

Wednesday, March 29, 2023

Vertical Farming – The Future of Sustainable Agriculture

Market Size and Growth	2
Key Growth Drivers and Players (Growers, Precision Farming Names)	3
Building-based Farms vs. Shipping Container-based Farms, and Key Players	7

Hydroponics – Creating Ancillary Plays

Comparison of- and Market Share- by Growth Mechanisms	8
Key Hydroponics Players and Segments	10
Cannabis Legalization – An Inflection Point for Industry Growth	12

Vertical Farming's Rising Share of AgTech Investments

Investment Trends	16
Indoor Agtech Landscape	18

Top Picks

AeroFarms	19
Infarm	21
Bowery Farming	22
Plenty	24
Upward Farms	25
Freight Farms	27
Iron Ox	29
Hydrofarm (HYFM)	30
Hydrobuilder	33

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Vertical Farming Climbing Higher

Investment Thesis

- Vertical farming is well placed to meet the global agriculture market's unmet needs of sustainability, growing demand for food, higher yield, and higher quality of produce. As a result, the market is expected to grow at a 23.2% CAGR to \$19.4 billion by 2027.** The key drivers of this growth will be 1) higher yield and better distribution ability offered by vertical farms, 2) ability to produce high-quality herbs, fruits, and vegetables throughout the year, 3) growing popularity of organic foods, 4) rising focus on ESG trends aimed at preserving natural resources and enhancing the transparency and safety of food supply chains, and 5) the rapid pace of development of precision farming technologies. The key growers targeting this opportunity include AeroFarm, Infarm, Bowery Farming, Plenty, Upward Farms, Iron Ox, and Gotham Greens.
- Shipping container-based farms—that offer the ability to grow food irrespective of geographic location—will dominate the vertical farming landscape in the foreseeable future and create investment opportunities.** These recycled containers can be used in urban and remote settings alike, are easy to transport, and do not require large land parcels to start farming, thus lowering the input cost and shortening the time and distance that food needs to travel from farm to table. This segment commanded a 55.8% share of the vertical farming market in 2020, led by U.S.-based Freight Farms and other players including FarmPod, CropBox, Growtainer, and AgriCool.
- Hydroponics will remain the most dominant growth mechanism – coupled with the global shift toward Controlled Environment Agriculture (CEA) and urban farming, and legalization of cannabis, this will create compelling picks-and-shovels plays.** Hydroponics accounts for >50% share of the vertical farming market (by growth mechanism) and is likely to maintain its lead as it can be used by a wider audience, requires less attention and monitoring, and is more cost effective. The growing adoption of vertical farming through hydroponics and other growth mechanisms is emerging as a key growth driver of the global CEA/hydroponics equipment and supplies market. Hydrofarm (HYFM), Hydrobuilder Holdings LLC, GrowGeneration (GRWG), and Hawthorne Gardening Company (SMG) are the key names levered to this trend.
- Vertical farming's share of Agtech investments grew from 2% in 2010 to 18%+ in 2020, and we expect this share to grow even further in coming years as companies like AeroFarms and Infarm (*rumored*) go public through SPAC deals, resulting in increased liquidity, value discovery, and multiple expansion.** We believe the vertical farming industry is on the cusp of receiving capital from public equity investors, and that the growing interest from big-ticket institutional investors will drive valuations of vertical farming and hydroponics companies higher.
- Investors looking to benefit from the Vertical Farming opportunity can consider evaluating the following names:**
 - Growers: AeroFarms, Infarm, Bowery Farming, Plenty, and Upward Farms
 - Container Farming Play: Freight Farms
 - Tech/Robotics Play: Iron Ox
 - Ancillary/Hydroponics Plays: Hydrofarm (HYFM), Hydrobuilder

Vertical Farming – The Future of Sustainable Agriculture

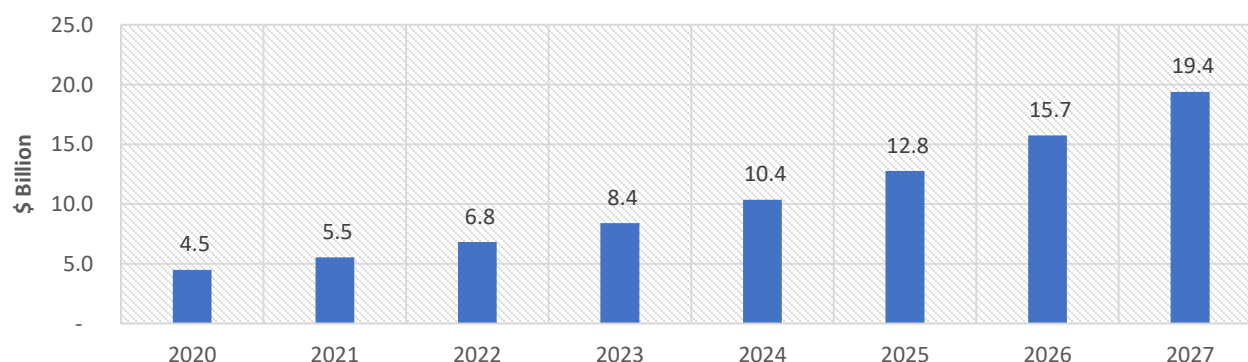
- The global agriculture market has unmet needs in the form of growing demand for food, higher yield, and higher quality of produce. Vertical Farming is best placed to meet these needs – according to GM Insights, the global vertical farming market is expected to grow at a 23.2% CAGR from \$4.5 billion in 2020 to \$19.4 billion by 2027. According to the Food and Agriculture Organization (FAO), due to the increasing population, food production is expected to rise 70% before 2050. On the other hand, natural prerequisites of agriculture – arable land and water – are depleting at a rapid pace due to urbanization across the world. As a result, productivity of food crops needs to be increased, thus creating the need for alternative farming techniques like vertical farming. **Vertical farming is an approach used to produce food and medicinal plants in vertically stacked layers such as in a skyscraper, used warehouse, or shipping container.** It facilitates huge quantity of nutritious and quality fresh food without relying on favorable weather conditions, high water usage, skilled labor, and high soil fertility. Further, by tuning the growing environment to the exact needs of the plant and using soil-free growing techniques, vertical farming can achieve yields much higher than conventional agriculture, 365 days a year, and without requiring pesticides. Driven by these advantages, the global market for vertical farming is estimated to grow at a 23.2% CAGR to \$19.4 billion by 2027.

Chart 1: Vertical Farming



Source: Intro-act, Hortibiz

Chart 2: Vertical Farming Market Is Expected to Reach \$19.4 Billion by 2027



Source: Intro-act, GM Insights

- Vertical farming offers higher yield and better distribution ability vs. other farming methods, and can be used to produce high-quality herbs, fruits, and vegetables throughout the year – this is one of the biggest growth drivers of the industry.** The atmosphere in vertical farming installations is controlled by using various equipment including lights, sensors, humidity controllers, coolers, etc. As a result, vertical farms are not affected by climate change and other factors like floods, droughts, soil-related diseases that typically impact crop production in traditional farms. This use of artificial environmental control, control of light, and fertigation not only protects crops from extreme weather conditions but also lends vertical farms the ability to produce herbs, fruits, and vegetables throughout the year, resulting in higher yield. According to the investor presentation of **leading vertical farming company AeroFarms that is merging with SPAC Spring Valley Acquisition Corp. (Nasdaq: SV), the yield of its vertical farm (measured in lbs/sqft) is 390x higher than that of a conventional farm and >30x higher than that of a greenhouse.** This substantially higher yield is an offset against the higher set up cost required for vertical farms and results in higher revenue generation for companies in this space. Another advantage of vertical farms is centralized distribution – since these farms can be operated from warehouses and containers, they can be located very close to major distribution hubs and consumers in urban and rural areas alike. This reduces the shipment time and cost required to transport the produce to consumers. According to the 2017 State of Indoor Farming study by Agrilyst, container farms and indoor vertical farms combined accounted for 37% of controlled environment agriculture (CEA) facilities in 2017, a percentage that we expect to rise substantially in the coming years. Leafy greens and tomatoes are the most dominant crops produced using vertical farming, followed by herbs, flowers, and microgreens. The high share of tomatoes is attributable to the high average demand for tomatoes in all regions compared to other crops such as lettuce, peppers, and cucumbers.
- Apart from AeroFarms, other key vertical farming players include Infarm, Iron Ox, Plenty, Bowery, Upward Farms, Gotham Greens, and others shown in the chart below. (We discuss our top picks among these later in the report.)**

Chart 3: Key Players – Vertical Farming Market



Source: Intro-act, Better Food Ventures – Indoor AgTech 2021 Landscape

Chart 4: Vertical Farms vs. Greenhouses

	Greenhouses	Vertical farms
		
Overview	- Controlled structure that uses natural light during the daytime — typically via a glass or plastic ceiling - Artificial light may be supplemented	- Fully enclosed environment that uses vertically stacked or vertically grown plants - Only uses artificial light
Features	Degree of control varies greatly, from little control other than temperature to all aspects being controlled	- All aspects of environment are fully controlled - Requires less land given vertical nature
Costs	- Typically requires new builds — ranging from ~\$0.5M to \$3M per acre* - Operating costs typically range from \$240K to \$1.5M per acre depending on the crop	- Requires very high capital expenditures of over \$10M per acre** - Operating costs are ~1.5-2.5x of a greenhouse due to continuous lighting
Crops	- Flowers - Fruits (e.g., strawberries, raspberries) - Vegetables (e.g., tomatoes, cucumbers, bell peppers) - Leafy greens (e.g., lettuce, kale, chard) - Microgreens - Cannabis	- Leafy greens (e.g., lettuce, kale, chard) - Microgreens - Herbs (e.g., basil, chives, mint, thyme) - Cannabis
Share of CEA acreage	~95%	~5%

Source: Intro-act, L.E.K. Research, Growcer, ZipGrow, Wired

Chart 5: CEA Share by Facility Type

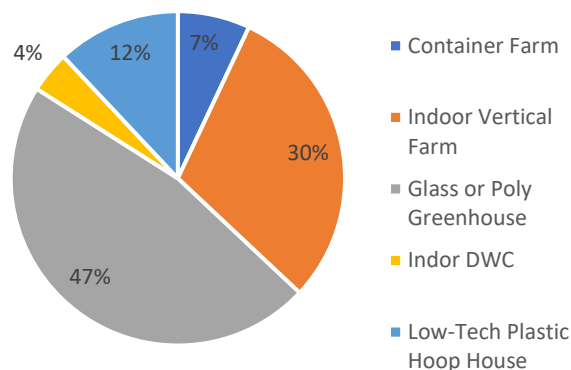
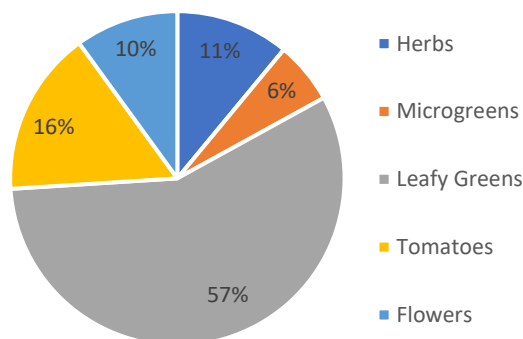


Chart 6: CEA Share by Crop Type



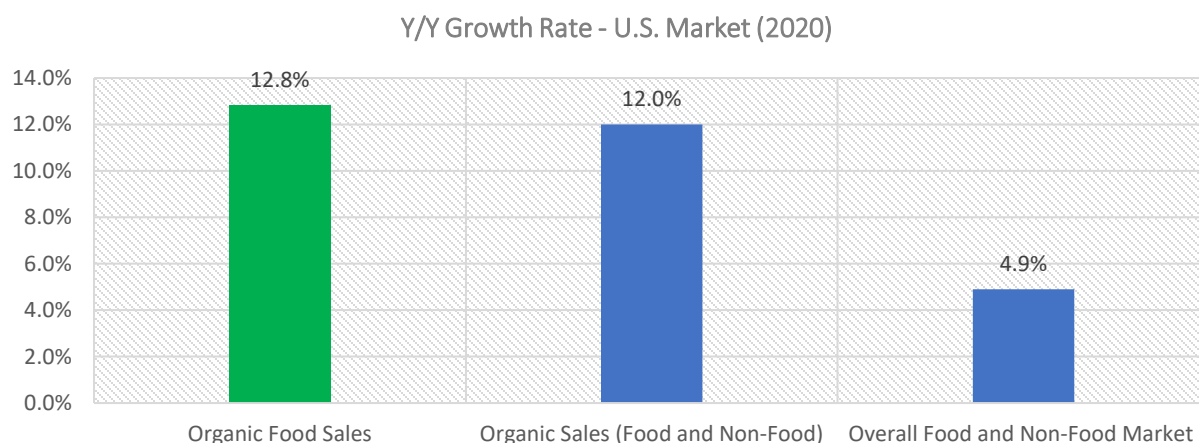
Source: Intro-act, State of Indoor Farming 2017 study by Agrilyst, WWF. CEA = Controlled Environment Agriculture.

- Growing popularity of organic foods will also contribute to the growth of the vertical farming market.** Organic foods are produced without the use of synthetic fertilizers, pesticides, and growth regulators. They are growing in popularity driven by consumers' improved standard of living, higher disposable income, and a growing focus on health-related issues like obesity, heart diseases, etc. Since vertical farms are not exposed to external climatic conditions and the temperature and other grow conditions in these farms are regulated using sensors, humidity controllers, coolers, etc., food produced in these farms does not involve the use of pesticides. This makes vertical farming an ideal technique for growing organic food like microgreens which are a rich source of polyphenols, a class of antioxidants that helps to lower the risk of diseases such as

heart disease, Alzheimer's disease, diabetes, and certain cancers. As a result, the vertical farming market's growth will be driven by the health advantages offered by organic foods their growing demand.

- According to the Organic Trade Association (OTA), driven by a combination of increased at-home eating during the COVID 19 pandemic and concerns about personal health, organic sales in the U.S. grew 12% y/y to \$62 billion in 2020, more than 2x the 4.9% growth of the overall U.S. market for food and non-food products. Organic food sales grew even faster at 12.8% to surpass \$56 billion during the year, the highest growth rate recorded in well over a decade. Organic non-food sales totaled nearly \$5.5 billion, up a strong 8.5%.

