PitchBook

EMERGING TECH RESEARCH

2021 Annual Foodtech Report

VC trends and industry overview

Published Q1 2022

Contents

Institutional Research Group

ANALYSIS

Alex Frederick Senior Analyst, Emerging Technology

alex.frederick@pitchbook.com

pbinstitutionalresearch@pitchbook.com

DATA

Matthew Nacionales Data Analyst

Publishing

Designed by **Megan Woodard** and **Chloe Ladwig**

Cover by **Megan Woodard**

Published February 10, 2022

Vertical overview

The food technology (foodtech) sector is incredibly diverse and rapidly evolving due to shifting consumer behavior, technological innovation, fragile supply chains, and shifting social and environmental concerns. Under the foodtech umbrella, we include startups developing products and services that are changing the ways food has traditionally been discovered, purchased, delivered, prepared, and consumed. PitchBook's foodtech ecosystem encompasses bio-engineered foods, software, hardware, and even real estate through ghost kitchens. The foodtech sector includes technology-driven startups developing products and services that are changing how food has traditionally been discovered, purchased, delivered, prepared, and consumed.

The foodtech industry has grown with remarkable speed. Seven of the 10 largest foodtech deals of the past three years occurred in 2021. Increasing deal sizes and funding velocity have led to record aggregate deal values and volume, which we attribute to three key macro trends:

COVID-19: The pandemic has had a tangible impact on capital flows within the foodtech industry, primarily by accelerating e-commerce trends enabling consumers to safely order food from home. Mass adoption of apps to order meals and groceries has fueled expansion of existing restaurant and grocery delivery models and led to an emergence of new models, such as ultrafast grocery, and support services such as ghost kitchens, order aggregation tools, and e-commerce enablement solutions.

Environment: Concerns regarding climate change and sustainability fueled investment in alt-proteins and other food technologies that promise a lower carbon footprint compared with industrial animal agriculture. This trend extended into food delivery, wherein operators have begun rolling out electrified delivery fleets, and in foodservice and retail, wherein software and biotech solutions help to reduce food waste. Key providers incorporating sustainability into business practices include **Picnic**, Apeel, **Misfits Market**, and **OLIO**.

Labor: Labor is a key cost component for foodtech business models characterized by low margins and high volume. Developers of food delivery apps that leverage gig workers to shuttle meals between restaurants and customers are pursuing delivery robots to automate delivery. In 2021, challenges with hiring and maintaining labor disproportionately affected the hospitality industry. Restaurants and other foodservice operators are exploring kitchen robotics to automate repetitive tasks. Key providers include **Nuro**, **Miso Robotics**, and **Botrista**.

2021 timeline

March 23, 2021
VC DEAL
Eat Just raises a $200.0 million Series F following regulatory approval to commercialize cultivated meat in Singapore.

March 31, 2021
VC EXIT
Food delivery provider **Deliveroo** raises $2.1 billion in its IPO on the London Stock Exchange. The company is one of the largest restaurant delivery providers in Europe and has been expanding grocery delivery to new markets.

May 3, 2021
NEWS
Grocery retailer **Kroger** announces a partnership with Drone Express to provide grocery delivery via autonomous drone. **Kroger** has been quick to incorporate tech, partnering with other providers including **Nuro** for autonomous delivery vehicles and Ocado to operate automated fulfilment centers.

June 29, 2021
VC EXIT
Online grocery provider **Dingdong Maicai** (NYSE: DDL) goes public on the New York Stock Exchange, raising $94.4 million. The company is China's largest quick commerce (30-minute delivery) provider.

July 19, 2021
VC DEAL
Microbial protein provider **Nature's FYND** raises a $350.0 million Series C to accelerate growth, increase production capacity, and extend its product portfolio.

July 23, 2021
VC EXIT
Indian food delivery provider **Zomato** (BOM: ZOMATO) goes public on the National Stock Exchange of India, raising $1.3 billion. The Indian food delivery market is expanding rapidly due, in part, to a growing middle class and a shift to digital channels.

December 16, 2021
VC DEAL
Ultrafast grocery provider **Gopuff** raises $1.5 billion of venture funding in the form of a convertible note with a maximum post-money valuation of $40.0 billion, hinting at a potential IPO in 2022.

October 6, 2021
NEWS
USDA and Tufts University announce a $10.0 million grant to develop an Institute for **Cellular Agriculture**, which will be a US organization focused on cultivated protein research.

Jan Feb Mar Apr May Jun Jul Aug Sept Oct Nov Dec

Q4 VC DEAL COUNT SUMMARY

318
total deals

-6.2%
QoQ growth

12.8%
YoY growth

32.6%
YTD YoY growth

Q4 VC DEAL VALUE SUMMARY

$10.1B
total deal value

-13.1%
QoQ growth

107.3%
YoY growth

149.7%
YTD YoY growth

Foodtech VC ecosystem market map

Click to view interactive market map on the PitchBook Platform.

Market map is a representative overview of venture-backed or growth-stage providers in each segment. Companies listed have received venture capital or other notable private investments.

Bio-engineered foods

Novel ingredients

MANUSBIO · GELTOR · MILE HIGH LABS · INTEGRATED CBD · DEMETRIX · TEBRIO · DMC · algaecytes · cellibre · protera · M2 INGREDIENTS · refine 瑞芬生物 · hyasynth · MONTANA CRAFT MALT · EPOGEE · beam

Fermented protein

Perfect Day · Fynd · NOBLEGEN · motif · EVERY · MYCO TECHNOLOGY · CALYSTA · remilk · culture · meati · ecovative · ENOUGH · Formo · BIOTORK · WILD EARTH · Arzeda · SOLAR FOODS · air protein · NEW CULTURE · Kingdom · holaina · SUPERBREWED FOOD · shiru

Cultivated protein

FUTURE MEAT · UPSIDE · ALEPH FARMS · Mosa Meat · BlueNalu · MEATABLE · Finless FOODS · GOURMEY · TurtleTree · NEW AGE MEATS · Shiok Meats Seafood, reinvented · MISSION · BIOMILQ · ATOMO · ivyfarm · GROUP 11 · WILDTYPE · FORK & GOODE · IntegriCulture · MZANSI · PROSLIN Technologies · JOES FUTURE FOOD · NOVONUTRIENTS

Plant-based protein

IMPOSSIBLE · JUST · BOLT THREADS · NotCo · ripple · REDEFINE MEAT · v2food · nobell · MEATLESS FARM · STARFIELD 星期零 · daring · HARMLESS HARVEST · terviva · fazenda futuro · kitehill · STRONG ROOTS · Gathered Foods · MIYOKO'S · URBAN REMEDY · green monday · SIMULATE · PARABEL · MYFOREST FOODS · planted.

Future food forms

kate farms · Cometeer · soylent · waterdrop · Feed. · Huel · Food · GEM

Industrial & consumer tech

Food waste & traceability

Apeel · hazel technologies inc. · purfresh · Afresh · FULL HARVEST · mori · winnow · FoodLogiQ · bluwrap · vericool · ODDBOX · CSS · Phenix · COMETBIO · Spoiler Alert · KARMA · AANIKA · OUTCAST · BOOST BIOMES · REGRAINED · smartway · ecozen

Kitchen tech & robotics

Brightloom · MISO ROBOTICS · creator · SESTRA · ColdSnap · spinn · THE LEVEL · Picnic · HYPHEN · BARTESIAN · SPARK · Botrista · EKIM · mitte · BRUVI

Advanced vending

FARMER'S FRIDGE · bevi · 天使之橙 · CAFEX · Blendid · FELFEL · Karakuri · BASIL STREET · ORIONSTAR · ratio:

Discovery & review

Restaurant recommendation & review

TASTEMADE · SEATED · THE INFATUATION · SARAH

Food & beverage discovery

VIVINO · 豆果美食 · Cookat · elmenus · Firstleaf · abillion · BRIGHT CELLARS · SEASON

Kitchen enablement software

日日煮 DAYDAYCOOK · innit · OLIO · FEXY · relish · salted · 下厨房 · drop · Chefclub · Perfect Company · CULTUREHERO

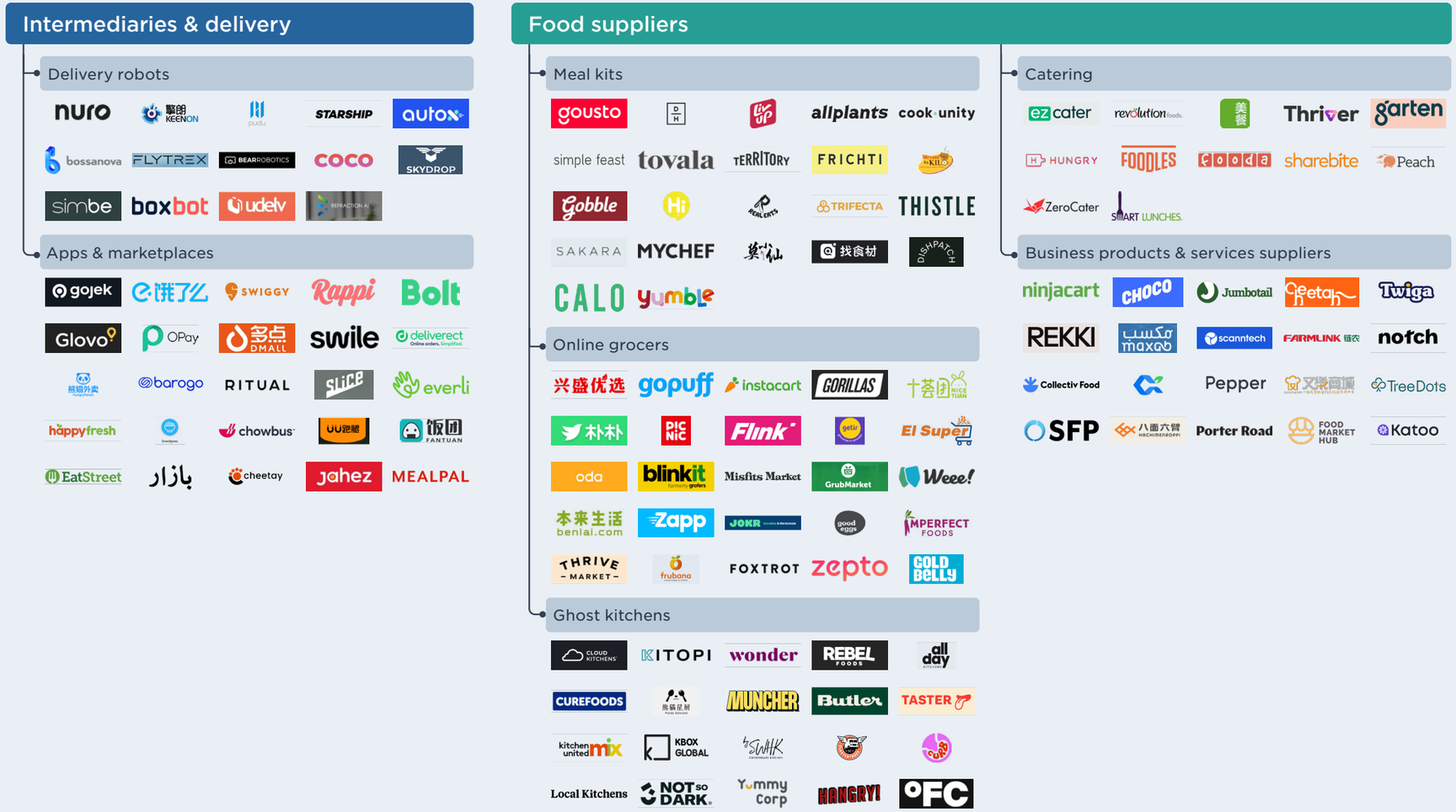
Personalized nutrition

VIOME · dnanudge · SEAPORT DIAGNOSTICS · DAY TWO · foodsmart · ZOE · 薄荷健康 · LEVELS · SIGNOS · MICROBA · January · SUPERSAPIENS · Floré by sun genomics · vitagene · FITNESS GENES · AnimalBiome

Foodtech VC ecosystem market map

Click to view interactive market map on the PitchBook Platform.

Market map is a representative overview of venture-backed or growth-stage providers in each segment. Companies listed have received venture capital or other notable private investments.



VC activity

Deal activity

2021 was a banner year for foodtech funding. Venture capital (VC) investment activity reached $39.3 billion across 1,358 deals, doubling deal values YoY. On a quarterly basis, funding totaled $10.1 billion across 318 deals, down 16.2% from Q3. However, deal data is a lagging indicator, and we expect that deal values will tick up 5% to 10% as new rounds are captured.

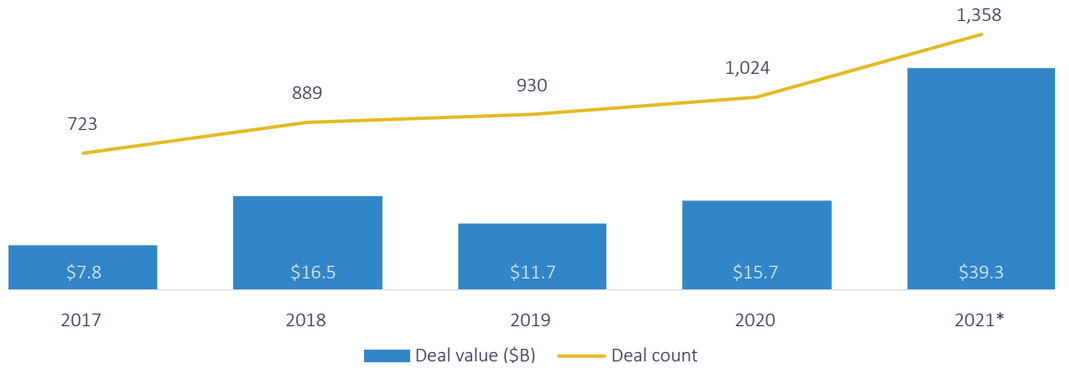
More than half of the VC invested into foodtech companies in 2021 was directed into two categories: online grocers and apps & marketplaces. Investment into food e-commerce has been rising over the past decade, and the trend accelerated significantly after the onset of COVID-19 required companies to build out infrastructure to meet consumer demand. The top 12 deals by value in 2021 were all from one of these two categories.

The largest deal of 2021 was a $3.0 billion late-stage VC round by online grocer **Xingsheng Selected** (also known as Furong Xingsheng) led by Sequoia Capital China. The company provides a community group-buying platform focused on fresh produce and grocery goods. Ultrafast was a major theme in 2021, and we logged 34 venture deals in companies such as **Gopuff**, **Gorillas**, and **Flink**. Deal count in ultrafast peaked in Q1 2021, with 12 deals logged. However, velocity declined by Q4, with only two deals logged. It remains to be seen whether this trend can maintain momentum and deliver on its value proposition in 2022.

ONLINE GROCERS*	APPS & MARKETPLACES*
	(Restaurants & other food delivery)
$18,428.7M	$6,798.2M
2021 VC deal value	2021 VC deal value
102	61
2021 VC deal count	2021 VC deal count

Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 1. FOODTECH VC DEAL ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

VC ACTIVITY

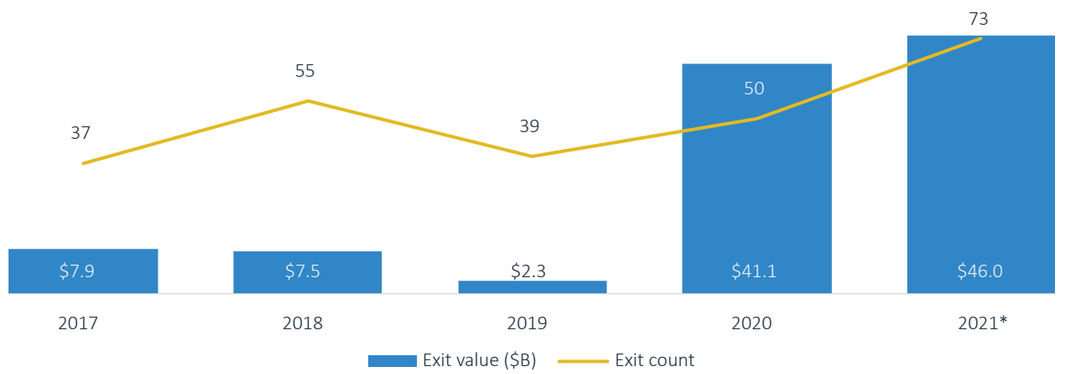
Although e-commerce startups dominated leaderboards when it came to funding values, investment in alt-protein startups continued a steady climb. This culminated in an incredible second half of 2021, during which investments in bio-engineered foods totaled $4.3 billion across 111 deals. The largest deal of Q4 was a $500.0 million late-stage VC investment in plant-based meat provider **Impossible Foods** as it nears an anticipated IPO in 2022. Other alt-protein categories received notable funding attention, as well. Cultivated meat provider **Future Meat** logged a $347.0 million Series B led by ADM ventures, while fermented protein provider **The Every Co**. tallied a $175.0 million Series C led by McWin and Rage Capital. We expect funding activity to continue to increase as the plant-based category matures and new regulatory paths for cultivated and fermented proteins clarify.

Exits

Exit activity soared to new heights in 2021, with exit values reaching $81.0 billion, while counts reached a record 73 exits. Exit count climbed 46.0% YoY, with growth logged across public listings, acquisitions, and buyouts, indicating a maturing of the foodtech vertical.

