KAIHAN'S

AGRICULTURE

INSIGHTS AND PERSPECTIVE

CONTEXT

- "The agriculture sectors comprise establishments primarily engaged in growing crops, raising animals, and harvesting fish and other animals from a farm, ranch, or their natural habitats." (EPA) For the purposes of this analysis, companies whose products or services are primarily focused on integrating with or innovating upon agriculture are included.
- "The world's population is growing, while available farmland is decreasing inside and outside of the United States. The global population is predicted to be at 9.8B in 2050, and farmers are expected to feed the world with fewer and fewer resources (Fast Company).
- Farms around the world will need to increase global food production by 70 percent in the next 40 years to keep pace with population growth (Forbes).
- The agricultural innovation market focuses heavily on biotechnology, which is a market projected to grow with a 7.07 percent compound annual growth rate (CAGR) between now and 2025 (Fast Company).
- Between 2018 and 2020, venture capitalists invested around $7B into AgTech (Crunchbase).

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TRENDS

1. Smart Farming:

- Overall employment in the agriculture sector has dropped over 30 percent since 1950, and food demand is expected to increase by 50 percent by 2050. The AgTech industry is full of need and opportunity. Tech startups in the agriculture sector see the best opportunity in building tools and platforms for private and corporate farms that enable farmers to do more with less (Fast Company).

- Drones are increasingly utilized in seeding, and it is estimated that 80 percent of drone sales by 2025 will be for agricultural purposes (Fast Company).

- With consumers increasingly desiring proximity to the food they consume, blockchain technology is making its way into food production to allow for transparency in food production. Companies utilize IoT in their technology to assist farmers in analyzing their crop yields (Business Insider). Other IoT applications allow farmers to measure temperature, soil properties, air quality, and even monitor the wellbeing of livestock.

- The use of data and analytics at the individual plant level and "precision agriculture" are growing quickly. Those using precision technology have seen a 15 percent average cost reduction and a 13 percent average growth in yields. Innovation in precision farming is expected to be a $43B market by 2025 (Fast Company).

- Automation technology like self-steering and driverless tractors, automated irrigation, planting, and seed spraying was already a $400M market in 2018.

- IBM's Food Trust created an "ecosystem" of producers, suppliers, manufacturers,and retailers which utilizes blockchain technology to unite aspects of food production in permission based, permanent, shared record of food production systems and supply chains (IBM).

2. Alternatives to Conventional Food:

- While plant-based meat makes up just 1 percent of the overall meat market as of this writing, it is predicted to grow to 11 percent of the market by 2035; with possible changes to regulations on conventional meat or better support for farmers producing ingredients for plant-based meats, alternative proteins could grow to 22 percent of the market in the same time (Forbes).

- The economy is expected to reach "peak meat," the year that animal protein consumption begins to decline, by 2030. (Forbes). It was estimated that the meat supply chain lost $20B in 2020.

- American demand for plant-based protein grew tremendously during the COVID-19 pandemic, with sales up by a staggering 264 percent at the beginning of May 2020 (CB Insights). Conventional meat giants JBS, Tyson, Smithfield, Hormel, and Cargill have all begun to offer their own lineup of plant-based alternatives. Oat milk sales showed a 347 percent increase in 2020 over 2019, while dairy sales were on the decline (CB Insights). Overall, the retail food market in 2019 grew by 2.2 percent, but plant-based foods saw an 11.4 percent growth spurt. Plant-based alternative companies such as Beyond Meat, Impossible Foods, and Good Catch Foods are receiving serious funding from private and corporate investors.

- Two billion people around the globe have a diet including insects; more than 1,000 insect species are consumed for food in 80 percent of countries. (CB Insights). The insects-as-food industry is expected to see a CAGR of 43.5 percent between 2020 and 2026, with an expected market valuation of $710B. (Global Market Insights).