Chart 7: Vertical Farming Is Well Placed to Support the Fast-Growing Organic Food Market in the U.S.



Source: Intro-act, Organic Trade Association (OTA)

- The growth of the vertical farming market will also be driven in part by a variety of ESG trends aimed at preserving natural resources and enhancing the transparency and safety of food supply chains.** Vertical farming offers higher rate of conservation and recycling of natural resources vs. traditional farming methods, a key differentiator and growth driver in a market where both consumers and investors are looking for techniques and companies that are ESG friendly. For example, most of the water used in traditional farming is lost due to evaporation or runoffs. On the other hand, vertical farms need less water than traditional farms and most of the water is recycled back, thus reducing the usage of water by 90%+. Further, hydroponics – the most dominant growing mechanism for vertical farming – does not require soil, further reducing the strain on natural resources. This farming technique also eliminates the dependence on fertilizers and pesticides, thereby reducing the resources/inputs required for production. Vertical farms are able to secure the food supply chain in a number of additional ways – according to the Vertical Farming Institute, because the space is utilized vertically instead of on the ground level, only a fraction of the ground surface is needed in vertical farms compared to what is required for conventional farming. For instance, one acre of an indoor area offers equivalent production to at least 4-6 acres of outdoor capacity. Optimum utilization of land and vertical spaces is another advantage as uninhabited properties, mines, and buildings can be rehabilitated into food production facilities, thereby reducing construction cost required in agriculture center. Further, innovative irrigation systems and lighting methods make food production possible year around – regardless of weather conditions – while wastewater is reused as irrigation water and plant residues are used for heat in the form of biogas.
- Overall, vertical farming is a strong ESG play because it** 1) reduces agricultural land use, 2) saves up to 95% water, 3) makes cultivation possible, independent of weather conditions and season, 4) delivers each harvest with continuous quality, 5) saves on transport to the consumer, 6) limits CO2 and puts less strain on the climate, and 7) brings agriculture back into urban everyday life.

- Rapid pace of development of precision farming technologies, and the ease of crop monitoring and harvesting using vertical farming will also drive industry growth.** Precision farming is a farming management concept based on observing, measuring, and responding to inter- and intra-field variability in crops with the goal of defining a decision support system (DSS) for optimizing returns on inputs while preserving resources. It includes unit tasks of transplanting, seeding, packaging, harvesting, and cleaning. The introduction of harvesting robots, automatic seed planters, and greenhouse roof washers will play an instrumental role in reducing operating costs and increasing revenues of the vertical farming market. Use of technology as a growth driver is also visible in the use of Internet of Things (IoT) to monitor crops in remote locations such as refugee camp in flooded or earthquake affected areas. This, coupled with the automation of the harvesting process, reduces the human intervention required, thus lowering the labor cost and material wastage. Overall, automation and use of IoT will help minimize time to market, reduce production and distribution bottlenecks, lower the environmental costs, and standardize the high quality of produce. Further, the use of imagery and sensors – another key component of precision farming – will also help drive market growth by providing field performance monitoring, soil monitoring, and in-field computer or real-time operation through the employment of satellite, drone imagery, and crop conditions sensors. A report by Mordor Intelligence highlights that the precision farming market is expected to grow from \$5.1 billion in 2020 to \$10.4 billion by 2026, led by strong growth in the APAC region, followed by North America and Europe. **Key names levered to this trend include AGCO Corporation (AGCO), Ag Junction Inc (TSE: AJX), John Deere (DE), Dickey-John Corp., and TeeJet Technologies.**

Chart 8: Global Precision Farming Market

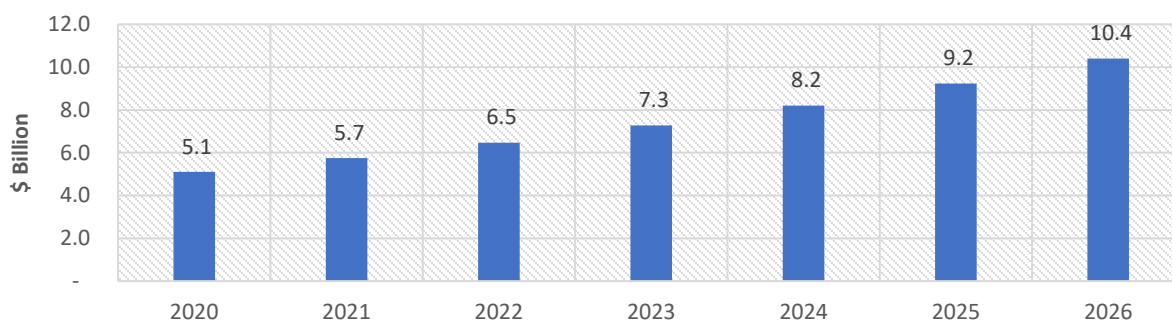


Chart 9: Precision Farming Market – Growth by Region

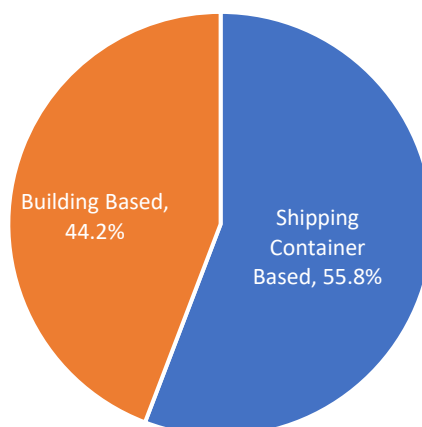


Source: Intro-act, Mordor Intelligence

Shipping Container-Based Structure to Offer Investment Opportunities

- **Shipping container-based farms are expected to dominate the vertical farming landscape and are leading to the growth of many innovative start-ups like Freight Farms that are focused on this segment.** Based on structure, the vertical farming market can be bifurcated into two segments – building based and shipping container based.
 - **Building-based vertical farms are created in unused building as well as newly constructed multistorey buildings.** They can further be segmented into Despommier Skyscrapers and Mixed-Use Skyscrapers. In Despommier Skyscrapers, crops can be grown in vertically stacked shelves, and mass produced within closed and controlled environments. These skyscrapers can be built anywhere regardless of agronomic conditions and can also be integrated with renewable energy technology. On the other hand, Mixed-Use Skyscrapers integrate traditional farming with vertical farming and instead of growing crops in a completely controlled environment, crops in these structures are grown in natural sunlight on the top floor of office buildings, etc. that receive good sunlight. According to Grand View Research, building-based structures accounted for 44.2% share of the vertical farming market in 2020, and their growth in coming years will be driven by advancements in precision farming techniques and the lower installation cost of such farms.
 - **Shipping container-based vertical farms held a 55.8% share of the vertical farming market and are expected to remain the dominant segment in the foreseeable future, led by companies like Freight Farms.** This method of vertical farming uses stackable shipping containers to grow leafy green vegetables, herbs, etc. These recycled containers can be used in urban and remote settings alike. This ability to grow food – with the help of hydroponic components, LED lighting, heating and ventilation systems, and sensors – irrespective of geographic location is one of the biggest growth drivers of this segment. Further, these container farms are easy to transport and do not require large land parcels to start farming, thus lowering the input cost and shortening the time and distance that food needs to travel from farm to table. The ready availability of such containers and that fact that they are easy to modify, stackable, durable, and can be recycled and refurbished at a lower cost are other drivers of the popularity of shipping container-based vertical farms. This segment commanded a 55.8% share of the vertical farming market in 2020 and is expected to remain the dominant structure in the coming years. **U.S.-based Freight Farms (discussed in detail later) is the leading player in this segment. Other players include FarmPod, CropBox, Growtainer, and AgriCool, among others.**

Chart 10: Global Vertical Farming Market by Structure Type (2020)



Source: Intro-act, Grand View Research

Hydroponics – The Dominant Growth Mechanism Creating Ancillary Plays

- Depending on growth mechanism, the vertical farming market is sub-segmented into hydroponics, aeroponics, and aquaponics.
- **Hydroponics is the most dominant growth mechanism that accounts for >50% share of the vertical farming market.** Hydroponics involves the process of growing plants by using mineral nutrient solutions in sand, gravel, or liquid, without using soil. Hydroponic systems reduce consumption of resources – not only do they eliminate the need for soil/land, they also consume much less water. This resource-light nature, coupled with growing awareness about sustainable farming, is enabling the adoption of hydroponics by a large number of stakeholders, ranging from home gardeners to professional growers, and supermarkets to restaurants. Further, for hydroponic systems, crop harvest cycles are shorter in comparison to traditional farming techniques, thereby increasing the annual yield. According to the United Nation (UN), plants grown in hydroponic systems achieve 20% to 25% higher yield than the traditional agriculture system, with productivity being two to five times higher. Also, since hydroponic techniques allow for controlled environmental conditions, climatic changes have a minimal effect on such systems, implying that crops can be produced all year round, thus positively impacting the produce. Hydroponic systems also eliminate the use of artificial ripening agents and pesticides, which helps in creating nutritionally superior quality vegetable products, another factor driving their popularity higher. Driven by these advantages, the hydroponics growth mechanism held >50% share of the vertical farming market in 2020, according to Grand View Research. A separate research report by Agrilyst found that hydroponics is the dominant growing mechanism of the controlled environment agriculture (CEA) industry, that includes vertical farming. Driven by these advantages, the global hydroponics market is expected to grow at 6.8% CAGR from ~\$25 billion in 2019 to ~\$35 billion by 2024, according to Mordor Intelligence.

Chart 11: CEA Market by Growth Mechanism

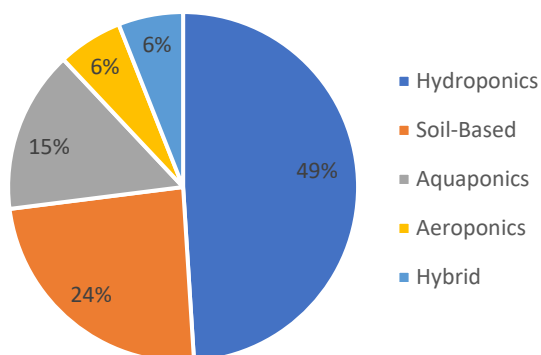
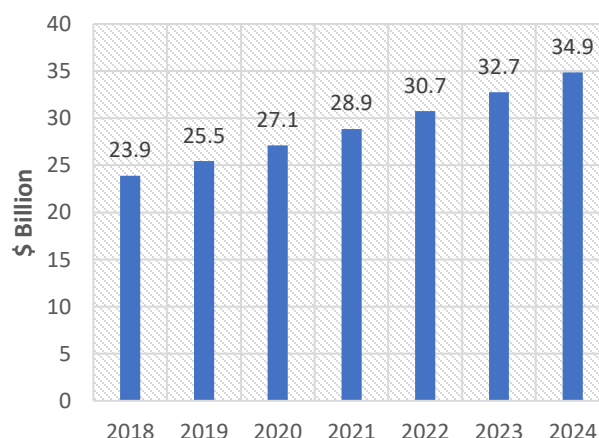


Chart 12: The Global Hydroponics Market Will Be Worth ~\$35 billion by 2024

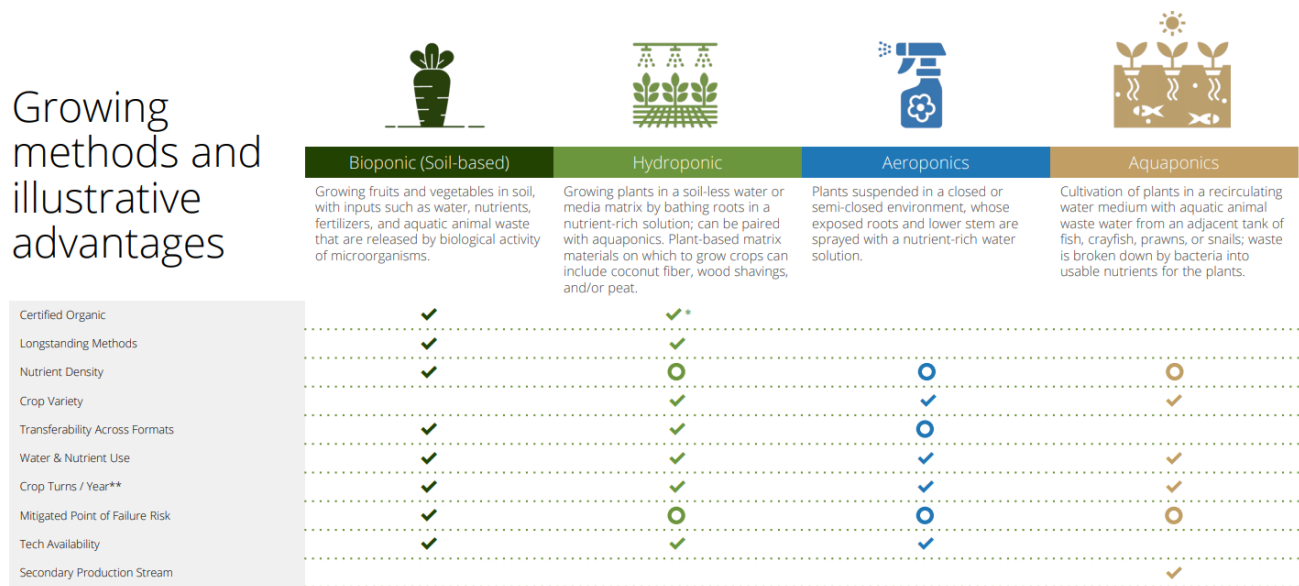


Source: Intro-act, State of Indoor Farming 2017 study by Agrilyst, WWF, Mordor Intelligence. CEA = Controlled Environment Agriculture.

- **Aeroponics is another popular growing mechanism for vertical farming.** In aeroponics, plants are grown without soil and by using little water. The roots of the plant are suspended in air and sprayed with a nutrient and water solution. Normally, the roots are in a covered environment to make sure the nutrient mist is taken by the root structures. Aeroponics is usually used within greenhouses, using sunlight as the key light source with additional lighting if needed. Aeroponics has been observed as the most water viable type of growing, using less than 90% water than some hydroponic systems, which are already believed to be sustainable themselves.