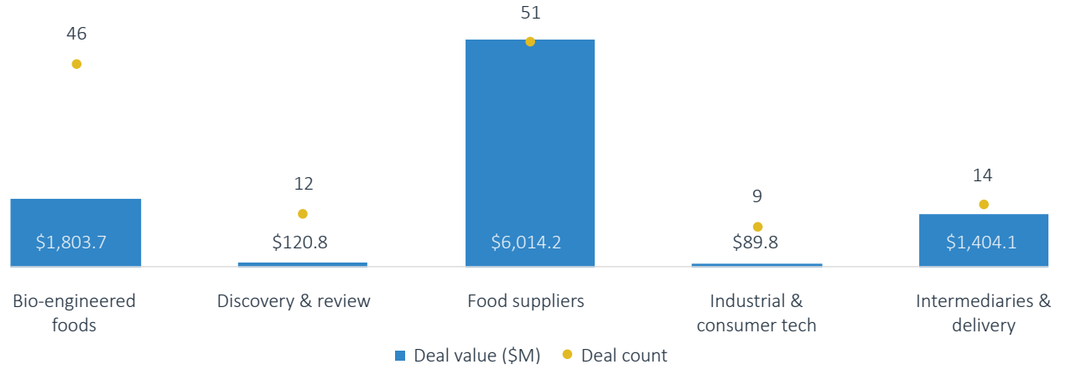
In our "**2021 Emerging Technology Outlook**" we predicted that we would see an uptick in alt-protein M&A. We saw this play out as the industry matured and as a proliferation of startups faced a crowded and competitive environment, as adjacent food companies looked to expand into alt-proteins and as incumbents sought to solidify their market positions. We logged nine acquisitions in the alt-protein category compared with zero in 2020.

Figure 2. FOODTECH VC EXIT ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 3. FOODTECH VC DEAL ACTIVITY BY SEGMENT* IN Q4 2021



Source: PitchBook | Geography: Global | *As of December 31, 2021

Segment overview

Bio-engineered foods

Alt-proteins log triple-digit growth propelled by healthy and environmentally conscious eating trends.

Food suppliers

Online grocery and other digital-first food providers ramp up fundraising to improve infrastructure and race to dominate new markets.

Intermediaries & delivery

Delivery robots record massive funding gains to improve food delivery profitability through automation.

Industrial & consumer tech

Companies addressing food waste see a doubling of investment activity as sustainability becomes an increasingly important value proposition.

Discovery & review

The personalized food trend leads to major funding gains.

Bio-engineered foods

Overview

Bio-engineered food providers develop novel consumer packaged goods (CPG) and commercial ingredients that evolve consumers' food encounters. Alt-proteins (plant-based, fermented, and cultivated proteins) provide consumers with animal-free alternatives to meat and dairy. Future food forms shift how consumers experience foods and beverages, while novel ingredients impart functional benefits to conventional food items. This sector is influenced heavily by consumer trends, such as the pursuit of foods and beverages, that improve health and benefit the environment.

Many large, multinational food companies exist as investors and innovators in the bio-engineered foods sector. Mars, Kraft Heinz, and Tyson Foods are just a few food companies that have invested in the alt-protein space. Investment can often inform future organic and inorganic innovation, as we observed with Tyson's plant-based Raised & Rooted brand, which followed earlier investments in alt-protein startups, including **Beyond Meat**. Specialty biotech companies have expanded their focus to the food & beverage industry to capitalize on the growing need for alt-protein inputs. Providers **Novozymes** and **Koninklijke DSM** are two biotech companies that now provide inputs to the fermented protein manufacturing process. Key startups include **Impossible Foods**, **Eat Just**, **Manus Bio**, and **Kate Farms**.

Segments include:

Alt-proteins

- **Plant-based protein**: Vegetarian food products that mimic meat and dairy in taste, texture, and appearance.
- **Cultivated protein**: Meat, seafood, dairy, and egg products manufactured by growing live animal cells in labs instead of through traditional methods of slaughtering, harvesting, and fishing.
- **Fermented protein**: Animal-free ingredients and CPG foods manufactured through fermentation. Fermented proteins can come in the form of stand-alone CPG products or can be used to improve the characteristics of plant-based and cultivated protein products.

Future food forms: Liquid and solid food products that come in forms that defy traditional presentation. This could include ice cream in powder form, salad in a bar, or coffee in a pod. We also include meal replacement products in the category, such as bars and shakes, that provide the nutrients and calories necessary for a healthy meal.

Novel ingredients: Unconventional food and beverage inputs that lend functional or environmental benefits. Examples include CBD, which is used for health and recreational benefits, and insects, a sustainable and low-cost protein source.

Industry drivers

Sizable vegetarian market and growing interest in alternative diets: Consumers are becoming more informed about their food, leading to more thoughtful and healthier eating decisions. Vegetarianism, veganism, and flexitarianism (reducing meat consumption in favor of fresh produce) are increasing in popularity for both health and environmental reasons. One study indicated that the number of vegans in the US had grown to 9.7 million in 2019, up from 290,000 in 2004.[1]

1: "Vegan Trends in the U.S.," Ipsos Retail Performance, 2019.

BIO-ENGINEERED FOODS

Health benefits of meat alternatives: Overconsumption of certain types of meat has been linked to several health issues, including cardiovascular disease and colorectal cancer. According to a University of Oxford study, reducing meat consumption to established global dietary guidelines could help reduce the cost of public and environmental health issues by $1.5 trillion globally by 2050.[2]

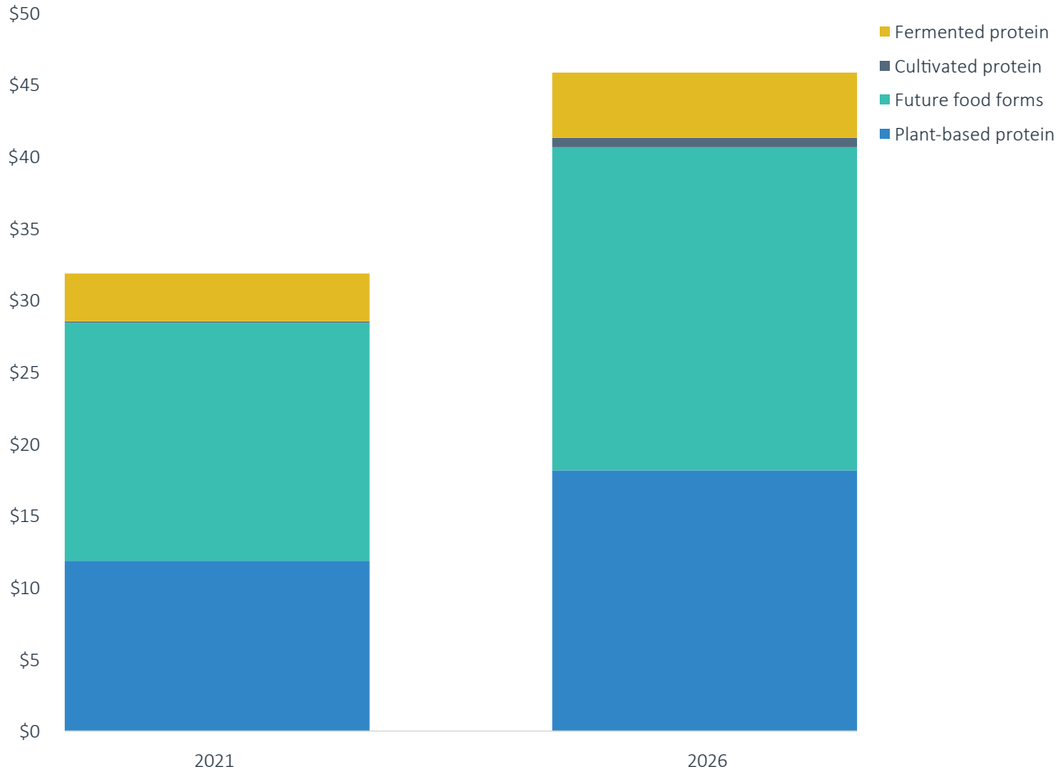
Environmental awareness and concerns about traditional food production: A recent study confirmed public perception of the environmental benefits of vegetarian and vegan diets, indicating that, compared with omnivore diets, vegan and vegetarian diets provide significant reductions in land-use impacts, water use, and greenhouse gas emissions (GHGs).[3] Interest in improving the environment through the reduction of meat consumption is gaining traction among consumers and many prominent social activist investors.

Advances in biofood sciences enabling more efficient production of bio-engineered foods: Food science innovations have allowed plant-based producers to create more realistic alternatives to meat and dairy products.

Market size

The global bio-engineered foods market is expected to reach $31.9 billion in 2021 and has been forecast to grow to $45.9 billion by 2026, representing a 7.6% CAGR. Growth is enabled by rapid new product introduction, as the theme has been embraced by incumbent multinational

Figure 4. BIO-ENGINEERED FOODS MARKET SIZE ESTIMATE ($B)*



Source: PitchBook Emerging Tech Research | Geography: Global | *As of December 31, 2021

2: "Plant-Based Diets Could Save Millions of Lives and Dramatically Cut Greenhouse Gas Emissions," University of Oxford, March 21, 2016.
3: "A Review of Environmental Life Cycle Assessments of Diets: Plant-Based Solutions Are Truly Sustainable, Even in the Form of Fast Foods," MDPI, Anna Kustar and Dalia Patino-Echeverri, September 3, 2021.

food companies such as **Nestlé**, JBS, and Tyson. Fermented protein technology is a small but growing segment of alt-proteins. A few fermented protein products launched in 2020 and 2021. However, many more are expected to launch in 2022, including animal-free cream cheese spreads, sport protein powders, and whole-culture seafood from The Urgent Company, **Superbrewed Food**, and Aqua Cultured Foods, respectively. The cultured protein category is small but has witnessed an explosion in startups and investor interest. In Q4 2020, **Eat Just** became the first company to receive regulatory approval to commercialize cultivated meat products in Singapore. This milestone is likely to speed the adoption of regulatory frameworks in other countries and expand the size of the market.

Business model

Companies in the bio-engineered foods segment produce ingredients and consumer packaged goods food products. Providers sell primarily CPGs such as plant-based meats to consumers through restaurants and grocery stores. These companies tend to have high lab-based research & development (R&D) expenses. Novel ingredient providers sell primarily to food manufacturers, which use the products as an input.

Common industry key performance indicators (KPIs) for bio-engineered food companies include:

- Monthly recurring revenue and growth
- Revenue and client churn
- Customer acquisition costs and customer acquisition costs/lifetime value
- Return on research capital

VC activity

Investment activity in 2021 totaled $6.0 billion across 224 deals, a 93.4% increase YoY in deal value. On a quarterly basis, we logged $1.8 billion across 46 deals. This was a 29.2% decline in deal values QoQ following a monumental Q3, during which deal values topped the previous quarter by more than 3.5x. The bio-engineered foods segment has been percolating for several years, slowly gaining momentum with new startups and growing investor interest from food companies, specialist foodtech VCs, and generalist VCs. In 2021, we witnessed the culmination of key milestones, including:

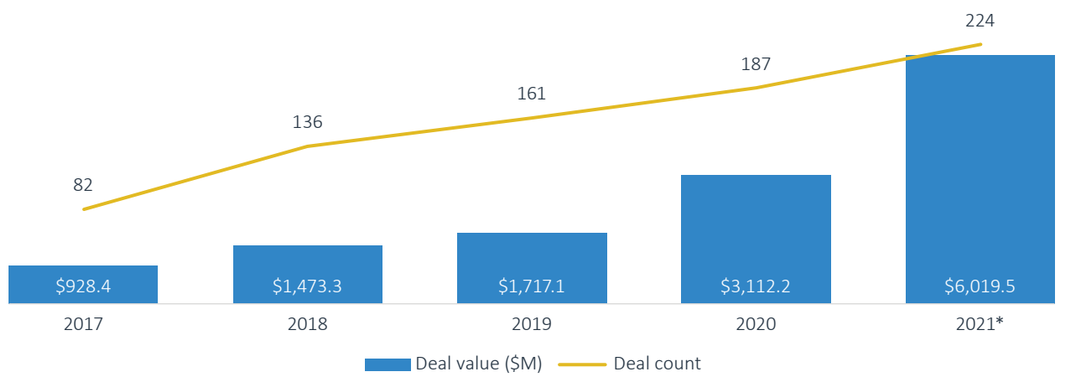
- The maturation of the plant-based sector and an extensive list of companies seeking late-stage VC funding
- Successful demonstrations of the benefits of fermented proteins in CPG, leading to new startups, product introductions, and VC funding
- Commercialization of the first cultivated protein product by **Eat Just**

These three factors generated significant excitement from consumers and investors alike in 2021 and led to a near doubling in VC funding YoY. We expect this momentum to continue into 2022 as bio-engineered foods providers continue to raise capital for R&D, building new production facilities, and expanding market availability.

BIO-ENGINEERED FOODS

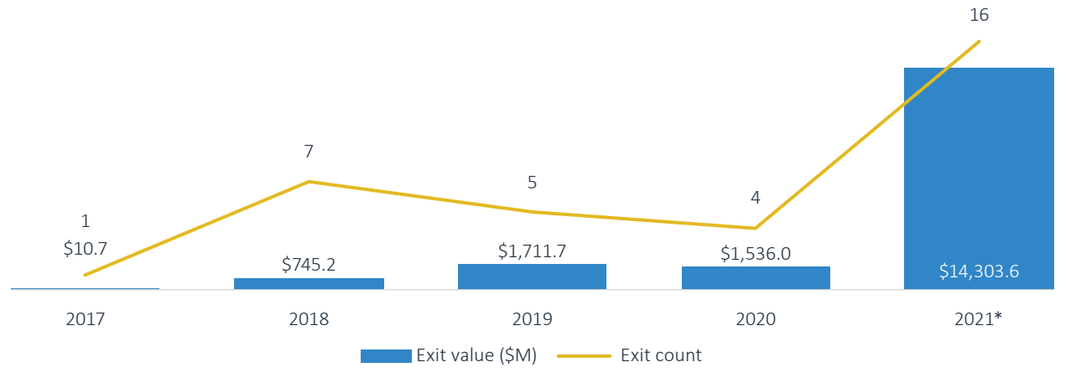
Exit activity totaled $14.3 billion across 16 exits in 2021, 4x the exit count of the previous year. Consolidation by industry leaders including Danone, **LIVEKINDLY**, and **MeaTech** drove exit activity. This indicates a maturing industry with rising category leaders rather than a loss of momentum. We also logged three successful public listings, including **NextFerm**, **Zoglo's Incredible Food**, and **Plant Veda**, indicating that public appetite for alt-proteins remains strong. The largest exit of the year was **Ginkgo Bioworks**' $14.2 billion SPAC on the NYSE. The company has used its biomanufacturing platform to create and spin off several businesses, including fermented protein provider **Motif Ingredients**.

Figure 5. BIO-ENGINEERED FOODS VC DEAL ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 6. BIO-ENGINEERED FOODS VC EXIT ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

BIO-ENGINEERED FOODS

Figure 7.

Key bio-engineered foods VC deals in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	STAGE	DEAL SIZE ($M)	LEAD INVESTOR(S)	VALUATION STEP-UP
Impossible Foods	November 23, 2021	Plant-based protein	Late-stage VC	$500.0	Mirae Asset Global Investments	N/A
Nature's FYND	July 19, 2021	Fermented protein	Series C	$350.0	SoftBank Investment Advisers	3.7x
Perfect Day	September 29, 2021	Fermented protein	Series D1	$350.0	Canada Pension Plan Investment Board, Temasek Holdings	1.5x
Future Meat	December 19, 2021	Cultivated protein	Series B	$347.0	ADM Ventures	N/A
Eat Just	September 20, 2021	Cultivated protein, plant-based protein	Series F	$267.0	N/A	N/A
Bolt Threads	September 1, 2021	Plant-based protein	Series E	$253.0	N/A	1.2x
NotCo	July 26, 2021	Plant-based protein	Series D	$235.0	Tiger Global Management	N/A
Motif	June 16, 2021	Fermented protein	Series B	$226.0	BlackRock, Ontario Teachers' Pension Plan	3.1x
Eat Just	March 23, 2021	Cultivated protein, plant-based protein	Series F	$200.0	Qatar Investment Authority	N/A
The EVERY Company	December 7, 2021	Cultivated protein, fermented protein	Series C	$175.0	McWin, Rage Capital	3.4x

Source: PitchBook | Geography: Global | *As of December 31, 2021

BIO-ENGINEERED FOODS

Figure 8.

Key bio-engineered foods VC exits in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	EXIT SIZE ($M)	EXIT TYPE	ACQUIRER(S)/INDEX
Ginkgo Bioworks Holdings	September 17, 2021	Novel ingredients	$14,225.0	Public listing	Soaring Eagle Acquisition
Laurus Bio	January 20, 2021	Fermented protein	$33.6	Acquisition	Laurus Labs
NextFerm	January 26, 2021	Fermented protein	$26.4	Public listing	Tel Aviv Stock Exchange
Peace of Meat	February 10, 2021	Cultivated protein	$18.6	Acquisition	MeaTech
Protifarm	April 13, 2021	Novel ingredients	Undisclosed	Acquisition	Ynsect
Gaia Foods	August 9, 2021	Cultivated protein	Undisclosed	Acquisition	Shiok Meats
New Barn Organics	June 3, 2021	Plant-based protein	Undisclosed	Acquisition	Nestfresh Eggs
Sol Cuisine	May 19, 2021	Plant-based protein	Undisclosed	Public listing	Platform 9 Capital
Zoglo's Incredible Food	July 26, 2021	Plant-based protein	Undisclosed	Public listing	Canadian National Stock Exchange
Bugfoundation	September 22, 2021	Novel ingredients	Undisclosed	Acquisition	Hans Kupfer & Sohn

Source: PitchBook | Geography: Global | *As of December 31, 2021

BIO-ENGINEERED FOODS

Figure 9.

