova metal additive products



Genova Additive Manufacturing

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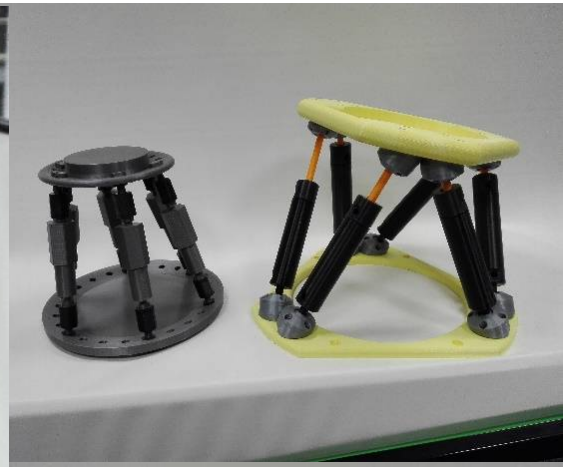
Ge AM
laser per costruire, a Genova



Advanced manufacturing technologies, circular economy in Central European regions

AMICE Project Introduction

Flavio Tonelli, Massimiliano Avalle, Giovanni Berselli, Melissa Demartini, Fabrizio Barberis

University of Genoa

Advanced manufacturing technologies, circular economy in Central European regions

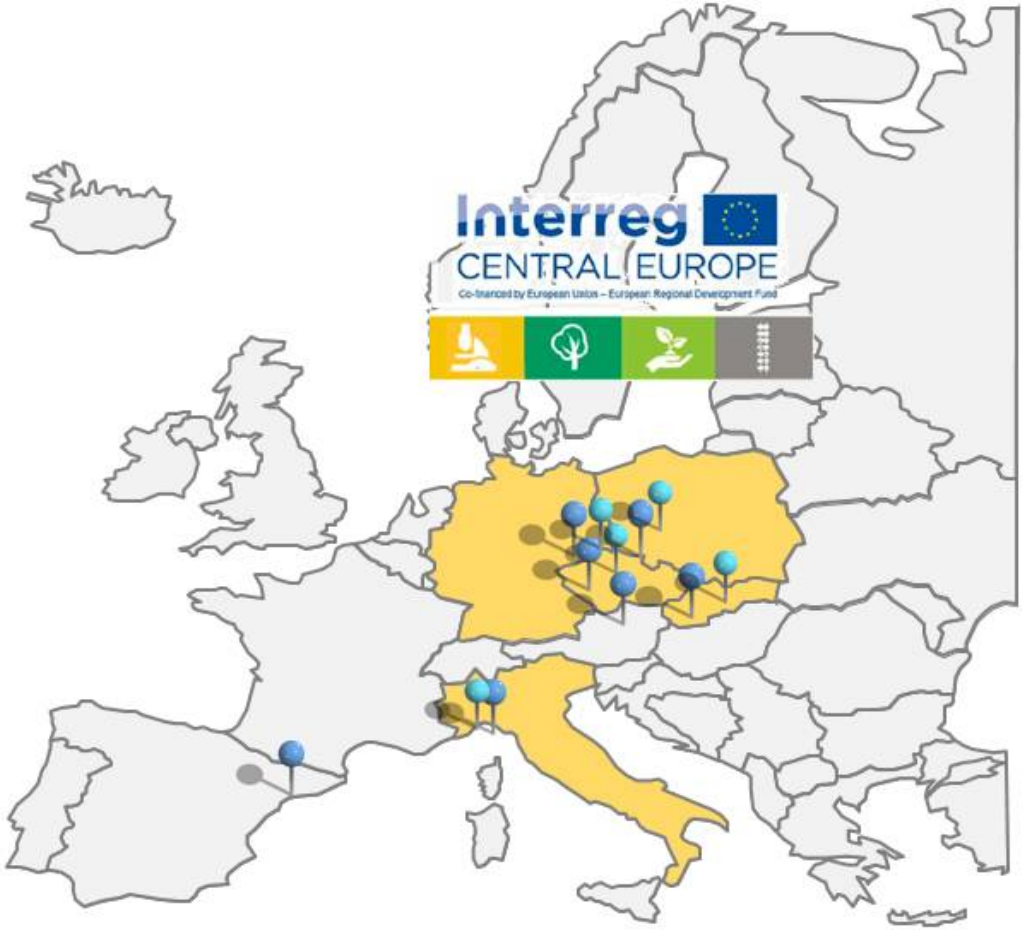
1. Promote the uptake of advanced manufacturing (AM) technologies by SMEs, facilitated through
   - high quality,
   - collaborative,
   - transnationally coordinated innovation services

2. Promote and facilitate a faster and efficient knowledge – and technology transfer between RTO-SMEs-Policy

3. Develop an inducive innovation ecosystem for the manufacturing sector

Advanced manufacturing technologies, circular economy in Central European regions