- **Fogponics has been portrayed as the next phase of aeroponic technology.** Using the same basic premise of suspending the root system in the air in an enclosed environment and supplying the plant with water and nutrients, fogponics uses droplets that are practically vapor. The nutrient-rich fog is delivered to the stems, leaves, and roots for faster and better absorption.
- **Aquaponics uses a combination of aquaculture (raising fish) and hydroponics.** In a thriving ecosystem, the waste from the fish (ammonium and urea) and the bacteria in the system deliver all the required nutrients to the plants. Aquaponics depend on fast growing fish (tilapia, perch, catfish, trout, etc.) to supply the needs of the plants and can be set up indoors as they do not require soil. Water can then be recycled back to the fish. Each species nurtures the other with no requirement for chemical fertilizers.
- **Despite the introduction of aeroponics and aquaponics, the hydroponic growing method is likely to remain popular in the near future as it can be used by a wider audience (including home gardeners and amateurs), requires less attention and monitoring, and is more cost effective.** Aeroponic systems are growing in popularity but are unlikely to replace other hydroponic systems in the foreseeable future because 1) aeroponic systems are difficult for beginners to understand and manage, thus home growers and small growers are less likely to use them; 2) aeroponics is a highly sensitive method of cultivation that require a lot of attention and has a lot of moving parts. For example, in case of a power outage or a failure of the mist spraying nozzles, plants can die in a few hours as the nutrient supply gets cut immediately. Hydroponic plants, on the other hand, can survive longer since the growing medium continues to supply water and nutrients; 3) aeroponic systems are costlier than hydroponic ones since they require various accessories to function well – these include automation tools, pumps, fine spray nozzles, and timers, among others. The need for such accessories drives the cost of ownership of such cultivations system higher, thus making them less beneficial vs. hydroponic systems.

Chart 13: Comparison of Different Growing Mechanisms

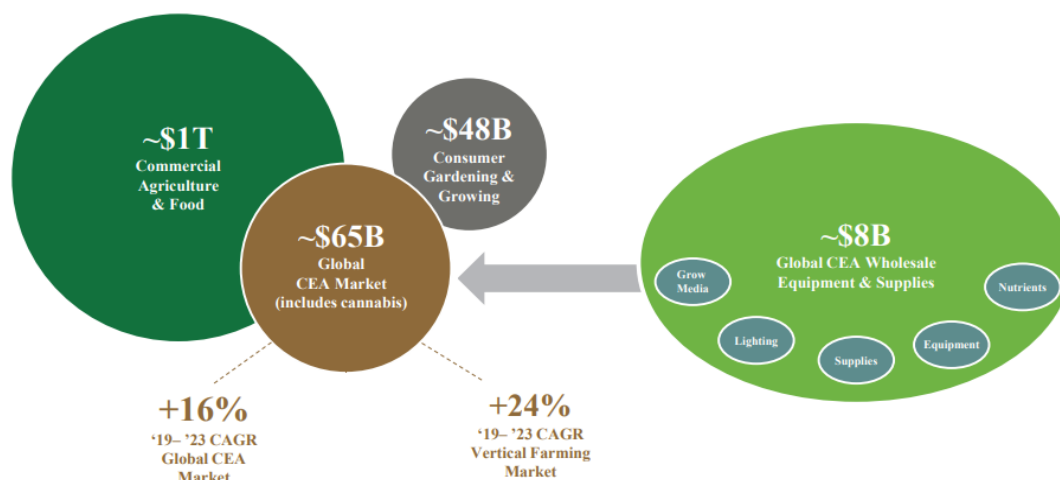


Source: Intro-act, S2G Ventures

Note: Advantages / disadvantages are relative to different methods and are situational depending on a number of factors. *Only in U.S., not an international standard **Dependent on crop type.

- **Urban gardening will be a significant driver of future hydroponics growth.** Urban gardening has seen increased adoption in the past few years, with the number of millennial gardeners growing significantly compared to prior generations. This growth is being driven by increased use of hydroponic systems that allow home gardeners to grow their own food while optimizing use of natural resources like water and ensuring year-round production. According to the National Gardening Survey, in 2017, 77% of U.S. households participated in lawn and garden activities, spending on average a record of \$503 per household. We expect this spending to grow in the coming years, driven by both increased participation by millennials and strong continued participation by married households, adults over age 55, and adults without children. The entry of global major IKEA into the vertical farming space will also boost urban gardening and hydroponics growth.
- **The growing adoption of vertical farming through hydroponics and other growth mechanisms is emerging as the key growth driver of the global wholesale Controlled Environment Agriculture (CEA)/hydroponics equipment and supplies industry that is expected to reach \$16.6 billion in sales by 2025.** CEA equipment and supplies includes grow light systems; advanced heating, ventilation, and air conditioning (HVAC) systems; humidity and carbon dioxide monitors and controllers; water pumps, heaters, chillers, and filters; nutrient and fertilizer delivery systems; and various growing media typically made from soil, rock wool or coconut fiber, among others. These equipment monitor the farm's atmosphere, crop growth, and control the number of nutrients in the solutions. The demand for this equipment is expected to rise with the growing popularity of vertical farming and non-traditional farming techniques, such as aquaponics, hydroponics, and aeroponics. According to the S-1 filing of Hydrofarm (HYFM), the global CEA industry totaled ~\$65 billion in 2019 and is expected to grow at a 16% CAGR through 2023. The rapid growth of CEA crop output will subsequently drive growth in the wholesale CEA equipment and supplies industry. According to industry publications, the global wholesale CEA equipment and supplies industry totaled ~\$8 billion in 2019 and is expected to grow at a 12.8% CAGR between 2019 and 2025.
 - **Hydrofarm (HYFM), the leading producer, manufacturer, and distributor of hydroponics/CEA equipment and supplies in the U.S., is one of the best picks-and-shovels plays on the growth of this fragmented industry.**
 - **Other players that should be on investor radar include specialty retailer GrowGeneration (GRWG), Hawthorne Gardening Company, a subsidiary of The Scotts Miracle-Gro Company (SMG), Hydrobuilder Holdings LLC, a leading omni-channel retailer of specialty agriculture and hydroponics equipment and supplies, and Growers House, a digitally native, omni-channel hydroponic equipment and supplies retailer.**
 - **Other key players and brands in the hydroponics equipment market are listed in the table on next page.**

Chart 14: Global Hydroponics/CEA Equipment Market is Expected to Double from \$8Bn in 2019 to \$16Bn+ by 2025



Source: Intro-act, Hydrofarm (HYFM) S1 SEC Filing

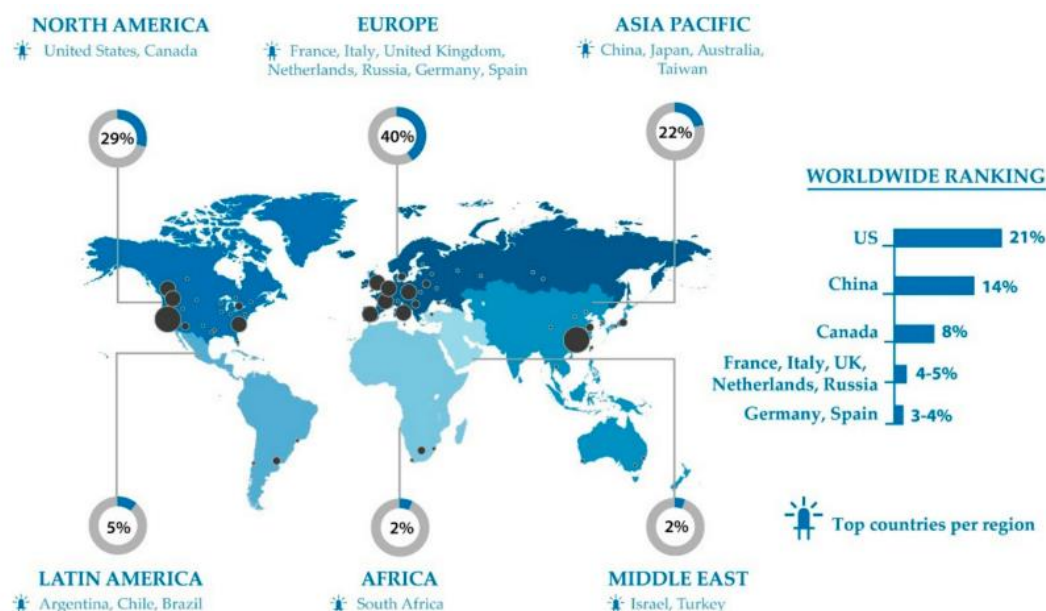
Chart 15: Key Brands and Players in Different Sub-Segments of the U.S. Hydroponics Equipment Market

Segment	Key Brands and Players
Grow Lights	Nanolux, Phantom, SunSystem, Dimlux, Grower's Choice, Luxx Lighting, Fluence, and VividGro
Hydroponics	Active Aqua, Dosatron, Fast Fit, Netafim, Duralastics, Floraflex
Nutrients	Botanicare, Emerald Harvest, CYCO, House & Garden, General Hydroponics, Cutting Edge Solutions
Climate	Anden Dehumidifiers, Titan Controls, Can-Fan, and Ideal-air
Cloning / Propagation	Grodan, Turboklone, EZ-Clone, Oasis, Super Sprouter, IHort, and Clonex
Greenhouses and Tents	Gorilla Grow Tent, Secret Jardin, Growlab, LightHouse, OneDeal,
Soils and Mediums	Royal Gold, FoxFarm, Pro-Mix, Grodan, Mother Earth, Roots Organics
Harvest	Twister Trimmers, CenturionPro, Greenbroz, and TrimPal

Source: Intro-act, GRWG SEC Filing

- Grow lights – especially LED grow lights – are critical to the success of the vertical farming; hence, this is one of the most important segments of the hydroponics equipment market for investors to monitor.** Advancement in LED technology is one of the key growth drivers of the vertical farming market as these lights make it possible to create the perfect environment to grow vegetables at a large scale with shorter growing cycles and higher yields. The price of LEDs has dropped significantly in the recent past, with increased efficiency and long lifespan. This has resulted in higher return on investment for growers and has helped increase the number of installations of vertical farms with profitable produce. According to a report by MarketsandMarkets, LED-based grow lights have surpassed all conventional lighting technologies in terms of energy efficiency, lifetime, versatility, and color quality. The legalization of cannabis has also resulted in an increased requirement for vertical farms and greenhouses which is further boosting the demand for LED-based grow lights. As a result, the market for these lights is expected to grow at a 32% CAGR and reach ~\$5 billion by 2026.
 - The key players in the grow light market are** Signify Holding (Netherlands), OSRAM (Germany), Gavita (Netherlands), Valoya (Finland), California Lightworks (US), Heliiospectra AB (Sweden), LumiGrow Inc. (US), Hortilux Schröder (Netherlands), Eye Hortilux (US), ILUMINAR Lighting (US), PARsource (US), GE Lighting, A Savant Company (US), Hubbell (US), and Agrolux (Netherlands).

Chart 16: Global Distribution of Horticultural LED Manufacturers

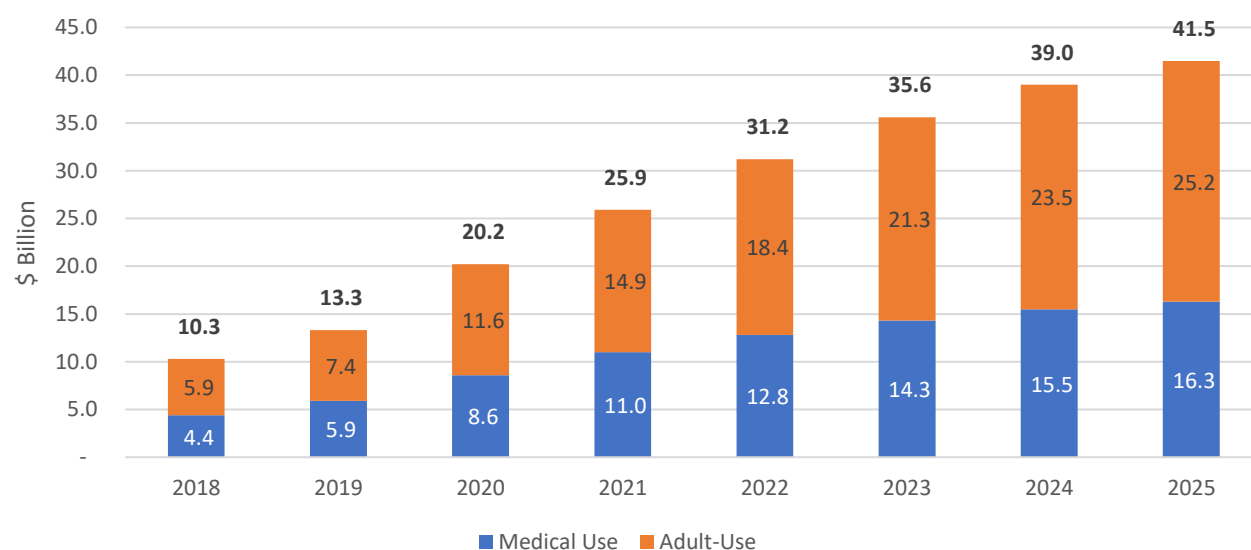


Source: Intro-act, MDPI, DISTAL, FEEM

Cannabis Legalization – A New Growth Frontier for Vertical Farming and Hydroponics