Key bio-engineered foods VC-backed companies*

COMPANY	SUBSEGMENT	VC RAISED TO DATE ($M)	POST-MONEY VALUATION ($M)	MOST RECENT VC STAGE
Impossible Foods	Plant-based protein	$1,862.5	N/A	Late-stage VC
Perfect Day	Fermented protein	$711.5	$1,585.3	Series D1
Nature's FYND	Fermented protein	$463.0	$1,750.0	Series C
Noblegen	Fermented protein	$27.6	N/A	Series B
NotCo	Plant-based protein	$363.0	$1,500.0	Series D
Motif	Fermented protein	$343.5	$1,226.0	Series B
The EVERY Company	Cultivated protein, fermented protein	$246.9	$605.0	Series C
Ripple Foods	Plant-based protein	$221.7	$357.3	Series E
MycoTechnology	Fermented protein	$198.2	$521.8	Series E
Calysta	Fermented protein	$172.8	$284.0	Series D1

Source: PitchBook | Geography: Global | *As of December 31, 2021

BIO-ENGINEERED FOODS

Figure 10.

Key bio-engineered foods incumbents*

COMPANY	HOLDING STATUS	CATEGORY	KEY PRODUCTS	EV/TRAILING REVENUE
Danone	PAR: BN	Plant-based & fermented protein	Silk & So Delicious plant-based beverages and dairy alternatives	1.9x
Tyson Foods	NYSE: TSN	Plant-based & fermented protein	Raised & Rooted plant-based meat	0.8x
Beyond Meat	NASDAQ: BYND	Plant-based protein	Plant-based burgers and sausages	8.3x
Oatly	FRA: 9ZX	Plant-based protein	Oat milks and dairy alternatives	5.3x
Nestlé	SWX: NESN	Plant-based protein	Garden Gourmet burgers & sausages, Wunda plant-based milks	4.2x

Source: PitchBook | Geography: Global | *As of December 31, 2021

Opportunities

Plant-based and fermented meat and fish: The popularity of **Beyond Meat** and **Impossible Foods** has validated the market for plant-based meat & dairy. Although a slew of incumbent CPG companies such as Boca and **MorningStar Farms** have been selling fake chicken products for years, we believe today's providers are tapping into a different consumer base—one that is more focused on the health, environmental, and ecological impacts of the traditional meat industry. As plant-based proteins continue to increase in sophistication and ability to imitate animal-based meats, fermentation technology has emerged as an innovative tool, lending key sensory characteristics such as meaty taste and texture, in addition to superior digestibility and nutrition profiles. A prime example of these benefits can be found with Meati, a fermented protein provider developing whole cuts of meat analogs such as chicken breasts, steak, and jerky from mycelium. The company piloted its mycelium steak at restaurants in Boulder, Colorado, and is planning its first product launch in 2022. Other key fermented protein products include bacon from **Atlast Food** Co. and animal-free, whole-cut fish from **Aqua Cultured Foods**.

Dairy alternatives: Animal-free dairy products are experiencing rapid growth, leading to an increasingly diverse and crowded marketplace. Well-known providers include Silk and Soy Delicious, which sell single-ingredient dairy products made from soy, peas, oats, or nuts. Incumbents are increasingly disrupted by startups including **Lavva**, **Kite Hill**, and **Forager Project**, which are producing new animal-free dairy products that seek to better mimic dairy by improving the sensory characteristics. Some providers are using precision fermentation to produce real dairy without animals. Precision fermentation uses microorganisms as micro-production factories that produce substances identical to animal proteins, fats, and enzymes that can then be used as ingredients.[4] **The Urgent Company**. uses precision fermentation to produce milk proteins, from which it has developed a growing list of animal-free dairy products including ice cream, cream cheese, and sports protein powder. Other startups developing animal-free dairy products using fermentation include **Superbrewed Food**, **ENOUGH Food**, and **Nature's Fynd**.

Cultivated proteins: Animal meat and dairy manufactured without animals and traditional animal agriculture remains the holy grail of alt-proteins due to the potential health, environmental, ethical, and food security benefits. However, significant challenges stand in the way of mass adoption including regulatory hurdles, production costs, and technological barriers to scaling production and producing a desired end product. Although **Eat Just** achieved a major milestone in 2020 as the first provider to sell a cultivated meat product after receiving regulatory approval in Singapore, there have been few regulatory advances since then. There remains no clear path to regulatory approval in the US or any other country—Singapore included. However, other cultivated meat companies, including **Shiok Meats** and **Avant Meats**, have established facilities in Singapore in anticipation of a friendlier regulatory environment. Other key providers include **Future Meat**, **Upside Foods**, and **BlueNalu**. For an in-depth analysis of the cultivated protein opportunity, see our analyst note, "**Reinventing Meat**."

Tissue engineering suppliers: Approaches to producing cultivated agriculture are based mainly on existing medical technologies that rely on traditional laboratory equipment and technology. We believe several of these suppliers are significantly exposed to the cultivated agriculture opportunity, including:

4: "State of the Industry Report: Fermentation," Good Food Institute, January 19, 2022.

BIO-ENGINEERED FOODS

- **OSPN GmbH:** develops modular molecular bioreactors to propagate animal cells
- **Culture Biosciences:** third-party "biomanufacturing-as-a-service," including lab testing facilities and a digital biomanufacturing platform
- **Robur Health:** genome-level metabolic modeling
- **CELLINK:** bioprinting technologies
- **3D Cultures:** economic tools for biofabrication and tissue engineering

Novel ingredients and a rising protein imperative: The global population is growing rapidly and is expected to reach 9.7 billion by 2050, according to the United Nations.[5] To feed the increasing number of people, new sources of food must be identified and existing raw materials expanded where feasible. Insects and fungi are two food sources that are less expensive and faster to produce than industrial meat. Investors are funding startups developing production techniques that can scale to meet the growing demand.

Future food forms: In a world with an increasing number of dietary options and meal choices, many consumers are experiencing decision fatigue instead of seeking a simple way to eat healthy without the stress. Meal replacements are an inexpensive option that allows consumers to replace meals with a drink or bar that is, in theory, nutritionally balanced and complete. These products can help consumers maintain healthy diets and limit calories. Although **Soylent** is the original and best-known meal replacement company, several other providers have helped expand the market, such as **Huel** and **YFood**. Future food forms come in unconventional forms to reduce perishability and increase convenience. Examples include dehydrated and dissolvable tea pods by **Tea Drops**, sliced condiments by **Slice of Sauce**, and vitamins in the form of chocolate candy by Source.

5: "Growing at a Slower Pace, World Population is Expected to Reach 9.7 Billion in 2050 and Could Peak at Nearly 11 Billion Around 2100," United Nations Department of Economic and Social Affairs, June 17, 2019.

Risks and considerations

Regulation, politics, and social backlash: Incumbent animal meat producers are competing with the alternative meat industry across numerous avenues. For example, Missouri prohibited the use of the word "meat" to define food products "not derived from harvested production livestock or poultry." This would make it illegal to label plant-based meat alternatives as "meat" for marketing or packing purposes without qualifiers that explain the product is plant-based. Additionally, animal meat advocacy groups such as the Missouri Cattlemen's Association are lobbying to create more regulation of plant-based meat producers.[6]

Sales channel risk: The two largest plant-based meat companies, **Beyond Meat** and Impossible, initially pursued very different sales strategies. **Beyond Meat** focused on grocery stores with product placement in the meat section alongside animal meat products. The company has since expanded to restaurants, focusing primarily on fast food. Impossible initially focused on high-end restaurants, partnering with celebrity chefs to showcase the product. The company has since expanded into lower-end fast-food restaurants and launched a growing list of CPG products including animal-free beef burgers, meatballs, and chicken nuggets. Targeting high-end restaurants allows companies to achieve greater margins and position their brand as a luxury good. Grocery sales allow access to a larger pool of potential customers, although at higher expense, which may be implausible for early-stage businesses. Restaurant sales have struggled during the pandemic, thus creating additional headwinds for this channel.

6: "Missouri Becomes First State to Regulate Use of the Word 'Meat,'" *USA Today*, Zlati Meyer, August 28, 2018.

BIO-ENGINEERED FOODS

Alternative meat development requires significant R&D: R&D represents a considerable barrier to entry for startups, given the high degree of technology needed to develop, produce, and refine plant-based meat. This will keep the pressure on margins, at least in the short term. While scale could increase margins, the industry likely faces commoditization over the long run.

Expensive production process: Cultivated agriculture technology is based on tools and techniques initially developed in a lab for medical and biotech purposes. As such, the production process is currently performed in tiny batches at great expense.[7] As the technology and production process have matured, costs have plummeted. Several startups are convinced that the price will continue to decline to less than $5 per pound within the next two years, compared to $3 to $4 for regular beef.[8] Despite advancements, scaling for mass production is complicated and may require the advent of new technologies, which will put mass production at least a few years away.

Consumers have an uncertain perception of lab-grown meat: A 2018 survey of consumer perceptions of cultivated agriculture indicates that, despite interest in reducing health risks, environmental harm, and animal welfare issues, concerns for product taste, price, safety, and "naturalness" may pose significant barriers to adoption.[9] Cultivated agriculture advocates must be careful to manage public perception of cultured meat and work to educate consumers on the benefits and considerations of cultivated agriculture versus industrial agriculture.

7: "The $325,000 Lab-Grown Hamburger Now Costs Less Than $12," *Fast Company*, Ariel Schwartz, April 1, 2015.
8: "$5 Lab-Grown Burger Could Be Ready by 2022," Genetic Literacy Project, Daniel Nelson, September 28, 2018.
9: "A Survey of Consumer Perceptions of Plant-Based and Clean Meat in the USA, India, and China," Frontiers in Sustainable Food Systems, Christopher Bryant, et al., February 21, 2019.

Food suppliers

Overview

Companies in this category use innovative digital technologies to manufacture or distribute food to consumers or other businesses, often selling their goods directly to consumers via an app. Food suppliers include digital-first startups, as well as incumbents, such as grocers, that have expanded beyond brick-and-mortar operations to include digital solutions.

Legacy incumbent food suppliers include a mix of large grocery and e-commerce companies, as well as newly public, digital-first companies. **Kroger** has been a grocery company since 1882. Over the past decade, it has rapidly expanded into e-commerce, partnering with third-party digital grocery enablement provider **Instacart**, developing automated fulfilment centers with Ocado, and building an autonomous delivery vehicle fleet with **Nuro**. Amazon has come to dominate the online grocery space with its 2017 acquisition of Whole Foods, expansion of Amazon Fresh grocery stores, cashierless Amazon Go convenience stores, and the stickiness of its Amazon Prime membership program. Disruptive startups include Weee!, with its community grocery shopping model and a growing cadre of ultrafast grocery providers such as **Fridge No More**, **Food Rocket**, and **Gorillas**.

Subsegments include:

Meal kits: Companies within this category can be segmented into two groups:

- **Ready-to-prepare:** Provide recipes and fresh ingredients to prepare those recipes at home, thereby saving customers the time and effort to find new recipes and shop for ingredients.
- **Ready-to-heat:** Provide freshly prepared meals that can be microwaved or heated in the oven. These exist as a fresh alternative to frozen meals.

Online grocers: Online grocery stores that allow customers to order grocery goods for pickup or delivery. Orders can be filled out of local brick-and-mortar grocery stores and local fulfilment centers or shipped through the mail from regional fulfilment centers.

Business products & services suppliers: Web-based grocery vendors that sell directly to food businesses in innovative ways.

Ghost kitchens: Commercial kitchens serving meal delivery platforms that operate without a brick-and-mortar dining experience for patrons. The companies operating within these kitchens may be delivery-only brands or expansion kitchens that extend the reach of existing restaurants.

Catering: Companies that cater meals for school, office, and event functions.

Industry drivers

COVID-19 and home confinement: Government-recommended—or government-ordered—self-isolation in 2020 drove many consumers to order groceries from home, many for the first time. This “forced” adoption accelerated the adoption curve of online grocery services, thus creating headaches for overwhelmed online grocers and a new sales channel for traditional brick-and-mortar providers.

Steadily rising consumer demand: Prior to the pandemic, consumer adoption for all e-commerce services including grocery was on the rise. As investment in infrastructure is realized, we expect the consumer experience to improve, which will lead to improved adoption

and retainment metrics. Demographic trends also favor this shift, as the millennial and Z generations represent more purchasing power in the economy.

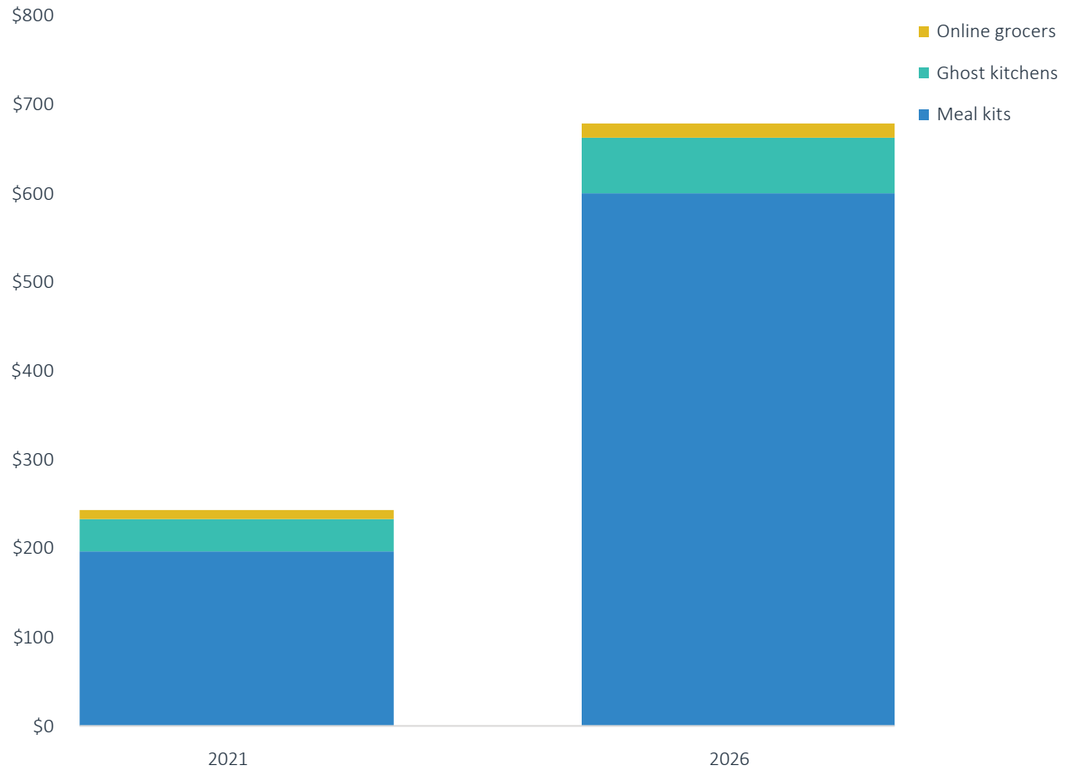
Growing demand for organic, specialty, or premium foods: Product selection in brick-and-mortar grocery stores is limited by store size and shelf space. Consumers can source a much more extensive range of organic, premium, international, and other specialty goods from online providers.

Investment by Amazon and Walmart: Investment and expansion of grocery services by Amazon (NASDAQ: AMZN) and Walmart (NYSE: WMT) have made online grocery services through these providers more affordable and more widely available.

Market size

The pandemic shut down restaurant dine-in service and sent consumers hunting for meal alternatives, which included online groceries, meal kits, and food delivery via third-party delivery apps and ghost kitchens. This resulted in net positive growth in the food supplier market in 2021 and accelerated adoption of these emerging food trends. We estimate the global food supplier market size reached $242.1 billion in 2021 and forecast a CAGR of 22.8% over the next five years, resulting in a $676.9 billion market by 2026.

Figure 11. FOOD SUPPLIERS MARKET SIZE ESTIMATE ($B)*



Source: PitchBook Emerging Tech Research | Geography: Global | *As of December 31, 2021

FOOD SUPPLIERS

Online grocery sales currently represent 13% of the total grocery market in the US,[10] and the industry is expected to grow to 20% of total grocery retail by 2025, which represents a significant growth opportunity in an otherwise low-growth industry.[11] According to IBIS, the US grocery market is a $655.0 billion industry with a 0.9% CAGR, implying that US online grocery sales may grow to roughly $132 billion by 2025.[12]

The two largest meal kit providers, **Blue Apron** (NYSE: APRN) and **HelloFresh** (FRA: HFG) have roughly 5.7 million combined active users and saw combined TTM revenues of $7.1 billion as of September 30, 2020. The meal kit market saw a revitalization of demand in 2020 and 2021 due to COVID-19, and we estimate the industry represents $9.5 billion in spend globally in 2021. We believe the market growth experienced in 2020 and 2021 will begin to taper in 2022 as pandemic-related drivers gradually recede. We estimate the market will reach $16.0 billion by 2026, representing an 11.0% CAGR.

Business model

Food supplier companies sell groceries and food products online, often using third-party apps and marketplace intermediaries to advertise products and manage delivery logistics. Businesses in the food supplier segment generate revenue through their retail price markup, charging delivery fees, and selling memberships. Emerging ghost kitchen models generate revenue through consulting services and restaurant operations services. See our **ghost kitchen analyst note** for more information.

