



ENRICH

EUROPEAN NETWORK OF
RESEARCH AND INNOVATION
CENTRES AND HUBS, USA

US Innovation Market Guide on Food Technology



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Executive Summary

This Market Guide is a product of the ENRICH in the USA, which is the European Network of Research and Innovation Centers and Hubs. Promoted by the European Commission 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 to maximize chances of success.

This Market Guide provides relevant information on the US innovation and market landscape regarding Food Technology (FoodTech). FoodTech is a leading innovation area in the European Union (EU) and US, as both regions are highly committed to introducing groundbreaking technology in the way food is manufactured.

The Market Guide identifies US key innovation hubs/facilitators and industry related centers, as well as the US main FoodTech market opportunities and barriers. The Market Guide also provides some of the key FoodTech related networks, events and assesses the existing funding initiatives and programs at both federal and state level that promote FoodTech innovation. Overall, this market guide aims to be an effective tool for EU research and business representatives in FoodTech related fields to gain knowledge on the US FoodTech innovation and market landscapes, and therefore facilitate their initial approaches to establishing innovation and business collaborative activities with their US counterparties (Figure 1).

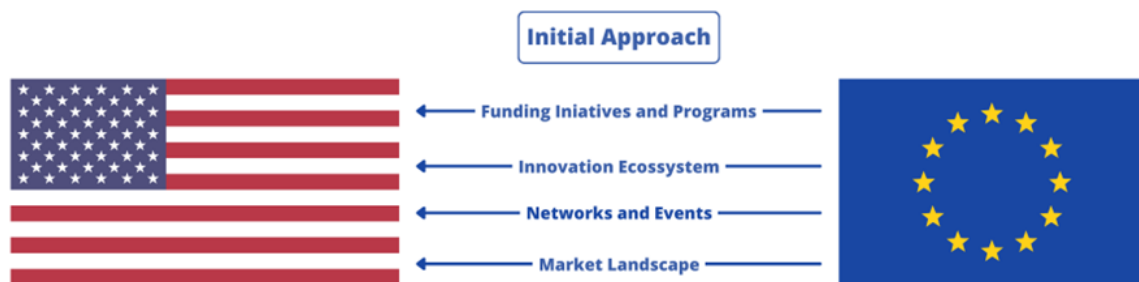


Figure 1 – Initial Approaches for Establishing Collaborative Innovation and Business Activities

Importance of FoodTech innovation to the EU and the US

The food and beverage industry is the largest manufacturing industry in the EU in terms of jobs and value added¹. SMEs play a key role in the sector, representing 99% of the food and drink companies². SMEs are also responsible for almost 40% of the EU food and beverage turnover³. Recognizing the significant impact that the food and beverage industry has on the economy of the EU, the European Commission is committed towards the promotion of the research, development and innovation (RDI) of the industry through the FOOD 2030 Research and Innovation (R&I) Policy Framework⁴. In 2021, the EU FoodTech ecosystem has been growing fast, with an increasing number of investments, approximately €9.5 billion, which is three times more than in 2020. In the same year, the EU's share among global investments in FoodTech was 20%. Paris, London, Stockholm, Amsterdam and Berlin are recognized as some of the leading ecosystems of FoodTech in Europe⁵.

With more than a third of the world's top 50 global food and beverage manufacturing companies headquartered in the US, the country is on the forefront of the Global FoodTech⁶. Almost half of the global investments in the FoodTech ecosystem are occurring in the US (45%)⁷. In addition, one third of the Global FoodTech unicorns⁸ are in the US⁹. As it is the case with the EU, the food and beverage industry is of vital importance for the US economy. The economic contribution from food and beverage processing and manufacturing industries is embedded within the economic value of retail and food service sales, which is estimated to be \$2.7 trillion or 13.1% to the Gross Domestic Product (GDP)¹⁰.

Innovation ecosystem

The US is the world leading country in terms of R&D investment, with the country's total spending on R&D in 2020 of \$717.0 billion (around €681.30 billion). In 2021, the total FoodTech R&D investments in the US were \$12.8 billion. The industry accounted for almost all of the FoodTech R&D investment (99%), with the remainder of the support coming from the public (Federal) sector¹¹. Although most of the FoodTech R&D investments were targeted towards development, which in turn led to a minimal amount of funding for basic to applied research, the US remains a global leader in FoodTech research. Research within the field of novel processing technologies is a particularly illustrative example, where the US is positioned as a global leader with the highest number of published patents and articles¹².

¹ https://ec.europa.eu/growth/sectors/food_en

² Approximately 280,000 SMEs.

³ <https://www.fooddrinkurope.eu/wp-content/uploads/2023/01/FoodDrinkEurope-Data-Trends-2022-digital.pdf>

⁴ <https://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=food2030>

⁵ <https://www.digitalfoodlab.com/foodtech-europe-2022/>

⁶ <https://www.austrade.gov.au/International/Invest/Opportunities/agribusiness-and-food>

⁷ <https://www.digitalfoodlab.com/where-look-foodtech/>

⁸ As per the definition from the Digital FoodLab, FoodTech unicorn is a startup with a valuation (the worth of the whole company) bigger than one billion dollars.

⁹ <https://www.digitalfoodlab.com/foodtech-unicorns/>

¹⁰ <https://www.statista.com/statistics/247991/value-added-to-the-us-gdp-by-industry/#:~:text=U.S.%20value%20added%20to%20GDP%202022%2C%20by%20industry&text=In%202022%2C%20the%20finance%2C%20real,GDP%20of%20the%20United%20States>

¹¹ <https://www.fooddive.com/news/food-tech-investments-will-keep-coming-2022/621086/>

¹² Jingdun, J, Donghong, L & Haile, M, 2019, *Advances in Food Processing Technology*, Springer Nature Singapore, Singapore



When analyzing the US FoodTech innovation ecosystem, the European SMEs should first identify the innovation hubs and facilitators of innovation that are most relevant for their fields. The innovation ecosystem is the term used to describe the numerous participants and resources that are needed for the innovation process¹³. Considering the multiplicity of actors that the innovation ecosystem encompasses, this guide focuses on the identification of leading FoodTech 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 Chicago, greater Sacramento area, New York City, Minneapolis, Philadelphia, and Atlanta.

Innovation hubs are ecosystems comprised of SMEs, large industries, start-ups, researchers, accelerators, and investors that aim to foster relationships between these entities and to act as a bridge between research and market needs¹⁴.

Facilitators of innovation are responsible for supporting, promoting and accelerating the innovation process. Thus, organizations such as business accelerators, incubators, science parks, and specialized consulting firms are considered facilitators of innovation, playing a very important role in the FoodTech innovation process.

Industry related RDI centers are entities that include businesses as members or partners. Taking into consideration the transformative potential that the application of new technologies has on the food and beverage manufacturing process, the cooperation between researchers, industry members and innovation facilitators is crucial to foster the advancement of new FoodTech technologies and tools.

Market landscape

In 2021, the contribution of the agrifood industry to the US GDP was \$1.264 trillion (€1.15 trillion)¹⁵. The total value of food manufacturing industry shipments in the US was estimated to be \$797.4 billion (€728.13 billion). Meat processing represents the largest single component of food and beverage manufacturing, with 24% of the total shipments^{16, 17}. According to the Census Bureau's County Business Patterns, in 2021, there was a total of 41,080 food and beverage manufacturing plants in the US. In the past decade, the food and beverage market in the US has been experiencing a major transformation, primarily driven by the shift in the consumer value drivers. In this sense, the former "niche" portions of the market are rapidly gaining in significance today, while the new market environment is constantly evolving. Within the industry, the Plant-Based market can be highlighted as one of the fastest growing markets in the US food industry.

¹³ https://www.researchgate.net/publication/282122544_Innovation_Ecosystems_Implications_for_Innovation_Management

¹⁴ <http://americanjobsproject.us/system/innovation-ecosystem/>

¹⁵ Agriculture, food, and related industries aggregated.

¹⁶ <https://www.statista.com/study/15804/industry-report--food-manufacturing/>

¹⁷ <https://www.marketresearch.com/Kentley-Insights-v4035/Food-Manufacturing-Research-COVID-Forecasts-13184442/>



Considering the size of the US FoodTech market, there are states that can be considered leading regions from a market perspective. If one assesses the US FoodTech market by the number of food and beverage manufacturing businesses and manufacturing plants, five states that particularly stand out are California, Illinois, Texas, Washington and New York.

Networks and events

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

Initiatives and programs

In the US, the FoodTech innovation is supported by federal and state initiatives and programs that prioritize research areas that can lead to technological breakthroughs. However, throughout the last decades, the Food R&D landscape has been characterized by a decline in public funding, with an offset in private funding. As a result, in 2018, less than 5% of the US Department of Agriculture (USDA) funded grants were directed towards food related research⁹. At the federal level, the FoodTech innovation is primarily supported by programs and initiatives from the USDA, National Science Foundation (NSF), Department of Commerce (DoC), Environmental Protection Agency (EPA), Food and Drug Administration (FDA) and Department of Defense (DoD). At the state level, several states have recognized the need to launch initiatives, challenges and grants that promote the advancement of FoodTech technologies.

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 Centres and Hubs. Promoted by the European Commission through Horizon 2020, the ENRICH network currently offers services to connect European research, technology and business organisations 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 Centres 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 Headquarter in the US** (at Temple University, Philadelphia)
- **Two physical Centers:**
 - **San Francisco Center:** ENRICH West Coast Hub at EAEC
 - **Boston Center:** 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 Centres' 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 organisations to explore technology/product partnerships and/or business development middle/long term opportunities, pitching to potential



investors, entrepreneurial bootcamps, workspace access, hands on business acceleration programmes, and more. As the ENRICH in the USA initiative is highly competitive to best serve the strongest researchers and entrepreneurs, application for all services must be done 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 (

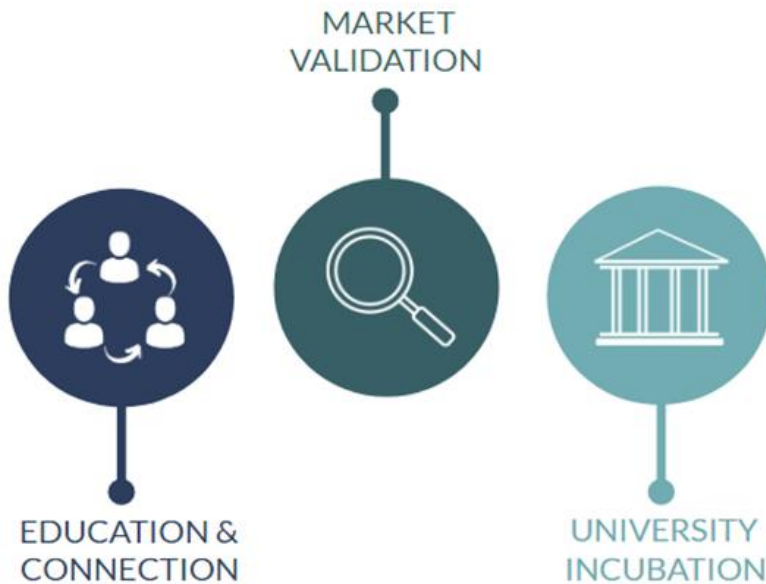


Figure 2).

NearUS Consortium:

Coordinator: GAC Group (GAC), France

Partners:

- > German Aerospace Centre (DLR), Germany
- > Temple University SBDC (Temple), USA
- > European Business and Innovation Centre Network (EBN), Brussels - Partner in Phase 1 (2017-2020)
- > International Business Innovation Association (InBIA), USA - Partner in Phase 1 (2017-2020)
- > European American Enterprise Council (EAEC), USA - Partner in Phase 1 (2017-2020)
- > INTRASOFT International (INTRA), Luxembourg - Partner in Phase 1 (2017-2020)
- > Sociedade Portuguesa de Inovação (SPI), Portugal
- > Regional Centre for Information and Scientific Development (RCISD), Hungary
- > National Council of University Research Administrators (NCURA), USA



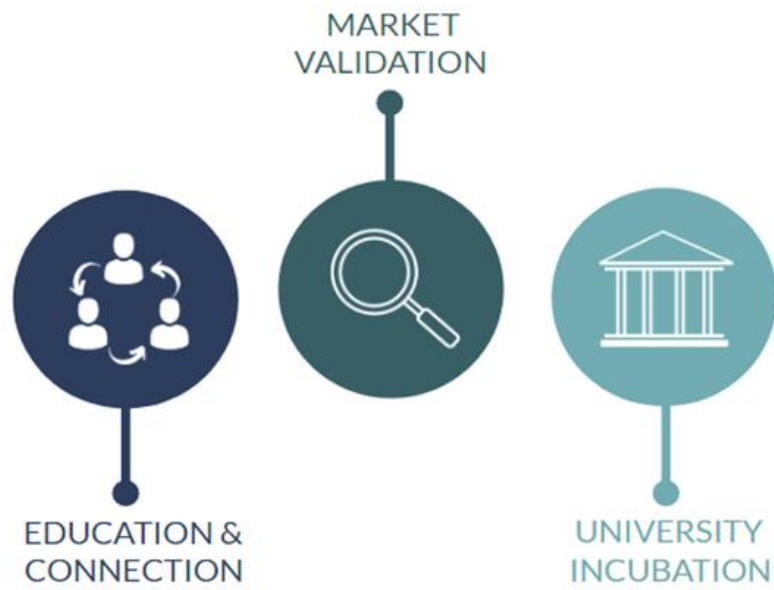


Figure 2 – ENRICH in the USA Services

Table of Contents

List of Abbreviations	11
1 Introduction	15
2 US innovation ecosystem	18
2.1. Innovation Hubs	20
2.2. Innovation facilitators	30
2.3. Industry related RDI centers.....	37
3 US market landscape	46
3.1. Market overview	47
3.2. Leading regions.....	48
3.3. Market considerations.....	58
3.3.1. Opportunities	58
3.3.2. Barriers	59
4 Recognized networks and events.....	61
4.1. Innovation and market networks/ associations	61
4.2. Innovation and market events	68
5 US innovation initiatives and programs	73
5.1. Federal initiatives/programs	73
5.1.1. National Science Foundation (NSF)	74
5.1.2. Department of Commerce (DOC).....	81
5.1.3. Department of Agriculture (USDA).....	83
5.1.4. Small Business Administration (SBA).....	85
5.2. State initiatives/programs	87
5.2.1. California: Food Production Investment Program.....	87
5.2.2. Michigan: Value-Added Grant Program	88
5.2.3. Minnesota: AGRI Value-Added Grant Program	89
5.2.4. Pennsylvania: Dairy Investment Grant Program	89
6 Observations.....	90
Annex 1: Summary of the US Federal and State Funding Initiatives and Programs	92

Table of Figures

Figure 1 – Initial Approaches for Establishing Collaborative Innovation and Business Activities	3
Figure 2 – ENRICH in the USA Services	8
Figure 3 – US Mapping of leading Innovation Hubs focused on FoodTech-related products.....	22
Figure 4 – US areas with higher concentration of food and beverage manufacturing businesses.....	50
Figure 5 – US states with the highest concentration of food and beverage manufacturing businesses	51
Figure 6 – US states with the highest concentration of food and beverage manufacturing businesses which individually invest an average of \$50,000 or more in technology annually	51
Figure 7 –Ten US states with the highest number of fruit and vegetable preserving and specialty food manufacturing plants	54
Figure 8 – Ten US states with the highest number of dairy product manufacturing plants	54
Figure 9 – Ten US states with the highest number of seafood product preparation and packaging plants	55
Figure 10 – Ten US states with the highest number of other food manufacturing plants	56
Figure 11 – Ten US states with the highest number of soft drink manufacturing plants	57
Figure 12 – Ten US states with the highest number of other beverage manufacturing plants.....	58
Figure 13 – US Government Organizational Chart highlighting the main sponsors of innovation programs in FoodTech related fields.....	74

List of Tables

Table 1 – List of Abbreviations	11
Table 2 – A sample of industry connected RDI Centers in the FoodTech related fields	39
Table 3 – Total number of food and beverage manufacturing plants in the US.....	52
Table 4 – Food and beverage manufacturing plants with over 100 employees	53
Table 5 – Examples of key US FoodTech related networks and associations	63
Table 6 – FoodTech related innovation and market events.....	69
Table 7 – Summary of the US Federal and State Funding Initiatives and Programs	92



List of Abbreviations

Table 1 – List of Abbreviations

Abbreviation	Explanation
AFRI	Agriculture and Food Research Initiative
AgTech	Agriculture Technology
AI	Artificial Intelligence
AMNPO	Advanced Manufacturing National Program Office
ARM	Advanced Robotics Manufacturing Institute
CADMIM	Center for Advanced Design and Manufacturing of Integrated Microfluidics
CAGR	Compound Annual Growth Rate
CBSS	Center for Biophotonic Sensors and Systems
CFA	Commonwealth Financing Authority
Cornell FPDL	Cornell Food Processing Development Laboratory
CPaSS	Center for Particular Surfactant Systems
CPG	Consumer Packaged Goods
DCED	Department of Community and Economic Development
DoD	Department of Defense
DoE	Department of Energy
DoI	Department of Interior
DoIT	Department of Innovation & Technology
EAEC	European American Enterprise Council
EBN	European Business and Innovation Centre Network



EC	European Commission
EPA	Environmental Protection Agency
EU	European Union
FDA	Food and Drug Administration
FFAR	Foundation for Food and Agriculture Research
FOA	Funding Opportunity Announcement
FoodTech	Food Technology
FY	Financial Year
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HHP	High Pressure Processing
I/UCRC	Industry/University Cooperative Research Center
ICT	Information and Communication Technologies
IFT	Institute of Food Technologists
IIT	Illinois Institute of Technology
InBIA	International Business Innovation Association
INTRA	INTRASOFT International
IoT	Internet of Things
IT	Information Technology
MDARD	Michigan Department of Agriculture & Rural Development
MEP	Manufacturing Extension Partnership
MoU	Memorandum of Understanding
MS	Member State
NAICS	North American Industry Classification System



NCFST	National Center for Food Safety and Technology
NCURA	National Council of University Research Administrators
NIFA	The National Institute of Food and Agriculture
NIST	National Institute of Standard and Technology
NSF	National Science Foundation
OAM	Office of Advanced Manufacturing
OISE	Office of International Science and Engineering
PDA	Philadelphia Department of Agriculture
PEAB	High Pressure Plasma Energy, Agriculture and Biomedical Technologies
PEF	Pulsed Electric Field
R&D	Research and Development
R&I	Research and Innovation
RDI	Research, Development and Innovation
RCISD	Regional Centre for Information and Scientific Development
SBA	Small Business Administrations
SBIR	Small Business Innovation Research
SME	Small and Medium Enterprise
SMM	Small and Medium Manufacturers
SPI	Sociedade Portuguesa de Inovação
STI	Science, Technology and Innovation
US	United States
US CBP	US Customs and Border Protection
USDA	US Department of Agriculture
USDA ERS	US Department of Agriculture Economic Research Service



USDA FSIS

USDA Food Safety and Inspection Service



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1 Introduction

This market guide, 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 regarding the Food Technology (FoodTech) related innovation ecosystem and market. It provides relevant information on the US FoodTech 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 level.

The Market Guide can be an effective source or tool for the European Union (EU) academic and industry communities to gain knowledge on the US related to FoodTech 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 business;
- 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 FoodTech to propose potential partnerships with US organizations.

Therefore, it is the hope of the Market Guide 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 FoodTech innovation ecosystem and market.

Food industry: FoodTech

Today, the food industry is facing a great deal of technical and economic changes despite a growing global population with increasing welfare standards. These trends are coupled with a background of increasing consumer demands, sustainability concerns and resource demands for bio-based applications. As a result, the emphasis within the food value chain has been shifting from more to better.

Consumers are now demanding healthy, next generation processed foods from fresh ingredients, with high nutritional value, healthy components, and assured food safety. The industry is becoming increasingly competitive and dynamic, striving towards quality. To meet the demands, the food manufacturers are turning towards new and innovative manufacturing technologies. The adoption and application of such innovations enables further optimization of food production with a minimum environmental footprint, lower production costs, and improved quality and nutritional value. As a result, the importance of technology for manufacturers continues to grow.



Food technology, or FoodTech, is a term which describes new, innovative, and emerging technologies that have the potential to transform the food industry. FoodTech as a term encompasses a broad range of technological applications across different stages of the food value chain¹⁸. This guide will explore the application of technology towards the food and beverage manufacturing sector. For this guide, the agricultural industry, food retailing and food service sectors will not be considered as a FoodTech target market.

