



# Agriculture Technology Industry Report

## AgReat Opportunity

The AgTech (agriculture technology) industry relates to technology-focused businesses and improvements within the entirety of the agriculture industry. The agriculture industry includes businesses that engage in many diverse agricultural activities, which are at the forefront of global food consumption. Although agriculture is often considered traditional, it is on its way to becoming a high-tech industry as advancements in machinery, the number of start-ups, and VC investment data prove that AgTech is undergoing a period of transformational change.

What used to be a handful of funds servicing the market has grown into a well-respected and sought-after industry for innovation. More so, with tech entrepreneurs focused elsewhere, the entire agriculture industry is one of the least digitized industries in the world and is just waiting for disruption.

The agriculture industry is a complex and diverse market with many subsectors. AgTech, therefore, has significant scope for stakeholders and investors to navigate. These many innovations across agriculture comprise numerous sectors and sub-sectors, all substantial in size.

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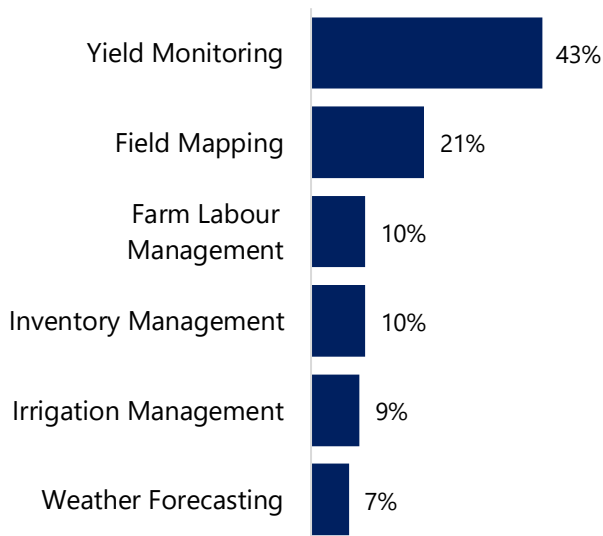
## Introduction to the Industry

### Industry Description

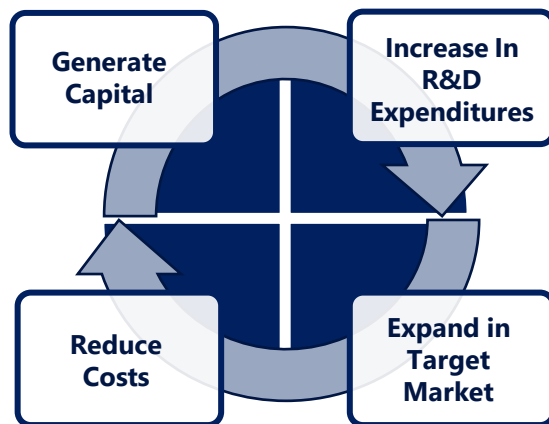
AgTech has begun gaining the attention of many innovators due to the impact the industry has, and its overall importance to the global economy. It has cemented its place as an industry of interest in the tech VC community, with investment in the field totalling roughly \$4.9 billion in 2021: up 188% compared to \$1.7 billion in 2019.

The many challenges of today are bringing many pressures to bear on agriculture; including population growth, the impact of climate change, the need to reduce greenhouse gas emissions, the rapid development of emerging economies, and the growing instability associated with land, water, and energy shortages. Agriculture is one of the very few industries that affects virtually every person on earth. With a growing population, changing climate, and increased demand for a "western-style" diet, agriculture faces some clear challenges which further the need for more sustainable practices. The agricultural technology industry has seen a massive decline in productivity over past years, which is now at the lowest point since the 1960s.

### Technologies Breakdown by Market Share



### Industry Processes



Major segments in AgTech include smart farm & indoor equipment, crop protection, big data, and agriculture marketplace. Indoor farming, including vertical, is the fastest growing AgTech segment, and has received funding at a rate of nearly 50% YoY. The crop protection & input management segment is the largest overall – expected to reach \$74 billion by 2025 with a CAGR of 3.1%, which has seen a slow in funding over previous years.

Disruptive AgTech sub-verticals include:

- **Farming Systems & Machinery** – Includes lighting, automated maintenance systems, vehicle innovations, technology aiding efficiency in production, etc.
- **Vertical Farming** – Replicate the entire farming environment through water irrigation systems, lighting, oxygen, and other gases into a smaller more efficient chamber.
- **Crop Protection** – Seeds and chemical products are advanced so that they can perform in more variable conditions and adapt to new environments. Also producing a higher yield and becoming more consumer modified.
- **Big Data (AgTech Analytics)** – Data-driven approach, calculating the number of seeds used to define the number of chemicals and fertilizers applied. Also using satellites & drones to map out optimal conditions.

