A Study on the US Innovation Ecosystem and Market - Related to Production Technologies
Disclaimer

This document is provided with no warranties whatsoever, including any warranty of merchantability, non-infringement, fitness for any particular purpose, or any other warranty with respect to any information, result, proposal, specification or sample contained or referred to herein. Any liability, including liability for infringement of any proprietary rights, regarding the use of this document or any information contained herein is disclaimed. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by or in connection with this document. This document is subject to change without notice. ENRICH has been financed with support from the European Commission. This document reflects only the view of the author(s) and the European Commission cannot be held responsible for any use which may be made of the information contained herein.
Executive Summary

This study is a product of ENRICH in the USA, which is a European Network of Research and Innovation Centers and Hubs. Promoted by the European Commission (EC) through Horizon 2020, ENRICH in the USA acts as a central contact point for European research and innovation actors seeking to grow and reinforce collaboration across the Atlantic. The mission of the Network is to provide standardized as well as various tailor-made, research & innovation internationalization support services to European researchers and innovators, to accelerate access to the United States (US) market, and maximize chances of success.

The Study on US Innovation Ecosystem and Market - Related to Production Technologies provides an assessment of the US innovation and market landscape and aims to support cooperation between the European Union (EU) and the US.

The Study identifies US key innovation hubs/facilitators and industry related centers, as well as the US main market opportunities and barriers related with production technologies. The Study also provides some of the key production technologies related networks and events, and assesses the existing funding initiatives and programs at both federal and state level that promote nanotechnology innovation. Overall, this study aims to be an effective tool for EU research and business representatives in production technologies related fields to gain knowledge on the US innovation and market landscapes, and therefore facilitate their initial approaches to establishing innovation and business collaborative activities with their US counterparties.

Figure 1 Initial Approach for Establishing Collaborative Innovation and Business Activities

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
Importance of Production Technology innovation to the EU and the US

Production Technology can be defined as the process of applying innovative technologies to develop new manufacturing products and processes\(^1\). Thus, production technologies are focused on improving manufacturing processes, techniques, or equipment in order to reduce costs, increase efficiency, enhance reliability, or to incorporate safety measures\(^2\). In this context, production technologies are deeply connected with Industry 4.0.

Industry 4.0 is considered the cyber-physical transformation of manufacturing\(^3\). The vision behind Industry 4.0, which is deeply grounded in the recent advances in information and communication technologies (ICT), is to develop a social network where machines can communicate with each other. In this context, machines would be able to communicate with each other and with the manufacturers in order to develop advanced cyber-physical production systems (CPPS)\(^4,5\). Industry 4.0 introduces what has been called “smart manufacturing,” where cyber-physical production systems control the production of physical processes and make decentralized decisions\(^6\).

The EC considers Industry 4.0 as a way to create products with high added value, as well as a way to promote sustainable manufacturing. In this context, the EU has been promoting several initiatives to promote the advance of production technology, such as the I4MS initiative\(^7\), an initiative to create a digital single market\(^8\), as well as the organization of a biannual event to discuss the national and regional initiatives that promote Industry 4.0\(^9,10\).

In the US, the implementation of initiatives to promote Industry 4.0 has been a priority during President Obama Administration. Therefore, the launch of the Advanced Manufacturing Partnership (AMP) and the creation the Manufacturing USA network of institutes have proved to be key initiatives to promote the development of next-generation production technologies to advance the US manufacturing industry\(^11\).

Innovation ecosystem

The US federal government allocated $155 million (€139.5 million) for the Industrial Technology Services (ITS) R&D activities in fiscal year 2018 (FY2018). From this budget, $130 million (€117 million) were allocated to the Manufacturing Extension Partnership; while $25 million (€22.5 million)

\(^{1}\) https://businesscasestudies.co.uk/business-theory/operations/production-technology.html
\(^{2}\) http://www.businessdictionary.com/definition/manufacturing-technology-MANTECH.html
\(^{3}\) https://searcherp.techtarget.com/definition/Industry-40
\(^{4}\) https://www.cleverism.com/industry-4-0/
\(^{6}\) https://www.forbes.com/sites/bernardmarr/2016/06/20/what-everyone-must-know-about-industry-4-0/#62aaa050795f
\(^{7}\) https://www.plattform-i40.de/i40/Navigation/EN/InPractice/International/EuropaesicheEbene/europaesiche-ebene.html
\(^{8}\) https://www.plattform-i40.de/i40/Navigation/EN/InPractice/International/EuropaesicheEbene/europaesiche-ebene.html
\(^{9}\) https://www.plattform-i40.de/i40/Navigation/EN/InPractice/International/EuropaesicheEbene/europaesiche-ebene.html
\(^{10}\) https://www.cbi.eu/market-information/sourcing-itobpo/industry-4-0/
\(^{11}\) https://ostausia.org/bridges-magazine/item/8310-industry-4-0
were allocated to the Network for Manufacturing Innovation\textsuperscript{12}. Furthermore, $24.8 million (€22.3 million) was provided to the Manufacturing USA network\textsuperscript{13}. This reflects the importance of research and development (R&D) activities related with production technology fields.

When analyzing the US production technology innovation ecosystem, the European SMEs should first identify the innovation hubs and facilitators of innovation that are most relevant for these particular fields. The innovation ecosystem is the term used to describe the numerous participants and resources that are needed for the innovation process\textsuperscript{14}. Considering the multiplicity of actors that the innovation ecosystem encompasses, this study focuses on the identification of the leading production technology innovation hubs, facilitators of innovation and industry related centers. From the assessment of the US innovation and industry communities’ landscape, it is clear there is a particular concentration of innovation hubs/facilitators and industry related RDI centers in the states of California, Illinois, New York, Ohio, and Texas.

Innovation hubs are ecosystems comprised by SMEs, large industries, startups, researchers, accelerators, and investors\textsuperscript{15} that aim to foster relationships between these entities and to act as a bridge between research and market needs\textsuperscript{16}. Currently, production technology innovation hubs are focused on related fields such as Artificial Intelligence (AI), Big Data, CPS, Internet of Things (IoT), and Robotics. Austin, Chicago, Cincinnati, New York, San Francisco Bay Area and Pittsburgh were identified as leading innovation hubs in at least one of these five production technology related fields.

Facilitators of innovation are responsible for supporting, promoting and accelerating the innovation process. Business accelerators, incubators, science parks, and specialized consulting firms are considered facilitators of innovation, which are crucial for the advancement of the production technology innovation process. Thus, innovation facilitators play a key role in supporting early-stage startups that aim to promote the advancement of production technology fields, such as AI, Big Data, CPS, IoT, and Robotics.

Industry related RDI centers are entities that include businesses as members or partners. Considering the importance of the manufacturing sectors to the US economy, the National Science Foundation (NSF) and the Manufacturing USA network have been highly focused on promoting the establishment of industry related RDI centers in order to advance production technologies.

\textsuperscript{12} \url{https://fas.org/sgp/crs/misc/R44888.pdf}
\textsuperscript{13} \url{https://www.nist.gov/fy-2019-presidential-budget-request-summary/industrial-technology-services/manufacturing-usa}
\textsuperscript{14} \url{https://www.researchgate.net/publication/282122544_Innovation_Ecosystems_Implications_for_Innovation_Management}
\textsuperscript{16} \url{http://americanjobsproject.us/system/innovation-ecosystem/}

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
Market landscape

Manufacturing plays a significant role in the US economy, accounting for $2,244 billion (€2,019 billion) of the US GDP\(^{17}\). In 2017, Manufacturing was the fourth largest sector contributor to the GDP, accounting for 11.6% of the US GDP\(^{18}\). Food Manufacturing, Fabricated Metal Product Manufacturing, and Machinery Manufacturing are the sectors with the highest Potential Production Technology customer base in the US.

According to the National Association of Manufactures (NAM), the US Manufacturing sector alone would represent the ninth largest economy in the world, without even considering its multiplier effect on other sectors\(^ {19}\). In this context, the manufacturing market presents several opportunities for EU businesses.

Considering the size of the US manufacturing market, there are states that can be considered leading regions from a market perspective. If one assesses the production technology market based on three of the largest purchasers of production technologies (Machinery Manufacturing, Food Processing and Aerospace Product and Parts Manufacturing businesses), the market is particularly concentrated in the states of California, New York, Pennsylvania, Texas and Washington.

Networks and events

Recognized networks and events play a key role in fostering interaction between academia and industry members, which is crucial to advance production technologies. Innovation and market networks are collaborative forums that foster interaction between production technology stakeholders and promote exchange. In this context, a sample of the key production technology related networks and events are presented within the Study.

Initiatives and programs

In the US, production technology R&D activities are highly supported by federal and state initiatives and programs that prioritize research areas that can lead to technological breakthroughs. At the federal level, the US Department of Commerce (DoC), the DoD and the NSF are the entities primarily responsible for initiatives and programs that promote innovation in production technology related fields. Furthermore, the DoC, DoD, Department of Energy (DoE), National Aeronautics and Space Administration (NASA), NSF, and the Department of Agriculture (USDA) also promote Production Technology R&D activities through Manufacturing USA. At the state level, several states have recognized the need to launch initiatives, challenges or grants that promote the advance of production technologies.

\(^{17}\)https://bea.gov/iTable/iTable.cfm?reqid=51&step=51&isuri=1&5114=a&5102=1
\(^{19}\)http://www.nam.org/Newsroom/Top-20-Facts-About-Manufacturing/

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
Although, there are several programs and initiatives at both federal and state level, it is important to note the information related to funds and grants for European representatives is difficult to find. In most cases, the European research and business representatives interested in US initiatives and programs need to contact the program officers to know specific details about international eligibility.
ENRICH in the USA Summary

ENRICH is the European Network of Research and Innovation Centers and Hubs. Promoted by the European Commission through Horizon 2020, the ENRICH network currently offers services to connect European research, technology and business organizations with three global frontrunner innovation markets: Brazil, China and the USA.

ENRICH in the USA is powered by NearUS, a H2020 initiative to establish a Network of European Research and Innovation Centers throughout the United States of America. ENRICH in the USA acts as a central contact point for European research and innovation actors seeking to grow and reinforce collaboration across the Atlantic. The mission of the Network is to provide standardized as well as various tailor-made, research & innovation internationalization support services to European researchers and innovators, to accelerate access to the US market, and maximize chances of success.

ENRICH in the USA targets to serve the following actors:

- Accelerators
- Businesses
- Clusters
- Entrepreneurs
- Funding Agencies
- Incubators
- Networks
- R&D institutes and labs
- Research managers and administrators
- Research Parks
- SME’s
- Start-ups
- Universities
- University Associations

ENRICH in the USA includes the following entities:

- One “Coordination Node” in Europe (at EBN)
- One “Coordination Node” in the US (at InBIA)
- Two physical “Landing Hubs”:
  - San Francisco Centre: ENRICH West Coast Hub at EAEC
  - Boston Centre: ENRICH East Coast Hub at CIC
- Five Associate Hubs across the US, and plans to expand the ENRICH in the USA Network beyond these first five Hubs, over four years.

The ENRICH in the USA Network is built on local US experience and strong existing ties between the EU and USA, while providing new researcher- and entrepreneur-serving capabilities which address the resource gaps necessary to enable access for all EU Member States and Associated Countries, as well as every state in the US.

A variety of services are proposed for researchers and entrepreneurs engaged by the Network during the pilot phase, then the Centers’ pilot activities will be evaluated to inevitably retain the initiative’s most successful components to ensure a sustainable plan for ENRICH in the USA in the future.

Services will target various, commercially viable technology maturity levels, both research-oriented and market-oriented and will include research connection symposia, business matchmaking opportunities, working visits and innovation tours to US organizations to explore technology/product
partnerships and/or business development middle/long term opportunities, pitching to potential investors, entrepreneurial boot camps, workspace access, hands on business acceleration programs, and more. As the ENRICH in the USA initiative is highly competitive to best serve the strongest researchers and entrepreneurs, all services must be applied for through an open and transparent selective mechanism.

60 associated partners in the EU and USA support NearUS and ENRICH in the USA, with more associated partners expected in the future.

**NearUS Consortium:**

**Coordinator:** German Aerospace Center (DLR), Germany

**Partners:**

- inno TSD, France
- European Business and Innovation Centre Network (EBN), Belgium
- International Business Innovation Association (InBIA), USA
- European American Enterprise Council (EAEC), USA
- INTRASOFT International (INTRA), Luxembourg
- Sociedade Portuguesa de Inovação (SPI), Portugal
- Regional Centre for Information and Scientific Development (RCISD), Hungary
- National Council of University Research Administrators (NCURA), USA

---

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
# Table of Contents

List of Abbreviations ........................................................................................................ 12

1 Introduction ................................................................................................................... 15

2 US innovation ecosystem .............................................................................................. 19
   2.1. Innovation Hubs .................................................................................................... 20
   2.2. Innovation facilitators ......................................................................................... 26
   2.3. Industry related RDI centers .............................................................................. 29

3 US market landscape ....................................................................................................... 34
   3.1. Market overview .................................................................................................. 35
   3.2. Leading regions ................................................................................................... 35
   3.3. Market considerations ......................................................................................... 45
      3.3.1. Opportunities ............................................................................................... 45
      3.3.2. Barriers ......................................................................................................... 46

4 Recognized networks and events .................................................................................. 48
   4.1. Innovation / market networks and associations .................................................. 48
   4.2. Innovation and market events .............................................................................. 53

5 US innovation initiatives and programs ......................................................................... 57
   5.1. Federal initiatives/programs ................................................................................ 57
      5.1.1. Manufacturing USA ...................................................................................... 58
      5.1.2. Department of Commerce (DoC) .................................................................. 59
      5.1.3. Department of Defense (DoD) ...................................................................... 60
      5.1.4. National Science Foundation (NSF) ............................................................... 61
   5.2. State initiatives/programs ..................................................................................... 66
      5.2.1. Pennsylvania Manufacturing Initiative .......................................................... 66
      5.2.3. Smarter Illinois Initiative .............................................................................. 67

6 Observations .................................................................................................................... 68

Annex 1: Summary of the US Federal and State Funding Initiatives and Programs ............ 70
Table of Figures