Attractive characteristics of the space include:

- Cost savings from having no retail locations
- Capture of rich consumer data to drive personalized experiences and increase stickiness
- Ability to market via e-commerce channels
- Ability to gain access to demand for organic, natural, and specialty goods
- Legacy competitors disadvantaged in digital commerce

Common industry KPIs for food suppliers companies include:

- Revenue and client churn
- Gross merchandise volume
- Payback period/sales efficiency
- Customer acquisition costs
- Lifetime value and customer acquisition costs/lifetime value
- Customer acquisition costs recovery time (months to recover customer acquisition costs)

VC activity

The food suppliers segment experienced a remarkable 2021 in terms of VC funding, with $21.4 billion logged across 172 deals. This is a 3.6x increase in capital invested YoY. We recorded 43 mega-deals ($100 million+) and four deals of $1 billion+, which is indicative of the perceived importance and opportunity of building out complex and costly fresh food infrastructure to support grocery e-commerce.

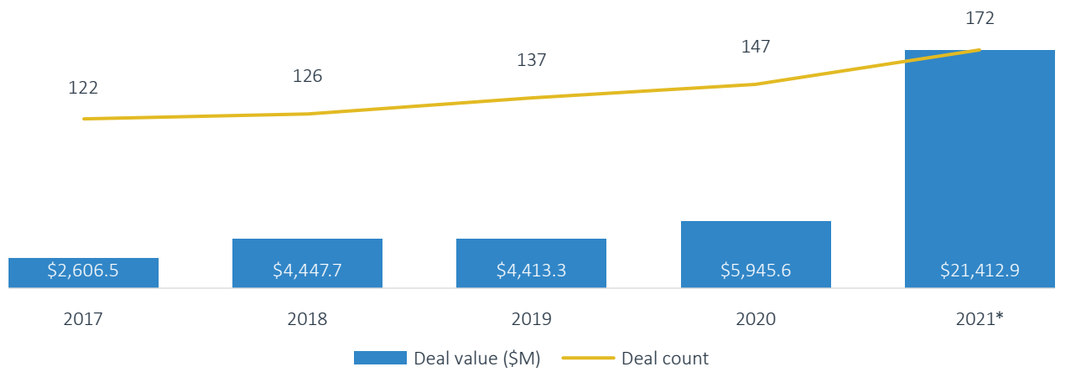
10: "Annual 2021 US Online Grocery Sales Total Nearly $98 Billion," Brick Meets Click, David Bishop, January 11, 2022.
11: "Online Grocery Shopping Is Misunderstood," Explorer Research, Anne Stephenson, November 7, 2018.
12: "Supermarkets & Grocery Stores Industry in the US—Market Research Report," IBIS World, December 29, 2021.

FOOD SUPPLIERS

Four of the top 10 largest deals in 2021 were directed into China-based grocery startups. Online grocery is expanding rapidly in China, and competition is fierce. Providers are competing for the massive market opportunity presented by a national population of 1.4 billion and a growing middle class. **Xingsheng Selected** logged the largest deal of the year, a $3.0 billion late-stage VC round led by Sequoia Capital China.

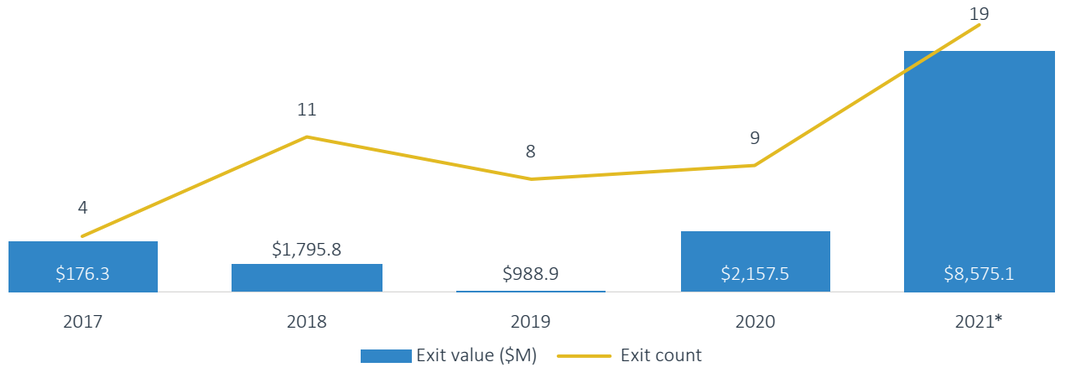
Exit activity was driven by a $5.5 billion IPO of China-based online grocer **Dingdong Maicai**, which listed on the NYSE. The company differentiates by operating its own logistics network, which includes many local micro-fulfillment centers, thereby allowing it to guarantee delivery within 30 minutes to customers living within one kilometer. Other providers, including **Gorillas** and **Gopuff**, are raising massive rounds to build out ultrafast grocery infrastructure. If this proves to be a strong value proposition for consumers, we may see other providers turning to in-house logistics models to rein in fulfillment and delivery times. We also logged two SPACs in 2021: online grocer **BigBasket**, and micromobility provider **Helbiz**, which has a growing ghost kitchen business.

Figure 12. FOOD SUPPLIERS VC DEAL ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 13. FOOD SUPPLIERS VC EXIT ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

FOOD SUPPLIERS

Figure 14.

Key food suppliers VC deals in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	STAGE	DEAL SIZE ($M)	LEAD INVESTOR(S)	VALUATION STEP-UP
Xingsheng Selected	February 18, 2021	Online grocers	Late-stage VC	$3,000.0	Sequoia Capital China	1.0x
Gopuff	December 16, 2021	Online grocers	Late-stage VC	$1,500.0	N/A	2.6x
Gopuff	March 23, 2021	Online grocers	Series G	$1,150.0	N/A	2.0x
Gopuff	July 30, 2021	Online grocers	Series H	$1,000.0	Hedosophia	1.6x
Pupumall	November 29, 2021	Online grocers	Late-stage VC	$950.0	Gaorong Capital, IDG Capital	N/A
Gorillas	September 24, 2021	Online grocers	Series C	$950.0	Delivery Hero	1.3x
Flink	December 10, 2021	Online grocers	Series B	$750.0	DoorDash	4.7x
Nice Tuan	March 9, 2021	Online grocers	Series D	$750.0	Alibaba Group, DST Global	N/A
Picnic	September 16, 2021	Online grocers	Series D	$707.5	Bill & Melinda Gates Foundation	N/A
Dingdong Maicai	April 6, 2021	Online grocers	Series D	$700.0	Coatue Management, DST Global	N/A

Source: PitchBook | Geography: Global | *As of December 31, 2021

FOOD SUPPLIERS

Figure 15.

Key food suppliers VC exits in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	EXIT SIZE ($M)	EXIT TYPE	ACQUIRER(S)/INDEX
Dingdong Maicai	June 29, 2021	Online grocers	$5,451.5	Public listing	NYSE
BigBasket	March 2, 2021	Online grocers	$1,305.2	Acquisition	Tata Group
Boxed	December 9, 2021	Online grocers	$521.0	Public listing	Seven Oaks Acquisition
Pasta Evangelists	January 15, 2021	Meal kits	$54.1	Acquisition	Barilla Holding
Milkbasket	August 1, 2021	Online grocers	$40.0	Buyout	Kohlberg Kravis Roberts, Reliance Retail Dhabi Investment Authority, Saudi Arabia's Public Investment Fund, Government of Singapore Investment Corporation (GIC), Silver Lake, General Atlantic, Mubadala Investment Company, TPG
iKcon	November 7, 2021	Ghost kitchens	Undisclosed	Acquisition	REEF Technology
Vitafy	December 17, 2021	Online grocers	Undisclosed	Buyout	Capiton, Euro Vital Pharma
Helbiz	August 13, 2021	Ghost kitchens	Undisclosed	Public listing	GreenVision Acquisition
Easilys	June 3, 2021	Catering	Undisclosed	Buyout	Providence Strategic Growth, Pantheon International, MAPAL Software
Guanghetang	December 14, 2021	Meal kits	Undisclosed	Acquisition	Undisclosed

Source: PitchBook | Geography: Global | *As of December 31, 2021

FOOD SUPPLIERS

Figure 16.

Key food suppliers VC-backed companies*

COMPANY	SUBSEGMENT	VC RAISED TO DATE ($M)	POST-MONEY VALUATION ($M)	MOST RECENT VC STAGE
Xingsheng Selected	Online grocers	$5,440.0	$12,000.0	Late-stage VC
Nice Tuan	Online grocers	$1,227.5	N/A	Series D
Pupumall	Online grocers	$1,106.5	N/A	Late-stage VC
Picnic	Online grocers	$1,093.2	N/A	Series D
Blinkit India	Online grocers	$641.0	$1,144.8	Late-stage VC
Misfits Market	Online grocers, food waste & traceability	$526.5	$2,000.0	Series C1
Wonder	Ghost kitchens	$500.0	N/A	Late-stage VC
Rebel Foods	Ghost kitchens	$458.4	$1,400.0	Series F
ezCater	Catering, apps & marketplaces	$420.7	$1,600.0	Series D2
GrubMarket	Business products & services suppliers, online grocers	$384.2	N/A	Series E

Source: PitchBook | Geography: Global | *As of December 31, 2021

FOOD SUPPLIERS

Figure 17.

Key food suppliers incumbents*

COMPANY	HOLDING STATUS	CATEGORY	KEY PRODUCTS	EV/TRAILING REVENUE
Amazon.com	NASDAQ: AMZN	Online grocers	Amazon Fresh, Whole Foods online grocery ordering	3.2x
Kroger	NYSE: KR	Online grocers, ghost kitchens	Online grocery ordering	0.4x
Ocado Group	LON: OCDO	Online grocers	Online grocery ordering	4.6x
HelloFresh	FRA: HFG	Ghost kitchens	Meal kits	1.5x
Blue Apron	NYSE: APRN	Ghost kitchens	Meal kits	0.5x

Source: PitchBook | Geography: Global | *As of December 31, 2021

Opportunities

Speeding up fulfillment times: Ultrafast grocery represents the latest online food delivery trend and is characterized by startups offering 20-minutes-or-less delivery of goods from "dark" convenience stores or grocers. Similar to conventional convenience stores, corner shops, and bodegas, dark stores carry a few thousand high-demand convenience items—much fewer than grocery stores, which can stock 10x this amount. Dark convenience stores are generally located in dense urban markets that might include 50,000+ households in a 1- to 2-mile delivery radius. This model allows providers to fulfill and deliver orders within minutes. Providers generally hire couriers as employees to minimize response time and operate dark stores themselves instead of turning to a third party. Key providers include **Gopuff**, **Gorillas**, **Flink**, and **Getir**.

Improving shipping capabilities for food products: Grocery goods are an especially difficult product to manage and ship for several reasons. Nearly all have a degree of perishability, and some can be heavy, such as cases of beverages, pet food, or charcoal, or fragile, such as chips or tomatoes. Consumers also have specific preferences about the size and condition of certain items, especially produce. The largest online grocery providers, such as **BigBasket** or Weee!, have developed proprietary dark grocery distribution centers where orders are packaged and delivered within limited driving distance from the facilities.

AI for inventory planning: With average grocery stores stocking 30,000 to 50,000 unique items, inventory management of perishable goods presents a formidable challenge. Fortunately, grocery shopping habits tend to be repeatable, thus creating an opening for AI & predictive analytics technologies to anticipate orders and optimize inventory to maximize profit and reduce spoilage. Companies involved in food supplier analytics include retail data analytics company **Kuona** and e-commerce management platform **Skubana**.

Warehouse & assembly automation: Food supplier companies struggle with high operational costs related to sourcing ingredients and assembling orders. Warehouse automation software and hardware can streamline the process, optimizing operations and reducing costs. For example, **Blue Apron** cites the implementation and expansion of automation in production and fulfillment as essential to meeting target business, financial, and operating results. **TakeOff** is using robotics and micro-fulfillment centers to facilitate rapid order fulfillment for online grocers. Existing players include **TakeOff**, **Flexe**, **Stord**, **Clearpath Robotics**, and **GreyOrange**.

Focusing on the high end: While traditional grocery spending largely tracks GDP growth, luxury, organic, and natural food products are experiencing higher growth rates—in the mid- to upper-single digits—and often have higher price points, as well. We believe providers catering to this segment of the food market may experience growth and margin opportunities.

Ghost kitchens: Ghost kitchens are commercial kitchens that operate without a retail dine-in or pickup location. Food produced in ghost kitchens is generally made available for delivery or pickup through meal delivery apps. Ghost kitchens can also provide a channel for existing restaurants to outsource delivery-only operations. One of the key benefits of operating a virtual restaurant within a ghost kitchen is the reduced overhead costs compared with traditional full-service restaurants. The lower startup costs allow both new and existing brands to launch or expand with less capital.

Ghost kitchens rely on intermediaries and delivery companies for both delivery and strategic intelligence. As food delivery companies accumulate customer demand data, they can identify

product gaps in particular markets. For example, a ghost kitchen startup could identify an opportunity to sell more tacos in a neighborhood that is statistically underserved by Mexican food vendors. Many top meal delivery companies have already rolled out ghost kitchen operations, including **DoorDash**, **Deliveroo**, and **Grubhub**. Startups include Fulton Kitchens, Kitchen United, **CloudKitchens**, and **Brightloom**. Recently exited food delivery provider **Swiggy** has been particularly aggressive with ghost kitchens, opening over 1,000 facilities in India. Incumbents, including **Uber** and **Grubhub**, are also piloting cloud kitchen capabilities. We believe ghost kitchens could become more critical in a post-pandemic environment, wherein restaurants place a higher value on delivery capabilities. For more detail on ghost kitchens, see our most recent **analyst note** on the subject.

Differentiated meal kit models: Providers continue to innovate on the meal kit model to provide more convenience and differentiated services to customers. For example, **Tovala** launched a meal kit product alongside a custom-designed smart oven. The raw meal kit ingredients arrive in ready-to-bake aluminum containers that are placed in the oven, thus providing a freshly cooked meal with minimal work.

Specialty diets: Several meal kit startups are focused on selling diet-compliant recipes or providing a user interface that allows customers to filter by desired diets, such as vegan, paleo, keto, Atkin's, which makes it easier to comply with diet guidelines. For example, meal kit provider **Urban Remedy** features meals categorized by 11 different "needs" or health goals, such as "keto friendly," "post baby," and "energy boost." The company has raised $70.5 million over six rounds of VC funding.

Risks and considerations

Supply chain vulnerabilities during a pandemic: Disruptions to food supply have occurred at multiple points throughout the supply chain due to container shortages, worker shortages, facility shutdown, and other factors. Heightened border control restrictions have prevented many foreign field laborers from entering the US. In 2018, agriculture companies used 243,000 H-2A workers, and with virtually no domestic workers willing to replace them, their inability to enter the country is preventing harvest. Combined with panic buying and hoarding, the outcome of these issues is continued shortages and stock outages.

Competition from Amazon: The acquisition of Whole Foods Market in 2017 provided Amazon with an established food sourcing network that could be bolted onto its sophisticated delivery infrastructure capabilities to optimize costs. Prime membership and multiple delivery models, including delivery, Prime Now delivery, and pickup, give the company a significant lead in the industry.

Low margins challenge profitability: Grocery is traditionally a low-margin commodity business despite a trend toward higher-margin goods. Shipping and packaging requirements for e-commerce present additional expenses. High perishability of fresh products and the complicated and expensive infrastructure required to facilitate storage, packing, and delivery of grocery goods creates significant capital expenditure requirements and ongoing costs—sizable barriers to entry for business models that warehouse grocery goods.

FOOD SUPPLIERS

Discount grocers undercut online grocers' low-cost advantage: Discount grocers such as Germany-based Aldi and Lidl have driven down the price of groceries by as much as half while subsequently finding ways to offer premium and organic products. Warehouse clubs and big-box stores such as Costco and Walmart provide fresh groceries at discount prices. These grocers provide delivery services or partner with third-party delivery services such as Google Express, thereby increasing competition for food suppliers.

Inconsistent quality for certain grocery products: Balancing consumer preference with what is achievable in an online setting represents a significant pain point. Consumers can have idiosyncratic preferences for certain goods, especially produce items, which are chosen based on size, quality, and ripeness, among other factors. Offering these options in an online setting is logistically challenging and could harm the customer experience if done incorrectly.

Intermediaries & delivery

Overview

The intermediaries & delivery segment connects consumers with food providers, restaurants, and other vendors. In addition to supplying a directory and marketplace to discover and order food, intermediaries & delivery providers manage delivery, payment, and order history to make the ordering process quick and effortless to increase user stickiness and reduce churn.

Intermediaries & delivery providers differentiate by developing cross-functional features intended to expand market opportunity. Feature sets are driven mainly by user data and meant to drive positive network effects to attract more users and service restaurants to the platform. Innovative business models continue to emerge and gain traction for unique dining occasions. For example, Ritual offers customers the option to combine orders with colleagues and is creating unique ways to incorporate corporate wellness and social programs into its platform.

The market for food delivery apps & marketplaces is maturing, with a few providers dominating each market. Companies such as **DoorDash** (NYSE: DASH), **Just Eat Takeaway** (AMS: TKWY), and **Uber** Eats (NYSE: UBER) have accumulated a large enough market share to ward off or acquire new entrants. This has shifted early-stage investment opportunities away from pure delivery to emerging services higher up the value chain, including food production and delivery service aggregation.

Operational issues such as logistics and delivery costs pose challenges and pressure margins of businesses in this category. Advanced technologies such as machine learning and predictive analytics are helping companies overcome challenges and gain a competitive edge. For example, several providers are using consumer purchasing behavior to suggest menu changes for restaurants. On the flip side, product stickiness is especially challenging as consumers generally make decisions based on price alone. With VC investment helping subsidize price in recent years, regular run-rate unit economics are likely very low for these models. Over the longer term, however, autonomous could play a significant role in reducing the cost of food delivery.