## AgTech Sub-industries Overview

### Ag Biotech

Ag biotech includes agricultural inputs and services that improve crop or animal production yields using biological or chemical processes. Technologies in this segment are expansive, ranging from genetics and microbiomics to fertilizers and genetically modified organisms (GMOs), and from breeding technologies to animal health feed additives. Synthetic biology, which could be defined as the construction or modification of biological components, is experiencing rapid innovation with the development of new agtech use cases.

Subsegments include: i) Animal biotech (e.g., solutions optimizing animal health and production) ii) Plant biotech (e.g., developing new crops, microorganisms, fertilizers) iii) Plant data & analysis (e.g., analyzing plant traits)

### Precision Agriculture

The precision ag segment includes farm equipment, robotics, and machinery that help optimize or automate in-field operations such as seeding, fertilizing, irrigating, and harvesting. Emerging products in this segment include unmanned ground vehicles (UGVs), which replace heavy tractors with small autonomous machines that use sensors and digital maps to get closer to plants without damaging them, as well as crop-picking robots and drones that can seed fields. Advanced farm equipment providers primarily differentiate through hardware and software features that may be specialized for individual crops or have broad applications.

Field IoT solutions provide software and sensors to monitor, analyze, predict, and optimize in-field elements including crops, water, weather, and pests. Startups in this sector offer hardware sensors designed to collect specific farm data such as weather, moisture, and plant health. Other providers in the space develop software that can interpret data and improve decision making.

### Agrifinance & e-commerce

Agricultural finance (agrifinance) & e-commerce start-ups provide financial services designed for agricultural companies and growers. These include business loans, insurance services, and tools to assess risk for agrifinance purposes. Ag marketplaces connect industry stakeholders, including growers, input vendors, distributors, agronomists, and financing providers, allowing for the trade of goods and services. Some, such as DeHaat, go further and connect couriers and delivery agents that will transfer goods after they have been sold. Providers operating in this space tend to focus on local opportunities and offer products specialized to specific local needs. The financial needs of rural growers in developing countries often differ vastly from those in developed countries, as the specific crop types and cycles vary.

Subsegments include:

- Agribusiness marketplaces: Online platforms to buy, sell, lease, and trade ag equipment or inputs. Providers may also offer auxiliary services and tools, including input and commodity price monitoring, logistics tools, weather forecasting, and more.
- Finance & insurance: Financial products to help growers manage risk and gain access to capital for operations.

### Ag Biotech

Animal ag companies are developing technology solutions to monitor, analyze, and optimize animal health and production. Software platforms are differentiated by use case and animal type. This subsector included two categories within animal ag: livestock, including dairy operations, and aquaculture/fish production. However, recently there were added two more categories: insect farming and pollination tech. Within these four categories, companies are focused on a variety of objectives, such as activity tracking via wearables, herd management, automation, and operations management.

## Technology Overview

### AI and Machine Learning

New technologies are continuously becoming part of various industries and adapting their processes. The same is happening to the agricultural sector which is investing a lot of resources into AI and Machine learning. Both fields as well as others in the AgTech systems and technologies sector are expected to triple revenues by 2025, reaching a cumulative annual figure of \$15.3 billion. With a growing population, demand is increasing for crops and technologies that create smooth and seamless value chains with minimized risks of failure. For instance, various sensors and servers would allow farmers to keep track of the temperatures and conditions of their fields and all the surroundings.

Technologies are developing and the advantages of these tools are quite obvious as learning and improving are possible without the ongoing and substantial help of the human mind, which, at least in the case of global food security, can widely be seen as a positive.

### Blockchain

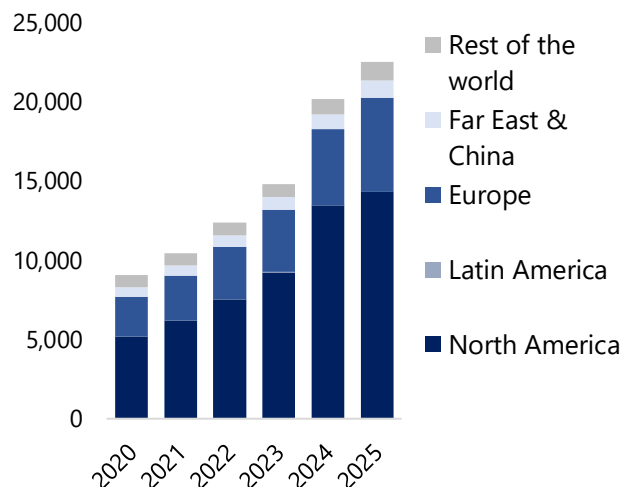
The notion of blockchain is relatively new for most, and it's still a developing technology. The idea of the shared ledger is not new by any means; however, the digitized version of it is something that is not used daily. Blockchain allows multiple businesses to securely exchange information that is encrypted and supported by a certificate of authenticity. This process would significantly ease the process of sourcing and tracing the origins of certain items in the agricultural value chain. A good example of this technology would be a platform called "TraceHarvest" which was designed by Bayer and BlockApps. This tool would allow smaller farmers to provide premium products on the market and would add the capability of tracing each step of the supply chain starting from the seed itself. The current blockchain market size is around \$6B and has an expected growth rate of 85.9% by 2030. This provides a tremendous potential for continuous development and investments from larger agriculture players globally.

