



Ohio's Food Industry:

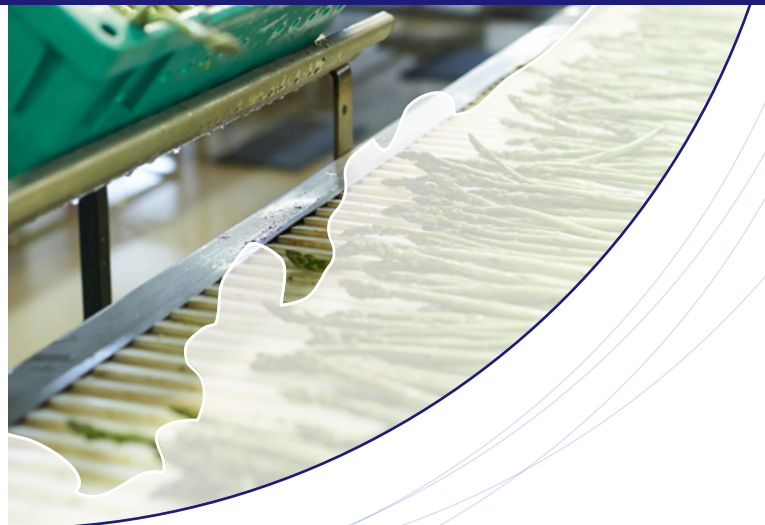
The Future of Future Food Processing, Manufacturing, and Distribution

EXECUTIVE SUMMARY

Performed For: The Center for Innovative Food Technology (CIFT)

Performed By: TEconomy Partners, LLC

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**For more information on this report please contact its authors: Deborah Cummings, Jonathan Dworin and Simon Tripp
| 1.800.TEC.1296 | info@teconomypartners.com | www.teconomypartners.com**

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The Food Industry is Essential

It is easy to take for granted many of the industrial activities that sustain our nation’s economy, society, and way of life. The challenges of 2020 and 2021 have, however, served to raise the profile of our “essential” industries—those that produce and make available the fundamental goods and services that sustains our high quality of life.

This report examines one of the core essential industries that powers the U.S. economy—the food industry. The food industry sector is a driver of national economic competitiveness, responsible for roughly one-fifth of the country’s economic activity and directly supporting nearly 20 million jobs, which equals more than 13% of U.S. employment.¹

The food industry has key characteristics that make it ideal as an economic development engine:

Feeding the World and Sustaining Human Life:

The food industry provides essential products that every human needs to survive thereby ensuring demand for its output. The industry is experiencing increasing demand as global populations expand and increasing wealth enables global consumers to access varied diets and processed foods.

The global population will reach nearly 10 billion people in 2050, with a growing demand for processed/refined foods and animal products.²

Adding Value through Innovation:

The food industry takes domestically produced farm products and adds value through refining, processing, packaging, and branding. The industry is highly innovative with large-scale opportunities for ongoing development of novel products and new processes. The industry is also set to increase productivity and output through implementation of a broad range of new and expanding digital and Industry 4.0 technologies.

From 2015–2017, an estimated 61% of food manufacturing firms and 75% of beverage manufacturing firms engaged in innovative activities compared to 58% for all manufacturing industries and 43% for the total private sector.³

Promoting Economic Opportunity:

The food industry provides a diversity of employment opportunities from entry levels workers through skilled production trades and managerial and professional food science positions. It is also a geographically distributed industry, with a footprint and presence that impacts urban, suburban, and rural communities.

U.S. food manufacturing generates over \$4.00 of additional value added in the economy for each dollar generated by the food industry itself and five additional jobs for every industry job.⁴

1 John Dunham & Associates. “2021 Feeding the Economy Study.” <https://feedingtheeconomy.com/>
2 See: <https://sdg.iisd.org/news/world-population-to-reach-9-9-billion-by-2050/>; <https://www.nationalgeographic.com/foodfeatures/feeding-9-billion/>
3 TEconomy Analysis of National Science Foundation Data; beverage manufacturing also includes tobacco.
4 https://www.ced.org/pdf/Economic_Contribution_of_the_Food_and_Beverage_Industry.pdf

The Food Industry is Complex

As illustrated in Figure ES-1, the food industry value chain is comprised of a wide range of interconnected elements, including:

PRODUCTION:

Farmers produce commodities that are sometimes consumed with limited processing (such as fresh fruits and vegetables), but more often than not, serve as inputs for the broader food processing sectors.