The food and beverage manufacturing sector is responsible for transforming raw agricultural materials into intermediate foodstuffs, animal feed or edible products¹⁹. The global food and beverage industry is massive, valued at \$6.7 trillion globally with an annual growth of around 7.3%²⁰. Within the industry, the food processing and handling segment has been leading the industrial group²¹. Valued at \$106 billion, the market is poised for accelerated growth, amid the demographic change, innovation, and evolving customer needs²². Since food and beverage manufacturing includes a wide range of technologies related to processes, each technology should be analyzed as the result of several developments within a broader research context. In fact, FoodTech is a multidisciplinary field deeply linked to advances in different research areas. Thus, this guide is focused on five of the thematic areas related to FoodTech.

- **Digitalization:** Digitalization in the food and beverage industry refers to the application of the solutions that aim to exploit the high innovation and economic potential resulting from the continuing impact of rapidly advancing information and communication technology (ICT)²³. Latest digital trends such as Big Data Analytics and Internet of Things (IoT) have the potential to increase the predictability and enable the food and beverage manufacturers to gain a greater grip on information along the value chain.
- **Novel Processing Technologies:** Food processing technologies include a set of physical and chemical techniques in the transformation of food ingredients or agricultural products into food²⁴. To meet the changing consumer demands, several emerging food physical processing technologies are already being applied in the food industry. Novel processing technologies include high hydrostatic pressure (HHP), radiation, microwave, ultrasound, pulsed electric field (PEF), and cold plasma²⁵.
- **Robotics:** Robotics is the branch of engineering that involves the conception, design, manufacture, and operation of robots. Robotics overlaps with electronics, computer science,

¹⁸ <https://techcrunch.com/2019/10/22/the-foodtech-investment-opportunity-present-and-future/>

¹⁹ https://www.ers.usda.gov/webdocs/publications/44951/11777_err130_1_.pdf?v=0

²⁰ <https://www.prnewswire.com/news-releases/food-and-beverages-industry-2023-analysis-by-the-global-market-model-from-tbrc-301906864.html>

²¹ McKinsey & Company defines the industrials group as following 13 sub sectors: multiapplication components, test and measurement, electrical equipment, flow control, industrial machinery, building technologies, diversified, mechanical power transmission, distribution, power equipment, electronic components, cables and wires, and food processing and handling equipment.

²² <https://www.fortunebusinessinsights.com/industry-reports/food-processing-and-handling-equipment-market-101701>

²³ <https://www.sciencedirect.com/science/article/pii/S2405896318314617>

²⁴ <https://foodtechnology.nutritionalconference.com/events-list/food-processing-technology>

²⁵ Jingdun, J, Donghong, L & Haile, M, 2019, *Advances in Food Processing Technology*, Springer Nature Singapore, Singapore



mechatronics, nanotechnology, and bioengineering²⁶. Applying robotics to food and beverage manufacturing leads to increased automation, resulting in the improved stability of the food production process and lower labor-intensity.

- **Sensor Technology:** Sensor technology in food and beverage manufacturing has two major applications: process control and quality control. For the process control, sensor technologies support the optimization of the manufacturing process, while reducing the energy costs²⁷. For quality control, sensory technologies enable the detection and identification of contaminants throughout the manufacturing process²⁷. Some examples of the novel sensor technologies include radio frequency identification, the application of wireless technology, nano-enabled sensors, and biosensors.
- **Sustainable Packaging:** The packaging process is one of the most important among all the food manufacturing processes, as it maintains the quality of food products for storage, transportation, and end use²⁷. Sustainable packaging is defined as packaging that has been sourced responsibly, designed to be effective and safe throughout its life cycle, meets market criteria for performance and cost, is made entirely using renewable energy, and once used, is recycled efficiently to provide a valuable resource for subsequent generations²⁸. Some examples relevant for the food and beverage industry include active/smart packaging, modified atmosphere packaging, edible films and coatings, and packaging that addresses environmental issues (i.e. biobased material input).

Importance of FoodTech to the EU and US

The food and beverage industry is the largest manufacturing industry in the EU in terms of jobs and value added²⁹. SMEs play a key role in the sector, where there are approximately 290,000 SMEs, representing 99% of the food and drink companies³⁰. SMEs are also responsible for almost 40% of the EU food and beverage turnover³¹. Recognizing the significant impact that the food and beverage industry has on the economy of the EU, the European Commission is committed towards the promotion of the research and development (R&D) of the industry. FOOD 2030 is the EU's Research and Innovation (R&I) Policy Framework, created as a response to the recent international policy developments and dedicated towards the transformation of the EU food system towards more sustainable, resilient, responsible, diverse, competitive, and inclusive model³². From 2018 to 2022, the EU FoodTech ecosystem has been growing fast, with an increasing number of investments approximately €9.2 billion (\$9.8 billion) in 2021³³. In 2022, investments decreased by 36%, driven mainly by the reduction of the investments in delivery services, which represents 68% of the decrease.

²⁶ <https://whatis.techtarget.com/definition/robotics>

²⁷ <https://www.manufacturing.net/home/article/13182921/sensor-technology-for-food-and-beverages-control>

²⁸ <https://tipa-corp.com/sustainable-packaging/>

²⁹ https://ec.europa.eu/growth/sectors/food_en

³⁰ <https://www.fooddrinkurope.eu/policy-area/smes/>

³¹ <https://www.fooddrinkurope.eu/wp-content/uploads/2023/01/FoodDrinkEurope-Data-Trends-2022-digital.pdf>

³² <https://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=food2030>

³³ <https://www.digitalfoodlab.com/reports/2023-europe/download>



By contrast, the investments in other FoodTech areas, such as agriculture, food products and supply chains, increased by 21% compared to 2021, having an investment of €4 billion (\$4.2 billion), resulting in a balanced portfolio of investments³³. In the same period, the EU's share among global investments in FoodTech was 21%. Paris, London and Berlin are recognized as some of the leading ecosystems of FoodTech in Europe³³. At the level of the EU Member States (MS), the Directorate-General for Research and Innovation Bioeconomy of the European Commission conducted the Assessment of Research and Innovation on Food Systems by European Member States, in 2018. One of the observations arising from the assessment was that a majority of the EU MS had a strong commitment for R&I funding targeted towards food processing, food safety and food waste³⁴.

With more than a third of the world's top 50 global food and beverage manufacturing companies headquartered in the US, the country is on the forefront of the Global FoodTech³⁵. Despite the recent decline of public food Research and Development funding, the private sector has been driving the development of the FoodTech in the US. Over the years, the US remained the main hub for FoodTech with almost half of the global investments in FoodTech occurring in the US (45%)³⁶. In addition, 1/2 of the Global FoodTech unicorns³⁷ are in the US³⁸. As it is the case with the EU, the food and beverage industry is of vital importance for the US economy. The economic contribution from processing and manufacturing industries is embedded within the economic value of retail and food service sales, which is estimated to be \$23 trillion or 12.% of the Gross Domestic Product (GDP)³⁹. Within the industry, there are approximately 36,000 food and beverage manufacturing plants and 113,000 food warehouses in the US⁴⁰. Most of the food and beverage manufacturers are increasingly focused on implementing greater automation in the manufacturing process to drive productivity⁴¹.

2 US innovation ecosystem

The US is the world's leading country in terms of R&D investment, with a total spending on R&D in 2021 of \$790.0 billion (around €672.0 billion), which represents 3.4% of its GDP^{42, 43, 44}. The R&D programs are mainly supported by industry (\$587.7 billion, nearly €556.9 billion), the Federal Government (\$153.3 billion, nearly €145.4 billion), higher education (\$24 billion, nearly €22.7 billion), nonfederal government (\$5.8 billion, nearly €5.5 billion), and non-profits organizations (\$20.9 billion,

³⁴ https://ec.europa.eu/research/bioeconomy/pdf/publications/Assessment_of_R_and_I_on_food_systems.pdf

³⁵ <https://www.austrade.gov.au/International/Invest/Opportunities/agribusiness-and-food>

³⁶ <https://dealroom.co/guides/foodtech#:~:text=The%20US%20attracted%20by%20far,in%20the%20last%20two%20years>

³⁷ A unicorn is a startup with a valuation (the worth of the whole company) bigger than a billion dollars.

³⁸ <https://www.digitalfoodlab.com/reports/2023-unicorns/download>

³⁹ <https://www.nist.gov/el/applied-economics-office/manufacturing/total-us-manufacturing/manufacturing-economy/total-us#:~:text=In%202021%20Manufacturing%20contributed%20%242.3,12.0%20%25%20of%20total%20U.S.%20GDP.>

⁴⁰ <https://www.ift.org/career-development/learn-about-food-science/food-facts/about-fs-and-t>

⁴¹ <https://www.india.fujielectric.com/blog/factory-automation-future-of-food-and-beverage-manufacturing>

⁴² <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>

⁴³ <https://fas.org/spp/crs/misc/R44307.pdf>

⁴⁴ <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=US>



nearly €19.8 billion)⁴⁵. Moreover, according to the latest data available, in 2020 the US R&D investment represented a third of the global R&D investment⁴⁶. Around 15% of the R&D performance in the US is for basic research, with the remainder, more than 85%, for applied research and experimental development⁴⁷.

In 2018, the total Food R&D investments in the US were \$10 billion (€9.1 billion). The industry accounted for almost all the Food R&D investment (\$9.9 billion), with the remainder of investments coming from the public sector (\$0.1 billion). Thus, the total Food R&D represented 0.65% of the direct GDP⁴⁸. Moreover, in 2021 alone, \$12.8 billion (€11.9 billion) were directed to FoodTech companies⁴⁹. Even though most of the FoodTech R&D investments were targeted towards development, which led to a minimal amount of funding for basic to applied research, the US has remained a global leader in FoodTech research. As an example, in terms of the number of published patents, the US is the global leader in all the major food processing technologies, such as the high-pressure processing, microwave, irradiation, ultrasound and pulsed electrical fields. The US is also a global leader in terms of published articles about food processing technologies, such as high-pressure processing, microwave, irradiation, ultrasound, and cold plasma¹².

The innovation ecosystem is the term used to describe the numerous participants and resources that are needed for the innovation process⁵⁰. This process includes researchers, universities, venture capitalists, industry companies, SMEs, start-ups, accelerators, incubators and investors⁵¹.

The innovation factor in the FoodTech industry constitutes an essential element for success, as it leads to the generation of an increased economic return thanks to their ability to release purchasing dynamics from the automatic correlation between quality and price, which characterizes the choice of traditional products⁵². For the major actors in the food industry, innovation does not only represent an opportunity, but also a major prerequisite to gain the competitive advantage, apply specific pricing policies, penetrate new markets and improve sustainability of the technologies and policies applied⁵³. Considering the large number of actors that comprise the FoodTech innovation ecosystem, this market guide focuses on the leading FoodTech innovation hubs, the facilitators of innovation and the industry related R&D centers in order to identify the US regions that most contribute to the FoodTech innovation process.

When analyzing the US FoodTech innovation ecosystem, the EU academic and industry communities should first identify the innovation hubs/facilitators and industry related R&D centers that are most

⁴⁵ <https://nces.nsf.gov/pubs/nsf23320>

⁴⁶ <https://www.statista.com/statistics/1102478/research-and-development-gross-domestic-spending-g7-countries-china/>

⁴⁷ <https://nces.nsf.gov/pubs/nsb20225/recent-trends-in-u-s-r-d-performance>

⁴⁸ <https://www.ers.usda.gov/data-products/agricultural-and-food-research-and-development-expenditures-in-the-united-states/documentation/>

⁴⁹ <https://www.fooddive.com/news/food-tech-investments-will-keep-coming-2022/621086/>

⁵⁰ https://www.researchgate.net/publication/282122544_Innovation_Ecosystems_Implications_for_Innovation_Management

⁵¹ <https://innovolo-group.com/innovation-en/innovation-terminology-en/what-is-an-innovation-ecosystem/#:~:text=An%20innovation%20ecosystem%20is%20an,developing%20new%20products%20and%20services.>

⁵² Tarabella, A, 2019, *Food Products Evolution: Innovation Drivers and Market Trends*, Springer Nature Switzerland, Cham

⁵³ Galanakis, C, 2016, *Innovation strategies in the food industry: Tools for implementation*. Academic Press, Elsevier



relevant for their field. The assessment of the US FoodTech innovation landscape, which comprises of these key innovation actors, allows EU research organizations and SMEs to identify relevant US FoodTech research and industry organizations that often develop multi-partner collaborative partnerships to advance FoodTech.

2.1. Innovation Hubs

Innovation hubs are ecosystems comprised of SMEs, large industries, start-ups, researchers, accelerators, and investors⁵⁴. Innovation hubs foster 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 and incubates early-stage companies⁵⁵.

The US is home to some of the world's most recognized innovation hubs. Cities and areas such as Silicon Valley, Research Triangle, Boston, New York, and the San Francisco Bay are internationally recognized for their world class high-tech companies and numerous highly innovative start-ups⁵⁶. Innovation hubs located in these cities and areas promote world leading technological trends as well as important advances in technology⁵⁷. However, in recent years, new hotspots across the US 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^{58, 59}.

Currently, FoodTech hubs are shaping the future of the food and beverage industry in the US. The innovation driven changes arising from these hubs present the best solution for the rapidly growing market challenges in the industry. The challenges have been primarily launched by the environment protection, competitiveness of the globalized market, and more recently as requests by consumers and society strongly require innovations that break away from the past rather than simple continuity. According to Galanakis (2016), the main drivers that support developments in the food industry are:

1. assuring food security and safety;
2. providing transparency within the ever-increasing complexity of the food system;
3. coping with urbanization of society;
4. complying with society's ethical concerns⁶⁰.

⁵⁴ <https://www.mckinsey.com/industries/public-sector/our-insights/building-innovation-ecosystems-accelerating-tech-hub-growth>

⁵⁵ <http://americanjobsproject.us/system/innovation-ecosystem/>

⁵⁶ <https://www.forbes.com/sites/kathryndill/2015/02/12/the-10-most-innovative-tech-hubs-in-the-u-s/#34364b7f5d7d>

⁵⁷ <https://medium.com/@RussellMoopa/silicon-valley-innovation-hub-of-the-world-1925278c6289>

⁵⁸ <https://www.forbes.com/sites/noahkirsch/2016/10/18/why-boston-is-the-next-hub-for-innovation/#75ab33693d6a>

⁵⁹ <https://www.crowdspring.com/blog/startups-entrepreneurs-best-startup-cities-us/>

⁶⁰ Galanakis, C, 2016, *Innovation strategies in the food industry: Tools for implementation*. Academic Press, Elsevier



For the transformation of the industry, an unprecedented collaboration between stakeholders is required, and both radical and incremental innovation across the entire food value chain⁶¹. As new and alternative food and beverage manufacturing methods are continually being sought in pursuit of producing better quality foods economically, new innovations, technologies, and concepts continue to emerge primarily in the FoodTech hubs, which provide conditions for the creation of the “ecosystem effect”.

Today, many companies and innovation facilitators related to the food and beverage industry are focusing on Digitalization, Novel Processing Technologies, Robotics, Sensor Technology and Sustainable Packaging.

According to several studies, the US major innovation hubs for FoodTech are primarily located in Chicago, greater Sacramento area, New York, Minneapolis, Philadelphia, and Atlanta. These areas are characterized by a high number of companies, startups, technology centers, incubators, research centers and other major stakeholders relevant to FoodTech with significant funding dedicated to FoodTech-related activities, which demonstrates the areas’ potential to attract investment and promote innovation^{62, 63 64, 65, 66}.

Important FoodTech hubs have also emerged in different states across the US such as Texas, Florida, New Jersey, and Wisconsin. Currently, certain areas within these states are highly committed to invest in the development of the required infrastructure to host FoodTech companies and support new ideas, technologies and tools related to FoodTech products.

The FoodTech innovation hubs identified in this section, and listed by innovation ratings, have been selected based on different sources. The identified hubs are focused on at least one of the five areas: Digitalization, Novel Processing Technologies, Robotics, Sensor Technology and Sustainable Packaging. Figure 3 presents an overview of the US leading Innovation hubs in these FoodTech related fields.

⁶¹ De Bernardi, P and Azucar, D, (2019), *Innovation in Food Ecosystems: Entrepreneurship for a Sustainable Future*, Springer Nature Switzerland, Cham

⁶² <https://www.census.gov/data/datasets/2017/econ/cbp/2017-cbp.html>

⁶³ Agtech: Advancing Agribusiness and Food Processing US Clusters. Available at: www.austrade.gov.au

⁶⁴ <https://www.ers.usda.gov/topics/food-markets-prices/processing-marketing/manufacturing/>

⁶⁵ https://www.clustermapping.us/cluster/food_processing_and_manufacturing

⁶⁶ <https://fi.co/insight/foodtech-startup-resource-guide-300-accelerators-incubators-and-more>



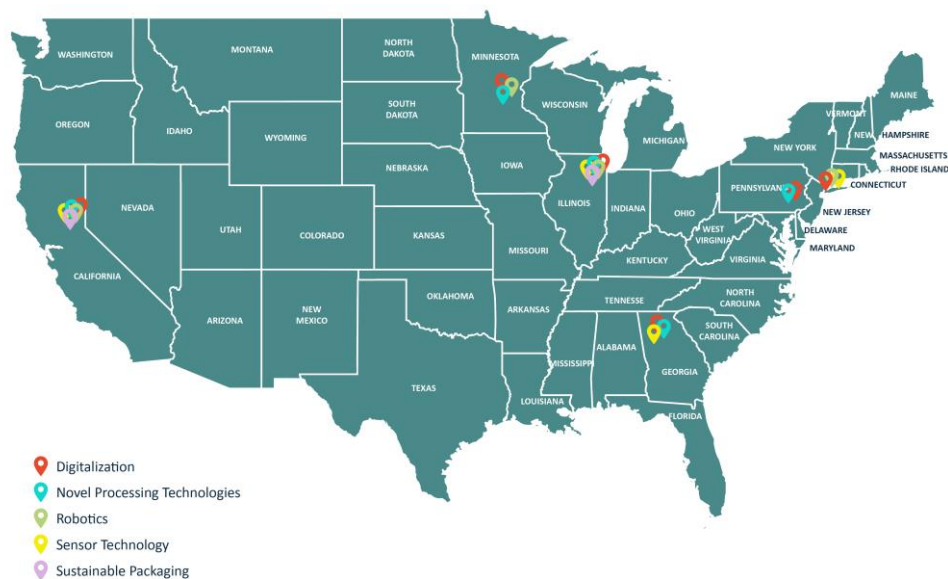


Figure 3 – US Mapping of leading Innovation Hubs focused on FoodTech-related products

Chicago, Illinois

Areas: Digitalization, Novel Processing Technologies, Robotics, Sensor Technology and Sustainable Packaging

The Illinois food industry has a long and rich history. With over 2,500 food manufacturing companies and 1,240 food processing plants, Illinois ranks as the number one US state in processed food sales⁶⁷. Illinois also ranks first in the US in terms of food-related patents and second by the number of patents in the food cluster⁶⁸.

As the major tech hub and biggest city in Illinois, Chicago has long been a center for food manufacturing. The city has the second largest food processing cluster in the US and it is home to some of the biggest companies in the food industry such as Archer Daniels Midland, Mondelez International and Conagra Brands. Most recently, Kraft Heinz and McDonald's have also relocated their headquarters to downtown Chicago to gain access to the city's innovative workforce⁶⁹. Chicago also ranks as the number one US city in terms of both overall Food Manufacturing Gross Regional Product and Employment in Food Manufacturing⁷⁰.

⁶⁷ <https://intersectillinois.org/industries/food-processing/>

⁶⁸ <https://www.istcoalition.org/data/index/illinois-rd-landscape-path-forward>

⁶⁹ <https://www.istcoalition.org/data/index/2018-rd-index/>

⁷⁰ <https://www.fooddive.com/news/why-chicago-is-the-nations-capital-of-food-and-beverage-manufacturing/560943/>



Consequently, Chicago has a booming FoodTech innovation ecosystem that consists of highly innovative start-ups, FoodTech dedicated venture funds and numerous accelerators and incubators. One such example is Tyson Ventures, a Tyson Foods' US\$150 million venture fund, which is headquartered in Chicago. The Fund invests in innovative, early-stage food industry companies. Other major Chicago-based funds that are relevant for FoodTech startups include S2G Ventures and 2X Ventures. Chicago is also home to several FoodTech dedicated accelerators and incubators such as 1871 - Chicago's Technology & Entrepreneurship Center, The Hatchery Chicago, and the Good Food Business Accelerator. Located south of the city, in Champagne, is also the University of Illinois, one of the best US universities for Food Science & Technology.

Furthermore, the National Center for Food Safety and Technology (NCFST) is headquartered in Chicago. The Center represents a unique cooperative research venture among the US Food and Drug Administration (FDA) and the Illinois Institute of Technology (IIT). The Center researches the basis for regulatory policy and establishes parameters that address the effectiveness of processing and packaging technologies.