Figure 1 Initial Approach for Establishing Collaborative Innovation and Business Activities ............. 3
Figure 2 - NearUS Butterfly ......................................................................................................................... 9
Figure 3 - US Mapping of the leading Innovation Hubs focused on Production Technologies ............. 21
Figure 4 – Location of the US areas with higher concentration of Machinery Manufacturers ............. 38
Figure 5 - US states and cities with the highest concentration of Machinery Manufacturers ............. 38
Figure 6 US states and cities with the highest concentration of Machinery Manufacturers which individually invest over $50,000 in technology annually ................................................................. 39
Figure 7 - US areas with higher concentrations of Food Processors ...................................................... 40
Figure 8 - US states and cities with the highest concentration of Food Processors ............................. 41
Figure 9 - US states and cities with the highest concentration of Food Processing Businesses which individually invest an average of $10,000 or more in technology annually ............................. 42
Figure 10 US areas with the highest concentration of Aerospace Product and Parts Manufacturers . 43
Figure 11 US states and cities with the highest concentration of Aerospace Product and Parts Manufacturers ................................................................. 44
Figure 12 US states and cities with the highest concentration of Aerospace Product and Parts Manufacturing businesses which individually invest over $50,000 in technology annually ............. 45
Figure 13 - US Government Organizational Chart highlighting the main sponsors of innovation programs in production technology related fields ................................................................. 58

List of Tables

Table 1 - List of Abbreviations .................................................................................................................... 12
Table 2 – A sample of Industry connected RDI Centers in production technology related fields .......... 31
Table 3 - Examples of key US production technology related networks and associations ..................... 50
Table 4 – Production technology related innovation and market events ................................................. 54
Table 5 - Summary of the US Federal and State Funding Initiatives and Programs ............................. 70

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
## List of Abbreviations

Table 1 - List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAM</td>
<td>Alliance for American Manufacturing</td>
</tr>
<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>AIM Photonics</td>
<td>American Institute for Manufacturing Integrated Photonics</td>
</tr>
<tr>
<td>AM</td>
<td>Advance Manufacturing</td>
</tr>
<tr>
<td>AMNPO</td>
<td>Advanced Manufacturing National Program Office</td>
</tr>
<tr>
<td>AMP</td>
<td>Advanced Manufacturing Partnership</td>
</tr>
<tr>
<td>AMT</td>
<td>Association for Manufacturing Technology</td>
</tr>
<tr>
<td>ARM</td>
<td>Advanced Robotics Manufacturing Institute</td>
</tr>
<tr>
<td>CAEML</td>
<td>Advanced Electronics through Machine Learning</td>
</tr>
<tr>
<td>CBP</td>
<td>Customs and Border Protection</td>
</tr>
<tr>
<td>CESMII</td>
<td>Clean Energy Smart Manufacturing Innovation Institute</td>
</tr>
<tr>
<td>CMTA</td>
<td>California Manufacturers &amp; Technology Association</td>
</tr>
<tr>
<td>CPaSS</td>
<td>Center for Particular Surfactant Systems</td>
</tr>
<tr>
<td>CPS</td>
<td>Cyber-Physical Systems</td>
</tr>
<tr>
<td>DoD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>DoE</td>
<td>Department of Energy</td>
</tr>
<tr>
<td>DoIT</td>
<td>Department of Innovation &amp; Technology</td>
</tr>
<tr>
<td>EAEC</td>
<td>European American Enterprise Council</td>
</tr>
<tr>
<td>EBN</td>
<td>European Business and Innovation Centre Network</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
</tr>
<tr>
<td>FMA</td>
<td>Fabricators &amp; Manufacturers Association</td>
</tr>
<tr>
<td>FOA</td>
<td>Funding Opportunity Announcement</td>
</tr>
<tr>
<td>FY</td>
<td>Fiscal Year</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
</tr>
<tr>
<td>IMS</td>
<td>Intelligent Maintenance Systems</td>
</tr>
<tr>
<td>InBIA</td>
<td>International Business Innovation Association</td>
</tr>
<tr>
<td>INTRA</td>
<td>INTRASOFT International</td>
</tr>
<tr>
<td>IoT</td>
<td>Internet of Things</td>
</tr>
<tr>
<td>IPS</td>
<td>Intelligent Physical Systems</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>ITS</td>
<td>Industrial Technology Services</td>
</tr>
<tr>
<td>I/UCRC</td>
<td>Industry/University Cooperative Research Center</td>
</tr>
<tr>
<td>LPAM</td>
<td>Laser and Plasma for Advanced Manufacturing</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>MoU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>NAICS</td>
<td>North American Industry Classification System</td>
</tr>
<tr>
<td>NAM</td>
<td>National Association of Manufacturers</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>NCR</td>
<td>National Center Region</td>
</tr>
<tr>
<td>NCURA</td>
<td>National Council of University Research Administrators</td>
</tr>
</tbody>
</table>

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIST</td>
<td>National Institute of Standard and Technology</td>
</tr>
<tr>
<td>NNMI</td>
<td>National Network for Manufacturing Innovation</td>
</tr>
<tr>
<td>NSF</td>
<td>National Science Foundation</td>
</tr>
<tr>
<td>NSTC</td>
<td>National Science and Technology Council</td>
</tr>
<tr>
<td>NYCEDC</td>
<td>New York City Economic Development Corporation</td>
</tr>
<tr>
<td>OAM</td>
<td>Office of Advanced Manufacturing</td>
</tr>
<tr>
<td>PMIP</td>
<td>Pennsylvania Manufacturing Innovation Program</td>
</tr>
<tr>
<td>RCISD</td>
<td>Regional Centre for Information and Scientific Development</td>
</tr>
<tr>
<td>RI</td>
<td>Robust Intelligence</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>SIC</td>
<td>Standard Industrial Classification</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium Enterprise</td>
</tr>
<tr>
<td>SPI</td>
<td>Sociedade Portuguesa de Inovação</td>
</tr>
<tr>
<td>SS&amp;TP</td>
<td>Sandia Science and Technology Park</td>
</tr>
<tr>
<td>S&amp;AS</td>
<td>Smart and Autonomous Systems</td>
</tr>
<tr>
<td>US</td>
<td>United States</td>
</tr>
<tr>
<td>USDA</td>
<td>US Department of Agriculture</td>
</tr>
</tbody>
</table>
1 Introduction

This study, which has been developed in the context of the ENRICH in the USA network, aims to provide relevant information on the United States (US) landscape in regard to the production technology innovation ecosystem and market, including: the leading regions from an innovation and market perspective; the key innovation hubs/facilitators; a sample of the main research networks/professional organizations; as well as important funding programs and initiatives at both federal and state levels.

The Study can be an effective source or tool for the European Union (EU) academic and industry communities to gain knowledge on the US related to production technology fields and:

▪ To identify the US leading regions from an innovation and market perspective;
▪ To identify potential approaches for developing collaborative partnerships with US facilitators of innovation and/or businesses;
▪ To identify relevant US networks and conferences that can be used as a conduit to meeting potential innovation and market partners; and
▪ To identify and assess the opportunity to access US funding programs related to Production Technology fields in order to propose potential partnerships with US organizations.

Therefore, it is the hope of the Study authors that the information is useful in assisting the EU research organizations and Small and Medium Enterprises (SMEs) in their efforts to develop stronger ties to the US production technology innovation ecosystem and market.

Production Technology

Production technology can be defined as the process of applying innovative technologies to develop new manufacturing products and processes. Thus, production technologies are focused on improving manufacturing processes, techniques, or equipment in order to reduce costs, increase efficiency, enhance reliability, or to incorporate safety measures. In this context, production technologies are deeply connected with Industry 4.0.

---

20 https://near-us.eu/project-overview
21 https://businesscasestudies.co.uk/business-theory/operations/production-technology.html
22 http://www.businessdictionary.com/definition/manufacturing-technology-MANTECH.html

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
Industry 4.0 is considered the cyber-physical transformation of manufacturing\(^{23}\). The vision behind Industry 4.0, which is deeply grounded in the recent advances in information and communication technologies (ICT), is to develop a social network where machines can communicate with each other. In this context, machines would be able to communicate with each other and with the manufacturers in order to develop advanced cyber-physical production systems (CPPS)\(^{24,25}\). Industry 4.0 introduces what has been called “smart manufacturing,” where CPPS control the production physical processes and make decentralized decisions\(^{26}\).

Furthermore, the concept of Industry 4.0 comprises a wide range of technologies, as well as a variety of key concepts, such as Interoperability, Virtualization, Decentralization, Optimization, Service-Orientation, and Modularity\(^{27,28}\). Thus, Industry 4.0 introduces a new manufacturing concept where robotics connected remotely to computer systems equipped with machine learning algorithms can learn and control the systems with very little human input\(^{29}\).

Since production technologies include a wide range of innovative technologies, they should be analyzed as the result of several developments within a broader research context. In fact, production technology is a multidisciplinary field deeply linked to advances in different research areas. Thus, this Study will be focused on five of the thematic research areas related to production technologies.

- **Artificial intelligence (AI):** AI is a division of computer science that deals with the simulation of intelligent behavior in computers, i.e. the capability of a machine to imitate intelligent human behavior\(^{30}\). Particular applications of AI include expert systems, speech recognition and machine vision\(^{31}\).

- **Big Data:** Big data analysis is the use of advanced analytic methods against diverse data sets that include different types and sizes of data\(^{32}\). This allows uncovering hidden patterns and unknown correlations, as well as identifying trends and preferences, mainly relating to human behavior and interactions\(^{33}\).

---

23 [https://searcherp.techtarget.com/definition/Industry-40](https://searcherp.techtarget.com/definition/Industry-40)
24 [https://www.cleverism.com/industry-4-0/](https://www.cleverism.com/industry-4-0/)
26 [https://www.forbes.com/sites/bernardmarr/2016/06/20/what-everyone-must-know-about-industry-4-0/#62aaa050795f](https://www.forbes.com/sites/bernardmarr/2016/06/20/what-everyone-must-know-about-industry-4-0/#62aaa050795f)
27 [https://ottomotors.com/blog/5-industry-4-0-technologies](https://ottomotors.com/blog/5-industry-4-0-technologies)
28 [https://www.cleverism.com/industry-4-0/](https://www.cleverism.com/industry-4-0/)
29 [https://www.forbes.com/sites/bernardmarr/2016/06/20/what-everyone-must-know-about-industry-4-0/#62aaa050795f](https://www.forbes.com/sites/bernardmarr/2016/06/20/what-everyone-must-know-about-industry-4-0/#62aaa050795f)
31 [https://searchenterprisai.techtarg ct.com/definition/Al-Artificial-Intelligence](https://searchenterprisai.techtarg ct.com/definition/Al-Artificial-Intelligence)
33 [https://www.techopedia.com/definition/28659/big-data-analytics](https://www.techopedia.com/definition/28659/big-data-analytics)

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
• **Cyber-physical systems (CPS):** CPS are integrations of computation, networking, and physical processes. Embedded computers and networks monitor and control the physical processes, with feedback loops where physical processes affect computations and vice versa.

• **Internet of Thing (IoT):** IoT is a system of interrelated computing devices, mechanical and digital machines, objects, or people that are provided with unique identifiers, as well as with the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

• **Robotics:** Robotics is the branch of engineering that involves the conception, design, manufacture, and operation of robots. Robotics overlaps with electronics, computer science, mechatronics, nanotechnology and bioengineering.

**Importance of Production Technologies to the EU and US**

The EC considers Industry 4.0 as a way to create products with high added value, as well as a way to promote sustainable manufacturing. Currently, the EU accounts for more than a third of the global Industry 4.0 investments, with Germany having a frontrunner position. In this context, the EU is launching a wide variety of measures to support and connect national initiatives that focus on Industry 4.0 advances.

The EU organizes a biannual event that brings together representatives from the Member States’ initiatives, which discuss the national and regional initiatives that promote Industry 4.0. An overview of the EC shows that there are more than 30 national and regional initiatives at European level, such as Industria Conectada 4.0 (Spain), Produktion der Zukunft (Austria), Plattform Industrie 4.0 (Germany) and Made Different (Belgium). These initiatives are an indication that the EU Member States are highly committed to promote the digitalization of their industries and advancement of new production technologies.

In 2013, the EU launched the I4MS initiative, which aims to digitalize the manufacturing industry in the EU. Under this initiative, the centers of excellence have supported SMEs in testing and implementing ICT across the entire value chain. Furthermore, in April 2016, the EU launched an initiative to create a digital single market. The aim of this initiative is to prepare the Member States for the challenges related with new digital products and services. Currently, there are several barriers...

---

34 [http://cyberphysicalsystems.org/](http://cyberphysicalsystems.org/)
35 [https://ptolemy.berkeley.edu/projects/cps/](https://ptolemy.berkeley.edu/projects/cps/)
36 [https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT](https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT)
37 [https://whatis.techtarget.com/definition/robotics](https://whatis.techtarget.com/definition/robotics)
39 [https://www.cbi.eu/market-information/outourcing-itobpo/industry-40/](https://www.cbi.eu/market-information/outourcing-itobpo/industry-40/)

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
related with digital transfer, which makes cross-border exchanges more challenging. In this context, the EC wants to foster the creation of joint standards that make cross-border transfers possible. These will include 5G technology, IT security solutions, cloud computing and data technologies\textsuperscript{42}.

In the US, the implementation of initiatives to promote Industry 4.0 was a priority during President Obama Administration. Thus, considering the importance of the Manufacturing sectors to the US economy, in 2011 President Obama launched the Advanced Manufacturing Partnership (AMP), which is a national effort to bring together industry, universities, and the federal government to invest in the emerging technologies that will create high quality manufacturing jobs and enhance the US’ position in the global manufacturing market\textsuperscript{43, 44}.

Moreover, the President Obama Administration also created the Manufacturing USA, a network of regional institutes that have a specialized technology focus, such as AI, automation, electronics, sensors, or robotics. Manufacturing USA has established 14 manufacturing innovation institutes that promote cooperation between private industry, nonprofit, academia and government entities\textsuperscript{45}. These initiatives demonstrate the US is highly focused on promoting next-generation production technologies to advance its manufacturing industry\textsuperscript{46}.

Overall, as the EU and the US consider the advancement of production technologies as a priority from both academic and business perspectives, the cooperation among public and private sector entities from both regions is perceived as key for the development and deployment of technologies crucial for the manufacturing market.

