

# Sowing Disruption for a New Generation

Agriculture Technology Outlook Through 2024

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## KEY TAKEAWAYS

- *The farm management software and sensor precision farming segments will have the highest CAGR over the projection period.*
- *Products that offer comprehensive solutions, rather than best-of-breed, that will increase yields and not just cut costs will have the highest chance for broad adoption across the industry.*
- *A deep understanding of the value-chain, inherent volatility of commodities, and understanding of traditional stakeholders will be best positioned to succeed in the AgTech market.*

## BACKGROUND

Unpredictability in extreme weather, produce shortages, and growing populations have threatened farmers and brought agriculture technology (AgTech) into the spotlight. As a result, new startups are receiving investments to increase efficiency across all parts of the farming process, from farm management software to robotics. Historically, tech entrepreneurs have focused elsewhere, keeping farming one of the least digitized industries in the world and a “dinosaur waiting or disruption.”<sup>1</sup> In recent years, agribusinesses like John Deere and DuPont have made small to medium-size acquisitions at relatively capital efficient exits generating sizeable returns and encouraging increased investment in the space. Notably, the industry began gaining significant attention after Monsanto acquired The Climate Corporation, a company specializing in collecting and analyzing farmers field data to assist in making better decisions, in 2013 for over \$1B.<sup>2</sup>

AgTech is defined as technology that increases the efficiency of farms, in the form of software, sensors, aerial-based data, internet distribution channels and tools for technology enabled farming.<sup>3</sup> All new innovation within this industry can be categorized into hardware, software, biotech, and ecology applications. Many startups are generating sizeable revenue and the US-based agri-startups generated over \$2B from connected agriculture products in 2016.<sup>4</sup> For example, some

startups are involved in helping reduce waste at the production stage, while other technology driven companies focus on reducing spoilage and waste in processing, packaging and distribution. During the growing phase, companies are replenishing nutrients through a deeper understanding of a plant's needs, extending the life of the land and earning a premium paid by consumers for lower chemical produce. At the seed level, there is continued evolution of crop characteristics that will enable plants to sustain natural challenges better and longer.

Currently, the majority of investment capital is concentrated in North America. Outside the US, especially in Europe and Asia Pacific innovation is being driven from the bottom up, allowing farmers to experiment and determine what works for them. In the US, fulfilling contracts with major food processors are motivating data averse farmers into adoption.<sup>5</sup>

Overall, investment across AgTech is picking up pace with universally high optimism especially given low penetration rates in the current market. Foreshadowed by a digital revolution, investors are funding new investments and partnerships across a fragmented industry.

<sup>1</sup> <https://investmentbank.com/agtech-trends/>

<sup>2</sup> [http://finistere.com/wp-content/uploads/2018/03/Finistere\\_Ventures\\_PitchBook\\_2017\\_Agtech\\_Investment\\_Review.pdf](http://finistere.com/wp-content/uploads/2018/03/Finistere_Ventures_PitchBook_2017_Agtech_Investment_Review.pdf)

<sup>3</sup> <https://www.cbinsights.com/research/agtech-trends-shaping-the-future-of-farming-expert-intelligence/>

<sup>4</sup> <https://www.goldsteinresearch.com/report/global-smart-agriculture-market-outlook-2024-global-opportunity-and-demand-analysis-market-forecast-2016-2024>

<sup>5</sup> <https://www.precisionag.com/industry-news/agritechnica-2017-5-quick-takeaways-from-worlds-top-farm-show/>

## MARKET SIZE

The Agriculture market in the US alone brings in \$3T annually in revenue, of which about \$150B moves to the bottom line as profit.<sup>1</sup> Specifically, the Ag and Food Tech markets saw another record investment year in 2017 with just over \$10B deployed in early stage investments, up 29 percent from 2016.<sup>6</sup> Additionally, the sector saw more than 300 distinct investors spanning over 160 deals in 2017.<sup>7</sup>

The previous three years have seen an average of \$77B of total capital invested, including M&A, despite deal count dropping; suggesting greater overall deal size and an indicator that industry leaders are emerging and maturing.<sup>7</sup> Bolstering that fact is the overall deal count falling by 17% in 2017 with the most dramatic contraction at the seed stage at 29% while, remarkably, investment at every other stage increased.<sup>4</sup> Several developing countries are encouraging AgTech startup innovation through new accelerators and funds. With these new resources coming to the forefront, seed-funding isn't on the decline, but does stress the role of incubators and accelerators in this emerging category.