Greater Sacramento area, California

Areas: Digitalization, Novel Processing Technologies, Robotics, Sensor Technology and Sustainable Packaging

The state of California represents one of the major hotspots for the food industry in the US. In California alone, in 2021, the investments in the agrifood-tech industry totaled \$9.7 billion, which represents around 25% of the total global investments in the industry^{71, 72}. As a result, the agrifood-tech startups in the state did not only raise the most funding in the US, but also more than any other country in the rest of the world. In addition, California has more food and beverage manufacturing plants, as well as the published patents in the food cluster, than any other US state^{73, 74}.

Within California, aside from being one of the world's leading Agricultural technology (AgTech) hubs, the greater Sacramento area is one of the hubs for FoodTech innovation in the US. The region is home to over 200 food processing businesses including industry leaders, like Pacific Coast Producers and Nippon Shokken⁷⁵. With lower costs compared to the Silicon Valley, the greater Sacramento area is highly attractive for the startups and early-stage companies in the food industry. It is also home to University of California Davis (UC Davis), one of the most prestigious universities in food and agricultural technology in the world. In proximity to downtown Sacramento, UC Davis has always been a source of talent for the food industry in the US. In 2022, the College of Agricultural and Environment

⁷¹ AgTech and FoodTech industries combined.

⁷² <https://research.agfunder.com/2022-agfunder-agrifoodtech-investment-report.pdf>

⁷³ <https://www.ers.usda.gov/topics/food-markets-prices/processing-marketing/manufacturing/>

⁷⁴ https://www.clustermapping.us/cluster/food_processing_and_manufacturing

⁷⁵ <https://www.greatersacramento.com/es/business-climate/industries/agtech/>



Sciences received \$225 million (€205.45 million) in research funding, the most among the universities in the US⁷⁶. In 2017–18, UC Davis filed 177 records of invention and 159 patent applications, and negotiated 77 license agreements, in addition to supporting the establishment of 16 startups⁷⁷. Greater Sacramento hosts incubators and facilitators such as UC Davis Big Bang and AgStart, both supporting FoodTech companies.

ENRICH in the USA Soft Landing Hubs: Initial contact points for California

Through the ENRICH J-1 Soft Landing Programs, interested participants can access Incubators/Innovation Centers of Universities dedicated to R&I in the FoodTech domain.

ENRICH in the USA has some Soft-Landing Hubs located near the California industry cluster. These soft-landing hubs help SMEs to venture into North America, through a low-cost strategy and temporary visa. All the tools are provided, to conduct proof of concept tests, to connect with new strategic partners and potential clients, to revamp your product development, research, and intellectual property strategy within the U.S. market. Soft-landing hubs also ease access to local funding opportunities and grants to support research and commercialization efforts. Through the ENRICH J-1 Soft Landing Programs, interested participants can access Incubators/Innovation Centers of Universities dedicated to R&I in the FoodTech domain, namely: CalPoly University – CIE, Citris Foundry at UC Berkeley, Galvanize – San Francisco and Santa Clara University.

CalPoly University – CIE

Cal Poly is a highly rated public university located in San Luis Obispo, California. It is one of two polytechnical universities in California, with the other located in Pomona. It is a large institution with an enrollment of 19,685 undergraduate students.

Admission is competitive as the Cal Poly acceptance rate is 28%. The university has six colleges that offer 65 undergraduate degrees and 39 Master's degrees. Popular majors include Business, Mechanical Engineering, and Biology. Cal Poly was ranked 115 out of 650 in a list of the best colleges in America by Forbes in 2019.

The CIE HotHouse is a community space created through the efforts of Cal Poly, the city and county of San Luis Obispo, the business community, and the Cal Poly Center for Innovation and Entrepreneurship (CIE). It is an off-campus location that houses CIE programs. The goal of the HotHouse is to support students and community members as they work to create new innovations and start business ventures.

⁷⁶ <https://caes.ucdavis.edu/news/uc-davis-sets-new-record-surpasses-1-billion-research-funding>

⁷⁷ <https://www.topuniversities.com/universities/university-california-davis>



Citris Foundry at UC Berkeley

The University of California, Berkeley is a public land-grant research university in Berkeley, California. Established in 1868 as the University of California, it is the state's first land-grant university and the first campus of the University of California system. Its fourteen colleges and schools offer over 350 degree-programs and enroll some 31,000 undergraduate and 12,000 graduate students. Berkeley is ranked among the world's top universities by major educational publications.

When it comes to Research, from expeditions to Egypt in the late 1800s to stem cell research and artificial intelligence today, Berkeley has been at the forefront of research throughout its history. Here students can work side-by-side with Nobel Laureates, Fields medal winners, Fulbright Scholars, and MacArthur fellows.

Uniquely situated across multiple UC campuses, the CITRIS Foundry is ideally positioned to help new generations of innovators and entrepreneurs bridge the gap from lab to market and actualize rigorous, validated solutions to society's biggest challenges. The Foundry's Incubator offers guidance, education, and a home-base to de-risk entrepreneurship for early-stage founders, especially supporting those who have been historically marginalized, allowing innovators to confidently identify pathways to success and reach the next stage of development and investment for their emerging technology venture.

CITRIS FOUNDRY is part of CITRIS as one of its programs. Citris Banatao Institute departments focus on health research, energy, robots, policy lab, and enterprise innovation represented by Citris Foundry.

Galvanize – San Francisco

Galvanize helps to build and scale companies or projects with a custom co-working solution. Companies can get access to mentors, workshops, talent, and resources.

- Upskill & train teams: With custom curriculums, businesses can upskill their technical talent and accelerate business growth.
- Hire bootcamp graduates: At no cost, Galvanize's partnerships team connects organizations with job-ready software engineering talent graduating from their coding bootcamps.
- Hire trained veterans: As a VA VET TEC Preferred Provider, Galvanize matches talented, job-ready Veterans to open roles.
- Access corporate resources: Galvanize has the resources to help companies upskill or reskill their organizations, find efficiencies, and onboard talents.



Santa Clara University

Santa Clara University (SCU) is partnering with tech companies to bring smart solutions to its campus. Thus, in 2017 USC have adopted smart parking technology (which includes sensors to keep track of open spaces in parking garages; up to the minute information about the status of parking spaces), but also a system that detects pedestrians crossing the streets and automatically activates warning lights.

Additionally, SCU has been working towards energy savings, to the extent that photovoltaics, solar thermal systems, and wind turbines have been gradually installed on the campus as part of the Green Power Program, a program that aims to prevent the emission of over 21,545 tons of carbon dioxide each year and at the same time provide smart energy solutions to the campus.

New York City, New York

Areas: Digitalization, Robotics, Sensor Technologies

Today, New York City is one of the largest urban centers for tech companies and the second-largest tech hub in the world with around 6,000 tech companies. With a huge market base and the world's largest food distribution center, New York City is also home to a thriving food innovation ecosystem. With promising early-stage companies such as Botaniline, Blue Apron and Ocean Hugger Foods and well-known multinational corporations such as PepsiCo, New York City has one of the most vibrant food innovation ecosystems in the US. The city exhibits strong R&D performance and with a deep pool of talent, the city has seen a rapidly growing network of FoodTech start-ups, incubators, and programs.

Located within four hours of New York City, Cornell University is recognized as one of the world leaders in the food engineering science and research⁷⁸. New York City is also a home to numerous FoodTech dedicated incubators and accelerators, such as AccelFoods, Food Hatch, Food-X and Chobani. In addition, New York City is one of only four cities in the World that hosts the annual "Future Food-Tech" networking event, which brings together some of the major brands, entrepreneurs, and investors in the food industry⁷⁹.

Minneapolis, Minnesota

Areas: Digitalization, Novel Processing Technologies, Robotics

Minnesota hosts a collaborative FoodTech ecosystem fostering innovation through public-private partnerships, strong academic and business expertise, and increasing number of food industry-

⁷⁸ <https://www.collegefactual.com/majors/agriculture-ag-operations/food-science-technology/rankings/top-ranked/>

⁷⁹ <https://www.futurefoodtechprotein.com/>



oriented accelerators. The state is ranked as 4th in food product patents per capita and 4th by the number of food and agricultural technicians with almost twice the concentration of food scientists and technologists as the national average⁸⁰. Furthermore, 5 out of the 30 largest food and agriculture companies are based in Minnesota.

Minneapolis, which is the center of the food industry in Minnesota, headquarters food industry giants such as General Mills, Land O'Lakes, and Hormel. Aside from the well-known food conglomerates, the city is home to a vibrant FoodTech ecosystem that includes several highly innovative start-ups, accelerators, and incubators. University of Minnesota is one of the US' highest ranked universities in food science. The University of Minnesota supports the industry through several of its research centers, such as the Food Industry Center, Sensory Center, and Food Science pilot plant^{81, 82}. Co-funded by Cargill and Ecolab, "Techstars Farm to Fork Accelerator", located in Minneapolis, also hosts a mentorship-driven accelerator program that attracts FoodTech and AgTech startups from around the world.

Atlanta, Georgia

Areas: Digitalization, Novel Processing Technologies, Sensor Technology

As a home to a third of the US largest food manufacturing companies and more than 80 cold storage chains, Georgia is known for its extensive logistics and supply chain infrastructure⁸³. Georgia's well-known food manufacturing industry is characterized by high employment in poultry processing, bakery and beverages⁸⁴. With an already well-established food and beverage manufacturing system, in the past years, Atlanta has been building a tech startup environment for local food industry. Atlanta is also the home and headquarters to the global giant, the Coca Cola Company.

Some of Atlanta's key players in the food manufacturing innovation ecosystem include the Center for Innovation of Agribusiness and the Center of Innovation for Manufacturing. Both centers provide the food manufacturers with access to some of the leading researchers and expertise in the industry. Centers for Food Safety and Food Product Innovation and Commercialization at University of Georgia also provide a strong pool of young experts with the expertise in food safety and food product development. Furthermore, within GeorgiaTech, the Intelligent Sustainable Technologies Division conducts food science research with a specific expertise in the application of advanced sensors and

⁸⁰ https://mn.gov/deed/assets/food-industry_tcm1045-305984.pdf

⁸¹ <https://sensorycenter.cfans.umn.edu/>

⁸² <https://fscn.cfans.umn.edu/research/pilot-plant>

⁸³ <https://www.georgia.org/industries/food-processing>

⁸⁴ <http://online.flowpaper.com/79590748/foodprocessingbrochure/>



robotic systems⁸⁵. Finally, Atlanta is also home to many incubators and accelerators, such as Atlanta TechVillage, which supports startups and companies from various areas, including FoodTech⁸⁶.

Boston, Massachusetts

Areas: Digitalization, Novel Processing Technologies

Boston has established itself as a leading hub for FoodTech innovation, hosting over 130 companies and organizations that are transforming various aspects of the food supply chain. The city's comprehensive approach, combining strengths in consumer-facing apps, agricultural technology, and technology applications across the entire food value chain, sets it apart. With a talent pool fueled by a substantial number of STEM graduates and capital investments totaling \$8.3 billion (€7.58 billion) between 2019 and 2022, Boston leads in the field. The city's success is attributed to its research-oriented environment, strong academic and entrepreneurial presence, and a robust traditional industrial foundation, making it a key player in shaping the future of food technology^{87, 88}.

Philadelphia, Pennsylvania

Areas: Digitalization, Novel Processing Technologies

The state of Pennsylvania is one of the leaders in the US based on the number of food manufacturing companies, with more than 2,300 operating across the state⁸⁹. As a result, the food manufacturing sector is a very important contributor to the greater Philadelphia economy. It is the largest sub-sector of Greater Philadelphia's manufacturing industry, with over 24,000 employees⁹⁰. Many big companies have sites in the area, including Nestle USA, which has four manufacturing plants in the greater Philadelphia area⁹¹. Aside from being one of the food manufacturing centers in the US, next to Boston and New York City, Philadelphia has been emerging as one of the innovation hubs in the East Coast.

Compared to Boston and New York City, Philadelphia can offer lower costs for the startups, maintaining a large pool of talent. The "innovation district", formed along the University City and South areas, has the highest concentration of Philadelphia's strong research capabilities⁹². University of Pennsylvania is one of the highest ranked universities in food science. The University also has the 4th highest R&D expenditure among the universities in the US⁹³. It is also the home to two accelerator programs, VIP-C

⁸⁵ <https://fptd.gatech.edu/about>

⁸⁶ <https://atlantatechvillage.com/community/current-villagers/>

⁸⁷ <https://now.tufts.edu/2023/09/12/innovation-thrives-here-new-report-names-boston-top-food-tech-hub>

⁸⁸ <https://www.startus-insights.com/innovators-guide/top-5-global-startup-hubs-food-tech/>

⁸⁹ <https://dced.pa.gov/key-industries/agribusiness/>

⁹⁰ <https://selectgreaterphl.com/doing-business/workforce/>

⁹¹ <https://www.nestleusa.com/about-us/state-facts/pennsylvania>

⁹² <https://convene.com/catalyst/philadelphia-next-major-innovation-hub/>

⁹³ <https://ncesdata.nsf.gov/profiles/site?method=rankingBySource&ds=herd>



and VIP-Xcelerate, both of which have funded FoodTech startups. As a part of Philadelphia's Drexel University, the High-Pressure Plasma Energy, Agriculture and Biomedical Technologies (PEAB) IUCRC Centre investigates the applications of plasma in non-chemical / non-thermal plasma food processing⁹⁴. In addition, Saint Joseph's University Center for Food Marketing, located in the greater Philadelphia area, is a designated national center for food marketing by the USDA.

ENRICH in the USA Soft Landing Hubs: Initial contact points for Pennsylvania

Through the ENRICH J-1 Soft Landing Programs, interested participants can access Incubators/Innovation Centers of Universities dedicated to R&I in the FoodTech domain.

ENRICH in the USA has a Soft-Landing Hub located near the Pennsylvania industry clusters. These soft-landing hubs help SMEs to venture into North America, through a low-cost strategy and temporary visa. All the tools are provided, to conduct proof of concept tests, to connect with new strategic partners and potential clients, to revamp your product development, research, and intellectual property strategy within the U.S. market. Soft-landing hubs also ease access to local funding opportunities and grants to support research and commercialization efforts. Through the ENRICH J-1 Soft Landing Programs, interested participants can access Incubators/Innovation Centers of Universities dedicated to R&I in the FoodTech domain, namely: Temple University-SBDC.

Temple University – SBDC

Founded in 1884, is a public research and higher education institution. Temple University maintains eight campuses: one in Tokyo, Japan; one in Rome, Italy; and six in Pennsylvania, including a hospital. Temple University operates a number of research, teaching, and commercialization centers and institutes as a Carnegie Classified R1 "Doctoral University with Highest Research Activity" institution with a total operating budget of \$1.29B (fiscal year 2020).

Temple University's Small Business Development center (SBDC) is an outreach a center of Temple University's Fox School of Business and Management, where highly qualified and experienced staff give professional expertise and help to local and international businesses. Its objective is to assist pre-venture, startups, and SMEs in growing and succeeding locally and globally. Temple SBDC has been the US lead and coordinator of the North American ENRICH in the USA network of Hubs and university-based Soft-Landing incubators since January 2021.

⁹⁴ <https://drexel.edu/nyheimstitute/newsandevents/news/2018/March/NSF%20PEAB%20Research%20Center/>



2.2. Innovation facilitators

The US economy is deeply grounded on innovation as a source of economic growth⁹⁵. Public and private programs support the development of an entrepreneurial ecosystem, which is based on flexibility, diversity, creativity, and novelty⁹⁶. 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 FoodTech innovation process.

Accelerators support early-stage innovative companies through programs that offer education, mentorship, access to capital and investment, office space and supply chain resources over a fixed period⁹⁷. 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 to attract investment⁹⁸. Incubators support early-stage innovative companies with a nurturing environment and often provide affordable workspaces, 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^{99, 100}.

Science parks are areas, often created or supported by a college or university, where companies involved in scientific work and new technology are located¹⁰¹. Science parks are catalyzers 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 acceleration¹⁰².

Technology helps manufacturers to produce food more efficiently during every step of the process. Novel manufacturing technologies contribute to the improvement of shelf life and food safety, while the greater use of machines and software ensures affordability and consistent quality. Therefore, the importance of technology continues to grow, as the FoodTech innovation facilitators play a key role in supporting early-stage start-ups. However, despite the abovementioned, it is important to highlight that as it is the case with AgTech, FoodTech focused innovation facilitators are only a recent and growing phenomenon in the US¹⁰³. Therefore, in addition to the FoodTech specialized innovation

⁹⁵ <https://www.uschamberfoundation.org/enterprisingstates/assets/files/Executive-Summary-OL.pdf>

⁹⁶

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

⁹⁷ <https://smallbiztrends.com/2016/08/business-accelerator-differ-incubator.html>

⁹⁸ <https://hbr.org/2016/03/what-startup-accelerators-really-do>

⁹⁹ <https://www.bdc.ca/en/articles-tools/entrepreneur-toolkit/templates-business-guides/glossary/business-incubators>

¹⁰⁰ <https://www.british-business-bank.co.uk/finance-hub/what-is-a-business-incubator/>

¹⁰¹ <https://dictionary.cambridge.org/dictionary/english/science-park>

¹⁰² <http://www.unesco.org/new/en/natural-sciences/science-technology/university-industry-partnerships/science-and-technology-park-governance/concept-and-definition/>

¹⁰³ <https://agfundernews.com/what-is-agrifood-tech.html>



facilitators, the facilitators focused on the next-generation technologies that support FoodTech companies are also presented in this section.

Based on desk research, this Market Guide identifies 21 leading facilitators of innovation in the FoodTech sector, which are not focused on a specific FoodTech related field.

AGR Partners, Greater Sacramento Area (CA)

AGR Partners is a growth investment company that provides capital through non-controlling equity and subordinated debt to companies in food and agricultural sectors. To date, AGR Partners has invested over \$500 million. Only in the last four years, the company manages over \$1.0 billion and has made 16 investments in food processors, manufacturers, and agribusinesses platforms¹⁰⁴. The areas of interest include companies developing superfoods¹⁰⁵ and nutraceuticals¹⁰⁶, vegetable and animal-based protein and companies serving higher food demand needs in emerging markets.

<https://agrpartners.com/>

AgStart, Greater Sacramento Area (CA)

AgStart is a non-profit incubator that accelerates the growth of innovative AgTech and FoodTech companies. AgStart is based on a network-centric model and offers mentorship, education, facilities, and networking benefits to the resident companies. The incubator is supported through membership fees and the support from sponsors. Sponsors include Bayer, Ernst Young and HM Clause.

<https://www.agstart.org/>

Plug and Play Technology Center, Palo Alto (CA)

Plug and Play (PNP) Food & Beverage programs bring together start-ups, venture capitals (VCs), and corporations from around the globe to participate in growing the food industry. The programs are focused on the areas of personalized nutrition, food freshness & safety, automation, functional foods, protein & ingredient alternatives, asset tracking, distribution, and waste reduction. Major corporate partners include DuPont, Red Bull, Mondalez International, PepsiCo and Tyson Foods. Aside from FoodTech, PNP provides support in areas such as FinTech, travel and hospitality, InsurTech, health and

¹⁰⁴ <https://agrpartners.com/investments/>

¹⁰⁵ Superfoods can be defined as foods, mostly plant-based, that are thought to be nutritionally dense and thus, good for one's health.

¹⁰⁶ Nutraceuticals can be defined as products which, other than nutrition, are also used as medicine.



wellness, among others. PNP has assisted 2,000+ start-ups through 220+ corporate partners and 300+ venture capital partners.

<https://www.plugandplaytechcenter.com/food/>

UC Davis Big Bang!, Greater Sacramento Area (CA)

The annual UC Davis Big Bang! Business Competition provides startups with a platform for collaboration, development and testing of business visions and plans. The Big Bang! offers resources for team formation, education, mentorship and networking for aspiring and early-stage entrepreneurs. Since 2000, over 1,500 individuals and teams have participated in the annual UC Davis Big Bang! Business Competition. The UC Davis Big Bang! competition is also the largest annual business competition in the Sacramento region¹⁰⁷. The competition provides an excellent opportunity for new entrepreneurs from the food industry to benefit from the resources offered by one of the most prestigious universities for food science and food engineering in the World¹⁰⁸.

<https://gsm.ucdavis.edu/big-bang-business-competition>

FoodBytes by Rabobank, San Francisco Bay Area (CA)

Rabobank Group is a global financial services provider and one of the World's largest banks with over \$750 billion in assets. In the US, Rabobank is a premier bank for the food, agribusiness, and beverage industry.

