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2022

IATI Israel's Life Science Annual Industry Report

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Herzliya Pituach, Israel   

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Executive summary

IATI Israel's Life Science Annual Industry Report provides the broadest, deepest view of this thriving industry. The continuity, the annual comparison and the long-term view, all make the Report the most comprehensive take on the Israeli Life Science Industry. As the Israel's Umbrella Organization of the High-Tech & Life Science industries, IATI continuously acts to connect and promote the country's massive resources of academic and technological prowess towards creating a fertile ecosystem which will nourish growth in the coming years as well.

The Israeli life science industry kept growing in 2021 despite the COVID-19 pandemic. Continuance increase in the number of companies, stable maturity levels and innovation in new and developing sectors, all contribute to the industry's success and its significant role in the Israeli economy. 2021 was a record year in capital raising from VCs, public offerings and other investors with a challenging H1 of 2022 in these aspects.

After putting a spotlight on the industry's rising sub-sectors in our prior report, we focus this time on some new promising sub-sectors and following up on those we have identified in the past. This is in addition to the traditional sub-sectors discussed in our prior reports. The spotlight is put on those sectors not only because they are fast populated by new companies and attract more investments, but mainly as being leaders in innovation and multidisciplinary abilities, demonstrating the industry's ability to take advantage of the excellence in academic research, deep government support and the innovative ecosystem in Israel.

The healthtech industry has been experiencing dramatic changes due to the COVID-19 pandemic. From unique collaborations with players coming outside of the life sciences industry through fast paced adoption of digital health and remote health solutions, the pandemic had a huge impact on the industry. This also led to a record year when it comes to funding, as aforementioned.

The healthcare landscape is continuing to shift towards a more integrated ecosystem, converging biopharma, medtech, digital health and healthcare into a single bioconvergent industry. This emerging bio-convergent healthtech space holds great potential to make a transformative impact on health and healthcare practices. When it comes to holding a leading position in this emerging bio-convergent field, Israel has substantial strengths and capabilities. The new shifts and trends in the Israeli Health Tech space were all demonstrated for the first time in a conference driven by IATI by the industry and for the industry in continuation of the legacy of the MIXIII conference.

A broader discussion on Israel's value proposition in the bio-convergence sphere can be found in the "Bio-Convergence Revolution" chapter of this report.

The healthcare system is confronting skyrocketing costs, while the biopharma industry is coming up against aggressive pricing pressures. In an effort to meet these challenges, the healthtech industry is seeking new innovation growth engines.

Israeli life science companies can play, and in many ways already are playing, a leading role in facing the coming challenges. Fostering digital health innovation to address actual needs and not perceived ones, for example, can lead to significant improvements in integrating technological solutions, even from sources outside of traditional healthcare. We invite you to read insights from the field in the "How Can the Israeli Health-Tech Industry Reduce the Cost Burden" chapter and throughout the report.

We would like to warmly thank Omer Gavish, Partner, Pharmaceuticals & Life Sciences Leader at PwC Israel, for all the support in preparing this Report; Dr. Ami Appelbaum Chairman and Dror Bin, CEO of The Israeli Innovation Authority for supporting our Report and for partnering with us on promoting the industry throughout the year; Prof. Yossi Matias, Vice President, Engineering & Research, Google; Dr. Yair Schindel, Co-Founder & Managing Partner and the team of aMoon Fund; Oded Har-Even, Co-Managing Partner, Sullivan & Worcester Tel-Aviv; and Dr. Ruth Dagan, Partner, Head of Environment & Climate Change, Herzog Fox & Neeman.

Here's to another year of Israeli Health- Tech pride!

Karin Mayer Rubinstein

CEO & President

IATI

Yaacov Michlin

Chairman

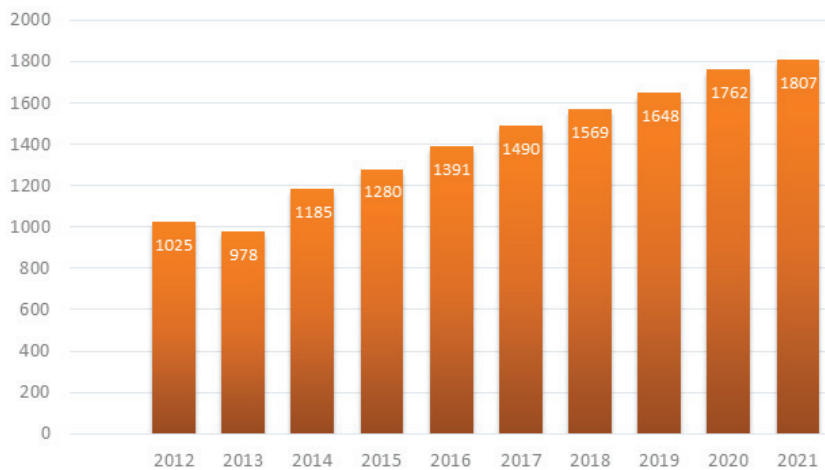
MIXiii Health-Tech.IL

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Israel's Life Sciences Industry

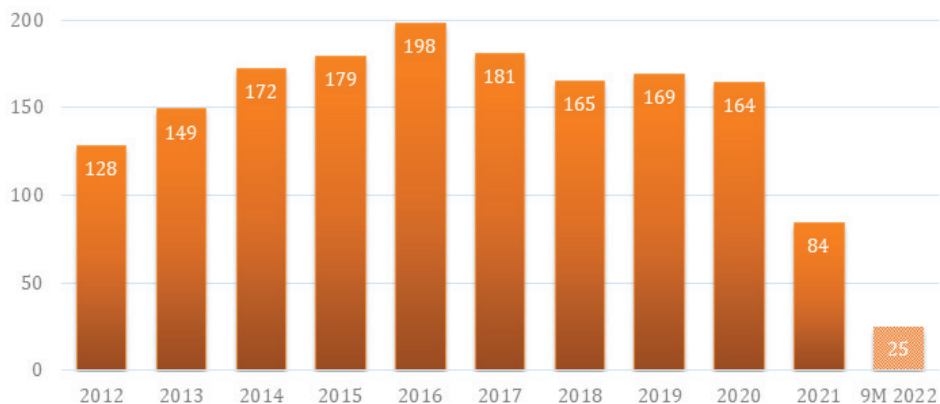
According to our own database and estimates, as well as other databases, as of the third quarter of 2022 approximately 1,800 life science companies are active in Israel (Figure 1). Over 1,600 life sciences companies were established in Israel in the last decade (Figure 2), and approximately 750 companies discontinued their operation, resulting with an increase of more than 80% in the number of active life sciences companies. While between 2014 and 2020, the number of newly established companies is above the decade average of 105 companies every year, only 84 companies were established in 2021. This figure is the lowest in the past decade and corresponds with global trend of steep decrease in life science companies established throughout 2021. This trend continues with only 25 life science companies established in the first nine-months of 2022.

Figure 1 - Cumulative Number of Active Life Science Companies (at the end of the period)



Source: IVC-Online Database
IATI Database

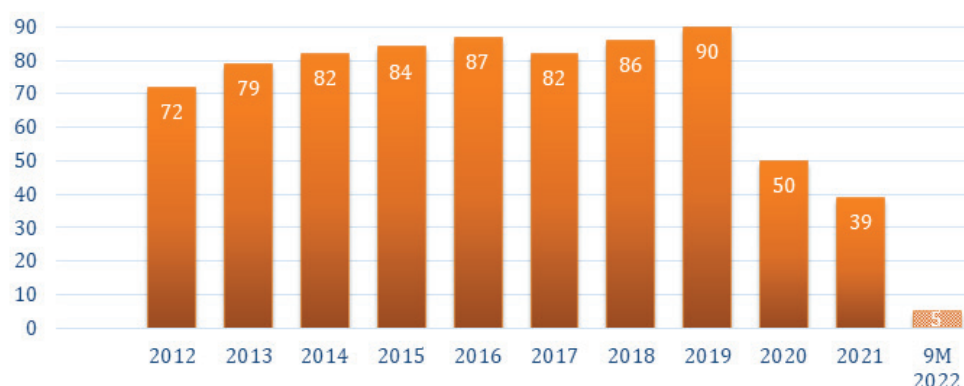
Figure 2 - Number of Israeli Life Sciences Companies Established (2012 - Q3 2022)



Source: IVC-Online Database
IATI Database

750 life sciences companies, or 75 companies every year on average, ceased to operate in the last decade for various reasons such as insufficient funding and immature technologies (Figure 3). Most of the companies which ceased their operation in 2021, were from the Digital Health sub-sector (47% of the companies), similar to the percentage of this sub-sector out of the companies established on the same year. Overall, this subsector continues to thrive with a slightly higher percentage of the companies year over year.

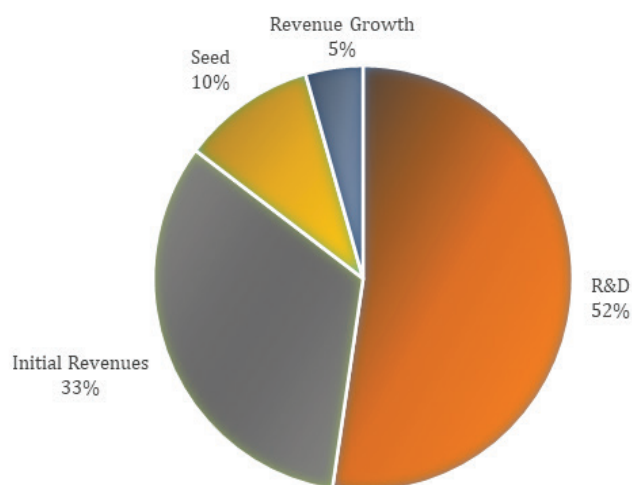
Figure 3 - Number of Israeli Life Science Companies Discontinuing Operations (2012 - Q3 2022)



Source: IVC-Online Database
IATI Database

The maturity stage of life sciences companies did not change much over the last few years. 38% of the total active life sciences companies are in advanced stages. This percentage is stable over the last few years, as well as the percentage of companies in initial revenue and revenue growth stages (included in the advanced stages), with 33% and 5%, respectively (Figure 4). The remaining of the companies are mainly in R&D stage, representing 52% of the total active life science companies.

