



START-UP NATION CENTRAL:
FINDER INSIGHTS SERIES

**ISRAEL'S AGRIFOOD-TECH
SECTOR 2019**

**START-UP
NATION
CENTRAL**

EXECUTIVE SUMMARY

The Israeli AgriFood-tech sector is gaining momentum. The rate of start-up creation has more than tripled in the last decade, with 124 start-ups founded in the last three and a half years alone – more than the total of the previous six years. This trend represents a second wave of AgriFood-tech innovation, one driven by both the growing global demand for efficient and sustainable food production technologies and the strength of various technologies in Israel.

As the world’s population grows and urbanizes, standard agricultural methods are not enough to supply it without depleting natural resources and causing severe environmental damage. Climate change has made the weather more volatile and less predictable, making agriculture even more difficult. In addition, as consumers become wealthier, they demand not just more affordable, but healthier food. And the growing momentum of vegetarian and vegan trends worldwide suggests that people are becoming increasingly conscious of the moral and sustainability issues surrounding food production.¹

Israeli entrepreneurs and technologists are well positioned to address these challenges. They are accustomed to reacting quickly to global needs; they are highly interdisciplinary, quickly importing relevant technologies from other fields (60% of all new start-ups utilize Israel’s strength in information and communication technologies); and they improve the capacity to transfer technologies from academia to commercial applications.

This second wave of innovation builds on a longstanding tradition of excellence in agriculture which Israel has developed over the last 100 years – even before the establishment of the State of Israel – to address the existential need to achieve food and water security in an extremely challenging climate. It also

benefits from the innovative spirit of Israeli farmers, who are ready to experiment with new technologies in order to improve their competitive position and open up new markets.

There is growing interest among investors in the influx of entrepreneurship to AgriFood-tech. In the last five years, the total annual investment in AgriFood-tech more than doubled, totaling over \$100M. The median investment more than doubled as well, up to \$2.5M, and several large follow-on rounds this year also show the sector steadily maturing.

Another indication of maturity is the growing collaboration among some of the world’s largest AgriFood companies through joint R&D, trials, and co-marketing. Partners include members of both the Big 4 inputs companies and the ABCD group, as well as an increasing number of multinational food manufacturers. Many large Israeli food companies are also actively engaged in supporting innovative companies.

Key challenges remain, however. Dedicated and focused investors are crucial to the growth prospects of start-ups, but since 2014 only 14% of investors active in the sector have invested in two companies or more. To overcome this lack of dedicated support and provide higher financing certainty, the government contributes to seed financing, primarily through the Israel Innovation Authority, participating in 21% of early-stage deals since 2014.

The AgriFood-tech sector is one of the three focus sectors for Start-Up Nation Central. We support the development of this sector through data, insights, and community and skills development, as well as by building bridges between Israel’s innovators and global corporates and investors.

SECTOR DEFINITIONS

The AgriFood-tech sector contains companies dealing with a wide variety of challenges across the entire value chain, ranging from inputs production to final consumption. In this report, we have decided to focus on the first four stages of this process (Figure 1):

Figure 1: Focus on the Upstream of the AgriFood Value Chain



¹ Google search trends show that the term “vegan” surpassed “vegetarian” by 2011, increased five-fold thereafter, and has even been more common than “meat” since 2017.

To better focus the discussion, we have organized the sector into three categories: species domains, industry challenges, and core technologies.²

SPECIES DOMAINS



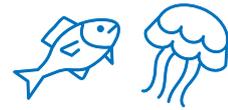
Crops

All land-grown vegetation.



Livestock

All land-grown animals, including insects for food and feed, and meat-alternative technologies.



Marine Life

All aquatic vegetation and animals, including insects for aquatic feed.

INDUSTRY CHALLENGES



Inputs Production

Research and creation of materials for the three species domains, including seeds, fertilizers, pesticides, and feed.



Cultivation

- **Water Management**
Using and treating water.
- **Pathogen and Pest Management**
Treating invasive organisms, plants, or animals.
- **Yield and Harvest Management**
Ensuring the resilience and yield of crops or animals from germination to harvest, including general monitoring of external conditions, crop/animal nutritional status, quantity, and readiness for harvest, slaughter, milking, etc.



Preservation and Supply Chain

Post-harvest spoilage, including waste management, preservation of harvested commodities, packaging, and monitoring for safety and traceability.



Alternative Food Sources

Foods, nutrients, and proteins derived from unconventional sources, such as rare plants and lab-grown meat.

CORE TECHNOLOGIES



Information and Communication Technologies (ICT)

- **Data and Computation**
Data-centric solutions (AI, ML, etc.) and other software for optimization.
- **Machinery and Robotics**
Mechanized systems including drones, robots, grafting devices, and food processing lines. Many of these solutions include data and computation innovation. A company is included in this category if the essence of its solution is a specific action aimed at mechanizing or improving the performance of an agricultural output (e.g. spraying or picking as opposed to simply monitoring).
- **Sensing**
Detection of physical occurrences, such as light or vibration, and their conversion into data. These solutions almost always involve innovation in Data and Computation. A company is included in this category if its solution includes its own sensing technology and centers on its sensing capabilities.



Biologicals

All solutions based on small or micro-organisms, including cellular technologies.



Materials and Substances

Non-living materials ranging from peptides to oils, plastics, etc.



Infrastructural Components

Fixed, non-moving hardware installed on farms, such as trays, heating lines, and PV panels.

² There is some overlap between categories as many companies deal with multiple species domains, address more than one challenge, and often apply a group of technologies to create a product. We assign companies based on their self-declared primary business.

OVERVIEW OF THE SECTOR AS AN ECOSYSTEM

We characterize a start-up-driven ecosystem by the set of entities and capital inputs indicated in Figure 2. The innermost circle represents the start-ups themselves. The second layer represents the primary resources required by start-ups: financial capital (investments), intellectual capital (knowledge), and human capital (founders and employees). The third layer depicts the supporting environment for start-ups:



Large established firms (both Israeli and foreign) – directing innovation toward their needs and providing resources



Government – as a regulator and a supporter of the ecosystem



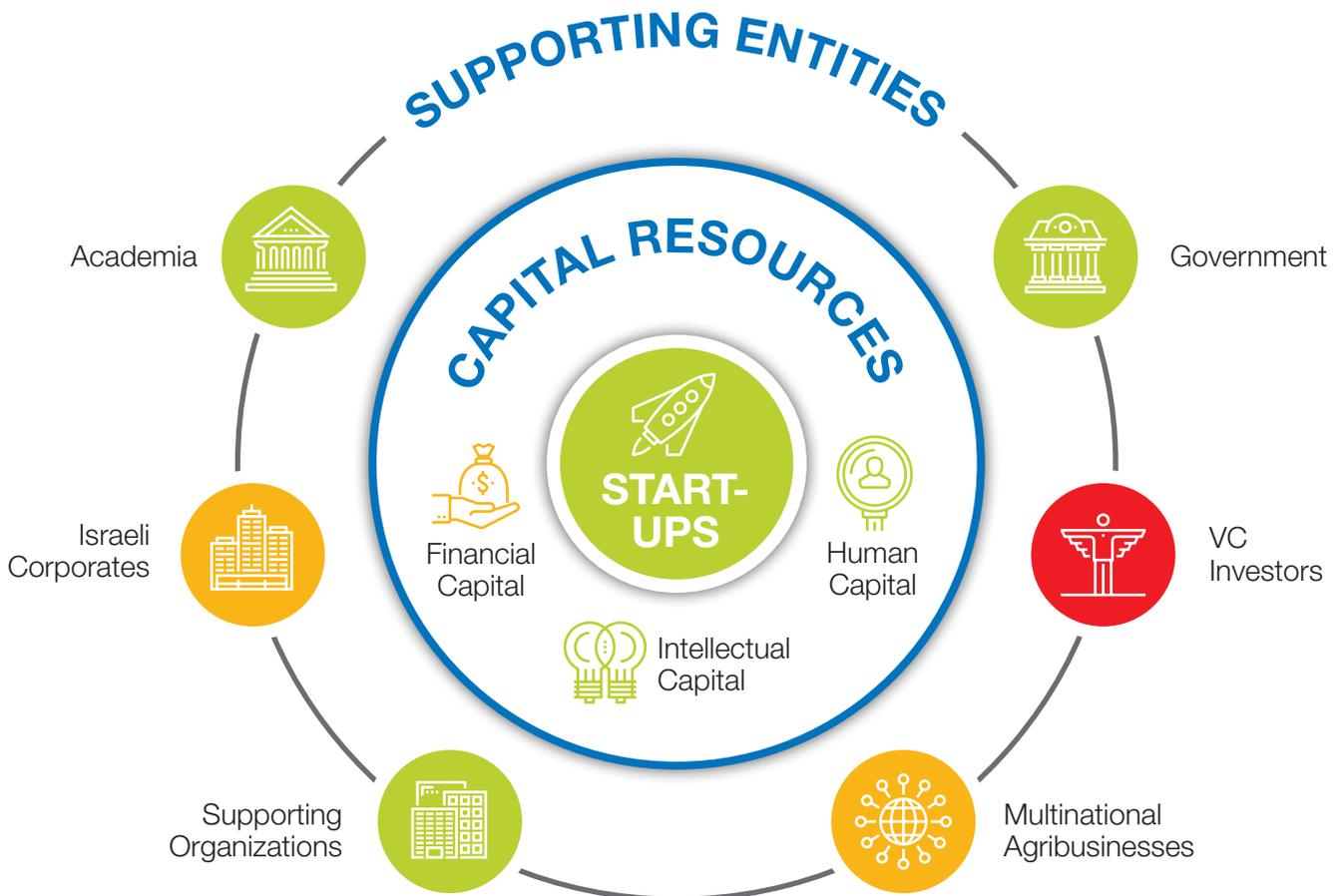
Academia and research institutions - driving intellectual capital through research and training human capital



Supporting organizations – NGOs, hubs, communities, etc., assisting start-ups

The color-coding in Figure 2 indicates the degree to which the given entity or capital resource is currently feeding into relevant innovation. Green refers to a stable presence in the sector; orange to a medium presence; and red to lacking or unstable. The need for a given resource or entity is relative to each sector.

