CBINSIGHTS

Our Meatless Future:

How The $1.8T Global Meat Market Gets Disrupted

2019

CBINSIGHTS

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Table of Contents

CONTENTS

Startups innovating across the meatless ecosystem 8

- Meal replacement & dairy substitutes
- Insect protein goes mainstream
- Trends in meat-free “meat"
- Open-source clean meat
- Fish-free seafood substitutes

Corporates and accelerators back the meatless future 25

- Corporates bet on new protein sources
- IndieBio & New Crop Capital

Why the shift towards meatless? 29

Global trends 33

Challenges 35

Where is the meatless revolution headed? 37

Will a meatless food industry featuring lab-grown meat, seafood substitutes, and insect protein be the future of food? Food giants from Tyson to Cargill are working to navigate a future where protein isn't dominated by traditional animal sources.

At the moment, meat is still king.

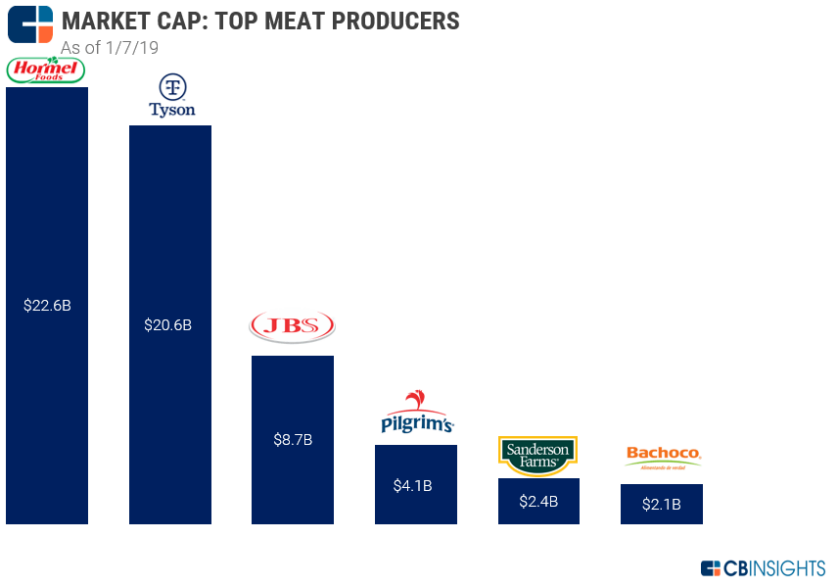
By some estimates, 30% of the calories consumed globally by humans come from meat products, including beef, chicken, and pork. The global meat market is worth $1.8T, according to CB Insights' Industry Analyst Consensus.

Americans consumed a near-record 220 pounds of red meat and poultry per capita in 2018 — in 1960, that figure was just 167 pounds, according to the USDA.

Also in 2018, USDA figures showed domestic production of meat hit a record high of more than 100B pounds. That translates to a staggering number of animals grown for food: around 30M beef cows in the US and 20M+ pigs in Iowa alone.

To meet this skyrocketing demand, the meat industry has evolved into a complex global business that involves farms and feed lots, as well as meat middle-men, like processing and storage centers, transportation and logistics, slaughterhouses, and more.

Together, the 6 largest meat companies represent $60B in market capitalization — as of the beginning of the year — with the largest, Hormel, boasting a $23B valuation.



The industry has seen massive consolidation, as companies like Hormel and Brazil-based JBS have grown bigger and bigger through the acquisition of new meat brands and products.

Since 2014, Hormel has spent around $3B on acquisitions, including Applegate, Fontanini Italian Meats and Sausages, Ceratti, and Columbus Manufacturing.

One of the biggest deals in this space was pork producer WH Group's 2013 acquisition of US-based Smithfield Foods, which owns brands such as Armour and Farmland. At the time of the deal, Smithfield was valued at $7.1B.

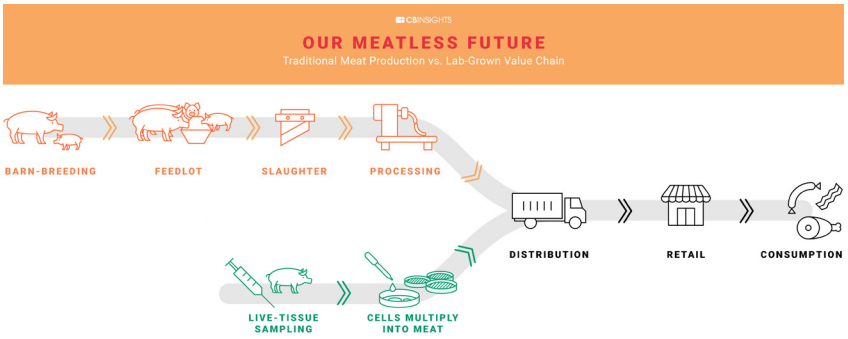
Despite high-profile deals in the sector, the industrial meat industry faces a rising tide of challenges related to business, ethical, and environmental concerns.