Figure 4 - Number of Active Israeli Life Science Companies by Stage

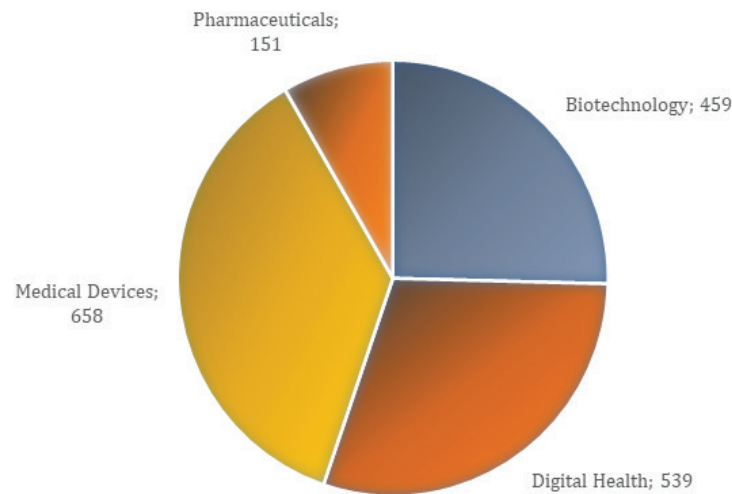


Source: IVC-Online Database
IATI Database

➤ Israel Life Sciences Industry Sub-Sectors

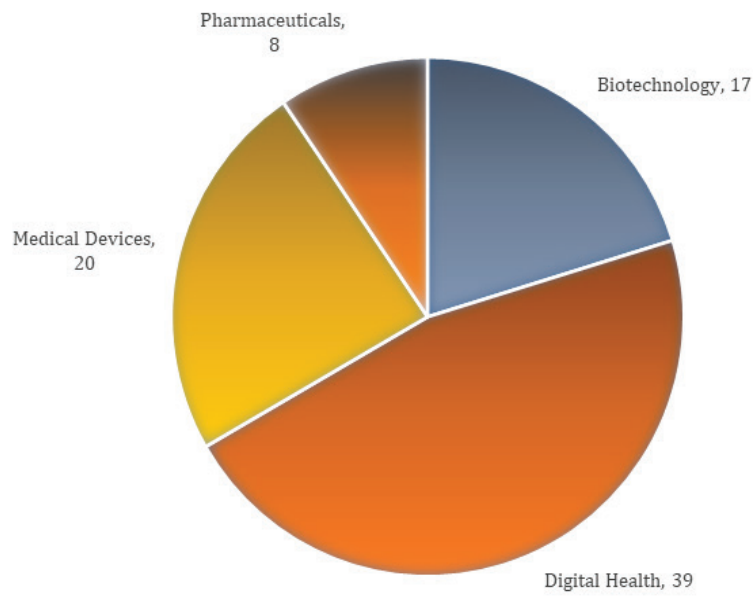
The Israeli life sciences industry can be generally divided into four major sub sectors - Digital Health, Medical Device, Biotechnology and Pharmaceutical Therapeutics. Historically, the industry is heavily biased towards medical devices, and this remains the same this year as well. Medical devices represent approximately 36% of the life science companies in 2021, however its percentage has decline in 4% compared to 2020. Digital Health is the next largest sub-sector, representing 30% of the life science companies and its percentage has increased in 3% compared to 2020, making it the most growing sub-sector for both 2020 and 2021. The number of the companies in Biotechnology and Pharmaceuticals sub-sectors is stable compared to 2020 (Figure 5). Looking at the first nine months of 2022, the percentage of all the sub-sectors remains the same as in 2021.

Figure 5 - Israel Life Sciences Industry Sub-Sectors



Source: IVC-Online Database
IATI Database

Figure 6 - Number of Israeli Life Sciences Companies Established (2021)

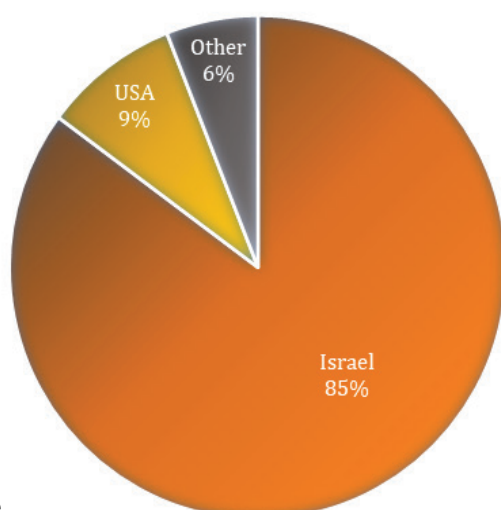


Source: IVC-Online Database
IATI Database

➤ Israel Life Sciences Industry by Geographic location

As mentioned above, there are approximately 1,800 active Israeli life sciences companies. Although all these companies are incorporated in Israel and were founded by Israeli entrepreneurs, and while their main operations are in Israel, some of the companies' headquarters are located in foreign countries. However, these companies are the minority, and for the vast majority of the companies, 85%, the headquarters are located in Israel (Figure 7).

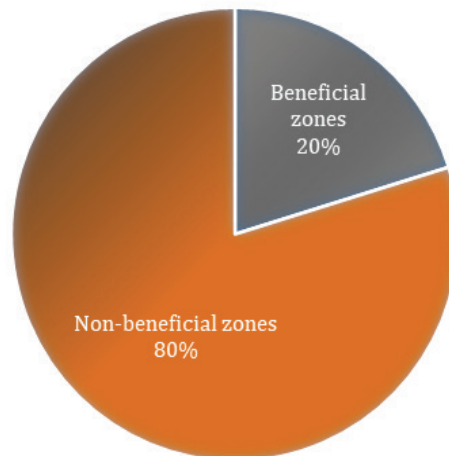
Figure 7 - Headquarters' Location of Israeli Life Science Companies by Country



Source: IVC-Online Database
IATI Database

The development of industrial zones in the periphery is viewed by the State of Israel as a growth engine of the Israeli economy. To encourage entrepreneurs to bring their companies to these areas, the State of Israel identified National Priority Areas and Development Zones, in which companies can be entitled to certain economic benefits. Although these benefits can be substantial for many companies, 80% of the life sciences companies as of 2021 chose not to locate their headquarters in these areas (see Figure 8). This percentage, which is stable over the years, can be explained by the fact that many of these companies are still in early stages, while most of the benefits are relevant to more mature companies and for production facilities. Therefore, companies can have their factories or other production facilities in these areas while their headquarters are located in non-beneficial areas.

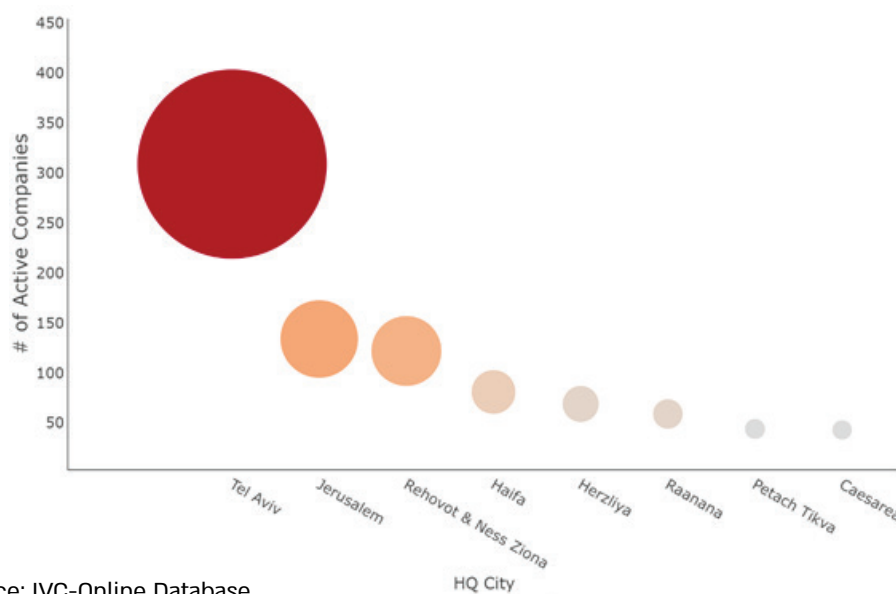
Figure 8 - Headquarters' Location of Israeli Life Science Companies by Beneficial/ Non-beneficial Zones



Source: IVC-Online Database
IATI Database

As most of the companies are located in non-beneficial areas, it is not surprising to see that they are located in the central cities and close to hospitals or research institutions. Tel-Aviv, with 20% of the life-sciences companies, continues to be the city with the highest number of life sciences companies and the only city in Israel hosting more than 10% of the Israeli life sciences companies. Tel Aviv is also the city with the highest growth in the percentage of companies, and we believe this is a result of the increase in the digital health sub-sector. Jerusalem, with 9% of the companies, is followed by Rehovot and Ness-Ziona which are both located next to the Weizmann Institute of Science, with 8% when referred to as one location (Figure 9). Haifa is the fourth, exceeding Herzliya by 1%.

Figure 9 - Headquarters' Location of Israeli Life Science Companies by City



Source: IVC-Online Database
IATI Database

Israel Life Sciences Industry Rising Sectors

The following sectors, typically included under various sub-sectors and not identified separately in the data shown in this report, are a few of the sectors identified by us as the rising sectors in the Israeli life sciences industry. We believe that these sectors, together with these identified by us in our prior reports, will be the future engines of the Israeli Life Science Industry and will draw a larger portion of investments, efforts and support.

Wellness¹

Why Wellness, Why Now?

Wellness is defined as “the active pursuit of activities, choices, and lifestyles that lead to a state of holistic health”.² This pursuit is often individual but influenced by one’s surroundings. It comprises many spheres, including emotional, spiritual, mental, social, physical, vocational, and sometimes financial. Therefore, the pursuit of leading a healthy life is where all of these components are considered. The Global Wellness Institute defines wellness as a *process* of building habits, not a state of being (i.e. being happy) or an ultimate destination.

Today, this holistic view of health is not exclusive to the wellness world. The World Health Organization defines health as a state of complete physical, mental and social well-being and not merely *the absence of disease or infirmity*. This paradigm shift, where the holistic philosophy of wellness converges with the world of health, has been years in the making due to increased healthcare expenditures³. Chronic noncommunicable diseases have become the leading source of early mortality rates, surpassing those of communicable diseases. Noncommunicable diseases⁴ kill 41 million people annually (equivalent to 74% of all deaths globally), 77% of which occur in low and middle income countries⁵. Chronic disease going undiagnosed until it is too late has led to a fundamental change and focus on preventative care and wellness rather than curative care in traditional healthcare.

Promoting wellness to prevent chronic disease has become a priority all across the board, from the individual consumer to employers, insurance companies, governments, academia, hospitals, and the healthcare system, bringing together many disciplines under the wellness umbrella. This crossover also includes Biopharma, Medtech, Digital Health, and Healthcare into a single bio-convergent industry.