Figure 2: Israel's AgriFood-Tech Sector



We see the AgriFood-tech sector in Israel as a rapidly developing young ecosystem. It exhibits strong entrepreneurial activity that is based on solid knowledge foundations and highly capable talent. But the second layer of this ecosystem has a gap: despite a substantial rise in investments, start-ups

still rely on sporadic funding by opportunistic investors, which delays their development and slows their move into the market. Government attempts to fill this gap, but for a sector to grow and develop it needs specialized private investors and strategic partners to increase dedicated involvement.

START-UPS³



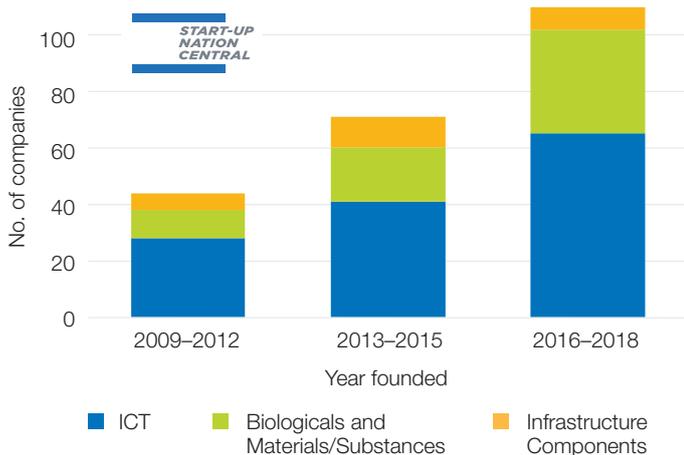
There are more than 350 innovative Israeli AgriFood-tech companies as of mid-2019, of which 239 are start-ups.⁴ The rate of new company creation has sharply accelerated in recent years, with an annual average of 37 new start-ups since 2014 (Figure 3). This trend represents an increasing number of Israeli entrepreneurs detecting an opportunity to disrupt global food production using current advances in the hard sciences and data and computation technologies in particular. We refer to this acceleration as the “second wave” of Israeli AgriFood-tech.

This rapid growth builds on 100 years (the first wave) of agricultural innovation in Israel, which originated from the existential need to achieve food and water security for Israel's fast-growing population. This need was a national challenge considering the desert conditions spanning much of Israel, and the endeavor to meet it was based on science and technological innovation from the start.

The Agricultural Research Organization, Volcani Center, which was established almost a century ago, and Israeli universities engage in basic and applied scientific research and then bring it to the field. Israeli farmers have had no choice but to be innovative in their attempts to win markets and stay ahead of lower-cost competition. These efforts have resulted in world-recognized advances in fields including water management, livestock productivity, farming in arid conditions, aquaculture, and many others.

While these achievements produced strong companies, the sector's level of innovation slowed near the beginning of the 21st century as the newly booming high-tech sector attracted a disproportionate share of available technical and entrepreneurial talent. In the last decade, however, many entrepreneurs and technologists coming from farming communities have chosen to combine their areas of interest and expertise, creating a second wave focused on data, AI, and robotics.

Figure 3: AgriFood-tech Start-ups



³ Start-Up Nation Central is a non-revenue NGO that does not formally endorse any of the companies, institutes, or individuals mentioned in this report. Those featured were chosen on the basis of pertinence to a given topic presented in the report and are not necessarily superior in any way to other entities that are not mentioned.

⁴ In this report we use the term “start-up” for companies developing new products and founded within the last 10 years, unless public or acquired. All other innovative companies in this sector are not considered start-ups and are classified as public or established (revenue-financed companies more than 10 years old). The 350 companies represent “deep tech” innovation for primarily the global AgriFood industry. This figure reflects a stricter methodology than we have used previously. In the past we included important but not currently innovative AgriFood companies, proprietary breeders, start-ups focusing on gardening and home growing, and companies with AgriFood as a tertiary target vertical.

AGRIFOOD-TECH START-UPS IN FIGURES



239
active start-ups

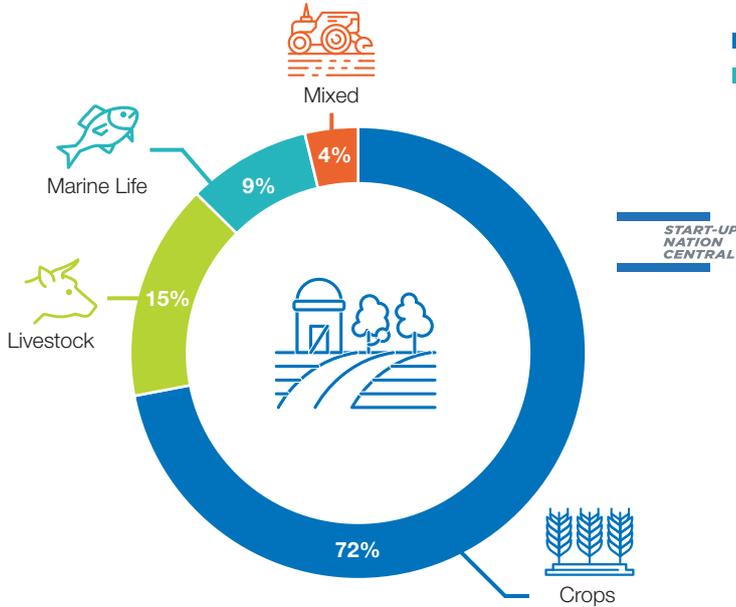


195 (82%)
founded since 2013

Innovation in crops predominates, with an emphasis on row crops.

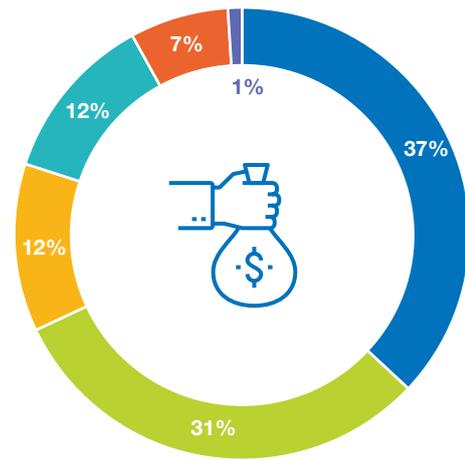
Most start-ups are still in early stages.

Species Domains



Funding Stages

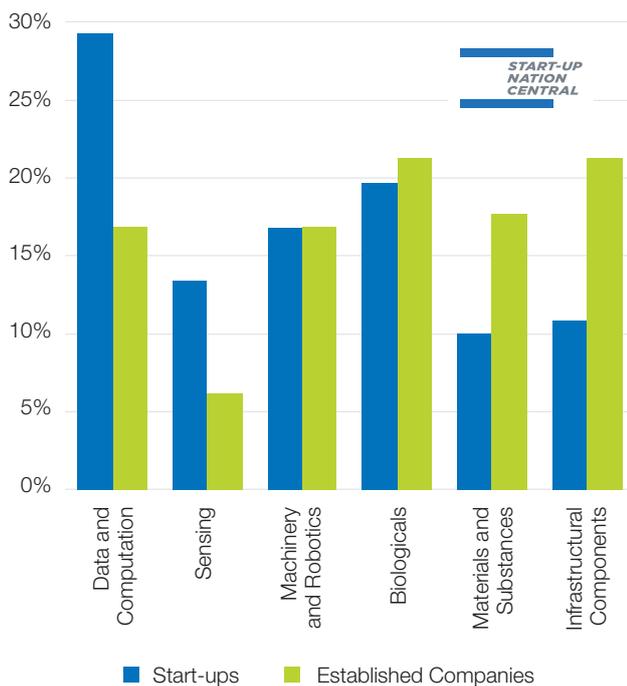
■ Seed ■ Bootstrapped ■ Revenue financed
■ A round ■ B round ■ C+ round



The second wave of innovation derives primarily from ICT, especially the areas of Data and Computation and Sensing.

The second wave is most focused on Yield and Harvest Management, but there is increasing momentum in Pathogen and Pest Management and Alternative Food Sources.