Subsegments include:

Apps & marketplaces: Platforms that operate two-sided markets to connect restaurants or other food purveyors with consumers and a network of couriers. These third-party food delivery services offer a variety of marketing, sales, and payment services to restaurants and offer consumers a one-stop-shop platform to discover new restaurants and purchase meals for pickup or delivery.

Delivery robots: Autonomous delivery machines that vary in size from cooler to compact car. Smaller robots operate on sidewalks at a slower speed and smaller delivery radius. These small robots are most often found on university or corporate campuses. Larger delivery vehicles operate on roads alongside passenger cars. Provider **Nuro**'s latest model has a maximum operating speed of 45 miles per hour. Providers partner with grocers, restaurants, third-party delivery providers, and other companies with last-mile delivery services.

Industry drivers

Consumer preference for digital commerce: The near ubiquity of smart devices and continual pursuit of convenience is driving a long-term shift to mobile commerce and e-commerce for many consumer industries, including food.

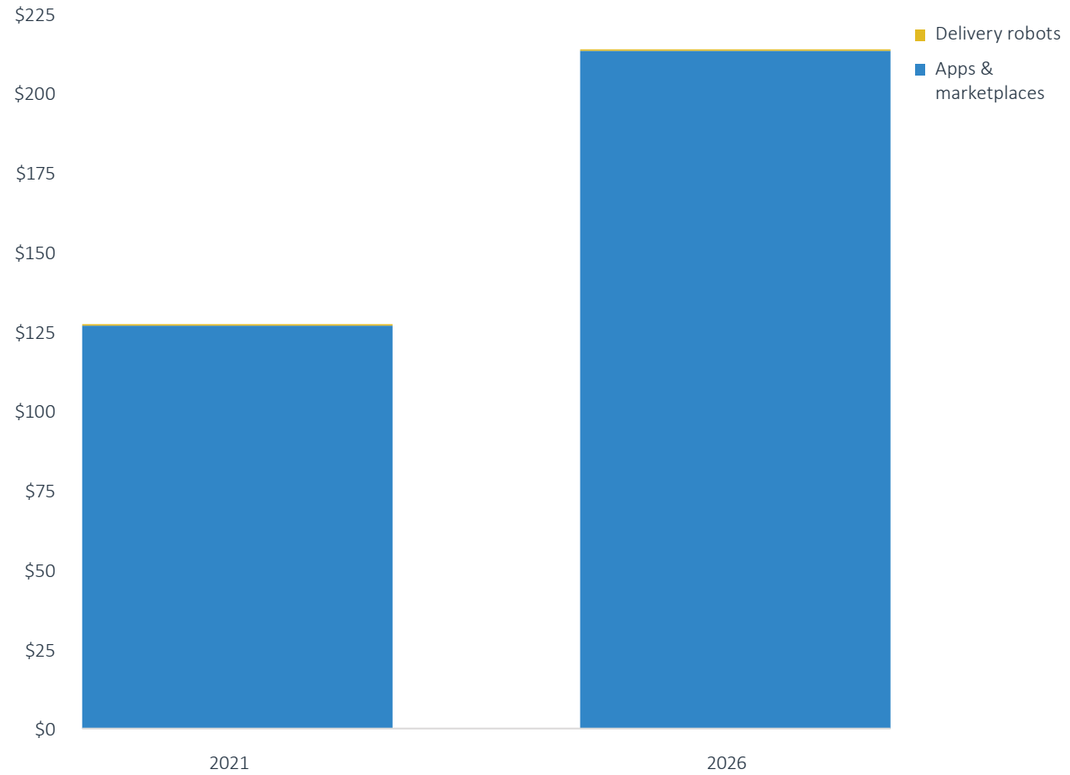
The sophistication of ordering platforms: Digital ordering technology continues to improve. Apps are more responsive and integrated with other services and provide targeted, curated suggestions. These advancements improve the customer experience and help attract new users.

Appealing marketing channel for restaurants: Apps and marketplace providers offer an attractive new marketing channel for legacy restaurants incapable of developing digital ordering capabilities on their own. As digital delivery remains a relatively small portion of overall restaurant sales, we expect a long-term growth opportunity lies ahead.

Market size

We estimate the intermediaries & delivery market grew to $127.1 billion in 2021 and forecast the market to grow to $213.7 billion at an 11.0% CAGR by 2026. The market opportunity for apps & marketplaces vastly outpaces delivery robots, with an estimated market size of $126.9 billion in 2021. The market for delivery robots is nascent but expected to experience a surge in growth in the long term. Last-mile delivery services are a major cost component for online grocers and food delivery services. Autonomous delivery robots could significantly lower costs. Startups including **Nuro**, **Waymo**, and **Starship** are operating pilot programs with food providers such as **Kroger** and **Dominos**, and we expect more pilots and launches as companies achieve milestones in regulatory approval and manufacturing capabilities.

Figure 18. INTERMEDIARIES & DELIVERY MARKET SIZE ESTIMATE ($B)*



Source: PitchBook Emerging Tech Research | Geography: Global | *As of December 31, 2021

INTERMEDIARIES & DELIVERY

Business model

Apps & marketplaces startups such as **Rappi** and **HungryPanda** derive revenue from the fees charged to restaurants and customers for delivery, transaction processing, and marketing. For example, provider **Grubhub** charges restaurants a 10% commission plus 3.05% and $0.30 processing fees on each transaction. Restaurants can also pay intermediaries for favorable app placement, an effective advertising technique that can cost an additional 20%. In total, delivery startups tend to take 20% to 40% of the menu price, a sizable piece of revenue in an industry known for razor-thin margins—3% to 5% on average. Consumers tend to bear the cost of delivery through added fees. Key services provided by intermediaries include e-commerce enablement, such as restaurant landing pages, menu hosting, and ordering portals; transaction and payment processing services; and delivery and advertising services. Drivers—gig workers—are sourced through marketing campaigns, and gig workers tend to switch between providers depending on which is offering the best commissions.

Common industry KPIs for intermediaries & delivery companies include:

- E-commerce conversion rate
- Average order value
- Customer lifetime value
- Gross merchandise volume
- Monthly active users

VC activity

The intermediaries & delivery segment recorded $1.4 billion across 14 deals in Q4 2021, a 50.2% decrease in deal value from Q3. On an annual basis, we logged $7.3 billion across 72 deals, a 57.3% increase in deal values YoY.

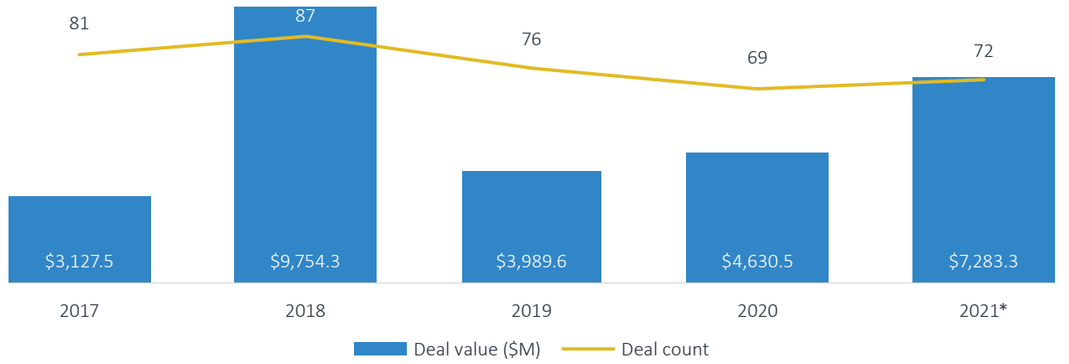
Investment activity in apps & marketplaces has increased steadily over the past two years as the industry has matured and as the largest providers have raised funding rounds of increasing proportions and engaged in new business models and partnerships to become one-stop shops for consumer food purchases. Reliance on delivery services during the pandemic lockdown has only served to increase funding to shore up software issues and meet the rising demand. Key deals include **Swiggy**'s ($1.2 billion pre-IPO Series J and **Bolt**'s $709.6 million Series E.

Investment in delivery robots surged to $1.6 billion in 2021, up from $126.0 million. Autonomous delivery robot provider **Nuro**, which raised two rounds of funding in 2021 totaling $1.1 billion in aggregate, drove investment activity. **Nuro** counts **Kroger** (NYSE: KR) as a key investor and has been piloting vehicles for grocery delivery since 2018. The company is using a portion of the funding to build a $40 million manufacturing facility, which it will use to ramp up production of its latest third-generation vehicles. Other key delivery robot deals include **Keenon**'s $200.0 million Series D and **PuduTech**'s $78.9 million series C2.

INTERMEDIARIES & DELIVERY

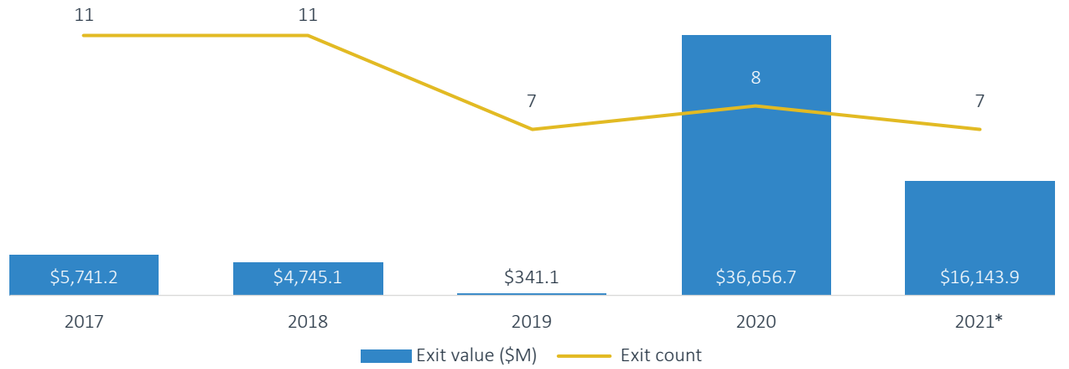
Exit volume in the intermediaries and delivery segment was low in 2021, with only seven exits logged. Three key providers successfully exited to the public markets. The largest exit of the year was Singapore-based provider **Grab**, which exited via a $35.0 billion SPAC. England-based **Deliveroo** achieved a $7.9 billion IPO and India-based **Zomato** exited with a $6.8 billion IPO. M&A activity was low in 2021, with only three exits logged via that route.

Figure 19. INTERMEDIARIES & DELIVERY VC DEAL ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 20. INTERMEDIARIES & DELIVERY VC EXIT ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

INTERMEDIARIES & DELIVERY

Figure 21.

Key intermediaries & delivery VC deals in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	STAGE	DEAL SIZE ($M)	LEAD INVESTOR(S)	VALUATION STEP-UP
Swiggy	July 20, 2021	Apps & marketplaces	Series J	$1,236.3	MIH India Food Holdings, Prosus Ventures, SoftBank Investment Advisers	0.9x
Bolt	August 2, 2021	Apps & marketplaces	Series E	$709.6	Sequoia Capital	N/A
Nuro	November 2, 2021	Delivery robots	Series D	$600.0	Tiger Global Management	1.6x
Glovo	March 31, 2021	Apps & marketplaces	Series F	$535.7	Luxor Capital Group	N/A
Wolt	January 25, 2021	Apps & marketplaces	Series G	$535.2	ICONIQ Capital	3.1x
Nuro	March 25, 2021	Delivery robots	Series C	$500.0	T. Rowe Price	1.9x
OPay	August 23, 2021	Apps & marketplaces	Series C	$400.0	SoftBank Investment Advisers	N/A
Instacart	March 2, 2021	Online grocers, apps & marketplaces	Series I	$265.0	Andreessen Horowitz, D1 Capital Partners, Fidelity Management & Research, Sequoia Capital, T. Rowe Price	2.2x
Zomato	February 22, 2021	Apps & marketplaces	Late-stage VC	$250.0	Kora Management	1.3x
Instacart	November 1, 2021	Online grocers, apps & marketplaces	Late-stage VC	$232.0	N/A	N/A

Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 22.

Key intermediaries & delivery VC exits in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	EXIT SIZE ($M)	EXIT TYPE	ACQUIRER(S)/INDEX
Grab	December 1, 2021	Apps & marketplaces	$35,010.0	Public listing	Altimeter Growth
Deliveroo	March 31, 2021	Apps & marketplaces	$7,880.0	Public listing	London Stock Exchange
Zomato	July 23, 2021	Apps & marketplaces	$6,792.6	Public listing	National Stock Exchange of India
Flaschenpost	July 1, 2021	Online grocers, apps & marketplaces	$1,203.3	Acquisition	Dr. August Oetker Nahrungsmittel
SberMarket	January 1, 2021	Apps & marketplaces	$162.3	Acquisition	Sberbank of Russia
OrderYOYO	July 2, 2021	Apps & marketplaces	$105.6	Public listing	NASDAQ OMX Nordic Exchange Copenhagen
Epicery	September 16, 2021	Apps & marketplaces	Undisclosed	Acquisition	Dynamic Parcel Distribution
Foodee	June 30, 2021	Apps & marketplaces	Undisclosed	Acquisition	Sodexo

Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 23.

Key intermediaries & delivery VC-backed companies*

COMPANY	SUBSEGMENT	VC RAISED TO DATE ($M)	POST-MONEY VALUATION ($M)	MOST RECENT VC STAGE
Rappi	Apps & marketplaces	$2,253.6	$5,250.0	Series F
Nuro	Delivery robots	$2,132.0	$8,600.0	Series D
Glovo	Apps & marketplaces	$1,323.4	N/A	Series F
OPay	Apps & marketplaces	$570.0	$2,000.0	Series C
ezCater	Catering, apps & marketplaces	$420.7	$1,600.0	Series D2
Swile	Apps & marketplaces	$328.2	$1,000.0	Series D
Deliverect	Apps & marketplaces	$85.2	$276.9	Series C1
HungryPanda	Apps & marketplaces	$218.2	N/A	Series D
Keenon	Delivery robots	$204.2	N/A	Series D
Pudu Tech	Delivery robots	$190.9	N/A	Series C2

Source: PitchBook | Geography: Global | *As of December 31, 2021

INTERMEDIARIES & DELIVERY

Figure 24.

Key intermediaries & delivery incumbents*

COMPANY	HOLDING STATUS	CATEGORY	KEY PRODUCTS	EV/TRAILING REVENUE
Uber	NYSE: UBER	Apps & marketplaces	Third-party restaurant, grocery & alcohol delivery	5.1x
Grab	NASDAQ: GRAB	Apps & marketplaces	Restaurant and convenience delivery	38.9x
DoorDash	NYSE: DASH	Apps & marketplaces	Restaurant & grocery delivery, DashMart ultrafast convenience delivery	6.4x
Delivery Hero	ETR: DHER	Apps & marketplaces	Third-party restaurant delivery, ultrafast grocery through Gorillas investment	4.3x
Zomato	BOM: 543320	Apps & marketplaces	Third-party restaurant delivery	19.8x

Source: PitchBook | Geography: Global | *As of December 31, 2021

Opportunities

Category expansion: Competition and commoditization have driven providers to seek new avenues for growth. The COVID-19 crisis has also created opportunities to deliver other kinds of products in new merchant categories. Incumbent **DoorDash** has expanded into two trending areas with the launch of convenience stores called DashMarts, which feature ultrafast delivery and private-label products. In addition to restaurant food, consumers will be able to order groceries and convenience goods from DashMarts and receive orders in 10 to 15 minutes. Fresh salads and private-label CPGs will generate new revenue streams.

Delivery aggregation management: A growing headache for restaurant operators is managing multiple delivery and ordering services providers at the point of sale. Some restaurants may use eight or more tablets, which clutters the register, complicates order pickup, and eats up time and resources. Order aggregation startups such as Chowly and ItsaCheckmate seek to reduce this complexity by integrating meal delivery platforms into a single interface. Other startups in this space include Ordermark and Olo.

Delivery robots: Autonomous delivery could help propel the next phase of growth for food suppliers. As last-mile delivery is estimated to comprise as much as 28% of total transportation costs, delivery robots and other driverless methods could dramatically improve the economics of food delivery for both suppliers and consumers. Multiple autonomous delivery companies ranging from startup Tortoise to large technology conglomerate Panasonic are partnering with food providers to pilot autonomous delivery. Road-ready autonomous delivery startup **Nuro** received California's first-ever permit to commercialize autonomous delivery services and has numerous partnerships with large food and convenience retailers, including Dominos, **Kroger**, and 7-Eleven. Although it will likely be years before autonomous delivery is ready for mass consumer adoption, the California permit lays out an encouraging regulatory path for other startups. Existing players include Starship, **Kiwibot**, and **Robomart**.

Leveraging ridesharing infrastructure: Delivery companies such as Indonesia's **Gojek** and Singapore's **Grab** Holdings are leveraging existing ridesharing infrastructure to expand into an increasing number of businesses. Food delivery is quickly becoming a leading revenue driver for these super apps. A growing list of services—including medicine delivery, auto repair, home cleaning, and massage services—are helping build stickiness on these super app platforms.

Serving smaller cities and rural markets: The intermediaries & delivery market is highly competitive for several reasons, including limited price elasticity of consumers and larger providers' ability to subsidize pricing via VC funding. To help reduce costs, most operators compete in large urban markets, where travel distances are short and the concentration of drivers, restaurants, and consumers is high. Consequently, many smaller cities are underserved, thus leaving an opportunity for startups to penetrate those markets. Both **DoorDash** and **Wolt** have started focusing efforts on suburban markets, turning to artificial intelligence & machine learning (AI & ML) technology for help. Continued development of these technologies and autonomous delivery will likely help drive opportunities in these markets.