¹ With the support of Welltech Ventures

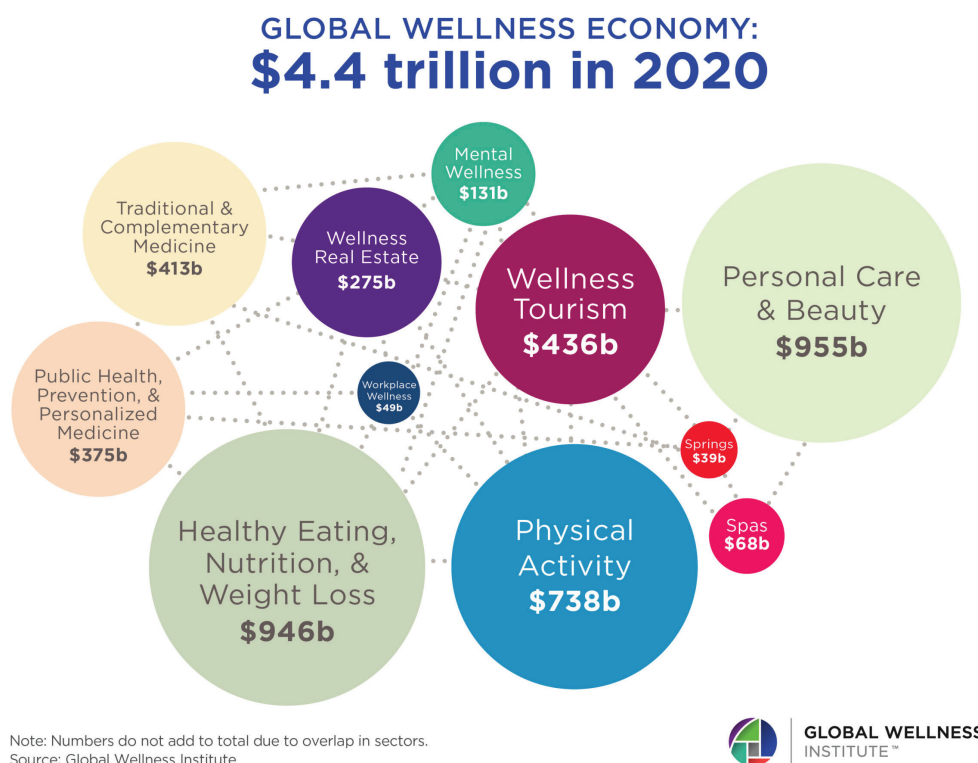
² <https://globalwellnessinstitute.org/what-is-wellness/>

³ <https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NHE-Fact-Sheet>

⁴ <https://www.cdc.gov/globalhealth/healthprotection/ncd/global-ncd-overview.html>

⁵ <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>

Figure 10 - Global Wellness Industry in Size



Global Wellness Industry Size

The Global Wellness industry has been on the rise in recent years. In 2020, the global wellness economy was valued at \$4.4 trillion, and the figure is only increasing post-Covid 19 pandemic. It is predicted to reach nearly \$7.0 trillion in 2025, with a 10% annual growth rate⁶. This growth is spurred by increased adoption of preventative care to reduce healthcare expenditures caused by chronic diseases and by groundbreaking technologies that make wellness accessible to the masses.

Technology - The Wellness Enabler

Technology can support individuals and organizations in their pursuit of wellness. It can range from apps to reduce anxiety, improve sleep and fitness, to telemedicine and digital health solutions to promote and improve one's physical and mental wellness.

Today, the lines between health and wellness startups are blurred as more wellness technologies rely on clinical trials and science-backed claims to bring their products to market. This blurring of lines has led to a whole new field that brings together engineering and life sciences, known as bio-convergence, which is of particular significance to startups.

⁶ <https://globalwellnessinstitute.org/industry-research/the-global-wellness-economy/>

The past decade has seen the rise of groundbreaking technologies that rely on AI, big data, and machine learning to bring wellness to the masses. Today, some wellness startups have already

Israel - A Fertile Ground for Innovation & Wellness

While Israel has been a world leader in tech for the past two decades, it is only in the last couple of years that the Israeli ecosystem has seen rapid growth in wellness. This rapid increase in wellness technologies is due to global trends, market demands, and the Israeli ecosystem's legacy as a fertile ground for innovation. Furthermore, due to Israel's centralized healthcare system, clinical trials are relatively easier to complete in Israel, an attractive option for wellness startups. Another trend we've identified at Welltech Ventures is experienced founders and serial entrepreneurs from more traditional Israeli tech sectors, such as Cyber and Fintech entering the wellness and health tech arena.

There are hundreds of wellness-specific startups in Israel today and thousands of more that touch upon the wellness space - from digital health, sports tech, agrotech, climate tech, and food tech companies. For example, when food tech companies are built on the concept that "food is medicine", it feeds into the holistic concept of wellness and preventative care, thus making it part of the wellness ecosystem even though they may not be classified as such on public record.

Emerging Global Wellness Trends

- **Remote Care & Preventive Medicine, Telehealth & Telewellness**

The COVID-19 pandemic undoubtedly accelerated the need and adoption of remote care, a trend gaining traction in the last decade. Between 2017-2020 alone, 20% of startups founded Remote care, mainly made up of "monitoring" and "telehealth" are also significant pillars of preventative care.

Remote care technologies offer patients a virtual HMO solution for primary care, mental health, monitoring, and preventative care.

The widespread adoption of these technologies has also given way to the digitization of care and the aggregation of data otherwise not accessible, using machine learning that allows for more precise, personalized care based on shared parameters.

- **Mental Health, Neuro-Wellness & Sleep Wellness**

Mental health is perhaps one of the most talked about trends in the media and popular culture of today. While there was an increase in new mental wellness startups in both 2019 and 2020, the true growth has occurred post-pandemic. In 2021, global mental health apps market size was valued at USD 4.2 billion and is expected to expand at a compound annual growth rate of 16.5% from 2022 to 2030⁷. Mental health app downloads increased during the pandemic as people felt lonely and depressed, offering significant growth opportunities in the digital health and mobile health space.

Mental health apps also offer personalized and accessible care, with solutions such as one-on-one therapy, anxiety management apps that generate a daily mental health score based on how people interact with their phone, and therapeutic games to maintain overall health and stress to a minimum. Technologies also exist to improve symptoms of mild-to-moderate depression and anxiety through the use of Facilitating Thought Progression (FTP), integrated into a mobile gaming solution that requires only a few minutes each day to deliver results. In addition, devices and wearables that reduce stress hormones by activating the parasympathetic nervous system, providing immediate drug-free relief are also entering the market.

With 1 in 6 people in the UK alone having a neurological condition, another field gaining traction is neuro-wellness (neurological wellness). This focuses on emotional wellbeing, mood enhancements, and innovation. Both academic researchers and startups are studying the scientific relationship between our body's control center (the brain) and emotional health, bringing drug-free innovations such as devices and apps into this space. One example is an app that offers motor and cognitive evaluations that can lead to Parkinson's and Alzheimer's early diagnosis with nothing more than a smartphone.

Quality of sleep is also being addressed by wellness technologies. With 1 in 3 Americans not getting enough sleep, sleep represents a space in desperate need for innovation. Wireless technologies are being developed to monitor medical-grade sleep patterns using multimodality measurements of EEG, EOG, EMG, and ECG to diagnose sleep disorders based on an advanced cloud machine learning algorithm, all in a natural, at-home sleep environment. Sleep wellness solutions are becoming more accessible and readily available as technology advances.

⁷ <https://www.grandviewresearch.com/industry-analysis/mental-health-apps-market-report>

- **Fitness Technologys**

Another trend that accelerated during COVID-19 isolation is the adoption of fitness technologies. While wearable fitness devices with the ability to gather biometric data and derive data-driven insights to improve one's overall wellness were already part of the mainstream, the demand for these increased during the pandemic. As the need for staying fit while socially distancing increased, so too did digital solutions for working out. Fitness technologies continued to be developed not only in the wearable device space, but also computer-based methodologies to make workouts more efficient, more social, and help people fulfill their physical goals anywhere at any time.

- **Nutrition & Food Technology**

Nutrition is an integral part of the wellness philosophy of using "food as medicine". Digital technologies that support a balanced diet include counting calories, virtual clinical nutritionists and dieticians, and one-on-one support similar to that of telemedicine. Nutrition tech today offers a holistic, science-backed view of health with clinical nutritionists. We're seeing disruptive technologies in the nutrition space aimed at making the food one consumes healthier. For example, technologies that reduce sugar in food are gaining traction; combining agile-integrative computational protein design with precision fermentation in order to design a new protein for food and beverages.

- **Wellness Sustainability**

In 2022, climate change is no longer possible to ignore. With extreme heat and one environmental disaster after the other, sustainability has become top of mind for all global stakeholders. The wellness space is no exception. Sustainable wellness is the notion of considering people's wellness while taking consideration of the environmental impact this may have. Technologies in wellness sustainability include integrating deep tech with system biology to develop animal free protein-based products, using fermentation to create plant-based proteins, as well as agritech solutions that promote sustainability.

- **Wellness Metaverse**

As the rise of the metaverse becomes mainstream and cross-disciplinary, the space is ripe with opportunity and particularly attractive for wellness. Virtual reality (VR) can promote wellbeing in the workplace through relaxation sessions (imagine entering a rainforest, aquarium, or natural scenery). In one study with NHS staff, wellness improved

after VR experiences. VR can also enhance workplace wellbeing by creating immersive experiences for remote teams that otherwise don't have social interactions.⁸ But the wellness metaverse is not limited to the workspace and corporate setting. Extended reality (EX) and VR technologies are being developed to support mental health and help more accurate medical diagnoses, as physicians can use augmented reality (AR) to overlay digital images on a patient in person.

Wellness Technology Will Continue to Rise

The need for wellness solutions accelerated by the COVID pandemic coupled with the convergence of the health and wellness industry and the focus on preventative care has made innovations in this space grow at record speed. As we look toward 2023, this growth is only expected to expand and rely on science to bring wellness innovations to the masses.

⁸ <https://pmclegacy.ncbi.nlm.nih.gov/pmc/articles/PMC8905197/>

FoodTech and Biomedicine⁹

Together, Biomedicine and FoodTech Exemplify Synergy in Biotechnology

Biotechnology solves problems by harnessing naturally occurring processes in living organisms. Often, a naturally occurring process can solve numerous problems, making biotechnology's breakthroughs applicable in multiple settings. Both food technology (FoodTech) and biomedicine imitate the most intricate elements of living nature, so it should come as no surprise that many of these fields' frameworks and capabilities intersect.

Biomedicine has helped lay the groundwork for many of the proprietary technologies and patents now advancing FoodTech, including fundamental mechanisms, techniques and principles essential for innovation. This includes technology transfers from academia to industry that have allowed research in biomedical engineering laboratories to form the foundation of scalable platforms for cell-cultured food products.

Between FoodTech and biomedicine lies a two-way street

The space between FoodTech and biomedicine is neither incidental nor trivial, and just as biomedicine has played a significant role in propelling FoodTech, the converse is true as well. In addition to the widely acknowledged concept of "food as medicine," advances in molecular biology, computational design, tissue engineering and other life sciences have enabled many other facets of FoodTech to become highly translatable to medical applications.