FOOD AND BEVERAGE MACHINERY AND PACKAGING:

In order to process and ultimately package foods, there is a need for specialized manufacturing and packaging equipment.

PRIMARY PROCESSING AND MANUFACTURING:

In the first stages of processing beyond the farmgate, notable processing activities include crushing, refining, and milling items such as grains, seeds, and sugars. Meat and dairy processing are also considered primary processing sectors.

SPECIALIZED TESTING AND RESEARCH AND DEVELOPMENT:

For firms across the food value chain, R&D is an essential part of economic competitiveness.

SECONDARY PROCESSING AND MANUFACTURING:

Partially processed commodities are further processed to create final consumer goods, with notable tasks including measuring, weighing, boiling, mixing, shaping, dicing, extruding, baking, drying, assembling, portioning, and packaging foods.

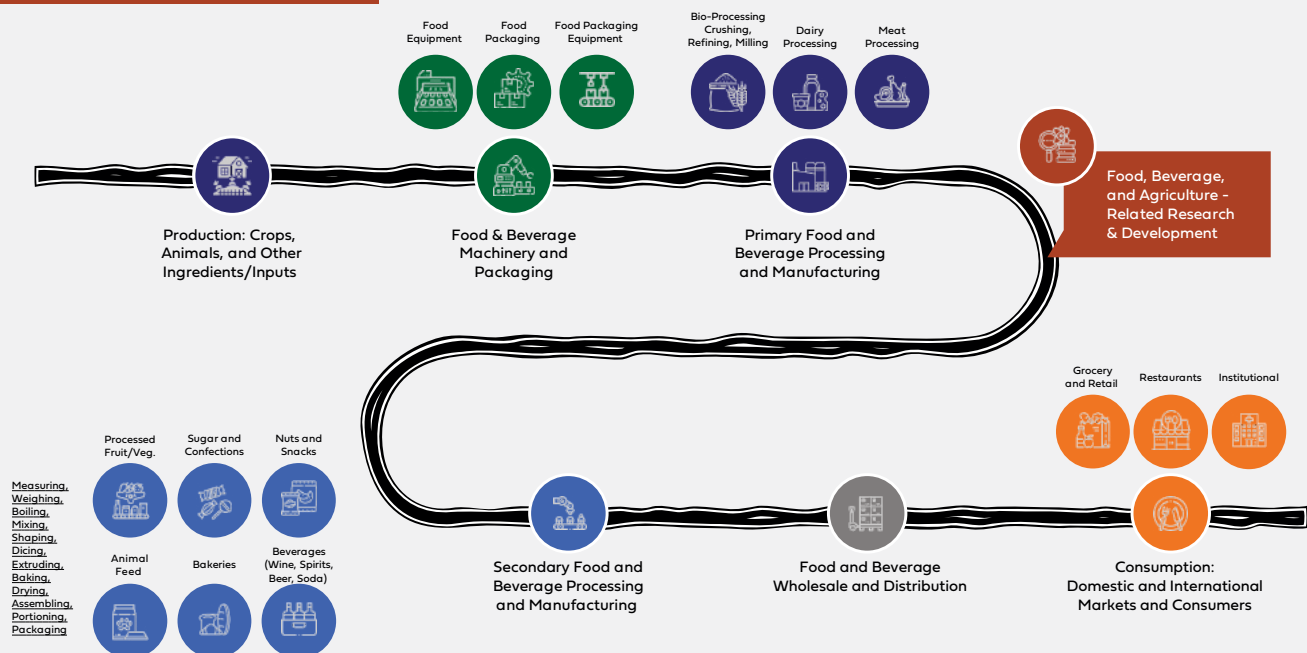
WHOLESALE AND DISTRIBUTION:

Across the country, wholesalers and distributors connect the food value chain with consumers.

CONSUMPTION:

While some food is purchased for consumption at home, many meals are eaten away from the house at places like restaurants and institutions such as hospitals and school or university cafeterias.