### IoT and Connectivity

The global telecommunications industry is valued at \$1.6 trillion and growing at a CAGR of 5.4%. However, the agricultural sector is still lagging and most of the work that is done by farmers is manual and doesn't include modern connectivity tools. Lately, some individuals began consolidating data regarding essential connection points for farmers and how those needed additions can influence their work. Nevertheless, only a few are implementing obtained results to have a better workflow. It's key to have an ongoing development of the IoT features in the farming industry to have an efficient value chain system.

There is a huge upside if this infrastructure is implemented and can add \$500 billion to world GDP by 2030. Considering all the challenges and upcoming issues with the world's food supply, one must not waste any opportunities and focus on sustainable farm practices. The use of simplistic tools like 3G, and 4G are covering the basic needs of farmers nowadays, but with the rapid change of requirements to uphold new standards, more advanced instruments are needed. These technologies will unlock potential for current and new providers in the market, which will only benefit society in the long term

**AgTech Market Value (Worldwide)**





## Major Players

### Bayer AG



**Bayer** is a very diverse company that has two core competencies in the areas of health care and agriculture. It was founded in 1863 with headquarters in Germany and is represented in over 80 countries. It has a market cap of \$70.1B with a revenue of \$52.1B. Bayer's business operations are split into three subsectors such as Pharmaceuticals, which is focused on prescription products; Consumer Health, which is streamlining over-the-counter solutions; and the Crop Science division, which is focused on digital farming, seeds, and crop protection. Bayer is supporting its AgTech innovations through smart technologies and combines, as well as platforms that enhance the decision-making process.

A wide variety of products and services allows Buyer to have a stable stream of incomes that are growing proportionately.

### Deere & Company



**Deere & Co.** was founded in 1837 with its HQ based in Moline, Illinois. The two main segments of its operations are supply agriculture and forestry equipment. The full-year revenue for last year topped \$44B, up by 20% more than the previous year. With continuous growth and a substantial market cap of \$132B, Deere & Co. is one of the largest AgTech players in the world. Enormous potential for EVs in the farming industry paired with the revolution of precision farming and robotics places Deere & Co. in a leadership role in this growing market and rightfully so, as their customer base is estimated to cover over 230M+ acres of production data that can be used to a future benefit. One of the technologies that is used by Deere & Co. is called "Precision AG", which reduces costs, increases yields, and allows for an automated service that greatly aids users in making their farming needs achievable.

Financially, Deere & Co. is managed quite well with profitable fiscal 2021 EBITDA margins around 21% and EBITDA of \$9.0B, which are much higher figures than its competitors.

### Archer-Daniels-Midland (ADM)



**ADM** is a multinational food processing conglomerate founded in 1902. It is a global leader in human and animal nutrition, and a premier agricultural origination and processing company with sales of over \$60B, EBITDA of \$5.77B and a P/E of 13x. ADM's services span a variety of industries and over 200 countries across the globe that are supported by over 800 facilities and 59 innovation centers. ADM covers a number of sub-verticals of the food industry, but mainly focuses on ingredients (e.g., oils, starches, sweeteners, etc.)

As a part of the investment model, ADM Ventures established business incubators that oversee high-tech development projects. Through its incubator, ADM collaborates with portfolio companies to provide capital, SME suggestions, R&D, etc. One of the ventures that were supported and grew into a successful business is "Future Meat" which produces meat from sourced animal cells through proprietary technology. Additionally, ADM is focusing on its sustainability efforts by working to support AgTech developments.