The North American smart agriculture market is expected to reach \$20B by the end of 2024.<sup>4</sup> Geographically, North America is dominating and accounted for over 70% of the market in 2016.<sup>4</sup> This industry is expected to grow at a CAGR of 28.3% from 2016 through 2024.<sup>4</sup> Specifically, the global farm management software industry, a major sector of precision agriculture, was valued at just over \$1B in 2016. Another indicator of a maturing industry is represented by half of the largest 20 deals in 2017 exceeded \$50M, whereas only 2 reached this mark in 2016.<sup>8</sup>

## PRECISION AGRICULTURE

Precision agriculture involves the use of technology, through internet of things (IoT) devices and other communication technology, to preserve resources and optimize yields. Based on agriculture type, the market is segmented into precision farming, livestock monitoring, smart greenhouses, and others, including horticulture and fish farming. The precision farming segment dominated the overall smart agriculture market in 2016 and expected to remain dominant over the forecast period.<sup>9</sup> The global precision agriculture market was valued at \$3.58B in 2017 and is expected to reach \$7.3B by 2023, at a CAGR of 12.6%.<sup>10</sup> Comparatively, the global precision agriculture software market, including predictive analytics for crop rotation, soil management, as well as web and cloud-based applications, was valued at \$824M in 2017 and is expected to grow at a CAGR of about 16.7% through 2023.<sup>11</sup>

Another way to breakdown this area is into hardware, software and service categories. The hardware segment dominated the market in terms of revenue and is expected to continue through the forecast period. Specifically, sensors are expected to make up a majority of the market at about 19% market share by 2024.<sup>12</sup> This is due to increasing applications and remote-sensing capabilities integral to precision farming. The services segment will exhibit unprecedented growth through 2024 based on its highly scalable deployment and management of farming systems over cloud networks. This segment is increasingly seeing a service-based subscription model generating large amounts of recurring revenue. Software-based companies are increasingly relying on machine-to-machine communication and betting on the formal rollout of more connected rural internet infrastructure. Specifically, that 5G technology will

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<sup>6</sup> <https://www.reuters.com/article/agriculture-tech-investment/global-ag-tech-startup-investments-rise-29-percent-in-2017-study-idUSL2N1QO1PW>

<sup>7</sup> <https://techcrunch.com/2018/03/08/major-trends-in-agtech-for-2018/>

<sup>8</sup> <https://www.agweb.com/article/agfunder-26-billion-invested-in-ag-tech-in-2017/>

<sup>9</sup> <https://www.grandviewresearch.com/industry-analysis/farm-management-software-market>

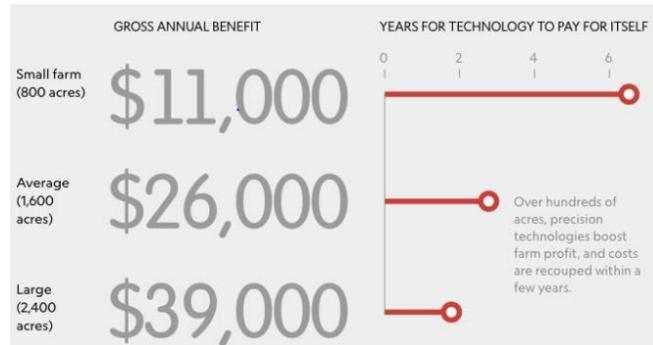
<sup>10</sup> <http://www.hawaiinewsnow.com/story/38268328/precision-farming-market-report-size-share-outlook-to-2023-update-2018-capacity-generation-investment-trends-regulations-and-key-company-profiles>

<sup>11</sup> <https://www.mordorintelligence.com/industry-reports/precision-farming-market>

<sup>12</sup> <https://globenewswire.com/news-release/2018/02/14/1347894/0/en/Precision-Farming-Market-to-hit-10bn-by-2024-Global-Market-Insights-Inc.html>

lead to broader adoption of precision agriculture and field monitoring systems.<sup>13</sup> The agriculture market is poised to take advantage of this new technology as it won't be affected by 5G's major drawback - penetrating walls, people, or inanimate objects.