Core Technologies: Proportions of Sector (Start-ups vs. Established Companies)



Industry Challenges: Proportions of Sector (Start-ups vs. Established Companies)

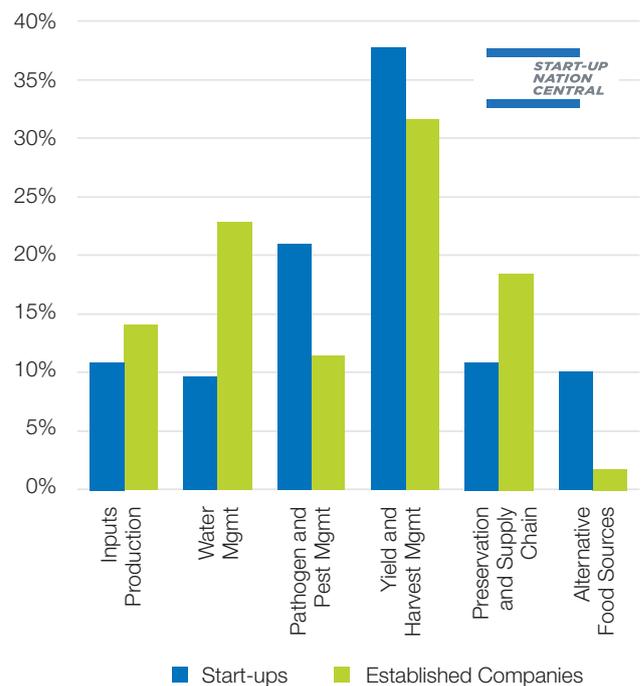


Table1: Current Number of Active Start-ups		Core Tech					Total	
		Data and Computation	Machinery and Robotics	Sensing	Biologicals	Materials and Substances		Infrastructural Components
Industry Challenge	Inputs Production	12	0	2	7	3	2	26
	Water Mgmt	8	1	6	0	1	7	23
	Pathogen and Pest Mgmt	6	12	6	14	9	3	50
	Yield and Harvest Mgmt	30	20	15	8	4	13	90
	Preservation and Supply Chain	14	3	3	2	4	0	26
	Alternative Food Sources	0	4	0	16	3	1	24
Total		70	40	32	47	24	26	239

The above table classifies all start-ups according to the industry challenges they are dealing with and the core technology they use. We define any cell that contains 10 or more companies as a “hot spot,” marked in green in the table. We have identified four clusters of these hot spots in which Israeli start-ups are particularly strong: Data and Computation technologies, with 70 start-ups and three hot spots; Yield and Harvest Management, with 90 start-ups and four hot spots; and to a lesser extent,

Pathogen and Pest Management, with 50 start-ups and two hot spots; and Alternative Food Sources, an industry challenge gaining momentum in the last few years, with 24 start-ups and one hot spot.

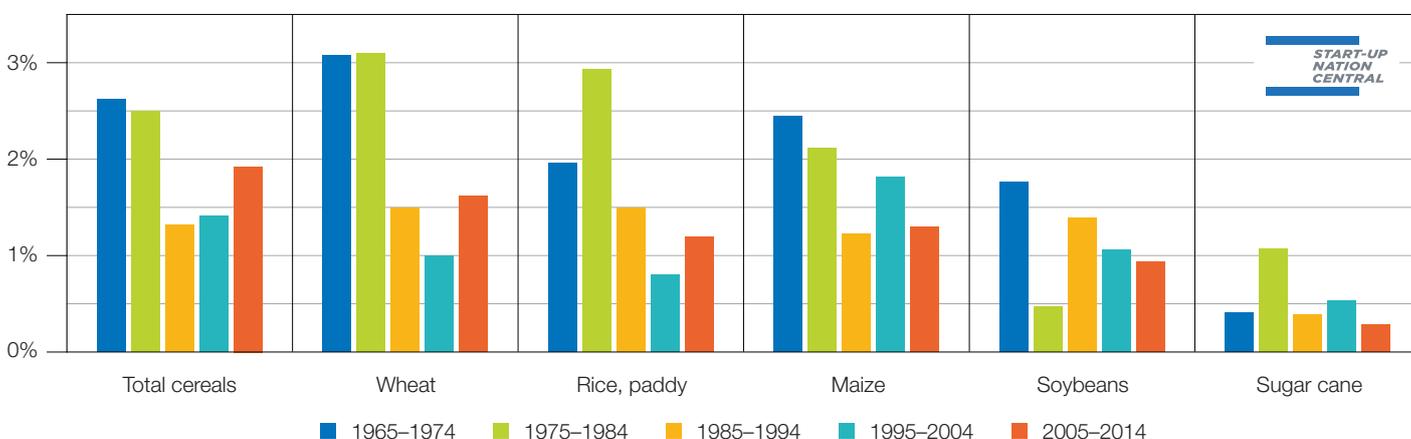
In the following section, we briefly describe the activity in these four clusters.

DATA AND COMPUTATION

Global yields of staple crops have been increasing for half a century, but the rate has slowed (Figure 4). The UN’s Food and Agriculture Organization (FAO) warns that a “business as usual” approach to agriculture is not sustainable and will cause

widespread food insecurity.⁵ Boosting yields, despite adverse conditions, is not a new challenge for Israeli AgriFood-tech, but the sector now deploys large data and optimization techniques to reduce the negative side effects of chemicals and pesticides.

Figure 4: FAO – Average Annual Growth Rates for Selected Crop Yields⁶



With these new capabilities, Israeli start-ups are using Data and Computation across several industry challenges, creating software to handle large and complex data sets in order to speed the discovery and development of inputs, empower and guide farmers through cultivation, or inform farmers and commodities traders about market demand and opportunities.

Start-ups focusing on Data and Computation are especially active in Yield and Harvest Management. Some, such as [AgriOT](#), guide farmers in determining the optimal fertilizers for their crops. Others specialize in keeping farmers informed, such as [BeeHero](#), which tracks beehive conditions and pollination

patterns in fields. And for farmers raising livestock, [AgIT](#), [LIVEgg](#), and [PoultriX](#) are focused on keeping farmers apprised of the current status of their animals throughout the growing process.

While most historical advances in Inputs Production have occurred in Materials and Substances, the Israeli sector contains an increasing number of start-ups applying big data tools to increase efficiency in the discovery of better inputs. Such start-ups are targeting the long development process of identifying genes and substances that boost crop resilience and yield or lead to environmentally safer fertilizers and more effective pesticides.

⁵ *The Future of Food and Agriculture: Alternative Pathways to 2050*, FAO (Rome, 2018) ix.

⁶ *Ibid.* 28.

Examples in this area include [NRGene](#), [Phenome Networks](#), and [Equinom](#) – three companies at the more established end of the start-up spectrum, which have strategic collaborations with corporates Bayer, Syngenta, BGI (NRGene), Delair, Hill Biosystems (Phenome), and Roquette (Equinom). Newer start-ups like [Seed-X](#) bring imagery and AI expertise from some of the world’s largest Internet companies, transplanted to phenotyping seeds for genetic purity. This subset of newer companies also includes [eggXYt](#), which uses its own CRISPR-based technology to identify the sex of chicks pre-incubation.

Data and Computation is also becoming particularly important for Preservation and Supply Chain challenges. Israeli start-ups targeting this hot spot, such as [Trellis](#), are using complex combinations of historical farming data, weather conditions, yield data, and market demand to strengthen communication between growers and traders. Several others, including [Farmster](#), [Avenews-GT](#), and [OKO](#), tailor their platforms to emerging markets. Such entrepreneurs have to work with limited data input and facilitate trade guidance that is accessible to small farmers and their traders and distributors. This type of Data and Computation is drawing participation in the sector by non-AgriFood incumbents, including insurers and banks.

YIELD AND HARVEST MANAGEMENT

Start-ups focused on the challenges of Yield and Harvest Management constitute a subsector of 90 companies, 37% of which were founded since 2016. Their solutions are designed to increase farmers’ awareness of their crop conditions, grant greater control over sustaining and tailoring phenotypes, and alleviate farm labor shortages through automation.

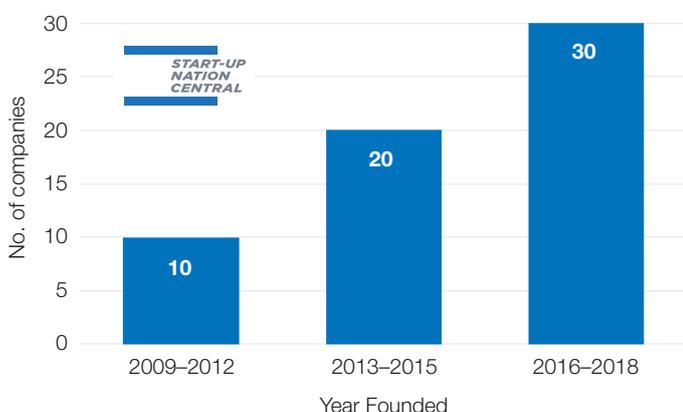
There has been an increase in new ICT companies over the last several years, driving the second wave of innovation (Figure 5). Prominent examples of platforms based on comprehensive sensing and big data analysis are [CropX](#), [Taranis](#), and [SeeTree](#) (see box below), with each focusing on different crops and data, and all utilizing big data and sophisticated algorithms through elaborate sensing systems.