### Cargill



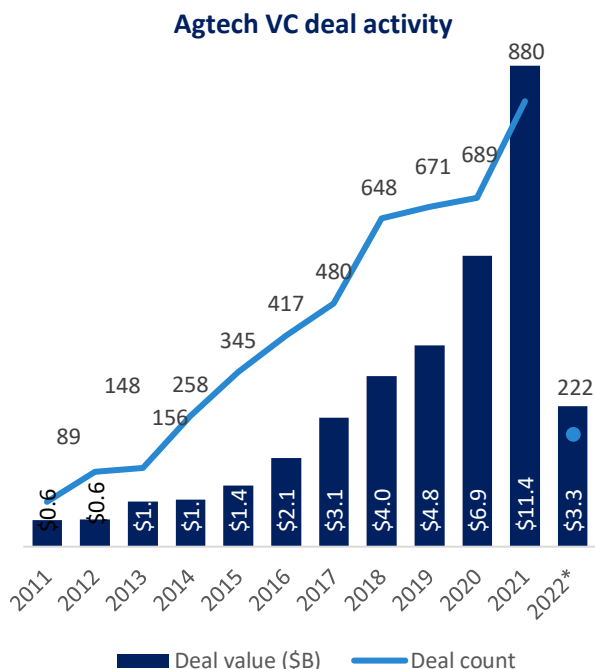
**Cargill** is one of the largest private corporations in the United States which serves customers and communities in 70 regions. The four main sectors are Agriculture, Animal Nutrition and Protein, Food, and Financial and Industrial. With such a wide variety of services, Cargill can bring over \$130B in revenue while reinvesting ~80% of their cash flow back into the business. Insightful data and continuous support allow them to stay a leader and a trusted partner between farmers and major customers such as McDonald's. As the company grows year over year it continues to implement new technologies such as the "Hot Take" app that allows farmers to provide feedback and share experiences. Another tool implemented is computer vision which allows for tracking the movement of livestock and provides insightful details for further examination.

## Q1 2022 VC and M&A Activity

### VC Activity

The agricultural technology (agtech) vertical continued to log elevated venture capital (VC) activity in Q1 despite significant market volatility and macroeconomic concern driving funding slowdowns in many other markets. Evolving environmental and geopolitical events buffered investment in agtech. The war in Ukraine diminished global supplies of fertilizer and agricultural goods, including wheat, corn, and vegetable oil. Surging fertilizer and commodity crop prices pose a growing threat to global food supplies and geopolitical stability.

Funding activity continued its upward trajectory in Q1 2022, as agtech companies globally logged \$3.3 billion across 222 deals, with deal values up 15.5% QoQ. VC enthusiasm for agtech startups persisted in Q1 despite volatility in the public markets that has negatively affected major indexes as well as agtech stock prices. The agrifinance & e-commerce segment garnered the majority of agtech's VC funding in Q1, logging \$921.8 million across 36 deals. Strong agtech funding momentum has elevated median deal sizes and valuations across most stages.



### M&A Activity

M&A activity in the North American agriculture industry has slowed in Q1 2022, with 97 total transactions, trailing Q4 2021 which had 104 transactions. Total transaction value of publicly disclosed transactions in Q1 2022 exceeded \$1.0 billion which lagged behind Q4 2021 of \$5.7 billion. A vast majority of transactions in the agriculture landscape in Q1 2022 were in the food products sub-sector, which comprised 78.4% of the disclosed transactions. There was also notable deal volume in the agricultural services, fertilizers and agricultural chemicals, and agricultural farm machinery sub-sectors.

M&A activity in Q1 2022 was predominantly driven by industry operators (i.e. strategic buyers) who accounted for the vast majority of total deal volume during the period. However, private equity buyers still remain active and are closing deals with ample capital to deploy. The largest disclosed transaction in Q1 2022 was Swedencare's acquisition of The Garmon Corporation for \$590 million, accounting for 51.6% of the total publicly disclosed transaction value in the quarter.

### Key Trends

Many companies within Agribusiness are focusing on portfolio diversification and growth via acquisition. Large legacy Agribusiness companies looking to increase their organic, better-for-you, and branded offerings have increasingly sought to consolidate smaller companies that have well-established offerings in the market. Another reason for consolidation is offsetting the results that the war in Ukraine had on the overall global economy, especially in the agriculture space.

Some fragmented segments with multiple niche players, including farm distribution and retail, farming inputs, and ingredient processors, are facing challenges stemming from their lack of scale, financial reserves, and portfolio diversity.

## Developments and Trends

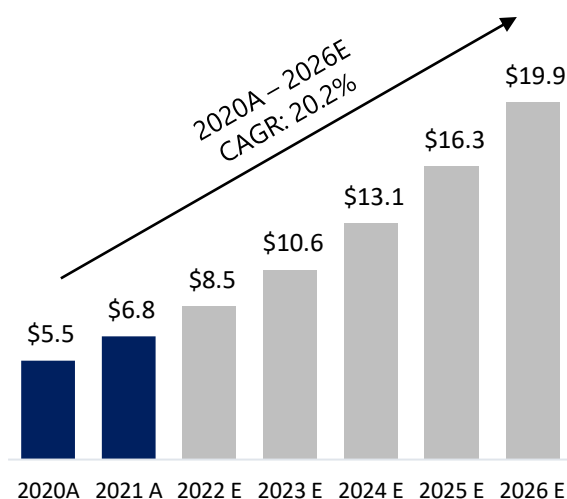
### Vertical Farming

The global vertical farming market has been steadily rising over the last years, and in 2020, stood at a value of USD\$5.5B billion. Being able to use vertical space and reduce the need for additional land contributes to the appeal of vertical farming in large cities. Demand is also expected to increase largely due to the popularity of organic food and a growing global population.