Macronutrients (fats, carbohydrates and proteins), vitamins and minerals are all imperative for high quality nutrition, making food items essential as any commodity can be. This perpetual and unavoidable demand for quality nutrition makes FoodTech a steady and reliable source of innovation, much of which seeks to achieve health-focused goals shared by biomedicine.

⁹ With the support of Didier Toubia, Co-Founder & CEO at Aleph Farms

Precision fermentation - the same technology for shared health goals

For ages, fermented food items were produced through controlled microbial growth and the conversion of foods' composition through enzymatic reactions. Common examples of foods and ingredients fermented in this way include wine, beer, yogurt, tempeh, and sauerkraut. The fermentation process involves adding starter cultures such as yeast or other fungi to raw materials like soya beans and cabbage, enabling the microorganisms in the starter culture to transform the raw materials biochemically (e.g., by developing nutrients) and organoleptically (i.e., taste, texture, etc.)¹⁰.

Today, *precision* fermentation is turning microorganisms into hosts capable of producing complex organic structures needed for specific ingredients or entire food items, many of which are geared towards improving human health. While the use of yeasts in bread-baking, beer-brewing and other food and beverage production goes back thousands of years, these single-celled eukaryotes are now being harnessed to make the proteins found in cow milk. Instead of placing yeast *inside* a system, precision fermentation converts yeast *into a system itself*, turning it into a sort of factory for the desired proteins. The result is being able to make cow milk¹¹ - the very same commodity dairy consumers know and love - without potential risk factors like lactose or certain cholesterol.

Similarly, agricultural biotechnologists are working to alter and remove proteins that cause allergic reactions in specific foods. Computational design is developing the proteins¹² behind healthier sweeteners that reduce reliance on sugar, a leading cause of obesity, diabetes and other health problems.

Precision fermentation is contributing not only to health-focused goals, but also to making health products themselves. For instance, some of the technology supplying cellular agriculturalists with recombinant proteins for growth media implements the same methods to create dietary supplements for heart health¹³.

¹⁰ <https://ourworld.unu.edu/en/benefits-of-traditional-fermented-foods>

¹¹ <https://www.remilk.com/science>

¹² <https://www.calcalistech.com/ctech/articles/0,7340,L-3917187,00.html>

¹³ <https://www.wacker.com/cms/en-us/products/applications/dietary-supplements/heart-health/heart-health.html>

A growing symbiotic relationship between branches of biotech

As food-related health challenges become more complex, the relationship between biomedicine and FoodTech stands to become even stronger. The latter's capacity for lowering the risk of foodborne illnesses and antimicrobial resistance directly contributes to the most fundamental goal of biomedicine – making and keeping people healthy. Large global authorities on food safety and health¹⁴ are paying increasing attention to FoodTech's ability to create safe and scalable sources of nutrition.

Together, both biomedicine and FoodTech are making great strides in empowering humanity to create more resilient food systems and overcome prevailing challenges in global health.

¹⁴ <https://www.fao.org/food-safety/news/news-details/en/c/1604412/>

Addressing Climate Change through Bioscience and Biotechnology Innovation¹⁵

Introduction

Simultaneously with the publication of this report, nations of the world are coming together in Sharm El-Sheikh for the 2022 United Nations Climate Change Conference (COP 27). As delegates commence discussions, strong commitments are expected from both governments and the business sector towards achieving the Paris Agreement mitigation goal of limiting global warming to below 1.50c.

It is widely agreed that this "all hands on deck" state of urgency requires utilization of much more than what are considered to be "traditional" technologies for addressing climate change, such as solar energy and electrification. As a result, we are evidencing an exponential growth in diverse fields within the climatech ecosystem, which has become a lucrative \$13.8 billion industry in 2021 and is expected to reach \$147.5 billion by 2032¹⁶.

The world of climatech is comprised of numerous technology fields including clean manufacturing, circularity and materials, green construction and buildings, smart agriculture, alternative foods, clean energy, water technologies, clean transport and supply chains, and nature tech along with broad applications of digital technologies such as emission reduction measurement, big data analytics and AI.

Many of the relevant scientific and technological disciplines are closely connected to one another and at times intrinsically intertwined. Furthermore, numerous tech companies currently operating in the climatech space had their origins in completely different fields and for different purposes, while only recently realizing their true calling was addressing climate change. For example, high-tech companies originally founded to provide digitized data collection tools to increase profitability of manufacturing plants, have discovered that with a dedicated shift in their product, it could become a game-changing tool in reducing process-related carbon emissions – thus, clean manufacturing technologies emerged. A similar evolutionary process being witnessed in recent years is the gradual turn of life science and biotechnology companies towards a focus on climate-related applications and solutions.

¹⁵ With the support of Dr. Ruth Dagan, Partner, Head of Environment and Climate Change Practice, Herzog..

¹⁶ <https://www.futuremarketinsights.com/reports/climate-tech-market>

Bioscience and Biotechnology at the Forefront of the Climate Challenge

In examining the science of biology at the intersection of climate change, it becomes clear that the connection is infinite. It is reflected in all aspects of life – how we eat, how we live, whether we succumb to the effects of climate or prevail.

It is thus estimated that the application of biosciences and biotechnology to climate-related challenges harnesses the potential to mitigate the equivalent of 3 billion tons of carbon dioxide annually by 2030, which reflect roughly half of the USA's total annual emissions¹⁷. Furthermore, while mitigation is key, biosciences equally hold solutions to climate adaptation challenges, as we prepare to live in a warmer environment with increasingly volatile climate patterns.

There are numerous ways in which biosciences and biotechnology can contribute to the fight against climate change. These include the following¹⁸:

- **Bioenergy and Biomaterials** – biofuels and biomaterials are gradually replacing petrochemicals and GHG emission-intense construction materials such as concrete. Bio-products are geared to revolutionize energy and raw material consumption in manufacturing processes, infrastructure and buildings. Examples include construction materials grown from fungi and bio-fuels produced from algae.
- **Agtech and Foodtech** – food production is responsible for a staggering one-quarter of global greenhouse gas emissions. The ability to engage in sustainable agriculture and low-carbon food production is key to both climate change mitigation and adaptation, while biosciences and biotechnology innovation is at the forefront in confronting this challenge. Cellular agriculture is allowing for the development of new strains of rice and other grains, while cutting-edge technologies are allowing for the production of cultured meat and dairy proteins in laboratory conditions. These will all result in drastic reduction of methane emissions resulting from food consumption.
- **Molecular Biology and Synthetic Biology** – gene editing allows growing organisms that are not only adapted to climate change but can help fight it. Trees and plants are being engineered for enhanced photosynthesis and new plant species are being cultivated to lock away more carbon, and faster. Rearrangement of genes creates new biological carbon-fighting systems such as pollution-removing microbes.

¹⁷ [Climate Report Executive Summary_FINAL.pdf \(bio.org\)](#)

¹⁸ [13 ways bioscience is helping fight climate change \(rsb.org.uk\)](#)

- **Climate Change and Health** – building resilience to the effects of climate change is a critical component in addressing the global climate challenge. This includes not only adaptation to rising temperatures and sea levels, but preparedness for the possible spread of diseases and increased prevalence of pandemics. Here too, life science - based applications come into play and will have a significant impact on human adaptability to climatic effects in coming decades.

Israel's Role in Addressing Climate Change through Bioscience and Biotechnology

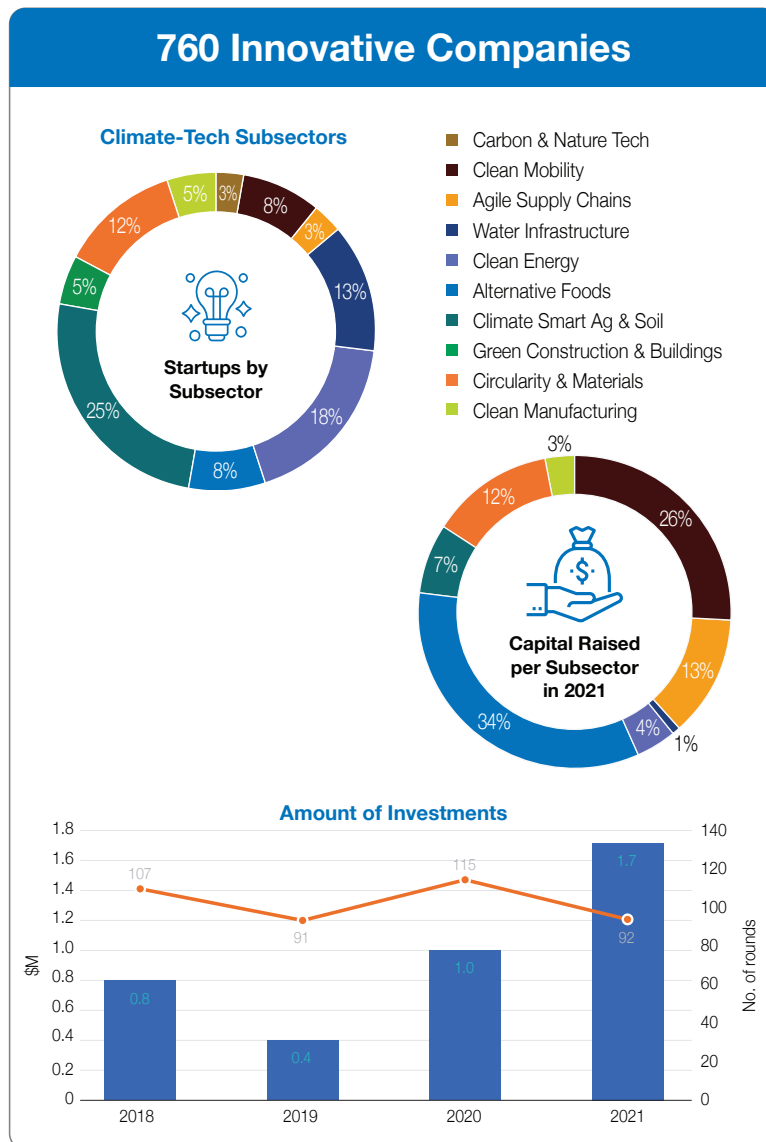
It is no secret that similar to global trends, Israel's climatech ecosystem is booming. It is estimated that the Israeli sector has seen investments in the range of \$5.2 billion between the years 2018-2021 while in the first half of 2022 alone they totaled an estimated \$1.47 billion¹⁹.

While it is unclear from sectoral breakdowns precisely what portion of this funding went to bioscience and biotechnology related companies, figures indicate this portion could be significant. According to Startup Nation Central data²⁰, 34% of capital raised in 2021 went to the alternative foods sector. 12% went to circularity and materials and 7% to climate smart agriculture.

¹⁹ <https://www.planetech.org/planetech-world-Israel's-State-of-Climatech-2022-Update>.