\textsuperscript{42} https://www.plattform-i40.de/I40/Navigation/EN/InPractice/International/EuropaeischeEbene/europaeische-ebene.html
\textsuperscript{43} http://web.mit.edu/pie/amp/
\textsuperscript{44} https://ostaustria.org/bridges-magazine/item/8310-industry-4-0
\textsuperscript{45} https://www.manufacturingusa.com/
\textsuperscript{46} https://ostaustria.org/bridges-magazine/item/8310-industry-4-0
The US is the world leading country in terms of R&D investment, and this is still a fact when the public and private sectors are analyzed separately. In 2017, the country’s total spending on R&D is expected to reach $527.5 billion (€474.8 billion), which represented about 2.9% of its Gross Domestic Product (GDP), and more importantly, accounted for over a quarter of the global R&D investment. The R&D programs are mainly supported by industry ($347.7 billion, €312.9 billion), the Federal Government ($43.22 billion, €38.9 billion), academia ($19.3 billion, €17.4 billion), federally funded R&D centers ($15.5 billion, €13.9 billion), and non-profits organizations ($20.3 billion, €18.3 billion).

The US federal government allocated $155 million (€139.5 million) for the Industrial Technology Services (ITS) R&D activities in fiscal year 2018 (FY2018). From this budget, $130 million (€117 million) were provided to the Manufacturing Extension Partnership; while $25 million (€22.5 million) were allocated to the Network for Manufacturing Innovation. Furthermore, $24.8 million (€22.3 million) was provided to the Manufacturing USA network. This reflects the importance of the development of R&D activities related with production technology fields.

In addition, in the US private-sector R&D expenditure is crucial for advancing production technologies. R&D in the Manufacturing sectors has increased from $126.2 billion (€113.6 billion) in 2000 to $236.1 billion (€236.8 billion) in 2015. In 2015, the R&D intensity for manufacturing companies was 4.4%, well above the 3.3% average for nonmanufacturing industries. In this context, manufacturing companies are at the forefront of next-generation production technologies with, for instance, the precision machining industry growing its investment in R&D by 48% between 2010 and 2011.

The innovation ecosystem plays a key role in the development of new production technologies. The term innovation ecosystem is used to describe the various participants and resources that are needed for the innovation process. This process includes researchers, universities, venture capitalists, industry companies, SMEs, startups, accelerators, incubators and investors. Considering the multiplicity of actors that the innovation ecosystem encompasses, this study focuses on the

References:
48 https://www.iriweb.org/sites/default/files/2016GlobalR%26DFundingForecast_2.pdf
49 http://digital.rdmag.com/researchanddevelopment/2017_global_r_d_funding_forecast?pg=4#pg4
50 http://digital.rdmag.com/researchanddevelopment/2017_global_r_d_funding_forecast?pg=6#pg6
51 https://fas.org/sgp/crs/misc/R44888.pdf
54 http://www.nam.org/Newsroom/Facts-About-Manufacturing/
55 https://www.forbes.com/sites/pelktokin/2016/06/21/the-u-s-cities-where-manufacturing-is-thriving/#2c8019ae93f1
57 https://www.researchgate.net/publication/282122544_Innovation_Ecosystems_Implications_for_Innovation_Management
leading production technology hubs, the facilitators of innovation and the industry related R&D centers in order to identify the US regions that most contribute to advancing production technologies.

In this context, when analyzing the US production technology innovation ecosystem, the EU academic and industry communities should first identify the innovation hubs/facilitators and industry related R&D centers that are most relevant for this particular sector. The assessment of the US production technology innovation landscape, which comprises these key innovation actors, allows EU research organizations and SMEs to identify relevant US organizations that often develop multi-partner collaborative partnerships to develop next-generation production technologies.

### 2.1. Innovation Hubs

Innovation hubs are ecosystems that comprise SMEs, large industries, startups, researchers, accelerators, and investors\(^{59}\). They promote relationships among these entities and act as a bridge between the research activities and the market needs. Thus, a successful innovation hub promotes R&D activities, facilitates the development of new technologies, incubates early stage companies and attracts funding\(^{60}\).

The US is home to some of the world’s most recognized innovation hubs. The San Francisco Bay Area is internationally recognized for its world class high-tech companies and numerous highly innovative startups. This innovation hub promotes world leading technological trends as well as important advances in technology\(^{61}\). However, in recent years, Austin, Chicago, Cincinnati, New York and Pittsburgh have also emerged as world leading innovation hubs due to their combination of funding with highly talented professionals, which can lead to important innovation breakthroughs in production technology fields\(^{62,63}\).

It is also important to highlight that the Manufacturing USA Institutes have been created with the aim of bringing together industry, academia and federal partners within a growing network of advanced manufacturing institutes. Thus, each Institute would attract academia, industry and innovation players, which would lead to the development of new smart manufacturing hubs\(^{64}\). Currently, there are 14 Manufacturing USA Institutes related with production technologies located in leading metropolitan areas, such as Chicago, San Francisco Bay and New York\(^{65}\).

\(^{60}\)http://americanjobsproject.us/system/innovation-ecosystem/
\(^{61}\)https://medium.com/@RussellMoopa/silicon-valley-innovation-hub-of-the-world-1925278c6289
\(^{62}\)https://www.forbes.com/sites/noahkirsch/2016/10/18/why-boston-is-the-next-hub-for-innovation/#75ab33693d6a
\(^{63}\)https://www.forbes.com/sites/techonomy/2014/07/21/innovation-hubs-are-accelerating-american-manufacturing/#5c35e25a1938
\(^{64}\)https://www.manufacturing.gov/
\(^{65}\)https://www.manufacturingusa.com/institutes

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
Important innovation hubs have also emerged in Austin, Cincinnati and Pittsburgh metropolitan areas (listed by innovation rating). Currently, these areas are highly committed to invest in the creating of an innovation ecosystem that attracts funding, innovation facilitators, startups and big corporations.66,67

The production technology innovation hubs identified in this section, and listed by innovation rating, have been selected based on the presence of leading innovation facilitators, startups and big corporations, as well as their ability to attract funding. The identified hubs are focused on at least one of the five production technology related areas: AI, Big Data, CPS, IoT, and Robotics. Figure 3 presents an overview of the US leading innovation hubs in production technologies.

---

66 https://www.builtinchicago.org/2017/03/06/kpmg-chicago-tech-ranking
San Francisco Bay, California

**Areas:** AI, Big Data, CPS, IoT, Robotics

The San Francisco Bay area is widely recognized as a leading hub for innovation and technology disruption. The San Francisco Bay area encompasses a wide range of assets, such as the presence of leading technology companies, world-class universities, abundant venture capital, and an academy-industry collaborative culture, which allows the development of cutting edge production technologies\(^68,69\).

Currently, the San Francisco Bay area is home to some of the world’s leading players in the development of R&D activities related with production technologies. AI, IoT, robotics, among other technologies are the new frontier in the San Francisco Bay area. In this context, global technological companies based in the Bay area, such as Waymo, Space Systems Loral or Nvidia, have been investing in R&D activities related with Industry 4.0 technologies\(^70\). Furthermore, the Bay area is also home to leading startups in fields related with production technologies, such as IoTium, Mtell or Sight Machine\(^71\).

In addition, the San Francisco Bay innovation hub is composed of a group of leading universities in fields related with production technologies, such as Carnegie Mellon Silicon Valley; Stanford University; University of California, San Francisco; and University of California, Santa Cruz.

**Initial contact point:** California Manufacturers & Technology Association (CMTA), Phone: +1 916-441-5420

New York City, New York

**Areas:** AI, Big Data and IoT

New York is a world recognized innovation hub. In this context, the Partnership for New York Innovation has been highly focused on supporting the collaboration between tech startups and manufacturing leaders to ensure New York’s position as a leading innovation hub\(^72\).

The city of New York is widely known as the home for leading startups in the fields of AI, Big Data and IoT, such as Sisense, Socure, Clarifai, Trendalytics, Wink, and Yext\(^73,74,75\). New York City is also home to

\(^{68}\) https://static1.squarespace.com/static/54b4afe7e4b096f7dca62bef/t/55a7e4afe4b079318ff0d68d/1437066415176/2+The+Silicon+Valley+Ecosystem+2015.pdf
\(^{69}\) https://www2.deloitte.com/content/dam/insights/us/articles/tapping-into-silicon-valley-culture-of-innovation/DUP_3274_Silicon-Valley_MASTER.pdf
\(^{71}\) https://siliconvalley.tours/14-machine-learning-startups-in-silicon-valley-by-industry/
\(^{72}\) https://innovateinnyc.org/
\(^{73}\) https://www.builtinnyc.com/companies/type/artificial-intelligence-companies-nyc
\(^{74}\) https://www.builtinnyc.com/blog/big-data-startups-nyc
\(^{75}\) https://www.builtinnyc.com/2017/01/01/iot-companies-making-awesome-products-nyc
3D printing pioneers, such as MakerBot and Shapeways. In this context, New York is considered a leading sight for startup incubation and acceleration, which fosters innovation.

New York is also a leading innovation sight for the development of R&D activities related with production technologies. Thus, the city of New York has been investing in a cutting-edge Advanced Manufacturing Center, which aims to advance production technologies. Moreover, the Center for Particulate and Surfactant Systems (CPaSS) and the Rapid Advancement in Process Intensification Deployment Institute are also two examples of recognized industry related research centers based in New York.

Initial contact point: New York City Economic Development Corporation (NYCEDC), Email: newbusiness@edc.nyc

Cincinnati, Ohio

Areas: Big Data, IoT, Robotics

Cincinnati has declared itself an “Industry 4.0 demonstration city”. In recent years, Cincinnati has been attracting highly innovative tech companies and startups, which have led to the development of a leading innovation ecosystem.

Currently, Cincinnati brings together big manufacturing companies, such as GE Aviation, with recognized production technology startups, such as Losant or Polar3D. In this context, TechSolve (a Cincinnati based manufacturing solutions company) has been in the forefront in developing electronic communication standards for machines to communicate with each other and provide data in a standardized format, which is crucial to help local manufacturers with Industry 4.0. In addition, Cincinnati is home to highly important academia members in the Industry 4.0 ecosystem, such as the Department of Mechanical and Materials Engineering of the University of Cincinnati and the Center for Intelligent Maintenance Systems (IMS).

Initial contact point: Manufacturers’ Agents of Cincinnati, Email: info@maccincinnati.org

---

77 https://www.nycedc.com/industry/industrial
78 https://4acc.com/article/industry-4-0/
80 http://thetechtribune.com/10-best-tech-startups-in-cincinnati/

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
Chicago, Illinois

**Areas:** AI and IoT

In recent years Chicago has become a digital manufacturing hub. Currently, Chicago has a startup ecosystem that has been attracting investment and innovation to the city. In 2016, Chicago attracted more than $1.7 billion (€1.5 billion) in funding for startups, which has enhanced its position as a leading technology hub\(^83,84\).

Considering the importance of the Manufacturing sector to the city of Chicago, the mHUB has been created to be a leading innovation center focused on physical product development and manufacturing. In this context, the mHUB promotes connections between local manufacturers, university researchers, innovation facilitators and investors in order to promote the advancement of production technologies\(^85\).

Chicago is also home to numerous startups working on promising trends in production technologies, including AI and IoT\(^86\). In addition, the University of Illinois, Chicago has been playing an important role in fostering R&D activities related with production technologies, especially through its Center for Advanced Design and Manufacturing of Integrated Microfluidics (CADMIM).

**Initial contact point:** mHUB, Phone: (312) 248-8701; Email: team@mhubchicago.com

Pittsburgh, Pennsylvania

**Areas:** AI and Robotics

Pittsburgh is a leading manufacturing sight. The city leverages world-class strengths in additive manufacturing, engineering, information technology and robotics. In recent years, Pittsburgh has been attracting highly skilled professionals, as well as STEM researchers, which has been fostering innovation\(^87\).

In Pittsburgh several public-private partnerships have been promoting the development of R&D activities focused on AI and robotics. Astrobotic Technologies Inc, Carnegie Mellon University, National Robotics Engineering Center, CMU Robotics Institute and Uber Technologies Inc. are

---

\(^{84}\) https://wwwbuiltinchicago.org/2017/03/06/kpmg-chicago-tech-ranking
\(^{85}\) https://mhubchicago.com/page/our-story
\(^{86}\) https://wwwbuiltinchicago.org/2017/03/06/kpmg-chicago-tech-ranking
examples of leading players that are highly committed to promoting R&D activities related with AI and robotics.88

Furthermore, Pittsburgh is home to additive manufacturing leading industry-academia players, such as Aerotech, Alcoa Technical Center, America Makes, General Electric Center for Additive Technology Advancement, and University of Pittsburgh-ANSYS Additive Manufacturing Research Laboratory. Thus, recent R&D investments are turning Pittsburgh into a prototyping and on-demand fabrication hub.89

Initial contact point: Pittsburgh Regional Alliance, Phone (412) 281-1890

Austin, Texas

Areas: Robotics

Austin has become a leading innovation hub for technology development. The city is one of the youngest cities in the US and has a large pool of tech-industry graduates that have been partnering with industry players to advance production technologies.90, 91

Currently, Austin is a leading hub for semiconductor and electronics R&D and manufacturing activities. Austin’s growth in high technology sectors, such as automotive technology, medical devices, nanotechnology, and aerospace manufacturing, has also attracted global manufacturers and leading high tech companies, such as Intel, IBM, and NXP Semiconductors. Furthermore, leading computer and microchip firms have also established major design and production centers in Austin, such as Samsung Austin Semiconductor.92 Austin is also home to important universities in areas related with production technologies, such as the University of Texas at Austin.

Initial contact point: Texas Association of Manufacturers, Email: lauren.fairbanks@manufacturetexas.org

91 https://www.austinchamber.com/economic-development/key-industries/advanced-manufacturing
92 https://www.austinchamber.com/economic-development/key-industries/advanced-manufacturing

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
2.2. Innovation facilitators

The US economy is deeply grounded on innovation as a source of economic growth\textsuperscript{93}. Public and private programs support the development of an entrepreneurial ecosystem, which is based on flexibility, diversity, creativity and novelty\textsuperscript{94}. In the US, facilitators of innovation are responsible for supporting, promoting and accelerating the innovation process. Business accelerators, incubators, science parks and specialized consulting firms are considered facilitators of innovation, as they play a very important role in the advancement of production technologies.