Other companies are combining drones with machine learning and computer vision – two areas of particular tech expertise in Israel – to mitigate cultivation problems arising from climate change and urbanization. [edete Precision Technologies](#) is developing an automated pollen-collection and pollination system. This robotic solution reduces agriculture’s dependence on insects, which are adversely affected by climate change, for pollination. Several other new start-ups are attempting to address the root of the issue by using data and robotics for monitoring and tending to beehives.

ICT for Yield and Harvest Management has grown in global relevance as several of its strongest start-ups expanded their solutions from other cultivation challenges. Taranis and [FieldIn](#) spent several years honing pathogen and disease detection in row crops and orchards, respectively. CropX originally focused on smart irrigation. They have all incorporated data and decision support for Yield and Harvest Management, creating end-to-end smart-farming platforms focused on a specific crop family. The increasing number of companies and their expansion into new farming needs exemplify innovators’ quick reaction time and the founders’ use of their interdisciplinary skills to transplant relevant technologies from other high-tech sectors.

Regarding Infrastructural Components addressing Yield and Harvest Management, 13 start-ups offer solutions focused primarily on optimizing the physical conditions in which plants and animals grow. Start-ups such as [FOTONICA](#), [Zeveled](#), and [SunBoost](#) are ensuring that crops grown indoors or in greenhouses receive sufficient light in an efficient way. Other companies are taking more novel approaches to ensuring effective yields, such as installing underground heating elements in order to regulate plants’ temperature for optimal health.

Figure 5: ICT Start-ups Targeting Yield and Harvest Management



The company has developed an end-to-end technology creating an “intelligence network for trees,” modeled after defense intelligence networks. It combines large data, AI, and human agronomic expertise to assist large citrus growers in making better decisions. SeeTree is two years old and already has a team of 60 professionals, partnering with some of the largest growers in California and Brazil.

PATHOGEN AND PEST MANAGEMENT

Pathogen and Pest Management is an area of global need that is continually attracting new solutions. On the one hand, 20–40% of crops worldwide are lost in the wake of pathogens and pests,⁷ a problem that is worsening due to climate change.⁸ On the other hand, conventional chemical treatments are widely considered overused, to the detriment of the environment.⁹

While historically solutions to this problem have been primarily biological or chemical in nature, today there are 12 Israeli start-ups using Machinery and Robotics to ensure that farmers can identify threats quickly and treat them with the precise amount of pesticides needed. Among these start-ups are [Skyx](#), [Green-eye Technology](#), and [AgroScout](#), all of which use drones to scout fields and customize spraying plans. In the more niche but globally relevant area of bee cultivation, [ToBe2](#) emerged in 2018 along with several other start-ups to identify and precisely fumigate mite infestations in beehives.

Still, the predominant technology among start-ups targeting Pathogen and Pest Management challenges is Biologicals. These solutions represent effective yet environmentally friendly alternatives to pesticides and non-animal sources of protein, as a major challenge in conventional agriculture worldwide is to create sustainable alternatives to chemical treatments. There are 14 start-ups in Israel that offer environmentally friendly alternatives to conventional pesticides and crop-protection inputs. Among these is [WeedOUT](#), which treats the most problematic weed in the corn industry using its sterile pollination, based partly on its founders' training at the Weizmann Institute and experience at Monsanto. Others include licensed research from several of Israel's academic institutions being commercialized by [Copia Agro & Food](#). Their companies develop biological pesticides against a variety of pathogens and pests, including nematodes and phloem bacteria. [ViAqua Therapeutics](#), having also licensed its technology from Israeli academia, fortifies shellfish and fish against viral infection, using its own GRAS RNAi particle and nano-delivery materials.

AgriTask This company offers a unified data platform to assist farmers.

Partnering with FAO, AgriTask helps Kenya's smallholders to cope with the Fall Armyworm. It builds a comprehensive area-wide picture of the Fall Armyworm infestation levels, that is used by Kenyan authorities to issue timely alerts and advice to thousands of farmers.



7 *The Future of Food and Agriculture: Trends and Challenges*, FAO (Rome, 2017) 58.

8 *Ibid.* 61 citing Bebbler, Ramotowski, and Gurr, "Crop Pests and Pathogens Move Polewards in a Warming World," *Nature Climate Change* (2013).

9 *The Future of Food*, FAO (2018) 33.

ALTERNATIVE FOOD SOURCES

In 1931 Winston Churchill wrote: “We shall escape the absurdity of growing a whole chicken in order to eat the breast or wing, by growing these parts separately under a suitable medium.”¹⁰ While this may have sounded like science fiction at the time, today biofarmed animal protein is considered by many to be feasible. This industry challenge highlights the growing global trend toward disrupting the livestock industry, a major cause of climate change.¹¹

A number of Israeli start-ups are at the forefront of this process. Twelve companies, including start-ups targeting Alternative Food Sources for other global food issues, have been founded since 2016 (with another seven slightly older), leading to several major investments and positioning Israel as a global hub for these types of solutions (see Figures 6a and 6b).

Figure 6a: Start-ups Targeting Alternative Food Sources

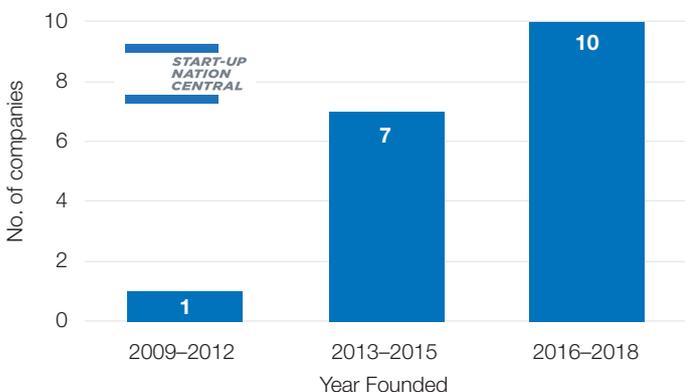
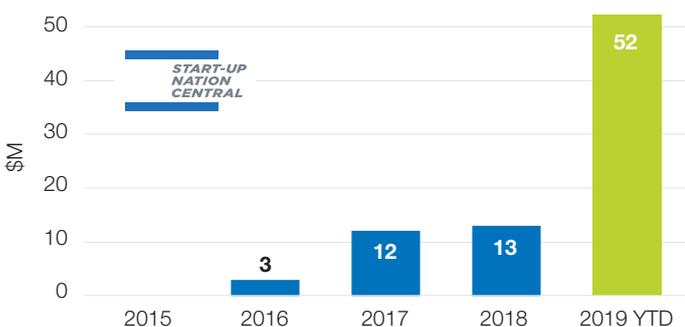


Figure 6b: Equity Investment in Alternative Food Sources



Israeli start-ups offer several diverse approaches to replacing conventional meat. Thirteen start-ups offer vegetarian stand-ins for meat dishes, including two based on additive manufacturing: [SavorEat](#) and [Redefine Meat](#). [Future Meat Technologies](#) and [SuperMeat](#) grow beef and poultry cells, respectively. Two others, [Aleph Farms](#) and [Biofood Systems](#), are among the few initiatives in the world offering whole-muscle beef grown without the animal.



The company has created a prototype of the world’s first 3D-printed meatless burger. The technology represents six years of research by Prof. Oded Shoseyov, head of research at Hebrew University’s Faculty of Agriculture. Shoseyov is an award-winning serial entrepreneur and co-founder of more than 14 companies, has authored or co-authored more than 180 scientific publications, and holds 62 patents.

SavorEat’s printed meals will reproduce the taste and texture of meat-based products using only plant-based ingredients through 3D printing and cooking technology, while calibrating nutritious values to meet personalized requirements. The combination of the printer and the start-up’s ingredients enables on-the-spot creation of vegetarian meat with natural texture.



This revenue-financed start-up is developing a non-GM, fermentation-derived yeast protein that will provide maximum performance for optimal body weight. It already produces novel active ingredients for food based on its yeast fermentation technologies. Two of its three products developed have been licensed to Lallemand (a global yeast manufacturer), and its third is about to launch.

Sugar alternatives derive mainly from materials and chemicals although there are also biological solutions. [Amai Proteins](#) has developed a sweet protein to replace sugars in beverages, improving nutrition by simultaneously removing the harmful component (sugar) and replacing it with a beneficial one (protein). [DouxMatok](#), on the other hand, has drawn considerable attention recently for halving the amount of sugar and salt in food products with a harmless additive that tricks the brain’s perception of sweetness and saltiness.

¹⁰ “Fifty Years Hence,” *Strand Magazine* (Dec 1931).

¹¹ *Global Nutrition Report: Actions and Accountability to Advance Nutrition and Sustainable Development*, International Food Policy Research Institute (Washington, DC, 2015) 79–81.