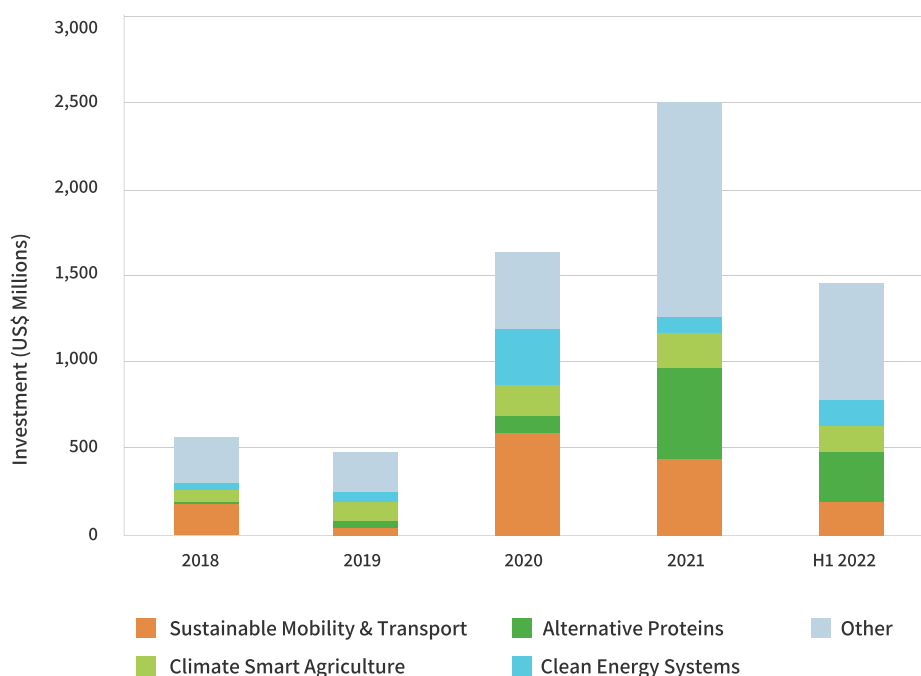
²⁰ https://startupnationcentral.org/wp-content/uploads/2022/07/Climate_tech_2-pager-JUNE22.pdf

Figure 11 - Capital raised by subsector in 2021



Source: Start-Up Nation Central - The Israeli Climate-Tech Sector

Figure 12 - Investments in Israeli Climate Tech Startups



According to PLANTech data²¹, out of approximately 700 startups identified in the climatech space in Israel, close to 140 are classified as operating in the climate smart agriculture sector, close to 60 in alternative proteins, over 70 in materials and circularity and tens of additional startups in related fields including forest and land ecosystems, oceans and water ecosystems and biodiversity.

Based on global climatech projections, this upward trend is expected to continue. Moreover, Israel has pledged as a matter of national policy, to promote its climatech capabilities worldwide and essentially become the "Climatech Nation"²². This fact alone will do much to advance climatech companies originating in Israel, bioscience and biotechnology sectors included. This government-backed agenda has helped to create a flourishing ecosystem of entrepreneurs, investors and experts, all working together towards a mutual goal²³.

²¹ <https://www.planetech.org/planetech-world-Israel's State of Climatech 2022 Update>.

²² https://www.gov.il/en/departments/news/spoke_climate241021

²³ Primary initiatives include those pioneered by the Israeli Ministry of Environmental protection, Ministry of Energy, Innovation Authority, PLANTech and Startup Nation Central. <https://innovationisrael.org.il/growth/pilot/environment>; https://www.gov.il/he/departments/news/press_120922 ; <https://innovationisrael.org.il/kol-kore/energypilot> ; <https://www.planetech.org/abinbev-planetech-innovation-lab>

Most significantly, in June 2022 the Israeli Government resolved to invest NIS 3 billion through 2026 to support national climate innovation. This resolution was approved following work of an inter-ministerial committee led by the Ministry of Environmental Protection, the Ministry of Energy and the Innovation Authority. The primary stated goals under the resolution are to accelerate development of climate technologies in Israel and to mobilize these technologies to meet Israel's climate goals while building upon the relative advantages of Israeli innovation and implementing incentives for the business sector in Israel to become involved²⁴.

This most recent resolution comes at the heels of several early programs which were initiated by various relevant government bodies to promote climate tech in Israel. These include funding and grants by the Ministry of Environmental Protection in collaboration with the Innovation Authority as early as 2018, to support climate-related pilot programs by Israeli technology companies with the aim of accelerating development, implementation and commercialization of climate and environment related technologies²⁵. Under this program, a number of the grants awarded were to companies in the biosciences and biotechnology space (examples include companies offering crop protection solutions and new bio-based construction materials)²⁶.

Looking ahead, there can be identified several key trends which will affect the development of this ecosystem, as well as a number of challenges it is expected to be faced with.

Future Outlook - Key Trends, Challenges and Opportunities

Bioscience and biotechnology-based solutions can play a transformative role in the global effort to both mitigate climate change and adapt to it. However, these particular technology fields are abound with challenges and obstacles. Most significantly, such solutions are subject to stringent regulation worldwide and are characterized by lengthy approval processes²⁷. This, together with the burdensome and capital-intense processes associated with the POV stage and the heavy infrastructure element involved in climate tech technology implementation in general, create significant barriers for entrepreneurs in the field.

²⁴ https://www.gov.il/he/departments/news/climate_260622

²⁵ <https://innovationisrael.org.il/growth/pilot/environment>; https://innovationisrael.org.il/press_release/5994

²⁶ https://innovationisrael.org.il/general_content/4120

²⁷ <https://www.weforum.org/agenda/2022/05/biosolutions-clear-path-to-fight-climate-change/>

The fact that the Israeli government has decidedly focused on funding major initiatives in this space will do much to support companies having to overcome these obstacles. However, funding alone will not be enough and a major government effort will have to be made to reduce regulatory and bureaucratic barriers. An additional major effort will have to be undertaken to streamline processes and regulations in relation to those existing in other OECD countries and particularly in the US and the EU, in order to support global implementation and scaling of innovative solutions originating in Israel.

One of the central recent initiatives by the Israeli Ministry of Environmental Protection is the publication of the Green Taxonomy²⁸. The Israeli Taxonomy, mirroring the EU Green Taxonomy²⁹, is a list of activities which shall be regarded as compliant with set sustainability criteria and therefore eligible for investments from financial institutions and investment funds. The publication of the Israeli Green Taxonomy will go far to promote investment in the climatech sector and in biotech-for-climate specifically.

Two key opportunity areas can be identified going forward for companies in the biotech-for-climate space:

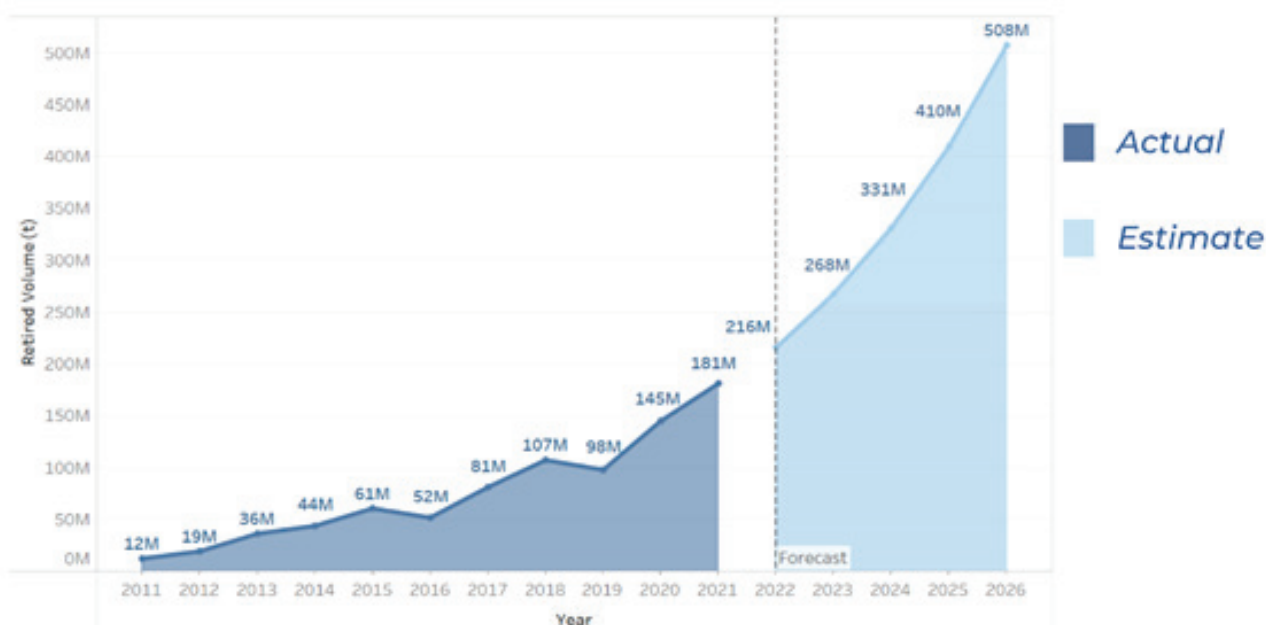
- **Harnessing Digitization and Infrastructure Innovation to Create Scalability**
- transitioning from laboratory and pilot phases to scaled POV and ultimately to scaled solutions for global implementation are a major challenge in any technology field. For bioscience and biotechnology innovations in particular, integration of scaled digital solutions in the fields of big data, AI and carbon measurement can be game changing. The majority of biotech- for-climate initiatives existing today can benefit from adoption of such technologies, which are abundant within the Israeli tech sector and we are likely to be seeing such joint initiatives come to fruition in coming years.

²⁸ A draft of the Israeli Green Taxonomy was released for public comment on October 26th, 2022. https://www.gov.il/he/Departments/publications/Call_for_bids/taxonomy

²⁹ https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

- Leveraging Carbon Markets to Fund R&D and Implementation Projects** - in recent years the overall value of global carbon markets has skyrocketed³⁰. Projections through 2030 and beyond remain consistent and predict exponential growth in both voluntary³¹ and compliance market transactions, while having potential for synergies through international and bilateral carbon trading under Article 6 of the Paris Agreement³². Looking to 2030 and 2050 net zero targets set by the business sector, multinationals and financial institutions are incorporating market elements into their corporate decarbonization strategies. In doing so, they are intensively looking to identify both short-term and long-term investments which could be potentially produce future carbon offsets and credits. With bespoke tailoring of projects and offerings, this market can be significantly leveraged by biotech-for-climate startups and allow for both early-stage funding and for project financing.