Accelerators support early-stage innovative companies through programs that offer education, mentorship, access to capital and investment, office space and supply chain resources during a fixed period of time\textsuperscript{95}. During the accelerating process, early-stage companies are often grouped with other early stage financing organizations, such as incubators, angel investors and seed-stage venture capitalists in order to attract investment\textsuperscript{96}. Incubators support early-stage innovative companies with a nurturing environment and often provide affordable working spaces, shared offices and services, management training, marketing support and access to finance. Overall, incubators support early-stage innovative companies reducing their costs and growing their businesses faster\textsuperscript{97,98}.

Science parks are areas, often created or supported by a college or university, where companies involved in scientific work and new technology are located\textsuperscript{99}. Science parks are catalysts for innovation and promote university-business collaborations, which are likely to lead to important advances in technology. In addition, science parks provide an ecosystem that supports early-stage businesses’ incubation and acceleration\textsuperscript{100}.

Furthermore, specialized consulting firms can act as important facilitators of innovation. These firms provide services that help startups to promote the creation of strategic partnerships, to promote research and technology transfer, and to foster entrepreneurship. Moreover, specialized consulting firms play a crucial role in applying their entrepreneurial approach, business experience, and fundamental scientific knowledge to support the development of next-generation production technologies.

Production technologies encompass a wide range of next-generation technologies, such as AI, Big Data, CPS, IoT, or Robotics. Thus, the abovementioned innovation facilitators play a key role in

\textsuperscript{93}https://www.sba.gov/sites/default/files/rs425-Innovation-Accelerators-Report-FINAL.pdf
\textsuperscript{94}https://www.researchgate.net/publication/266392166_A_Review_of_the_Entrepreneurial_Ecosystem_and_the_Entrepreneurial_Society_in_the_United_States_An_Exploration_with_Global_Entrepreneurship_Monitor_Dataset
\textsuperscript{95}https://smallbiztrends.com/2016/08/business-accelerator-differ-incubator.html
\textsuperscript{96}https://hbr.org/2016/03/what-startup-accelerators-really-do
\textsuperscript{97}http://www.diogenes-incubator.com/incubation/business-incubation-definition
\textsuperscript{98}http://www.businessdictionary.com/definition/business-incubator.html
\textsuperscript{99}https://dictionary.cambridge.org/dictionary/english/science-park
supporting early-stage startups that aim to advance Industry 4.0 production technologies. Nonetheless, it is important to highlight that manufacturing accelerators are a recent phenomenon in the US. In fact, the majority of programs promoted by manufacturing accelerators are still in their first cycles and their funding is still considered low when compared to more traditional accelerators. Based on desk research, this study identifies eight leading facilitators of innovation in the five selected production technology fields.

**Alchemist Accelerator, San Francisco**

Alchemist Accelerator has an AI Program targets startups that aim to advance next generation IoT technologies, such as healthcare machinery or software development. This six month program is limited to 25 startups and includes $36,000 (€32,000) in funding. During the program, the startups receive mentoring sessions from experienced mentors in the field and have access to Fortune 100 Customer Prospects lined up to accelerate customer development and validation.

https://alchemistaccelerator.com/iot/

**FASTLANE, Dayton**

Fastlane's is a non-profit organization that aims to accelerate production technologies. Fastlane’s team comprises manufacturing and engineering consultants with a background in manufacturing. The accelerator’s main goal is to develop a customized process to accelerate short-term results and build a solid foundation to support the growth of production technologies. Furthermore, Fastlane has direct contact with the University of Dayton-led Institute for the Development and Commercialization of Advanced Sensor Technology, which is highly focused on advancing sensors and electronics.

https://fastlane-mep.org/solutions/technology-acceleration/

**Massachusetts Manufacturing Accelerator, Springfield**

The Massachusetts Manufacturing Accelerator aims to support manufacturing SMEs to discover new ways to do business. Thus, the accelerator offers a training program focused on identifying the needs.

101 http://mcnair.bakerinstitute.org/blog/manufacturing-incubators/
104 https://alchemistaccelerator.com/iot/
105 https://alchemistaccelerator.com/
106 https://fastlane-mep.org/solutions/technology-acceleration/
of the SMEs’ potential buyers, as well as adapting/fine-tuning their business models. During the program, buyers and SMEs discuss the buyers’ needs in order to help the SMEs reaching their goals\textsuperscript{107}.

www.vvmmanufacturing.com/

Nvidia, Santa Clara

Nvidia sponsors the Nvidia Inception Program that targets startups focused on making industry advances on AI and data science. This virtual accelerator program aims to support startups during critical stages of product development, prototyping, and deployment. By joining this program, each startup gets a set of benefits, such as hardware grants, marketing support, and training sessions with mentors from the field\textsuperscript{108}. In addition, NVIDIA invests in next-generation AI startups through its GPU Ventures program, which provides seed funding and growth investment to startups that pursue advances in data analytics, AI, robotics or self-driving cars\textsuperscript{109}.


Sandia Science and Technology Park (SS&TP), Albuquerque

The SS&TP is home to companies, engineers, and researchers focused on advancing new technologies. Currently, SS&TP’s mature companies and startups collaborate with leading laboratories on a wide range of technologies, such as 3D printing, circuits and systems, and photonics\textsuperscript{110}. The Advanced Manufacturing Analysis & Research Corporation is one of the current SS&TP partner organizations, which demonstrates the important connection between manufacturing and next-generation technologies\textsuperscript{111}.

https://sstp.org/

Techstars, New York

Techstars provides its accelerator portfolio companies with access to financial, human and intellectual capital to accelerate their businesses\textsuperscript{112}. The Techstars IoT Program aims to support startups that are focused on industrial IoT, through a 90-day mentor-based accelerator program with

\textsuperscript{107} http://www.vvmmanufacturing.com/
\textsuperscript{108} https://www.nvidia.com/en-us/deep-learning-ai/startups/
\textsuperscript{109} http://www.nvidia.com/object/gpu_ventures_program.html
\textsuperscript{110} https://sstp.org/about-sstp
\textsuperscript{111} https://sstp.org/companies-organizations
\textsuperscript{112} https://www.techstars.com/faq/

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
personal mentorship\textsuperscript{113}. This program is based in New York City but is open to startups from around the world. Every company that participates in the program is offered a $100,000 (€90,000) convertible note\textsuperscript{114}.

www.techstars.com/programs/iot-program/

### UpTech Accelerator, Cincinnati

The UpTech Accelerator manages a program aimed to support startups that are developing leading technologies in the fields of AI, IoT, cyber security, or cyber physical systems. In this context, UpTech invests up to $50,000 (€45,000) \textit{per} startup in the form of a convertible note with a $250,000 (€225,000) capital. During the 5 month program the startups receive mentorship; legal and accounting support services; one-on-one weekly coaching; access to investors; the possibility to work with students interns from the Northern Kentucky University, greater Cincinnati region; and participation in the #StartupCincy ecosystem\textsuperscript{115}.

www.uptechideas.org/accelerator-program/

### 2.3. Industry related RDI centers

The advancement of production technologies requires an interdisciplinary approach that includes the contribution of researchers and industry members from different disciplines, such as engineering, computer science or physics. In this context, the majority of production technology R&D activities are developed through the cooperation between industries and universities or research centers.

Considering the importance of the Manufacturing sector to the US economy, the NSF has been highly focused on promoting industry-research collaborations in order to advance production technologies. Thus, there are several Industry–University Cooperative Research Centers (IUCRC) focused on fields related with production technologies. The NSF IUCRCs promote industry-relevant research through the development of multi-member partnerships among industry, academia, and government\textsuperscript{116}. Furthermore, as mentioned in previous sections, the Manufacturing USA Institutes also promote important partnerships and collaborations between industry and academia members\textsuperscript{117}.

In this context, this study considers three main types of research centers focused on production technology related fields:

\textsuperscript{113} https://www.techstars.com/programs/iot-program/
\textsuperscript{114} https://www.techstars.com/faq/
\textsuperscript{115} https://www.uptechideas.org/accelerator-program/
\textsuperscript{116} https://www.nsf.gov/eng/iip/iucrc/home.jsp
\textsuperscript{117} https://www.manufacturingusa.com/institutes

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
- University centers that have a strong direct collaboration with industry members (e.g. MIT Computer Science & Artificial Intelligence Lab);
- Research centers that have a strong direct collaboration with universities (e.g. Clean Energy Smart Manufacturing Innovation Institute (CESMII)); and
- Centers that are established by universities and several companies and other organizations (e.g. NSF sponsored IUCRCs).

The research centers highlighted in this section were identified based on the abovementioned criteria and are examples of centers that are globally recognized by their R&D activities related with production technologies. The selection of the centers was done by desk research, which included an extensive literature review and a review of known federal entities that support the establishment of these types of research centers.
## Table 2 – A sample of Industry connected RDI Centers in production technology related fields

<table>
<thead>
<tr>
<th>Industry Connected RDI Center</th>
<th>Examples of Academic Partners/Members</th>
<th>Examples of Industry Partners/Members</th>
<th>Location</th>
<th>Examples of Research Fields</th>
<th>Internet link</th>
</tr>
</thead>
</table>
| Advanced Electronics through Machine Learning (CAEML) (I/UCRC) | University of Illinois at Urbana-Champaign | IBM Intel Samsung\(^{118}\) | Urbana, Illinois | • Electronic design automation  
• Machine Learning | [https://publish.illinois.edu/advancedelectronics/industry-partners/](https://publish.illinois.edu/advancedelectronics/industry-partners/) |
| Advanced Robotics Manufacturing Institute (ARM) | Carnegie Mellon University  
Texas A&M University | Airbus Siemens Corporate Technology\(^{119}\) | Pittsburgh, Pennsylvania | • Sensor technologies  
• End-effector development  
• Software  
• Artificial intelligence | [https://arminstitute.org/membership/](https://arminstitute.org/membership/) |
| American Institute for Manufacturing Integrated Photonics (AIM Photonics) | Columbia University  
SUNY Polytechnic Institute  
University of Arizona  
University of California, Santa Barbara | Cadence Cisco Systems\(^{120}\) | Albany, New York | • Laser based radar  
• Data communications  
• Sensor technologies | [www.aimphotronics.com](http://www.aimphotronics.com) |
| Center for Advanced Design and Manufacturing of Integrated Microfluidics (CADMIM) (I/UCRC) | University of California, Irvine  
University of Illinois, Chicago  
University of Cincinnati | ALine, Inc. Beckman Coulter\(^{121}\) | Chicago, Illinois  
Irvine, California | • Integration and control systems  
• Manufacturable processes and materials  
• Sample Processing and | [www.iucrc.org/center-center-advanced-design-and-manufacturing-integrated-microfluidics](http://www.iucrc.org/center-center-advanced-design-and-manufacturing-integrated-microfluidics) |

\(^{118}\) [https://publish.illinois.edu/advancedelectronics/industry-partners/](https://publish.illinois.edu/advancedelectronics/industry-partners/)  
\(^{119}\) [http://arminstitute.org/membership/](http://arminstitute.org/membership/)  
\(^{120}\) [http://www.aimphotronics.com/tier-1-industry-members/](http://www.aimphotronics.com/tier-1-industry-members/)  
<table>
<thead>
<tr>
<th>Industry Connected RDI Center</th>
<th>Examples of Academic Partners/Members</th>
<th>Examples of Industry Partners/Members</th>
<th>Location</th>
<th>Examples of Research Fields</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center for Intelligent Maintenance Systems (I/UCRC)</td>
<td>Missouri University of Science and Technology University of Cincinnati University of Michigan University of Texas at Austin</td>
<td>Alstom Ford Huawei¹²²</td>
<td>Ann Arbor, Michigan Austin, Texas Cincinnati, Ohio Rolla, Missouri</td>
<td>• Watchdog Agent Prognostics • Device-to-Business Platform • Decision Support Tools</td>
<td><a href="http://www.imscenter.net/">www.imscenter.net/</a></td>
</tr>
<tr>
<td>Clean Energy Smart Manufacturing Innovation Institute (CESMII)</td>
<td>University of California, Berkeley University of Tennessee, Knoxville University of Texas at Austin</td>
<td>Arconic Calsoft Systems¹²³</td>
<td>Los Angeles, California</td>
<td>• Integrated advanced sensors • Digital process controls</td>
<td><a href="http://www.cesmii.org/">www.cesmii.org/</a></td>
</tr>
</tbody>
</table>

¹²² [http://www.imscenter.net/Companies](http://www.imscenter.net/Companies)
¹²³ [https://www.cesmii.org/current-members/](https://www.cesmii.org/current-members/)
¹²⁴ [https://clpam.engin.umich.edu/](https://clpam.engin.umich.edu/)

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
<table>
<thead>
<tr>
<th>Industry Connected RDI Center</th>
<th>Examples of Academic Partners/Members</th>
<th>Examples of Industry Partners/Members</th>
<th>Location</th>
<th>Examples of Research Fields</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIT Computer Science &amp; Artificial Intelligence Lab</td>
<td>Massachusetts Institute of Technology</td>
<td>Wistron World Wide Web Consortium(^\text{125})</td>
<td>Cambridge, Massachusetts</td>
<td>• Artificial Intelligence&lt;br&gt;• Machine Learning&lt;br&gt;• Robotics</td>
<td><a href="https://www.csail.mit.edu/">www.csail.mit.edu/</a></td>
</tr>
</tbody>
</table>

\(^{125}\) [https://www.csail.mit.edu/sponsors/strategic-partners](https://www.csail.mit.edu/sponsors/strategic-partners)

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
3 US market landscape

According to the North American Industry Classification System (NAICS), the Manufacturing sector includes establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products. The assembling of component parts of manufactured products is also considered part of the Manufacturing sector; except when the activity is classified within the construction sector126, 127.

Manufacturing plays a significant role in the US economy, accounting for $2,244 billion (€2,019 billion) of the US GDP128, which represents more than the agriculture, construction, information, and mining industries combined. According to the National Association of Manufactures (NAM), the US Manufacturing sector alone would represent the ninth largest economy in the world, without even considering its multiplier effect on other sectors129.

The US National Science and Technology Council (NSTC) considers that manufacturing plays a leading role in the US economy. In the US, the Manufacturing sector acts as an economic multiplier for other sectors, contributing to the country’s prosperity and security. Therefore, the advanced manufacturing sub-sectors130 are considered highly important drivers of technological innovation and business development131.

Considering the importance of the Manufacturing sector, the US Government has been highly committed to support the sector through several federal programs, such as the Manufacturing Extension Partnership, ARPA-E program and Manufacturing USA. In fact, the creation of more jobs related with the sector is one of the main priorities of the current Administration132.