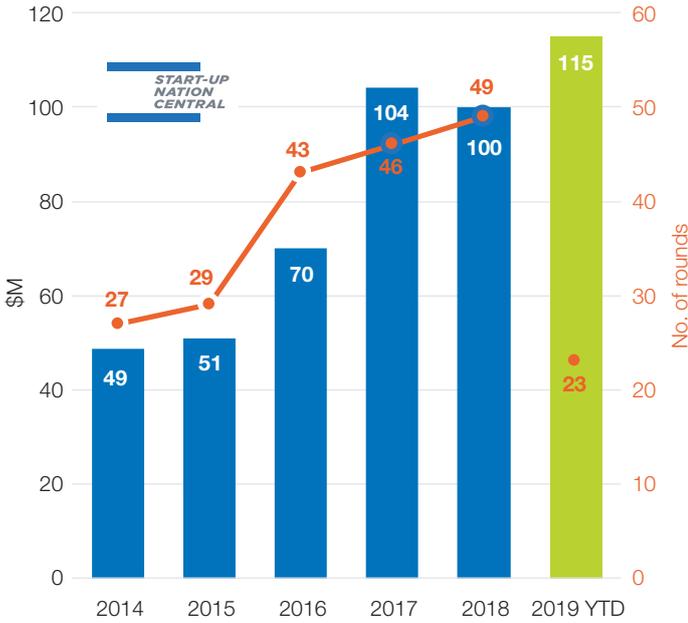
CAPITAL RESOURCES

Capital resources, represented in the second layer of the sector diagram (see Figure 2), refer to the three inputs that every start-up needs to operate: financial, intellectual (i.e. innovative ideas and technologies), and human (i.e. entrepreneurs and skilled workers).

FINANCIAL CAPITAL: INVESTMENTS

Alongside the strong growth in start-up creation, investments are rising, having reached \$100M in 2018 and already \$115M by September 2019 (Figure 7).¹²

Figure 7: Equity Investment



While the number of rounds has increased slightly from 2016 to 2018, the median investment has risen more steeply, reaching nearly \$2.5M this year (Figure 8). Moreover, 2019 is already an exceptional year, with six disclosed follow-on rounds of over \$10M (Table 2). The vast majority of investment rounds are in the early stages, supplying new start-ups with capital (Figure 9).

Figure 8: Median Investment Value

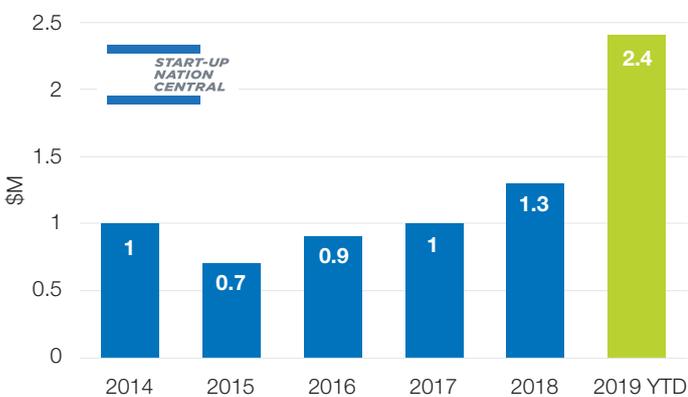
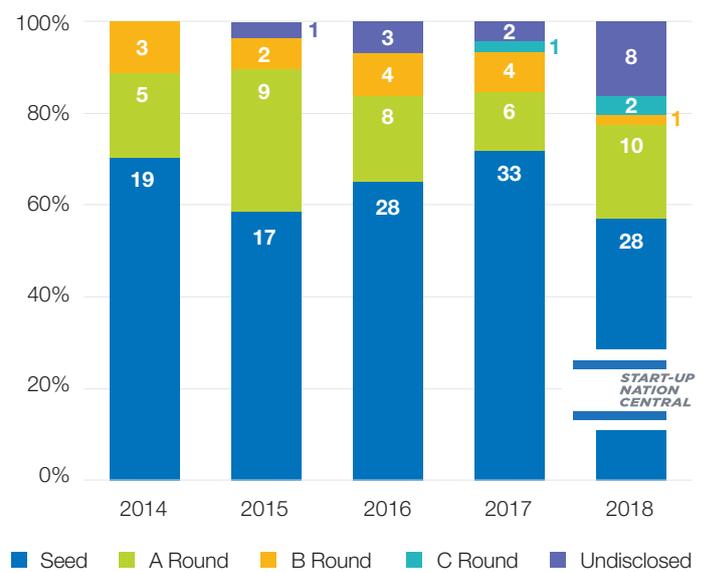


Table 2: Investment Rounds of \$10M or More (Jan–Sept 2019)

Company	Size (\$M)	Solution
BouxMatok	22	Mineral that interacts with sugar and salt to enhance their flavor in reduced amounts.
ALEPH FARMS MEAT GROWERS	12	Bioengineering whole-muscle meat.
fieldin	12	Sensing and data for orchards, with special expertise in pathogen management.
See Tree	11.5	Intelligence platform for orchards.
Tevel Aerobionics Technologies	10	Fruit-harvesting swarm of autonomous airborne robots.
cropx	10	Soil data for yield management and smart irrigation.

Figure 9: Number of Equity Investments per Type



¹² The 2017 and 2018 investment totals differ from those we have presented elsewhere. The lower numbers here reflect a stricter methodology, now excluding companies whose main business is not in AgriFood-tech. In this report, we present AgriFood-dedicated innovation.

Table 3: Investments Matrix of Industry Challenges and Core Technologies of Solutions (2014–Sept 2019)

Total Financing (\$M), 2014–present		Core Tech					Total	
		Data and Computation	Machinery and Robotics	Sensing	Biologicals	Materials and Substances		Infrastructural Components
Industry Challenge	Inputs Production	44	1	7	4	6	0	62
	Water Mgmt	43	2	7	0	2	7	61
	Pathogen and Pest Mgmt	7	12	3	17	8	1	48
	Yield and Harvest Mgmt	29	18	103	26	0.8	16	193
	Preservation and Supply Chain	11	7	14	5	7	0	44
	Alternative Food Sources	0	6	0	39	31	4	80
Total		134	46	134	91	55	28	\$488

Table 3 classifies all start-ups in the same way as Table 1 above, but with higher amounts of capital raised. We classify a hot spot in this table as any cell whose value is over \$25M.

The results are similar to Table 1: Data and Computation is the leading technology with three hot spots, while Yield and Harvest Management is the leading industry challenge, also with three hot spots. This challenge has raised the most

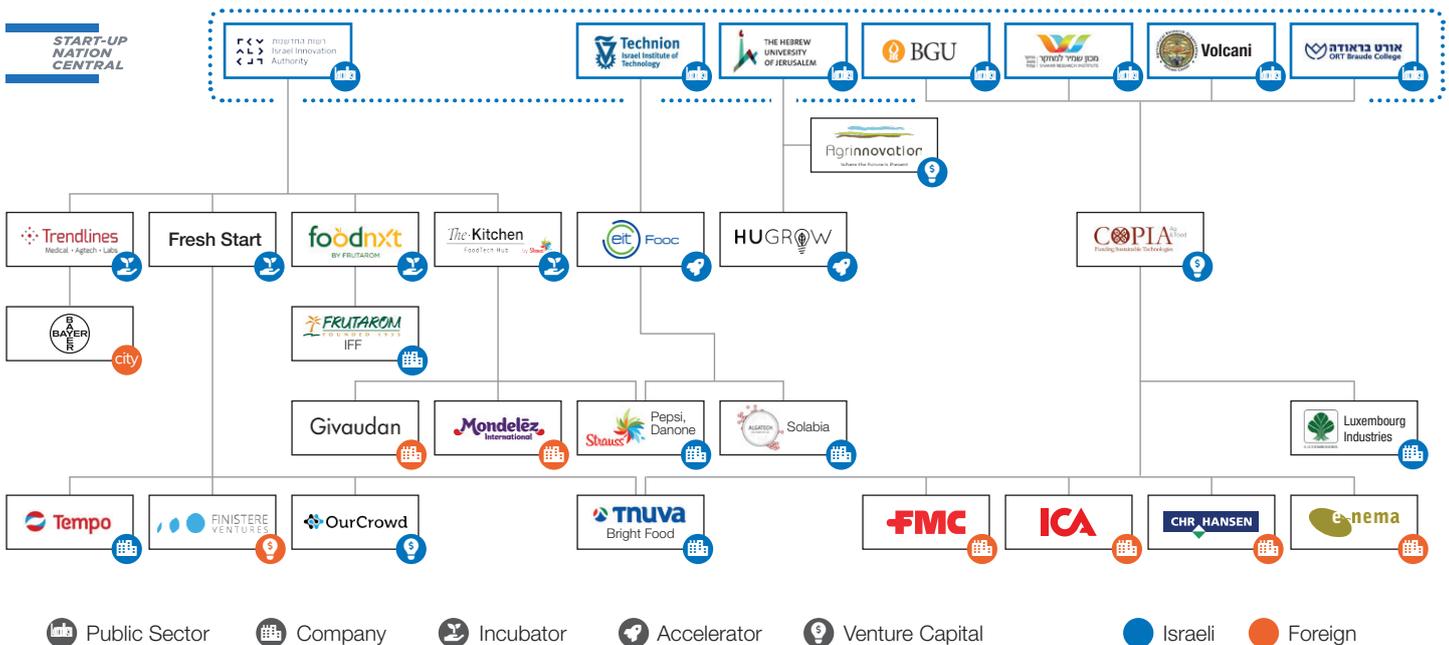
money, with over half in Sensing and almost 80% in ICT as a whole. This reflects the willingness of investors to commit to technologies that they are familiar with, often from outside AgriFood-tech. Alternative Food Sources has two hot spots in Biologicals and Materials and Substances – the only two hot spots outside the ICT space. This reflects the strong availability of capital for that industry challenge, which has been part of a global phenomenon this past year.