FoodBytes! by Rabobank is a next-generation pitch competition and networking platform that aims to bring together the promising food and agriculture startups, corporates, and investors, helping them to grow further and pioneer new solutions.

<https://www.foodbytesworld.com/>

THRIVE, Virtual - San Francisco Bay Area (CA)

THRIVE is a global agrifood innovation platform in Silicon Valley that accelerates, invests, and works with entrepreneurs, investors, and Fortune 500 corporations to advance the future of food and agriculture industries through innovation. The accelerator supports FoodTech startups at all stages of

¹⁰⁷ <https://startupsac.com/20th-annual-big-bang-business-competition-launches-october-22/>

¹⁰⁸ <https://www.ucdavis.edu/news/food-ag-and-social-enterprise-innovations-make-big-bang>



development through both seed accelerator and corporate innovation programs, each with its requirements and benefits.

Seed start-ups are at the developmental stage, while growth start-ups already have a product in the market. Seed start-ups receive \$50,000 in investments and another \$50,000 in program value in return for 5% equity. Other benefits include working space, legal counsel, and mentorship.

<https://thriveagrifood.com/>

EnterpriseWorks Incubator at University of Illinois, Champagne (IL)

EnterpriseWorks is a startup incubator at the University of Illinois, Champagne Research Park. The incubator provides resources and facility space, and hosts meet ups and workshops. Early-stage technology companies from different areas, including the food industry, are encouraged to apply for tenancy. The incubator is owned and operated by the University of Illinois. To date, the incubator has launched more than 200 startup companies.

<https://researchpark.illinois.edu/locate-here/enterpriseworks-incubator/>

Indie Bio Program, San Francisco (CA) and New York City (NY)

Each startup that completes the intensive four-month program receives initial funding (normally \$250,000), lab and co-working space, specialized coaching, and a membership in IndieBio's extensive alumni network. To date, it has been involved in building over 200 firms¹⁰⁹. 42% of their companies are led by female founders, which is higher than in previous programs¹⁰⁹.

<https://indiebio.co/program/>

Seeds of Change Accelerator, Chicago (IL)

Owned by Mars Inc., the Seeds of Change startup accelerator supports innovative fast-growing healthy food startups and entrepreneurs. The Accelerator focuses on companies in the following areas: start-up food brands, innovative experiential offerings, new business models, and emerging technology. The companies that are involved in the program benefit from a grant of up to \$50,000 as well as a tailored four-month program to scale up operations.

<https://www.socaccelerator.com/>

¹⁰⁹ <https://indiebio.co/program/>



The Good Food Accelerator, Chicago (IL)

The accelerator is focused on building supply chains for sustainable local food with a focus on the CPG (Consumer Packaged Goods) brands. The fellowship program provides the necessary support for the scaling. The accelerator is based at 1871, a Chicago based center of innovation. The chosen companies and entrepreneurs are paired with industry-leading mentors and are connected to potential customers and investors. Essentially the program helps food entrepreneurs and companies expand the existing production, marketing and distribution of food. Other support provided includes coaching, mentoring, strategic support, and access to resources and sources of capital.

<https://familyfarmed.org/good-food-accelerator/>

The Hatchery, Chicago (IL)

The Hatchery is a non-profit food and beverage incubator focused on innovative startups and entrepreneurs from the food industry. The incubator offers access to networking events, financing, co-working space as well as teaching and coaching opportunities. The majority of Hatchery's tenants work in the consumer-packaged goods space, but the incubator also hosts FoodTech companies.

<https://thehatcherychicago.org/>

PepsiCo's Greenhouse Accelerator (Nation-wide)

Under the Greenhouse Accelerator initiative, up to ten chosen startups will be granted \$20,000 (€18,262) in funding and will participate in a six-month mentoring scheme designed to expedite their growth. This program entails personalized business optimization led by experts from various PepsiCo functions, including Research and Development, Nutrition Science, Supply Chain Management, and Business Development. The objective is to assist startups in addressing crucial early-stage business operations such as scientific and regulatory compliance, financial management, and the development of a robust business model. Upon program completion, one startup will receive an additional \$100,000 (€91,313) investment to further its expansion. Additionally, it will have the opportunity to continue collaborating with PepsiCo to augment its growth prospects.

<https://greenhouseaccelerator.com/>

Techstars Farm to Fork Accelerator, Greater Minneapolis Area (MN)

Techstars connects companies and startups with other entrepreneurs, experts, mentors, alumni, investors, community leaders, and corporations. Techstars operates three divisions: Techstars Start-



up Programs, Techstars Mentorship-Driven Accelerator Programs, and Techstars Corporate Innovation Partnerships.

Techstars Farm to Fork Accelerator is a mentorship-driven accelerator for startups from around the world. It is co-funded by Cargill and Ecolab. The accelerator is Techstars' first of a kind program that is focused on the tech and digital sides of food and agriculture industries. The program aims to identify the best entrepreneurs across the entire food value chain, including the food manufacturing and supply chains, food safety, food waste reduction and traceability.

<https://www.techstars.com/accelerators/farm-to-fork>

Pennovation Accelerator, Philadelphia (PA)

Pennovation Startup Accelerator is a six-week support program for innovative startups. The companies are hosted at the Pennovation Center and participate in weekly educational sessions presented by subject matter experts. Each company is paired with an experienced mentor. The Pennovation Accelerator concludes with Demo Day, where companies pitch to mentors, investors, and peers at the Pennovation Center. FoodTech is one of the focus areas of the program.

<https://pci.upenn.edu/>

Union Kitchen, Washington (DC)

With an emphasis on packaged goods, Union Kitchen supports firms in every step of the food tech supply chain. The program's ecosystem of kitchen spaces, distribution networks, and stores provide support for establishing and growing a business while reducing the need for additional financial expenditure. Since 2012, Union Kitchen has partnered with over 650 enterprises, generating over \$350 million (€319.47 million) in sales. Applications are constantly open.

<https://www.unionkitchen.com/>

TechSquare, Atlanta (GA)

Located in Atlanta, Georgia's Tech Square has the highest density of startups, corporate innovators, and academic researchers in the southeastern United States. It stretches across 10 blocks of Georgia Tech's campus, and it is comprised of accelerators, incubators, innovation centres and high-tech spaces and facilities. Incubators and accelerators located within the Tech Square, such as Advanced Technology Development Center, Enterprise Innovation Institute and CreateX, focus on the tech companies and startups from many different sectors and industries, including the FoodTech.

<https://techsquare.co/>



The Food Innovation Center at Rutgers University, Newark (NJ)

Established in 2000, The Food Innovation Center at Rutgers University is a food business incubator and accelerator. The Center supports established early-stage entrepreneurs and existing food companies through all stages of business development, from concept to commercialization. Support provided includes business, marketing, food safety, product design and scale up expertise within FDA and USDA certified facilities.

<https://foodinnovation.rutgers.edu/>

AF Ventures (formerly AccelFoods), New York City (NY)

AF Ventures, based in New York, is an incubator and venture fund that invests in innovative food and beverage companies. As one of the most active investors in the FoodTech sector, AF Ventures has supported the growth of numerous authentic, innovation driven startups, including plant-based food companies Alpha Foods and Jica Chips¹¹⁰. AF Ventures currently has over 30 portfolio companies under management. Their main focuses are the startups developing natural and organic brands.

<http://www.afventures.vc/>

Chobani Incubator, New York City (NY)

The Chobani Incubator is a New York City based program for startups and early seed companies operating in the food industry. The program supports the companies through grants, mentorship and training programs and the access to the incubator's investor network and expertise. The incubator has more than 150 mentors, a portfolio of 30 companies and a total grant funding of \$750,000.

In 2018, Chobani launched a residency for FoodTech companies. The Residency brings together food industry entrepreneurs from all the stages of the value chain and provides them with the operations, supply chain, logistics and quality assurance expertise.

<https://www.chobani.com/impact/incubator>

Cornell Food Processing Development Laboratory, New York City (NY)

¹¹⁰ <https://www.forbes.com/sites/douglasyu/2019/10/07/qa-with-100-women-led-vc-fund-accelfoods-on-investing-in-future-food-and-beverage/#f72130978a32>



The Cornell Food Processing Development Laboratory (FPDL) offers a unique food product development and manufacturing space that allows individuals and companies to perform research, develop new products, and start new food related businesses. In line with the diverse needs of industry, the laboratory offers spaces primarily for product testing, cheese and dairy product incubation (levels I and II) and short-term manufacturing and product development.

<https://foodscience.cals.cornell.edu/about-us/facilities/ithaca-facilities/food-processing-and-development-laboratory/>

Food-X, New York City (NY)

Food-X is an accelerator program that works with early-stage companies focused on the innovation in the food industry. Companies from any part of the food supply chain are considered, including food distribution, food processing, consumer packaged goods, food-related apps and green/clean tech. The accelerator program provides the startups with capital, hands-on help, mentorship, and the access to Food-X's global network. Food-X's partners include Amazon, HubSpot, Microsoft and Stripe. The accelerator program takes place over 14 weeks.

<https://food-x.com/>

2.3. Industry related RDI centers

Research can be considered as critical component for the development of the food industry in the United States. The research in food industry does not only bring innovation and improve the quality of the processes along the value chain, but it also provides additional contributions to public health, environmental, and global solutions. Therefore, the advancement of FoodTech requires an interdisciplinary approach that includes the contribution of researchers and industry members from different disciplines, such as engineering, computer science, environmental sciences, chemistry, biology, and physics.

Industry's collaboration with academic institutions expands the range of expertise and can support the development of innovations across the whole industrial value chain. Due to the increased applications of novel technologies, current global trends and industry's structural characteristics, the collaboration between industry and academia is especially important for the food industry. Therefore, a significant portion of FoodTech R&D solutions seem to be developed through the cooperation between industries and universities or research centers.

Some of the industry related RDI centers that demonstrate the value derived from such collaboration are highlighted in Table 2. These centers have been selected through desk research. Even though some of the identified centers are not located in the aforementioned innovation hubs (e.g.,



Industry/University Cooperative Research Center for Advanced Knowledge Enablement), they represent important contributors to the FoodTech innovation ecosystem.



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

Table 2 – A sample of industry connected RDI Centers in the FoodTech related fields

Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
California Institute of Food and Agricultural Research at UC Davis	UC Davis affiliates: College of Agricultural and Environmental Sciences, College of Biological Sciences, College of Engineering, Research Triangle Institute, Ctr. Ag & Environmental Biotechnology, National Renewable Energy Laboratory, Fuzhou University, Zhejiang University and Southern Yangtze University	DuPont Industrial Bioscience, Agrian, CreAgri, Fujian Fuda Biotech, and WildBee Fine Wine Inc	Davis, California	Digitalization, Novel Processing Technologies, Robotics, Sensor Technology, Sustainable Packaging	https://cifar.ucdavis.edu/
Center for Advanced Design and Manufacturing of Integrated Microfluidics (CADMIM)	University of California, Irvine University of Illinois in Chicago	ALine, Inc., Amgen, Inc., Asahi Kasei Corporation, Beckman Coulter, Corning, Inc., Corteva Agriscience, Agriculture Division of DowDuPont, ESI Group, Genomics Institute of the Novartis Research Foundation, Genus PLC, KWS SAAT SE, VTT Technical Research Center of Finland, Ltd. and Wainamics, Inc.	Chicago, Michigan and Irvine, California	Sensor Technology, Digitalization	www.inrf.uci.edu/cadmim
Center for Biophotonic Sensors and Systems (CBSS)	Boston University University of California at Davis	Nikon, Moxtek, InBios, Optfluidics, ThorLabs, Fraunhofer IPK	Boston, Massachusetts	Sensor Technology	http://www.bu.edu/cbss/

Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
Center for High Pressure Plasma Energy, Agriculture and Biomedical Technologies (PEAB)	University of Michigan Drexel University George Washington University		Camden, New Jersey; Washington, Washington DC and Ann Arbor, Michigan	Novel Processing Technologies	https://pstlab.engin.umich.edu/
Center for Particulate and Surfactant Systems (CPaSS)	University of Florida Columbia University	Colgate-Palmolive, L'oreal, Solvay, Unilever, Solvay, Ecolab, Johnson & Johnson, Nalco Championm, Unilever	Gainsville, Florida and New York, New York	Sensor Technology	http://iucrc.perc.ufl.edu/
Center for Innovative Food Technology (CIFT)	-	,	Toledo, Ohio	Novel Processing Technologies, Sustainable Packaging	http://ciftinnovation.org/
Department of Food Science at Purdue University	Purdue University	Cargill, Clabber Girl, Conagra Brands, Danone North America, General Mills, Heartland Food Products Group, Hershey's, Kalsec, Mead Johnson, Morgan Foods, Nestle R&D Center ¹¹¹ ,	West Lafayette, Indiana	Novel Processing Technologies, Sensor Technology, Sustainable Packaging	https://ag.purdue.edu/foodsci/Pages/default.aspx

¹¹¹ The list of Nestle R&D public-private partnerships can be found at https://www.nestle.com/sites/default/files/asset-library/documents/r_and_d/public-private-science-research-partnerships.pdf



Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
		PacMoore, PepsiCo, Red Gold, Skidmore Sales & Distributing Co., Verdure Sciences			
Food Processing and Innovation Center at Michigan State University	Michigan State University	US DoC, Michigan Department of Agriculture and Rural Development, Consumers Energy, MJS Packaging, Neogen, Highlight Industries	Michigan, Ohio	Novel Processing Technologies	https://www.canr.msu.edu/fpic/index
Food Research Institute at University of Wisconsin–Madison	University of Wisconsin – Madison	Coca Cola Crop, Campbell’s, Kraft Heinz, DuPont, General Mills	Madison, Wisconsin	Novel Processing Technologies, Sensor Technology	https://fri.wisc.edu/index.php
Food Technology Center at University of Idaho	University of Idaho	-	Caldwell, Idaho	Novel Processing Technologies, Sustainable Packaging	https://www.uidaho.edu/cals/food-technology-center
Foundation for Food and Agriculture Research	Universities across US that conduct research in the agricultural and food sectors	Bayer, General Mills, AgLaunch, PepsiCo, Cargill, Syngenta, McDonald’s, KWS SAAT SE, Rijk Zwaan, Tyson Foods and BASF	Washington, District of Columbia	Digitalization, Robotics, Sensor Technology, Sustainable Packaging	https://foundationfar.org/



Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
Institute for Food Safety and Health at Illinois Institute of Technology (Center for Processing Innovation)	Illinois Institute of Technology	Coca Cola, Starbucks, Nestle, Mars, Land O' Frost, NASA, Kraft Heinz, Unilever	Chicago, Illinois	Digitalization, Novel Processing Technologies, Robotics, Sensor Technology, Sustainable Packaging	https://www.ifsh.iit.edu/
Institute of Food and Agricultural Sciences at University of Florida	University of Florida Agriculture Institute of Florida	-	Gainesville, Florida	Digitalization, Novel Processing Technologies, Sensor Technology	https://ifas.ufl.edu/
Phonemics and Plant Robotics Center at University of Georgia	University of Georgia	-	Athens, Georgia	Sensor Technology, Robotics	https://pprc.uga.edu/
Robert Mondavi Institute for Wine and Food Science at UC Davis	UC Davis affiliates: UC Davis College of Agricultural and Environmental Sciences, UC Davis Department of Viticulture and Enology, UC Davis Department of Food Science and Technology, UC Davis Olive Center, UC Davis Honey and Pollination Center, Robert and	Wine Institute, Winebusiness.com, Pierre Spahni	Davis, California	Digitalization, Novel Processing Technologies, Robotics, Sensor Technology, Sustainable Packaging	https://rmi.ucdavis.edu/



Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
	Margrit Mondavi Center for the Performing Arts				
The Center for Food Safety at University of Georgia	University of Georgia	Cargill, Chipotle Mexican Grill, Chobani, Church Brothers Farms, The Coca-Cola Co, ConAgra Foods, Driscoll's of the Americas, Eurofins Food Integrity and Solutions, Foster Farms, General Mills, Hormel Foods, Kellogg's, Keurig Dr Pepper, Kraft Heinz Co., McDonald's Corp., RB-Infant & Nutrition, Nestlé, PepsiCo, Publix Super Markets, Starbucks Coffee Co., Unilever Foods, Yum! Brands	Griffin, Georgia	Novel Processing Technologies, Sensor Technology	https://cfs.caes.uga.edu/
The Cornell Institute for Food Systems	Cornell University	Nestle Health Science, Rheonix, Wegmans, Campbell's Soup Company, Chr. Hansen, DFA, Land O'Lakes, Mengniu Dairy, Siena Development	New York City, New York	Digitalization, Novel Processing Technologies, Robotics, Sensor Technology,	https://foodscience.cals.cornell.edu/industry-partnership-program/



Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
				Sustainable Packaging	
The Food Industry Center at University of Minnesota	University of Minnesota	CHS, General Mills, Kelloggs, Land O'Lakes, Midwest Dairy Association, NPD, Old Dutch, Sun Opta, and SuperValu	St. Paul, Minnesota	Digitalization, Novel Processing Technologies, Robotics, Sensor Technology, Sustainable Packaging	http://foodindustrycenter.umn.edu/
The Food Innovation Center at Rutgers University	Rutgers University	Omega, Mazars, NJ Food Processors Association	Newark, New Jersey	Digitalization, Novel Processing Technologies, Robotics, Sensor Technology, Sustainable Packaging	https://foodinnovation.rutgers.edu/
The Food Processing Center at University of Nebraska-Lincoln	Nebraska Manufacturing Extension Partnership University of Nebraska-Lincoln	-	Lincoln, Nebraska	Novel Processing Technologies, Sensor Technology	https://fpc.unl.edu/
The WG Center for Innovation and Technology	-	Taylor Farms, JV Smith companies, Trimble, Bosch, Sun world Innovations, Rava Ranch, Terranova, AeroVironment, AT&T,	Salinas, California	Digitalization, Robotics, Sensor Technology	http://www.wginnovation.com/



Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
		BioWorks, Wells Fargo, Yamaha and Bayer			
Western Center for Food Safety at UC Davis	University of California at Davis The Food and Drug Administration Western Institute for Food Safety and Security	-	Davis, California	Novel Processing Technologies, Sensor Technology	https://www.wcfs.ucdavis.edu/



3 US market landscape

The agrifood industry has a significant role in the US economy, with a complex food value chain that spans from farm producers to food consumers and includes farming, processing, packaging, storage, transportation, and retail sales. The industry is responsible for meeting the continuous needs of 320 million American consumers, as well as many consumers overseas. In 2021, 10.5% of the total US employment was related to the agrifood industry (21.5 million people)¹¹².

In the past decade, the food and beverage market in the US has been experiencing a major transformation, primarily driven by the shift in the consumer value drivers. In that sense, the former “niche” portions of the market are rapidly gaining significance, while the new market environment is constantly evolving. According to Deloitte’s Report titled “Capitalizing on the shifting consumer food value equation”, the five main evolving trends that are driving the change are: health & wellness, safety, social impact, experience, and transparency¹¹³.

Within a complex food value chain, the USDA recognizes twelve industry groupings, based on the importance of their contributions to the market value of food^{114, 115}. Aggregated, the total contribution of these 12 industry groups, which include the food industry and related sectors, was \$1.26 trillion (€1.15 trillion) to the US GDP in 2021, or 5.4% of the total US GDP¹¹⁶. Out of the 12 industry groups, the highest value added to the US Economy was from food services (37.4%), food processing (14.9%) and retail trade (12.3%)¹¹⁷.

The food and beverage manufacturing sector is responsible for transforming raw agricultural materials into intermediate foodstuffs, animal feed, or edible products¹¹⁸. It does not include the food wholesale, retailing, or service sectors. Therefore, within the USDA’s 12 industry groupings, the food and beverage manufacturing sector is represented by the food processing industry grouping, which is defined as “all establishments classified within the food and beverage manufacturing industries, and all subcontracting establishments”⁸⁰.

The US food processing sector is extensively regulated by both the state and federal agencies. Federal agencies are mainly responsible for the regulatory oversight. The sector is divided in two categories: meat and poultry and all other food processing businesses. USDA Food Safety and Inspection Service (FSIS) is responsible for the oversight of the meat and poultry processing businesses and FDA for the oversight of all other food processing businesses. State agencies have an active role in overseeing food

¹¹² <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/ag-and-food-sectors-and-the-economy/#:~:text=Agriculture%20and%20its%20related%20industries,percent%20of%20total%20U.S.%20employment>

¹¹³ <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/consumer-business/us-fmi-gma-report.pdf>

¹¹⁴ <https://www.ers.usda.gov/data-products/food-dollar-series/documentation.aspx#industry>

¹¹⁵ Agribusiness, Farm Production, Food Processing, Packaging, Transportation, Wholesale Trade, Retail Trade, Food Service, Energy, Finance and Insurance, Advertising, Legal and Accounting.