Even though the US manufacturing market presents several opportunities for EU businesses, it is difficult to identify an initial approach to enter the US market due to the market’s size. Therefore, due to the size of the market and the complexity of the Manufacturing sector, this study identifies the US leading regions based on three manufacturing sub-sectors that represent a large portion of possible production technology customers: Machinery Manufacturing, Food Processing, and

---

126 https://siccode.com/en/naicscodes/31-33/manufacturing-industry
127 https://www.mbtmag.com/article/2018/01/technology-plays-role-manufacturing-skills-gap-also-offers-solution
128 https://bea.gov/iTable/iTable.cfm?reqid=51&step=51&isuri=1&5114=a&5102=1#reqid=51&step=51&isuri=1&5114=a&5102=1
130 Advanced manufacturing Advanced manufacturing is a family of activities that (a) depend on the use and coordination of information, automation, computation, software, sensing, and networking, and/or (b) make use of cutting edge materials and emerging capabilities enabled by the physical and biological sciences, for example nanotechnology, chemistry, and biology. It involves both new ways to manufacture existing products, and the manufacture of new products emerging from new advanced technologies. President’s Council of Advisors on Science and Technology. Report to the President on Ensuring American Leadership in Advanced Manufacturing. June 2011. https://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-advanced-manufacturing-june2011.pdf
132 https://tcf.org/content/report/strategy-rebuilding-manufacturing-sector-united-states/?agreed=1
Aerospace Product and Parts Manufacturing. An EU production technology company would target any one or more of these sub-sectors, or another more relevant sub-sector depending on their product or service portfolio.

3.1. Market overview

In the US, the Markit Manufacturing Purchasing Managers’ Index measures the performance of the Manufacturing sector based on a survey of 600 industrial companies. This Index is based on individual indexes with the following weights: New Orders (30%), Output (25%), Employment (20%), Suppliers’ Delivery Times (15%) and Stock of Items Purchased (10%), with the Delivery Times index inverted so that it moves in a comparable direction. Thus, according to this Index, the US manufacturing has been expanding and attracting more investors, which represents an opportunity for EU businesses. In 2017, the US manufactured goods exports accounted for $478,728 million (€430,852 million), while the imports totaled $885,787 million (€797,208 million). This represented a trade balance of negative $407,058 million (€366,352 million). The sub-sectors of Transportation Equipment Manufacturing, Food Manufacturing and Chemical Manufacturing were the ones with the largest value of shipments.

In the US, manufacturing generates more economic activity than any other sector. For every dollar of domestic manufacturing value-added, another $3.60 (€3.4) of economic activity is generated in other sectors; and for every manufacturing job, there are 3.4 jobs created in other sectors. Therefore, manufacturing is a key catalyst of economic growth and job creation, which helps raise the living standards in the US.

3.2. Leading regions

Considering the size of the US manufacturing market, there are states that can be considered leading regions from a market perspective. Therefore, the European businesses interested in the US market should map the US states and cities that have a higher concentration of opportunities in order to focus their market approach and effort. Consequently, the US leading regions in manufacturing were identified by analyzing the geographical concentration of targeted customers in certain sub-sectors of manufacturing that may be of interest to EU production technology businesses. As indicated

---

133 https://www.fxstreet.com/economic-calendar/event/38ec9435-34cc-4704-9445-80fabf6c0120
137 Industries in this sector create end products that apply mechanical force, for example, the application of gears and levers, to perform work. Some important processes for the manufacture of machinery are forging, stamping, bending,
earlier, the three manufacturing sub-sectors that represent a large portion of possible production technology customers are: Machinery Manufacturing, Food Processing, and Aerospace Product and Parts Manufacturing.

The geographical concentration of Machinery Manufacturing and Aerospace Product and Parts Manufacturing businesses was identified based on the North American Industrial Classification Codes (NAICS). The NAICS is used by businesses and governments to classify and measure economic activity in the US, Canada, and Mexico. Furthermore, NAICS is a 6-digit code system that is currently the standard used by federal statistical agencies in classifying establishments\textsuperscript{138}. NAICS organizes establishments into industries according to the similarity in the procedures used to produce goods or services, which facilitates the process of collecting, analyzing, and publishing statistical data related to the US economy\textsuperscript{139}. Taking into account the US manufacturing market, this study used two different NAICS: NAICS 333 (Machinery Manufacturing)\textsuperscript{140} and NAICS 3364 (Aerospace Product and Parts Manufacturing)\textsuperscript{141}.

In addition, the geographical concentration of Food Processing Businesses was identified based on the Standard Industrial Classification (SIC) codes. The SIC codes are four-digit numerical codes assigned by the US government to business establishments to identify the primary business of an establishment. Thus, the SIC codes facilitate the collection and analysis of information as well as promote the standardization, comparability and presentation of statistical data\textsuperscript{142}. This study used two different SIC codes to identify Food Processing Businesses: SIC 363408 (Food Processors Household)\textsuperscript{143} and 203801 (Frozen Food Processors)\textsuperscript{144}.

The regions with a higher concentration of Machinery Manufacturing, Food Processing and Aerospace Product and Parts Manufacturing businesses seem to represent important market opportunities for production technology companies in general. Among those regions, there are two states which particularly stand out: California and Texas.

forming, and machining that are used to shape individual pieces of metal. Processes such as welding and assembling are used to join separate parts together. Although these processes are similar to those used in metal fabricating establishments, machinery manufacturing is different because it typically employs multiple metal forming processes in manufacturing the various parts of the machine. Moreover, complex assembly operations are an inherent part of the production process.

\texttt{https://siccode.com/en/pages/what-is-a-naics-code}
\texttt{https://www.census.gov/eos/www/naics/}
\texttt{https://siccode.com/en/pages/what-is-a-sic-code}
\texttt{https://siccode.com/en/siccodes/2038/frozen-food-processorsmfrs}

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
Although there are other sectors that may also represent important opportunities for the EU businesses related production technologies, the scope of this report is based on demonstrating the various avenues that EU businesses can take to approach the US market. A similar approach could be taken for many related manufacturing sub-sectors.

**Machinery Manufacturing**

In 2017, the Machinery Manufacturing sector had an added value of $150.6 billion (€135.5 billion) to the US GDP. This sector includes around 30,000 establishments with combined annual revenue of about $370 billion (€333 billion)

Moreover, the US Machinery Manufacturing sector was forecasted to grow 5.9% per year from 2016 to 2030, as well as to contribute nearly 27% to the total US merchandise exports from 2016 to 2020.

As an initial step to understanding the Machinery Manufacturing market, this study identifies the US states and cities with the highest geographical concentration of Machinery Manufacturing verified businesses, as well as the states and cities with the highest concentration of Machinery Manufacturing verified businesses that spend on average over $50,000 (€45,000) in technology per year. There are 66,017 verified businesses related with Machinery Manufacturing of which 7,073 spend on average over $50,000 per year in technology. Figure 4 provides a US map that highlights the areas with higher concentrations of Machinery Manufacturing verified businesses.

---

146 [https://www.bls.gov/iag/tgs/iag333.htm](https://www.bls.gov/iag/tgs/iag333.htm)

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
Figure 4 – Location of the US areas with higher concentration of Machinery Manufacturers

Figure 5 indicates the US states and cities with the highest concentration of Machinery Manufacturing verified businesses. The US Machinery Manufacturing verified businesses are primarily located in the states of California and Texas. This indicates that these two states are important areas to find production technology market opportunities related with Machinery Manufacturing.

Even though California is the state with the highest concentration of Machinery Manufacturing businesses, it is important to highlight that none of the cities of this state are among the five cities with the highest concentration of Machinery Manufacturers. On the contrary, even though the cities of Phoenix and Indianapolis are ranked in the top five in terms of geographical concentration, the states of Arizona and Indiana are not among the US states with the highest concentration of Machinery Manufacturing businesses. This is primarily due to the size of the economies in these states. For example, California is currently the fifth largest economy in the world and, therefore, would be among the top states regarding concentration of Machinery Manufacturing businesses without having a single city identified in the top cities by concentration. Where Arizona’s economy is quite small in comparison and centers primarily on one city Phoenix.

Furthermore, it is important to highlight that the city of Houston (Texas) seems to play a leading role in terms of geographical concentration of Machinery Manufacturing businesses, which may represent a market opportunity for the EU production technology businesses targeting Machinery Manufacturing customers.

Top 8 states by concentration of Machinery Manufacturers

Top 5 cities by concentration of Machinery Manufacturers

Figure 5 - US states and cities with the highest concentration of Machinery Manufacturers

The technology expenditure of Machinery Manufacturing businesses is a key indicator to measure the predisposition of the market to invest in production technologies. Therefore, from a market perspective, the states and cities with the highest concentration of Machinery Manufacturing...
businesses that spend on average over $50,000 in technology per year represent important areas in terms of business opportunities.

Figure 6 indicates the US states and cities with the highest concentration of Machinery Manufacturing businesses that spend on average over $50,000 in technology per year. According to Figure 6, Texas is the state with the highest technology expenditure of Machinery Manufacturing businesses. Moreover, it is important to highlight that Houston (Texas) is also the city with the highest technology expenditures, which means the state of Texas represents an important market for EU production technology businesses targeting Machinery Manufacturing customers.

Moreover, even though the cities of Charlotte, Minneapolis and St. Louis are ranked in the top five in terms of technology expenditure, the states of North Carolina, Mississippi and Missouri are not among the US states with the highest concentration of Machinery Manufacturing businesses that spend on average over $50,000 in technology per year.

Figure 6 US states and cities with the highest concentration of Machinery Manufacturers which individually invest over $50,000 in technology annually

Food Processing

In 2016, the US Food Processing industry accounted for 21,000 companies and $750 billion (€675 billion) in revenue. Moreover, this industry is expected to grow at an annual rate of 1.0% until 2023, which reveals its level of maturity in the US.

---


Since Food Processing is a US industry that requires extensive use of innovative machines, this study provides an overview of the US states and cities that have a higher geographical concentration of Food Processors, as well as the states and cities that have Food Processors which individually invest an average of $10,000 (€9,000) or more in technology annually. In the US, there are 434 verified businesses related with Food Processing of which 225 invest an average of $10,000 or more in technology per year. These numbers are seemingly low, since the identified businesses are the headquarters of food processing companies. Therefore, the number does not include all processing facilities, which could be substantially higher. Figure 7 provides a US map highlighting the areas with higher concentrations of verified business related with Food Processing.

![Figure 7 - US areas with higher concentrations of Food Processors](image)

Figure 8 shows the US states and cities with the highest concentrations of Food Processing businesses. According to Figure 8, California is the state with the highest geographical concentration of Food Processing businesses, with the cities of Anaheim and Hayward listed among the top five cities in the country in terms of concentration of Food Processing businesses. Hence, the state of California represents an important market opportunity for EU production technology businesses that target food processing customers.

As presented in Figure 8, the cities of Salem (Oregon) and Minneapolis (Minnesota) are the two cities with the highest concentration of Food Processing businesses. In this context, it is also important to highlight that all the cities listed in Figure 8 are located in states that are among the identified top 8 US states by geographical concentration of Food Processing businesses.
The Food Processing industry is deeply grounded in technology. Big companies make extensive use of automation and cutting edge machines to do formerly labor-intensive processes like canning, baking, freezing, and packaging. Thus, the technology expenditure of Food Processing Businesses is an important indicator for EU businesses that develop processing production technologies. In this context, from a market perspective, the US states and cities with the highest concentration of Food Processing businesses that spend on average over $10,000 (€9,000) in technology per year represent important areas in terms of business opportunities.

According to Figure 9, California is the state with the highest concentration of Food Processing businesses that spend on average over $10,000 in technology per year. Moreover, the leading position of California is reinforced by the fact that Oxnard (California) being the city with the highest technology expenditure of Food Processing businesses. In this context, California can be considered a leading region for EU production technology businesses that target food processor customers.

Furthermore, it is also important to emphasize that the state of Washington is ranked second in terms of technology expenditure of Food Processors and the cities of Quincy and Pasco are also ranked among the top five cities by this criteria; therefore, Washington can also be considered an important region in terms of market opportunities.

---

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.

Aerospace Product and Parts Manufacturing:

The US Aerospace Products and Parts Manufacturing industry comprises about 1,400 companies with combined annual revenue of approximately $232 billion (€208 billion). Until 2022, the industry revenue is forecast to continue rising. Global and domestic demand for commercial aircraft is expected to continue generating revenue growth and demand for innovation.

Considering the importance of the industry to the US economy, this study identifies the US states and cities that have a higher geographical concentration of Aerospace Product and Parts Manufacturing verified businesses (NAICS 3364), as well as the states and cities that have Aerospace Product and Parts Manufacturing businesses which individually invest over $50,000 (€45,000) in technology annually. In the US, there are 3,044 verified business related with Aerospace Product and Parts Manufacturing. Figure 10 provides a US map highlighting the areas with higher concentrations of Aerospace Product and Parts Manufacturing verified businesses.

---

153 This industry group comprises establishments primarily engaged in manufacturing aircraft, missiles, space vehicles and their engines, propulsion units, auxiliary equipment, and parts thereof. The development and production of prototypes is classified in this industry, as is the factory overhaul and conversion of aircraft and propulsion systems.

Figure 10 US areas with the highest concentration of Aerospace Product and Parts Manufacturers

Figure 11 indicates the US states and cities with the highest concentration of Aerospace Product and Parts Manufacturing businesses. US Aerospace Product and Parts Manufacturing businesses are primarily concentrated in the states of California, Texas and Florida. This indicates that these three states are important areas to find market opportunities related with aerospace production technologies. All three states have a long history of an aerospace industry, which continues to this day.

The state of Texas, which is ranked second in terms of geographical concentration of Aerospace Product and Parts Manufacturing businesses, has two cities among the identified top five cities, which confirms its importance to production technology providers. Even though Wichita is the city with the highest concentration of Aerospace Product and Parts Manufacturing businesses, the state of Kansas is only ranked fifth in terms of geographical concentration of Aerospace Product and Parts Manufacturers. Furthermore, the city of Phoenix is the second city with the highest concentration of Aerospace Product and Parts Manufacturing businesses; however, the state of Arizona is not among the identified top eight states.
This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.