GOVERNMENT SUPPORT FOR EARLY-STAGE START-UPS

Financial capital through government support, which has come mostly through the Israel Innovation Authority (IIA), has been critical for the sector's development (Figure 10). Since 2014, the IIA has participated in 40 investments by incubators, which it initiated, and issued over 35 grants (>\$100k each) to new Israeli AgriFood-tech start-ups. In a sector like AgriFood-

tech where development periods are long, investments are frequently too long and risky for private investors. Partial de-risking by public money can bring investors to the table. The principal mechanism for this support in AgriFood-tech is through incubators; two of which (Trendlines and The Kitchen) have become the most frequent investors in Israeli AgriFood-tech.¹³

Figure 10: Public Sector Involvement in Early-stage Investing in the Sector



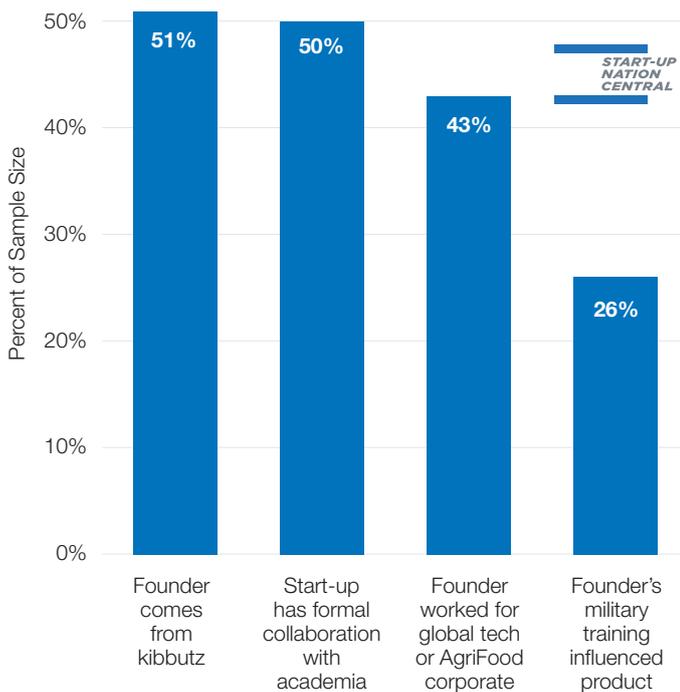
13 For details of the Incubators Program, see [the description](#) on the Israel Innovation Authority's website



INTELLECTUAL AND HUMAN CAPITAL

Israel's second wave of AgriFood-tech innovation is being driven by entrepreneurs with an unusual combination of experience in farming, the military, and academia. Most start-ups have at least one founder from a kibbutz (Figure 11). These Israeli farming communities have been the testing grounds for Israeli upstream AgriFood-tech through both its first and second waves.

Figure 11: Sources of Human and Intellectual Capital¹⁴



Some of today's AgriFood-tech innovators gained directly relevant training in the military's intelligence and tech units. In a Start-Up Nation Central survey of the sector at the end of 2018, 26% of 80 responding companies indicated that their solutions draw from their founders' military background. This was most frequently cited, not surprisingly, by start-ups based in ICT.

In addition, 43% of companies' leadership acquired their expertise through experience at global tech and AgriFood firms. Google, Microsoft, Intel, and IBM, among others, appear in founders' backgrounds, as do Monsanto, Bayer, and Syngenta. Academic and research institutions are also major contributors to the human and intellectual capital of the Israeli AgriFood-tech sector. Survey results showed 142 PhDs working in 50 of the AgriFood-tech companies that responded, and half of the companies partner with an Israeli academic institution.¹⁵ Many companies in this sector have a strong scientific basis necessitating such close collaboration.

Some of Israel's leading start-ups across the value chain are the direct result of academic research, and 17 start-ups license their technology from Israeli universities and research centers. These include Groundwork BioAg (Volcani); Future Meat, [ChickP](#), and [GemmaCert](#) (Hebrew University); ViAqua Therapeutics and [BactuSense Technologies](#) (Technion); and [Unispectral](#) (Tel Aviv University), among others. The Israeli sector is an example of a global hub successfully integrating the expertise of academic and research institutions – a synergy lacking in other AgriFood sectors in the world.



This start-up's embedded miniature sensor, which measures stem water potential to facilitate precise irrigation, is based on years of academic research and collaboration. The sensor enables farmers to better manage fruit size, improve grapevine quality, and prevent diseases such as fire blight in pears and hull rot in almonds, as well as helping growers of avocados, prunes, citrus fruit, and apples. Saturas recently won of a €1.5M grant from the European Commission's Horizon 2020 program.

¹⁴ Percentages relative to the total number of respondent companies per metric.

¹⁵ Start-Up Nation Central issued two surveys to the sector in the past year, which elicited responses from 105 companies (30% of the sector). The surveys were sent to C-level managers and asked about annual financing, crop focus, current and intended geographical markets, the education caliber of employees, the work experience of managers in other industries and global ICT or AgriFood corporates, and other topics.

SUPPORTING ENTITIES

INVESTORS

Despite the rise in investments, dedicated investors in this sector are still few. We count 181 unique investors that participated in deals since 2014, of which 156 (86%) have invested in only one start-up. Many of these investors seem opportunistic, while others might simply be new to the sector (96 new investors as of 2017). Since 2014, only three entities made 10 investments or more in the sector, including the IIA. Six investors have made 5–9 deals; 39 invested in 2–4 deals. Most investors are attracted by a particular company, founder, or technology rather than the sector itself. In particular, more investors with expertise in ICT are identifying a company in AgriFood-tech that utilizes these technologies, sometimes along with applications in other sectors.

The lack of dedicated investors reflects the early stage of the second wave as well as the perceived high risk associated with this sector, partially due to long testing cycles and the uncertainty about the willingness of farmers to adopt advanced technologies. This lack of investors is, in fact, a global challenge – there are not many dedicated VCs in AgriFood-tech globally, thus the total venture funding in this sector is relatively modest, totaling \$2.3B in 2018,¹⁶ much lower than what would normally be predicted given the scope and scale of the challenges.

As a result, government support programs play a big role, especially with early-stage companies. Two out of the three most active investors in AgriFood-tech in the last five years were technological incubators initiated by the IIA (see Table 4).

Trendlines is the most frequent investor by a wide margin. As both an incubator and the recipient of a small fund from Bayer, it focuses on early-stage rounds and plays a critical role in supporting new start-ups in the areas of inputs and cultivation tech. Trendlines' strategy is to make small investments with partners and to help them through validation, development, and go-to-market.

OurCrowd is the second largest investor in AgriFood-tech. With strong global AgriFood-tech partners such as [Finistere Ventures](#), its portfolio companies in the sector tend to be focused on data-driven processing tech for farmers and distributors.

Recently, generalist VCs [JVP](#) and [Pitango Venture Capital](#) have created funds that have AgriFood-tech as part of their mandate. Another generalist VC, [Viola Ventures](#), made an investment in the sector in 2018. These VCs are some of the largest sources of venture capital for the Israeli innovation ecosystem, and they are increasingly showing interest in directing investments to the AgriFood-tech sector.

Outside of Israel, prominent global financial investors have been investing in the Israeli sector since 2017, including some of the most active AgriFood-tech investors in the world, such as AgFunder, New Crop Capital, Finistere, and SVG Partners.¹⁷ New Crop Capital has already invested in three Israeli start-ups targeting Alternative Food Sources. These companies join global industry leaders Beyond Meat and Memphis Meats and make up the largest country contingent of the foreign minority in New Crop's portfolio.

Table 4: Most Dedicated Investors

Investor	Home country	No. of AgriFood-tech investments 2014–2019	Investor type
 Trendlines Medical · Agtech · Labs	Israel, Singapore	22	Incubator
 OurCrowd	Israel	11	Crowdfunding VC
 The Kitchen FoodTech Hub by Shalom	Israel	9	Incubator
 ICV	Israel	7	VC
 COPIA AgriFood Funding Sustainable Technologies	Israel	5	Private – Academic – Corporate partnership
 Agrinnovation Where the Future is Present	Israel	5	VC (academia)
 foodlab CAPITAL	Israel	5	VC
 GREENSOIL INVESTMENTS	Israel, Canada	5	VC

¹⁶ Pitchbook (accessed September 2019).

¹⁷ AgFunder AgriFood Tech Investing Report: '18 – Year in Review, AgFunder (2019) 57.



**VIOLA
VENTURES**

**VIOLA VENTURES –
ZVIKA ORRON, PARTNER**

Viola Ventures is one of Israel's largest financial investors, managing over \$1B in assets. Though the VC supports primarily Fintech and internet start-ups, it recently contributed a \$22M investment in Taranis, one of Israeli AgriFood-tech's leading second-wave companies. Viola Ventures' confidence in Taranis exemplifies the growing interest among investors from other high-tech sectors in Israeli AgriFood-tech.