Vertical farming takes away the reliance on weather, skilled labor, and water consumption. It allows for a consistent and reliable crop yield throughout the year and minimizes the chance of negative external factors. Furthermore, monitoring technologies are available to track plant growth and harvesting, allowing for plant growth optimization. The vertical farming market is most prominent in Asia and North America. Although it is currently breaking through in Europe and the Middle East.

Some challenges facing vertical farming are the start-up costs along with the continuous cost of energy and maintenance. These challenges are being combated by the advance in automation technology, the development of solar energy, along with improving power grids in most of the world. Adoption will grow exponentially as production becomes more widely available and as power grids become more reliable.

**Vertical Farming Market (in USD\$B)**



### Farming Systems & Machinery

Widespread adoption of robotics by companies in the agriculture industry has been slow compared to others, although there is reason in saying the interest will surge quickly. Robotic devices and machines can perform in adverse conditions, increase efficiency, and strengthen agricultural output. The rising market demand for specific agricultural products will force many farms to adopt robotics in their operations. Due to the highly competitive landscape of the industry, lagging slightly behind isn't an option.

Out of all farm machinery, tractors have reigned supreme for numerous years. Machines such as tractors are immensely expensive and do not allow smaller operations to utilize them as effectively. As a result, some businesses are looking to rent out tractors, meaning manufacturers can take up a larger market share and deliver the desired tools. As the demand for crop yield grows, higher power tractors are also expected to be in high demand and better at keeping up, without compromising the company's bottom line.

Irrigation is one of the most important aspects of agriculture, allowing farms to keep up with rising food demands. For instance, an innovation in this area is optimized sprinkler systems. The development of water solutions is expected to have exponential growth as other advancements such as advanced drip irrigation systems will provide the necessary tools for optimization.

Fertilization technology advancement has been overlooked globally in the past, and fertilizers were mostly broadcasted over a large field instead of being targeted directly. The market is changing, as new technologies emerge, fertilizer equipment can use data derived from other sources to predict the exact requirements and provide recommendations. Additionally, highly advanced modeling systems can allow farmers to consider different geometries such as slopes, allowing for optimal use. As new technologies are implemented, fertilizer equipment can use data derived from other sources to predict the exact requirements and provide adjustment recommendations.



## Developments and Trends

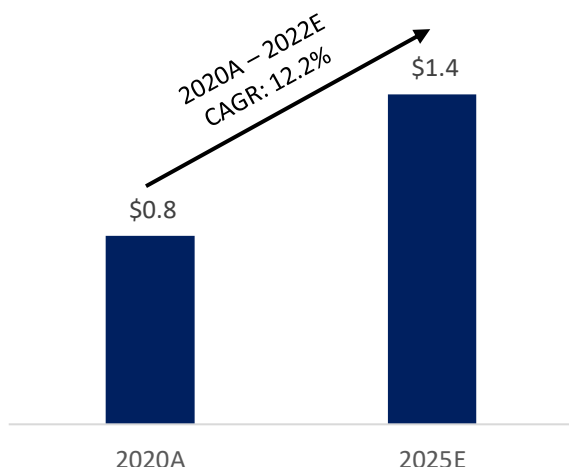
### Big Data “Agriculture Analytics”

For every industry, big data analysis is becoming an integral business strategy. The rapidly increasing volume and complexity of data are due to growing mobile data traffic, cloud-computing traffic and burgeoning development and adoption of technologies including the Internet of Things (IoT) and artificial intelligence (AI), which is driving the growth of big data.

The agriculture industry is currently facing a challenge of enormous global scale – the need to increase agricultural production to feed a population that is expected to grow to 10 billion people by 2025. This incredible feat needs to be accomplished while maintaining sustainable agricultural systems and simultaneously facing additional barriers, such as unpredictable weather and depletion of water resources.

With the incorporation of big data analytics into Precision Agriculture, an important shift began within the agriculture industry. With big data gathering information from a huge number of sources and translating it into actionable information to improve business processes and solve problems at scale and speed, real-time performance optimizations have occurred across the industry. Now, big data analytics can show how farmers are utilizing their inputs and what adaptations are required to take account of emerging weather events or disease outbreaks.