Risks and considerations

Maturing market dominated by incumbents: An overcrowded playing field has led to consolidation and aggressive competition. Market leaders are solidifying positions in many large metropolitan markets.[13] **DoorDash** and **Uber** Eats represent approximately 82% of US food delivery monthly sales as of December 2021,[14] and they are rapidly expanding in regional markets. We believe this leaves little room for new entrants without differentiated offerings.

Margins are slim: The economics of restaurant delivery can be challenging for providers. Between the price sensitivity of customers and low-profit margins of the restaurant business, the ability to charge additional fees for service and delivery can be challenging. Labor availability and increasing wage pressures—often owing to minimum wage increases—add further challenges. Although **DoorDash** reported a gross margin of 49% in 2020, the profit margin is much lower. According to analysis by Deutsche Bank,[15] the company profits only 2.5% on each order after accounting for refunds, promotions, advertising, and other costs. Over time, economies of scale, expanded platform monetization, and autonomous driving technology may provide opportunities to improve margins.

13: "Foodservice Delivery in U.S. Posts Double-Digit Gains Over Last Five Years with Room to Grow," The NPD Group, Ben Warren, April 5, 2018.
14: "Which Company Is Winning the Restaurant Food Delivery War?" *Bloomberg Second Measure*, Janine Perri, January 14, 2022.
15: "DoorDash and Uber Eats Are Hot. They're Still Not Making Money," *Wall Street Journal*, Preetika Rana and Heather Haddon, May 28, 2021.

Industrial & consumer tech

Overview

Industrial & consumer tech includes technologies and services that improve the precision of cooking, reduce food waste, enhance kitchen efficiency, and help food suppliers track products through the supply chain. This segment addresses key operational challenges of safety, traceability, automation, and waste affecting food production and transportation. Due to the vast array of automation and waste reduction opportunities throughout the food supply chain, use cases, products, and customer types vary greatly.

Leading startups integrate advanced software technology with purpose-built hardware, such as ovens or other devices. While retail providers focus primarily on the cooking experience, industrial providers seek to help customers operate more efficient kitchens at scale. We believe retail kitchen tech may benefit from the current pandemic as more people cook at home; industrial kitchen tech may see reduced demand as restaurant activity slows and labor availability remains high.

Incumbent De'Longhi is a 100-year-old Italy-based kitchen appliance manufacturer that is integrating cooking automation and intelligence into its Kenwood brand small kitchen appliances. Incumbent **AgroFresh Solutions** markets a suite of technologies that maintain produce freshness throughout the supply chain. Startups in the space include shelf-life extension technology producer **Apeel** and ugly produce box provider **Misfits Market**. Other key providers include **Imperfect Foods**, **Brightloom**, and **Bevi**.

Subsegments include:

- **Kitchen tech & robotics:** Kitchen automation technology that addresses labor constraints and health risks and drives efficiency and productivity gains
- **Food waste & traceability:** Food waste and traceability providers reducing food waste from harvest to plate, with a focus on food transportation, storage, and preparation
- **Advanced vending:** Stand-alone robotic food and beverage distributors, including kiosks, vending machines, and contactless restaurants

Industry drivers

Rise of food delivery: The rise of third-party delivery apps such as **DoorDash** and **Grubhub** incentivizes restaurants to launch virtual kitchens devised explicitly for takeout. Historically, restaurants have designed kitchens that optimized dining room service. The recent consumer shift toward takeout and delivery has spurred restaurants to make changes to meet demand. These changes include standardizing menus, streamlining kitchen processes, and reconfiguring kitchens to prioritize delivery services. Kitchen tech hardware has the potential to add automation capabilities to facilitate pickup and delivery.

An ongoing effort to reduce labor costs at restaurants: Wage management and employee churn reduction are primary drivers of kitchen automation. These challenges can drag significantly on margins. While reopening remains the most immediate concern for restaurants, automation technologies were generating significant interest pre-pandemic and will likely continue to represent longer-term objectives.

INDUSTRIAL & CONSUMER TECH

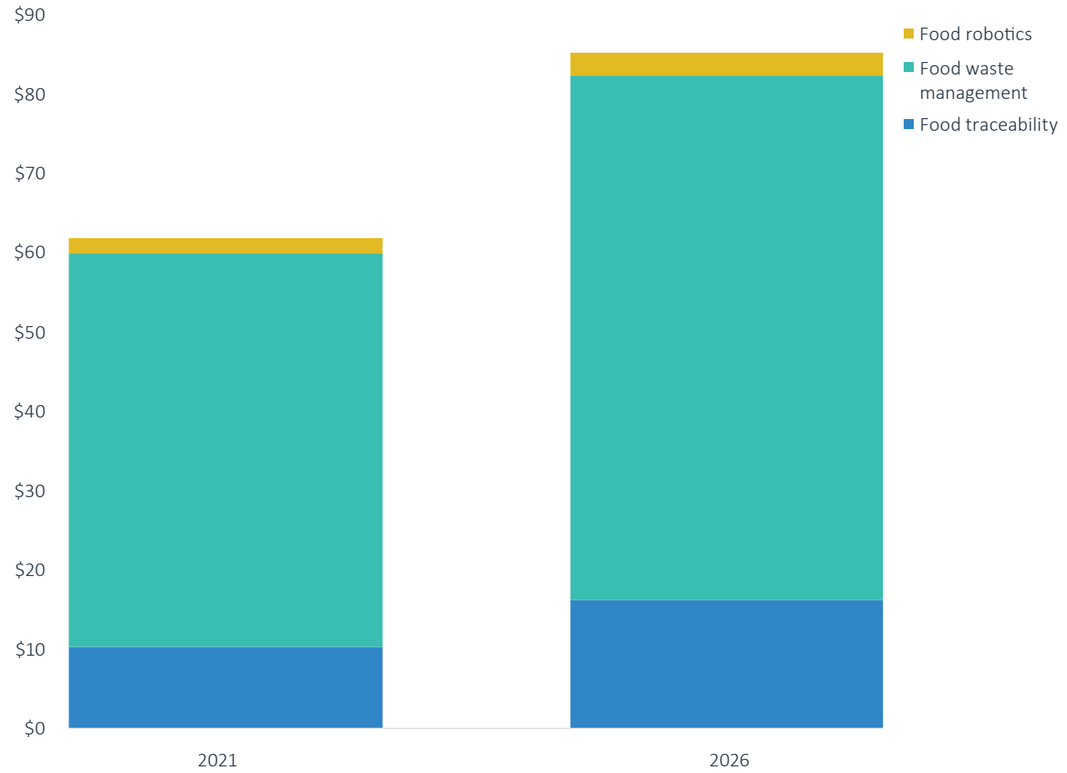
Global demand for cost reduction in the food industry: The total cost of restaurant operations is on the rise, and restaurants are seeking tools and technologies to reduce costs.

Growing consumer demand toward convenient in-home cooking: Kitchen tech is benefiting from two trends: enhanced food appreciation ("foodies") and convenience. Consumers are increasingly looking for ways to prepare high-quality, restaurant-style meals with less effort.

Market size

We estimate global industrial & consumer tech market revenue to be $61.9 billion in 2021, growing in the mid-single digits to reach $85.2 billion by 2026. Food waste reduction opportunities drive most of this estimate due to increased focus on sustainability, operational cost savings, and government rules and regulations. Food traceability opportunities, including software, sensors, and RFID technologies that reduce food waste and safety issues, also contribute to this estimate. While the pandemic has negatively affected demand for kitchen robotics, we expect increased investment in digital food ordering and delivery infrastructure to be a key growth driver of this category.

Figure 25. INDUSTRIAL & CONSUMER TECH MARKET SIZE ESTIMATE ($B)*



Source: PitchBook Emerging Tech Research | Geography: Global | *As of December 31, 2021

Business model

Business models in this segment vary dramatically by use case, industry, and customer type. Hardware providers in the space such as **Picnic** and **Café X** typically monetize by selling or leasing equipment. Some providers such as **Botrista** sell hardware at cost or less and monetize by selling ingredients on a subscription basis via an infrastructure-as-a-service (IaaS) model. Software providers such as **FoodDocs** and **Satis.ai** are largely reliant on software-as-a-service (SaaS) models that provide steady revenue streams.

Common industry KPIs for industrial & consumer tech companies include:

- Production time per dish
- Total labor cost percentage
- Sales per employee per hour
- Social engagement rate
- Shrink ratio—loss as a share of inventory
- Recovery ratio—food recovered as a share of surplus inventory

INDUSTRIAL & CONSUMER TECH

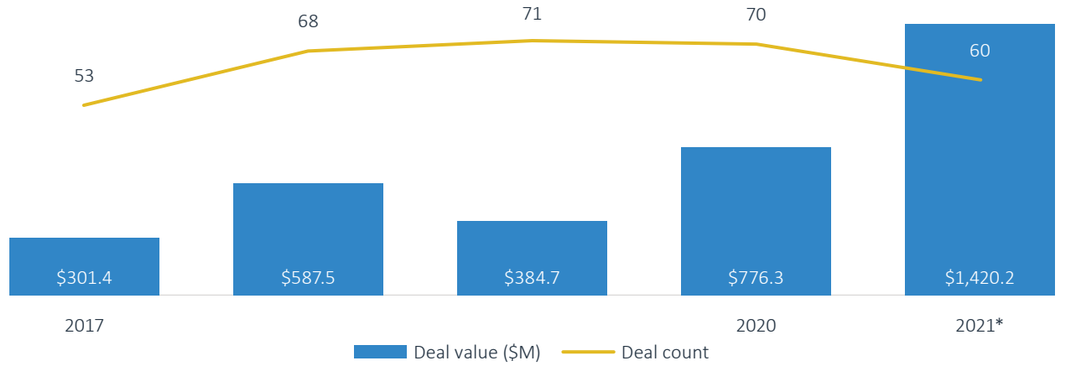
VC activity

Investment activity in the industrial & consumer tech segment totaled $1.4 billion across 60 deals in 2021, up 82.9% from 2020. On a quarterly basis, we logged only $89.8 million in Q4, down from a record $701.7 million logged in Q3. The largest deal of the year was a $280.0 million Series E for food waste reduction startup **Apeel Sciences**. Deal values in the food waste & traceability category nearly doubled YoY, climbing to $1.1 billion from $584.2 million in 2020, demonstrating investor sentiment toward sustainability-focused business models.

Kitchen tech deal values increased by 250.4% on an annual basis, reaching $279.5 million. We believe labor shortages, increased focus on operational efficiency, and consumer preference for contactless experiences are three factors driving increased investment in this category. The largest deal of the year was a $40.0 million investment in **Miso Robotics**, which makes robots that can perform key kitchen tasks such as flipping burgers, operating fry stations, and preparing beverages.

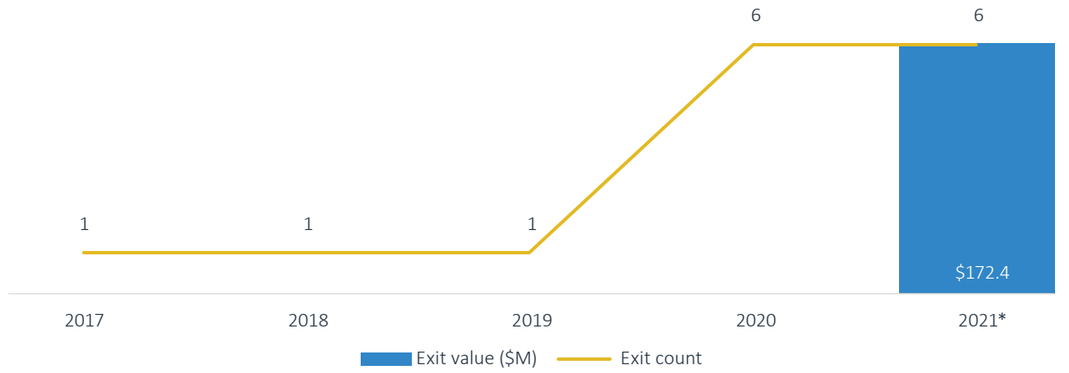
Exit activity in this segment is nascent compared with other foodtech segments. We logged six exits in 2021, equal to 2020 exit activity. All the exits in 2021 were M&A. Key exits include JBT Corporation's acquisition of food safety provider **Prevenio** and **DoorDash**'s acquisition of salad robot provider **Chowbotics**. **DoorDash** will use the **Chowbotics** acquisition to build out private-label food products that it will sell out of its DashMart dark convenience stores.

Figure 26. INDUSTRIAL & CONSUMER TECH VC DEAL ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 27. INDUSTRIAL & CONSUMER TECH VC EXIT ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

INDUSTRIAL & CONSUMER TECH

Figure 28.

Key industrial & consumer tech VC deals in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	STAGE	DEAL SIZE ($M)	LEAD INVESTOR(S)	VALUATION STEP-UP
Apeel	August 18, 2021	Food waste & traceability	Series E	$280.0	N/A	2.00x
Hazel Technologies	April 13, 2021	Food waste & traceability	Series C	$70.0	Pontifax Global Food and Agriculture Technology Fund, Temasek Holdings	3.6x
Miso Robotics	May 14, 2021	Kitchen tech & robotics	Series D	$40.0	N/A	N/A
Spinn Coffee	July 26, 2021	Kitchen tech & robotics	Series B	$33.7	Spark Capital	2.2x
Too Good To Go	January 7, 2021	Food waste & traceability	Early-stage VC	$31.3	N/A	N/A
Brightloom	December 17, 2021	Kitchen tech & robotics	Late-stage VC	$25.4	N/A	N/A
Full Harvest	December 17, 2021	Food waste & traceability	Series B	$23.0	TELUS Ventures	N/A
Oddbox	August 25, 2021	Food waste & traceability	Series B	$22.1	N/A	N/A
Comet Bio	July 13, 2021	Food waste & traceability	Series C	$22.0	Open Prairie Ventures	N/A
Picnic	July 26, 2021	Kitchen tech & robotics	Series A1	$20.5	Thursday Ventures	2.8x

Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 29.

Key industrial & consumer tech VC exits in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	EXIT SIZE ($M)	EXIT TYPE	ACQUIRER(S)/INDEX
Prevenio	July 2, 2021	Food waste & traceability	$172.4	Acquisition	John Bean Technologies
WISErg	April 5, 2021	Food waste & traceability	Undisclosed	Acquisition	Plant Response
MyFoody	October 12, 2021	Food waste & traceability	Undisclosed	Acquisition	Phenix
Spyce	August 24, 2021	Kitchen tech & robotics	Undisclosed	Acquisition	Sweetgreen
June	January 12, 2021	Kitchen tech & robotics	Undisclosed	Acquisition	Weber-Stephen Products
Chowbotics	January 1, 2021	Advanced vending	Undisclosed	Acquisition	DoorDash

Source: PitchBook | Geography: Global | *As of December 31, 2021

INDUSTRIAL & CONSUMER TECH

Figure 30.

Key industrial & consumer tech VC-backed companies*

COMPANY	SUBSEGMENT	VC RAISED TO DATE ($M)	POST-MONEY VALUATION ($M)	MOST RECENT VC STAGE
Apeel	Food waste & traceability	$665.0	$2,450.0	Series E
Brightloom	Kitchen tech & robotics	$172.2	N/A	Late-stage VC
Hazel Technologies	Food waste & traceability	$87.1	$234.0	Series C
Miso Robotics	Kitchen tech & robotics	$55.2	N/A	Series D
Creator	Kitchen tech & robotics	$63.4	$65.0	Series B
OLIO	Kitchen enablement software, food waste & traceability	$57.4	$130.3	Series B
Too Good To Go	Food waste & traceability	$43.0	N/A	Early-stage VC
Sestra Systems	Kitchen tech & robotics	$48.4	$109.4	Series B
Afresh	Food waste & traceability	$45.8	$121.0	Series A2
ColdSnap	Kitchen tech & robotics	$16.9	$77.4	Series B

Source: PitchBook | Geography: Global | *As of December 31, 2021

INDUSTRIAL & CONSUMER TECH

Figure 31.

Key industrial & consumer tech incumbents*

COMPANY	HOLDING STATUS	CATEGORY	KEY PRODUCTS	EV/TRAILING REVENUE
LG Electronics	KRX: 066570	Kitchen tech & robotics	Smart kitchen appliances	0.4x
Groupe SEB	PAR: SK	Kitchen tech & robotics	Smart kitchen appliances	1.2x
Electrolux	STO: ELUX A	Kitchen tech & robotics	Smart kitchen appliances	0.4x
De'Longhi Group	MIL: DLG	Kitchen tech & robotics	Smart kitchen appliances	1.7x
AgroFresh Solutions	NASDAQ: AGFS	Food waste & traceability	Freshness control	3.0x

Source: PitchBook | Geography: Global | *As of December 31, 2021

Opportunities

Commercial kitchen robots: Commercial kitchen tech robots consist of employee-operated commercial robots used in the hospitality industry, including hotels, restaurants, and bars. These robots automate key tasks, thereby allowing hospitality businesses to offer new products, increase speed and consistency, and maintain operations with fewer workers. Use cases are diverse: **Botrista** makes a robot that produces premium drinks, or "mocktails," while **Miso Robotics** sells soda fountain robots that automate and accelerate dispensing soda and adding lids to cups. Commercial robot manufacturers typically target medium and large hospitality groups that have both the capital and sales volume to justify the implementation cost. The target customer for a premium mocktail robot might be fast-casual chains, such as Panera Bread, looking to add a premium offering, while automated soda fountains would likely be highly valuable for QSRs, such as McDonald's (NYSE: MCD), with high sales volume and where fast order fulfillment is key.