Technological innovation is crucial for the Aerospace Product and Parts Manufacturing sector. Consequently, the technology expenditure of the Aerospace Product and Parts Manufacturing businesses is a key indicator for production technology providers. From a market perspective, the states and cities with the highest concentration of Aerospace Product and Parts Manufacturing businesses which individually invest over $50,000 (€45,000) in technology annually represent important areas in terms of business opportunities.

Figure 11 indicates the US states and cities with the highest concentration of Aerospace Product and Parts Manufacturing businesses that spend on average over $50,000 in technology per year. In this context, California is also the state with the highest concentration of Aerospace Product and Parts Manufacturing businesses, which individually invest over $50,000 in technology annually. On the other hand, although the states of Alabama and Arizona are not among the top eight states, two of their cities are among the five cities with the highest technology expenditure of Aerospace Product and Parts Manufacturing businesses. Furthermore, it is interesting to highlight that when considering technology expenditure the top eight states remain the same.
3.3. Market considerations

3.3.1. Opportunities

Large and growing market

As previously stated, the US has been highly focused on promoting advances in Industry 4.0. In this context, over the last decade, the US has launched several initiatives to advance smart manufacturing, such as Manufacturing USA. Thus, and taking into account the budget allocated to Manufacturing Extension Partnership and Network for Manufacturing Innovation, the market for products related with production technologies is expected to continue growing in the next few years.

Increasing demand for manufactured good

In the US, the demand for manufactured goods can be considered a fundamental advantage. While consumer demand may have decreased due to the economic crises, access to the US market remains a key lure for domestic and foreign manufacturers. Therefore, the US demand for heavy machinery
and equipment has been increasing, which could be an important opportunity for EU businesses related with production technologies154.

3.3.2. Barriers

Depending on the production technology, there could be more barriers that are as significant, or more significant, than those identified below. The identified barriers are barriers the authors have encountered the most in their experience with production technology companies interested in the US market.

**Tariffs**

In the US, tariffs can be imposed by the federal government and individual states, which creates a complex tariff system. EU companies interested in exporting to the US may be subject to US direct or indirect taxes155. Moreover, the US tariffs imposed on specific imported goods may also vary depending on the good’s composition156. Therefore, EU production technology businesses that provide manufacturing systems composed of several pieces of equipment may have higher tariffs shipping the complete systems to the US instead of shipping in pieces and assembling in the US. Consequently, there may be added complexity to assembling a solution or system in the US, when the production technology company normally ships the complete solution within its domestic markets.

**Regulatory requirements**

The US regulatory regime is highly complex and diverse. According to the US Customs and Border Protection (CBP) any consumer product offered for importation will be refused admission if it fails to comply with an applicable product safety standard, regulation, specified labelling, or certification requirement157. For example, EU companies that manufacture medical devices and/or products that emit radiation must comply with applicable US regulations before, during, and after importing into the US. Thus, the imported devices and/or products that emit radiation must meet the US Food and Drug Association (FDA) regulatory requirements since the association does not recognize regulatory approvals from other countries158. Taking this into account, the EU technology companies that provide manufacturing solutions need to be compliant with the US regulatory requirements in order to be able to import them into the US.

155 [https://www.gov.uk/guidance/exporting-to-the-us#taxation-in-the-us](https://www.gov.uk/guidance/exporting-to-the-us#taxation-in-the-us)
157 [https://www.cbp.gov/sites/default/files/documents/Importing%20into%20the%20US.pdf](https://www.cbp.gov/sites/default/files/documents/Importing%20into%20the%20US.pdf)
158 [https://www.fda.gov/medicaldevices/deviceregulationandguidance/importingandexportingdevices/ucm050126.htm](https://www.fda.gov/medicaldevices/deviceregulationandguidance/importingandexportingdevices/ucm050126.htm)
Procedures related with importing machinery and electrical equipment

The CSI screening and related additional US customs routines are often considered a burden for Europeans that aim to export machinery and electrical equipment to the US. Therefore, these procedures can lead to significant additional costs and delays to shipments of EU machinery and electrical equipment to the US\textsuperscript{159}.

\textsuperscript{159} http://trade.ec.europa.eu/doclib/docs/2009/july/tradoc_144160.pdf
4 Recognized networks and events

Recognized networks and events play a key role in fostering interaction between academia and industry members, which is crucial to promote the advancement of production technologies. Innovation and market networks are collaborative forums that foster interaction between production technology stakeholders and promote exchange.

As previously mentioned, the development of innovative production technologies requires an interdisciplinary approach that should include academia and industry inputs. Thus, innovation networks and professional associations represent important platforms to identify cooperation opportunities with leading US academia and industry members in production technology fields.

In addition, the organization of conferences and events is one of the main activities of the innovation networks and professional associations focused on production technology fields. Thus, a review of the US conferences and events that are focused on production technologies was conducted to identify the most relevant research networks and professional associations in this area.

Through gaining knowledge of the relevant production technology networks, professional associations and future events that will occur in 2018/2019, one can identify the most effective approach to establishing relevant contacts in the US innovation/business community in order to pursue cooperation opportunities.

4.1. Innovation / market networks and associations

Innovation as a collaborative phenomenon has led to the development of the concept of innovation/market networks160. Innovation/market networks are collaborative platforms of individuals, small and large corporations, startups, academic and government institutions that aim to cooperate to create new ideas, products, services or business models161. Thus, innovation/market networks can foster important linkages between actors in order to promote the advancement of technologies162.

Moreover, the development of innovation processes has contributed to the increase of the role of innovation activities in SMEs and startups. However, the majority of the SMEs and startups do not own innovation capacities and face financial constraints. Thus, innovation/market networks can help


This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
SMEs and startups reach innovation targets, access to complementary resources, attract investment and advance technologies\textsuperscript{163,164}.

In turn, a professional association is a body of practitioners of a given profession, formed usually to control entry into the profession, maintain standards, and represent the profession in discussions with other relevant bodies\textsuperscript{165,166}. Professional associations are a crucial segment of the US Industry. In 2013, membership organizations alone employed over 1.3 million people in the US\textsuperscript{167}.

Table 3 provides a brief description of some of the main research networks and professional associations in production technology fields.

\textsuperscript{163} http://www.innosupport.net/index.php?id=2331
\textsuperscript{164} http://www.innosupport.net/index.php?id=2331
\textsuperscript{165} https://www.vocabulary.com/dictionary/professional%20association
\textsuperscript{166} http://www.dictionary.com/browse/professional-association
**Table 3 - Examples of key US production technology related networks and associations**

<table>
<thead>
<tr>
<th>Network</th>
<th>Main goal</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>International networks and associations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabricators &amp; Manufacturers Association, International (FMA)</td>
<td>The FMA is a professional organization that aims to bring together metal fabricators and equipment manufacturers through technology councils, educational programs and networking events. Currently, the FMA has around 2,500 individual and company members, which work together to advance metal processing, forming, and fabricating industry(^{168}). Moreover, FMA is the organizer of FABTECH, one of the leading manufacturing trade shows(^{168}).</td>
<td><a href="http://www.fmanet.org/">www.fmanet.org/</a></td>
</tr>
<tr>
<td>IEEE Robotics and Automation Society</td>
<td>The IEEE Robotics and Automation Society aims to promote the development and facilitate the exchange of scientific and technological knowledge in Robotics and Automation. Thus, the Society provides support to its members by promoting close cooperation and exchange of technical information and sponsoring periodicals and special technical resources(^{170}). Currently, the Society has around 13,000 members around the world(^{171}).</td>
<td><a href="http://www.ieee-ras.org/">www.ieee-ras.org/</a></td>
</tr>
<tr>
<td>SEMI</td>
<td>SEMI is a global industry association, with headquarters in the US, focused on serving the manufacturing supply chain for the electronics industry, including semiconductors, sensors, or micro- and nano-electronics(^{172}). SEMI membership includes several benefits, such as access to SEMI</td>
<td><a href="http://www.semi.org/en/">www.semi.org/en/</a></td>
</tr>
</tbody>
</table>

\(^{168}\) [https://www.fmanet.org/membership](https://www.fmanet.org/membership)

\(^{169}\) [https://www.fmanet.org/about-fma](https://www.fmanet.org/about-fma)

\(^{170}\) [http://www.ieee-ras.org/about-ras](http://www.ieee-ras.org/about-ras)

\(^{171}\) [http://www.ieee-ras.org/membership/member-statistics](http://www.ieee-ras.org/membership/member-statistics)


---

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
### Federal networks and associations

<table>
<thead>
<tr>
<th>Network</th>
<th>Main goal</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alliance for American Manufacturing (AAM)</td>
<td>The AAM is a non-profit partnership that intends to strengthen the US manufacturing industry and create a new private-sector through effective public policies. The AAM achieves its goal through research, public education, advocacy, strategic communications, and coalition building around key issues for US manufacturers. The AAM also promotes manufacturing innovation through specialized campaigns.</td>
<td><a href="http://www.americanmanufacturing.org/">www.americanmanufacturing.org/</a></td>
</tr>
<tr>
<td>Association For Manufacturing Technology (AMT)</td>
<td>The AMT is a professional association that promotes US-based manufacturing technology through business intelligence systems and analysis. Thus, AMT aims to promote the importance of policies and programs that promote manufacturing technology R&amp;D. AMT’s membership consists of regular members, research and educational affiliates, and commercial affiliates. AMT organizes the International Manufacturing Technology Show (IMTS), which is a premier manufacturing technology event in North America.</td>
<td><a href="http://www.amtonline.org/">www.amtonline.org/</a></td>
</tr>
</tbody>
</table>

---


174 [http://www.semi.org/en/Membership/MemberDirectoryAdvanced?field_company_name_value=&field_directory_description_value=&field_country_revised_value=United+States&field_primary_industry_revised_value=All&field_primary_product_category_value=Device+Manufacturing](http://www.semi.org/en/Membership/MemberDirectoryAdvanced?field_company_name_value=&field_directory_description_value=&field_country_revised_value=United+States&field_primary_industry_revised_value=All&field_primary_product_category_value=Device+Manufacturing)


176 [http://www.amtonline.org/AboutAMT/](http://www.amtonline.org/AboutAMT/)

177 [http://www.amtonline.org/section_display.cfm?section_id=1](http://www.amtonline.org/section_display.cfm?section_id=1)

178 [http://www.amtonline.org/AboutAMT/](http://www.amtonline.org/AboutAMT/)

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
<table>
<thead>
<tr>
<th>Network</th>
<th>Main goal</th>
<th>Internet link</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Internet Consortium</td>
<td>The Industrial Internet Consortium is an organization that aims to promote the acceleration of the Industrial IoT. The Industrial Internet Consortium’s membership provides members with the opportunity to have an active role in defining standards, best practices and processes of Industrial IoT. Furthermore, the organization comprises working groups that coordinate and define priorities in order to accelerate market adoption of new production technologies.</td>
<td><a href="http://www.iiconsortium.org/index.htm">www.iiconsortium.org/index.htm</a></td>
<td></td>
</tr>
<tr>
<td>National Network for Manufacturing Innovation (NNMI)</td>
<td>The NNMI is a US initiative focused on supporting advanced manufacturing. NNMI is composed of public-private partnerships focused on manufacturing. NNNI’s main goal is to bring together innovative manufacturers, university engineering schools, community colleges, federal agencies, non-profits, and regional and state organizations to invest in manufacturing technologies.</td>
<td><a href="http://www.manufacturing.gov/">www.manufacturing.gov/</a></td>
<td></td>
</tr>
<tr>
<td>National Association of Manufacturers (NAM)</td>
<td>The NAM is a professional association that represents small and large manufacturers across the US. The NAM aims to offer solutions to build a talent pipeline for the industry and to improve manufacturers’ competitiveness. In order to achieve its goal, the NAM provides its members access and information on key manufacturing issues, such as trade policy and taxes. Moreover, the NAM aims to advance manufacturing leadership though its Manufacturing Executive Leadership Program.</td>
<td><a href="http://www.nam.org/">www.nam.org/</a></td>
<td></td>
</tr>
</tbody>
</table>

**State networks and associations**

---

179 https://www.iiconsortium.org/become-member.htm
180 https://www.iiconsortium.org/working-committees.htm
181 https://www.manufacturing.gov/
182 http://www.nam.org/Membership/Why-Join-the-NAM/
183 http://www.nam.org/Events/Manufacturing-Executive-Leadership-Program/

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
<table>
<thead>
<tr>
<th>Network</th>
<th>Main goal</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Manufacturers &amp; Technology Association (CMTA)</td>
<td>The CMTA is a state organization that aims to create a better business climate for California’s manufacturing, processing and technology based companies. The CMTA works with the state government in order to develop balanced laws, effective regulations and public policies that promote economic growth and create new manufacturing jobs in California. ¹⁸⁴</td>
<td><a href="http://www.cmta.net/">www.cmta.net/</a></td>
</tr>
<tr>
<td>Pittsburgh Robotics Network</td>
<td>The Pittsburgh Robotics Network is focused on promoting the growth of Pittsburgh's robotics companies and research institutions. Thus, the network aims to support its members in attracting investment and new specialized talents, as well as developing an innovation supply chain ¹⁸⁵. The Pittsburgh Robotics Network membership includes members from several industries, such as vehicles manufacturing ¹⁸⁶.</td>
<td><a href="http://robopgh.com/">http://robopgh.com/</a></td>
</tr>
</tbody>
</table>

### 4.2. Innovation and market events

Innovation and market events are crucial to enhance the connection between academia and industry members. They provide a great opportunity for academia and industry representatives from production technology fields to meet in person, which may promote knowledge and experience exchange, as well as the establishment of partnerships.

Due to the importance of production technology, there are several conferences and other networking events focused on these fields in the US. The events identified show an emphasis on AI and IoT. Furthermore, the geographic distribution of the US innovation and market events related to production technology is diverse and covers a wide range of regions.

---

¹⁸⁴ [https://www.linkedin.com/company/california-manufacturers-technology-association-cmta/](https://www.linkedin.com/company/california-manufacturers-technology-association-cmta/)
¹⁸⁶ [http://robopgh.com/companies/](http://robopgh.com/companies/)

---

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
technology fields reveal a high degree of spatial concentration in two states: California and Illinois. The identified conferences and other networking events are also highly concentrated in the months of April, May, June, September and October. However, the dates and location of some of the identified events still need to be determined.