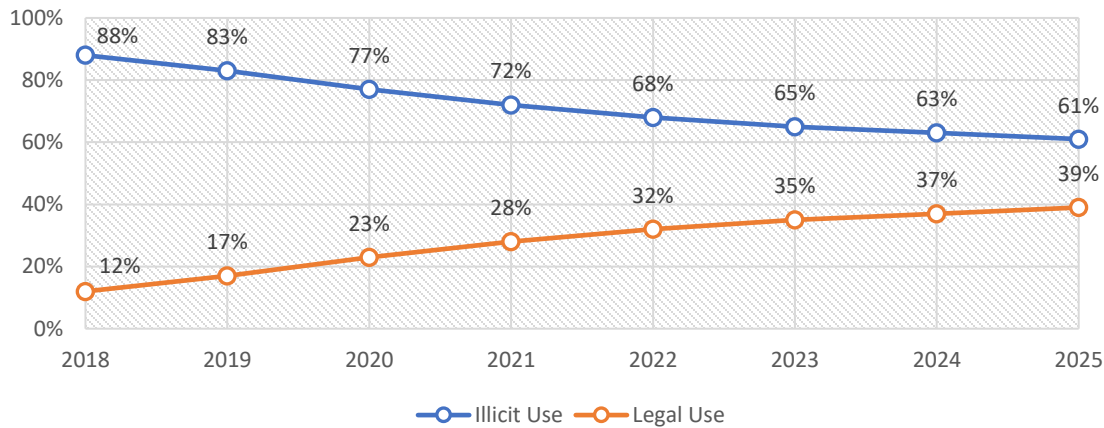
- **We believe that the trend of legalization of cannabis in North America – especially the U.S. – marks an inflection point in the growth of the vertical farming market.** Cannabis is one of the key crops that can be grown with vertical farming and hydroponic techniques. Marijuana growers using vertical farming benefit from various advantages including higher yield, more annual crop cycles, healthier root system, high quality produce, consistency in quality of produce, protection from adverse climatic conditions and pests, etc. Given these advantages, such growers will migrate from traditional cannabis cultivation techniques to vertical farming/hydroponic ones as cannabis legalization spreads across states and eventually at the federal level, thus resulting in the need to produce high quality cannabis products around the year. Companies already using vertical farming for growing cannabis include California-based MedMen Enterprises (MMNFF), Denmark's International Cosmetics Science Centre, Poland's Vertigo Farms, and South Korean startup Farm 8 Co. We expect this list to grow substantially in the coming years as MSOs and small growers alike migrate to vertical farming.
- **U.S. legal cannabis market is expected to more than double from ~\$20 billion in 2020 to \$41 billion+ by 2025, creating a huge opportunity for vertical farming and hydroponics players that are sitting at the intersection of two of the most compelling market opportunities – CEA and Cannabis Legalization – at this time.** According to New Frontier Data and our analysis, cannabis' total addressable U.S. market (TAM) is expected to reach \$41.5 billion by 2025, driven by favorable regulatory changes, gradual growth in population, and rising prevalence rate. However, the key underlying trend for investors to focus on in this growth is the rising share of the legal market. Driven by a transition in demand from the illicit market to the legal market in states that legalize cannabis use, share of the legal market will rise from just 12% in 2018 to 39% in 2025. The key components of the rising cannabis demand in the U.S. are:
 - **The legal medical cannabis market which will grow at a 20.5% CAGR to an estimated \$16.3 billion by 2025,** driven by the rising awareness of the medical applications of cannabis and medical use becoming legal in more states.
 - **The legal adult-use market which is expected to grow >300% from \$5.9 billion in 2018 to \$25.2 billion in 2025,** driven by increasing state-level legalization and rising social acceptance of recreational use.

Chart 17: U.S. Legal Cannabis Industry Market Size



Source: Intro-act, New Frontier Data

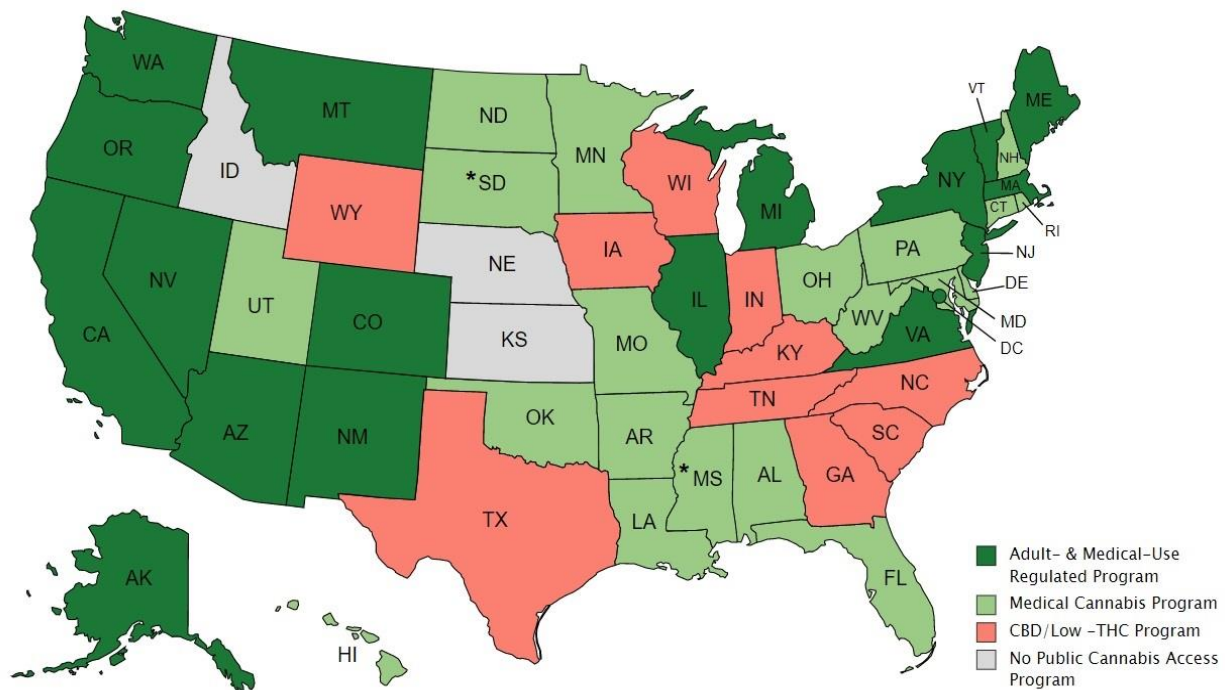
Chart 18: Share of Legal Cannabis Sales in the U.S. Will More Than Triple from 12% in 2018 to 39% in 2025



Source: Intro-act, New Frontier Data

- The biggest tailwind driving the cannabis industry's growth is the state-level legalization momentum, which is stronger than ever and is accelerating the illicit to legal value migration in the industry.** Encouraged by the multiple medical benefits offered by the plant, the U.S. began the process of cannabis legalization for the majority of West Coast states, starting with California and the Compassionate Use Act of 1996. This process moved forward steadily through 2019, gathered pace in 2020, and is stronger than ever in 2021. As of now, the total number of medical marijuana states in the U.S. stands at 37 plus District of Columbia, while those with recreational cannabis markets now total 18.

Chart 19: U.S. Marijuana Legalization Map – May 2021



Source: Intro-act. *Voter mandates in Mississippi and South Dakota are currently being challenged in court and may get overturned.

- **We expect state-level legalization efforts to continue at a fast pace in the next 12-18 months and legal cannabis (medical or recreational) could potentially reach 90% of the U.S. population.** Following the success of multiple state-level legalization measures last year, election of a cannabis-favoring Democratic government, and falling tax revenue due to COVID-19, many state governments are initiating measures to legalize recreational and/or medical cannabis in their jurisdictions. If all these reforms were to move forward, ~90% of the U.S. population will have access to legal cannabis of some sort over the next 12-18 months. Regardless of the timeframe in which these measures are passed, cannabis legalization in the U.S. is moving in only one direction – forward.

Chart 20: States That Have Legalized Marijuana in 2021

State	Type	Legalization Date	Progress/Key Milestones to Monitor
NJ	Adult-use	February 22, 2021 (Ballot Vote)	Retail sales expected to begin in 2022
NY	Adult-use	March 30, 2021 (Legislative Vote)	Retail sales expected to begin in late 2022
NM	Adult-use	April 12, 2021 (Legislative Vote)	Retail sales expected to begin on April 1, 2022
VA	Adult-use	April 21, 2021 (Legislative Vote)	Retail sales expected to begin on July 1, 2021
AL	Medical	May 17, 2021 (Legislative Vote)	Business license applications would be accepted from Sept. 2022
MT	Adult-use	May 18, 2021 (Ballot Vote)	Retail sales expected to begin on January 1, 2022

Source: Intro-act

- **In addition to the above recently legalized states, Louisiana, Connecticut, Delaware, Minnesota, Texas, and North Carolina are the other states where efforts to legalize adult-use or medical marijuana have intensified.** All these states have a high possibility of passing marijuana bills through the legislative process in 2021.

Chart 21: States Moving Forward with Marijuana Legalization Initiatives in 2021

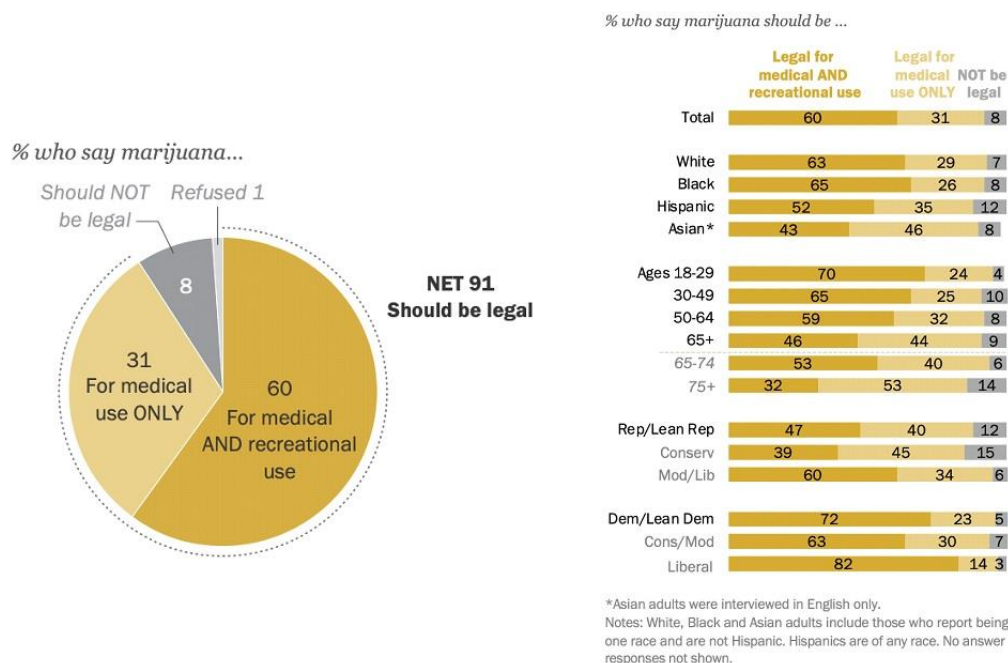
State	Bill No.	Type	Status	Key Milestones to Monitor
LA	HB 699, HB 243	Adult-use	Pending House final passage	State legislature action in 2021
CT	SB 888	Adult-use	In Senate	Legal sales could start May 2022
DE	HB 150 -HA 1	Adult-use	Pending House action	State legislature action in 2021
MN	HF 600	Adult-use	Headed to Senate	Legal sales could start Dec. 2022
TX	HB 2593, HB 1535, HB 441	Medical	HB 2593 – In Senate; HB 1535 – Headed to Governor; HB 441 – In Senate	State legislature and Governor's action in 2021
NC	SB 711, SB 669	Medical	Pending Senate Rules and Operations of the Senate Committee Action	State legislature action in 2021

Source: Intro-act

- **While state-level legalization measures will act as growth drivers in the immediate future, federal legalization prospects are now stronger than ever with Democrats gaining control of both the House and the Senate.** Cannabis now has its best chance ever at federal legalization with both President Joe Biden and Vice President Kamala Harris being supporters of cannabis reform. Legalization prospects is also being boosted by the appointment of Sen. Chuck Schumer as the Majority Leader – he is a big supporter of cannabis reform, unlike his predecessor Mitch McConnell, and is also the chief sponsor of the Marijuana Freedom and Opportunity Act. He has said that he will push to pass a sweeping marijuana legislation this year, which would end the federal prohibition on marijuana. **We believe that investors should monitor the progress the movement on the following three acts that can legalize cannabis at a federal level and stimulate growth of the cannabis market, and thus the vertical farming and hydroponics markets.**
 - **SAFE Banking Act**, which would amend federal law so that commercial banking and other financial institutions could legally offer services to state-compliant cannabis businesses. On April 19, the Act was approved with strong bipartisan support in the House, although it remains in committee and has not been voted on in the U.S. Senate. The likelihood of this Act passing through Senate is relatively higher than in 2019 as it is expected to face less opposition from Republicans given the Democrats' takeover of the upper chamber in January. Moreover, Senator Schumer indicated that he might propose combining the SAFE Banking Act with a federal marijuana bill in order to bring it to the floor.

- **STATES Act**, which would allow states that have legalized cannabis through their legislatures or citizen initiatives to regulate cannabis in a manner they deem best. Specifically, the STATES Act – introduced in June 2018 by Sen. Elizabeth Warren (D) and former Sen. Cory Gardner (R) – would amend the Controlled Substances Act to exclude its application to persons who are acting in compliance with state law relating to the manufacture, production, possession, distribution, dispensation, administration, or delivery of cannabis.
- **MORE Act**, which would decriminalize cannabis at the federal level by removing it from the list of Schedule I controlled substances. Co-sponsored by Vice President Kamala Harris, the MORE Act that was cleared by the House in December 2020 but did not advance in the Senate under GOP control. Six months later, the bill has recently been reintroduced in the House by Judiciary Committee Chairman Jerrold Nadler (D-NY) with significant amendments from the previous version and is expected to move forward given that Democrats now run both chambers and the White House.
- **Per a survey conducted by Pew Research in April 2021, U.S. consumers are overwhelmingly in favor of legalizing marijuana in some form – this could result in a faster-than-expected transition from the illicit to the legal market.** Pew Research Center conducted a survey between April 5 and April 11 that involved ~5,100 U.S. adults and found that 91% of Americans believe either marijuana should be legal for medical- and recreational-use (60%) or it should be legal for medical use only (31%), with 8% of consumers saying it should not be legal. The survey also found that a majority of those polled, regardless of age, ethnicity, or political affiliation, believe marijuana should be legalized in some form. The support for marijuana legalization was unsurprisingly higher among younger adults (75%) than older adults (46%). 72% of Democrats and people leaning toward the party's direction were in favor of both medical- and adult-use, higher than the support among Republicans and those leaning toward the GOP at 47%. It is worth noting that the share of U.S. consumers supporting marijuana legalization has doubled between 2010 and 2019.