Meanwhile, startups using technology to engineer meat in labs or manufacture it from plant-based products are rising in popularity. In 2019, one of the world's biggest alternative protein brands, Beyond Meat, the manufacturer of the plant-based Beyond Burger, went public at a valuation of almost $1.5B.

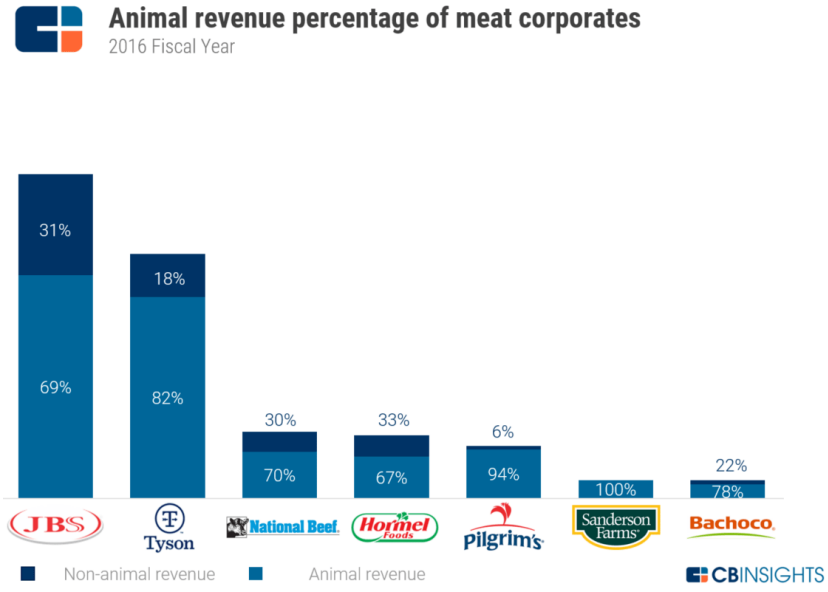
Shortly after, Burger King released the Impossible Whopper — a meatless variant of its most well-known product. The Impossible Whopper replaces beef with plant-based meat manufactured by Impossible Foods, a Redwood City-based company that has raised more than $700M in disclosed equity funding. The company was given a valuation of $2B at its last funding round.

In addition to offering new products, these alternative protein startups have the potential to upend the meat production process.

Going forward, the meat value chain could be simplified dramatically, as “clean meat" labs could take the place of farms, feed lots, and slaughterhouses.



Especially vulnerable to these changes are food companies like Tyson, Pilgrim's, and Sanderson Farms, which rely on animal meat products for 80% or more of their revenue, as seen below.



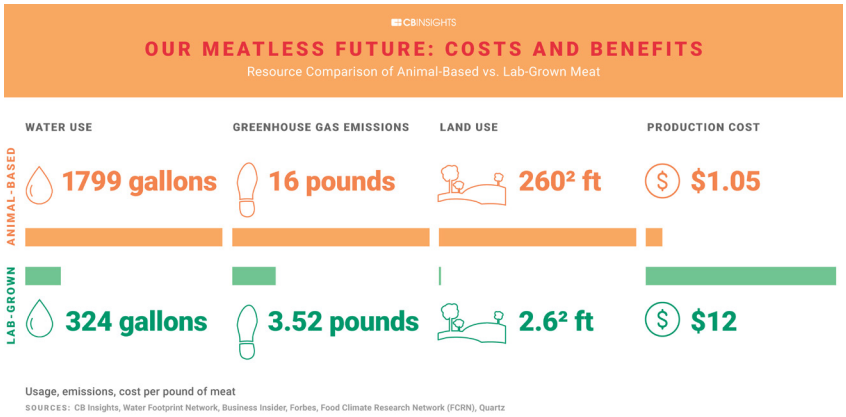
Using CB Insights data, we dug into some of the major trends in the growing meatless industry, from startups to watch to key investors to future trends & challenges.

Startups innovating across the meatless ecosystem

Startups are disrupting the meat production value chain through the development of high-tech protein products, threatening established players like Tyson.

Meat substitute startups are not only competing with prepared and frozen meats, but are also creating alternative snacks (such as Beyond the Shoreline's kelp jerky).

While the environmental benefits of lab-grown meat are potentially dramatic, meatless products are still significantly more expensive on a per-pound basis than animal alternatives.



MEAL REPLACEMENT & DAIRY SUBSTITUTES

It's not just meat substitutes disrupting the traditional food chain: meal replacement alternatives are also gaining momentum in the food space.

Among these startups, Soylent leads the pack with over $71M in disclosed funding from investors like Andreessen Horowitz, Lerer Hippeau Ventures, Google Ventures, and others.

The drink has run into some problems, including a ban in Canada, where regulators said it does not meet all of their specific requirements for meal-replacement products.

But Soylent has expanded distribution steadily. It focuses mostly on a D2C model, but is also available in some stores across the US and launched in the UK in late 2018.

The UK-based Huel, which raised $26M from Highland Europe, launched its product in 2015 and offers a flavored meal replacement shake similar to Soylent's. In mid-2017, the company launched in the US and announced $10M of sales in the country in its first year, increasing to $19M the year after, according to the company.