Figure ES-1: Visualization of Ohio's Food Industry

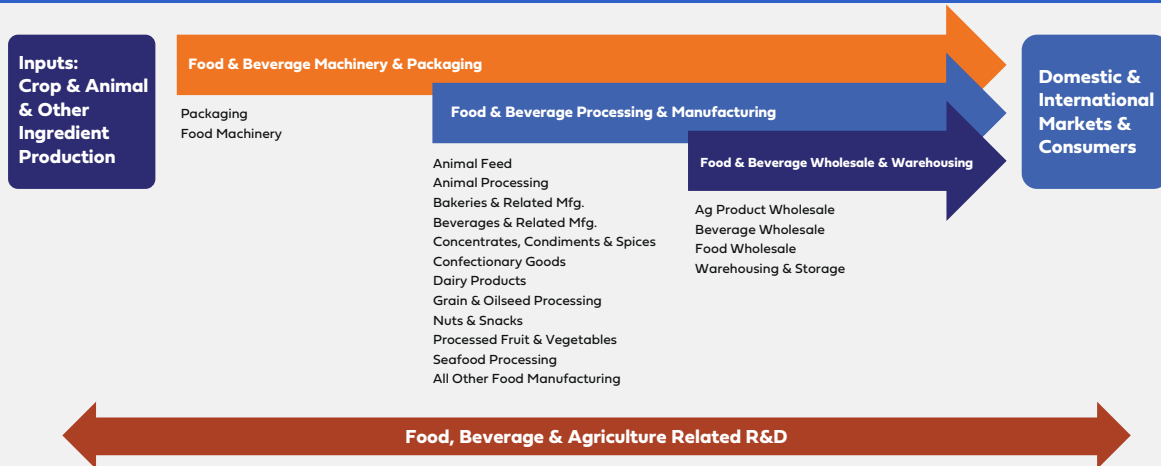


Source: TEconomy Partners, LLC.

The State of Ohio's Food Industry

The food industry sector, defined as companies involved in food and beverage machinery and packaging, food and beverage processing and manufacturing, and food and beverage wholesale and warehousing and illustrated in Figure ES-2, is one of Ohio's signature industries.

Figure ES-2: Ohio's Food Industry Sector Value Chain



Source: TEconomy Partners, LLC.

Ohio's food industry is robust, comprised of 3,595 establishments employing 125,842 Ohioans across all 88 counties. Ohio is home to industry leaders, and there are many examples of mutually beneficial partnerships occurring between Ohio's food companies. As noted by JobsOhio in a May 2019 white paper: "A distinct advantage of being part of the food system in Ohio is its end-to-end supply chain. As the easternmost state in the main area of corn, bean, and soft wheat production of the U.S., Ohio is home to a robust commodity processing sector, significant animal production, one of the nation's largest food manufacturing industries, extensive food packaging production, storage and distribution systems, and a strong food retail system."⁵ Ohio also benefits from a centralized location and multiple infrastructure options for shipping perishable and industrial goods.

Innovation drives Ohio's global competitiveness in the food industry, buoyed by a strong concentration of R&D and high-skilled employment. Examples of Ohio's innovative prowess in the food industry sector include:

- \$114 million in food-related R&D expenditures
- 43% more food industry R&D than the nation
- 1,207 patent records, including 580 issued patents
- 60% more engineers than the U.S. average and 40% more engineering technicians, and
- 38% more food scientists and technologists than the U.S. average, with growth outpacing the nation.

Finally, indicative of the strong demand for Ohio's goods and services, Ohio is a net exporter of food industry products. Export sales total \$42.2 billion⁶, which does not include agricultural farming exports.

5 JobsOhio "Opportunities and Trends in Ohio's Food Industries" Whitepaper (2019).

6 TEconomy Partners analysis of Enhanced U.S. Bureau of Labor Statistics CEW data (from Emsi, Datarun 2021.2).

Disruptive Technologies Facing the Food Industry Sector

Innovation reflects an underlying strength and comparative advantage for Ohio's food industry. The ability to strengthen and preserve this innovative industry sector, which touches all corners of the state, should be of the utmost importance for the State of Ohio. However, the entire food industry value-chain is experiencing the penetration of revolutionary and disruptive technologies that present both opportunities for new advancements as well as threaten elements of the sector.

Labor shortages are a key driver of technology adoption in Ohio's food industry. Ramifications stemming from the COVID-19 pandemic have only made the labor situation more untenable. In many cases, pressures imparted by the pandemic have tended to have an accelerative effect on technological solution demand and adoption. Companies that were only considering digitalization of supply chains and automation of production processes have moved these higher up their list of priorities.