¹¹⁶ <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/ag-and-food-sectors-and-the-economy/>

¹¹⁷ <https://data.ers.usda.gov/reports.aspx?ID=17885>

¹¹⁸ https://www.ers.usda.gov/webdocs/publications/44951/11777_err130_1_.pdf?v=0

processing businesses within their respective states; however, their role is limited to the collaboration with the federal agencies¹¹⁹.

Due to the size and complexity of the US FoodTech sector, this guide focuses on the food and beverage manufacturing process and identifies leading US regions for the areas based on the geographical concentration of food and beverage manufacturers, as well as the key considerations for EU businesses interested in accessing the US FoodTech market.

3.1. Market overview

The total value of food manufacturing industry shipments in the US, for 2019, is estimated to be \$797.4 billion (€727.84 billion)¹²⁰. Over the past 3 years, the industry has grown at an annual rate of 1.4% with an estimated total of 22,500 companies in the industry. The average sales per company are estimated to be around \$35.5 million (€32.4 million). The average Fixed Asset Turnover ratio of the companies in the industry is 2.7, while the industry operating expenses have grown by 2.8% in the past year¹²¹. According to the latest data from USDA ERS, the share of food and beverage manufacturing value added represented 14.7% in all US manufacturing. Furthermore, the number of employed people in the food and beverage manufacturing sector¹²² is estimated to 2 million or 1% of the total employment⁷³. The five largest food and beverage companies for 2023 in the U.S. are PepsiCo Inc., Tyson Foods Inc., Nestle, JBS USA and Kraft Heinz Co^{123,124}.

In the US, food and beverage manufacturing is, more than other manufacturing sectors, largely a domestic industry producing for the domestic market. Much of the value added comes from workers on the production floor.

Meat processing represents the largest single component of food and beverage manufacturing, with 26.2% of the total shipments in 2021. Other important components include dairy (12.8%), beverages (11.3%), grains and oilseeds (10.4%), fruits and vegetables (8%), and bakery and tortilla products (8%)⁷³. As noted from the previous section, the food processing sector contributes to the US economy with an added value of \$157 billion. The US Department of Commerce stated, in 2021, that there were over 41,080 US food and beverage processing establishments (plants) in the US, mostly in the states of California, Texas and New York⁷³.

¹¹⁹ <https://www.ndsu.edu/pubweb/~saxowsky/aglawtextbk/chapters/foodlaw/USagencies.html>

¹²⁰ <https://fred.stlouisfed.org/series/A11SVS>

¹²¹ <https://www.marketresearch.com/Kentley-Insights-v4035/Food-Manufacturing-Research-COVID-Forecasts-13184442/>

¹²² According to the North American Industry Classification System (NAICS) codes 311 and 312. The employment number also accounts for the employment in tobacco manufacturing.

¹²³ <https://www.foodprocessing.com/top100/2023>

¹²⁴ Based on the annual revenue in the US.



Some of the leading players in the United States Food Processing Equipment Market include Bucher Industries, Alfa Laval, GEA Group, Fenco Food Machinery, Krones AG, JBT Corporation, Rexnord Corporation, Marel, SPX Corporation and Buhler AG¹²⁵.

As it is the case with the whole food value chain, the US food and beverage manufacturing industry has been transforming significantly in the past years. Namely, consumers are putting more emphasis on healthier food, primarily the contribution of sugar, salt, and fat to nutrition-related problems. These trends are currently having a direct impact on the dynamics of the industry and are shifting the manufacturers towards the development of technologies that reduce detrimental changes in food and maintain the nutritional value. In addition, due to climate and the environment concerns, food and beverage manufacturers are required to reduce energy consumption and minimize the waste¹²⁶.

In other words, the manufacturers are making sustainability the standard, significantly opening more to the new processing technologies as well as the trends such as digitalization and robotics. In addition, consolidation is occurring among many manufacturers, where plant sizes have increased sharply, and mergers have led to fewer but larger companies. The consolidation has been facilitated primarily by the change in the processing plant technologies and the emergence of new scale economies.

It should be noted that among the different market segments, the Plant-Based market is emerging as one of the fastest growing markets in the US food industry. The market has recorded a growth of 11% in the past year and 29% over the past two years to reach the present market value of \$5 billion (€4.56 billion). Consequently, across all key sectors in the US, the dollar sales of plant-based foods are growing significantly, while dollar sales of conventional animal foods are declining or growing modestly¹²⁷.

3.2. Leading regions

Considering the size of the US FoodTech market, there are states that can be considered leading regions from a market perspective. For this guide, the US leading regions in the food and beverage manufacturing industry were identified by analyzing the geographical concentration (number of food and beverage manufacturing plants and number of food and beverage manufacturing businesses) of certain sub-sectors of food and beverage industry that may be of interest to EU FoodTech businesses.

The geographical concentration of US food and beverage manufacturers was identified based on the North American Industrial Classification Codes (NAICS) and Census Bureau's County Business Patterns 2017¹²⁸. 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

¹²⁵ <https://www.techsciresearch.com/report/united-states-food-processing-equipment-market/2030.html>

¹²⁶ <https://www.deskera.com/blog/sustainable-practices-in-food-manufacturing/>

¹²⁷ <https://www.gfi.org/marketresearch>

¹²⁸ <https://www.census.gov/programs-surveys/cbp.html>



standard used by federal statistical agencies in classifying establishments¹²⁹. 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 economy¹³⁰. Considering the US FoodTech market, for the identification of the food and beverage manufacturing businesses, this guide applied two different NAICS: 311 (food manufacturing) and 3121 (beverage manufacturing). For the identification of the food and beverage manufacturing plants, eight different NAICS were used: 3114 (fruit and vegetable preserving and specialty food manufacturing), 3115 (dairy product manufacturing), 3117 (seafood product preparation and packaging), 3119 (other food manufacturing), 3121111 (soft drink manufacturing) and aggregated 312120, 312130 and 312140 (breweries, wineries and distilleries).

In this context, food and beverage manufacturers were the main target market for businesses commercializing FoodTech products from the following categories: Digitalization, Novel Processing Technologies, Robotics, Sensor Technology and Sustainable Packaging. Thus, the states with the highest concentration of food and beverage businesses and manufacturing plants were highlighted as important market opportunities for businesses providing FoodTech products. This approach identified five states, which particularly stand out: California, Illinois, Texas, Washington and New York.

Although there are other types of sectors that may also represent important opportunities for the EU businesses related to FoodTech, the scope of this guide 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 FoodTech sub-sectors.

Food and beverage manufacturing businesses in the US

In the US, there are 398 verified businesses related with food and beverage manufacturing of which 243 (61%) invest an average of \$50,000 (€46,000) or more in technology per year. These numbers are

¹²⁹ <https://siccode.com/en/pages/what-is-a-naics-code>

¹³⁰ <https://www.census.gov/eos/www/naics/>



seemingly low, since the identified businesses are the headquarters of food and beverage manufacturing businesses. Therefore, the number does not include all manufacturing facilities.

Figure 4 provides a US map that highlights the areas with higher concentrations of food and beverage manufacturing verified businesses.

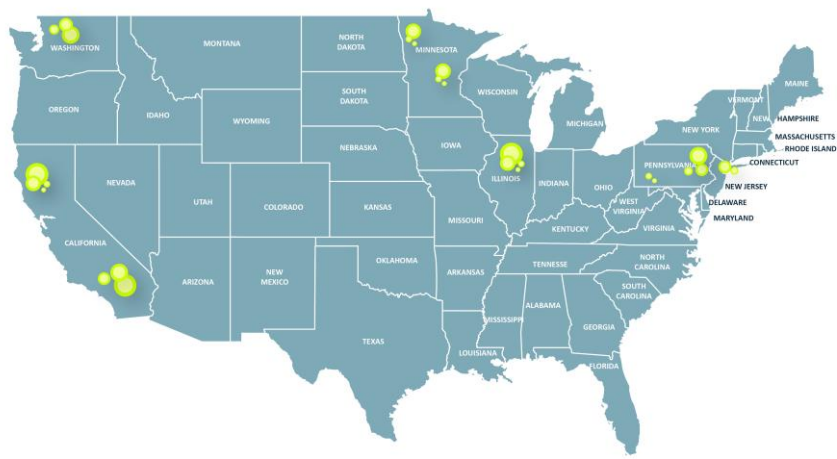


Figure 4 – US areas with higher concentration of food and beverage manufacturing businesses

Figure 5 shows the US states with the highest concentrations of food and beverage manufacturing businesses. According to Figure 5, California is the state with the highest geographical concentration of food and beverage manufacturing businesses. California is followed by Illinois and New York. Hence, these states represent an important market opportunity for EU FoodTech businesses that target food and beverage manufacturers.

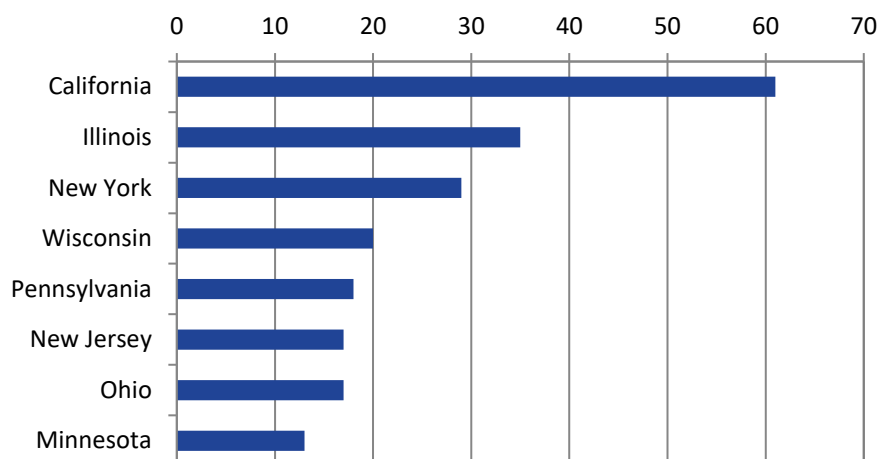


Figure 5 – US states with the highest concentration of food and beverage manufacturing businesses

Considering that large companies in the food and beverage manufacturing sector make extensive use of cutting edge FoodTech, the technology expenditure these manufacturing businesses is an important indicator for EU businesses that develop technologies relevant for food and beverage manufacturing. In this context, from a market perspective, the US states with the highest concentration of food and beverage manufacturing businesses that spend on average over \$50,000 (€46,000) in technology per year represent important areas in terms of business opportunities.

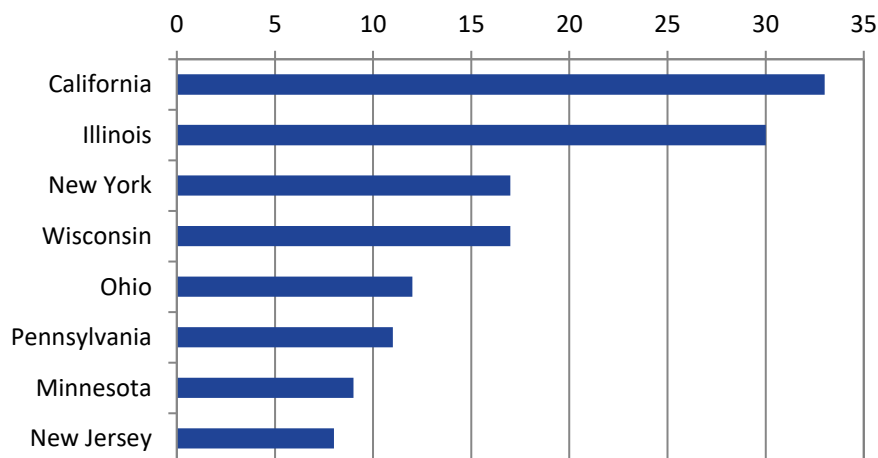


Figure 6 – US states with the highest concentration of food and beverage manufacturing businesses which individually invest an average of \$50,000 or more in technology annually

According to Figure 6, California is also the state with the highest concentration of food and beverage manufacturing businesses that spend on average over \$50,000 (€46,000) in technology per year. Furthermore, it is important to emphasize that the state of Illinois is ranked as second, closely behind California in terms of technology expenditure of food and beverage manufacturing business. Together

Illinois and California host one fourth of the US food and beverage manufacturing businesses, which individually invest an average of \$50,000 (€46,000) or more in technology annually. In this context, these two states can be considered as leading regions for EU FoodTech businesses that target food and beverage manufacturing businesses.

Total number of food and beverage manufacturing plants in the US

According to the Census Bureau's County Business Patterns, in 2017, there was a total of 36,555 food and beverage manufacturing plants in the US. As seen in Table 3, the highest concentrations of food and beverage manufacturers are in the states of California, New York and Texas. In addition, ten states with the most food and beverage manufacturing plants represent more than half (54%) of all food and beverage manufacturing plants in the US.

Table 3 – Total number of food and beverage manufacturing plants in the US

#	State	Total number of food and beverage manufacturing plants	Percentage of total
1	California	5,731	16%
2	New York	2,573	7%
3	Texas	2,273	6%
4	Pennsylvania	1,604	4%
5	Illinois	1,450	4%
6	Washington	1,366	4%
7	Florida	1,333	4%
8	Wisconsin	1,158	3%
9	Ohio	1,123	3%
10	New Jersey	1,121	3%

If the food and beverage manufacturing sectors are observed separately, California remains the state with the highest number of both food manufacturing and beverage manufacturing plants in the US. Food manufacturing occurs in all 50 US states with a total of 27,519 plants. 3,624 or 13% of all food manufacturing plants are in California. California is followed by New York (8%) and Texas (7%). Likewise, beverage manufacturing occurs in all 50 US states with a total of 9,036 plants. Almost one fourth (23%) of all beverage manufacturing plants in the US, are in California. California is followed by Washington (6%) and New York (6%).



Table 4 – Food and beverage manufacturing plants with over 100 employees

#	State	Food and beverage manufacturing plants	Food manufacturing plants	Beverage manufacturing plants
1	California	481	381	100
2	Texas	217	187	30
3	Illinois	207	199	8
4	Pennsylvania	195	171	24
5	Wisconsin	179	173	6
6	Georgia	142	133	9
7	Ohio	138	124	14
8	New York	130	117	13
9	Minnesota	121	116	5
10	Indiana	105	93	12

If the food and beverage manufacturing plants with over 100 employees are observed, the market landscape remains largely unchanged (Table 4). California has the highest number of food and beverage manufacturing plants with over 100 employees, followed by Texas and Illinois. Within California, 8% of all food and beverage manufacturing plants have over 100 employees. One exception is the state of New York, which is the second US state by the total number of food and beverage manufacturing plants but is only the 8th US state by the number of food and beverage manufacturing plants with over 100 employees. Plants with over 100 employees only represent 4.5% of the total food and beverage manufacturing plants in New York.

Fruit and vegetable preserving and specialty food manufacturing

In terms of fruit and vegetable preserving and specialty food manufacturing plants, California and Texas are top producers in the US (Figure 7). The total US production occurs in 47 states. From a total of 1900 plants, 333 plants or 18% are in California. A majority of all plants (59%) are located across ten states.



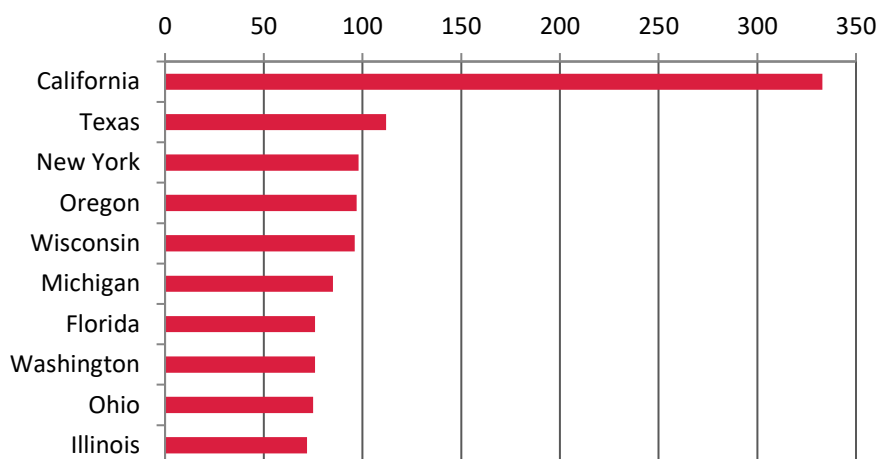


Figure 7 –Ten US states with the highest number of fruit and vegetable preserving and specialty food manufacturing plants

Within California, 20% or 67 fruit and vegetable preserving and specialty food manufacturing plants have over 100 employees, which is also the highest number in the US. The other two states with the highest number of plants employing over 100 people are Washington (24 plants) and Illinois (21 plants).

Dairy product manufacturing

In terms of dairy product manufacturing plants, Wisconsin, California, and New York are top producers in the US (Figure 8). The total US production occurs in 47 states. From the total of 1684 plants, 229 plants or 14% are in Wisconsin. From all dairy product manufacturing plants in the US, a majority (62%) are located across ten states.

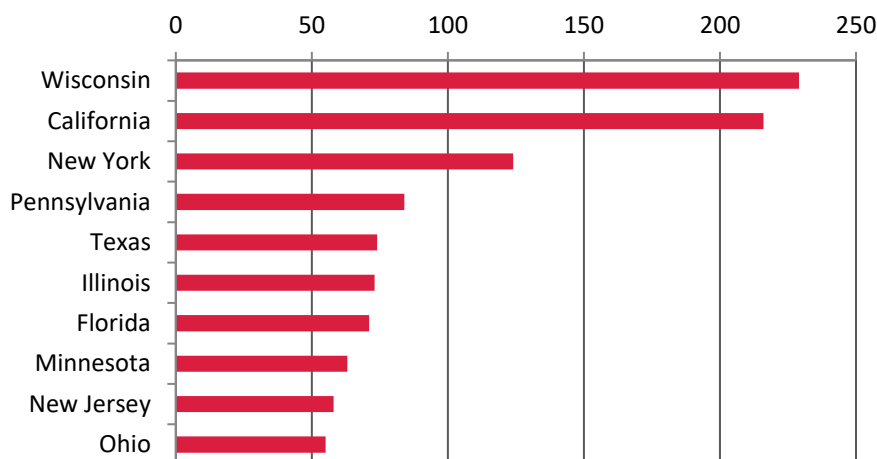


Figure 8 – Ten US states with the highest number of dairy product manufacturing plants



Within Wisconsin, 32% or 74 dairy product manufacturing plants have over 100 employees, which is also the highest number in the US. The other two states with the highest number of plants employing over 100 people are California (49 plants) and New York (30 plants).

Seafood product preparation and packaging

Alaska, Washington, and California are the states with the highest concentration of seafood product preparation and packaging plants in the US (Figure 9). The total US production occurs in 25 US states. From the total of 539 plants, 94 plants or 17% are in Alaska. This figure does not include the processing that occurs on fishing vessels at sea. From all of seafood product preparation and packaging plants in the US, almost three quarters (74%) are located across ten states.

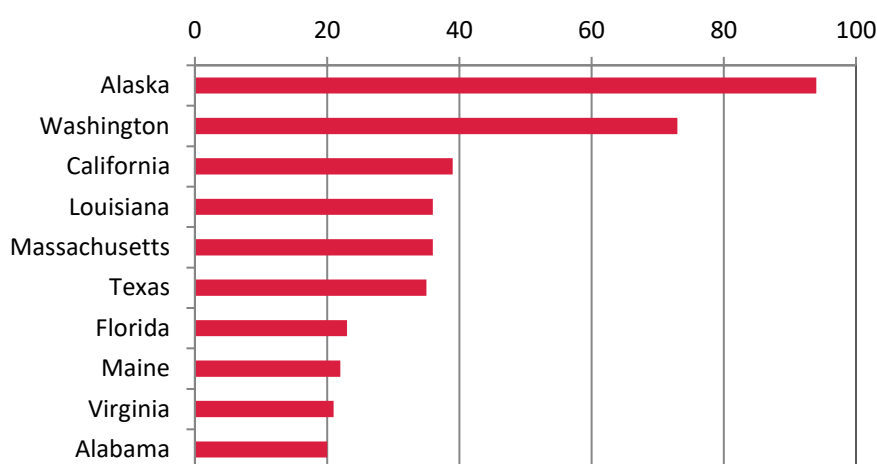


Figure 9 – Ten US states with the highest number of seafood product preparation and packaging plants

Within Alaska, 14% or 13 seafood product preparation and packaging plants have over 100 employees. However, Alaska is not the state with the highest number of plants with over 100 employees in the US. This is held by the state of Washington (16 plants). Washington is followed by Alaska (13 plants) and Mississippi (5 plants).

