

TRENDS REPORT:

FOOD TECH 2021



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he COVID-19 pandemic has disrupted businesses of nearly every size and shape in the food industry. The global food system has been tested in a way unlike any time prior as both businesses and consumers faced the realities of its inherently complex and intricate nature. Widespread lockdowns and reduced mobility had immediate impacts on food purchasing behavior early in 2020, leading to a 57% increase in retail food sales when comparing March 2019 to March 2020

and a 51% decrease in sales at restaurants and other dining establishments comparing April 2019 to April 2020⁽¹⁾. Needless to say, this level of disruption wasn't unique to consumer purchasing behavior alone. Businesses in the food space felt the crunch of wildly fluctuating supply and demand, reduced labor availability, and myriad food safety and security challenges.

For many businesses, the pandemic highlighted the significant potential impact of the issues and risks that had existed but been deprioritized for years in the industry. As a result, businesses began investing earnestly (and at times rapidly) into technologies and digital capabilities to address the immediate effects of the pandemic and enable greater resilience for the future. This broad awareness and investment resulted in something of a banner year for agrifoodtech. Agrifoodtech startups raised \$26.1 billion in 2020 with expectations that the total number would settle to over \$30 billion once all deals have been accounted for.

Emergent Tech Impacting the Supply Chain



Direct to Consumer

Personalization and an evolving digital interface are becoming driving forces in the food retail market.



Machine Intelligence

We are leveraging data in smarter ways, and benefiting from next-gen robotics and computer vision techniques.



IoT

Sensors, the Internet of Things and RFID are laying the groundwork for a more connected and optimized food supply chain.



Engineered Food

Food engineering is driving sustainable alternatives and more resilient food types, allowing consumers to make more sophisticated, and greener, choices in their diet.



Blockchain

Distributed databases and contracts can increase trust within the food supply chain. What are the best use-cases for blockchain, and is the industry ready to make the most of this technology?

The Driving Forces Behind Food Tech Trends

Capability

Moore's Law: computation is more powerful and cheaper than ever, and new forms of chip and scanning technology can be deployed at scale.

Sustainability

Climate change is adding new constraints to how food is produced, what foods are produced, and what consumers will buy.⁽²⁾ Population growth is also putting pressure on the global food supply chain.

Regulation

The Food Safety Modernization Act (FSMA) and other key pieces of legislation driven by organizations like the U.S. Food and Drug Administration (FDA) and the European Food Safety Authority (EFSA) are continuing to push new industry standards and compliance mandates.

ROI/Efficiency

Companies are realizing the **impact and liability legacy systems** have on their bottom line.⁽³⁾ Investors are **recognizing opportunity in an industry** that has been slow to change, adding pressure to the ecosystem.

Consumers

Food individualism is on the rise and being a **conscious consumer** is becoming status quo. People are buying from sustainable, transparent, safer brands.

Wellness

The pandemic further accelerated the already mature food-as-medicine trend as consumers became hyperfocused on building immunity and safeguarding health and wellness.

Food Security

Food security is a well-known issue for many geographies and populations but only in the course of the past year did distribution and transportation issues highlight how imminently food security can be a global threat.



Direct to Consumer

Few trends in the food industry (or adjacent retail and consumer goods industries) accelerated to the degree of eCommerce and direct to consumer in the COVID landscape. Safety concerns and stay-in-place orders forced major food retailers and CPG brands to quickly meet consumers digitally and offer a range of new purchasing and fulfillment options. That's not to say that eCommerce or DTC are new trends – leaders have been reading the tailwinds for quite some time. Only that the perfect storm driven by COVID forced the industry to rapidly accelerate, launch, test, and iterate these capabilities. Looking forward as the post-COVID landscape normalizes, leaders have the opportunity to further capitalize on the way consumers are planning, shopping, preparing, and eating food.