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3. Regenerative Agriculture:

- Climate change is driving innovative change in agriculture. Eighty-six percent of consumers want food that is “good for the world and good for me”; that is, organic, fair-trade, and ecologically responsible (BCG).
- By 2050, harvests are projected to see an average loss of 17 percent; arable land will decrease by 20 percent per capita; and 5.7 billion people may be threatened by water scarcity (Bayer).

- PepsiCo is investing in regenerative agriculture in partnership with tens of thousands of farmers on 7 million acres of farmland in its supply chain to reverse the effects of its agricultural footprint (Fast Company); the investment is estimated to eliminate 3 million tons of greenhouse gases.

- The growth of vertical farming, as well as hydro-, aero-, and aquaponics have resulted in reduced water consumption, increased crop production, lowered emissions, and increased food quality (Babylon Micro Farms).
- Biotech companies such as Inari are reengineering gene-editing technology to develop new varieties of the most widely consumed crops in the world, like corn, soybean, and wheat, to grow efficiently and sustainably (Forbes).

4. Urbanization of Agriculture:

- With demand for arable land increasing year after year, individuals and organizations have sought ways to maximize land, even in unexpected places. Indoor farming in urban environments creates new opportunities.

- Plenty, a pioneer in indoor farming, grows greens in an indoor facility in southern San Francisco (Fast Company). The indoor, vertical footprint allows Plenty to produce 150 to 350 times as much as a conventional farm would in the same ground area.

- AeroFarms commandeered a former steel factory in Newark, New Jersey to grow greens vertically at a rate 70 times higher than a conventional farm, and using 95 percent less water (Fast Company).

- In Westbrook, Maine (and Chicago and Philadelphia soon), Vertical Harvest combines urban farming with affordable housing by employing residents in the building to tend to crops growing in the same building (Fast Company).

- Gotham Greens, based in Queens, New York, grows food just minutes from the homes of New Yorkers in an effort to decentralize food production and increase urban proximity to fresh food (The Washington Post).

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Leverage Point	"8Ps" of Strategy	Opportunity for Disruption	Recommended Leverage Points
Position	The farmers, individual and corporate, that you are targeting. The need of the agricultural industry that you seek to fill.	3	• What technologies do you control that can help you tap into market segments that you previously thought unreachable? • What are the potential business alliances you could think about with key players in the segment to serve your customers with integrated solutions? (Serving customers with more integrated solutions example: serving farmers with fertilizers, crop protection and other).
Product	The products you offer, and the characteristics that affect their value to customers. The technology you develop for producing those products.	8	• What moves are your organization taking to implement Big Data and analytics to your operations? What IoT and blockchain applications can you use? • What tools and technology could you utilize or develop to improve food quality, traceability, and production? • How can you develop a more sustainable production model to accommodate constraints on arable land? • What is the future business model needed to serve new differentiated products to your customers?
Promotion	How you connect with farmers and consumers across a variety of locations and industries.	8	• How are you connecting your product with individual and corporate farms who could utilize it?

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Leverage Point	"8Ps" of Strategy	Opportunity for Disruption	Recommended Leverage Points
Promotion	How to make consumers, producers, and other stakeholders aware of your products and services.	8	• How could you anticipate market and customer needs to make customers interested in accessing your differentiated products?
Price	How consumers and other members of the agricultural supply chain pay for access to agricultural products.	7	• What elements of value comprise your pricing? How do each of those elements satisfy the varying needs of your customers?
Placement	How food products reach consumers. How the technologies, data, and services reach stakeholders in the supply chain.	8	• What new paths might exist for helping consumers access the food they desire? • How are you adapting your operations and supply chain to accommodate consumers' desire for proximity to the food they eat? • How could you anticipate customer expectation to make products more accessible to customers/agile supply chain? • Have you considered urbanization as a part of your growth strategy?