Other Food Manufacturing

NAICS code 3119, labeled as “other food manufacturing” encompasses 8 food manufacturing sub-sectors: roasted nuts and peanut butter manufacturing, other snack food manufacturing, coffee and tea manufacturing, flavoring syrup and concentrate manufacturing, mayonnaise, dressing, and other prepared sauce manufacturing, spice and extract manufacturing, perishable prepared food manufacturing, all other miscellaneous food manufacturing^{131, 132}. Altogether, 3,857 food

¹³¹ 6-digit NAICS codes are 311911, 311919, 311920, 311930, 311941, 311942, 311991, 311999.

¹³² <https://www.naics.com/naics-code-description/?code=3119#topbusinesses>



manufacturing plants operate under this NAICS code. The production occurs in all 50 US states. From the total 3,857 plants, the highest number of plants (622 plants or 16%) is in California (Figure 10). California is followed by Texas (6%) and New York (6%). From all the food manufacturing plants in the US registered under the NAICS code 3119, a majority (55%) are located across ten states.

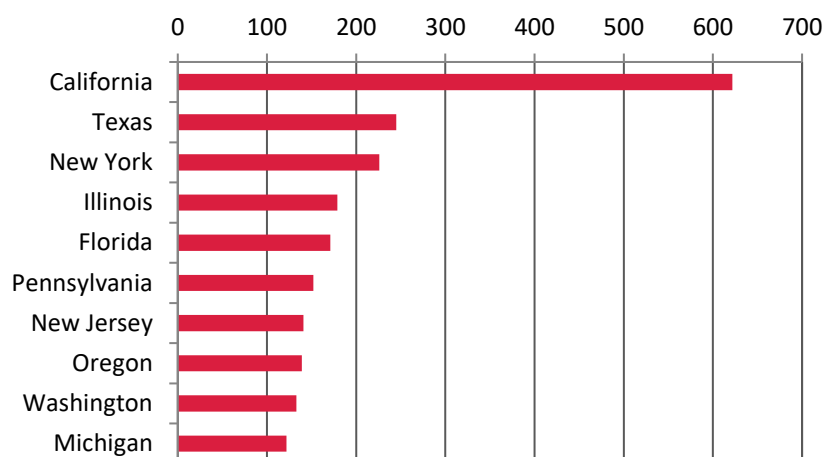


Figure 10 – Ten US states with the highest number of other food manufacturing plants

Within California, 14% or 85 other food manufacturing plants have over 100 employees, which is also the highest number in the US. The second and third states with the highest number of plants employing over 100 people are Pennsylvania (32 plants) and Texas (31 plants).

Soft drink manufacturing

California, Texas, and Florida are the states with the highest concentration of soft drink manufacturing plants in the US (Figure 11). The total US production of soft drinks occurs in 40 states. From the total of 527 plants, 75 plants or 14% located in California. From all the soft drink manufacturing plants in the US, a majority (57%) are located across ten states.

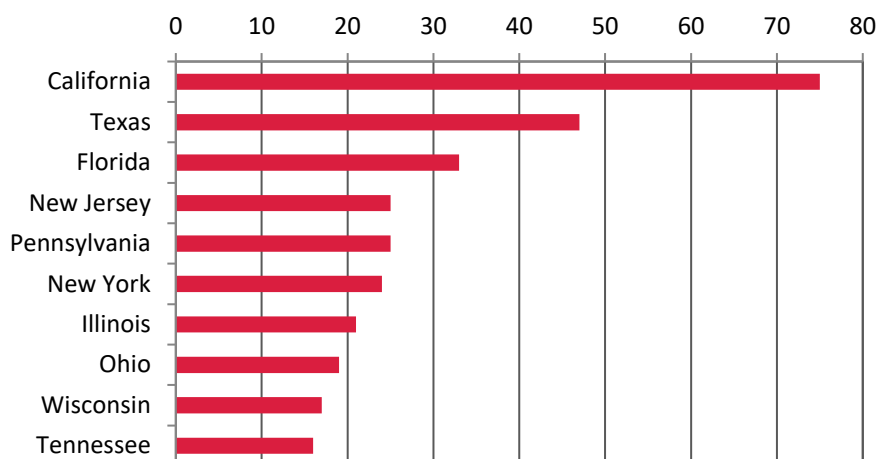


Figure 11 – Ten US states with the highest number of soft drink manufacturing plants

Within California, 28% or 21 soft drink manufacturing plants have over 100 employees, which is also the highest number in the US. California is followed by Texas (20 plants) and Florida (12 plants).

Other beverage manufacturing (Breweries, Wineries and Distilleries)

For this guide, manufacturing plants operating under NAICS codes: 312120, 312130 and 312140 (Breweries, Wineries and Distilleries), are analyzed together. Combined, there are 7,790 beverage manufacturing plants operating under these three codes. The production occurs in all 50 US states. From a total of 7,790 plants, the highest number of plants (1,963 plants or 25%) are in California (Figure 12). From all the beverage manufacturing plants in the US registered under these three codes, a majority (65%) are located across ten states.

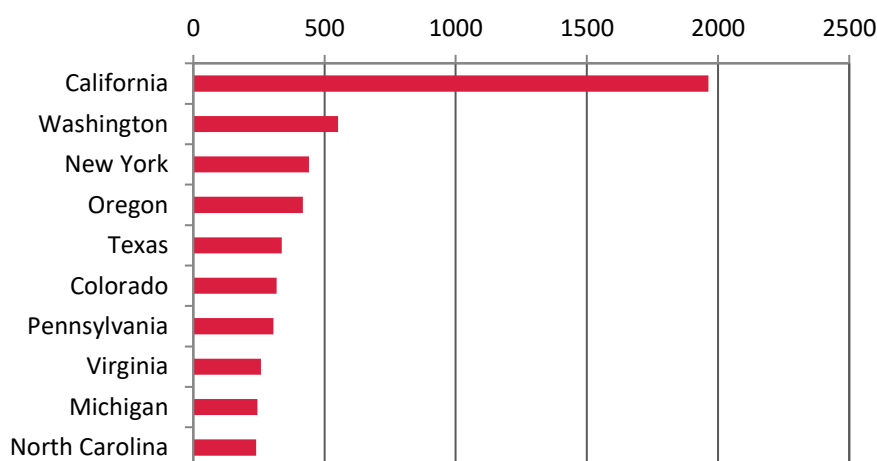


Figure 12 – Ten US states with the highest number of other beverage manufacturing plants¹³³

Within California, 3% or 65 of the other beverage manufacturing plants have over 100 employees, which is also the highest number in the US. California is followed by Pennsylvania (6 plants) and Kentucky (6 plants).

3.3. Market considerations

3.3.1. Opportunities

Technology budget increases

Innovation driven improvements in productivity are essential for the food manufacturers to remain competitive. With the consumer demands constantly shifting and regulations changing, the US food and beverage manufacturers constantly face the threat of production slowing down. As a result, the industry is continually seeking new ways to improve efficiency and increase manufacturing capability. According to the 2019 State of Manufacturing Survey in the US, 52% of the responding manufacturing companies stated that their budget for production, packaging and processing equipment has increased, with 30% of those noting the budget increased by more than 25%. Three quarters of the manufacturers surveyed stated that they are expecting to purchase process control hardware/or software this year for all the manufacturing locations (on average 3 purchases per company). The top three purchases of process control hardware and software are digital sensors/transmitters, lab analysis equipment/software, and plant control systems or upgrades¹³⁴.

Opportunities at several stages of the value chain

The food industry in the US is a vast and dynamic space with a significant impact on the economy. Consequently, FoodTech is applied at several stages of the value chain. On the global level, the FoodTech investment activity has been booming in the past year, with the largest share of the deal activity occurring in the US and the US being the country with the highest value of the investments¹³⁵. Considering the FoodTech R&D activity covers a different set of applications, opportunities at several levels of the value chain should be explored within the US market, where the investment in different areas is higher than in other regions at the global level.

¹³³ Combined Breweries, Wineries and Distilleries

¹³⁴ <https://www.foodengineeringmag.com/articles/98519-2019-state-of-food-manufacturing-survey>

¹³⁵ <https://agfunder.com/research/agfunder-agrifood-tech-investing-report-2019/>



A trend of increasing automation in the food manufacturing industry

According to estimates from Deloitte and the Manufacturing Institute, approximately 4.6 million industrial jobs might be unfilled over the next decade in the US, due to a combination of retirements and new jobs created by industrial growth¹³⁶. The lack of available labor is one of the biggest ongoing challenges to the food and beverage manufacturing industry¹³⁷. Due to increasing cost of labor and lower availability, automation is becoming more important for the food manufacturers. Therefore, the food and beverage manufacturing industry in the US continues to see huge interest in and adaptation of automation, as automated processes, and procedures, also help in improving the efficiency of the manufacturing operations.

3.3.2. Barriers

Regulatory requirements

The US regulatory regime is highly complex and diverse. When importing machinery, electrical and electronic equipment into the US, companies need to comply with several government regulations. As an example, most machinery is subject to EPA regulations, meaning that during the importation process, companies might have to submit the completed EPA Standard form 3520-21 to the US Customs and Border Protection^{138, 139, 140}. With regards to food manufacturing, the US agencies impose strict regulations to ensure that the manufactures meet high food quality and safety standards. As an example, the Food Safety Modernization Act requires food processors to use equipment that meets rigorous design standards, such as 3-A Sanitary Standards and National Science Foundation standards for food equipment, among others^{141, 142}. Taking this into account, the EU technology companies that provide manufacturing solutions need to be compliant with the US regulatory requirements to be able to export to the US.

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 subjected to US direct or indirect taxes¹⁴³. Moreover, the US tariffs imposed on specific imported goods may also vary depending on the good's composition¹⁴⁴. Therefore, EU FoodTech businesses that provide technologies

¹³⁶ <https://www2.deloitte.com/us/en/pages/manufacturing/articles/future-of-manufacturing-skills-gap-study.html>

¹³⁷ <https://www.foooddive.com/news/food-manufacturing-is-hungry-for-workers/541438/>

¹³⁸ EPA Standard form: Importation of Engines, Vehicles, and Equipment Subject to Federal Air Pollution Regulations

¹³⁹ <https://nvlpubs.nist.gov/nistpubs/ir/2017/NIST.IR.8118r1.pdf>

¹⁴⁰ https://usacustomsclearance.com/process/importing-machinery-to-usa/#Possible_Government_Regulations_for_Importing_Machinery

¹⁴¹ <https://www.3-a.org/>

¹⁴² <http://www.nsf.org/services/by-industry/food-safety-quality/food-equipment-certification>

¹⁴³ <https://www.gov.uk/guidance/exporting-to-the-usa#taxation-in-the-us>

¹⁴⁴ <http://www.pewresearch.org/fact-tank/2018/03/28/u-s-tariffs-vary-a-lot-but-the-highest-duties-tend-to-be-on-imported-clothing>



composed of several pieces of equipment may face higher tariffs when shipping the complete systems to the US instead of shipping in pieces and assembling in the US.

Procedures related with importing machinery and electrical equipment

The Container Security Initiative 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 food manufacturing machinery and equipment to the US¹⁴⁵.

¹⁴⁵ <https://ustr.gov/sites/default/files/2023-03/2023%20NTE%20Report.pdf>



4 Recognized networks and events

Networks and events are crucial to enhance the connection between researchers and between academia and industry at both national and international levels. Keeping in mind the technologies applied in the food industry are constantly evolving because of the changing consumer demands, networks and events provide a great opportunity for researchers and industry representatives to share knowledge and experience.

EU researchers and industry representatives are recommended to contact the key US FoodTech related networks as well as to attend events focused on FoodTech located in the US. These actions could ensure they are kept updated on the latest emerging innovation and market trends in the US FoodTech sector.

Through gaining knowledge of the relevant FoodTech related networks and organized events, one can determine the most effective approach to establish relevant contacts in the US community to pursue innovation and industry collaborative opportunities.

4.1. Innovation and market networks/ associations

Innovation as a collaborative phenomenon has led to the development of the concept of innovation/market networks¹⁴⁶. Innovation/market networks are collaborative platforms of individuals, small and large corporations, start-ups, academic and government institutions which aim to cooperate to create new ideas, products, services, or business models¹⁴⁷. Thus, innovation/market networks can foster important linkages between FoodTech actors to promote the advancement of technologies¹⁴⁶. The SME's ability to build a network is crucial to access a constant flow of information and skills that can meet the needs of the moment. The networks and the strategic cooperation that arises from them, allow SMEs to compete and innovate in a dynamic business environment. The success of a company largely depends on its collaboration with other organisations that influence the creation and delivery of its products or services.

Moreover, the development of innovation processes has contributed to the increase of the role of innovation activities in SMEs and start-ups. However, most SMEs and start-ups do not own innovation capacities and face financial constraints. Thus, innovation/market networks can help SMEs and start-ups to reach innovation targets, access complementary resources, attract investment and advance technologies¹⁴⁸.

¹⁴⁶ <http://www.emeraldinsight.com/doi/full/10.1108/JBIM-03-2015-0042>

¹⁴⁷ <https://innolytics.net/innovation-network/>

¹⁴⁸ <https://www.oecd-ilibrary.org/sites/f5539f94-en/index.html?itemId=/content/component/f5539f94-en>



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^{149, 150}. Professional associations are a crucial segment of the US Industry. In 2013, membership organizations alone employed over 1.3 million people in the US¹⁵¹.

Table 5 provides a brief description of some of the main research networks/ professional associations in the FoodTech related fields.

¹⁴⁹ <https://www.vocabulary.com/dictionary/professional%20association>

¹⁵⁰ <http://www.dictionary.com/browse/professional-association>

¹⁵¹ <http://www.thepowerofa.org/wp-content/uploads/2012/03/PowerofAssociations-2015.pdf>





Table 5 – Examples of key US FoodTech related networks and associations

Network	Main goal	Internet link
<u>International networks and associations</u>		
American Association of Meat Processors	The American Association of Meat Processors (AAMP) is North America's largest meat trade organization. AAMP's mission is to provide quality service, knowledge through education, regulatory representation, and networking opportunities for AAMP's members.	https://www.linkedin.com/company/american-association-of-meat-processors/
Institute for Thermal Processing Specialists	Institute for Thermal Processing Specialists (IFTPS) is an International Organization with a mission to provide leadership and education for thermal processing specialists to enhance awareness and ensure public health safety by using the knowledge of a diverse membership through communication, networking, research and establishing best practices.	https://www.iftps.org/
International Association for Food Protection	International Association for Food Protection (IAFP) is a member-based association of more than 4,500 food safety professionals committed to Advancing Food Safety Worldwide by providing food safety professionals worldwide. Working together, IAFP members, representing more than 50 countries, help the association achieve its mission through networking, educational programs, journals, career opportunities and numerous other resources.	https://www.foodprotection.org/
International Foodservice Manufacturers Association	The International Foodservice Manufacturers Association (IFMA) is a trade association comprised of the food, equipment and supply manufacturers in the foodservice industry, as well as related marketing service organizations, trade publications, distributors and brokers. By providing insights, developing best practices and fostering connectivity through events, IFMA's mission is to serve as a business partner to its members by bringing them relevant, actionable services that are fundamental to their business assessment, planning and execution.	https://www.ifmaworld.com/
The International Food and Beverage Technology Association	The International Food and Beverage Technology Association (IFBTA) is a nonprofit trade association, promotes the use of technology within the global food and beverage industries with a specific focus on education, certification, standards, research and networking.	https://ifbta.org/



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



Network	Main goal	Internet link
<u>National networks and associations</u>		
Association for Packaging and Processing Technologies	The Association for Packaging and Processing Technologies is a trade association representing more than 900 North American manufacturers and suppliers of equipment, components and materials as well as providers of related equipment and services to the packaging and processing industry	https://www.pmmi.org/
Food Industry Suppliers Association	The Food Industry Suppliers Association (FISA) is the trade association dedicated to promoting distribution in serving hygienic processing industries. FISA's aim is to strengthen and grow member companies through relationships, connectivity, and education. Formed by distributors more than 50 years ago, FISA membership includes independent distributors and manufacturers that reach the market through distribution.	https://www.fisanet.org/
Food Processing Suppliers Association	The Food Processing Suppliers Association (FPSA) is a non-profit global trade association serving suppliers in the food and beverage industries. FPSA member companies help their customers to assure the highest degree of food safety by providing manufacturing solutions for all links in the supply chain beginning with plant design and engineering, through packaging, logistics and finally delivery.	www.fpsa.org
Institute of Food Technologists (IFT)	IFT is a forum for food science professionals and technologists to collaborate, learn, and contribute all with the goal of inspiring and transforming collective scientific knowledge into innovative solutions for the benefit of all people around the world.	https://www.ift.org/
International Bottled Water Association	As the authoritative source of information about all types of bottled waters, International Bottled Water Association (IBWA) members include US and International bottlers, distributors, and suppliers based in the US. IBWA represents their industry's commitment to the safety and availability of bottled water worldwide. This is considered a national association since it only has US members.	https://www.bottledwater.org/



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Network	Main goal	Internet link
Plant Based Foods Association	The Plant Based Foods Association’s mission is to ensure a fair and competitive marketplace for businesses selling plant-based foods intended to replace animal products such as meats, dairy, and eggs, by promoting policies and practices that improve conditions in the plant-based foods industry and educating consumers about the benefits of plant-based foods.	https://plantbasedfoods.org/
The American Frozen Food Institute	The American Frozen Food Institute (AFFI) is the national trade association that promotes the interests of all segments of the frozen food industry. AFFI works with its members to advance food safety, advocate for frozen food and provide resources to boost category performance.	https://affi.org/
The Food Industry Association	As the food industry association, the organization works with and on behalf of the entire industry to advance a safer, healthier and more efficient consumer food supply chain.	https://www.fmi.org/
The International Dairy Foods Association	The International Dairy Foods Association (IDFA) represents the US dairy manufacturing and marketing industries and their suppliers, with a membership of 550 companies. IDFA’s membership ranges from multinational organizations, single-plant companies, companies and cooperatives to food retailers and suppliers. The members are focused on innovation and sustainable business practices. This is considered a national association since it only has US members.	https://www.idfa.org/
The Midwest Food Products Association	The Midwest Food Products Association (MWFPA) is a trade association that advocates on behalf of food processing companies and affiliated industries in Illinois, Minnesota, and Wisconsin. Established in 1905 as the Wisconsin Cannery Association, today the association represents a more diverse group of food processors on a variety of food issues. The primary role of MWFPA is to influence public policy and make the Midwest a great place for food processors to do business.	https://mwfpa.org/
The United States Agricultural Information Network	The United States Agricultural Information Network (USAIN) provides a forum for discussion of issues in agriculture, food, natural resources and the environment, sustainability, human ecology, and rural sociology. Through committees, interest groups, and a biennial conference, USAIN members are active in professional development; preservation and digitization of current and historical publications;	https://usain.org/



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Network	Main goal	Internet link
	dissemination of and access to publicly funded research information and data; and the exchange of research results generated by USAIN members and collaborators.	
Western Growers Association	Founded in 1926, Western Growers represents local and regional family farmers growing fresh produce in Arizona, California, Colorado and New Mexico. Association members and their workers provide over half the nation's fresh fruits, vegetables and tree nuts, including nearly half of America's fresh organic produce. Some members also farm throughout the US and in other countries, so people have year-round access to nutritious food.	https://www.wga.com/

Network	Main goal	Internet link
<u>State networks and associations</u>		
California League of Food Processors	The California League of Food Producers (CLFP) has been the voice and the advocate for California's food producing industry since 1905. CLFP represents the interests of both large and small food processors and beverage producers throughout the state and works to help ensure a favorable and profitable business environment for its members and the entire food producing industry.	http://clfp.com/





Network	Main goal	Internet link
Food and Beverage Wisconsin	Food and Beverage Wisconsin is Wisconsin's food and beverage industry cluster organization. With a focus on food, beverage, ingredient, equipment and packaging makers, the organization works to raise industry awareness and capacity for growth and advancement, from farm to factory to fork.	https://www.fabwisconsin.com/
Grow North Mn	Grown North Mn (GNM) supports Minnesota's food and agriculture entrepreneurs grow and scale their businesses faster. GNM's mission is to establish Minnesota as a known leader in food and agriculture entrepreneurship and innovation.	https://carlsonschool.umn.edu/grownorth
Pennsylvania Association of Meat Processors	The Pennsylvania Association of Meat Processors is dedicated to the continuing education of its members while offering a concerted voice for the meat industry and meaningful business to business networking. The members include locker operators, meat processors, slaughters, packers, custom operators, game processors, butchers, ham curers, wholesalers, caterers and retailers. In addition, supplier members include firms which provide machinery equipment, supplies and services to operators.	https://pameatprocessors.org/
Texas Food Processors Association	The Texas Food Processors Association (TFPA) is a non-profit trade association representing companies engaged in the production of food products. It includes those companies which provide the processors with necessary raw materials, packaging, equipment, plant layout and design services, laboratory testing, and an array of business services.	http://www.tfpa.org/



4.2. Innovation and market events

FoodTech innovation and market events represent an excellent opportunity to foster collaboration between researchers, professionals and industry members to share knowledge and discuss the development and deployment of FoodTech. Due to the importance and the size of the food sector, there are several conferences and other networking events related to FoodTech in the US. Over recent years, the FoodTech market has been expanding in the US, primarily due to the increasing application of novel technologies across the whole food value chain¹⁵². Therefore, the number of conferences and other networking events focused on FoodTech related fields has also been increasing and is expected to continue increasing in the short-term.