San Francisco-based startup Ample Foods raised $2M in seed funding in 2018 and an angel round in mid-2019, bringing its total disclosed funding total to approximately $3M. Ample has taken aim at the plant-based food industry by offering meal replacement products, including a vegan option and one intended for ketogenic diets.

French powder-based meal replacement startup Feed raised $17M in 2018, bringing its total funding to over $21M, with the goal of propelling its meal-replacement products forward in Europe, with plans for future expansion to other regions.

The company offers French-made, vegan, gluten-free, lactose-free, and GMO-free meal-replacement options, with the company saying that it has sold over 2M pounds of powder so far.

Dairy alternatives are also seeing greater investor and consumer attention, as consumers are increasingly leaning towards plant-based diets and protein alternatives.

Many of these companies are already selling their products in grocery stores for everyday consumption.

Pea-protein milk producer Ripple Foods, for example, raised a $65M Series C round in early 2018, led by Euclidean Capital. Its total disclosed funding is $120M.

In September 2019, plant-based cheese startup Kite Hill raised $15M in funding from General Mills, CAVU Venture Partners, and New Crop Capital, bringing the company's total funding to about $80M.

And in March of 2019, AI-powered eggless mayo producer NotCo raised $30M from a group of investors that included Amazon CEO Jeff Bezos.

Another company, Perfect Day, is attempting to use gene sequencing and 3D printing to create milk without the cow. The company raised just under $35M in Series B funding in February of 2019 from investors Horizons Ventures, Temasek Holdings, and ADM Capital, bringing the company's total disclosed equity funding to $61.5M.

By providing new food sources, meal and dairy substitutes could further chip away at traditional meat's market share.

INSECT PROTEIN GOES MAINSTREAM

2B people around the world eat insects, according to the UN's Food and Agriculture Organization.

While the idea is taboo in some countries, bugs and insects are nonetheless growing as an environmentally-friendly protein source.

In fact, with more than 1,000 species of insects and bugs eaten in 80% of nations around the world, consumers have been slowly shifting their attitudes toward insect-based food as a nutritious and sustainable meat substitute.

To make insect consumption more palatable, the new trend focuses on using insects to create alternative ingredients.

Manufacturers are making flour from crickets, mealworms, and other insects, which can be raised at scale.

Many companies are using insects and worms for snacks, protein bars, and even insect-enriched pasta.

Exo, for example, produces cricket-based protein bars.

Exo raised $5M before being acquired by Aspire Food Group, an edible insect company operating in both Ghana and the United States, in March 2018. Under that deal, Aspire's existing line of cricket-based products, Aketta, will be re-branded as Exo products.

However, Chapul, an early player in the protein bar space, exited in the summer of 2019, citing one reason as being the difficulty of convincing Western consumers to consume cricket-based products.

Cricket-raising results in 100x lower greenhouse gas emissions than beef cow production, and crickets also have higher proportions of protein than beef or chicken. And because crickets require proportionally less feed than livestock animals, production is more efficient.

Efforts to develop financially viable, tasty insect-based food solutions have attracted the attention and funding of major foundations and companies.

The Oklahoma startup All Things Bugs, founded in 2011, is seeking to develop a finely-milled cricket powder that can be supplemented as a base ingredient in recipes.

All Thing Bugs has supplied other insect-based food companies that are working in the cricket product space, including the aforementioned Exo and Chapul.

San Francisco-based Bitty Foods, which has raised $1.2M in disclosed funding, has a line of snack products that are made with insect powders. The company's cricket chips use crickets exclusively from US farms specializing in insects for consumption.

Insect-based protein brands could eventually displace meat-based snacks by offering healthier and more sustainable options.

TRENDS IN MEAT-FREE 'MEAT'

Plant-based burgers that 'bleed' and taste like the real thing

Plant-based burgers have recently become a lot more popular.

Startups producing these burgers are targeting both plant-based and meat-based diets by 1) increasing options for vegetarians and vegans and 2) using a meat-like taste to help entice meat eaters to consume environmentally-friendly protein.

"We think of it as meat made a better way … Meat today basically is made using pre-historic technology, using animals to turn plants into this very special category of food … But to your typical consumer … the value proposition of meat has nothing to do with its coming from an animal."

– Pat Brown, CEO of Impossible Foods

Impossible Foods, a major player in the space, leverages molecular engineering to create "bleeding" plant-based burgers that the company claims is nearly indistinguishable from meat.

The company's use of heme, an iron-rich molecule in animal proteins, has enabled it to replicate the "meaty" flavor in its plant-based products.

Impossible Foods raised a $300M Series E in May 2019, bringing the company's total disclosed equity funding to over $700M.

Instead of directly targeting consumers, Impossible Foods started by targeting the commercial and restaurant market with its meatless burger product. In 2017, Impossible patties could only be found in around 40 US restaurants. By 2018, that figure had reportedly grown to more than 3,000.

Early in 2019, Impossible Foods launched its largest restaurant partnership yet — the Burger King Impossible Whopper.

The company rolled out its patties to some American grocery stores in 2019 and plans to be available in grocery stores in every region of the US by the middle of 2020.