Chart 22: 91% of U.S. Consumers Favor Marijuana Legalization in Some Form

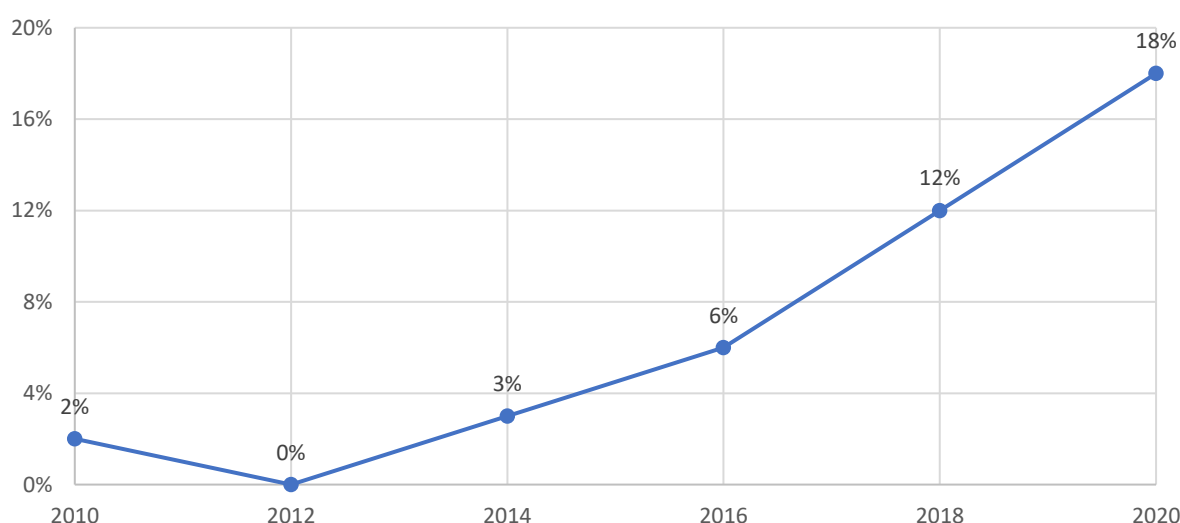


Source: Intro-act, Pew Research Center. Survey conducted between April 5 and April 11, 2021.

Vertical Farming – Grabbing a Higher Share of AgTech Investments

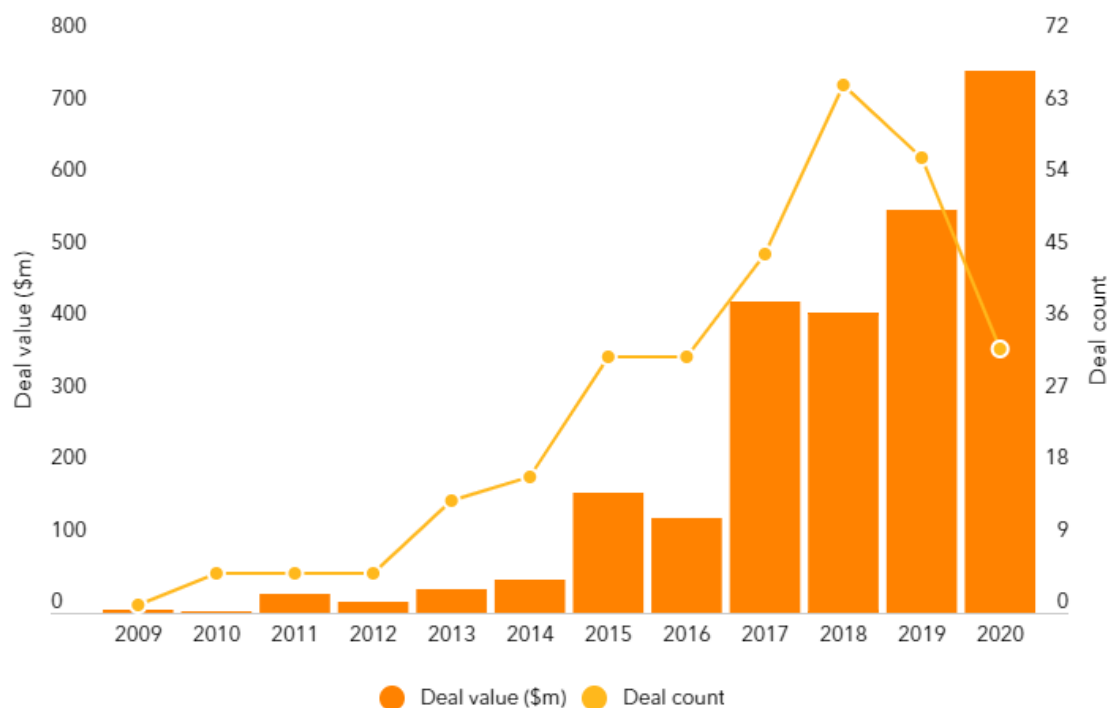
- Vertical farming's share of Agtech investments has grown from 2% in 2010 to 18%+ in 2020, and we expect this share to grow even further in the coming years as companies like AeroFarms and InFarm go public through SPAC deals, resulting in increased liquidity, value discovery, and multiple expansion.** Data from Pitchbook shows that indoor farming start-ups raised \$2 million or 2% of total VC investments in the Agtech space in 2010 and this number grew to \$246 million or 12% of the Agtech total by 2018. However, COVID-19 disrupted the global food supply chain and indoor farming – that includes greenhouses and vertical farming operations – emerged as a viable alternative to traditional farming techniques, thanks to its ability to meet needs of growing global food demand arising from rapid urbanization, growing CEA adoption, rising focus on sustainability, and agricultural labor shortage, among others. Driven by these factors, VC investment in indoor farming reached an all-time high of \$753 million by the end of 3Q20, accounting for 18.1% of the Agtech total of \$4.1 billion. This surge was led by the \$170 million Series C raised by vertical farming major InFarm in September 2020 (which was followed by another \$100 million raise in March this year). Pitchbook data also shows that investments in the indoor farming sector grew 168% y/y in 4Q20, propelled by mega-rounds used to build massive new facilities.
- We believe that the vertical farming industry is now set to enter its next phase of funding and will start receiving capital from public equity investors, and that the growing interest from big-ticket public equity investors will drive valuations of vertical farming and hydroponics companies higher.** After garnering strong and growing interest from private investors, we believe vertical farming is now on the cusp of finding a place in public institutional investor's portfolio. This is evident from the **SPAC deal announced by AeroFarms with Spring Valley Acquisition Corp. (Nasdaq: SV)**. The deal will allow AeroFarms to go public in a transaction that values the company at ~\$1.2 billion, making it one of the first publicly listed vertical farming plays. In addition, German vertical farming major **InFarm has reportedly hired Goldman Sachs to engage in talks with SPACs** about a potential merger that could value the company at \$1 billion+, the latest funding round for the company that has already raised \$400 million through private investors so far. Deal activity has been strong in the ancillary segment too, most notably the **IPO of hydroponics leader Hydrofarm (HYFM) in December 2020**. We expect deal activity to gather pace in coming quarters and believe vertical farming's share of Agtech investments will continue to rise at a fast pace throughout this decade. (See the 2021 Indoor Agtech Landscape later in this section.)

Chart 23: Indoor Farming's Share of Agtech VC Deals Hit an All-Time High of 18% in 2020



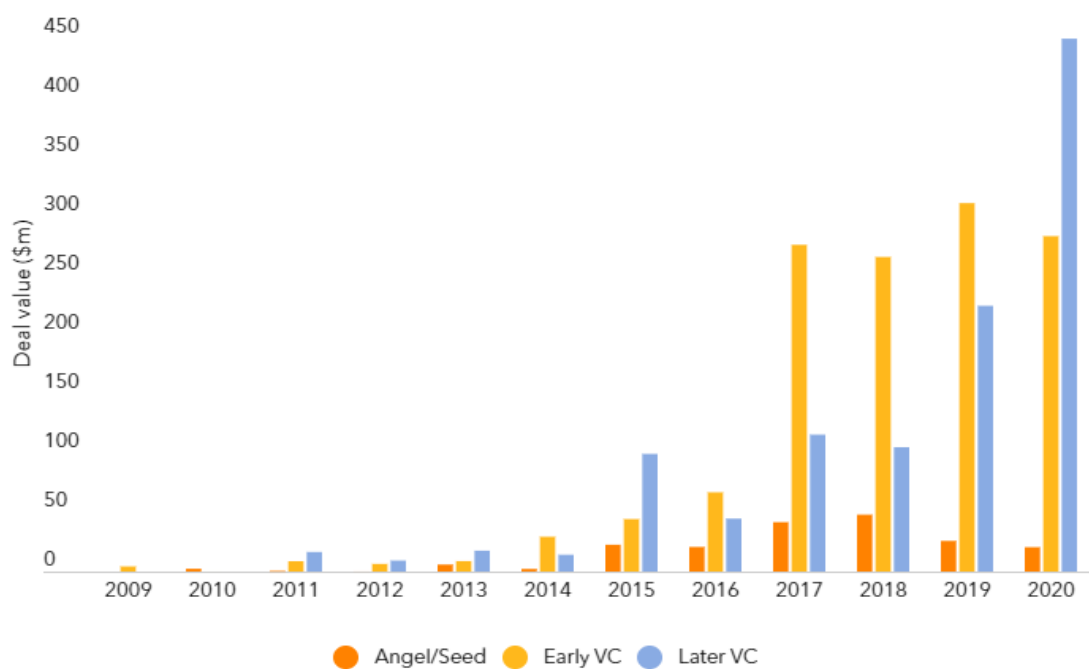
Source: Intro-act, Agroecology Capital, Pitchbook. 2020 Data Through 3Q20. Indoor Farming includes Vertical Farming and Greenhouses.

Chart 24: Indoor Farming VC Deal Activity by Year



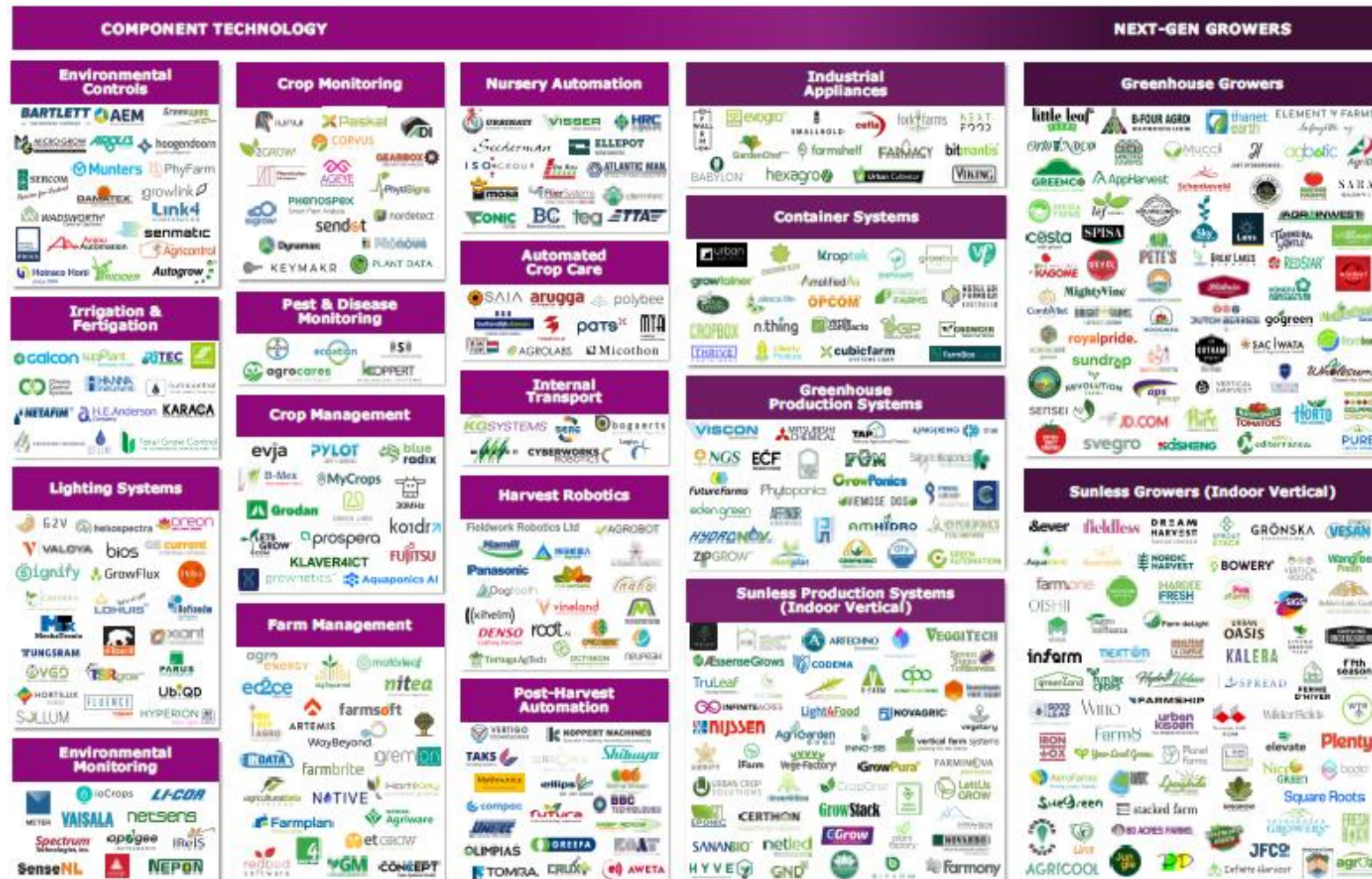
Source: Intro-act, Agri Investor, Pitchbook. 2020 Data Through 3Q20. Indoor Farming includes Vertical Farming and Greenhouses.

Chart 25: Indoor Farming Deal Activity by Stage



Source: Intro-act, Agri Investor, Pitchbook. 2020 Data Through 3Q20. Indoor Farming includes Vertical Farming and Greenhouses.

Chart 26: 2021 Indoor Agtech Landscape



Source: Intro-act, Better Food Ventures, The Mixing Bowl

Key Names for Investors to Monitor

- We believe investors evaluating the Vertical Farming space should focus on the following names.
 - Growers: AeroFarms, Infarm, Bowery Farming, Plenty, and Upward Farms
 - Container Farming Play: Freight Farms
 - Tech/Robotics Play: Iron Ox
 - Ancillary/Hydroponics Plays: Hydrofarm (HYFM), Hydrobuilder

AeroFarms

- **Founded in 2004, AeroFarms is a vertical farming leader and Certified B Corporation.** The company is the market leader in vertical farming due to its unmatched technology and data science platform. It has patented award-winning indoor vertical farming technology that provides perfect conditions for healthy plants to thrive, taking agriculture to a new level of precision, food safety, and productivity. Through its proprietary growing technology platform, AeroFarms has developed multi-year strategic partnerships ranging from government to major Fortune 500 companies to help solve agriculture supply chain needs. AeroFarms' Dream Greens® brand – focused on leafy greens – fares well on quality, flavor, taste, and texture with products sold throughout the Northeast U.S. at major retailers, including Whole Foods Market, ShopRite, Amazon Fresh, and FreshDirect. Headquartered in New Jersey, AeroFarms has been awarded with one of the World's Most Innovative Companies by Fast Company two years in a row and one of TIME's Best Inventions in Food.