As an investor in precision agriculture, it's important to understand how a farmer might profit off using the hardware and software that's been created. Farm size is one determinate and returns are generally estimated in \$/acre, therefore allowing larger farms to allocate a bigger budget and gain more returns overall. The second factor is based on yields. Research shows that 30-50% of farms with yields over 180 bushels/acre are willing to adopt this technology.<sup>14</sup> On the other hand, for typical farms with yields under 140 bushels/acre the adoption rate is less than 17%. Lastly, farmers tend not to invest when commodity prices are down. Since other costs are fixed, lower revenue may not cover the initial investment. In summation, precision agriculture technology requires investment with benefits outweighing costs that are most attributed to mapping, guidance and variable-rate technologies. However, for a farmer who must rely on strict budget and uneven cash flow, the timing must be right which may lead to longer than desired sales cycles.



Source: <https://news.nationalgeographic.com/future-of-food/food-future-precision-agriculture/>

Investors seeking to take a position within the space should observe the soil monitoring segment. Soil is arguably the single most prized element in a farmer's arsenal. Many farmers are already utilizing sensors to create irrigation systems driven by moisture, temperature and nutrient measurements. Farmers who have thousands of acres of land and multiple farms are most likely to adopt these technologies early to save time and the resources needed to monitor each and every acre.

## POTENTIAL FOR ACCELERATION

Consistent with a market that hasn't experienced significant change recently, there are many angles from which to tackle innovation. Three areas poised for high impact growth are improving yield efficiency, increasing supply chain efficiency, and decreasing complexity along the value chain.<sup>15</sup> Many companies have chosen different solutions to take advantage of these areas, but most companies can be categorized into five distinct segments - rerouting value chains, crop efficiency technology, bio-chemicals/bio-energy, food tech/artificial meat and contained and vertical farming. Most companies have identified 'low-hanging fruit' and huge market potential to harness rapid growth within the industry.

Rerouting value chains includes meal-kit delivery, e-groceries, shelf-life enhancement and waste reuse/reduction. Reducing waste has potential around the globe with developed countries wasting as much food as the entire net food production of sub-Saharan Africa.<sup>16</sup> Emerging markets see about 40% of losses occur at the post-harvest and processing levels due to financial, technical, storage and cooling constraints, whereas in developed countries 40% of losses happen at the retail and consumer levels which would entail changing consumer behavior.<sup>16</sup> In China alone, the cold-storage and transportation market generates \$12-\$18B in annual revenue an expected to grow at 10-15% annually over the projection period.<sup>17</sup> Additionally, blockchain technology has the potential to improve traceability and transparency within the value chain.

<sup>13</sup> <http://thehill.com/blogs/pundits-blog/technology/328901-how-technology-is-going-to-shape-farming-of-the-future>

<sup>14</sup> <https://news.nationalgeographic.com/future-of-food/food-future-precision-agriculture/>

<sup>15</sup> <https://www2.deloitte.com/content/dam/Deloitte/de/Documents/consumer-industrial-products/Deloitte-Transformation-from-Agriculture-to-AgTech-2016.pdf>

<sup>16</sup> <http://www.fao.org/save-food/resources/keyfindings/en/>

<sup>17</sup> <https://www.mckinsey.com/industries/chemicals/our-insights/pursuing-the-global-opportunity-in-food-and-agribusiness>

This becomes notable as more consumers are rejecting incumbent food products in favor of improved labeling and transparency as more genetically modified and organic foods come to market.

Crop efficiency technology can take on many forms including software analytics, robotics, IoT monitoring, efficient irrigation and satellite imagery. This segment offers arguably the most sex-appeal to investors but requires very thoughtful implementation as a company works directly with the farmer. Satellite imagery has become more sophisticated in recent years, indicated by recent acquisitions, but implementation of sensors and on-farm equipment continues to climb.<sup>2</sup> With advancements in wireless technology, modernizing GPS infrastructure, and ever-maturing sensors, this area will see exponential growth over the projection period. The other half of this segment which includes cloud-based monitoring and analytics is arguably the most mature of any segment. Although there are many large players in this area, it is still unknown who will own the dashboards and provide data feeds for in-field farming operations. Rafi Musher, CEO of Stax Inc. states it is “unlikely that we will see a closed-loop system gain wide-scale adoption [but rather] a flexible system that allows for various data feeds and exports.” Robots in the form of autonomous combines are becoming more commonplace in the industry and will eventually be built on AI platforms. This term can be lumped in with other technologies like standard autonomous vehicles and field sensors, but it is distinct in that it is designed to interpret data pulled from the field and act on its analysis. Another way to say this is that “AI will likely provide the foundation on which autonomous equipment is built and field sensors will be its eyes and ears.”<sup>18</sup> Alex Purdy, head of John Deere labs, envisions this equipment adjusting and optimizing itself based on real-time conditions whereas today equipment is set to one operating specification.<sup>18</sup>