“ On one hand, the long development period and seasonality that typify AgriFood-tech does not seem conducive to the VC model based on a projected exit within a few years. But the world's need for innovation in AgriFood-tech is serious enough that high-tech VCs need to take it seriously and adjust their timelines; they can expect substantial returns as the sector matures. Food security and measures to mitigate climate change are urgent issues worldwide. Environmental concerns such as these make innovation significant and valuable.

Environmental pressures and the need for solutions will likely force obstacles to market penetration, such as country regulations, to be relaxed, shortening the time it takes for start-ups to grow. Growth in business is essential for this sector, as the industry leaders will not act on hype but rather on demonstrated market value. Israeli innovators offer unusual tech and scientific innovation, but need local and international partners to help grow the business side of their enterprises. This is where VCs play an especially important role. ”

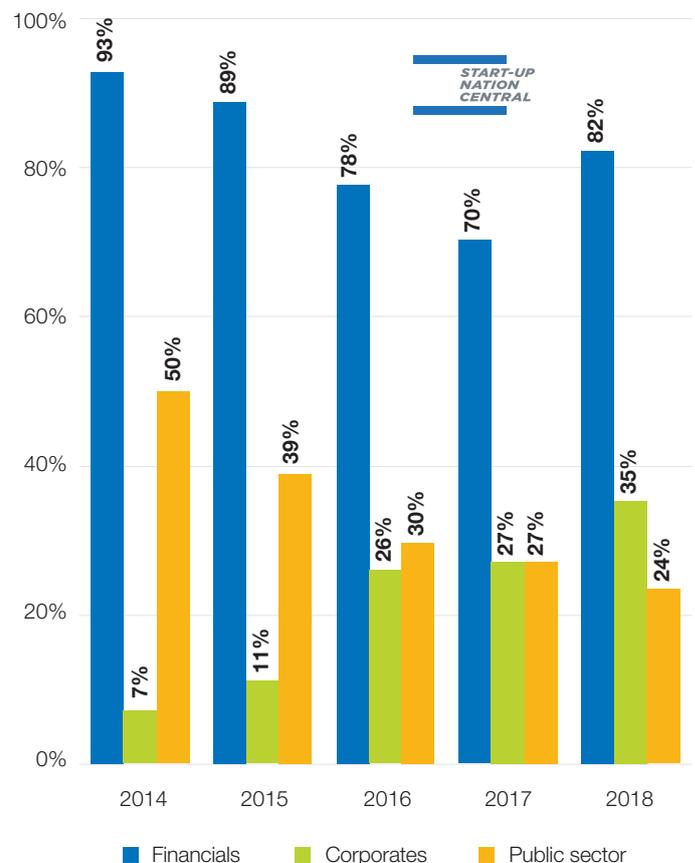
A clearer positive trend in AgriFood-tech is the growing inclination of corporate investors. Their participation in investment rounds grew four times over the last five years (Figure 12), reaching a level comparable to that of other tech sectors in Israel.

2017 was a breakthrough year in that some large CVCs invested in the sector for the first time, including Cisco and Qualcomm. Japan's Sumitomo also recently joined the sector, with an investment in Taranis last year and another in CropX this past August. Aleph Farms drew investment from Cargill and Switzerland's Migros earlier this year.

Other start-ups in Alternative Food Sources have similarly attracted corporate investors: DouxMatok's large B round this year is supported in part by Südzucker, and Future Meat's seed round in 2018 came from a group that includes Tyson Foods. As of September, Wilbur-Ellis began investing in Israeli AgriFood-tech through FieldIn. The increasing participation of these AgriFood-industry leaders, who would more naturally seek innovation close to their headquarters and major markets, suggests that they are finding Israeli AgriFood-tech innovation valuable and accessible.

We expect to see an increased number of foreign investors going forward as the number of larger rounds increases, as has occurred in other sectors. This has been evident in three of the larger rounds in 2019, each of which has attracted five or more foreign investors. But for the second wave to maintain momentum in producing new start-ups and maturing others, more dedicated investors are needed.

Figure 12: Investor Participation in Total Number of Rounds



EXITS

Exits in this sector in Israel have been rare in recent years. Since 2014 there have been 16 acquisitions, with all but two valued at under \$40M. Unlike other sectors in Israeli tech, AgriFood-tech has had only a few acquisitions by multinationals. It seems that multinationals in this industry do not often see start-ups as a natural fit for their core businesses and prefer to deal with them at arm's length (see section on multinationals below). As for public markets, the second wave is still quite young and will first require sources of late-stage capital.

The exit situation in Israel resembles that of the global sector, in which exits are much more common among start-ups further down the value chain. The second wave of AgriFood-tech is still growing, and start-ups worldwide, especially farmers, have yet to achieve the level of business that would boost their valuation and prompt bidders among the global agribusinesses.

MULTINATIONAL CORPORATIONS

Multinational corporations (MNCs) represent a very important part of the Israeli tech ecosystem, offering experience, know-how, networking, and partnership to many start-ups. Their involvement varies drastically across sectors, however, and involvement by the world's leading corporates is less in Israeli AgriFood-tech than in other sectors.

We divide MNCs into three main groups: the inputs-producing companies, namely the Big 4 – BASF, Bayer (owns Monsanto), ChemChina (owns Syngenta), and Corteva; the ABCD group (Archer Daniels Midland, Bunge, Cargill, and Louis Dreyfus Company) and other companies in cultivation, processing, and agricultural commodities trading; and large food manufacturers.

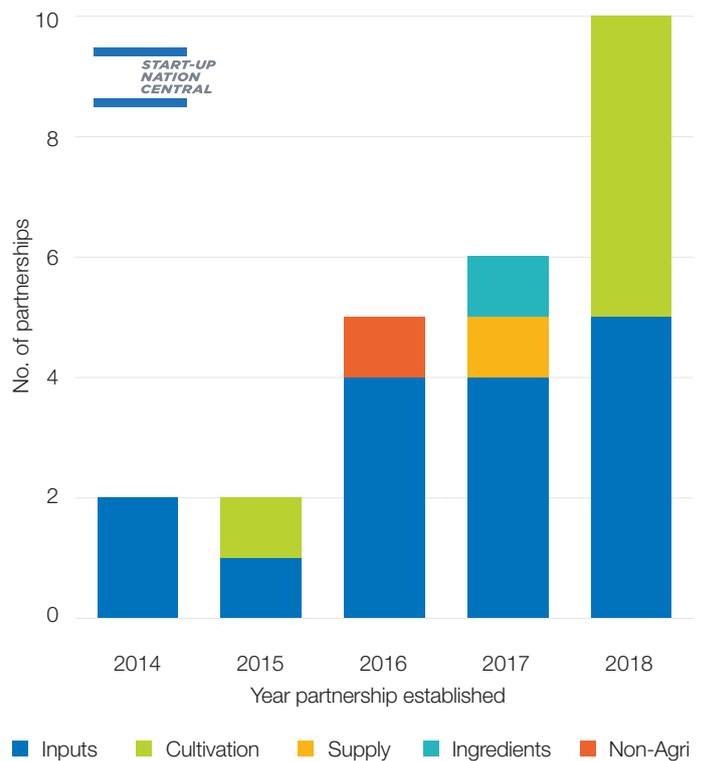
We have found 33 MNCs that have collaborated with the Israeli AgriFood-tech sector in 40 partnerships of various types (not including investments) since 2014, increasing in number annually (Figure 13). Most of these collaborations have been with an inputs-producing company (seven with one of the Big 4), and over half of all partnerships originated from 2018 forward, with 12 new ones in 2019 to date.

Significant partnerships with MNCs dealing with cultivation have appeared, especially since 2018, but most take place on farms outside Israel. The newest of the various MNC collaborations have come through the incubator program with The Kitchen and the innovative commercialization model developed by Copia. We have also identified 15 investments by MNCs.

The exceptions to this trend involve first-wave AgriFood-tech companies. [SCR](#), founded in 1976, was acquired in 2014 by Allflex for \$250M. The Israeli company's cow monitoring collars became a prominent feature of one of the three pillars of Allflex's business. The acquirer later rebranded to Antelq, which was acquired in 2018 by Merck for \$2.5B. Thus, an older yet innovative Israeli company indirectly participated in the largest global upstream AgriFood-tech acquisition in history.

Other major acquisitions have been secondary: [Netafim](#) was acquired by Mexichem in 2017 for \$1.5B, and [Frutarom](#) was acquired by IFF in 2018 for \$7B. These acquisitions demonstrate Israel's major contributions to technological standards in global AgriFood. They also underscore the fact that it can take many years for global agribusinesses to become convinced of the value of innovation.

Figure 13: New Partnerships between MNCs and Israeli AgriFood-tech Start-ups, with MNCs Value Chain Focus



THE “BIG 4” INPUTS PRODUCERS

The earliest stage of the value chain involves inputs that are sold directly to farmers, such as seeds and fertilizers. R&D in this area typically takes many years and is extremely capital intensive. Similar to the situation in Pharma, MNCs that produce inputs prefer to engage in joint R&D and POCs at a later stage of start-up development rather than becoming directly involved in the early stages. This results in fewer R&D centers, accelerators, and early investment in inputs by MNCs. Syngenta has been a notable exception, having hosted trials for a couple of young Israeli start-ups.