The geographic distribution of the US FoodTech related conferences and other networking events reveal a high degree of spatial concentration in the Midwestern region of the country, particularly in the state of Illinois. The identified conferences and other networking events are evenly distributed throughout the year. Table 6 lists some of the main conferences and other networking events focused on FoodTech. These were identified by desk research, which included an extensive literature review and a review of the conferences sponsored by recognized networks in the FoodTech area.

¹⁵² <https://techcrunch.com/2019/10/22/the-foodtech-investment-opportunity-present-and-future/>





Table 6 – FoodTech related innovation and market events

Date	Conference/ Event title	Interval	Location	Areas	Internet link
21-23 January 2024	2024 Winter Fancy Food Show	Annual	Las Vegas, Nevada	Digitalization, Novel Processing Technologies, Sustainable Packaging	https://www.specialtyfood.com/shows-events/winter-fancy-food-show-24/
21-24 January 2024	Dairy Forum 2024	Annual	Phoenix, Arizona	Novel Processing Technologies, Bussines Development, , Sustainable Packaging	https://www.idfa.org/events/dairy-forum-2024
11-12 March 2024	International Conference on Food Technology, Design and Nutrition	Annual	Miami, Florida	Digitalization, Novel Processing Technologies, Sensor Technology, Sustainable Packaging	https://waset.org/food-technology-design-and-nutrition-conference-in-march-2024-in-miami?utm_source=conferenceindex&utm_medium=referral&utm_campaign=listing
12-16 March 2024	Natural Products Expo West	Annual	Anaheim, California	Novel Processing Technologies, Novel Food Products, Food Service and Food Retail	https://www.expowest.com/en/exhibitor-resources/exhibit-in-2024.html



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



Date	Conference/ Event title	Interval	Location	Areas	Internet link
19-20 March 2024	World Agri-Tech Innovation Submmit	Annual	San Francisco, California	Digitalization, Sustainable Packaging	https://worldagritechusa.com/
21-22 March 2024	Fututre Food Tech (Innovation and Investment from Farm to Fork)	Annual	San Francisco, California	Digitalization, Novel Processing Technologies, Robotics, Sensor Technology, Sustainable Packaging	https://futurefoodtechsf.com/
26-27 March 2024	Food Innovate Summit	Annual	Atlanta, Georgia	Digitalization, Novel Processing Technologies, Sustainable Packaging	https://americanfoodinnovate.com/2024/en/page/home
23-24-15 April 2024	International Conference on Food Technology and Quality Control	Annual	New York City, New York	Digitalization, Novel Processing Technologies, Sensor Technology, Sustainable Packaging	https://waset.org/food-technology-and-quality-control-conference-in-april-2024-in-new-york?utm_source=conferenceindex&utm_medium=referral&utm_campaign=listing
6-9 May 2024	Food Safety Summit	Annual	Rosemont, Illinois	Novel Processing Technologies, Sustainable Packaging	https://www.food-safety.com/food-safety-summit/agenda#at-a-glance
11-12 May 2024	International Conference on Food Technology	Annual	Honolulu, Hawaii	Digitalization, Sensor Technology, Sustainable	https://waset.org/food-technology-and-functional-food-products-conference-in-may-



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



Date	Conference/ Event title	Interval	Location	Areas	Internet link
	and Functional Food Products			Packaging, Business Development	2024-in-honolulu?utm_source=conferenceindex&utm_medium=referral&utm_campaign=listing
14-16 May 2024	Sweets and Snacks Expo	Annual	Indianapolis, Indiana	Digitalization, Novel Processing Technologies, Sustainable Packaging	https://sweetsandsnacks.com/new-brand/
18-19 June 2024	Future Food-Tech (Alternative Proteins)	Annual	Chicago, Illinois	Digitalization, Novel Processing Technologies	https://www.futurefoodtechprotein.com/
25-27 June 2024	2024 Summer Fancy Food Show.	Annual	New York City, New York	Digitalization, Novel Processing Technologies, Sustainable Packaging	https://www.specialtyfood.com/shows-events/2024-summer-fancy-food-show/
14-17 July, 2024	IFT FIRST	Annual	Chicago, Illinois	Digitalization, Novel Processing Technologies, Robotics, Sensor Technology, Sustainable Packaging	https://www.iftevent.org/%5C
20-21 September 2024	International Conference on	Annual	Orlando, Florida	Digitalization, Sensor Technology, Sustainable Packaging	https://foodscience.averconferences.com//program.php



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Date	Conference/ Event title	Interval	Location	Areas	Internet link
	Food Science and Nutrition				
25-26 October 2024	International Conference on Global Food Technology and Innovation	Annual	Houston, Texas	Agrifood Industry Business Management, Digitalization	https://waset.org/global-food-technology-and-innovation-conference-in-october-2024-in-houston?utm_source=conferenceindex&utm_medium=referral&utm_campaign=listing



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

5 US innovation initiatives and programs

The US governmental funding system is highly decentralized and comprised of several actors, such as agencies of federal and state governments, universities, the private sector and non-profit organizations.

As detailed in Section 2, throughout the last decades, the Food R&D landscape has been characterized by a decline in public funding, with an offset in private funding.

Private investments target mainly the development of food and feed manufacturing, while the public R&D investments are almost exclusively targeted towards environment and natural resources, human nutrition and food safety. Such investment allocation might be seen as complimentary, as the private sector has little or no incentive to conduct R&D in areas where the financial returns may be low (such as social and community development).

A further detailed review of the US funding initiatives and programs at both federal and state level was conducted to identify some examples of relevant innovation initiatives and programs in the FoodTech related fields. The following subsections provide descriptions of the initiatives and programs. Annex 1 provides a summary table of the initiatives and programs detailed in this chapter.

5.1. Federal initiatives/programs

At the federal level, the Department of Agriculture (USDA), the Department of Commerce (DOC), the Environmental Protection Agency (EPA), the National Science Foundation (NSF) and the Small Business Administration (SBA) are the entities primarily responsible for initiatives and programs that promote innovation in the FoodTech relevant fields (Figure 13).



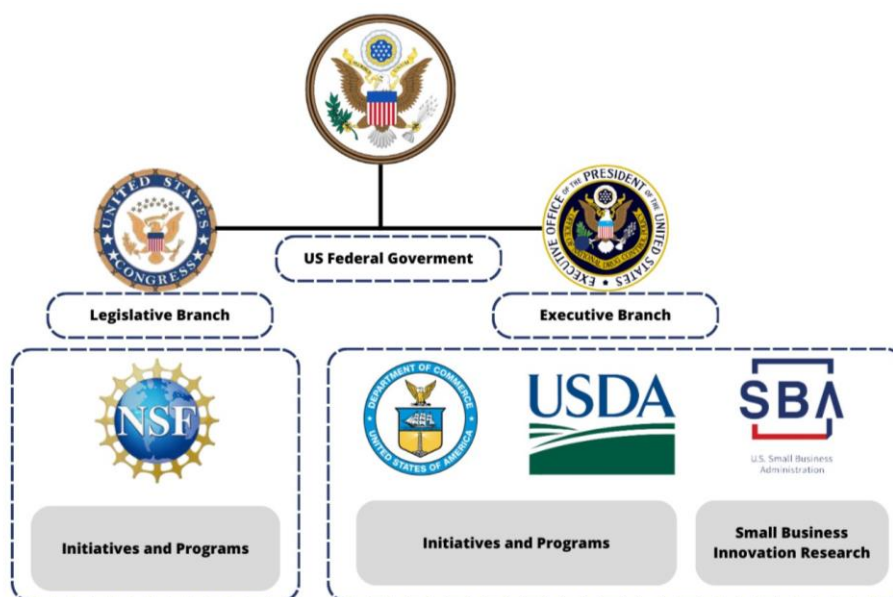


Figure 13 – US Government Organizational Chart highlighting the main sponsors of innovation programs in FoodTech related fields

A review of the US Federal Government innovation initiatives and programs was conducted to identify some of the most relevant ones in fields related to FoodTech. Although this market guide only provides federal initiatives and programs established by its main sponsors, it is important to highlight that there are several initiatives and programs in fields related to FoodTech promoted by several other US departments and entities. These include the US Department of Defense and the Food and Drug Administration¹⁵³.

5.1.1. 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 considerable technological progress. The NSF funds initiatives that aim to advance research that contributes to the scientific community's better understanding¹⁵⁴. 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.

¹⁵³ <https://www.fda.gov/food/science-research-food>

¹⁵⁴ <https://www.nsf.gov/about/how.jsp>



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 possibilities¹⁵⁵.

First Approach	
European Union OISE Regional Contact	eeinfo@nsf.gov
International Collaboration	OISE fosters institutional partnerships throughout the global science and engineering research and education community, and it supports international collaborations in NSF's priority research areas. OISE encourages funding applicants to include an international component in proposals submitted to the appropriate research directorate.
Internet Links	www.nsf.gov/od/oise/country-list.jsp

Advanced Manufacturing (AM)

Responsible entities: Division of Civil, Mechanical and Manufacturing Innovation

The Advanced Manufacturing (AM) program aims to accelerate advances in manufacturing technologies with emphasis on multidisciplinary research that fundamentally alters and transforms manufacturing capabilities, methods and practices. Areas of research for the program could include manufacturing systems, materials processing, manufacturing machines, methodologies, and manufacturing across length scales.

First Approach	
Contact	European researchers and SMEs interested in the AM Program could contact the Program officer, Khershed Cooper.
Email	advancedManufacturing@nsf.gov
Phone Number	(703) 292-7017
Internet link	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505572

Biosensing program

Responsible entities: Division of Chemical, Bioengineering, Environmental and Transport Systems

The Biosensing program supports fundamental engineering research on devices and methods for measurement and quantification of biological analytes. Examples of biosensors include, but are not

¹⁵⁵ <https://www.nsf.gov/od/oise/IntlCollaborations/EuropeanUnion/index.jsp>



limited to, electrochemical/electrical biosensors, optical biosensors, plasmonic biosensors, and paper-based and nanopore-based biosensors. In addition to advancing biosensor technology development, proposals that address critical needs in food safety, agriculture, and environmental protection are highly welcomed. Proposals that incorporate emerging nanotechnology methods are especially encouraged. Therefore, this program can be of particular interest for the European researchers and SMEs focused on the development of nano-sensors applicable in food sciences.

First Approach	
Contact	European researchers and SMEs interested in the Biosensing Program could contact the Program officer, Suk-Wah Tam-Chang.
Email	stamchan@nsf.gov
Phone Number	(703) 292-8684
Internet link	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505720

Communications, Circuits, and Sensing-Systems (CCSS)

Responsible entities: Division of Electrical, Communications and Cyber Systems

The Communications, Circuits, and Sensing-Systems (CCSS) Program supports innovative research in circuit and system hardware and signal processing techniques. CCSS also supports system and network architectures for communications and sensing to enable the next-generation cyber-physical systems (CPS) that leverage computation, communication, and sensing integrated with physical domains. CCSS invests in micro- and nano-electromechanical systems (MEMS/NEMS), physical, chemical, and biological sensing systems, neurotechnologies, and communication & sensing circuits and systems. The goal is to create new complex and hybrid systems ranging from nano- to macro-scale with innovative engineering principles and solutions for a variety of applications including agriculture and food industry.

First Approach	
Contact	European researchers and SMEs interested in the CCSS Program could contact the Program officer, Mohammad Ali.
Email	moali@nsf.gov
Phone Number	(703) 292-4632
Internet link	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505248



Environmental Convergence Opportunities in Chemical, Bioengineering, Environmental, and Transport Systems (ECO-CBET)

Responsible entities: Directorate of Engineering (ENG) and Division of Chemical, Bioengineering, Environmental and Transportation systems (ENG/CBET)

The Environmental Convergence Opportunities in Chemical, Bioengineering, Environmental, and Transport Systems (ECO-CBET) initiative provides significant funding for fundamentally interdisciplinary research aimed at facilitating the development of novel materials, processes, and systems to address environmental engineering and sustainability challenges. The program's intervention focuses on five key areas: ensuring sustainable access to food, water, and energy; mitigating the effects of climate change and adapting to its consequences; envisioning a future free of pollution and waste; building efficient, healthy, and resilient cities; and promoting well-informed decisions and actions. The current request for ideas highlights research activities focusing on climate change mitigation and reduction, notably with significant applicability in the food business and agriculture¹⁵⁶.

First Approach	
Contact	European researchers and SMEs interested in the ECO/CBET Program could contact the Program officer, Christina Payne.
Email	cpayne@nsf.gov
Phone Number	(703) 292-2895
Internet link	https://new.nsf.gov/funding/opportunities/environmental-convergence-opportunities-chemical

Future Manufacturing (FM)

Responsible entities: Directorate for Engineering

The goal of this program is to support fundamental research that will enable Future Manufacturing (manufacturing that either does not exist today or exists only at such small scales that it is not viable¹⁵⁷). The Program's focus areas include the design and deployment of diverse new technologies for synthesis and sensing, and new algorithms for manufacturing new materials, chemicals, devices, components and systems. In addition, the program looks for new advances in artificial intelligence and machine learning, new cyber infrastructure, new approaches for mathematical and computational modeling, new dynamics and control methodologies, new ways to integrate systems biology, synthetic

¹⁵⁶ <https://new.nsf.gov/funding/opportunities/environmental-convergence-opportunities-chemical>

¹⁵⁷ https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505737



biology and bioprocessing, and new ways to influence the economy, workforce, human behavior, and society.

Three major areas are identified for support in 2023 under this program:

1. Future Cyber Manufacturing Research,
2. Future Eco Manufacturing Research, and
3. Future Biomanufacturing Research.

First Approach	
Contact	European researchers and SMEs interested in the FM Program could contact the Program officer, Andrew B. Wells.
Email	awells@nsf.gov
Phone Number	(703) 292-7225
Internet link	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505737

Environmental Sustainability Program

Responsible entities: Directorate of Engineering (ENG) and Division of Chemical, Bioengineering, Environmental and Transportation systems (ENG/CBET)

The objective of the Environmental Sustainability program is to advance engineered systems that are both sustainable and conducive to human well-being while harmoniously coexisting with natural ecosystems. These systems play a vital role in providing ecological services essential for human survival. Research endeavors supported by the program typically adopt long-term perspectives and may incorporate insights from the social sciences and ethics. The program promotes engineering research that aims to strike a balance between meeting society's need for ecological protection and ensuring stable economic conditions. The program focuses on five primary research areas: Circular Bioeconomy Engineering, Industrial Ecology, Green Engineering, Ecological Engineering, and Earth Systems Engineering. Notably, the food and agriculture industries hold significant importance in waste reduction and the establishment of a circular economy, thereby enhancing the quality of life for citizens.¹⁵⁸

First Approach	
Contact	European researchers and SMEs interested in the Environmental Sustainability Program could contact the Program officer, Bruce K. Hamilton.

¹⁵⁸ <https://new.nsf.gov/funding/opportunities/environmental-sustainability-2>



Email	bhamilto@nsf.gov
Phone Number	(703) 292-7066
Internet link	https://new.nsf.gov/funding/opportunities/environmental-sustainability-2

National Artificial Intelligence (AI) Research Institutes program

Responsible entities: National Science Foundation (NSF), US Department of Agriculture (USDA) National Institute of Food and Agriculture (NIFA), US Department of Homeland Security (DHS) Science & Technology Directorate, US Department of Transportation (DOT) Federal Highway Administration (FHWA), and US Department of Veterans Affairs (VA)

The 2023 update to the National Artificial Intelligence Research and Development Strategic Plan, informed by visioning activities in the scientific community as well as interaction with the public, identifies as its first strategic objective the need to make long-term investments in AI research in areas with the potential for long-term payoffs in AI. The program seeks to enable such research through AI Research Institutes. This program solicitation describes two tracks: Planning and Institute tracks. One of the focus areas is AI-Driven Innovation in Agriculture and the Food System.

First Approach	
Contact	European researchers and SMEs interested in the AI Research Institutes Program could contact the Program officer, Nandini Kannan.
Email	nakannan@nsf.gov
Phone Number	(703) 292-8104
Internet link	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505686

Hydrologic Science Program

Responsible entities: Directorate for Geosciences (GEO) and The Division of Earth Sciences (GEO/EAR)

Hydrologic Science Program has a strong emphasis on continental water systems at all dimensions. The program funds basic studies into water on and beneath the Earth's surface, as well as water's interactions with material and biological components of the environment. The study of hydrologic processes (e.g., rainfall and runoff; infiltration and subsurface flow; evaporation and transpiration) as well as water fluxes (e.g., in soils, aquifers, and streams) is a main focus. Many projects involve the investigation of hydrologic transport (e.g., of dissolved solutes and sediment), the coupling of hydrological processes with other systems (e.g., ecosystem processes, geochemical cycles, food and



energy systems, socio-ecological systems), or hydrologic responses to change (e.g., changes in land use, climate change)¹⁵⁹.

First Approach	
Contact	European researchers and SMEs interested in the Hydrologic Science Program could contact the Program officer, Laura Lautz
Email	llautz@nsf.gov
Phone Number	(703) 292-7775
Internet link	https://new.nsf.gov/funding/opportunities/population-community-ecology-cluster

The NSF SBIR Program

Responsible entities: Various departments within National Science Foundation

The NSF SBIR Program encourages small businesses to submit ideas across all areas of science and engineering. Small businesses are required to submit a Project Pitch to determine whether their proposed project is a good fit for the program's objectives to support (i) innovative technologies that show promise of commercial and/or societal impact and (ii) involve a level of technical risk. For the grant, typically, there are two submission windows per year and Project Pitches are accepted anytime.

First Approach	
Contact	European researchers and SMEs interested in the NSF SBIR Program could contact the Program Directors Anna Brady-Estevéz (Chemical Technologies), Erik Pierstorff (Biological Technologies), or Peter Atherton (Information Technologies, Artificial Intelligence and Quantum Information Technologies)
Email	abrady@nsf.gov patherto@nsf.gov epiersto@nsf.gov
Phone Number	(703) 292-7077 (703) 292-8772 (703) 292-2165

¹⁵⁹ <https://new.nsf.gov/funding/opportunities/population-community-ecology-cluster>



Internet link	https://seedfund.nsf.gov/
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Population and Community Ecology (PCE) Cluster

Responsible entities: Directorate for Biological Sciences (BIO), Division of Environmental Biology (BIO/DEB)

The Population and Community Ecology (PCE) Cluster promotes investigation that contributes to a better conceptual or theoretical comprehension of population ecology, food-web structure and trophic dynamics, and community dynamics in terrestrial, wetland, and aquatic ecosystems. The cluster looks to better the quality of life of the citizens and at the same time preserve the ecological environment, digitalization, new packages methods and agriculture production advances have a key factor in the program, funding projects that will change the way of the populations and the community ecologies interact¹⁶⁰.

First Approach	
Contact	European researchers and SMEs interested in the PCE Cluster could contact the Program officer, Douglas J. Levey.
Email	dlevey@nsf.gov
Phone Number	(703) 292-5196
Internet link	https://new.nsf.gov/funding/opportunities/population-community-ecology-cluster

5.1.2. Department of Commerce (DOC)

The DOC is highly focused on continuing to promote innovative new techniques, a next-generation workforce, and a technology-driven economy. Through the Manufacturing USA initiatives, Manufacturing Extension Partnership (MEP) and the National Institute of Standard and Technology (NIST), the DOC can foster innovation and funding opportunities to promote the advancement of technologies, including technologies with the potential for application in Food manufacturing¹⁶¹.

National Institute of Standard and Technology (NIST) Hollings Manufacturing Extension Partnership (MEP)

¹⁶⁰ <https://new.nsf.gov/funding/opportunities/population-community-ecology-cluster>

¹⁶¹ <https://www.commerce.gov/bureaus-and-offices>



The National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership Program (MEP) aims to improve the competitiveness of US based manufacturing by making manufacturing technologies, processes, and services more accessible to small and medium-sized manufacturers (SMMs). The NIST MEP National Network comprises of 51 MEP Centers located in all 50 states and Puerto Rico, and over 1,300 advisors and experts at more than 375 MEP service locations¹⁶².