**Agriculture Analytics Market Size (USD\$B)**



### Drones & Satellites

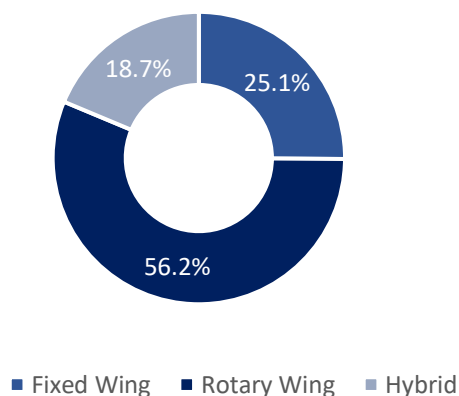
In 2015, the Federal Aviation Administration approved the Yamaha RMAX as the first drone weighing more than 55 pounds to carry tanks of fertilizers and pesticides to spray crops. Since then, the use of drones and satellites has been on a strong uptrend.

Generally speaking, global spending on drones is directly tied to defense budgets. The agricultural drone industry is directly impacted by defense budgets and follows defense budget trends quite closely. In 2020, drone defense R&D budgets were set to rise from \$11.1 billion to \$14.3 billion by 2029. This number has significantly increased since Russia's invasion of Ukraine last February.

Large amounts of VC funding also prove that the drone and satellite industry still has a long way to go in terms of industry growth. From January to August 2020, VC funding in the drone industry reached \$1.3 billion, beating capital deployment in 2019 (\$994 million) in just 8 months.

Based on type, the market is divided into rotary-wing, fixed-wing, and hybrid. The rotary-wing segment held the largest share in the market in 2019 and is projected to continue its leading position during the forecast period.

**Agriculture Drone Market Share, By Product Type**



## Industry Drivers

### Growing Population and Urbanization

The population of Earth is constantly growing. Consequently, the demand for food is growing proportionately and would require for an expansion in food production of 50%+ to address demand. With more and more people moving to big cities and the continuous urbanization of incomes, diets are changing drastically, becoming full of high-calorie and animal protein foods. The inputs to produce these needed ingredients may vary, but the general overview is that more farmland is required to implement the new global diet. However, the space where food can grow is limited and already utilised at 90% of capacity with some countries like China completely covering all the potential turf without much opportunity for expansion. Consequently, this mandates the implementation of technological advancements to overcome these limitations.

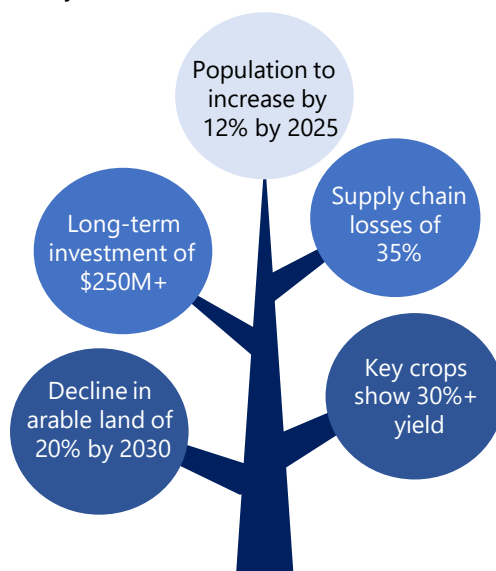
### Supply Chain Efficiency

Supply chain efficiency is an essential part of every production and distribution process and is key to having one that doesn't fail. It is shown that over 20-30% of losses could occur due to inefficient supply chains that are not adapted and controlled by proper technologies and procedures. Considering the importance of the role of logistics and value chain in any business, a slight improvement of only 5% would increase yield by at least 10%, thus showing that any possible ways of improvement would be greatly beneficial. When the whole process is controlled and ready to be adjusted this brings full flexibility and power to manipulate supply for the market promptly. Over 90% of grocery sales in European countries as well as in the U.S. are conducted in supermarkets nowadays in contrast to the 1960s when independent retailers had most of the market share. This change allows big chains to conduct many M&A transactions that maintain the completeness of distribution all the while implementing new technologies such as digital twins to compete and beat the competition

### Consumer Choices

Consumers drive the demand and adapt to the markets' availability. With the growing popularity of sustainable eating, more people are considering foods that are sourced and produced in a very efficient and environmentally-friendly manner. Trends such as organic and gluten-free produce shake up the industry and governments ought to tighten up their standards to comply with modern "standards". All these changes allow for the implementation of more and more tech into the production of foods.