Figure 13 - Global Voluntary Carbon Market - Evolution of Demand and Forecast



Source: South Pole

³⁰ <https://www.worldbank.org/en/news/press-release/2022/05/24/global-carbon-pricing-generates-record-84-billion-in-revenue>

³¹ <https://www.southpole.com/reports/voluntary-carbon-market-trend-report-2022>

³² https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf

Conclusion

The application of biosciences and biotechnology to climate-related challenges harnesses the potential to mitigate the equivalent of 3 billion tons of carbon dioxide annually by 2030. While it unclear precisely what portion of the booming Israeli climatech market can be attributed to bioscience and biotechnology related companies, figures indicate this portion could be quite significant. Based on global climatech projections, this upward trend is expected to continue.

For bioscience and biotechnology innovations in particular, integration of scaled digital solutions in the fields of big data, AI and carbon measurement can be game changing. Furthermore, tailoring projects within the biotech-for-climate space to global carbon market demand can be significantly leveraged to create investment and financing opportunities.

AI for Healthcare³³

The advancement of AI is already transforming health and wellness, and in the years to come, we can expect to see further breakthroughs and developments that will improve healthcare for billions of people globally. Machine learning is opening the door for advances across multiple medical fields, from the use of genomics for personalized healthcare to the use of imaging and diagnostics for the early detection of diseases such as breast cancer and diabetic retinopathy. Research teams and technology companies such as Google on one hand, and traditional pharmaceutical and life sciences on the other hand, are investing in the development of these types of AI technologies and applications that can help medical professionals deliver better care and can help make care more accessible for patients around the world.

Applying artificial intelligence to applications in endoscopy and minimally invasive surgery - a case study from Verily, an Alphabet precision health company and its Israel R&D Center

Verily is a subsidiary of Alphabet that is using a data-driven, people-first approach to change the way people manage their health and the way healthcare is delivered. Launched from Google X in 2015, Verily's purpose is to bring the promise of precision health to everyone, every day.

In August 2021, Verily opened a new R&D Center in Israel. It was established after successful early research conducted by Google Health and Jerusalem's Shaare Zedek Medical Center on the application of AI in detection of colonic polyps. The Verily Israel team is focused on applying artificial intelligence (AI) techniques to important biomedical problems, including applications in endoscopy, minimally invasive surgery and other imaging modalities. A key focus of the team is using AI to assist in identifying potentially cancerous growths that traditional colonoscopies sometimes miss. In addition, the team aims to develop a suite that supports surgeons and gastroenterologists in their daily activities before, during and after procedures. The Verily Israel team is led by Ehud Rivlin, Professor of Computer Science at the Technion, who worked with Google Health and joined Verily to establish and lead Verily Israel. Verily continues to collaborate closely with Google Health and Google's global Health AI Research team led by Yossi Matias, VP Engineering & Research at Google and managing director of Google Center in Israel.

³³ With the support of Verily Israel, a subsidiary of Alphabet, and Google

Diving in: Colonoscopy

Part 1: The need

As the third most common malignancy and the second most deadly type of cancer, colorectal cancer (CRC) was diagnosed in an estimated 1.9 million new cases and resulted in 0.9 million deaths worldwide in 2020³⁴. Recommended screening via colonoscopy is well known to be the most effective measure for reducing diagnoses and dramatically mitigating the risk of death³⁵. CRC originates in small pre-cancerous lesions in the colon, called polyps. During a colonoscopy, the gastroenterologist or other GI specialist uses a camera-containing probe called a scope to examine the large intestine for pre-cancerous polyps and early signs of cancer. These physicians can also simultaneously remove the tissue, or polyps, that appear worrisome. However, some complicating factors limit the effectiveness of colonoscopies, such as incomplete detection (in which the polyp appears within the field of view, but is missed by the GI, perhaps due to its size or shape) and incomplete exploration (in which the polyp does not appear in the camera's field of view). Both factors can lead to a high fraction of missed polyps. In fact, studies suggest that 22%–28% of polyps are missed during colonoscopies, of which 20%–24% have the potential to become cancerous.³⁶

Part 2: The AI solution in development

Verily is developing a Computer Aided Detection (CAD) solution intended to increase polyp detection rates without interrupting physician workflows. The solution is in active development, pending regulatory registrations and is not available for sale. One can simplistically think of this solution for colonoscopy as another GI expert - a second set of eyes observing the same video in real-time and supporting the overall process to reduce the number of polyps that may be missed. This AI-based system digests the live procedure video in real-time, examines the video for polyps and marks them for further examination by the GI specialist.

Behind the scenes, these functionalities rely on sophisticated video processing by trained deep computational neural networks. As in many other machine learning tasks, gathering sufficient labeled data is of prime importance, and the labeling must be done by domain experts. Verily-developed algorithms are then typically trained on this data while leveraging the most up-to-date self-supervised learning techniques.

34 Xi Y, Xu P. Global colorectal cancer burden in 2020 and projections to 2040. *Transl Oncol.* 2021 Oct;14(10):101174. doi: 10.1016/j.tranon.2021.101174. Epub 2021 Jul 6. PMID: 34243011; PMCID: PMC8273208.

35 https://www.cdc.gov/cancer/colorectal/basic_info/prevention.htm

36 Leufkens AM, van Oijen MG, Vleggaar FP, Siersema PD. Factors influencing the miss rate of polyps in a back-to-back colonoscopy study. *Endoscopy.* 2012 May;44(5):470-5. doi: 10.1055/s-0031-1291666. Epub 2012 Mar 22. PMID: 22441756.

Part 3: Partnership with Medical Staff and Hospitals

We believe that a development process should be enabled by strong established partnerships with leading hospitals and GI experts in Israel and abroad.

An example of such a partnership, is the research conducted by Verily, Google Health and Jerusalem's Shaare Zedek Medical Center (SZMC), overseen by Shaare Zedek Scientific and the hospital's Innovation Center, on the application of AI in detection of colonic polyps, and was published in *Gastrointestinal Endoscopy*³⁷. The study was approved by SZMC's Institutional Review Board (IRB) and complied with all requirements set by local regulators and the Ministry of Health. Patients who chose to participate in the initial study signed informed consent forms (ICF).

The SZMC study was followed by a larger investigator initiated, randomized controlled trial (RCT) at Elisha Medical Center in 2021. The results of this RCT were presented at UEGW, one of the largest worldwide conferences of GI specialists, held in Vienna, Austria in October 2022. The conclusions of this first Israeli clinical trial demonstrate that the AI system can significantly improve both ADR and APC³⁸, two important measurements for determining the quality of colonoscopies, while having a low false alert rate.

Partnerships such as these, support a vast and continuous data accumulation and labeling process. For example, Verily Israel has been licensing thousands of videos of colonoscopy procedures along with relevant metadata from partnering hospitals. Gastroenterologist annotators from around the world are labeling large portions of this anonymized data establishing ground truth for training Verily's ML models.

Part 4: From Colonoscopy to Surgery

Endoscopy is a procedure using a direct imaging system to see inside the body. Colonoscopy is one of several examples of endoscopy. Over the past two decades, numerous innovations and advancements in endoscopic and minimally invasive procedures have been developed across medical and surgical specialities, enabling faster recovery for the patient. AI capabilities have been applied to new domains of minimally invasive surgery, with research that covers both intra-procedural and post-procedural analysis for teaching, training, and quality improvement.

37 Dan M. Livovsky, Danny Veikherman, Tomer Golany, Amit Aides, Valentin Dashinsky, Nadav Rabani, David Ben Shimol, Yochai Blau, Liran Katzir, Ilan Shimshoni, Yun Liu, Ori Segol, Eran Goldin, Greg Corrado, Jesse Lachter, Yossi Matias, Ehud Rivlin, Daniel Freedman, *Detection of elusive polyps using a large-scale artificial intelligence system (with videos)*, *Gastrointestinal Endoscopy*, Volume 94, Issue 6, 2021, Pages 1099-1109.e10, ISSN 0016-5107

38 APC - the total number of adenomas detected during screening colonoscopies per total number of procedures. ADR- the number of screening colonoscopies with at least one adenoma per total number of procedures

Conclusion

The potential for AI to revolutionize healthcare is significant and we are already seeing the value of applied research in medical domains. As shown above, Verily Israel's unique AI expertise and exceptional engineering and research teams, combined with growing healthcare needs and opportunities, open up new horizons for novel research and development. Their efforts are further enhanced through close collaboration with Google Research in Israel and globally.

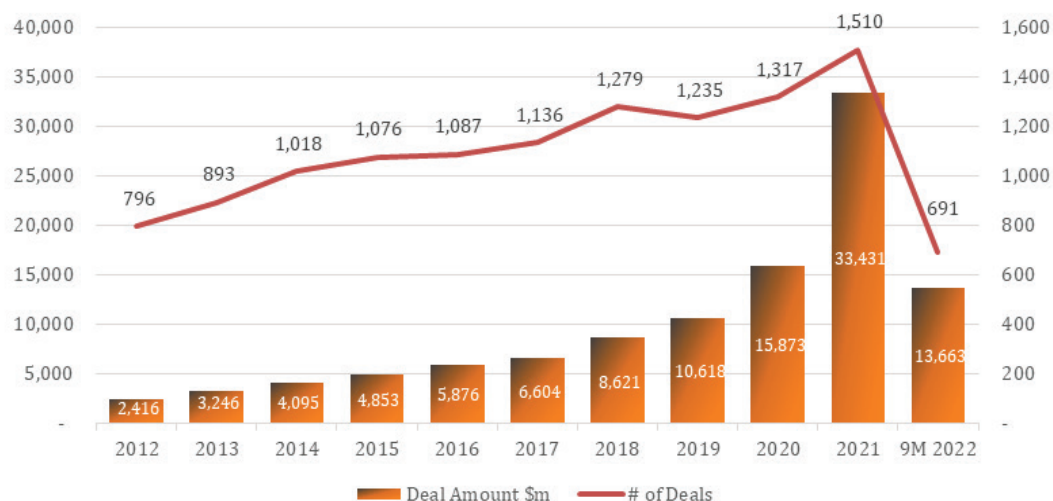
Israel High-Tech Funding

There are many funding sources for the Israeli life sciences industry, and the main ones are the Israel Innovation Authority, micro-funds and angels in the early stages, and venture capital funds (both Israeli and foreign), corporate investors and IPOs in the more advanced stages. We based our funding data mainly on information from our own database, as well as the IVC-Online Database and different global sources. While we note that exact figures are hard to come by, as the definitions used by various industry reports are different, these sources captures capital raised by Israeli High-Tech companies from local and foreign venture capital funds as well as other investors such as foreign or Israeli investment companies, corporate investors, incubators, accelerators and private investors like angels and angels' clubs. Similar to our prior reports, capital raised on public stock exchanges is reported separately in this chapter.

In 2021, Israeli companies raised \$33.4 billion in private investments, shattering 2020's previous record of \$15.8 billion in funding. Effects of macro-economic forces spurred the capital raising by Israeli high-tech companies throughout 2021 and as a result the average deal size was almost doubled from \$12.1 million in 2020 to \$22.1 million in 2021.