MEP centers provide support in various areas, including technical assistance services to US food manufacturers, with an emphasis on small US food processors. Some of the areas of technical service include quality and process optimization and improvement of food safety¹⁶³.

MEP is a public-private partnership, designed as a cost-share program. Federal appropriations pay one-half, with the balance for each Center funded by state, local governments, private entities and/or client fees.

First Approach	
Contact	European SMEs interested in the MEP services could contact the representatives identified for each MEP center. The list of MEP centers and contacts can be found through the link provided below.
Emails	Available for each center on the internet link provided below
Phone Number	+1 (800) 637 4634
Internet link	https://www.nist.gov/mep/centers/map

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

The OAM serves as the headquarters for the interagency Advanced Manufacturing National Program Office (AMNPO). In addition, the OAM works in close partnership with advanced manufacturing offices and other manufacturing related agencies of different federal departments, including USDA¹⁶⁴.

The OAM provides cost-shared funding opportunities to promote innovative technologies that allow increasing energy efficiency for companies of US manufacturing industries. 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^{165,166}.

¹⁶² <https://www.nist.gov/mep/mep-national-network>

¹⁶³ https://www.nist.gov/system/files/documents/2019/11/21/MEP_Annual_Report_2018_web-508-NEW.pdf

¹⁶⁴ <https://www.nist.gov/>

¹⁶⁵ <https://www.nist.gov/oam/about-us>

¹⁶⁶ <https://www.nist.gov/oam/funding-opportunities>



First Approach	
Information about Funding Opportunities	European researchers interested in the OAM funding opportunities could contact the representative identified in the Funding Opportunities Announcements (FOAs).
International Collaboration	The eligibility criteria for OAM's funding opportunities can be found in the FOAs listed on Grants.gov. Each opportunity details all eligibility requirements and definitions.
Internet Link	https://www.nist.gov/oam/funding-opportunities

5.1.3. Department of Agriculture (USDA)

USDA provides leadership on food, agriculture, natural resources, rural development, nutrition, and other related issues based on sound public policy, the best available science, and efficient management. USDA is made up of 29 agencies and offices with nearly 100,000 employees and more than 4,500 locations across the country and abroad¹⁶⁷. USDA provides support for both food and agricultural science research, including several other related topics. However, as mentioned in previous sections, past decades were characterized by the decline in the public funding towards food technology. Accordingly, the analysis of research grants funded by the USDA in 2018 conducted by IFT¹⁶⁸, suggests that only 4% of grants were directed towards food research, such as food safety, nutrition, health, and food processing. The remaining 36.6% was for agriculture research, and 59.4%, for all other research, including forestry, biofuels, education, and extension activities¹⁶⁹.

The National Institute of Food and Agriculture (NIFA)

NIFA is USDA's extramural research agency with a purpose of investing in and advancing food and agricultural research, education, and extension to solve societal challenges. NIFA consolidates federally funded agricultural and food science research, aiming to support innovative solutions to issues related to agriculture, food, the environment, and communities. Through Food Science & Technology Programs, NIFA promotes the development within food science and technology areas through collaboration and funding support with academia, industry, consumers, and other federal agencies. The programs fund research projects aimed at improving the processes, safety, and quality of foods.

¹⁶⁷ <https://www.usda.gov/our-agency/about-usda>

¹⁶⁸ The analysis encompassed 2,100 research grants with a total value \$1.5 billion (€1.37 billion).

¹⁶⁹ <https://www.ift.org/2020fundingwhitepaper>



Food Science and Technology Projects are funded under the Agriculture and Food Research Initiative, Small Business Innovation Research Program and the National Integrated Food Safety Initiative¹⁷⁰.

The Agriculture and Food Research Initiative (AFRI)

AFRI is a US leading competitive grants program for food and agricultural sciences. The National Institute of Food and Agriculture (NIFA) awards the AFRI research, education, and extension grants throughout several food science related areas including nanotechnology, novel technologies for food processing and advanced solutions for food packaging.

First Approach	
Contact	European researchers and SMEs interested in the USDA funding opportunities could contact the AFRI Coordination Team
International Collaboration	The eligibility criteria for USDA funding opportunities and support can be found in the FOAs listed on Grants.gov. Each opportunity details all eligibility requirements and definitions. . The authorizing legislation and agency policies will determine whether a foreign individual or organization could apply for a specific grant ¹⁷¹ .
Email	afri@usda.gov
Phone Number	(202) 734-0472
Website	https://www.nifa.usda.gov/grants/programs/agriculture-food-research-initiative-afri/afri-request-applications

National Integrated Food Safety Initiative

The National Integrated Food Safety Initiative supports competitive projects that address priority issues in food safety using the integrated approach. Therefore, special emphasis is given to projects describing multifunctional activities (such as research, education, and extension components). The

¹⁷⁰ <https://nifa.usda.gov/program/food-science-technology-programs>

¹⁷¹ <https://www.grants.gov/web/grants/learn-grants/grant-eligibility.html>



research component of the National Integrated Food Safety Initiative focuses on applied food safety research.

First Approach	
Contact	European researchers and SMEs interested in the USDA funding opportunities could contact Shousan Zeng at the Institute of Food Safety and Nutrition's (IFSN) Division of Nutrition
International Collaboration	The eligibility criteria for USDA funding opportunities and support can be found in the FOAs listed on Grants.gov. Each opportunity details all eligibility requirements and definitions. The authorizing legislation and agency policies will determine whether a foreign individual or organization could apply for a specific grant ¹⁷² .
Email	Shoushan.Zeng@usda.gov
Website	https://www.nifa.usda.gov/grants/programs/food-safety/national-integrated-food-safety-initiative

5.1.4. Small Business Administration (SBA)

The SBA was founded under the 1953 Small Business Act to “aid, counsel, assist and protect, insofar as is possible, the interests of small business concerns”¹⁷³. The SBA makes and guarantees small business loans, assists natural disaster victims, and assists small firms in obtaining financial and federal contracts. The SBA also offers management and business training to business owners. Furthermore, the SBA offers targeted outreach to women, minorities, and veterans of the armed forces. In addition, the agency provides specialist guidance and assistance in foreign trade.

Small Business Innovation Research (SBIR) program

The SBIR program is a highly competitive program that encourages US small businesses to participate in Federal R&D with the potential for commercialization. Thus, the SBIR awards competitive funds to businesses so they can advance their technological potential and commercialize new products¹⁷⁴.

¹⁷² <https://www.grants.gov/web/grants/learn-grants/grant-eligibility.html>

¹⁷³ <https://www.sba.gov/about-sba/organization/observances/celebrating-70-years-service-americas-small-businesses>

¹⁷⁴ <https://www.sbir.gov/about/about-sbir>



Altogether, 12 Federal agencies are participating in the program¹⁷⁵. Each agency administers its own individual program within guidelines established by Congress. For each financial year, Federal agencies with extramural R&D budgets that exceed \$100 million (nearly €90 million) are required to assign 3.2% of their R&D budget to SBIR programs. The agencies designate R&D topics in their solicitations and accept proposals from small businesses. Awards are made on a competitive basis after proposal evaluation.

Considering SBIR eligibility criteria, only US small businesses are eligible to submit applications for SBIR funds. Collaborating research institutions are considered subcontractors to the small businesses and may not apply as applicants. Moreover, the R&D projects awarded with SBIR funds must be performed entirely in the US. In cases where the project requires the use of a foreign site, the researcher must provide compelling scientific justification in the application for the use of a foreign site¹⁷⁶.

First Approach	
Contact	European researchers and SMEs interested in the SBIR program could contact the Program Specialist, Kelly McDonald (Division of Bioenergy at USDA NIFA).
Email address	kelly.mcdonald2@usda.gov answerdesk@sba.gov
Phone Number	(816) 926-2661 (800) 827 5722
Internet links	https://www.sbir.gov/node/1671753 https://nifa.usda.gov/program/small-business-innovation-research-program-sbir

Small Business Innovation Research (SBIR) program at the USDA

The SBIR program at USDA is administered and operated by the NIFA. Therefore, the USDA SBIR program office at NIFA directs all activities required under the SBIR law and executes the policy established by the Small Business Administration. Within the program, the USDA defines 10 SBIR research areas of interest: Air, Soil and Water, Animal Production and Protection, Aquaculture, Biofuels and Biobased Products, Food Science and Nutrition, Plant Production and Protection - Biology, Plant Production and Protection - Engineering, Rural and Community Development, Small and Mid-Sized

¹⁷⁵ Department of Agriculture, Department of Commerce - National Institute of Standards and Technology, Department of Commerce - National Oceanic and Atmospheric Administration, Department of Defense, Department of Education, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of Transportation, Environmental Protection Agency, National Aeronautics and Space Administration, National Science Foundation

¹⁷⁶ <https://sbir.nih.gov/about/eligibility-criteria#collapseThree>



Farms. With regards to FoodTech, the SBIR program is highly committed to funding projects that support research focusing on developing new and improved processes, technologies, or services that address emerging food safety, food processing and nutrition issues^{177, 178}.

First Approach	
Contact	European researchers and SMEs interested in the SBA/USDA funding opportunities could contact the National Program Leader, Dr. David Songstad.
International Collaboration	The eligibility criteria for USDA funding opportunities and support can be found in the FOAs listed on Grants.gov. Each opportunity details all eligibility requirements and definitions. The authorizing legislation and agency policies will determine whether a foreign individual or organization could apply for a specific grant ¹⁷⁹ .
Email	david.songstad@usda.gov
Internet Links	https://www.nifa.usda.gov/grants/programs/sbir-sttr

5.2. State initiatives/programs

State initiatives are one of the major ways states can support public projects in key research areas, such as FoodTech. Therefore, some US states are highly focused on promoting the advancement of the food industry through FoodTech initiatives.

In this context, some US states are particularly focused in being at the forefront of FoodTech development and application in their food value chains. These states, which include the states of California, Michigan, Minnesota, and Pennsylvania recognize the potential impact of FoodTech related testing programs and initiatives that bring together companies and research facilities. A handful of state initiatives are provided below.

5.2.1. California: Food Production Investment Program

The California Energy Commission provides grants to help food processors save energy while reducing greenhouse gas emissions (GHG). The Program helps producers replace high-energy-consuming



equipment and systems with market-ready and advanced technologies and equipment. The goal is to accelerate the adoption of state-of-the-art energy technologies that can substantially reduce energy use and costs and associated GHG emissions.

Funding comes from the California Climate Investments program, a statewide initiative that uses cap-and-trade dollars to help reduce GHG emissions, strengthen the economy, and improve public health and the environment.

First Approach	
Contact Person	European SME's interested in the Program can contact the Program officer at the Energy Research and Development Division of the California Energy Commission, Angela Hockaday.
Email	angela.hockaday@energy.ca.gov
Phone Number	800-555-7794
Internet link	https://www.energy.ca.gov/programs-and-topics/programs/food-production-program

5.2.2. Michigan: Value-Added Grant Program

The Michigan Department of Agriculture & Rural Development (MDARD) Value-Added Grant Program offers businesses a grant opportunity aimed at promoting the expansion of value-added agriculture production, food processing, and healthy food access within the state to enhance Michigan's food and agrifood industry. The maximum amount that can be awarded is \$125,000 (€113,923).

First Approach	
Contact	European researchers and SMEs interested in the Program could contact the Grant and Commodity Program Manager at the Agriculture Development Division, Heather Throne.
Email	thorneh@michigan.gov
Phone Number	517-712-0841
Internet link	https://www.michigan.gov/mdard/0,4610,7-125-1570_51684_78393---,00.html



5.2.3. Minnesota: AGRI Value-Added Grant Program

The AGRI Value-Added Grant helps Minnesota processors to add value to Minnesota agricultural products by helping them with the development of feasibility studies and the purchase of equipment. The maximum amounts that can be awarded for the equipment and feasibility studies are \$150,000 and \$25,000, respectively.

First Approach	
Contact	European researchers and SMEs interested in the Program could contact the Program officer at the Ag Marketing & Development, Michael Greene.
Email	Michael.Greene@state.mn.us
Phone Number	651-201-6458
Internet link	https://www.mda.state.mn.us/business-dev-loans-grants/agri-value-added-grant-program

5.2.4. Pennsylvania: Dairy Investment Grant Program

The Pennsylvania Dairy Investment Program is administered jointly by the Department of Community and Economic Development (DCED) and the PA Department of Agriculture (PDA), under the direction of the Commonwealth Financing Authority (CFA). The grant program supports the activities for research and development; transition to certified organic production, processing, and distribution; value-added processing; and marketing support of Pennsylvania's dairy industry.

First Approach	
Contact	European researchers and SMEs interested in the Program could contact the Program officer at the Pennsylvania Department of Agriculture, Ryan Emerson.
Email	ryemerson@pa.gov
Phone Number	717-720-1422
Internet link	https://dced.pa.gov/programs/pennsylvania-dairy-investment-program-pdip/



6 Observations

From the overall assessment of the US FoodTech innovation and market ecosystem, it can be concluded that the US remains a key player and one of the global leaders in food and beverage manufacturing.

As it is the case with the whole food value chain, the US food and beverage manufacturing industry has been transforming significantly in recent years. Namely, driven by consumer demand towards the healthier food, the food and beverage manufacturers are shifting towards the development of technologies that reduce changes in food and maintain the nutritional value. Contrary to the decline in public sector investments, the private sector spending in food R&D has grown significantly over the last decade, primarily driven by investments from the US headquartered conglomerates. Furthermore, consolidation is occurring among many manufacturers, where plant sizes have been increasing, while the number of companies has been declining. This consolidation has been facilitated primarily by changes in processing plant technologies and the emergence of new scale economies.

There is a particular concentration of innovation hubs/facilitators and industry related R&D centers in the greater Sacramento area, Chicago, New York City, Minneapolis, Philadelphia, and Atlanta. Apart from these areas and cities, the states with booming FoodTech R&D activity include Texas, Florida, New Jersey, and Wisconsin. When analyzing the US FoodTech market, the identification of the regions with a higher number of business opportunities is not as obvious. In this context, different food manufacturing businesses and food manufacturing plants were the main target market for businesses commercializing FoodTech products. This guide focused on the assessment of the geographical concentration of the following manufacturing facilities: fruit and vegetable preserving and specialty food manufacturing, dairy product manufacturing, seafood product preparation and packaging, other food manufacturing¹⁸⁰, soft drink manufacturing, breweries, wineries, and distilleries. From the analysis, five states stood out in particular: California, Illinois, Texas, Washington, and New York.

Recognized networks and events play a key role in fostering interaction between academia and industry members, which is crucial to promote the advancement of FoodTech. Therefore, it is highly recommended that EU researchers and industry representatives contact key US networks and attend events in the US focused on FoodTech.

In the US, FoodTech innovation is supported by federal and state initiatives and programs that prioritize research areas that can lead to technological breakthroughs. However, as mentioned in the paragraphs above, this support has been declining over the past decade. As a result, in 2018, less than 5% of the USDA funded grants were directed towards food research. At the federal level, FoodTech

¹⁸⁰ The following sub-sectors aggregated: roasted nuts and peanut butter manufacturing, other snack food manufacturing, coffee and tea manufacturing, flavoring syrup and concentrate manufacturing, mayonnaise, dressing, and other prepared sauce manufacturing, spice and extract manufacturing, perishable prepared food manufacturing, all other miscellaneous food manufacturing.



innovation is primarily supported by programs and initiatives from the USDA, NSF, SBA and DOC. At the state level, several states have recognized the need to launch initiatives, challenges or grants that promote the advancement of FoodTech. Although there are several programs and initiatives related with FoodTech at both federal and state level, 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 FoodTech. Both regions consider the advancement of FoodTech as a priority and are highly committed to promoting innovation and investing in this area with the aim of advancing the food industry.





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 field of FoodTech and provides relevant information on how EU researchers could first approach them.

Table 7 – Summary of the US Federal and State Funding Initiatives and Programs

Agencies	Programs/ Initiatives	Responsible entities	Contact Info	Internet link
<u>Federal Initiatives and Programs</u>				
National Science Foundation (NSF)	Advanced Manufacturing (AM)	Division of Civil, Mechanical and Manufacturing Innovation	Contact the Program Officer: advancedManufacturing@nsf.gov	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505572
	National Artificial Intelligence (AI) Research Institutes program	National Science Foundation (NSF), US Department of Agriculture (USDA), National Institute of Food and Agriculture (NIFA), US Department of Homeland Security (DHS), Science & Technology Directorate (S&T), US Department of Transportation (DOT), Federal	Contact the Program Officer: nakannan@nsf.gov	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505686



Agencies	Programs/ Initiatives	Responsible entities	Contact Info	Internet link
		Highway Administration (FHWA), and US Department of Veterans Affairs (VA).		
	Biosensing program	NSF Directorate of Chemical, Bioengineering, Environmental and Transport Systems.	Contact the Program Officer: stamchan@nsf.gov	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505720
	The NSF SBIR Program	Various departments within National Science Foundation	Contact the Program Directors: abrady@nsf.gov patherto@nsf.gov epiersto@nsf.gov	https://seedfund.nsf.gov/
	Communications, Circuits, and Sensing-Systems (CCSS)	NSF Directorate for Electrical, Communications and Cyber Systems.	Contact the Program Officer: moali@nsf.gov	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505248
	Environmental Convergence Opportunities in Chemical, Bioengineering, Environmental,	Directorate of Engineering (ENG) and Division of Chemical, Bioengineering, Environmental and	Contact the Program Officer: cpayne@nsf.gov	https://new.nsf.gov/funding/opportunities/environmental-convergence-opportunities-chemical



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Agencies	Programs/ Initiatives	Responsible entities	Contact Info	Internet link
	and Transport Systems (ECO-CBET)	Transportation systems (ENG/CBET)		
	Hydrologic Science Program	Directorate for Geosciences (GEO) and The Division of Earth Sciences (GEO/EAR)	Contact the Program Officer: llautz@nsf.gov	https://new.nsf.gov/funding/opportunities/population-community-ecology-cluster
	Future Manufacturing (FM)	Directorate for Engineering	Contact the Program Officer: awells@nsf.gov	https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505737
	Environmental Sustainability Program	Directorate of Engineering (ENG) and Division of Chemical, Bioengineering, Environmental and Transportation Systems (ENG/CBET)	Contact the Program Officer: bhamilto@nsf.gov	https://new.nsf.gov/funding/opportunities/environmental-sustainability-2
	Population and Community Ecology (PCE) Cluster	Directorate for Biological Sciences (BIO), Division of Environmental Biology (BIO/DEB)	Contact the Program Officer: dlevey@nsf.gov	https://new.nsf.gov/funding/opportunities/population-community-ecology-cluster



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Agencies	Programs/ Initiatives	Responsible entities	Contact Info	Internet link
Department of Agriculture	Agriculture and Food Research Initiative (AFRI)	National Institute of Food and Agriculture	Contact the point of the program: https://nifa.usda.gov/staff-contact/afri-coordination-team	https://nifa.usda.gov/program/afri-foundational-program
	National Integrated Food Safety Initiative	National Institute of Food and Agriculture	Contact the point of the program: https://nifa.usda.gov/staff-contact/primary-contact-division-nutrition-ifsni	https://nifa.usda.gov/program/national-integrated-food-safety-initiative
Small Business Administration (SBA)	Small Business Innovation Research (SBIR) Program	Various Federal Agencies	Contact the Program Officer: kelly.mcdonald2@usda.gov	https://nifa.usda.gov/program/small-business-innovation-research-program-sbir
State Initiatives and Programs				



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Agencies	Programs/ Initiatives	Responsible entities	Contact Info	Internet link
California	Food Production Investment Program	The California Energy Commission	Contact the Program Officer: angela.hockaday@energy.ca.gov	https://www.energy.ca.gov/programs-and-topics/programs/food-production-program
Michigan	Value-Added Grant Program	The Michigan Department of Agriculture & Rural Development	Contact the Program Officer: thorneh@michigan.gov	https://www.michigan.gov/mdard/0,4610,7-125-1570_51684_78393---,00.html
Minnesota	AGRI Value-Added Grant Program	Minnesota Department of Agriculture	Contact the Program Officer: Michael.Greene@state.mn.us	https://www.mda.state.mn.us/business-dev-loans-grants/agri-value-added-grant-program
Pennsylvania	Dairy Investment Grant Program	Department of Community and Economic Development and the Pennsylvania Department of Agriculture	Contact the Program Officer: ryemerson@pa.gov	https://dced.pa.gov/programs/pennsylvania-dairy-investment-program-pdip/



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