The way consumers are purchasing food is changing—not merely in terms of when and where they are buying groceries or meals, but how they are engaging with the industry. Consumers are living in an on-demand world. Whether purchasing food, consuming media or buying clothes, personalization and convenience have become the building blocks of a winning user experience. Technology has generally trended towards targeted customer experiences, and the food industry has been adapting as a means to incorporate more seamlessly into the digital lives of the modern consumer. Companies are appealing to consumer demands for transparent food through more targeted messaging that situates their brand as part of an ethical consumption portfolio in order to build trust.

Online Grocery

Just a few years ago, Nielsen predicted the online grocery market to become a \$100 billion market by 2022⁽⁴⁾. Already in 2021, U.S. grocery sales online reached a record high of \$9.3 billion in January, outstripping June 2020's high of \$8.8 billion⁽⁵⁾. While sales will certainly normalize to an extent as vaccine rollout continues and mandates are lifted, evidence suggests that online grocery could reach that \$100 billion milestone in 2021.

Beyond the unique COVID circumstances contributing to growth in this area, this rapidly growing area of retail has begun to penetrate the market thanks to high-growth grocery delivery apps like Instacart, which raised a \$600m series E in 2018⁽⁶⁾. Existing retail brands have also taken note and incorporated online ordering and delivery into their own business models. Hybridized experiences take the best from CSAs, recurring orders for staples, product discovery, and the convenience of in-store pickup or delivery.

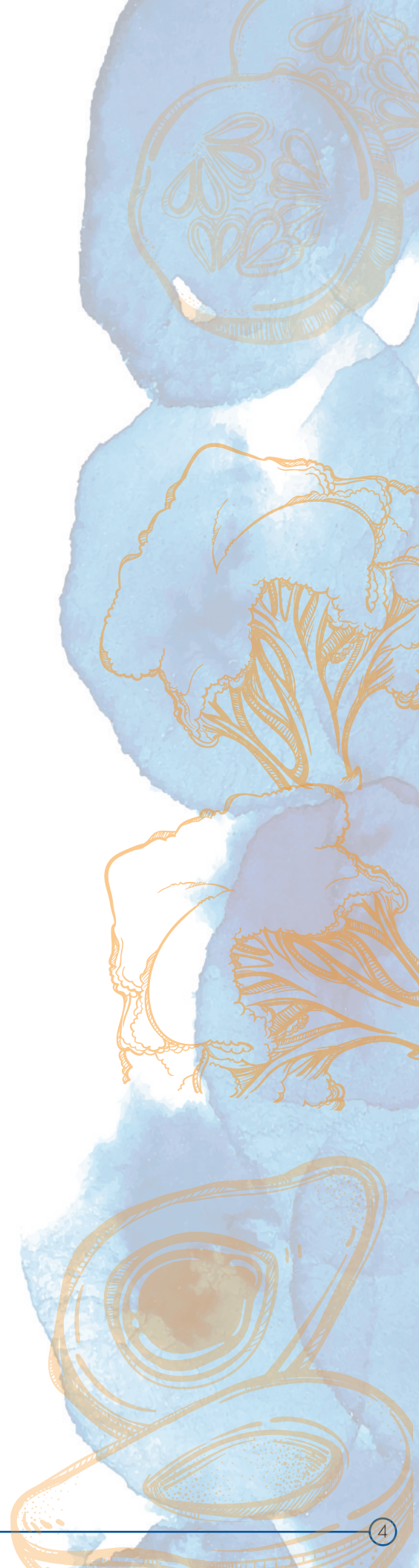
Consumer Product Personalization

CPG brands like [Target](#) are leveraging a digital presence to build direct relationships with consumers, diversifying the channels by which they are selling their products⁽⁷⁾. At the higher-end of this trend is product personalization. More companies than ever are finding ways to align their brand with customers on the level of the individual. Whether it's about addressing gut biology, ethics, nutritional concerns, discovery and convenience, or merely unique tastes, brands are finding scalable ways to allow consumers the control over their diet they have come to expect from all areas of retail. According to UBS, personalized nutrition is predicted to generate annual revenues up to \$64 billion by 2040⁽⁸⁾.