The five primary overarching innovation themes that currently are and will continue to impact Ohio's food industry cluster are:

Adaptability of Supply Chains:

The entirety of the food industry's supply chain has been impacted by shocks to the system emanating from COVID-19, climate change, and other extraneous events. This has required companies in the food industry to be adaptable, flexible, and nimble to overcome these challenges.

Digitalization of Food:

Multiple cyber and physical technologies are combining to build highly efficient and transparent supply chains, and these supply chains are increasingly able to be managed by sophisticated analytical algorithms and associated software systems.

Sensing and Artificial Intelligence

(AI) Enabled Automation and Machine Autonomy (Industry 4.0):

Advanced robotics and associated technologies in sensing and machine vision are combining with AI and machine learning to enable intelligent machine automation. This is opening pathways for autonomous systems that will have a profound effect on the food industry.

Consumer Empowerment:

Enhanced access to information and technology is driving consumer choice and convenience and providing improved access to novel foods, brands, and more healthful food choices.

Sustainability:

Industry, government, and the public are embracing the need to conserve finite resources and reduce negative externalities associated with food production. Advanced technologies are enabling resources to be managed more efficiently.

Across each of these themes, there are several driving forces that are impacting the food industry. Figure ES-3 illustrates drivers for the five core megatrends and disruptive technologies. Ultimately, it is essential to understand not only these drivers and how they contribute to the megatrends and disruptions at hand, but also how these phenomena converge with one-another. True disruption should not be viewed through the lens of a single megatrend or technology, but as an entire system of interactions that enable change and new opportunities.



Figure ES-3: Megatrends, Technologies, and Driving Forces Behind Disruption in The Food Industry



Source: TEconomy Partners, LLC.

Across the food industry, a wide range of macroeconomic forces are impacting producers, manufacturers, processors, distributors, and consumers alike. Some of these forces are technological in nature, including the digitalization of the food industry and advancements in sensors, artificial intelligence, automation, and robotics. Other megatrends disrupting the industry are also heavily influenced by new technologies, including rapidly changing supply chains, growing consumer empowerment, and shifts toward environmental sustainability.

Ultimately, all facets of the food industry have been penetrated by new technologies. These technologies range from the Internet-of-Things (IoT), advanced sensors (including biosensors), advancements in wireless communication, big data, and advanced analytics, blockchain, and autonomous mobile systems. Food manufacturing firms are developing computational simulations, practicing cybersecurity, using augmented and virtual reality (AR/VR) systems for training and maintenance, and leveraging automation, robotics, and other Industry 4.0-related technologies. Advanced technologies are also helping companies innovate around food processing methods such as automated steam jacket kettles, sous vide equipment, and high-pressure processing lines.

Mobilizing for Success: Advancing Ohio's Food Industry

Technological evolution and associated economic disruption are a given. There is simply too much advancement taking place in translational sciences and R&D-based innovation for the food industry to remain static. Today's markets expect and demand new, better, faster, cheaper, and competing companies and organizations are playing leapfrog with one another in an endless race to innovate, secure market share, and capture new market spaces. In this environment, companies and economies must embrace change and be prepared to accept the risks that exist at the leading-edge of innovation.

State and regional government, economic development consortia, and associated organizations have a critical role to play in helping to ensure their economy's support systems are structured to leverage disruptive change and adapt to it. The interconnected nature of the food sector, especially among family-owned/operated food-businesses, offers exciting opportunities for new partnerships and initiatives. By supporting growth in R&D, encouraging a culture of innovation, empowering entrepreneurship, ensuring access to capital resources, supporting STEM/STEAM education and retraining programs, and creating physical environments that appeal to advanced technology ventures and their workforce, economic development organizations can help position the food industry sector for continued growth.

Ohio has the opportunity to catalyze the development of the food industry sector across the state. While the economic benefit is significant, it is important to note that ultimately innovation in the food industry is not just a matter of economic importance, but also an issue that is critical for the longevity and security of the state's food supply chain. As a result of these social, political, environmental, technological, and economic implications, it is imperative that public policy be enacted and public-private partnerships be developed that seek to strengthen the food industry sector to help ensure a sustainable future for Ohio.