Adoption of set expectations from customers will drive the industry into the cycle of continuous improvement that fosters a competitive field, and subsequently promotes innovations and producer uniqueness. It might seem like a big step for some businesses but the growing AgTech market with an expected value of over \$1 trillion globally by 2025 makes this a worthwhile investment. Additionally, small players might benefit as well, due to ongoing investments from venture capitalists who currently spend over \$4 billion yearly on AgTech start-ups. Accountability and efficiency will be rising as well due to the clear flow of goods between parties. This will lead to a more sustainable future for the agriculture industry.



## Industry Drivers

### Government Incentives and Legislation

Federal governments provide numerous incentives for ag-tech companies and have a strong legislative framework they've developed over years to favor the industry. Ag-tech research is directly supported by the public sector via funding from the federal and provincial governments. In 2015-2016, an estimated 649 million dollars were invested in agriculture research and development by the Canadian federal government which contributed to the industry's growth in subsequent years.

Not only does financial support from government bodies help the industry, but so do tax incentives and the seal of approval from federal departments such as Agriculture and Agri-Food Canada, the Canadian Food Inspection Agency, and Health Canada, leads to a higher degree of trust and brand loyalty since customers are more trusting of the products and know that they aren't consuming any hazardous products such as pesticides, colorants and other food additives, chemicals, etc.

To ensure that the industry will have enough capital and motivation to create these indispensable technologies in the near future, governments have pledged billions of dollars and created programs for ag-tech companies to apply to receive said funding. A notable program that exists in Canada is called the Canadian Agricultural Partnership (CAP). The CAP's sole purpose is to fund ag-tech projects in the country that seek to innovate current technologies and offer modern solutions to modern problems.

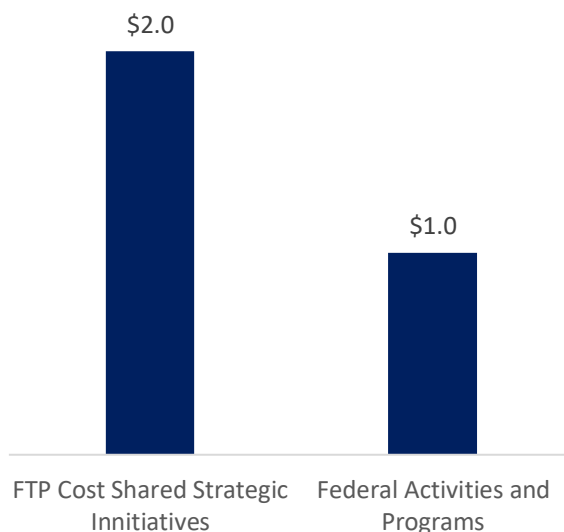
If governments continue incentivizing and supporting the industry to the same degree they are currently doing or more, the market can be expected to grow at a steady pace and meet the rising demands efficiently. Given how agri-food sectors play in the fight against climate change and supporting their need to adapt to new trade agreement, governments are recognizing the importance of incentives within this sector

### Innovation

Innovation in the ag-tech industry is arguably the most important element as it allows for more cost-efficient solutions, higher efficiency, and eco-friendly methods to be developed. Thanks to proper funding, innovation has permitted Canadian farmers to benefit from innovation by using fewer resources to produce their goods. Additionally, using recent advances in the field, Canada has become a leader in low greenhouse gas emission farming.

Currently, innovation efforts are more focused on providing solutions to climate change challenges such as frequent droughts and water stress for plants. Such innovations will not only benefit Canada, but also multiple other countries facing climate change-based issues such as the USA. In recent years, southern American farmers have faced multiple long-lasting droughts and a harsh sun which has made it difficult to produce crops. By developing drought-resistant plants and new technologies to help farmers, the latter will be able to meet the demands of a growing population efficiently.

**Government of Canada Ag-Tech Investments Program, CAD\$ Billion**



## Industry Outlook

### Short-Term Outlook

As tensions between the west and the east continue to run high, European/North American countries will continue to shift away from reliance on agricultural commodities from eastern countries, especially Russia and China. As stated in this report, the war in Ukraine has boosted R&D and investment in the AgTech sector, making it an attractive segment of the market. Russia's invasion of Ukraine is also having macroeconomic impacts and is exacerbating pre-existing challenges for the EU's economic growth. The European Central Bank (ECB) states that if the invasion continues into 2023, the recovery of the euro area's GDP to 2019 levels is not expected before 2024. As a result agriculture sector will be negatively affected in the short term, due to Ukraine being a significant player in that space. However, in the short run, AgTech should see an increase in investment activity to offset issues and challenges that happened as a result of the war.

Continued supply chain disruptions also incentivize countries to be as independent as possible in terms of agricultural commodities, which may help growth in various areas of AgTech such as analytics, vertical farming, drones, and other verticals which help manage resources and efficiency. The Covid-19 pandemic has also pushed companies within agriculture to think about and improve on their crisis-management strategies as well as improve on next-gen products.