Consumer kitchen robots: These include robots focused on convenience, consistency, and entertainment. Robot models tend to be compact to fit in a residential kitchen. Typical devices include air fryers, sous vide circulators, and smart ovens. Some are small appliances meant to sit on the countertop and be used instead of or in addition to large kitchen appliances such as ovens. **June** has developed smart ovens that aim to make it easier to perfectly cook food. **Bartesian** and **Drinkworks** sell consumer cocktail robots that use proprietary pods similar to Keurig coffee pods but that contain mixers and alcohol instead of ground coffee beans. A joint venture between Anheuser-Busch (BRU: ABI) and Keurig, **Drinkworks** represents one of the major industry incumbents.

Advanced vending: These machines provide an experience and end products that are superior to typical vending machine offerings while being more compact and automated than standard cafes or restaurants. This model is especially valuable in situations where consumers seek easily prepared foods and beverages, such as soup or coffee, and when labor management is challenging. **Cafe X**, a leading provider, develops Robotic Coffee Bars that use articulated robotic arms and automated machines to prepare hot and cold coffee beverages. **Blendid** provides a similar experience using articulated arms but produces juices and smoothies. By comparison, Numilk has simpler functionality, as it produces and bottles fresh alt-milks from almonds and oats. The company places its robot kiosks in grocery stores, coffee shops, and other retailers to compete against mass-produced alt-milks. As with any vending machine, operators are responsible for maintaining and stocking machines, which is more challenging when dealing with perishable goods. These robots are stationed primarily in airports, malls, and other public venues.

Food waste & traceability: Food waste & traceability providers seek to reduce food waste from harvest to plate, with a focus on food transportation, storage, and preparation. **Imperfect Foods** provides a market for surplus produce that is edible but often unsaleable due to cosmetic issues such as blemishes or bruises, thus allowing the sale of food that would otherwise go to waste. **Hazel Technologies** is focused on improving the shelf life of produce during storage and transit, thereby reducing spoilage costs. **Winnow** provides an AI-powered software and hardware solution to reduce food waste in commercial kitchens. Other key food waste & traceability providers include **Wiserg**, **FoodLogiQ**, and **Phenix**.

Risks and considerations

Incumbent competition and exit opportunities: Incumbent appliance manufacturers such as Bosch, **Electrolux**, and GE also provide proprietary smart solutions and typically have greater access to capital to scale production. **Electrolux** partnered with kitchen-enablement software provider Drop Kitchen to develop a smart blender. Amazon recently announced the launch of a microwave–convection oven that also functions as an air fryer. These incumbents provide competition and exit opportunities. In November 2019, cooking equipment company Middleby (NASDAQ: MIDD) acquired smart oven manufacturer **Brava Home**.

Rolling consumer trends challenge focused startups: Consumer interest in kitchen gadgets is fickle and ever-shifting. Sous vide technology experienced significant consumer interest in the mid-2010s. However, demand has since moved on to other technologies, and several prominent providers have shuttered. Today, air fryer technology is top-of-mind for kitchen gadget enthusiasts. We believe that a singular focus on a kitchen trend will leave focused startups vulnerable to shifting consumer preferences.

Discovery & review

Overview

The discovery & review category consists of startups that help users discover new foods, restaurants, or other unique dining experiences. These startups are generally apps that provide information and allow users to give reviews and share experiences with others. **Yelp**, arguably the most well-known restaurant recommendation and review company to go public, operates as a business directory and repository of customer reviews and photos, and provides restaurants with additional services such as reservation management and online ordering. Some providers in this sector take a more personalized and invasive approach to discovery, leveraging human data such as DNA to make diet recommendations.

Despite the COVID-19 pandemic, investors have continued to find opportunities in this sector, driven by the surge in demand for food e-commerce by both consumers and restaurant owners seeking to diversify sales channels. Startups in this segment focus on food & beverage discovery, restaurant recommendation & review, kitchen enablement software, and personalized nutrition apps.

Segments include:

Restaurant recommendation & review: Websites and mobile apps that allow users to search for restaurants by location and a variety of other criteria, such as type of cuisine.

Food & beverage discovery: Websites and mobile apps that help consumers learn about and share culinary brands and experiences.

Kitchen enablement software: Software and hardware meant to augment the home kitchen experience with smart appliances that allow access to recipes and cooking classes or tap into social media.

Personalized nutrition: Products and services tailored to specific consumer needs. Some providers monitor human data such as glucose, DNA, or the microbiome.

Industry drivers

Demand for personalized, customized products: Customers increasingly demand culinary products and services that are personalized and customizable and are willing to pay more for a premium experience. New data sources pulled from biomarkers of customers provide personalized insights and recommendations to achieve health goals.

Digital adoption: The continued migration of consumer food spend, from brick-and-mortar restaurants and groceries to online and mobile consumption, is creating opportunities for new digitally enabled providers. The development of digital payments infrastructure and rapid software development is helping increase speed to market.

Demographic shift and growth of experience economy: Younger generations are more likely to use mobile devices to seek out dining experiences beyond a delicious meal. Discovery and review platforms help consumers find unique eating options that peers have reviewed.

DISCOVERY & REVIEW

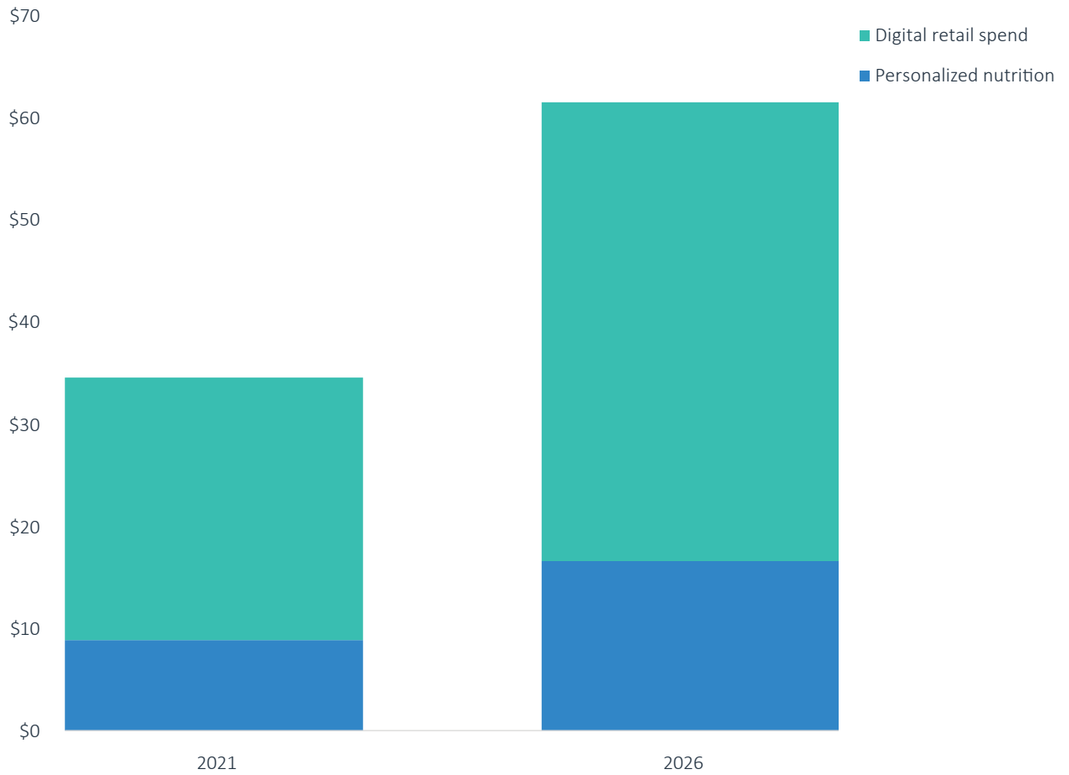
Business owners seek digital sales channels: Discovery and review platforms can provide proprietors of small businesses and restaurants in the food industry with valuable marketing channels. This is especially important as consumers spend more time online and shift spending to digital sales channels.

Market size

The discovery and review segment is estimated to yield a $34.6 billion market in 2021, growing in the low teens to reach $61.5 billion by 2026. We divide the market size into two categories: retail digital advertising and personalized nutrition. Companies under the restaurant recommendation & review category depend primarily on digital advertising for income, so retail digital advertisement spend represents a reasonable proxy for the industry. Global retail digital advertising spend is forecast to reach $25.7 billion in 2021 and climb to $44.9 billion by 2026, representing an 11.8% CAGR. The shift to digital and mobile e-commerce and entertainment is driving increased advertising spend in those channels. Although advertising spend may have been negatively affected by the pandemic, we expect growth will accelerate in the medium term.

The personalized nutrition category is much smaller and more nascent, although we believe it will grow at a faster pace due to rapid innovation and consumer interest in personalized nutrition technologies. We estimated the market size to be $8.9 billion in 2021, climbing at a CAGR of 13.4% to reach $16.6 billion by 2026.

Figure 32. DISCOVERY & REVIEW MARKET SIZE ESTIMATE ($B)*



Source: PitchBook Emerging Tech Research | Geography: Global | *As of December 31, 2021

Business model

Companies in this space use a variety of business models. Kitchen-enablement software companies charge licensing fees to hardware and appliance manufacturers that use the software, or charge fees to advertisers and content providers. Restaurant recommendation services charge advertising and marketing fees, and some food & beverage discovery companies also sell goods online. Some personalized nutrition companies sell at-home testing services and related hardware that guide personalized nutrition recommendations.

Common industry KPIs for discovery & review companies include:

- Monthly recurring revenue and growth
- Revenue and client churn
- Customer acquisition costs and customer acquisition costs/lifetime value
- Return on research capital

DISCOVERY & REVIEW

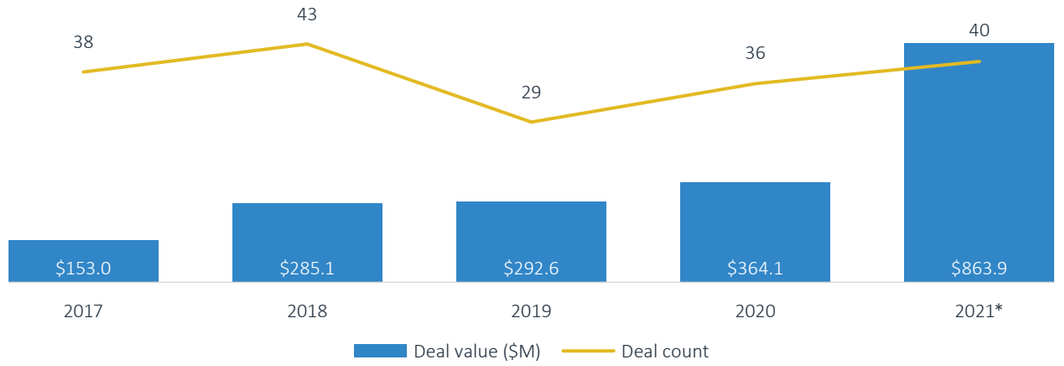
VC activity

VC investment activity in discovery & review startups declined in Q4, with $120.8 million logged across 12 deals. Annually, we logged record deal values of $863.9 million across 40 deals, up 137.3% YoY. Food & beverage discovery was the star category in 2021, with deal values up 857.1% YoY. The year's top deal was a $155.0 million Series D in wine discovery app **Vivino**. It's competitor **Winc** also raised a sizable $10.0 million Series F in 2021, indicating where consumer spending habits have been trending during the pandemic.

Kitchen enablement software deal values were up 158.3% YoY in 2021. Top deals involved surplus food discovery app Olio and online recipe hub **DayDayCook**. Lastly, the personalized nutrition category logged smaller but nonetheless remarkable deal value gains, rising 94.4% YoY. Top deals of the year include a $200.0 million Series E by Everly Health and a $69.7 million late-stage VC round by **DNANudge**. At the other end of the spectrum, investor interest in restaurant recommendation apps dropped 89.1% YoY, with only $3.8 million invested. This category has matured and is dominated by incumbents **Yelp**, **TripAdvisor**, and other regional variants.

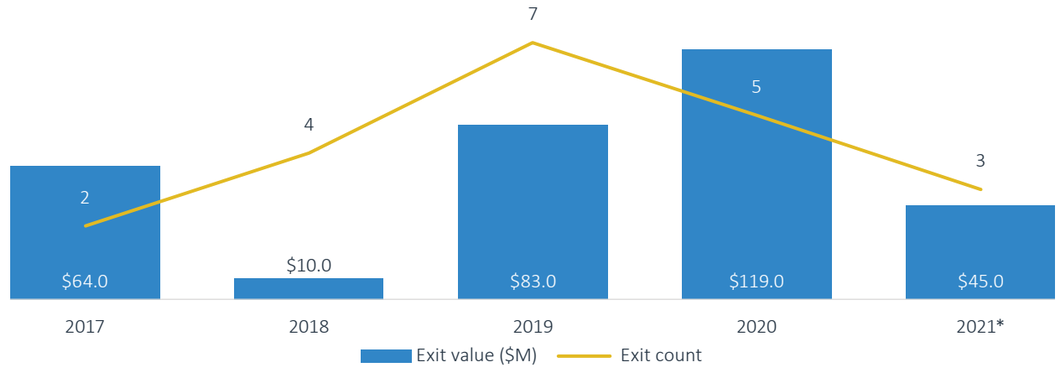
Exit activity was minimal in 2021, with three exits logged. Wine discovery platform **Winc** exited via IPO on the NYSE, raising $22.0 million in the process. Other exits include **Minibar Delivery**, which was acquired by **ReserveBar**, and **Fave**, which was acquired by Lone Pine Capital and Pine Labs, among others.

Figure 33. DISCOVERY & REVIEW VC DEAL ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 34. DISCOVERY & REVIEW VC EXIT ACTIVITY



Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 35.

Key discovery & review VC deals in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	STAGE	DEAL SIZE ($M)	LEAD INVESTOR(S)	VALUATION STEP-UP
Everly Health	March 23, 2021	Personalized nutrition	Series E	$200.0	N/A	2.1x
Vivino	February 3, 2021	Food & beverage discovery	Series D	$155.0	Kinnevik	N/A
DNANudge	May 6, 2021	Personalized nutrition	Late-stage VC	$69.7	N/A	3.7x
DNANudge	August 19, 2021	Personalized nutrition	Series A	$60.0	Ventura Capital	N/A
Viome Life Sciences	October 31, 2021	Personalized nutrition	Series C	$54.0	N/A	N/A
OLIO	August 3, 2021	Kitchen enablement software, food waste & traceability	Series B	$42.6	VNV Global	2.5x
DayTwo	May 31, 2021	Personalized nutrition	Series C	$37.0	aMoon Fund	N/A
Cookat	June 16, 2021	Food & beverage discovery	Series D	$28.6	LB Investment	N/A
Foodsmart	March 25, 2021	Personalized nutrition	Series C	$25.0	Advocate Aurora Enterprises	N/A
DayDayCook	February 23, 2021	Kitchen enablement software	Series C1	$25.0	Henderson Land Development Company, Jiajie Li	N/A

Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 36.

Key discovery & review VC exits in 2021*

COMPANY	CLOSE DATE	SUBSEGMENT	EXIT SIZE ($M)	EXIT TYPE	ACQUIRER(S)/INDEX
Fave	April 13, 2021	Food & beverage discovery	$45.0	Buyout	Temasek Holdings, Altimeter Capital Management, Lone Pine Capital, Pine Labs, Madison India Capital, Actis, Advent Capital Management, Sofina
Minibar Delivery	November 8, 2021	Food & beverage discovery	Undisclosed	Acquisition	ReserveBar
Winc	November 11, 2021	Food & beverage discovery	Undisclosed	Public listing	NYSE

Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 37.

Key discovery & review VC-backed companies*

COMPANY	SUBSEGMENT	VC RAISED TO DATE ($M)	POST-MONEY VALUATION ($M)	MOST RECENT VC STAGE
Vivino	Food & beverage discovery	$221.5	N/A	Series D
Viome Life Sciences	Personalized nutrition	$154.5	N/A	Series C
DNANudge	Personalized nutrition	$158.6	N/A	Series A
DayTwo	Personalized nutrition	$102.0	N/A	Series C
DayDayCook	Kitchen enablement software	$77.2	N/A	Series C1
Foodsmart	Personalized nutrition	$73.5	$125.0	Series C
OLIO	Kitchen enablement software, food waste & traceability	$57.4	$130.3	Series B
Seated	Restaurant recommendation & review	$30.0	N/A	Early-stage VC
Douguo.com	Food & beverage discovery	$34.9	$300.0	Series C
Salted	Kitchen enablement software	$34.3	N/A	Series A

Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 38.

Key discovery & review incumbents*

COMPANY	HOLDING STATUS	CATEGORY	KEY PRODUCTS	EV/TRAILING REVENUE
TripAdvisor	NASDAQ: TRIP	Restaurant recommendation & review	Restaurant reviews	4.8x
Retty	TKS: 7356	Restaurant recommendation & review	Social gourmet platform for food discovery	2.1x
Yelp	NYSE: YELP	Restaurant recommendation & review	Restaurant reviews	2.0x
Booking Holdings	NASDAQ: BKNG	Restaurant recommendation & review	OpenTable restaurant bookings	10.4x

Source: PitchBook | Geography: Global | *As of December 31, 2021

Opportunities

Consumers' use of digital sources to discover new foods: Websites and mobile apps that help consumers learn about and share culinary brands and experiences are highly valued by consumers and business owners. This is especially true in the wake of the pandemic, which has driven more online food ordering. Startups are also using innovative technology to enhance their offerings. For example, **Foodvisor** uses computer vision that allows consumers to obtain nutritional data of their food via a digital photo.