Chart 27: AeroFarms – Unrivalled Sustainability and Productivity



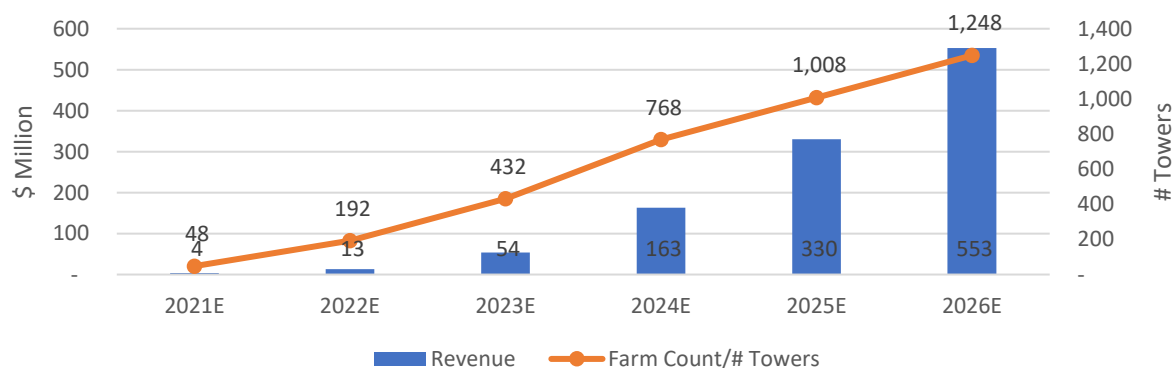
Source: Intro-act, AeroFarms Investor Presentation

- **AeroFarms has a differentiated platform with proven technology, innovation, and design evolution through five generations of farm models and a robust portfolio of over 250 invention disclosures.** AeroFarms' innovation is anchored by the precise control and integration across six disciplines of controlled environment agriculture: plant biology, mechanical design, environment controls, data analytics, operations, and plant genetics. Through the integration of these discipline, AeroFarms achieves up to 390 times greater productivity per square foot annually versus traditional field farming while using up to 95% less water and zero pesticides. With 26 crop turns per year and multiple layers of growing, AeroFarms can support the needs of a larger population and achieve greater annual yield in facilities than a conventional field farm in New

Jersey. AeroFarms grows without soil, and typically uses a patented growing media that is both reusable and often recyclable. The company uses its proprietary agSTACK system to create a fully connected farm. agSTACK integrates hardware, intelligent controls and sensors, SCADA, and manufacturing execution system to create a powerful data loop. By collecting and analyzing data, AeroFarms gather insights about plants, and applies these learnings for the continuous improvement of the platform. With over 250 invention disclosures and a vast library of data collected over 15 years of operations, AeroFarms has grown over 550 varieties of produce to date and is continually improving its systems.

- Strong planning and best-in-class execution complement AeroFarms' technological prowess and will help drive fast and profitable growth.** AeroFarms' goal is to build a portfolio of farms across North America that offer an advantageous cost structure. Utility costs differ significantly across the country, and getting electricity, labor, construction, and logistics costs correct are all important to achieving strong farm-level economics. Speed to build is also critical, so sites that are permit-ready, have utilities in place, and excellent infrastructure are key elements in decision making. Based on these criteria, AeroFarms has identified a pipeline of locations where it can execute over the coming years. Prime among them is AeroFarms' next-generation Model 5 farm being built in Danville, Virginia which meets all the above criteria. Expected to come online in 2Q22, Model 5 farm will be the largest and most technologically advanced aeroponic indoor vertical farm in the world. Strategically located in close proximity to more than 1,000 food retailers in the region, the 136,000 sq. ft. farm will provide access to approximately 50 million people located within a day's drive and expand AeroFarm's leafy greens business to the Mid-Atlantic region. The company's five-year growth plan represents an initial portfolio of Danville farm and 15 additional commercial farms in North America, constructed at a rate of three per year starting in 2022. AeroFarms' topline is expected to reach \$553 million by 2026 and the company expects to become EBITDA positive in 2H24. Over the next five years, gross margin is expected to reach nearly 50% while EBITDA margin will grow to 30%+ by 2026.

Chart 28: AeroFarms – Strong Revenue Growth Led by Increase in Farm Count



Source: Intro-act, AeroFarms Investor Presentation

- On March 26, AeroFarms announced that it will become a publicly traded company through a business combination with Spring Valley Acquisition Corp. (Nasdaq: SV) that assigns a pro forma equity value of ~\$1.2 billion to the combined company.** The business combination is expected to fully fund the equity needs of AeroFarms' growth strategy, including expanding retail distribution and market penetration, constructing additional farms, introducing future generations of proprietary farming technology, and entering new product categories. The transaction is expected to provide up to \$357 million in gross proceeds to AeroFarms, comprised of Spring Valley's \$232 million of cash held in trust, assuming no redemptions, and a \$125 million fully committed PIPE at \$10.00 per share, including investments from leading institutional investors, AeroFarms insiders, and Pearl Energy Investments, the sponsor of Spring Valley. Following the expected 2Q21 transaction close, AeroFarms will become publicly traded on Nasdaq under the new ticker symbol "ARFM". The combined company will be led by David Rosenberg, Co-founder and Chief Executive Officer of AeroFarms.

Infarm

- **Infarm is a Germany-based Agtech player up that focuses on vertical farming in urban areas and uses cloud-based farming technology to remotely control all its farms.** Infarm employs hydroponics system to produce a wide range of herbs, micro-greens, leafy greens, and lettuces, which also include exotic herbs such as Thai basil and Peruvian mint. The company's automated and modular 25 m² growing centers (blend of a local farm and distribution center) provide a crop yield equivalent to 10,000 m² of farmland, with up to 400x higher efficient food production than soil-based agriculture. It achieves this using a data-driven approach, which involves a combination of big data, IoT, and cloud analytics, resulting in 99.5% less space usage than conventional farming, 95% less water utilization, 90% less transportation, and zero usage of chemical pesticides. As of now, it has saved more than 40,000,000 liters of water and 50,000 m² of land. The cloud-connected, high-yield growing centers also allows Infarm to harvest 500,000+ plants per month with 90% of the electricity network drawn from renewable sources. Moreover, the company is planning to expand its cultivation capacity by 10x to 500,000 m² by 2025 and will add more varieties to its farms, including fruits and vegetables that are harder to cultivate inside.
- **The company, which currently operates in thousands of stores across 30+ cities in 10 countries, is offering fresh vegetables to 50% of the world's largest food retailers.** Infarm has collaborated with >30 major food retailers in Canada, Denmark, France, Germany, Japan, Luxembourg, the Netherlands, the UK, and the U.S., deploying more than 1,200+ farms in stores and distribution centers. These retailers include Aldi Süd, Amazon Fresh, Auchan, Casino, E.Leclerc, Edeka, Empire Company Ltd. (Safeway, Sobeys, ThriftyFoods), Farmdrop, Intermarché, Irma, Kaufland, Kinokuniya, Kroger, Marks & Spencer, Metro, Migros, and Summit (part of Sumitomo Corp). Infarm's multinational presence is attributed to the high-quality products it delivers using superior farming techniques. It is also reflected in the fact that Infarm became the first hydroponic farming company in 2017 to receive GlobalG.A.P certification – one of the world's most recognized standards for safe and sustainable food production.
- **Infarm has raised \$400+ million in funding to date and has reportedly hired Goldman Sachs to explore the possibility of going public through a SPAC merger that could value the company at \$1 billion+.** Infarm has received more than \$400 million through a mix of debt and equity from investors over nine funding rounds, out of which \$370 million came in the last three rounds. It was among the leading recipient of funds in the indoor farming space in 2021 and is currently backed by 20 investors that include LGT Lightstone, Hanaco, Bonnier, Haniel, Latitude, Atomico, TriplePoint Capital, Mons Capital, and Good Harvest. According to news report, the company is contemplating going public via a SPAC merger in deal that could value the company at \$1 billion+.

Chart 29: Infarm Hub in Berlin, Germany



Source: Intro-act, Infarm

Chart 30: Plants Ready To Cook At Marks & Spencer's Clapham Junction Store, London UK



Bowery Farming

- Bowery Farming Inc. is a New York-based indoor vertical farming Agtech company founded in 2015, offering 13 types of greens and herbs (such as Arugula, Crispy Leaf, Basil, and Butterhead) in urban facilities.** The company's leafy greens and other herbs are grown in its environmentally controlled smart indoor farms. Bowery controls the entire process from seed to store and uses its proprietary software system, the BoweryOS, to monitor plants and all variables that drive their growth. The BoweryOS evaluates optimal growing conditions and recipe for each crop by applying proprietary machine learning algorithms to environmental data and making automatic adjustments to temperature, humidity, airflow, light intensity, and nutrients to optimize crop quality, health, yield, and flavor. Leveraging the BoweryOS has resulted in the company to be 100x more productive than the conventional farming approach on the same footprint of land and grow pesticide-free produce 2x faster than in the field with minimal use of water.

Chart 31: Bowery Farming's Produce Ranges from Dark Leafy Greens Like Baby Kale, to Herbs Like Basil



Source: Intro-act, Bowery Farming

- Bowery is one of the largest vertical farming company in the U.S., serving 850+ grocery stores in the Mid-Atlantic and Northeast region and at major e-commerce platforms.** These grocery stores include Albertsons Companies (Safeway and Acme), Whole Foods Market, Giant Food, Stop & Shop, Walmart, Weis Markets, and a number of specialty grocers. In 2020, Bowery started supplying its packaged leafy greens and herbs to 100 grocery stores, which rapidly grew to 650 stores at the end of September, and crossed the 850-mark in May this year. This expansion is also reflected in the company's in-store sales which has grown 750% since January 2020 while its e-commerce sales is up 400% through e-commerce retailers, including Peapod and Amazon Fresh.
- The company is expanding its reach further into the Northeast and Pennsylvania region through its largest, most technologically advanced, and sustainable farm to date, and is also increasing its R&D capacity by fourfold.** Bowery currently grows its leafy greens and herbs in a commercial farm and R&D Center of Excellence in Kearny, New Jersey and a commercial farm in Nottingham, Maryland. The company's next farm will be located in Bethlehem, Pennsylvania, serving almost 50 million people living within the farm's 200-mile radius and will be Bowery's most technologically advanced farm to date. Bowery has also expanded its R&D capacity by ~300% with the opening of Farm X – its newest state-of-the-art innovation hub for plant science in Kearny, adjacent to Bowery's original R&D Center of Excellence and its first commercial farm.

- **Bowery's valuation is estimated at \$2.3 billion, and the company has raised \$470+ million till date from high-profile investors.** In May, Bowery closed its largest funding round of \$300 million, led by Fidelity Management & Research Co. with participation from existing investors GV (formerly Google Ventures), General Catalyst, GGV Capital, Temasek, and Groupe Artémis. Amplo and Gaingels also took part, as did a number of famous individual investors, including Lewis Hamilton, Chris Paul, Natalie Portman, José Andrés, and Justin Timberlake. Overall, the funding round brought the total capital raised by the company to \$472 million and sets its value at \$2.3 billion. Bowery will use the funds to expand its network of smart indoor farms across the U.S., accelerate its technological leadership, support ongoing research and product innovation efforts to bring crops other than leafy greens such as strawberries and root vegetables to market, and hire top talent.

Chart 32: Bowery Farming's Investors Include Alphabet's Venture Arm GV, Temasek, and Box Group Among Others



Source: Intro-act, Bowery Farming

Plenty

- Plenty Unlimited Inc. is a vertical farming tech company based in California offering pesticide-free plants with extraordinary flavor.** Founded in 2013, Plenty uses indoor vertical farming technology to grow pesticide-free and non-GMO products including baby arugula, baby kale, lettuce, and mizuna mix (combination of bok choy and mizuna) with flavorful strawberries expected to be added to its catalogue through a joint venture program with Driscoll's, a California-based consumer brand of fresh berries. Plenty grows its plants in a big box retailer-sized building, using a fraction of the water required in the field and running on 100% renewable sources, powered by a combination of wind and solar energy. With headquarters in South San Francisco, Plenty operates the biggest R&D farm in Laramie, Wyoming and is currently constructing the world's highest-output, vertical indoor farm in Compton, California. The company has expanded its operations in Northern California with 17 new Safeway stores, bringing the total number of stores carrying Plenty produce in the region to 53. In August 2020, Plenty signed its first major retail deal with Albertsons in a multi-year agreement where it will provide its four leafy greens products priced between \$4 and \$5 to 430 Albertsons' stores across California.
- The company relies on data analytics, machine learning, and customized lighting to obtain the natural flavors and nutrients from plants and offer a superior taste experience by leveraging more than 200 years' worth of growing data.** Because of its innovative agri-food technology, Plenty has seen a 700% increase in leafy green's output in the last two years, while keeping its distinct flavor and quality intact. The company's achievement in food innovation is also evident in Fast Company's World Changing Ideas Awards where Plenty was recognized in the *'Established Excellence: 5-14 Years in Business'* category, honoring the company's launch of its popular Crispy Lettuce in addition to getting recognition as an Honoree alongside Driscoll's in the Food category. Plenty ranked first in Forward Fooding 2020 FoodTech 500 out of a total of 2,000 nominees for its innovation across the AgriFoodTech ecosystem.
- Backed by big-ticket investors such as SoftBank, Jeff Bezos (Bezos Expeditions), and Eric Schmidt, Plenty has secured a total of \$541 million in funding till date to support its growth plans and carries a valuation of at least \$1.05 billion.** The company's latest capital infusion came in its Series D funding round during October 2020 where it raised \$140 million, led by existing investor Softbank Vision Fund 1 and new investor Driscoll's. The proceeds will be used to support Plenty's growth, including the commercial collaborations with Albertsons and Driscoll's, and the development of its new farm in Compton, California. Prior to its Series D funding round, Plenty raised \$175 million in its Series C funding round in June 2019 that pushed its valuation to \$1.05 billion.