The App-ified Food Interface

With 54% of online shoppers buying into some form of subscription box⁽⁹⁾, it has become clear that consumers are craving optimized, modern shopping experiences. This is leading to a shift in the food market interface. In addition to the widespread adoption of grocery subscriptions, meal kits, and waste-diverting CSAs and donation tools, the restaurant model is transforming to accommodate the needs of individual online shoppers.

With approximately 1,500 ghost kitchens already operating in the U.S., the dine-in focus of restaurants is shifting, particularly as delivery sales spike, to one that optimizes kitchen space, staff, and resources. Alternatively referred to as ghost kitchens, dark kitchens, cloud kitchens, or virtual restaurants, the model also adds a layer of personalization to online ordering and professional meal preparation. These no-location restaurants are bringing the concept of a delivery-dedicated kitchen to market⁽¹⁰⁾, separating the overhead of restaurant service from the premium of prepared meals.





Machine Intelligence is Having a Renaissance

The field of machine learning has been a major beneficiary of accelerated computational capacity. Many AI techniques used today, like artificial neural networks, have been theoretical knowns for decades, only finding real-world use-cases as processing efficiency has increased. Innovations in the field paired with gains in processing power and larger datasets have affected global markets across industries. The food industry is no different, however many of the predicted impacts of machine learning have yet to fully proliferate throughout the supply chain.

Foundational to many AI business use-cases is the existence of large, labeled datasets. As suppliers, distributors, and food brands adopt shared data standards and digitize their records, the industry will transform from farm to fork through the insights and efficiencies gained using a variety of machine intelligence techniques.

THE FUTURE OF ARTIFICIAL INTELLIGENCE IN THE SUPPLY CHAIN

Predictive Analytics and Modeling

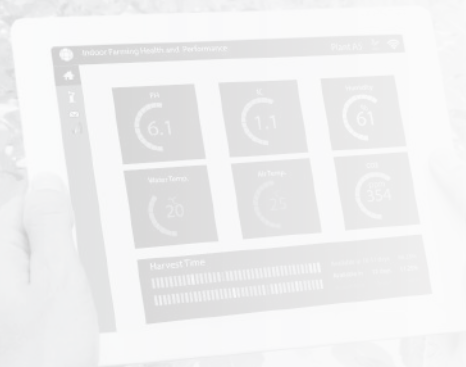
The use of data to make predictions or gather insights has a myriad of applications throughout the supply chain. Machine learning models can be applied to food events to find structures in the data that drive more efficient operations and identify high-risk areas of a supply chain. From recall risk prediction, supplier quality assessment, records reconciliation to carbon footprinting, crop condition monitoring, and climate-based ingredient modulation.

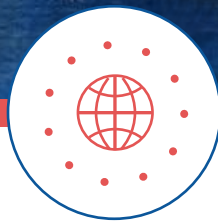
Computer Vision

Computer vision is a field of machine learning that applies to a variety of visual data types. Computer vision has use cases in food logistics, as well as quality control. Research has shown promising results for using computer vision in processes such as sorting, counting, measuring, and identifying food, as well as for quality issue detection, label reading, and space optimization across supply chain nodes. Computer vision is also an essential field in the realm of robotics and autonomous vehicles. Early successes using computer-generated, or synthetic, visual data to train “seeing” computers is also helping push forward semi-autonomous and autonomous robotics being deployed throughout the food system, from harvest to consumer delivery.

Food Needs to Embrace Data Standards to Benefit from AI

The quality and availability of data is fundamental to the successful use of AI, the ability to build sophisticated systems, and to find meaningful structures in the events that comprise our food supply chains. We will see massive gains in the industry by standardizing key data events and further investing in traceability.