Impossible Foods is also working on a few other types of meat products to accompany its main ground beef product, including meat-free sausage (in partnership with various American pizza chains) and a plant-based pork product the company is planning to launch in China.

Beyond Meat is another major company making plant-based burgers and other imitation meat products such as plant-based chicken and sausage.

After receiving a total of $164M in disclosed equity funding, Beyond Meat went public in May 2019. Beyond Meat's stock price surged after its IPO, with its market cap increasing more than 8x within a few months — though it's since slipped to a market cap of just under $5B.

Beyond Meat, which primarily sells directly to consumers in grocery stores, has launched its own major retailer partnership, working with Dunkin' Donuts to roll out a plant-based sausage breakfast sandwich in 2019.

Looking beyond the American market, the company has said that it plans to expand its plantless-meat product to China before the end of 2020.

Investors back lab-grown meat

Lab-grown or "cultured meat" is another alternative-meat product, but unlike some other offerings in the space this approach is not plant-based imitation meat — it's real.

San Francisco-based Memphis Meats produces meat from self-reproducing cells, thereby growing meat that is an "animal-based" product but avoiding the need to breed, raise, and slaughter huge numbers of animals.

The company debuted its first synthetic meatball in 2016 and followed up with the world's first cell-cultured chicken and duck in 2017.

Memphis Meats aims to decrease the cost of lab-grown meat in order to compete with commercial meat.

While its original meat cost $18,000 a pound, by Jan 2018, the company had gotten costs down to $2,400 per pound. The company also claims that it can produce animal-free products using just 1% of the land and 1% of the water compared to meat-producer incumbents. In March 2018, the company announced its intention to bring clean chicken and duck to stores by 2021.

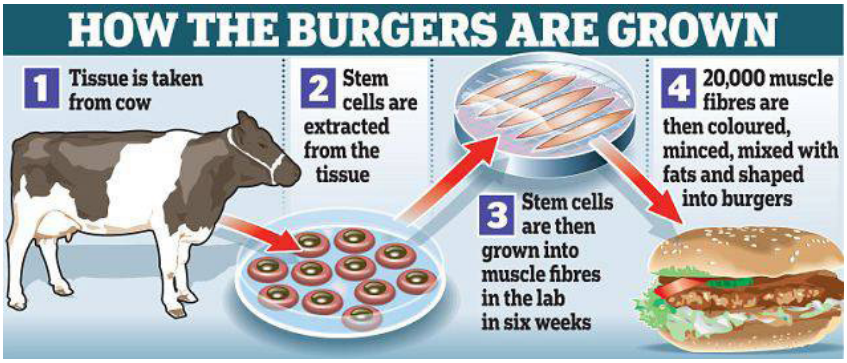
In 2017, Memphis Meats raised a $17M Series A led by DFJ, which invested alongside investors including Bill Gates and Richard Branson. Additionally, Tyson New Ventures backed the company for an undisclosed amount in early 2018.

More recently, in a series of patents, the company announced its intention to use the gene-editing technique CRISPR in order to help it develop its lab-grown meat products with even less impact on the environment and even less consumption of land and water.

In the future, companies like Memphis Meats could cut production, slaughter, and processing out of the meat production value chain.

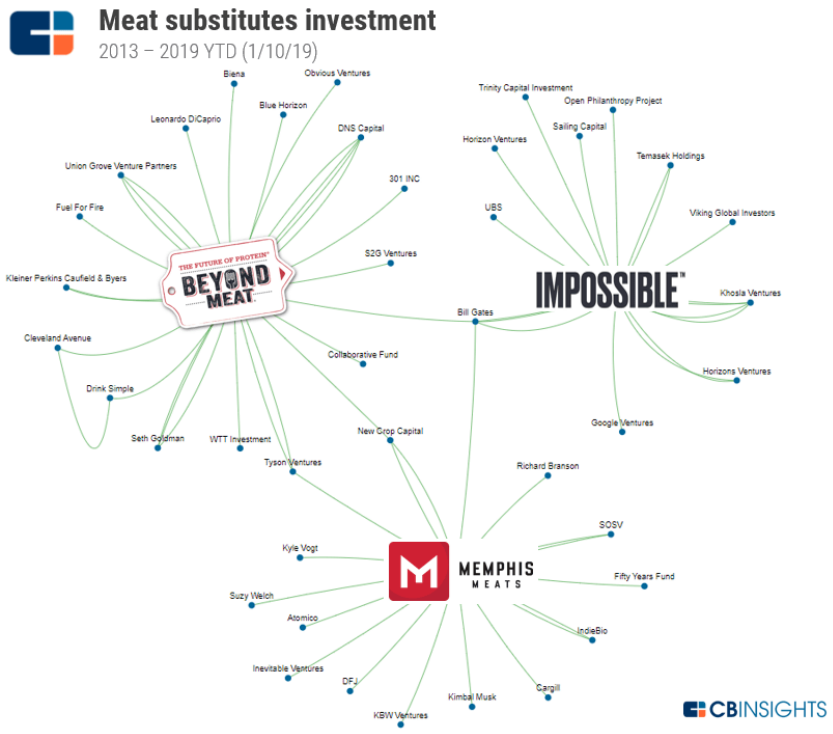
Memphis Meats wasn't the first company to explore lab-grown meat products: Dr. Mark Post, a Netherlands-based researcher, produced the world's first lab-grown burger in 2013, in research originally financed by Google's co-founder Sergey Brin. This initiative spun off into MosaMeat, which aims to bring in vitro meat to market in the future.