Recently, the Israeli high-tech sector is in the midst of a market correction. While the private sector is followed by the corrections in public stock exchanges, Israeli high-tech companies raised a relatively impressive amount of \$13.7 billion in the first nine-month of 2022. Although this amount is close to the funding raised in the whole of 2020, it still represented a decline of 41% compared to the first nine-month of last year.

Figure 14 - Israeli High-Tech Companies Capital Raising (2012 - Q3 2022)



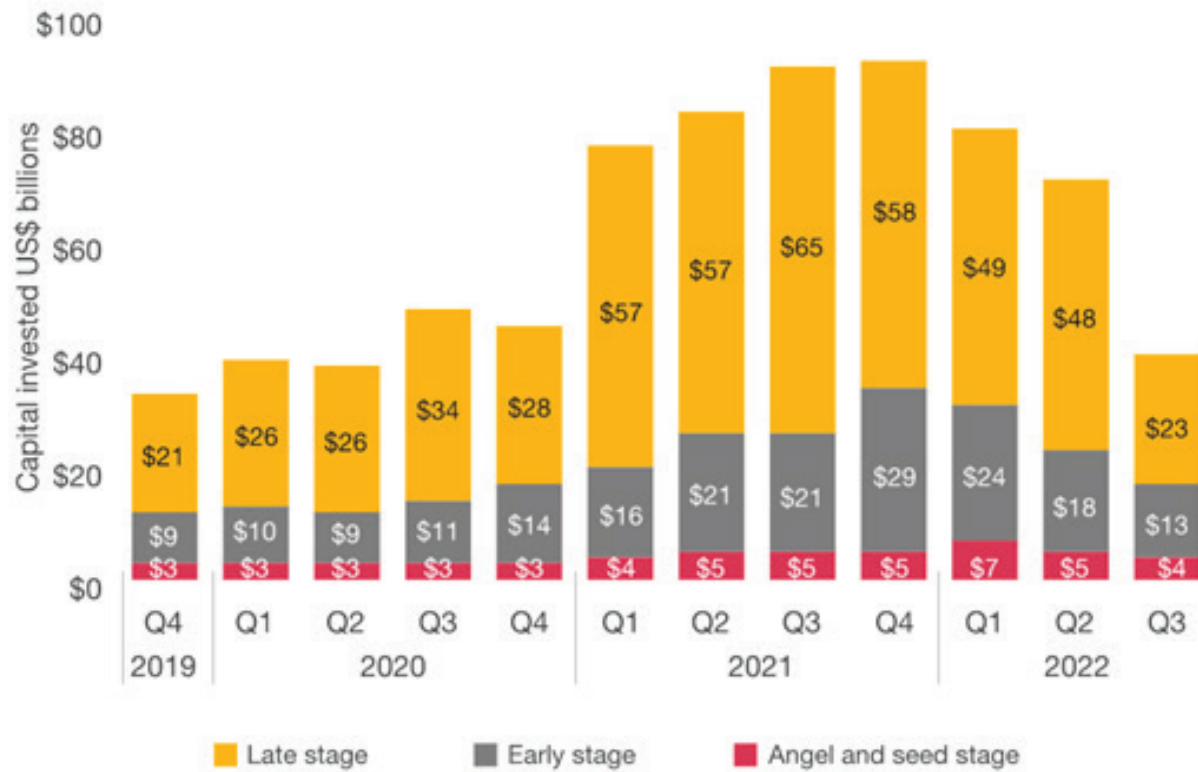
Source: IVC-Online Database
IATI Database

As we often see, the trend in Israel is similar to the trends in the US. According to the PwC Q3 2022 Capital Markets Watch report³⁹, the total US VC investments increased from \$170 billion in 2020 to \$343 billion in 2021 (Figure 15).

Throughout the first nine-months of 2022 VCs in the US invested \$191 billion, a decrease of \$60 billion or 24% compared to the same period last year. This decrease is not as steep as the one seen in Israel. In Q3 2022 alone, only \$40 billion were invested, the lowest level in the last two years. The decline was due to a long list of uncertainties, most notably the inflationary environment and corresponding rate hikes.

³⁹ <https://www.pwc.com/us/en/services/consulting/deals/capital-markets-watch-quarterly.html>

Figure 15 - PwC Capital Markets Watch Report - Venture Capital Deal Value



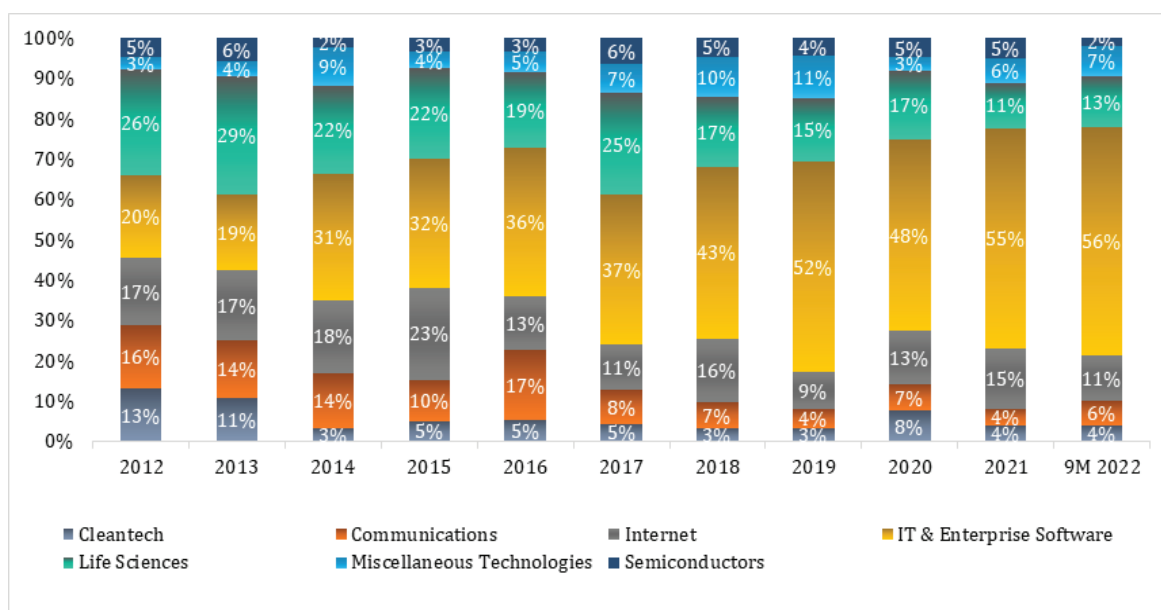
Source: Capital Markets Watch Report Q3 2022

➤ Israel Life Sciences Sector - Funding

Funding of the life sciences sector continues to grow in 2021, attracting funding of approximately \$3.8 billion - a new record for the last decade - and an increase of 41% from 2020 (Figure 17). However, the growth in the life sciences sector funding is lower than the growth of the entire Israeli high-tech capital raising in 2021, similar to the trend we have seen in the last few years. The portions of life sciences sector funding from the entire Israeli high-tech capital raising in 2021 and in the first three quarters of 2022 are 11% and 13%, respectively, lower than the 10 years average. It is important to note that although the portions are lower than prior years, as capital raising in Israeli high-tech has grown continuously over the past 10 years, the amounts related to the life science sector have also grown (Figure 16).

Throughout the first three quarters of 2022, \$1.7 billion were invested in life science companies, a decrease of \$0.5 billion or 22% compared to the same period last year. The Israeli high-tech funding in general and the Israeli life science sector in particular, are affected by global macro-economic trends, and we see a certain slowdown in investments in 2022 (mainly in Q3 2022).

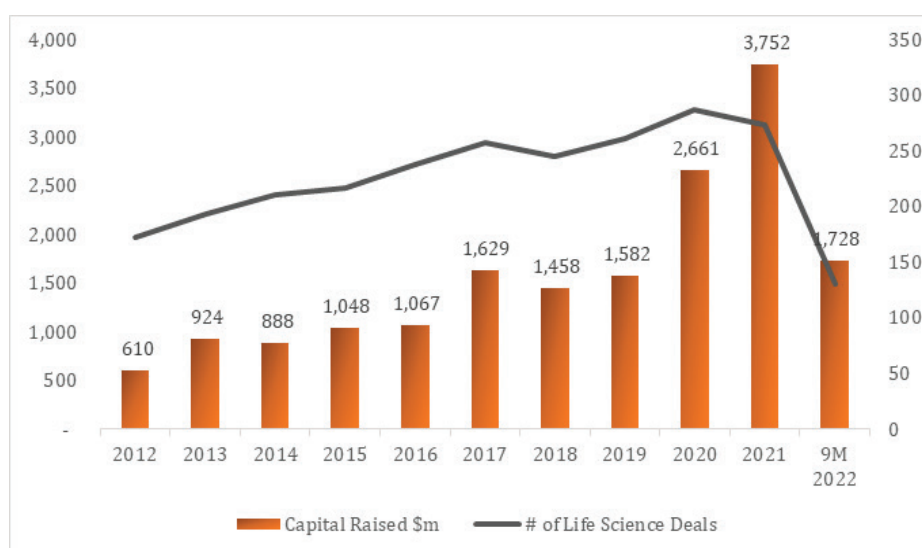
Figure 16 - Capital Raised by Israeli High-Tech Companies, by Sector (2012 - Q3 2022)



Source: IATI Database
IVC-Online Database

The number of life science companies involved in investment deals increased in 2021 in a lower pace than the amounts invested, resulting with a record high average funding per transaction of \$13.7 million. In the entire year of 2021 and in the first three quarters of 2022, 274 and 131 life science companies were involved in investment deals, respectively (Figure 17). Although we see only a slight decrease in the average funding per deal, to \$13.2 million, there is a significant decrease in the capital raising activity in 2022 and the number of the deals accomplished was less than 35% in the first three quarters of 2022 compared to the corresponding period in 2021.