The advancement of production technologies is a key priority for the US; therefore, the number of events focused on production technology fields has been increasing and is expected to continue increasing in the short-term. Table 4 lists some of the main events focused on production technology. These were identified in this study by desk research, which included an extensive literature review and a review of the conferences sponsored by recognized networks in the fields.

Table 4 – Production technology related innovation and market events

<table>
<thead>
<tr>
<th>Date</th>
<th>Conference/ Event title</th>
<th>Interval</th>
<th>Location</th>
<th>Areas</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 – 13 September 2018</td>
<td>AI Manufacturing 2018</td>
<td>Annual</td>
<td>Oak Brook, Illinois</td>
<td>AI and Big Data</td>
<td><a href="http://aimanufacturingconference.com/">http://aimanufacturingconference.com/</a></td>
</tr>
</tbody>
</table>

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.

<table>
<thead>
<tr>
<th>Date</th>
<th>Conference/Event title</th>
<th>Interval</th>
<th>Location</th>
<th>Areas</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 October – 1 November 2018</td>
<td>AME International Conference</td>
<td>Annual</td>
<td>San Diego, California</td>
<td>Ai, IoT and Virtual Reality</td>
<td><a href="http://www.ame.org/ame-conferences">www.ame.org/ame-conferences</a></td>
</tr>
<tr>
<td>06 – 08 March, 2019</td>
<td>Industry of Things World USA</td>
<td>Annual</td>
<td>San Diego, California</td>
<td>Industrial IoT</td>
<td><a href="https://industryofthingsworldusa.com/">https://industryofthingsworldusa.com/</a></td>
</tr>
<tr>
<td>16 – 18 April, 2019</td>
<td>Manufacturing &amp; Technology Conference and Expo 2019</td>
<td>Annual</td>
<td>Pittsburgh, Pennsylvania</td>
<td>To be determined</td>
<td><a href="http://www.mfgtechshow.com/mts18/Public/Enter.aspx">www.mfgtechshow.com/mts18/Public/Enter.aspx</a></td>
</tr>
<tr>
<td>17 – 18 April, 2019</td>
<td>Industrial IoT USA</td>
<td>Annual</td>
<td>Chicago, Illinois</td>
<td>Industrial IoT</td>
<td><a href="http://www.industrialiotseries.com/usa/">www.industrialiotseries.com/usa/</a></td>
</tr>
<tr>
<td>10 – 12 June, 2019</td>
<td>15th Annual Manufacturing</td>
<td>Annual</td>
<td>Huntington Beach</td>
<td>To be determined</td>
<td><a href="http://www.manufacturingleadershipcouncil.com/summit/">www.manufacturingleadershipcouncil.com/summit/</a></td>
</tr>
</tbody>
</table>
This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.

<table>
<thead>
<tr>
<th>Date</th>
<th>Conference/Event title</th>
<th>Interval</th>
<th>Location</th>
<th>Areas</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date to be determined</td>
<td>Leadership Summit</td>
<td></td>
<td>California</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date to be determined</td>
<td>Smart Manufacturing Experience</td>
<td>Annual</td>
<td>Northeastern US (to be determined)</td>
<td>Additive Manufacturing/3D Printing, Automation &amp; Robotics, Industrial IoT/Big Data</td>
<td><a href="http://smartmanufacturingexperience.com/">http://smartmanufacturingexperience.com/</a></td>
</tr>
</tbody>
</table>
5 US innovation initiatives and programs

The US government funding system is highly decentralized and comprises several actors, such as agencies of federal and state governments, universities, the private sector and non-profit organizations. The US government has identified the importance of supporting production technology R&D activities in order to advance its manufacturing industry. In this context, funding production technology related initiatives and programs is currently a priority for both federal and state agencies, which are focused on supporting the development of new technologies.

A review of the US funding initiatives and programs at both federal and state levels was conducted to identify some examples of relevant innovation initiatives and programs in production technology fields. It is relevant to highlight that there are additional public and private initiatives and programs, which are not described within this study. The following subsections provide descriptions of the initiatives and programs focused on production technology related fields. Annex 1 provides a summary table of the initiatives and programs detailed in this chapter.

5.1. Federal initiatives/programs

In the US, production technology R&D activities are supported by a set of public initiatives and programs. At the federal level, the US Department of Commerce (DoC), the DoD and the NSF are the entities primarily responsible for initiatives and programs that promote innovation in production technology related fields. Furthermore, the DoC, DoD, Department of Energy (DoE), National Aeronautics and Space Administration (NASA), NSF, and the Department of Agriculture (USDA) also promote production technology R&D activities through Manufacturing USA.

---

187 [http://www.euussciencetechnology.eu/assets/content/documents/InnovationSystemInnovationPolicyUS.pdf](http://www.euussciencetechnology.eu/assets/content/documents/InnovationSystemInnovationPolicyUS.pdf)
A review of the US Federal Government innovation initiatives and programs was conducted to identify some of the most relevant ones in production technology fields. Although, this study only provides federal initiatives and programs established by its main sponsors, it is important to highlight there are several initiatives and programs in production technology fields promoted by other US departments and entities.

5.1.1. Manufacturing USA

Manufacturing USA is a network of 14 established manufacturing innovation institutes that aim to promote manufacturing through innovation, education and public-private collaborations. Thus, through Manufacturing USA industry, academia, and government partners are taking advantage of existing resources, collaborating, and co-investing to foster manufacturing innovation and accelerate commercialization. Manufacturing USA’s main goal is to establish an innovation community that promotes next-generation manufacturing.

In order to achieve its goal, Manufacturing USA promotes several funding and project opportunities related with different technologies, such as AI, Automation, Electronics, Modeling and Simulation, and Sensors. The funding and project opportunities promoted by Manufacturing USA are directly

---

188 https://www.manufacturingusa.com/pages/how-we-work
189 https://www.manufacturingusa.com/institutes

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.

---

**First Approach**

<table>
<thead>
<tr>
<th>Information about Funding Opportunities</th>
<th>European researchers interested in the Manufacturing USA funding opportunities could contact the representative identified in specific Project Calls.</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Collaboration</td>
<td>European researchers interested in Manufacturing USA funding opportunities need to become a member of the network. Each Project Call details all eligibility requirements and definitions.</td>
</tr>
<tr>
<td>Internet link</td>
<td><a href="https://www.manufacturingusa.com/opportunities">www.manufacturingusa.com/opportunities</a></td>
</tr>
</tbody>
</table>

### 5.1.2. Department of Commerce (DoC)

The DoC is highly focused on continuing to promote manufacturing through innovative new techniques, a next-generation workforce and a driven economy. Through Manufacturing USA and the National Institute of Standard and Technology (NIST), the DoC is able to foster innovation and funding opportunities to promote the advancement of production technologies.

**National Institute of Standard and Technology (NIST) Office of Advanced Manufacturing (OAM)**

The NIST OAM aims to manage NIST’s outreach in the area of advanced manufacturing. The OAM also serves as the headquarters for the interagency Advanced Manufacturing National Program Office (AMNPO). Furthermore, the OAM works in close partnership with advanced manufacturing offices in the DoD, DoE, NASA, NSF, and USDA.

The OAM provides cost-shared funding opportunities to promote innovative technology that allows increasing energy efficiency in the Manufacturing sector. The OAM funding opportunities are awarded through an open and highly competitive process. The solicitations may include collaborative partnerships among manufacturers, universities, suppliers, national labs, and other relevant stakeholders.

---

190 [https://www.manufacturingusa.com/opportunities](https://www.manufacturingusa.com/opportunities)
191 [https://www.manufacturingusa.com/](https://www.manufacturingusa.com/)
192 [https://www.commerce.gov/tags/manufacturing](https://www.commerce.gov/tags/manufacturing)
194 [https://www.nist.gov/oam/funding-opportunities](https://www.nist.gov/oam/funding-opportunities)
## First Approach

<table>
<thead>
<tr>
<th>Information about Funding Opportunities</th>
<th>European researchers interested in the OAM funding opportunities could contact the representative identified in the Funding Opportunities Announcements (FOAs).</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Collaboration</td>
<td>The eligibility criteria for OAM’s funding opportunities can be found in the FOAs listed on <a href="https://www.grants.gov">Grants.gov</a>. Each opportunity details all eligibility requirements and definitions.</td>
</tr>
<tr>
<td>Internet link</td>
<td><a href="https://www.nist.gov/oam/funding-opportunities">www.nist.gov/oam/funding-opportunities</a></td>
</tr>
</tbody>
</table>

### 5.1.3. Department of Defense (DoD)

The DoD needs a mechanism for shaping and developing its manufacturing industrial base in order to support the national security needs. In this context, the department has launched several Manufacturing Technology Programs (ManTech programs) to advance manufacturing processes, bridge the gap from research and promote advances to full-scale production.

**DoD ManTech Program:** The ManTech Program is the DoD investment mechanism for promoting its manufacturing capability. The program supports the development of technologies and processes for the advancement of defense systems where there are more affordable, timely productive and sustainable. The program aims to reduce acquisition and total ownership costs by developing, maturing, and transitioning crucial production technologies. Thus, the program provides a highly important link between technology and industrial applications to support the development of low-risk systems.

<table>
<thead>
<tr>
<th>Information about Funding Opportunities</th>
<th>European researchers interested in the DoD ManTech Program could contact the point of contact identified in the Service and Agency ManTech Programs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Collaboration</td>
<td>The DoD foreign eligibility criteria depend on the level of sensitivity of the researchers and the specific policy of each agency. The authorizing legislation and agency policies will determine whether a foreign individual or organization may apply for a specific grant.</td>
</tr>
</tbody>
</table>

195 [https://www.manufacturing.gov/partners](https://www.manufacturing.gov/partners)
196 [https://www.dodmantech.com/About/History](https://www.dodmantech.com/About/History)
197 [https://www.dodmantech.com/About/](https://www.dodmantech.com/About/)
198 [https://www.dodmantech.com/ManTechPrograms/](https://www.dodmantech.com/ManTechPrograms/)
This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.

5.1.4. National Science Foundation (NSF)

The NSF provides support through grants and cooperative agreements to universities, businesses, informal science organizations and other research organizations focused on areas that are most likely to result in spectacular technological progress. The NSF supports cooperative research between universities and industry, as well as the US researchers’ participation in international scientific and engineering research activities. Collaboration between US researchers and European researchers can be funded in almost all new proposals to NSF or in supplements to existing NSF awards. Thus, European researchers interested in collaborating with US researchers could ask their US counterparts to contact the NSF disciplinary program officer or use the Office of International Science and Engineering (OISE) Regional and Country Contacts to inquire about funding possibilities.

<table>
<thead>
<tr>
<th>First Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>European Union OISERegional Contact</strong></td>
</tr>
<tr>
<td><strong>International Collaboration</strong></td>
</tr>
<tr>
<td><strong>Internet links</strong></td>
</tr>
</tbody>
</table>

**Advanced Manufacturing (AM) program:** The AM program aims to support fundamental research that accelerates manufacturing technologies with an emphasis on multidisciplinary research that transforms manufacturing capabilities, methods and practices. The program’s main areas of interest include manufacturing systems, materials processing, manufacturing machines, methodologies, and manufacturing across the length scales. In this context, the program provides grants to researchers.

---

200 [https://www.nsf.gov/about/how.jsp](https://www.nsf.gov/about/how.jsp)
201 [https://www.nsf.gov/od/oise/europe/](https://www.nsf.gov/od/oise/europe/)
202 [https://www.nsf.gov/od/oise/about.jsp](https://www.nsf.gov/od/oise/about.jsp)
working in the areas of cyber manufacturing systems, manufacturing machines and equipment, materials engineering and processing, and nano manufacturing\(^{203}\).

<table>
<thead>
<tr>
<th>First Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contact</strong></td>
</tr>
<tr>
<td><strong>Email</strong></td>
</tr>
<tr>
<td><strong>Phone Number</strong></td>
</tr>
<tr>
<td><strong>International Collaboration</strong></td>
</tr>
<tr>
<td><strong>Internet link</strong></td>
</tr>
</tbody>
</table>

**Big Data program:** The Big Data program aims to promote new approaches in computer science, statistics, computational science, engineering, physical sciences and mathematics that allow further development of the interdisciplinary field of data science. The program aims to support proposals that are motivated by specific big data problems in one or more science and engineering research domains. Thus, the proposals submitted to this program need to provide examples of the impacts of the big data techniques, technologies and methodologies on applications in one or more domains. The program includes two different solicitation categories, the Foundations (BIGDATA: F) and the Innovative Applications (BIGDATA: IA)\(^ {205}\).

Moreover, the Big Data program also includes the cloud option, which is developed in partnership with Amazon Web Services, Google Cloud, IBM, and Microsoft Azure\(^ {206}\).

<table>
<thead>
<tr>
<th>First Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contact</strong></td>
</tr>
<tr>
<td><strong>Email</strong></td>
</tr>
</tbody>
</table>

\(^{203}\) https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505572
\(^{204}\) https://www.nsf.gov/staff/staff_bio.jsp?lan=khcooper&org=NSF&from_org=NSF
\(^{205}\) https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504767
\(^{206}\) https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504767
\(^{207}\) https://www.nsf.gov/staff/staff_bio.jsp?lan=sspengle&org=NSF

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
Cyber-Physical Systems (CPS) program: The CPS program promotes the development of new and innovative ideas that will have high impact on the field of CPS. In this context, the program aims to develop the core research needed to engineer complex CPS, some of which may also require dependable, high-confidence, or provable behaviors. Thus, the core research areas of the program include control, data analytics, autonomy, design, information management, IoT, mixed initiatives including human-in- or on-the-loop, networking, privacy, real-time systems, safety, security, and verification.208

The proposals for the CPS program may be submitted by universities, research labs, and non-profit and non-academic organizations. In 2018, the program includes three different research projects, namely small projects, medium projects, and frontier projects. Thus, the EU researchers should take into consideration the differences between the scope and goals of the existing programs.209

### First Approach

<table>
<thead>
<tr>
<th>Contact</th>
<th>European researchers and SMEs interested in the CPS Program could contact the Program Director David Corman.210</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td><a href="mailto:dcorman@nsf.gov">dcorman@nsf.gov</a></td>
</tr>
<tr>
<td>Phone Number</td>
<td>(703) 292-8754</td>
</tr>
<tr>
<td>International Collaboration</td>
<td>The eligibility criteria of the CPS Program can be found in the NSF’s Proposal &amp; Award Policies and Procedures Guide: <a href="http://www.nsf.gov/pubs/policydocs/pappg18_1/nsf18_1.pdf">www.nsf.gov/pubs/policydocs/pappg18_1/nsf18_1.pdf</a></td>
</tr>
<tr>
<td>Internet link</td>
<td><a href="http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503286">www.nsf.gov/funding/pgm_summ.jsp?pims_id=503286</a></td>
</tr>
</tbody>
</table>

---


This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
National Robotics Initiative 2.0: Ubiquitous Collaborative Robots (NRI-2.0): The NRI-2.0 aims to support fundamental research to accelerate the development of collaborative robots (co-robots). The program is highly focused on ubiquity, which means seamless integration of co-robots to assist humans in every aspect of life. In this context, the program supports four main research topics, namely scalability, customizability, lowering barriers to entry, and societal impact. Thus, the NRI-2.0 fosters collaboration between academic, industry, non-profit, and other organizations in order to establish better linkages between fundamental science and engineering and technology development, deployment, and use.