The bio-chemicals/bio-energy segment, although a fast moving and popular investment area, is not as large as the others and requires significant organic chemistry background to understand seeds and plants at the molecular level. The two primary areas are crop enhancement and crop protection. Each have different obstacles ranging from difficulty in demonstrating consistent yield improvement to finding the right go-to-market strategy. Applications of more standardized hardware and software solutions for plant science can be a cost-effective entry point for startups.

Food tech and vertical farming segments both have important roles moving the agriculture industry to more sustainable modes of nutrient transportation. However, food tech deals directly with feeding the population, which subjects it a stringent regulatory environment and possible long payback periods. Vertical farming figures to be a strong supplemental produce supplier, but has difficulty achieving the scale of larger farms across the US. Additionally, an investor looking for greater returns might be more interested in the sensors and imagery technology that would be employed by a vertical farming outfit.

## **BARRIERS**

The food and agriculture investment arenas require a deep understanding of specific crops, geographies and complex value chains. Many of the opportunities are in unfamiliar geographic areas and profitability is dependent both on yields and how differing parts of the value chain - inputs, production, processing and retailing - perform. Although there has been high interest in the space in recent years, the AgTech space has not seen a multitude of venture-backed exits.<sup>2</sup> As more investors have come into the space, there has been a trend of higher valuations and steeper step-ups, slowing follow-on financing.

Investors should recognize the need for tailored solutions and not search for one-size-fits-all answers that don't perform as promised. Farmers, being extremely price and ROI-sensitive, will covet a cohesive solution as opposed to individual applications that can inflate costs. The ability to bring cost down will significantly open up the breadth of implementation, creating value for investors.

Recently there has been an inundation of sensor technology startups developing narrow applications that fix individual problems. Although helpful, there is still significantly more value in a comprehensive platform that captures data at scale and across different parts of the value chain. For most growers, they need

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<sup>18</sup> <https://www.precisionfarmingdealer.com/articles/3198-when-will-artificial-intelligence-become-a-natural-ingredient-in-ag-equipment>

several seasons worth of data for it to be of much use. It cannot be understated how packaging that data in a very easy to use and intuitive platform will be paramount to success. Agriculture.com cautions that “there is a limited amount of value that additional data brings, in part, because farmers wear a lot of different hats, and most operations are not staffed with an analytics department.”<sup>19</sup> Some within the investment ecosystem believe that farmers should be willing to pay for more data whereas the reality is that the product must provide actual value that translates into cash. In many cases, a farmer is being encouraged to convert entire operations at once without the warning of time-intensive background effort to ensure all data points are synched up. This leads to a poor customer experience and should reveal slower more manageable implementation by a company is superior. Despite these drawbacks, investors are betting on a handful of platforms although implementation to-date has been minimal.

Satellite imagery has become increasingly sophisticated as it becomes cheaper to produce high-frequency photos and send devices into low-earth orbit. Imagery companies who leverage these assets are competing directly with the yet-to-take hold drone market that has struggled to find its footing with growers in the industry.