Chart 33: Plenty's Flavor-First Products Include Baby Arugula, Crispy Lettuce, Baby Kale, and Mizuna Mix



A bold baby arugula with seductive spice and subtle hints of summer citrus and black pepper.



A crispy leaf delivering the fresh, clean crunch you crave and versatility deserving of your most creative ideas.



A velvety-soft baby kale highlighted by bright notes and a smooth finish.



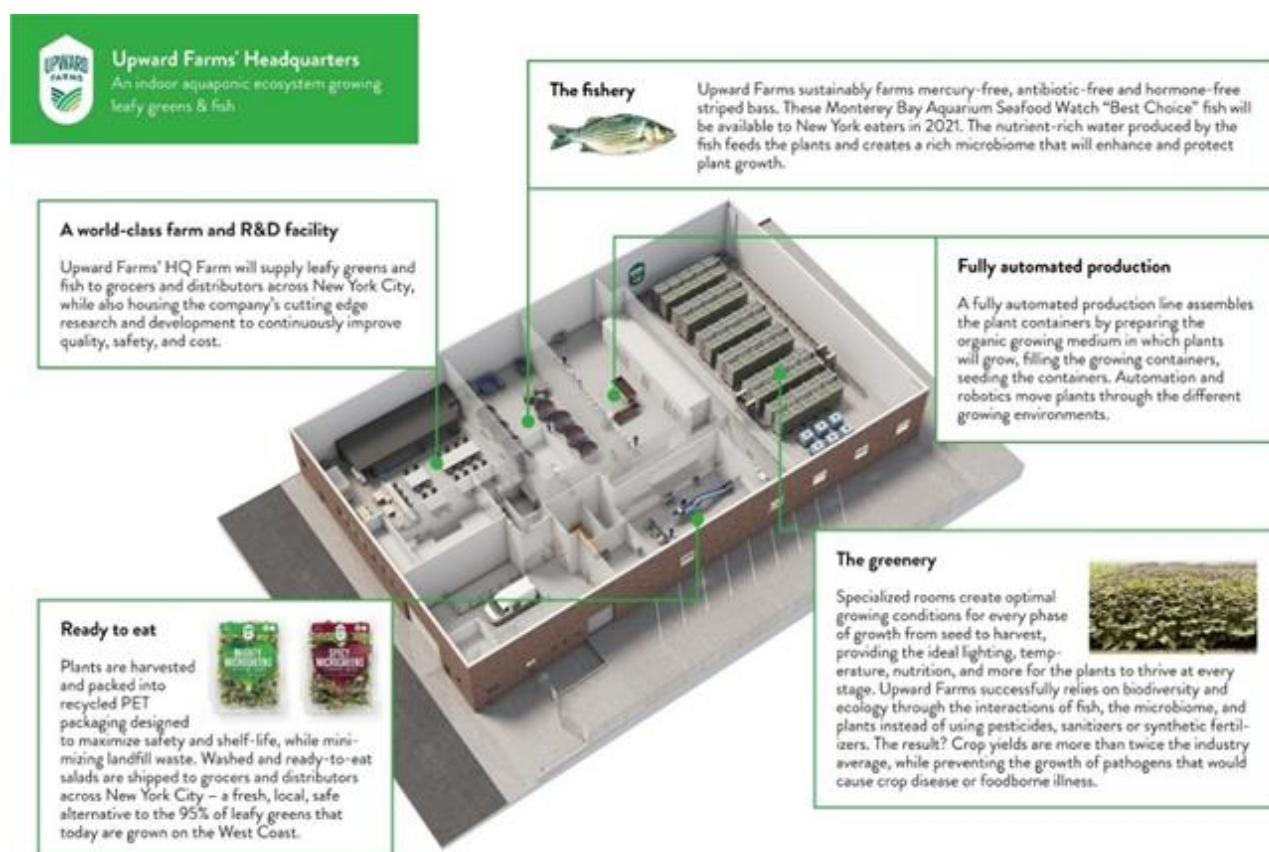
A crunchy, colorful mix of bok choy and mizuna that brings a mustardy heat to the table.

Source: Intro-act, Plenty

Upward Farms

- Founded in 2013, Upward Farms is a USDA Certified Organic farm growing leafy greens and fish with the high ecological and quality standard.** The company was co-founded by Jason Green, a neuroscientist and biotechnologist, Ben Silverman, a designer of high-performance building, and Matthew La Rosa, an innovator in manufacturing and construction. Upward Farms provides microgreens like broccoli, kale, cabbage, and white freshwater fish that are cultivated free of antibiotics, hormones, and mercury, thus allowing customers to have convenient and ready-to-eat food products.
- Upward Farms cultivates a food supply that is sustainable, scalable, and safe.** Upward Farms' core innovation is the ability to track and drive interactions between plants and microbes that have evolved over billions of years. It combines modern vertical farming with the ancient farming practice of aquaponics, and unlike other vertical farmers, Upward Farms yields more than twice the industry average for vertical farming with a fraction of the fertilizer (and no synthetic fertilizers), eliminates plant diseases without pesticides, and prevents the growth of pathogens like E. coli without sanitizers. This allows the company to achieve the industry's highest yields, disease resistance, and food safety, and allows its customers to enjoy flavorful and nutritious local food, rather than relying on long haul distribution systems and imported food.

Chart 34: Upward Farms' New Headquarters in Brooklyn, New York



Source: Intro-act, Upward Farms

- In May 2021, Upward Farms became the first and only Certified Organic vertical farm in U.S. Northeast region with the opening of its new headquarters in Greenpoint, Brooklyn, New York.** The new facility utilizes the company's "next-generation technology" in both commercial production and research and development and allows it to increase production of its USDA Certified Organic microgreens and baby greens by 20 times. The new headquarters includes a Monterey Bay

Aquarium Seafood Watch “Best Choice” rated fishery, and it can sustainably farm mercury-free, antibiotic-free, and hormone-free striped bass. Another portion of the new facility is the greenery, which contains specialized rooms that provide optimal growing conditions. According to the company, the interaction of the greenery and the resulting microbiome is the key driver behind the quality and yield of output produced by Upward Farms. The expansion enables Upward Farms to supply its washed and ready-to-eat salads to grocery stores across New York City. As a result of the expansion, two Upward Farms’ microgreen blends — Mighty Microgreens Mix and Spicy Microgreens Mix — will be available at Whole Foods Market stores across New York City.

- **Rebranded from Seed & Roe, Upward Farms raised \$15 million last year in a round led by U.S. VC firm Prime Movers Lab.** The raise was completed before the Covid-19 pandemic hit the U.S., bringing the company’s total funding to \$20 million from investors including Prime Movers Lab, Tribe Capital, and other strategic investors from the food, agriculture, and consumer packaged goods spaces. The new Upward Farms name and brand is an expression of the company’s mission to heal the broken food system. It also aligns with the company’s plans for expansion, including the opening of additional farms and broadening of its product portfolio for both retail and foodservice.

Freight Farms

- **Freight Farms is the world’s leading shipping container farming company and a good play on the expected growth of this segment of the vertical farming market.** Incorporated in 2013 by Brad McNamara and Jon Friedman, Freight Farms introduced the first vertical hydroponic farm built inside an intermodal shipping container — the Leafy Green Machine. Not only was Freight Farms the first to build a farm inside of a shipping container, but with the launch of the Greenery in 2019, it became the first to iterate on the original design. Today, the company offers a complete platform of products and services – the Greenery, farmhand®, and Client Services – to its community of partners across the world. The accessibility and versatility of the Freight Farms platform allow customers to use it in a diverse range of locations and applications, including the snowy Canadian wildernesses, Middle Eastern deserts, and concrete urban jungles. Freight Farms currently services more than 500 trained farmers across 48 U.S. states and more than 32 countries ranging from entrepreneurs and small business farmers to corporate, hospitality, retail, education, and nonprofit sectors.

Chart 35: Freight Farms – A Snapshot

48 U.S. States Our hydroponic container farms have found homes in almost every state in the country, and can be found in the densest cities and most rural neighborhoods.	32 Countries Since 2016, Freight Farms has been working with international farmers and businesses across five continents to help develop reliable food sources.	537+ Trained Farmers In addition to building farms, we also help create new farmers. Most Freight Farmers have no previous farming experience—our training programs get them ready to grow.
2 Billion Data Points Our smart farms pair with our IoT-connected app, farmhand®, to create optimal climates using live and historical data from your growing operation.	10 Innovative Farm Models In 2013, Freight Farms released the first hydroponic container farm into the market. Since then, we’ve innovated 8 different models, improving the system each time.	8 Years Strong Our first customer is still operating with his original 2013 farms! Over the years, he has sold direct to restaurants, at an indoor market and to a food delivery service.

Source: Intro-act, Freight Farms

- **In April 2021, Freight Farms unveiled its new container farm, the Greenery S – one of the most versatile platforms in the indoor farming industry.** The Greenery S is the tenth generation of Freight Farms’ technology. It combines specialized space, light, air, water, and control systems to make it possible to grow food anywhere in the world, thereby empowering individuals to grow food locally within their communities to decentralize the global food system. It is built with the same specifications as a standard 40-foot shipping container, making it possible to bring and install the farm in any location. Once at its location, the 320 sq. ft. container becomes a commercial growing space, capable of producing 2.5 acres worth of fresh food every year.
- **Of all the Greenery S features, one of the most notable is the re-imagined workspace.** Freight Farms focuses specifically on optimizing workflow for farmers with an all-new Workstation and a multi-functional farm command center.
 - Technical components – water and nutrient tanks, dosing panel, pumps – are hidden from view yet easily accessible with a simple push-to-open mechanism for instant access.
 - The ‘Tabletop Riser’ separates the workstation into two work zones, and includes an integrated, multi-functional LED bar (for tabletop illumination, plant spacing guidance, and task timing) and four full-range Bluetooth speakers.
- **Freight Farms also offers farmhand®, a complete software platform that allows hydroponic growers to remotely control farm components, automate tasks, and analyze growing data to make the most of their operation.** With farmhand data

analytics and cloud storage, it is easy to see the relationship between farm's settings and resulting harvests. Farmers can use farmhand to automatically optimize all growing variables based on the desired crop and create the perfect growing environment anywhere in the world. The latest release of farmhand® comes with the new Recipes feature.

- Recipes allow farmers to achieve consistent harvests with the touch of a button: Operators simply choose the crop they wish to grow and farmhand automatically adjusts in-farm settings to optimize for that crop production.
- Recipes are built by aggregating farmer network data and determining patterns that lead to exceptionally successful harvests; meaning the list of recipes will grow as the global Freight Farmer community continues to expand, creating a powerful network effect, a key driver of long-term value creation in our view.
- **The Greenery S also offers improved LED technology by allowing farmers to customize the lighting spectrum, intensity, and duration of light to achieve desired plant yields.** The Greenery S features Freight Farms' proprietary LEDs, which emit light with 60% greater intensity and 50% better efficiency compared to off-the-shelf options. According to the company, farmers have precise control over their lights with brand new Eco (prioritizing farm efficiency by reducing power consumption), Performance (prioritizing plant growth for greater yields, and Standard (balances the two) modes.
- **The company has raised >\$28 million in funding to date, including \$15 million in February 2020 in a Series B round led by Ospraie Ag Science.** The latest funding round received participation from existing investor Spark Capital and the proceeds were used to advance the technical potential of Freight Farms' platform through continued innovation, with new services designed to benefit its growing global network of farmers and corporate partners. The investment followed the announcement of **Freight Farms' strategic national partnership with Sodexo** to grow food onsite at educational and corporate campuses nationwide. In December 2020, the company also announced a **partnership with Arcadia**, a monthly subscription service that connects renters and homeowners across the U.S. to clean energy, to provide Freight Farms' U.S. customers with access to clean energy for their everyday operations. This ESG-focused partnership is aimed at increasing sustainability of indoor farming, while driving demand for more clean energy.
- **The company also strengthened its management team last year by appointing veteran consumer brand executive Rick Vanzura as CEO, and automation and robotics specialist Jake Felser as Head of Engineering.** Vanzura has led strategy for Panera, General Motors Information Services and GameStop, and as the CEO of Wahlburgers, he built the company from a single unit into one of America's fastest growing restaurant brands. He also brings significant international experience to his role, having run Borders Group's ~\$1 billion international business. Felser, on the other hand, is the former VP of Engineering for eatsa (now Brightloom), and is focused on automation, IoT, and machine learning-based integrations at Freight Farms. He has also worked at Cooper Perkins, Blue Origin, Prometheus Power Systems, and AGCO during in his career.

Iron Ox

- **Iron Ox is a robotics and AI-enabled farming company that has become one of the more prominent names in the field of agricultural robotics since its inception in 2015.** Iron Ox employs a semi-autonomous approach involving both human and robotics to grow 50 varieties of leafy greens and culinary herbs, including romaine, butterhead, kale, basil, cilantro, and chives in local urban settings. In 2018, the company opened its first completely autonomous production farm. While the process of seeding, pruning, and inspection are done by humans, lifting and moving large trays of growing vegetables is done by Angus, Iron Ox's automated 1,000-pound mobile transport system. A second robot, which moves in a linear track, is equipped with a computer vision system to monitor plant growth and to tend vegetables using its robotic grip. The company's hydroponic growing system utilizes 90% less water over conventional farming while growing 30x the number of crops per acre of land. In addition, Iron Ox runs its indoor farm fully on a highly energy-efficient LED lighting system.
- **Iron Ox presently runs two hydroponic farms in Gilroy and San Carlos, California and plans to expand its footprint across the U.S. in 2021.** The 10,000 sq. ft. Gilroy farm delivers vegetable to a variety of large retailers and restaurants across the state like Whole Foods and also to smaller businesses such as Bianchini's Market. The company plans to boost its nationwide presence in 2021, bringing its fresh produce to customers outside of California. And the expansion plan is on track – Iron Ox announced the construction of a 535,000 sq. ft. indoor hydroponic farm in Lockhart, Texas in April with 275,000 sq. ft. of the project to be finished by 4Q21 and the remaining 260,000 sq. ft. to be completed by 1Q22. Once completed, the farm will significantly boost Iron Ox's capacity to produce herbs, leafy greens, berries, and vine crops.
- **To date, Iron Ox has raised a total of \$45 million in funding.** The company received its last funding back in September 2020, raising \$20 million from a Series B funding round. The funding was led by Pathbreaker Venture and family office firms alongside Crosslink Capital, Amplify Partners, ENIAC Ventures, R7 Partners, Tuesday Ventures, At One Ventures, and Y Combinator. Iron Ox will use the proceeds to open new robotic growing facilities in California and in other states, and recruit more machine learning and robotics professionals, plant growers, and scientists. Iron Ox is well-positioned to draw more investor attention in the near future as it pushes for more innovation, automation, and optimization of processes in farming and expands its farms to more and large locations over time.