Another company in this space, New Age Meats, has raised a total of $250K in announced seed funding for its lab-grown sausage product. The company plans to put its sausage on the market by 2021.



Source: MosaMeat

Both plant-based meat products and lab-grown "clean" meat have seen notable investors, including some top VCs (Khosla Ventures, Kleiner Perkins Caufield & Byers), meat corporates (Tyson Foods, Cargill), and others.



Companies in adjacent spaces also have a stake in the meatless revolution. In 2018, vegan mayo producer Just (formerly Hampton Creek) announced plans to bring its first lab-cultured meat — in the form of chicken nuggets — to market as soon as it had regulatory approval. In 2019, the company announced a pilot of liquid egg alternative Just Egg being run in conjunction with a selection of Tim Horton's locations across Canada.

The regulatory future of lab-grown meat, however, is still a bit of an experiment. The USDA regulates meat production and advocates for agriculture, but the potential conflict of interest surrounding lab-grown meat left both the FDA and USDA in charge of oversight of alternatively grown meat.

Methane-based protein sees early funding

Biotech companies are even exploring methods for engineering meat-like products from methane. While companies are already creating methane-based animal feed, startups are now expressing interest in engineering methane-based protein fit for human consumption.

California-based Calysta has raised $45M this year, bringing its total disclosed funding to $138M.

India-based String Bio, another startup in the space, has raised funding from Future Food Asia, Ankur Capital, and others to commercialize its technology.

“We’d sell it [protein] to someone else who makes it into a steak-like product, or a fish-like product, or something like a tofu perhaps, that we could grill and eat…”

– Ezhil Subbian, Founder & CEO at String Bio

While protein products developed by these companies are not currently fit for human consumption, methane-based proteins could help reduce the environmental impact of meat production, and eventually further fuel the meatless revolution by creating another food source.

In line with String Bio CEO Ezhil Subbian's comment, the first step is creating a methane-based protein that can be marketed to humans and subsequently integrated into their diets.

OPEN-SOURCE CLEAN MEAT

Some companies in the meatless space are competing to be first-to-market with animal-free products. Taking a different approach, Yuki Hanyu, founder of Tokyo-based Integriculture and nonprofit Shojinmeat Project, is working to acclimate future generations to a meatless future through open-source tech.

Hanyu is providing Japanese high school students access to specially designed heated boxes that allow them to culture animal cells at home and grow them into meat-like products.

The concept may seem far-flung, but the Shojinmeat Project is looking to establish a crowd-sourced, bottom-up approach to meat development that allows people to play with lab-grown meat and ultimately integrate it into their diets.

FISH-FREE SEAFOOD SUBSTITUTES

In addition to land-based meat, companies are applying similar processes to create sustainable seafood alternatives.

This is due to the ever-increasing demand on the ocean's resources. With 90% of global fish stocks overwhelmed and overfished due to rising global demand, startups are looking for ways to satiate consumers without fully depleting the earth's fish supply.

Because of the increased pressure on the fishing industry, companies in the seafood-alternative space are seeing greater media attention and funding.

"Shrimp has one of the worst supply chains in the seafood industry,"

– Dominique Barnes, New Wave Foods Co-Founder & CEO

Pennsylvania-based startup Good Catch Foods raised $8.7M in Series A funding in April 2018 to develop vegetarian tuna, crab cakes, and fish patties. The company raised an additional $10M in 2019 — bringing its total disclosed funding to almost $19M — to help it scale production and support the company's placement in Whole Foods, FreshDirect, and Thrive Market stores.

The company's seafood look-alikes are made from lentils, chickpeas, fava beans, and other legumes.

There are a number of other startups in the space.

Finless Foods, which has raised almost $7M, uses cellular agriculture to grow fish meat, while New Wave Foods, which has received backing from Tyson Ventures, produces pea protein and algae-based imitation shrimp. Wild Type is a startup developing lab-grown salmon, it raised a $12.5M Series A in October to bring its total funding to $16M.

Additionally, French startup Odontella, which produces algae-based salmon, raised a seed round in October 2017. Its first product, a vegan smoked salmon from the Odontella aurita microalgae, was launched in April 2018. In mid-2019, the company announced that its next product would be a microalgae-based steak substitute named Tona.

While still in the early stages of R&D, fish-free seafood products are further expanding the possibilities of an animal-free future. As with animal-free meat, fishless seafood could radically simplify and clean up the associated production value chains.

Seafood substitutes financing history

2013 – 2019 (1/16/19)

Disclosed funding: $7M

Disclosed funding: $0.2M

Disclosed funding: $3M

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Corporates and accelerators back the meatless future

CORPORATES BET ON NEW PROTEIN SOURCES

Large corporations involved in the meat industry are themselves also investing in meat innovation as a form of outsourced R&D.