Furthermore, the NRI-2.0 is supported by different US Agencies, such as NSF, USDA, DoE, and DoD.

<table>
<thead>
<tr>
<th>First Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
</tr>
<tr>
<td>Email</td>
</tr>
<tr>
<td>Phone Number</td>
</tr>
<tr>
<td>Internet link</td>
</tr>
</tbody>
</table>

Robust Intelligence (RI): The RI program includes all aspects of the computational understanding and modeling of intelligence in complex and realistic contexts. This program incorporates the research of AI, computer vision, human language research, robotics, machine learning, computational neuroscience and other related areas<sup>212</sup>.

The program researchers are encouraged to submit proposals that lead to advances in RI. Moreover, proposals transcending RI disciplinary boundaries and fueling their intellectual co-evolution are also highly encouraged. These approaches might include methods from multiple computational disciplines that may lead to cutting-edge advances in RI<sup>213</sup>. The proposals for the RI program can be submitted by universities, research labs, and non-profit and non-academic organizations<sup>214</sup>.

---


<sup>212</sup> [https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503305](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503305)


This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
First Approach

<table>
<thead>
<tr>
<th>Contact</th>
<th>European researchers and SMEs interested in the RI Program could contact the contact person, James Donlon(^\text{215}).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td><a href="mailto:jdonlon@nsf.gov">jdonlon@nsf.gov</a></td>
</tr>
<tr>
<td>Phone Number</td>
<td>(703) 292-8074</td>
</tr>
<tr>
<td>International Collaboration</td>
<td>The eligibility criteria of the S&amp;AS Program can be found in the program guidelines: <a href="http://www.nsf.gov/cise/iis/ri_pgm12.jsp">www.nsf.gov/cise/iis/ri_pgm12.jsp</a></td>
</tr>
<tr>
<td>Internet link</td>
<td><a href="http://www.nsf.gov/staff/sub_div.jsp?org=IIS&amp;orgId=3947&amp;from_org=IIS">www.nsf.gov/staff/sub_div.jsp?org=IIS&amp;orgId=3947&amp;from_org=IIS</a></td>
</tr>
</tbody>
</table>

**Smart and Autonomous Systems (S&AS) program:** The S&AS program supports research on Intelligent Physical Systems (IPS), including robotic platforms and networked systems that combine computing, sensing, communication and actuation. The program is focused, but not limited to, robotic platforms, self-driving vehicles, underwater exploration vehicles, and smart grids. The proposals for this program may be submitted by universities, research labs, and non-profit and non-academic organizations.\(^\text{216}\)

<table>
<thead>
<tr>
<th>Contact</th>
<th>European researchers and SMEs interested in the S&amp;AS Program could contact the Program Director Reid G. Simmons(^\text{217}).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td><a href="mailto:resimmon@nsf.gov">resimmon@nsf.gov</a></td>
</tr>
<tr>
<td>Phone Number</td>
<td>(703) 292-4767</td>
</tr>
<tr>
<td>Internet link</td>
<td><a href="http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505325">www.nsf.gov/funding/pgm_summ.jsp?pims_id=505325</a></td>
</tr>
</tbody>
</table>

---

\(^{216}\) https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505325  
\(^{217}\) https://nsf.gov/staff/staff_bio.jsp?ian=resimmon&org=OPP&from_org=OPP

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
5.2. State initiatives/programs

State initiatives are one of the major ways states can support public projects in key research areas, such as production technology. Therefore, some US states are highly focused on promoting the advancement of production technologies through smart manufacturing initiatives.

In this context, some US states are particularly focused in being at the forefront of Industry 4.0. These states, which include the states of Pennsylvania and Illinois, recognize the potential economic impact of the advancement of production technology fields. Therefore, a sample of state initiatives that exist at the state level are provided below.

5.2.1. Pennsylvania Manufacturing Initiative

The Pennsylvania Manufacturing Initiative aims to support the growth and competitiveness of the state’s manufacturing companies through three programs, the Pennsylvania Manufacturing Training-to-Career Grant Program, the Industrial Resource Centers program, and the Pennsylvania Manufacturing Innovation Program (PMIP). These programs aim to bring together universities, technical schools and non-profit organizations and provide them with training and workforce development opportunities supporting the advance of the manufacturing industry in Pennsylvania.

<table>
<thead>
<tr>
<th>First Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contact</strong></td>
</tr>
<tr>
<td><strong>Email</strong></td>
</tr>
<tr>
<td><strong>Phone Number</strong></td>
</tr>
<tr>
<td><strong>International Collaboration</strong></td>
</tr>
<tr>
<td><strong>Internet link</strong></td>
</tr>
</tbody>
</table>

---

5.2.3. Smarter Illinois Initiative

The Smarter Illinois Initiative launched by the State of Illinois Department of Innovation & Technology (DoIT) aims to promote the development of the 3rd Platform focused on ICT. This platform will include mobile technologies, big data/analytics and cloud services as the foundation for a set of innovation accelerators, such as IoT, cognitive computing, augmented reality, robotics and next-generation security, that will allow the development of new work processes, services and products for several industries223.

In order to achieve this goal, Illinois’ DoIT has identified several resources such as grants, challenges and other initiatives that can support the development of smart projects224.

<table>
<thead>
<tr>
<th>First Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contact Person</strong></td>
</tr>
<tr>
<td><strong>Email</strong></td>
</tr>
<tr>
<td><strong>Phone Number</strong></td>
</tr>
<tr>
<td><strong>International Collaboration</strong></td>
</tr>
<tr>
<td><strong>Internet link</strong></td>
</tr>
</tbody>
</table>

---


This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.
6 Observations

From the assessment of the US production technology innovation and market ecosystem, it can be concluded that the country is one of the global leaders in the fields related with these technologies. As explained, production technology can be described as the process of applying innovative technologies to develop new manufacturing products and processes. Through a review of production technology related fields it was decided to focus this study on five specific thematic areas that have R&D activities greatly impacting production technologies, namely AI, Big Data, CPS, IoT and Robotics.

With the five selected thematic areas in mind, there is a particular concentration of innovation hubs/facilitators and industry related R&D centers in the states of California, Illinois, New York, Ohio, and Texas. It is no surprise California and New York are emphasized, since they are quite large from a population and economy perspective. Considering the multi-disciplinary aspects of the production technology fields, it is crucial to promote the development of joint activities between SMEs, large industries, startups, researchers, accelerators, and investors to advance new technologies.

Due to the large number of fields related with production technology, the analysis on the US market is not obvious. Thus, there is a need to analyze the specific segments within the manufacturing sector that are most likely to use production technologies. In this context, this study focused on the assessment of the geographical concentration of Machinery Manufacturing, Food Processing, and Aerospace Product and Parts Manufacturing businesses in the US. After analyzing the geographic concentration of these businesses, it was possible to conclude that these businesses are especially concentrated in the states of California, New York, Pennsylvania, Texas and Washington, which would represent important market opportunities for EU production technology businesses.

Recognized networks and events play a key role in fostering interaction between academia and industry members, which is crucial to promote the advancement of production technologies. Therefore, it is highly recommend that EU researchers and industry representatives contact key US networks and attend events in the US focused on production technology fields. Thus, this study provides a short summary of some potential relevant networks and events that could be of support for EU researchers and industry representatives.

Regarding the US innovation initiatives and programs, production technology has been highly supported by federal and states initiatives and programs. At the US federal level, production technology R&D activities are mainly supported by the DoC, the DoD and especially the NSF. Moreover, the DoC, DoD, DoE, NASA, NSF, and USDA also promote production technology R&D activities through Manufacturing USA. At the state level, several states have recognized the need to launch initiatives, challenges or grants that promote the advancement of production technologies. Although there are several programs and initiatives related with production technology at both federal and state levels, it is important to note that information related to funds and grants for European representatives is difficult to find. In most cases, the European innovators and business
representatives interested in US initiatives and programs need to contact the program officers to know specific details about international eligibility.

Overall, the assessment carried out demonstrates there are several and relevant EU-US innovation and business cooperation opportunities in production technology fields. Both regions consider the advancement of production technologies as a priority and are highly committed to promoting innovation and investing in this area with the aim of advancing Industry 4.0.
Annex 1: Summary of the US Federal and State Funding Initiatives and Programs

The table below summarizes the US Federal and State funding initiatives in the production technology related fields and provides relevant information on how EU researchers and SMEs could first approach the funding initiatives.

Table 5 - Summary of the US Federal and State Funding Initiatives and Programs

<table>
<thead>
<tr>
<th>Agencies</th>
<th>Programs/ Initiatives</th>
<th>Relevant Research Areas</th>
<th>Contact Info</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Initiatives and Programs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Department of Commerce (DoC), Department of Defense (DoD), Department of Energy (DoE), National Aeronautics and Space Administration (NASA), National Science Foundation (NSF) and the Department of Agriculture (USDA) | Manufacturing USA | AI, Automation, Electronics, Modeling and Simulation, and Sensors | Contact the representative identified in Project Call | www.manufacturingusa.com/opportunities | www.manufacturingusa.com/
<table>
<thead>
<tr>
<th>Agencies</th>
<th>Programs/ Initiatives</th>
<th>Relevant Research Areas</th>
<th>Contact Info</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Commerce (DoC)</td>
<td>National Institute of Standard and Technology (NIST) Office of Advanced Manufacturing (OAM)</td>
<td>No specific thematic area</td>
<td>Contact the representative identified in FOAs  <a href="http://www.nist.gov/oam/funding-opportunities">www.nist.gov/oam/funding-opportunities</a></td>
<td><a href="http://www.nist.gov/oam">www.nist.gov/oam</a></td>
</tr>
<tr>
<td>Department of Defense (DoD)</td>
<td>DoD ManTech Program</td>
<td>No specific thematic area</td>
<td>Contact the point of contact identified in the Service and Agency ManTech Programs. Email: <a href="mailto:Help@DoDManTech.com">Help@DoDManTech.com</a></td>
<td><a href="http://www.dodmantech.com/About/">www.dodmantech.com/About/</a></td>
</tr>
</tbody>
</table>
|                               | AM program                               | Cybermanufacturing systems, Manufacturing machines and equipment, Materials engineering and processing, and Nanomanufacturing | Contact the Program Director, Khershed Cooper  
Email: khcooper@nsf.gov  
Phone Number: (703) 292-7017  
| National Science Foundation (NSF) | Big Data program                          | Big Data                                                                                | Contact the Program Director, Sylvia Spengler  
Email: sspengle@nsf.gov  
Phone Number: (703) 292-8930  
<table>
<thead>
<tr>
<th>Agencies</th>
<th>Programs/ Initiatives</th>
<th>Relevant Research Areas</th>
<th>Contact Info</th>
<th>Internet link</th>
</tr>
</thead>
</table>
| CPS program | Control, Data analytics, autonomy, Design, Information management, IoT, Mixed initiatives including human-in- or on-the-loop, Networking, privacy, Real-time systems, Safety, Security, and Verification | Contact the Program Director, David Corman  
Email: dcmoran@nsf.gov  
Phone Number: (703) 292-8754 | www.nsf.gov/funding/pgm_summ.jsp?pims_id=503286 |
| NRI-2.0 | Robotics | Contact the Program Director, Radhakishan Baheti  
Email: rbaheti@nsf.gov  
Phone Number: (703) 292-8339 | www.nsf.gov/funding/pgm_summ.jsp?pims_id=503641 |
| RI program | AI, Computer vision, Human language research, Robotics, Machine learning, and Computational neuroscience | Contact the program contact person, James Donlon  
Email: jdonlon@nsf.gov  
Phone number: (703) 292-8074 | www.nsf.gov/staff/sub_div.jsp?org=IIS&orgId=3947&from_org=IIS |
| S&AS program | Intelligent Physical Systems | Contact the Program Director, Reid G. Simmons  
Email: resimmon@nsf.gov  
Phone Number: (703) 292-4767 | www.nsf.gov/funding/pgm_summ.jsp?pims_id=505325 |
This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 733286.

<table>
<thead>
<tr>
<th>Agencies</th>
<th>Programs/ Initiatives</th>
<th>Relevant Research Areas</th>
<th>Contact Info</th>
<th>Internet link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pennsylvania Department of Community and Economic Development (DCED)</td>
<td>Pennsylvania Manufacturing Initiative</td>
<td>No specific thematic area</td>
<td>Contact the Governor’s Action Team Email: <a href="mailto:ra-gat@pa.gov">ra-gat@pa.gov</a> Phone number: 717.787.8199</td>
<td><a href="https://dced.pa.gov/business-assistance/technology-innovation/manufacturing-pa-initiative/">https://dced.pa.gov/business-assistance/technology-innovation/manufacturing-pa-initiative/</a></td>
</tr>
<tr>
<td>Illinois Department of Innovation &amp; Technology (DoIT)</td>
<td>Smarter Illinois Initiative</td>
<td>IoT, Cognitive computing, Augmented reality, Robotics, and Next-generation security</td>
<td>Contact Illinois’s DoIT Email: <a href="mailto:DoIT.Helpdesk@Illinois.gov">DoIT.Helpdesk@Illinois.gov</a> Phone number: 217-524-3648 or 312-814-3648</td>
<td><a href="http://www2.illinois.gov/sites/doi/Strategy/Pages/SmarterIllinois.aspx">www2.illinois.gov/sites/doi/Strategy/Pages/SmarterIllinois.aspx</a></td>
</tr>
</tbody>
</table>