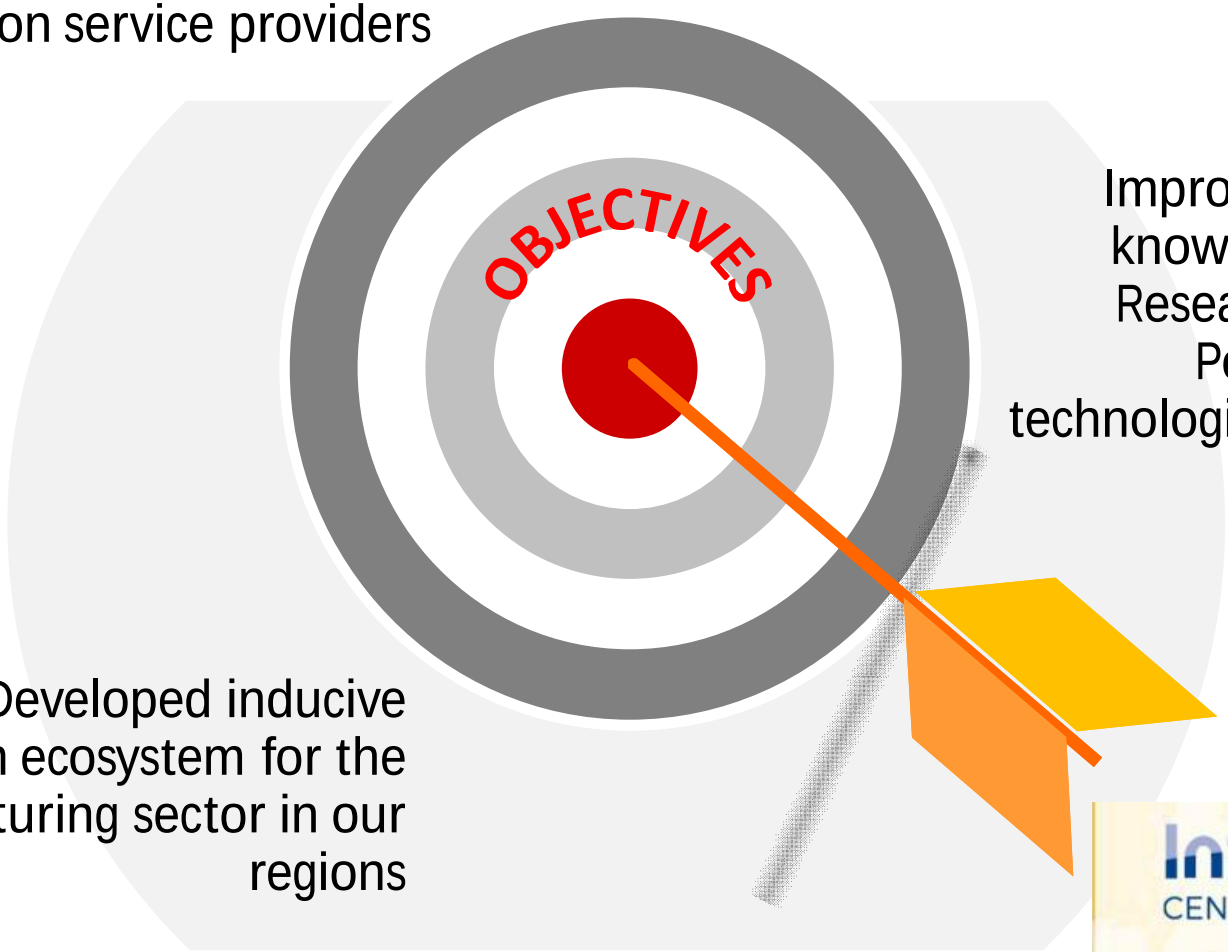
1	DE	Chemnitz University of Technology MERGE- Cluster of Excellence
2	DE	University of Applied Science Zittau/Görlitz
3	PL	Institute of Technology Transfer (ITT) Wroclaw
4	PL	Technology Park of Legnica
5	CZ	Regional Development Agency of Usti Region
6	CZ	Technical University of Liberec
7	IT	Liguria Regional Chamber of Commerce
8	IT	University of Genova-Polytechnic School
9	SK	University of Zilina
10	SK	Business and Innovation Centre (BIC) Bratislava
11	ES	LEITAT, Acondicionamiento Tarrasense, Barcelona



Interreg CENTRAL EUROPE
European Union European Regional Development Fund
AMiCE

Advanced manufacturing technologies, circular economy in Central European regions

Improved strategic interaction and co-operation of Innovation service providers



Improved transfer of knowledge between Research, SMEs and Policy about AM technologies and circular economy

Developed inducive innovation ecosystem for the manufacturing sector in our regions

Interreg CENTRAL EUROPE
European Union European Regional Development Fund
AMiCE

Thanks for your attention

Fabrizio Barberis, PhD
Vice Coordinator of Research & Innovation Commission of University of Genova
fabrizio.barberis@unige.it