Of the Big 4, three are involved in POCs and/or co-R&D with Israeli start-ups: BASF, Bayer, and ChemChina. The fourth, Corteva, recently announced its intention to make a \$10M investment and take a 30% stake in [Lavie Bio](#), a subsidiary of [Evogene](#). Bayer has established a \$10M fund with Trendlines, and Syngenta (ChemChina) has invested in [Phytech](#) after acquiring two Israeli agribusinesses almost a decade ago, through which it established its Israeli research center.

AGRIBUSINESSES

The next stage of the value chain involves the actual growing process and the procurement and trade of agricultural commodities. One of the main activities of multinationals at this stage has been as distributors of developed Israeli technologies. We observe a few partnerships between global agribusinesses and Israeli start-ups including [Prospera](#) – Valmont, and Saturas – [NaanDanJain Irrigation](#).

We have not seen acquisitions, accelerators, or the establishment of dedicated R&D centers by multinationals in this area, despite Israel's strength in ICT for farms. This is puzzling, as these technologies have the potential to increase productivity while saving on inputs, thus responding proactively to environmental and market pressures.

Agribusinesses such as the ABCD group are, in fact, investigating innovation; some have an international set of innovation centers, and others are known to have an investment arm. But their engagement with second-wave innovation, especially in Israel, is restricted and

SUPPORTING ORGANIZATIONS

Several entities actively supplement business and community development for the Israeli AgriFood-tech sector. These groups typically help start-ups keep pace with market needs and assist them with introductions to potential investors or clients. The Good Food Institute, a major American nonprofit organization focused on vegetarian alternatives to animal byproducts, opened its Israeli branch in early 2019. [GrowingIL](#) of the Israel

remains either at the level of scouting or early-stage investment. Cargill is somewhat of an exception, as it has not only invested in the sector of late, but also has a co-marketing agreement with an Israeli AgriFood-tech start-up.

Nevertheless, despite the sector's acceleration, a more vibrant form of engagement with early-stage innovation in Israel is lacking. Apparently the development of advanced farm-based technologies is not an urgent priority for large agribusinesses, possibly due to a “wait and see” approach or the lack of a clear role in the supply chain. While it is obvious that such technologies will be in high demand in a few years, further market education and penetration is required to prompt more expansive programs for open innovation.

FOOD MANUFACTURERS

Foodtech refers to the downstream of the value chain and, while not covered in this report, has been the biggest attraction of multinationals in Israel. Some of the world's largest Food and Beverage companies have established R&D centers or co-development relationships in Israel, including Coca-Cola, PepsiCo, Mondelēz, Heineken, AB InBev, Bright Food, and Mars.

In most of these cases, the MNCs were attracted to Israel's downstream offering, which has acted as a gateway to upstream innovation. Scouting and partnerships are increasingly in the direction of inputs, cultivation technologies, and alternative food sources, coinciding with food manufacturers expanding their business scope to control more of their supply chain. Consequently, these food and beverage corporates may be the ones to meet the supply of AgriFood-tech left unclaimed by inputs corporates and agritraders.

Several recent investments support this hypothesis, occurring primarily among start-ups targeting Alternative Food Sources, including Cargill in Aleph Farms, Tyson in Future Meat, and PHW in SuperMeat and Redefine Meat. Besides these investments, AB InBev has announced plans to open an innovation hub in Israel specifically for AgriFood-tech later this year.

Innovation Institute, a nonprofit co-sponsored by the Israeli government and Start-Up Nation Central, designs partnership programs and holds regular meetups for Israel's AgriFood-tech entrepreneurs. The organization identifies market and sector needs and exposes them to entrepreneurs. It also recently established a database of early-adopter Israeli farmers to enable more start-ups to facilitate POCs.



AGRIFOOD-TECH AT START-UP NATION CENTRAL

SECTOR DEVELOPMENT PROJECTS

AgriFood-tech is a leading focus of activity at Start-Up Nation Central. As part of our sector development activities, we strive to strengthen Israel's AgriFood-tech sector, to become a dominant global hub – an innovation valley offering relevant solutions towards ensuring sustainable nutrition worldwide. We work with a wide range of leading global corporates and investors to understand their needs, introduce them to relevant Israeli start-ups, and create platforms for engaging strategically with Israeli innovation.

Over the past couple of years, Israel has become a leading hub for AgriFood-tech, attracting MNCs coming to Israel to scout for innovation and develop collaborations. Inputs companies, like Bayer, BASF, Syngenta, and Corteva; farmer co-ops like Agrial, Fonterra, and Euralist; agritraders including LDC, Olam, and Cargill; food corporates including Givaudan, Pepsi, Mondelez, and AB InBev, all see Israel as a leading player in the global AgriFood ecosystem, and are coming here to scout for innovation. Our hope is that these visits will turn into ongoing strategic engagements with Israeli innovation, rather than a one-time investment or collaboration with a specific start-up. Only by communicating with leading corporates and finding ways to work with players that can really bring technology to market and scale can Israel fulfill its potential to provide meaningful solutions to some of the world's most pressing challenges.

Aside from our work with corporates, we put a special effort on investors in 2019. While raising funding is challenging for every start-up no matter which sector, AgriFood-tech has certain characteristics which make this even more complex. As mentioned above, there are still very few strategic, focused investors, that have deep knowledge of the market and a developed global network which are necessary to help their start-ups succeed. While there has been a rise in CVCs and strategic investors worldwide it is often difficult for Israeli start-ups to connect with these, especially when they are still at an early stage. For this reason, we've created our

“Deal Flow Platform.” By filling out a simple [questionnaire](#) we invite AgriFood-tech investors and corporates to tell us their investment criteria and indicate their areas of interest. We then send a list of Israeli start-ups we believe can be relevant. After launching an alpha version, we have already worked with over 60 investors and corporates, leading to over 250 introductions between global players and Israeli AgriFood start-ups.

As accelerators become an especially effective way for start-ups to engage with strategic corporates, gain early-stage funding, and enter new markets, this is another direction we are currently exploring. We are happy to collaborate with international acceleration programs, to expose them to the Israeli ecosystem and find ways to adapt their program so that it is most attractive to Israeli AgriFood-tech start-ups.

We look forward to continuing our work towards strengthening Israel's AgriFood-tech ecosystem, to help it play a larger role in the global market. It is a pleasure being part of this meaningful, impactful ecosystem.

ENGAGEMENTS

Start-Up Nation Central hosts numerous engagements with multinationals throughout the year in order to introduce them to the Israeli innovation ecosystem. Since the start of 2018, we have hosted 11 companies in the AgriFood field for a full engagement consisting of multi-day meetings with Israeli start-ups and other relevant players. These companies, which come from a wide range of locales, include AB InBev, DowDupont, Louis Dreyfus Company, Migros, and the Syngenta Foundation. We have also hosted many other AgriFood corporates, investors, foundations, and NGOs for meetings and introductions.

Over the course of these engagements, SNC surveys the challenges common to many large corporates and provides this aggregate knowledge to Israeli start-ups so that they can better focus their solutions.

ABOUT START-UP NATION CENTRAL

Start-Up Nation Central is an independent non-profit that builds bridges to Israeli innovation. We connect business, government, and NGO leaders from around the world to Israeli innovation through highly customized business engagements and through Start-Up Nation Finder, an easy-to-use, free online platform for discovering and connecting with thousands of relevant Israeli innovators.

We identify technological sectors with high growth potential and help them develop to maturity. We are currently focused

on the Digital Health, AgriFood-tech, and Industry 4.0 sectors, providing them with exposure to global audiences, helping them develop practical tools, attracting investors, and establishing and nurturing tech communities to increase collaboration, knowledge-sharing, and skill expansion.

We accumulate knowledge and generate in-depth insights about Israel's innovation sector and share these findings with our clients and partners.

Start-Up Nation Central – Your Partner for Israeli innovation

ANNEX: METHODOLOGY

DATA SET

AgriFood-tech Sector – In this report, we include in the sector companies engaged in the agriculture value chain that are not directly connected to the consumer. For agriculture, this includes inputs production for farmers, cultivation- and preservation-related technologies, and the supply chain of farm products. For food, this includes the development of alternative food sources but does not include food sorting and processing, food delivery, or the purchase and consumption of food.

Israeli companies – We use Start-Up Nation Finder to identify all of the entities in Israeli AgriFood-tech. These are companies that were founded by Israelis, pursue R&D activities in Israel, and are not primarily service providers.

Time frame – The data used here is generally for the period spanning January 2014 to September 2019 unless otherwise stated. Start-Up Nation Finder has accurate data for this period. In some statistics we have augmented Finder data with other data sources, as indicated.

INVESTMENTS

This refers to any equity transaction (e.g. VC, corporate, or angel investments; private equity in growth stage) but excludes major liquidity events, which are considered exits. In cases where companies receive investments from incubators conjointly with grants from the Israel Innovation Authority, the latter are included in the funding amounts and are not separated. Investments include only the currently invested amounts and not future obligations that exist within the round. Some aggregate investment figures may include rounds that do not appear to the public on Start-Up Nation Finder and have been given to us in confidence by companies that are under the radar.

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For more information on the Israeli AgriFood-tech sector and the companies cited in this report, please visit:

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