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Leverage Point	"8Ps" of Strategy	Opportunity for Disruption	Recommended Leverage Points
Physical Experience	How your food satisfies the needs and desires of your customer. How the services you provide to agribusiness fulfill their needs.	8	• Where does your food rate on a taste, appearance, and freshness scale? • Could the services you provide to companies and farms in the agriculture industry be expanded to meet more needs? • What senses does your food affect besides hunger? How does your customer extract value from your food in addition to consumption?
Processes	Guiding your food production operations in a manner cognizant of social pressure.	8	• How can you manage the supply chain differently to improve traceability and reduce waste? • How can you innovate systems in production, processing, storing, shipping, retailing, etc.? • What are new capabilities to increase sustainability (impact on the environment, or ESG) components?
People	The choices you make regarding hiring, organizing, and incentivizing your people and your culture.	4	• How are you leveraging the agricultural experience of your staff bottom-up to achieve your vision? • How do you anticipate new organizational capabilities needed to perform your future strategy (innovation, exponential technologies needed, agile customer relationship, innovative supply chain)? • How do you manage your talents to assure suitable development with exposure in the agrifood main challenges/allowing a more sustainable view of the opportunities/cross-sectors?

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OUTTHINKERS

IMPOSSIBLE™

- Impossible Foods was founded as a producer of plant-based substitutes for meat, dairy, and fish in 2011 and has received total funding of $1.6B to date (Crunchbase).
- The Impossible Burger, their top seller, is already positioned in supermarkets and featured in partnerships with Burger King and Disney (Reuters).
- Using food science and engineering, the company uses soybeans and yeast in a process in which they extract genetically modified heme, a protein additive that gives the Impossible Burger its meat-like flavor (Green Matters).
- The company presents that its food production generates 87 percent less greenhouse gas, uses 95 percent less land, and 75 percent less water than conventional
- beef operations.
  The company has recently released plant-based substitute Impossible Sausage in a partnership with Starbucks (Impossible Foods), and is currently developing an
- alternative to pork.
  Valued at $4B in 2020, the company now retails in over 20,000 stores, beyond the 150 it initially sold in.

- AgTech company Indigo was founded in 2014 as a microbiology and biotechnology company focused on increasing profitability, sustainability, and health in food production (Crunchbase).
- They innovated on the technology of microbially-treated seeds using a bio-coating which reduces or eliminates the need for chemical inputs that place a burden on the environment (The Counter).
- Indigo created a global data-gathering "apparatus" called Indigo Research Partners (IRP), or "The World's Largest Agricultural Lab," which harnesses one trillion data points per day from drones, satellites, and sensors around the world (The Counter).
- Their Terraton Initiative connects farmers with an eye on regenerative agriculture with corporations who seek to offset their carbon footprint with environmentally friendly investment. The company aims to sequester 1 trillion tons of carbon dioxide in the next few decades through the initiative (Fast Company).

- Freight Farms was founded in 2013 as a producer and designer of modular, scalable farming systems (Freight Farms).
- Freight Farms released the first hydroponic container farm in 2013, and now offers 10 different farm systems in its lineup.
- Freight Farms developed the farmhand® suite, IoT-based farm management software that provides optimization and automation tools for container farmers.
- In their new Greenery S model, Freight Farms uses IoT-connected sensors and cameras integrated with its farmhand® software to give farmers control over air, lighting, water, nutrients, and spacing (Freight Farms).

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- IBM Food Trust is a blockchain-based, shared record of transactions and data in the food supply chain.
- IBM Food Trust, through blockchain trackability, can improve supply chain efficiency, increase brand trust, innovate on food safety and sustainability, and improve food freshness, eliminate food fraud, and reduce food waste (IBM).
- The network provides users with permissions access to supply chain data, connecting farm to store, and store to consumer.
- According to IBM, the “complete history” of singular food items with relevant information, such as tests, certifications, and temperature data, could be accessible within seconds of upload to the blockchain.
- Clients can access data on food items in the store and track those individual items and their pertinent data points down the chain to the farm within 2.2 seconds.

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