Food-trading giant Cargill participated in Memphis Meats' Series A round, while Nestle, which owns a number of frozen food brands that incorporate meat, acquired vegan prepared foods producer Sweet Earth in September 2017.

“Plant-based protein is growing almost, at this point, a little faster than animal-based, so I think the migration may continue in that direction.”

– Tom Hayes CEO, Tyson Foods

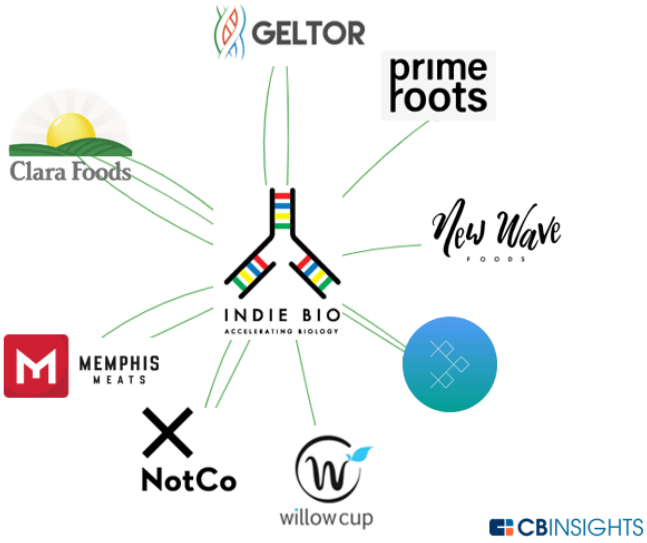
Additionally, the rise of corporate-backed funds with a strong emphasis on alternative meat production and innovation, such as Tyson Ventures, indicates that meat producers foresee the possibility of a meatless future.

Tyson Ventures made its first investment in Beyond Meat in October 2016. In 2017, it participated in the company's $55M Series G round. It's since invested in other similar companies like Memphis Meats, the Israel-based Future Meat Technologies, MycoTechnology, and New Wave Foods. With the launch of this "Internet of Food" fund, Tyson appears to be looking to pivot from a meat producer to a broader protein brand.

INDIEBIO AND NEW CROP CAPITAL BETS POINT TO A MEATLESS-MINDED FUTURE

Beyond corporates, venture capital firms and accelerators are also funding research and development into these high-tech foods. Biotech accelerator IndieBio has placed many bets in animal-free foods, with notable investments in Memphis Meats, New Wave Foods, and Finless Foods, as well as startups focusing on dairy and gelatin substitutes.

IndieBio investments across meatless ecosystem
2015 – 2019 YTD (1/10/19)



Early-stage venture capital fund New Crop Capital funds startups that develop cultured and plant-based meat, dairy, and egg products, along with service companies that facilitate the promotion and sale of these products.

New Crop Capital's investments include participating in a $10M investment for plant-based seafood company Good Catch, multiple seed rounds for packaged plant-based foods company Alpha Foods, and participation in lab-cultured meat startup Memphis Meats' $17M Series A.

New Crop Capital investments across meatless ecosystem
2015 – 2017 YTD (11/6/17)

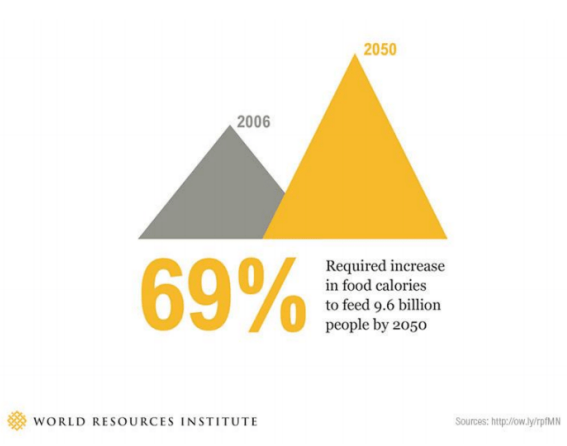
Why the shift towards meatless?

There are several macro reasons for the shift toward a more meatless future.

Forces like urbanization, population growth, and a rising global middle class lead to greater meat consumption. In 2016, approximately 55% of the world's population lived in urban settlements, and this percentage is expected to increase to 60% by 2030, according to the UN.

Meanwhile, the world's population is expected to surge to 9.6B by 2050, leading to a 61% increase in food production. Emerging markets are driving this growth: China, in particular, is the world's largest consumer of meat, with protein consumption expected to grow by around 4% a year due to its rising middle class.

This increasing demand could create challenges for feeding future generations, and meatless companies are looking to help fill the gap.