Kitchen enablement software: Kitchen enablement startups are developing software that can augment the home kitchen experience by connecting smart appliances or helping consumers share recipes and other information. The increased prevalence of digital personal assistants and smart homes brings advanced technologies into the kitchen and provides brands and content providers with new ways to interact with consumers. Although recipe discovery websites have existed for years, minimal innovation has occurred until recently. Providers are linking elements of the entire food journey, helping consumers order ingredients and personalize recipes. Startup **Innit** partnered with retail analytics company SPINS to enable personalized cooking and shopping experiences. Personalization, a growing foodtech trend, is being used by companies in this category to tailor recipes to dietary restrictions or preferences.

More data sources enable personalization: Internet of Things (IoT) devices, sales data, and DNA are just a few of the many sources of data that startups have at their disposal to mine for trends and insights that can be used to personalize products and services. Personalized nutrition startups are focused on helping consumers find foods and beverages that meet their special dietary requirements. Advances in genome and microbiome technologies are enabling providers to develop finely tuned dietary prescriptions. Startup **Viome** provides personalized food and supplement recommendations based on cellular, mitochondrial, and gut microbiome health factors. Startup **Signos** uses glucose monitors and data science to understand how specific foods affect weight loss. It can then make diet and meal recommendations based on that information. We expect the growing interest in food personalization and the adoption of at-home diagnostic tests will continue to grow the market for personalized nutrition.

Risks and considerations

Mass production of food limits personalization: Most food is mass-produced, which limits the ability to provide personalized offerings. For example, most vitamins are formulated to meet the needs of most consumers, and formulations are based on gender or age. Startup Nourished creates personalized 3D-printed vitamins based on consumer health attributes and goals. These vitamins are priced at a premium and must be ordered online instead of purchased at drug stores. We expect the operational hurdles and expense of mass-producing personalized goods will be a challenging factor to scale.

The market is mature and competitive: The restaurant recommendation and review category is a mature market with few large providers. Two of the leading restaurant recommendation incumbents, **Yelp** and **TripAdvisor**, have been in the business for 21 and 17 years, respectively. These companies rely on consumers to provide reviews and have built significant customer bases and an extensive database of reviews, so new entrants may struggle to achieve scale.

DISCOVERY & REVIEW

Need to acquire kitchen hardware: Kitchen enablement software enables appliances to connect and interact directly with other appliances and virtual assistant devices, thus facilitating the automation of cooking activities. For example, initiating a recipe may trigger a smart oven to preheat. Startups such as Drop rely on partnerships with manufacturers to ensure app integration and compatibility. Consumers must also own smart appliances to extract the full value of kitchen enablement software.

Appendix

Figure 39.

Top VC-backed foodtech companies by total VC raised to date*

COMPANY	CATEGORY	VC RAISED TO DATE ($M)	POST-MONEY VALUATION ($M)
Gojek	Apps & marketplaces	$5,501.0	$1,800.0
Xingsheng Selected	Online grocers	$5,440.0	$12,000.0
Gopuff	Online grocers	$4,934.7	$40,000.0
Swiggy	Apps & marketplaces	$2,850.8	$4,664.3
Instacart	Online grocers, apps & marketplaces	$2,966.8	N/A
Rappi	Apps & marketplaces	$2,253.6	$5,250.0
Nuro	Delivery robots	$2,132.0	$8,600.0
Impossible Foods	Plant-based protein	$1,862.5	N/A
Bolt	Apps & marketplaces	$1,188.0	$4,725.1
Glovo	Apps & marketplaces	$1,323.4	N/A

Source: PitchBook | Geography: Global | *As of December 31, 2021

APPENDIX

Figure 40.

Top strategic acquirers of foodtech companies since 2012

COMPANY	DEAL COUNT*
Delivery Hero	31
Foodpanda	26
Just Eat Holding	18
Grubhub	11
Just Eat Takeaway.com	8
Zomato	7
iFood	7
Glovo	5
LIVEKINDLY	5

Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 41.

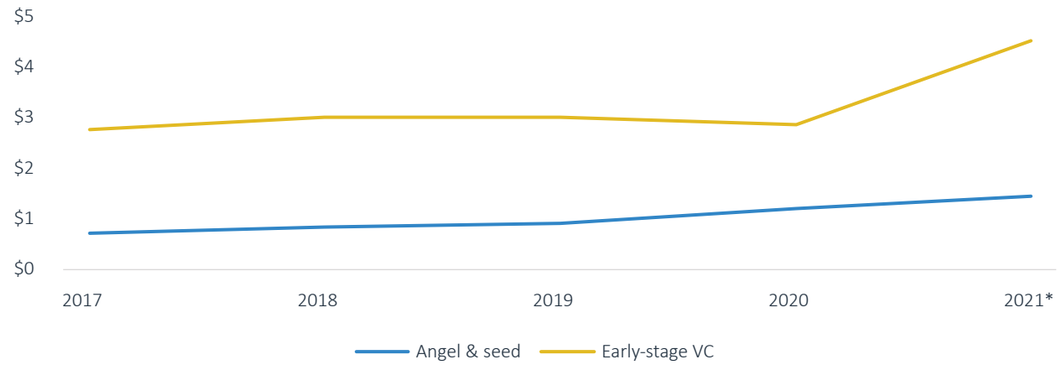
Top VC investors in foodtech companies in 2021

INVESTOR	DEAL COUNT*
SOSV	32
Gaingels	21
Global Founders Capital	20
Tiger Global Management	18
Siddhi Capital	16
CPT Capital	16
Big Idea Ventures	15
Alumni Ventures Group	15
SoftBank Investment Advisers	15

Source: PitchBook | Geography: Global | *As of December 31, 2021

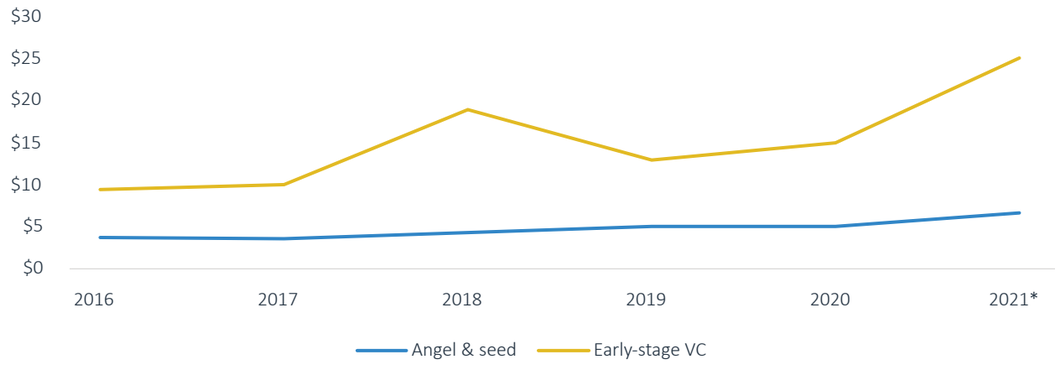
APPENDIX

Figure 42. MEDIAN FOODTECH VC DEAL VALUE ($M) BY STAGE



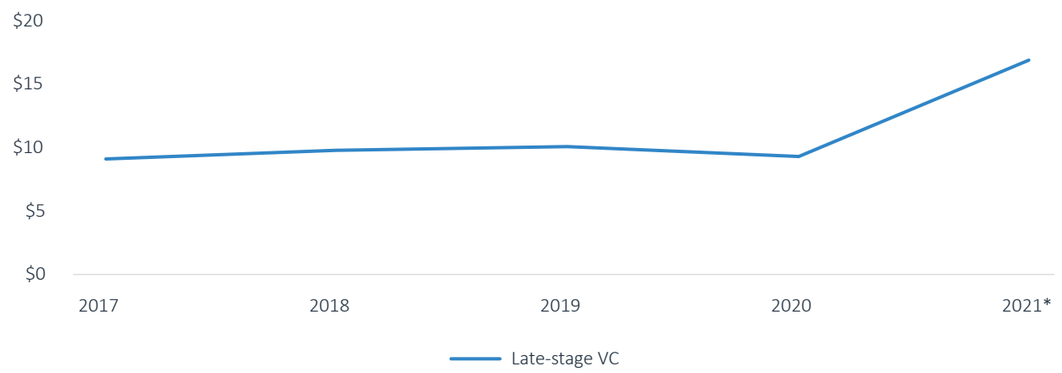
Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 43. MEDIAN FOODTECH VC PRE-MONEY VALUATION ($M) BY STAGE



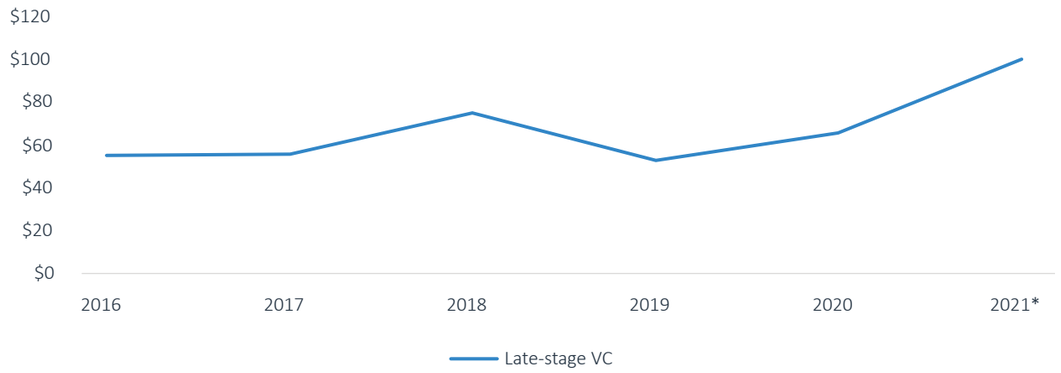
Source: PitchBook | Geography: Global | *As of December 31, 2021

Figure 44. MEDIAN LATE-STAGE VC FOODTECH DEAL VALUE ($M)



Source: PitchBook | Geography: Global | *As of December 31, 2021

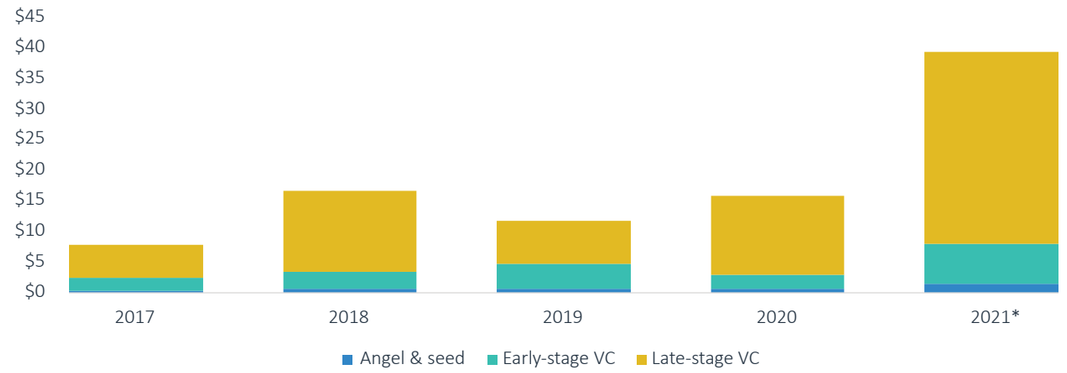
Figure 45. MEDIAN LATE-STAGE VC FOODTECH PRE-MONEY VALUATION ($M)



Source: PitchBook | Geography: Global | *As of December 311, 2021

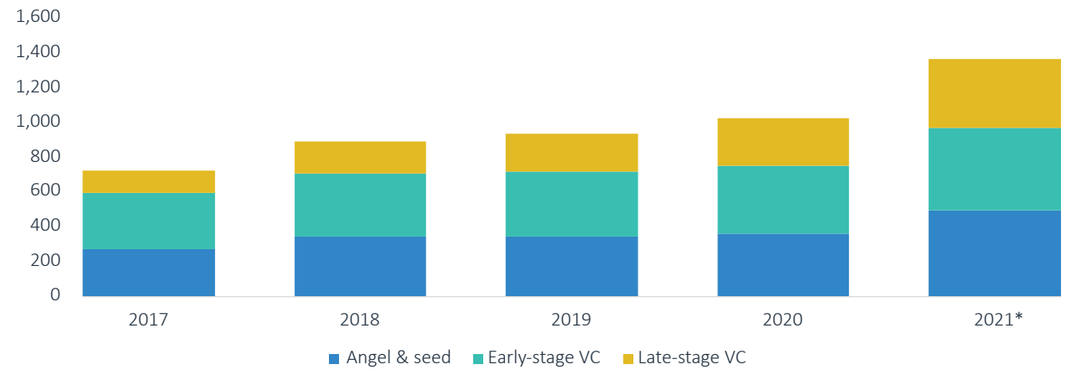
APPENDIX

Figure 46. FOODTECH VC DEAL VALUE ($B) BY STAGE



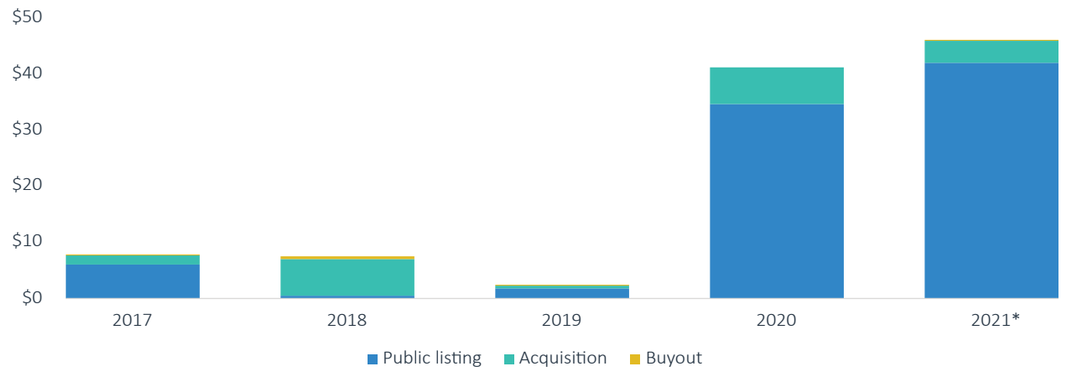
Source: PitchBook | Geography: Global | *As of March 31, 2021

Figure 47. FOODTECH VC DEAL COUNT BY STAGE



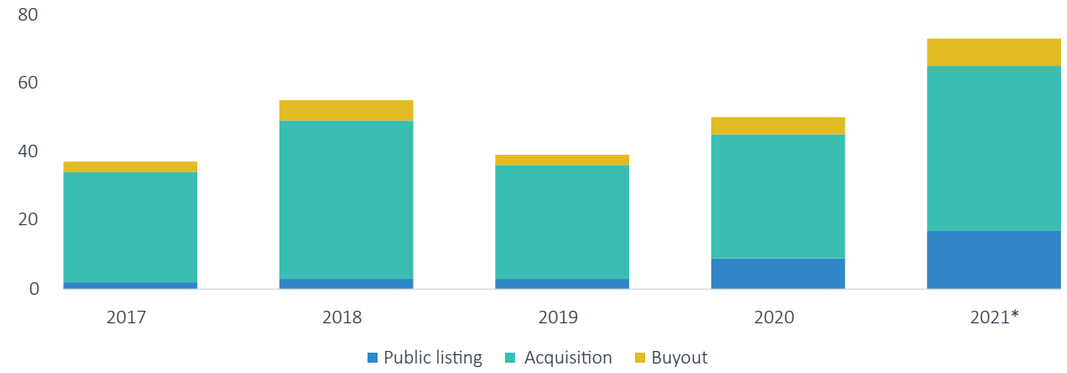
Source: PitchBook | Geography: Global | *As of March 31, 2021

Figure 48. FOODTECH VC EXIT VALUE ($B) BY TYPE



Source: PitchBook | Geography: Global | *As of March 31, 2021

Figure 49. FOODTECH VC EXIT COUNT BY TYPE



Source: PitchBook | Geography: Global | *As of March 31, 2021

About PitchBook Emerging Tech Research

Independent, objective, and timely market intel

As the private markets continue to grow in complexity and competition, it's essential for investors to understand the industries, sectors and companies driving the asset class.

Our Emerging Tech Research provides detailed analysis of nascent tech sectors so you can better navigate the changing markets you operate in—and pursue new opportunities with confidence.

PitchBook Data, Inc.

John Gabbert Founder, CEO

Nizar Tarhuni Senior Director, Institutional Research & Editorial

Paul Condra Head of Emerging Technology Research

Additional research

Agtech
Alex Frederick
alex.frederick@pitchbook.com

Artificial Intelligence & Machine Learning
Brendan Burke
brendan.burke@pitchbook.com

Cloudtech & DevOps
Paul Condra
paul.condra@pitchbook.com

Fintech
Robert Le
robert.le@pitchbook.com

Foodtech
Alex Frederick
alex.frederick@pitchbook.com

Healthtech
Kaia Colban
kaia.colban@pitchbook.com

Information Security
Brendan Burke
brendan.burke@pitchbook.com

Insurtech
Robert Le
robert.le@pitchbook.com

Internet of Things (IoT)
Brendan Burke
brendan.burke@pitchbook.com

Emerging Spaces and Vertical Snapshots
Ryan Vaswani
ryan.vaswani@pitchbook.com