Chart 36: Iron Ox's Self-Driving Robot Angus (Left) and Visual Monitoring System



Source: Intro-act, Iron Ox

Hydrofarm Holdings Group, Inc. (HYFM)

- Hydrofarm Holdings Group, Inc. (HYFM) offers a good opportunity for investors looking to own a high growth, non-plant-touching play on the cannabis industry as well as the ESG-related theme of controlled environment agriculture (CEA). HYFM is the leading independent distributor and manufacturer of CEA equipment and supplies, including high intensity grow lights, climate control solutions, and growing media, as well as a broad portfolio of innovative and proprietary branded products. It mainly serves the U.S. and Canadian markets and is one of the leading competitors by market share in an otherwise highly fragmented industry. HYFM reaches commercial farmers and consumers through a broad and diversified network of over 2,000 wholesale customer accounts, with whom it primarily connects through its proprietary eCommerce marketplace. Over 80% of HYFM's net sales are into the specialty hydroponic retailers. HYFM also distributes its products to a diversified range of retailers of commercial and home gardening equipment and supplies that include garden centers, hardware stores, eCommerce retailers, commercial greenhouse builders, and commercial resellers.
- In addition to its leadership position in fast-growing industries, HYFM enjoys the following competitive advantages that will allow the company to sustain its growth momentum:
 - Broad portfolio with innovative proprietary offerings and recurring consumables sales.** HYFM has one of the largest equipment and consumable product offerings in the industry. From lighting solutions to nutrients to grow mediums, it offers nearly everything growers need to ensure their operations are maximizing efficiency, output, and quality. The company maintains an extensive portfolio of products which includes 26 internally developed, proprietary brands across ~900 SKUs with 24 patents and 60 registered trademarks as well as >40 exclusive/preferred brands. HYFM maintains inventory across over 6,000 SKUs, and ~60% of its sales relates to proprietary and exclusive/preferred brands that command a significant gross margin premium relative to general distributed brands. Further, its revenue stream is highly consistent as ~66% of its net sales are generated from the sale of recurring consumable products including growing media, nutrients, and supplies.

Chart 37: HYFM Has a Market Leading Product Portfolio Across Key CEA Product Categories

Lighting	 Phantom Open Lighting System	 Agrobrite T5	 Phantom II Digital Ballast	 Phantom Enclosed Reflector	 PHOTOBIO MX	 PHOTOBIO TX LED
Equipment	 Autopilot Analog Grounded Timer	 Active Aqua Rolling Bench	 Active Aqua Chiller	 Active Aqua Flood Table	 HydroLogic Reverse Osmosis System	 Active Air Duct Fan
Grow Media	 GROW!T Commercial Block	 FoxFarm Potting Soil	 Grodan Delta 6.5 Block	 GROW!T Clay Pebbles	 PRO-MIX BX Biofungicide	 GROW!T Perlite
Nutrients	 Humboldt Nutrients Verde	 FoxFarm Bush Doctor Insecticide	 Cutting Edge Solutions pH Up	 Grotek Monster Grow Pro	 Rare Dankness Nutrients	 Roots Organics Worm Castings
Supplies	 Hydrofarm Ergonomic Pruner	 Raindrip Pressure Drippers	 JumpStart Seedling Heat Mat	 Trellis Netting Mesh	 Dirt Pot Flexible Portable Planter	 Xtrasun Conversion Lamp

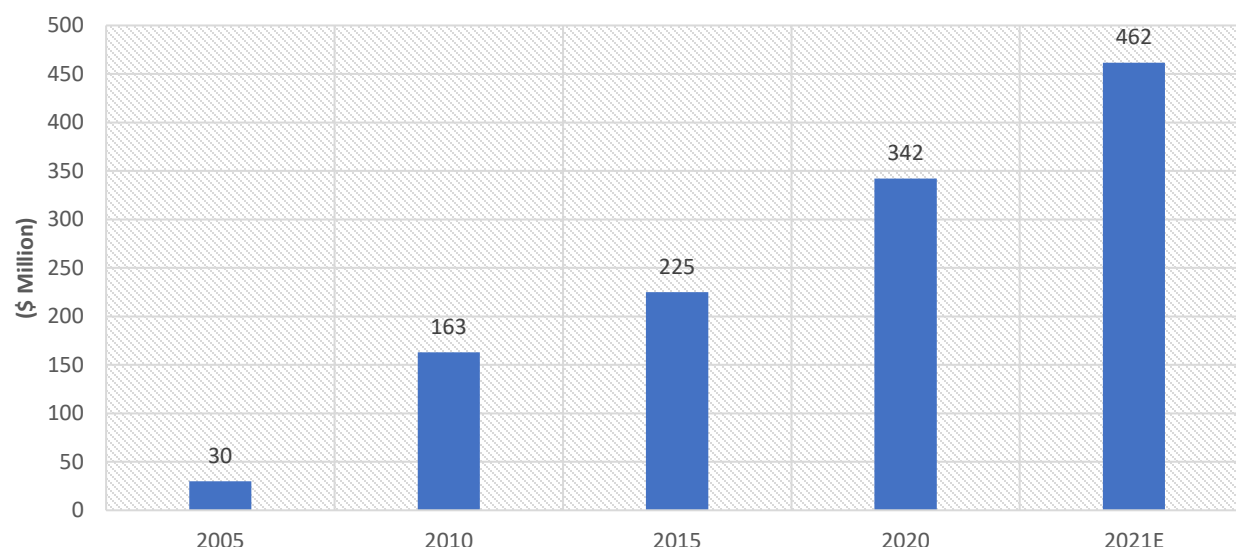
Source: Intro-act, HYFM

- **Infrastructure and reach for fast delivery, high in-stock availability, and exceptional service.** HYFM's infrastructure and reach enable it to provide delivery and service capabilities to a highly diverse group of customers across the U.S. and Canada. Its six U.S.-based distribution centers can reach approximately 90% of the U.S. population within 24 to 48 hours and its two Canadian distribution centers can provide timely coverage to the full Canadian market. Outside of North America, the company also operates a distribution center in Zaragoza, Spain, and has an office for product quality assurance and supply chain management in Shenzhen, China.
- **Proprietary sourcing and supplier relationships that create barriers to entry.** The company has developed exclusive distribution relationships and a geographic footprint that enables it to efficiently service customers across North America. It has ~900,000 square feet of distribution space across six distribution centers in the U.S. and two distribution centers in Canada. Furthermore, the company has forged relationships with a network of approximately 400 suppliers over the last 40 years. No single supplier makes up more than 10% of the company's total purchases.
- **Experienced management team.** Bill Toler, Chairman and Chief Executive Officer, has over 35 years of executive leadership experience in supply chain and consumer packaged goods, most recently as President and CEO of Hostess Brands from April 2014 to March 2018. Terence Fitch, President, possesses significant relevant business experience including more than 20 years of management experience with the Coca-Cola Company and Coke Enterprises, where he was responsible for manufacturing, supply chain, and sales and marketing for the multi-billion-dollar Refreshment Direct and Independent Bottlers business units. B. John Lindeman, Chief Financial Officer, brings more than 25 years of finance and leadership experience. Most recently, he served as CFO and Corporate Secretary at Calavo Growers, Inc. (Nasdaq-GS: CVGW).
- **HYFM is an acquirer of choice and has used M&A strategy effectively to emerge as a leading consolidator of market share.** HYFM's management team has extensive experience with execution and integration of M&A opportunities. In November 2017, HYFM acquired Eddi's Wholesale Garden Supplies, Ltd. and the distribution division of Greenstar Plant Products, Inc., which were two of the leading CEA and lawn and garden distributors in Canada at the time of the acquisitions.
 - **HYFM recently completed the acquisition of House & Garden, a Humboldt County, CA-based producer of quality nutrients under the House & Garden and Mad Farmer brands.** The acquisition continues HYFM's strategy of acquiring manufacturers of branded products in key CEA product categories and is expected to drive growth for the combined company. HYFM paid ~\$125 million for the acquisition and expects House & Garden to generate approximately \$55 million in net sales in CY21, representing significant y/y growth. House & Garden's profit margin profile will be accretive to HYFM. The transaction represents an acquisition multiple of <7x House & Garden's 2021E Adjusted EBITDA, excluding synergies.
 - **The above acquisition followed the purchase of branded nutrient manufacturer, HEAVY 16, earlier this year.** HEAVY 16 delivers a full line of premium nutrients with nine core products used in all stages of plant growth, helping increase the yield and quality of crops. Available across the U.S. in more than 300 retail stores, HEAVY 16 products provide a streamlined system for achieving demanding agricultural goals. The combination of HYFM's leading distribution capabilities and HEAVY 16's branded nutrient manufacturing capabilities is expected to enable the HEAVY 16 brand to grow more rapidly. HYFM expects HEAVY 16 to generate ~\$23 million in net sales in CY21, and the acquisition will enhance the HYFM's Adjusted EBITDA margin for 2021.
- **Driven by a combination of the company's strong moat and an effective inorganic growth strategy, HYFM has managed to grow its revenue from \$30 million in 2005 to \$342 million in 2020, and the growth momentum has been maintained in 2021 as well.** HYFM's net sales in 1Q21 grew 66.5% y/y to \$111.4 million, driven by a ~59.6% increase in product volume of and a 6.9% increase in price/mix of products sold. The growth in volume of products sold was driven by increased demand from multiple end-markets, including California, Oklahoma, Michigan, and Canada. Higher demand for the company's

proprietary brands was also a growth driver, as was the increase in price due to list price increases and more effective sales incentives. Gross margin expanded from 17.3% in 1Q20 to 20.8% in 1Q21, driven by a favorable sales mix. Further, adjusted EBITDA jumped >500% to \$9.9 million, driven by an increase in net sales, the improvement in gross profit margin, and leverage realized on SG&A expense, excluding stock-based compensation and depreciation/amortization expenses.

- The sales momentum is likely to continue as HYFM has guided for net sales growth of 30% to 40% (up from 20% to 25% earlier) in CY21, and an adjusted EBITDA of \$36 million to \$42 million, representing full year margin expansion to approximately 8.1% to 8.9% – we note that these estimates were given prior to the House & Garden acquisition and therefore could be revised. HYFM ended 1Q21 with a cash of ~\$62 million and completed a follow-on equity offering on May 3 that resulted in net proceeds of \$309.8 million (plus \$56.8 million in anticipated equity capital from future exercise of warrants), suggesting that the company is well capitalized to drive growth – both organic and inorganic – and create value for shareholders.

Chart 38: HYFM's Sales Have Grown at A Strong 18.6% CAGR Since 2005



Source: Intro-act, HYFM. 2021 sales estimate is based on the mid-point of the company's guided growth range given before the House & Garden acquisition. CAGR based on 16-year period of 2005-2021E.

Hydrobuilder Holdings LLC

- **Founded in December 2020, Hydrobuilder Holdings LLC is an omni-channel retailer of specialty agriculture and hydroponics equipment and supplies with a base in California.** The holding company operates through three sales channels: Hydrobuilder.com (online), GreenCoast Hydroponics (retail), and Elevated Equipment Supply (distribution).
 - **Hydrobuilder.com is a complete online hydroponic gardening center with >13,000 products working closely with 50+ vendors to help growers with indoor and outdoor gardening needs in Chico, California.** Aside from offering top product lines and a fast user-friendly website, Hydrobuilder.com also ensures robust safety and security to customers against rising online fraud attempts using Kount's Identity Trust Platform, helping the company to reduce fraud losses by 70%. The company was founded in 2011 by Justin Marshall, who helped Build.com—the largest online home improvement store in the U.S.—grow to over \$1 billion in sales.
 - **GreenCoast Hydroponics is the one of the largest hydroponics retailers in the U.S.** offering equipment, plant consumable products, and design services to growers of all sizes, ranging from hobbyists to large licensed commercial businesses. Based in Southern California, GreenCoast operates in 12 retail locations: 10 in California, one in Las Vegas, and one in Portland, Oregon. With 20+ years of experience, GreenCoast enjoys a strong management team with expertise in design of large-scale industrial growing facilities.
 - **Los Angeles, CA-based Elevated Equipment Supply is a full-service equipment and supplies provider for the commercial cultivation and extraction industries.** Founded in 2015, Elevated boasts one of the largest commercial supercenters in the industry and has a high-quality customer portfolio of hundreds of commercial growers and extractors in multiple states. It offers expert support in the areas of botanical extraction, agricultural cultivation, facility layout & design, irrigation optimization, and custom packaging. Moreover, the company operates a 75,000 sq. ft. warehouse through which it serves its commercial clients.
- **Hydrobuilder Holdings received over \$70 million in financing in January from a broad group of investors, led by Broadband Capital Investments and is building a best-in-class leadership team in the hydroponics industry.** The company is led by Markus Hockenson as CEO and Avi Levine as CFO, both of whom bring extensive digital and retail experience, as well as a proven track record of driving revenue, earnings growth, and value creation at private equity owned companies. In April, the company strengthened its already strong management team by appointing Will Ford as Vice President of Commercial Sales, who brings significant experience in the hydroponics industry to the company. Further, to oversee company's acquisition activities, Hydrobuilder onboarded Daniel Laughlin as Senior Vice President of Corporate Development, who helped create, implement, and execute an acquisition strategy that went on to acquire 55+ businesses and over \$1.0 billion in revenue during a six-year period in SiteOne Landscape Supply, Inc. The combination of a growing asset base (through acquisitions) and a best-in-class team make Hydrobuilder one of the best ancillary plays on the growth of the vertical farming and hydroponics markets.

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