It is important to note that although the thesis for investment in the AgTech industry is a strong one, U.S. markets have seen two-quarters of negative growth, a strong indicator of a recession. Although economists are unsure if a recession is certain, fears of a recession are causing widespread volatility in equity markets. This high volatility could very well impact big players in the agricultural industry and therefore the AgTech industry, especially if recession fears become reality.

### Long-Term Outlook

Due to phenomena such as climate change, overfishing, rising populations, urbanization, natural disasters, etc, modern day farmers are increasingly faced with unique challenges to which current technology and science can't offer much help. In the long term, it becomes evident the ag-tech industry's presence will grow as demand for innovative and efficient solutions to modern problems rises. To get a better idea of how significant this industry is, let's look at projections. In fact, it is estimated that by 2027, the ag-tech industry will have grown from \$9.11 billion in 2020 to \$32.50 billion, more than tripling its market value in less than a decade. This translates to a compound annual growth rate (CAGR) of 19.9%. With long-term damages to the environment being inevitable due to human activity, it becomes clear that the need for innovation and research from the ag-tech industry is essential making this a good long-term investment for investors with a more conservative portfolio.

The future of agriculture will use sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. These advanced devices and precision agriculture and robotic systems will allow farms to be a lot more profitable, efficient, safe, and more importantly environmentally friendly. Without a solid connectivity infrastructure, however, none of this is possible. If connectivity is implemented successfully in agriculture, the industry could tack on \$500 billion in additional value to the global gross domestic product by 2030, according to our research. This would amount to a 7 to 9 percent improvement from its expected total and would alleviate much of the present pressure on farmers. Demand for food is growing at the same time the supply side faces constraints in land and farming inputs. The world's population is on track to reach 9.7 billion by 2050, requiring a corresponding 70 percent increase in calories available for consumption, even as the cost of the inputs needed to generate those calories is rising.

## Valuation

Company	Ticker	Enterprise Value	EV/Revenue			EV/EBITDA			P/E		
			LTM	CY+1	CY+2	LTM	CY+1	CY+2	LTM	CY+1	CY+2
Agriculture Technology Companies											
Bayer Aktiengesellschaft	XTRA:BAYN	\$101,964	2.1x	2.1x	2.0x	18.4x	7.7x	7.6x	15.3x	8.5x	8.3x
Archer-Daniels-Midland Company	NYSE:ADM	\$65,156	0.7x	0.7x	0.7x	13.4x	10.6x	11.9x	14.4x	13.5x	15.6x
Deere & Company	NYSE:DE	\$168,104	3.7x	3.5x	3.3x	18.9x	14.6x	14.3x	20.8x	16.7x	15.6x
Corteva, Inc.	NYSE:CTVA	\$42,301	2.5x	2.5x	2.3x	11.2x	13.9x	12.5x	24.3x	22.5x	19.2x
Maximum		\$168,104	3.7x	3.5x	3.3x	18.9x	14.6x	14.3x	24.3x	22.5x	19.2x
75th Percentile		\$118,499	2.8x	2.7x	2.6x	18.5x	14.1x	13.0x	21.7x	18.1x	16.5x
Median		\$83,560	2.3x	2.3x	2.2x	15.9x	12.3x	12.2x	18.1x	15.1x	15.6x
25th Percentile		\$59,442	1.8x	1.7x	1.7x	12.8x	9.9x	10.8x	15.1x	12.3x	13.7x
Minimum		\$42,301	0.7x	0.7x	0.7x	11.2x	7.7x	7.6x	14.4x	8.5x	8.3x

## Conclusion

Regardless of which group drives the necessary investment for connectivity in agriculture, no single entity will be able to go it alone. These advances will require the industry's main actors to embrace collaboration as an essential aspect of doing business. Going forward, winners in delivering connectivity to agriculture will need deep capabilities across various domains, ranging from knowledge of farm operations to advanced data analytics and the ability to offer solutions that integrate easily and smoothly with other platforms and adjacent industries. For example, data gathered by autonomous tractors should seamlessly flow to the computer controlling irrigation devices, which in turn should be able to use weather-station data to optimize irrigation plans.

Agriculture, one of the world's oldest industries, finds itself at a technological crossroad. To handle increasing demand and several disruptive trends successfully, the industry will need to overcome the challenges to deploying advanced connectivity. This will require significant investment in infrastructure and a realignment of traditional roles. It is a huge but critical undertaking, with more than \$500 billion in value at stake. The success and sustainability of one of the planet's oldest industries may well depend on this technology transformation, and those that embrace it at the outset may be best positioned to thrive in agriculture's connectivity-driven future.