Abroad, the lack of access to connected devices and services is preventing the growth in IoT agriculture. Over 60% of farmers across the world lack access to proper internet connectivity, therefore constricting the current market to more developed countries.<sup>4</sup>

For autonomous vehicles, the major barrier to entry is a service network that accompanies the product. Time is money for a farmer and having a vehicle out of commission for 2+ days could directly influence a harvest and therefore, profit. However, smaller equipment might enable warehousable parts in smaller vehicles, opening interesting technology-based service opportunities in rural America.<sup>18</sup> Overall, industry leaders agree that “we’re still years away from a swarm of light-weight fully-autonomous planters and combines rolling across the field with crop scouting and spraying drones buzzing overhead.”<sup>18</sup>

## **OUTLOOK/IMPLICATIONS**

AgTech is trying to improve the agriculture business by way of efficiency gains and supply chain improvements. Efficiency gains will continue to drive VC and corporate M&A interest in the space. Lending to the appeal of seed-stage investment is the lack of corporate R&D being spent on new business lines; that money instead goes towards improving existing products and services.<sup>2</sup> Therefore, many startups can be complementary to existing corporate offerings, which alludes to higher M&A numbers in the future. Business valuations will continue to be company specific causing VCs and corporations to lead big deals and exits.<sup>20</sup> Additionally, this will cause the multiples of comparable companies to vary greatly. Non-traditional entrants will continue to move into the sector through partnerships and acquisitions. Many of the technologies within AgTech are within tech giants’ core competencies - data for Google and food supply chains with Amazon - possibly foreshadowing offerings by these companies in the future. The global presence in AgTech will continue to grow with Israel already boasting 460 AgTech startups.<sup>7</sup> Additionally, the EU, Latin America, and Asia Pacific have significant public R&D investment.<sup>7</sup>

At its purest form, AgTech is a horizontal sector with venture-backable sectors being replicated in the agriculture market. Both payments and insurance are two areas to watch in the projection period with crop insurance being an \$11B market worldwide.<sup>21</sup> Further, interest in separate markets and technology will continue as farming adopts a data-driven approach surrounded by imagery and sensors. AI platforms will propel precision agriculture to ‘predictive’ agriculture.<sup>7</sup> This will allow farmers to go beyond decision-making at a field and sub-field level but all the way down to the individual plant level. Purdy mentions “Deere is still a-ways from being able to employ that at scale across the entire production system.”<sup>18</sup> With the proliferation

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<sup>19</sup> <https://www.agriculture.com/technology/7-ag-tech-start-ups-to-watch-in-2018>

<sup>20</sup> <https://investmentbank.com/agtech-vc-acquisition-trends-valuations-and-investments/>

<sup>21</sup> <https://www.forbes.com/sites/outofasia/2018/01/16/how-the-agtech-investment-boom-will-create-a-wave-of-agriculture-unicorns/#27bd320a562b>

of sensor technology and more advanced algorithms eventually a farmer won't have to see the raw data before action is taken in the field, but rather will be notified when a robot has done so. In the future, startups will have the look of Silicon Valley's Blue River Technology, a non-chemical weed control company acquired by John Deere, but understand large-scale farming to assist in driving adoption of its product.

In general, there are three frameworks with which to build a farming startup that include targeting overhead or operating costs, assisting supply chains or efficiency or new processes altogether. However, simply identifying hot-spots within the market will not guarantee success. A thoughtful and sector-specific capability will allow a startup to create and capture value in AgTech. Due to the complexity of the AgTech market, there are some key characteristics that are paramount to success.<sup>17</sup> These include having a deep understanding of the value-chain as they vary immensely across each sector and understanding the importance of emerging markets. Next, investors must maintain an understanding of the underlying volatility of agriculture and the time it takes to realize investment. Further, the agriculture business is built on large traditional players who allow ideas and products to flow. Therefore, developing commercial relationships will be vital to mitigate risks and provide exit options. Lastly, an investor should be willing to build operational capabilities within the sector due to the disruption of established business channels.

If these characteristics can be followed within the framework, it will give the best chance for success within the AgTech market. Farmers are notoriously stubborn to outside forces pressuring change but have come to understand they can't cost reduce their way to prosperity. Therefore, showing how a company is going to increase yields through the use of sensors and other technologies allows farmers to be much more likely to adopt them and realize the benefits.

Finally, as more venture capital investment drives disruption and arms farmers with high-tech tools and digitized information, it foreshadows the millennial shift from family farms to smart "food factories."<sup>1</sup> The development of this new technology has encouraged young, tech-savvy people to both stay put and come back to rural communities allowing them to help usher in the next generation of farming entrepreneurs.<sup>22</sup>

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<sup>22</sup> <https://www.agweb.com/article/the-future-of-ag-tech-in-the-midwest-naa-alexandra-nordwald/>