POPULATION GROWTH OUTPACES FOOD SUPPLY

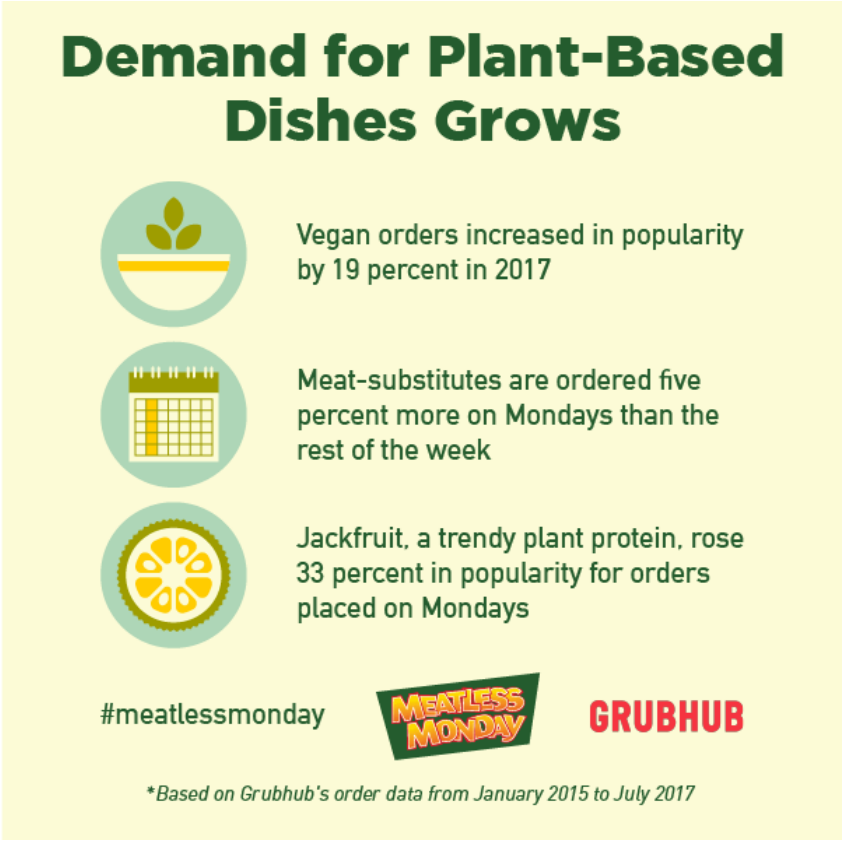
Even if food was distributed more evenly around the world, we still face a massive calorie gap between current food production, and food production required in the future.

At the same time, climate change will negatively impact global agriculture. In many areas, it already has.

Alternative protein sources can reduce the negative environmental impact associated with meat production. As mentioned above, livestock is a major contributor to greenhouse gas emissions. Additionally, reducing livestock could free up global cropland, decrease soil erosion, and relieve pressure on the world's water supply.

Consumers are seeking healthier food alternatives. Rising obesity rates across the globe, coupled with consumer interest in healthier food alternatives, are also driving demand for meatless proteins.

Nonprofit initiative Meatless Monday and US-based food delivery platform GrubHub partnered to demonstrate the growing popularity of meat alternatives. According to the analysis, the demand for meatless dishes is increasing every day of the week, not just Mondays.

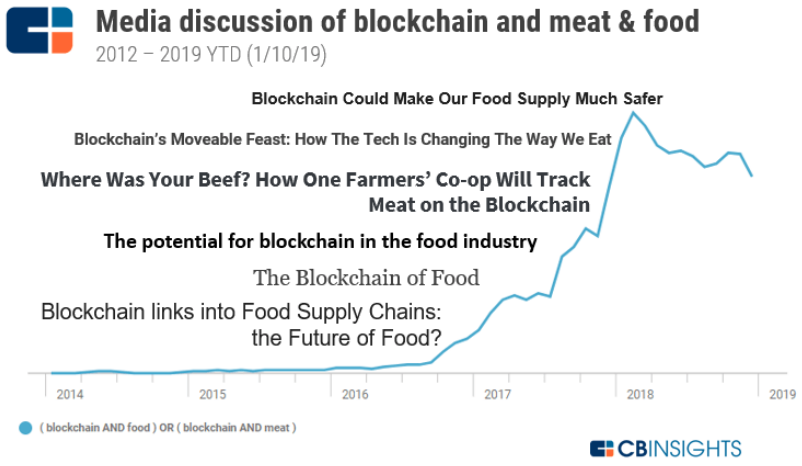


Advances in ag tech and synthetic biology are enabling high-tech meatless products. Cellular agriculture and molecular engineering are fueling tech-enabled meat substitutes that better emulate the flavor and texture of traditional animal meat.

Meatless consumption could alleviate ethical questions around meat consumption.

The meat industry has long been subject to ethical concerns behind meat production practices.

A spike in the discussion of blockchain in conjunction with meat and food indicates a rising consumer desire for transparency around the food supply chain. Agriculture giant Cargill announced in 2017 that it was testing blockchain technology to show turkey buyers where their individual bird came from.