Internet of Things and Sensors

After a year filled with uncertainty and insecurity, consumers are prioritizing transparency and trust in the post-COVID economy. Businesses in the food industry must be prepared to meet consumer demands for information about how their food is sourced, created, packaged, and distributed. Advancements in hardware and sensory technology are adding visibility and capability throughout the food system, from agri-tech to consumer appliances. Internet-connected objects and sensors can add a layer of intelligence, connection, and nodes for data collection to otherwise siloed or inaccessible areas of industry and daily life.



Sensors

Sensors are becoming cheaper and more scalable. In agriculture, sensor-enabled technology is contributing to a new wave of smart farming, which is predicted to be an \$18.21 billion market by 2025⁽¹¹⁾. With shifting climate patterns, hyper-localized crop optimization can help drive a more flexible food system by providing dynamic measurements on the local environment. Sensors are providing essential food preservation data within shipping units to enable food waste mitigation at every stage of the supply chain.

Paired with better data models, information collected from sensor technology will continue to drive smarter food business decisions and help establish the visibility needed for supply chain traceability.

RFID

Radio Frequency Identification (RFID) uses radio wave-based readers to activate and read tags that store data. These relatively cheap pieces of hardware allow product data transfer without a visual barcode. RFID technology is going to play a major role in reducing error and increasing our data tracking capabilities for food items throughout the supply chain.

Internet of Things

Smart packaging and IoT appliances can tell a more [complex story about food](#), add new avenues for consumer engagement, and extend food data collection beyond the supply chain. This area of technology is part of a feedback loop involving consumers learning and craving more visibility into food sourcing and quality.





Engineered Foods

Major innovations in food science and engineered foods over the past few years will continue to rise in 2021. Plant-based alternatives were just the first wave – as made most evident by the regulatory approval of Eat Just's cell-based chicken in Singapore at the end of 2020. While it's still early, similar regulatory approvals are currently in pursuit to varying degrees in Europe and the United States. Consumers have proved that they will welcome scientific intervention in food if there are clear environmental, economic, or nutritional benefits. From comprehensive meal replacements to plant-based alternatives, engineered foods will continue to bring creative solutions to complex issues throughout the industry

Maximizing Food

The engineered food trend is not merely about creating net new types of food or nutritional products. Food engineering is also focusing on how to maximize existing food. Innovations like edible protective materials that [extend shelf life](#) are already on the market, and crops created using CRISPR gene-editing are predicted to be available within the decade.⁽¹²⁾ Innovations in enhanced food will increase the level of resilience of perishable food supplies.

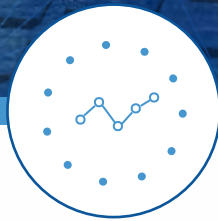
Engineered Alternatives

Engineered alternatives to environmentally costly items have grown in direct result to consumer pressures for options that are health-conscious for both the environment and themselves. Recent years have proven this trend, with, the Impossible Whopper brought Burger King its best quarter in four years in 2019⁽¹³⁾ and Beyond Meat going public with a market valuation of \$1.46 billion⁽¹⁴⁾. Companies are investing heavily in initiatives that boost the consciousness of their brand and the market is rewarding experiments in sustainable food engineering. Market leaders in the CPG space are betting big on this market. At the end of 2020, Unilever launched it's 'Future Foods' initiative which, among other ambitions, set a new annual global sales target of \$1.6 billion from plant-based meat and dairy alternatives within the next five to seven years⁽¹⁵⁾.

Personalized Nutrition

Personalized nutrition is taking on more complexity as human health factors are used as inputs for food production. Startups focusing on mapping food to biological factors like [DNA](#) and intelligent [analysis of consumers' diets](#) are bridging healthcare and the food industry through food engineering techniques.





Blockchain: Cart Before the Horse?

Blockchain technology is a shared method of record-keeping via a distributed network of nodes. Blockchain continues to play a central role in the food industry's imagination for the future. Distributed systems like blockchain technology provide an avenue for peer-to-peer transactions, transparency, consensus amongst stakeholders and immutability. Unlike many FoodTech trends, blockchain technology is not driven directly by shifting consumer demands, but rather is a technocratic solution providing one path towards building trust in the food chain.