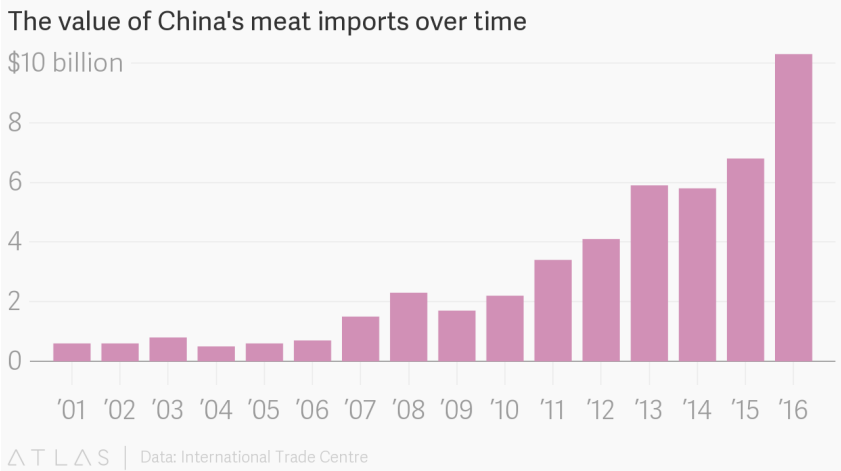


Alternative meats could reduce contamination. Growing lab-grown meat in a sterile environment can cut back on contamination and eliminate antibiotics from the meat production process. This could play a role in reducing global health problems linked to the current food production value chain.

The meatless revolution is global…

The greatest concentration of alternative meat deals has occurred in the US, which is home to a well-developed food and beverage sector. At the same time, there are also developed and fast-growing meatless markets in Europe and Asia.

In September 2017, China announced a $300M deal to import lab-grown meat from 3 Israel-based companies — SuperMeat, Future Meat Technologies, and Meat the Future — as part of a broader plan to decrease the country's meat consumption by 50%.



Regulation is also starting to play a bigger role, as regulators explore cellular agriculture as a viable food source in the future and individual US states, particularly in meat-producing regions, respond to the economic forces represented by meatless trends.

In March 2017, the National Academies of Sciences, Engineering, and Medicine in Washington, DC released a report on the future of biotechnology developments and regulation, while the White House launched a review of how US agencies regulate agricultural biotechnology.

Legislation seeking to prevent plant-based meat products from being labeled as "meat" or "beef" is now being developed in around half the states in the US, with successful bills passing in several prolific meat-producing states.

As of now, artificial meat regulation is still in the early stages. Regulatory responsibility in an animal-free ecosystem could extend across multiple bodies, as biotechnology for food overlaps with many regulatory systems.

Or, a single regulatory agency could be created in the future to deal with the unique challenges of artificial meat regulation.

…but a truly meatless future has challenges to overcome

While plant-based products and other protein sources are taking off, lab-grown meat, in particular, faces a few obstacles.

Fake meat sounds icky. Many consumers face a psychological barrier towards eating lab-grown foods and may prefer the familiar taste of traditional meat products.

While groups like the aforementioned Shojinmeat Project are looking to acclimate future consumers to cultured meat, this socialization will need to happen on a global scale.

High-tech meat is expensive. Cost remains a largely prohibitive factor, with high-tech meat alternatives priced as luxury goods.

One of the main reasons that lab-grown meat is so expensive is due to fetal bovine serum, or FBS, being prevalent in these products. FBS, which is extracted from cow fetuses, is a core and costly ingredient in lab-grown meat.

However, startups are looking to eliminate FBS from the meatless equation in order to cut costs. Just has reported that it has developed a method to grow cell-cultured chicken without FBS, while Memphis Meats is validating methods to produce its meats without the ingredient.

Can clean meat scale? Though many startups in the space claim that their products will revolutionize meat consumption, the question remains whether clean meat will provide a scalable method to feed the future — or whether it's simply a new wave of molecular gastronomy.

The aforementioned cost considerations are crucial in scaling these products for mainstream consumption.

Will meatless products really be better for the environment? Despite claims that less meat consumption will reduce environmental impact, lab-based technologies come with their own high costs for electricity, heating, and other resources.

The automation of meat production could have far-reaching job implications for the agriculture industry. The meat sector is the largest employer within US agriculture, and mainstream meatless consumption could create economic challenges that eliminate jobs across the meat production value chain.

Meat producers, lobbyists, and other bodies have a great deal at risk when considering the effects of automation across the meat industry.

Where is the meatless revolution headed?

The race is on.

Cost and scale are immediate considerations in moving these products from novelty purchases to kitchen staples.

This issue is particularly urgent when attached to the $1.6T annual bill in economic costs that meat consumption could rack up globally by 2050, according to a University of Oxford study.

In the next few years, we can likely expect to see the cost of lab-grown meat decrease considerably.

From there, it's just a matter of which companies will get their products to market first and best position their products as worth the price.

Continued advances in genetic engineering and plant-based innovation will enhance the taste, flavor, and healthiness of meatless products to incentivize consumption.

These technologies will also continue to expand across largely untouched meat and seafood categories (e.g. pork, duck, and eel). We could see direct competitors to meat incumbent brands across virtually all frozen and prepared food categories.

Regardless of the hurdles to a meatless future, alternative meat products are clearly diversifying and growing, capturing investor and public attention alike.

CBINSIGHTS

WHERE IS ALL THIS DATA FROM?

The CB Insights platform has the underlying data included in this report

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