Logistics and Traceability

Blockchain will remain a technology focal point within the food industry as momentum around food traceability continues to grow. Traceability, however, begins with supply chain event data, something the industry is only beginning to collect consistently in accordance with industry standards like GS1. Databases maintained by blockchain technology are only as powerful as the system's data inputs. When industry-wide data collection practices are in place and well maintained, there are a number of applications and key benefits of blockchain technology.

Smart Contracts

Smart contracts leverage blockchain technology to execute any number of business transactions using hard-coded logic. Smart contracts are often used to maintain and transfer ownership, execute automated payments, or to maintain simple forms of governance. Smart contracts can enable prorated payments between supply chain partners, provide the backbone for next-gen food co-ops, and automate exchange based on simple business logic.

Consumer Privacy

Consumer adoption of blockchain, primarily in the form of cryptocurrency, is still at its infancy. However, public concerns about data privacy have evolved over the last five years due to numerous high-profile data breaches compromising millions of U.S. consumers' information. As technology adoption within the food industry increases, blockchain technology may provide a promising avenue for safeguarding sensitive customer data.

“Blockchain is still in the early stages of providing real solutions for actual problems.”

DAVE DOWSETT, Global Head of Technology Strategy, Emerging Technology and Intentional Innovation at Investco.

SOURCE

The X Factor: Human Participation

Technology is a tool that can be implemented well or poorly. We need buy-in, training, and consensus. Food Tech must be developed and deployed in a way that advances the industry as a whole while protecting consumers. There are five key ways leaders can help drive innovation responsibly:

- 1 { Bringing in all stakeholders
- 2 { Open data standards and resilient data infrastructure
- 3 { Migrating food systems is high stakes: let's not "move fast and break things"
- 4 { Solving for labor shortages while protecting existing workers
- 5 { Access: let's not create digital food deserts



Food Tech 2030: A Possible Path

Media streaming companies haven't stopped at the online marketplace, subscription service, or content recommendation systems. They have built personalization engines that not only customizes the framing of each piece of content to a segment of one—from movie covers, to overview copy, to placement—they are feeding user behavior back into their content creation strategy.

What if through a digital supply chain, tracked and streamlined from seed to serving, every decision we make as consumers cascades back through the chain and drives the how, what, where, and when of every food product? Sensors in your fridge are sharing data that affects local produce programs or the optimization of yogurt shelf stability, and your buying power is weighted in the ingredient profile of the next snack product and grower/grocery hybrid strategy.

Food deserts are enriched by digital alternatives and waste mitigation, while foodborne illness is in decline. The system is more flexible and resilient in the face of climate change.

Embrace Tech

Regardless of the long term impacts of current Food Tech trends, companies that don't embrace new technologies will be left behind in many verticals of the food industry. The returns, efficiencies, and competitive advantages of embracing new technologies will increase as standards keep pace with innovation and consumer behavior.

1

Collect and Digitize Your Data

Adopt and implement **GS1 food industry standards** to ensure you are well-positioned to work with any supply chain partner. Invest in next-gen technology to help you keep and maintain your records. Partner with experts to ensure you're following best practices.

2

Stay Ahead of Regulators

The first wave of FSMA compliance dates have been rolled out mandating a breadth of food safety requirements. The FDA's **New Era of Smarter Food Safety** initiative has put an elevated focus on food traceability enabled by technology. Food safety requirements will continue to push companies towards a higher bar.

3

Listen to Consumers

Consumers dictate market trends with their purchasing power. Stay on trend with consumer demands by building a conscious brand and embracing transparency and traceability.

ABOUT CLARKSTON CONSULTING

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For more information about how we can help your company, [please contact us](#).



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Clarkston Consulting partnered with FoodLogiQ for the creation of this eBook!



Whether your organization is working from static spreadsheets and written documentation, or looking to leverage digitized supply chain data to generate business insights, FoodLogiQ helps business at all stages of technological maturity.

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