Figure 17 - Capital Raised by Israeli Life Sciences Companies (2012 - Q3 2022) - \$ millions

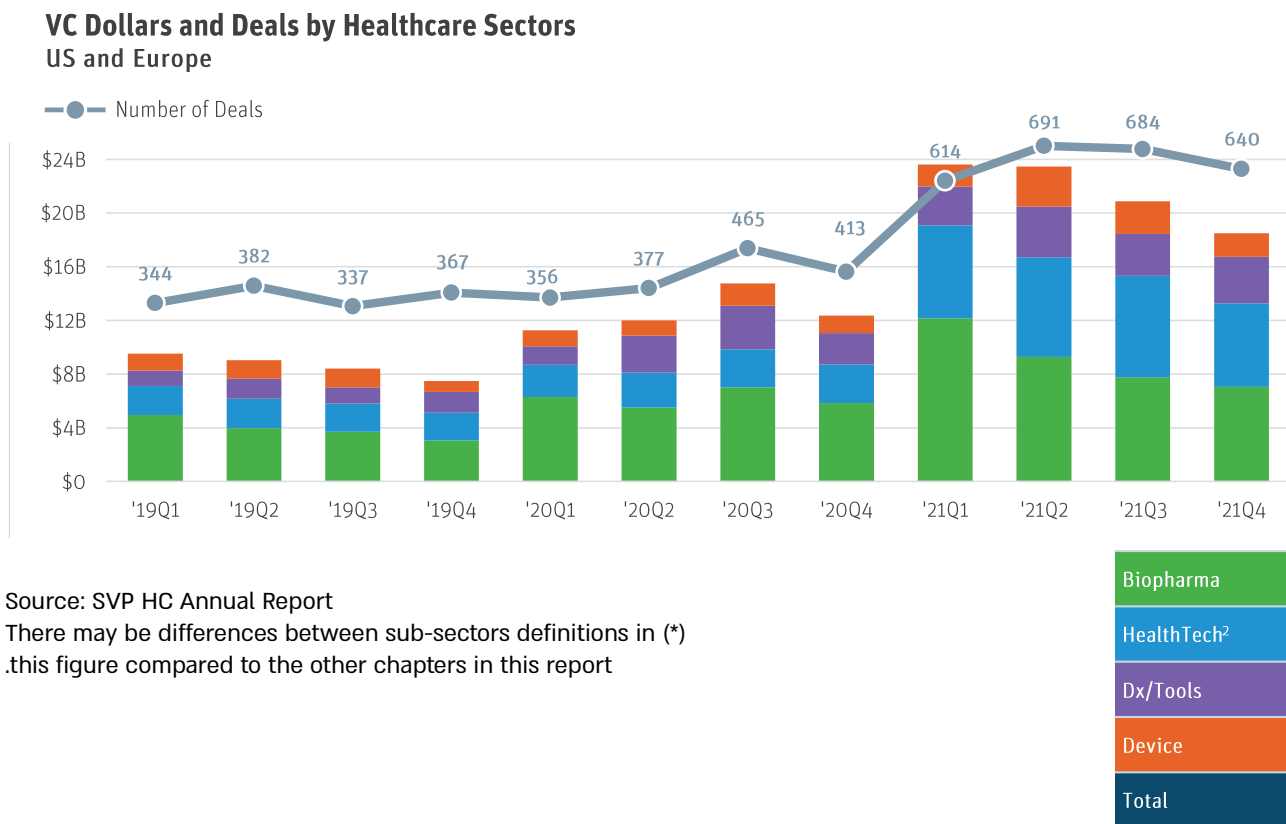


Source: IATI Database
IVC-Online Database

Similar trend can also be seen in the life sciences sector in the US and in Europe. According to Healthcare Investments and Exits report by Silicon Valley Bank⁴⁰, overall healthcare investment has more than doubled from \$34 billion in 2019 to \$86 billion in 2021 (Figure 18), with Q2 2021 setting a new quarterly record for investments. However, in the second half of 2021 we observed a slight decrease in the number of deals and at lower valuations. Slow-down in life science companies fundraising continued in 2022.

⁴⁰ <https://www.svb.com/globalassets/library/managedassets/pdfs/silicon-valley-bank-healthcare-investments-and-exits-annual-2022-report.pdf>

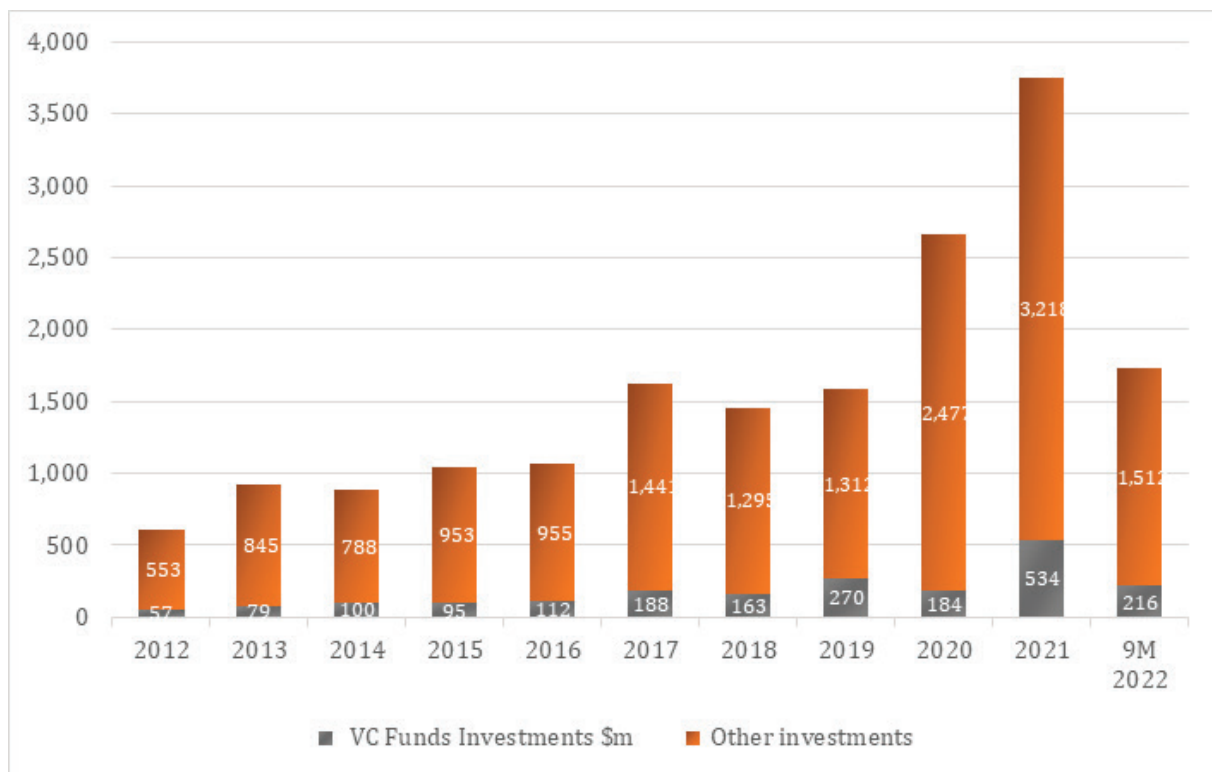
Figure 18 - VC-Backed Dollar and Deals by Sectors (*) in the US and Europe



➤ Breakdown of Life Sciences Investment Sources in Israel

As aforementioned in this report, total investments in life science companies in Israel in 2021 and in the first three quarters of 2022 were \$3.7 billion and \$1.7 billion, respectively. Out of the total investments in 2021, \$534 million were invested by Israeli VC funds, a significant increase of more than a double in Israeli VC investments compared to 2020 and a new record for the last decade. The investments made by the Israeli VC funds in 2021 represents approximately 14% out of the total investments in Israeli life sciences companies (Figure 19).

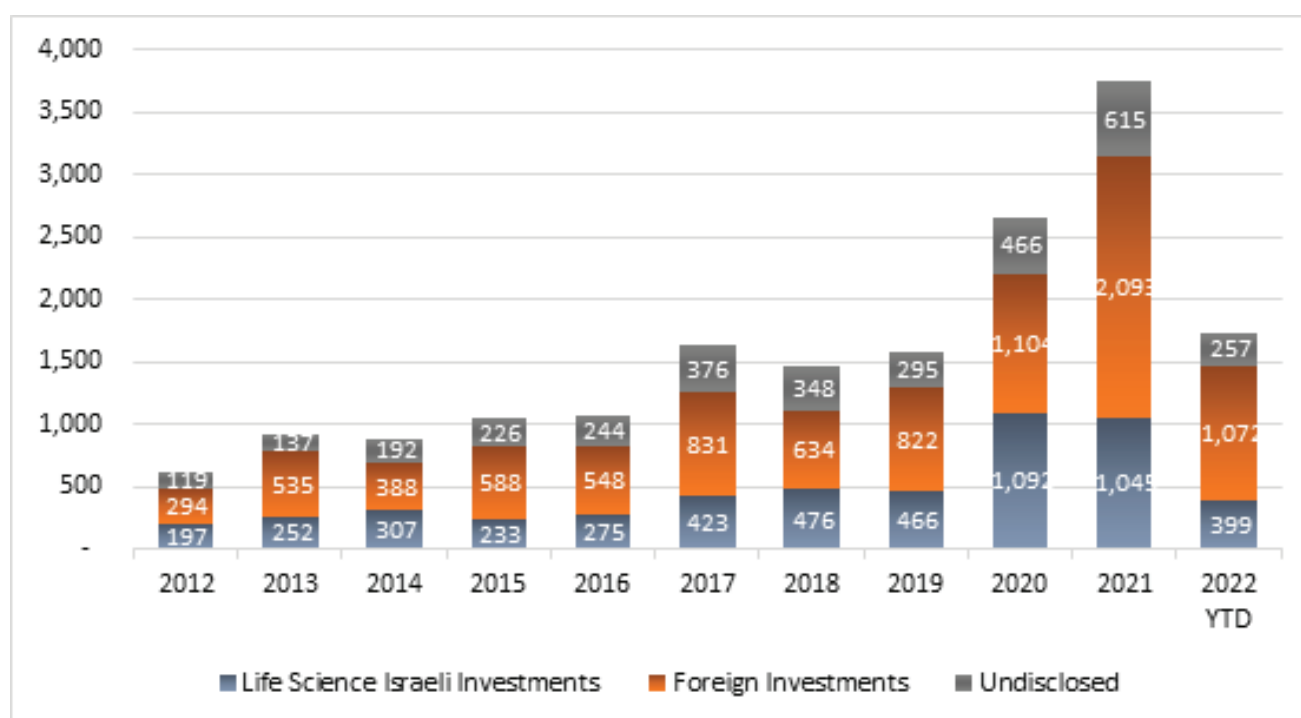
Figure 19 - Capital Invested by Israeli VC Funds vs. Other Investors in Life Sciences (2012 - Q3 2022) - \$ millions



Source: IATI Database
IVC-Online Database

Since 2012 we have seen a trend of increase in the amounts invested by Israeli investors in Israeli life science companies. Throughout 2021, Israeli investors contributed \$1.0 billion which is similar to the contribution in 2020. However, foreign investors contribution was doubled in 2021 compared to 2020, an increase from \$1.1 billion to \$2.0 billion, which led to a decrease in the Israeli investors' contribution share from the total investments in Israeli life sciences companies from 41% in 2020 to only 28% in 2021. We believe that the increase of foreign investments is mainly due to increased activity of US investors in the Israeli market in light of changes in the US economy. Throughout the first three quarters of 2022 we have seen that the capital invested by foreign investors was more than double the amounts invested by Israeli investors.

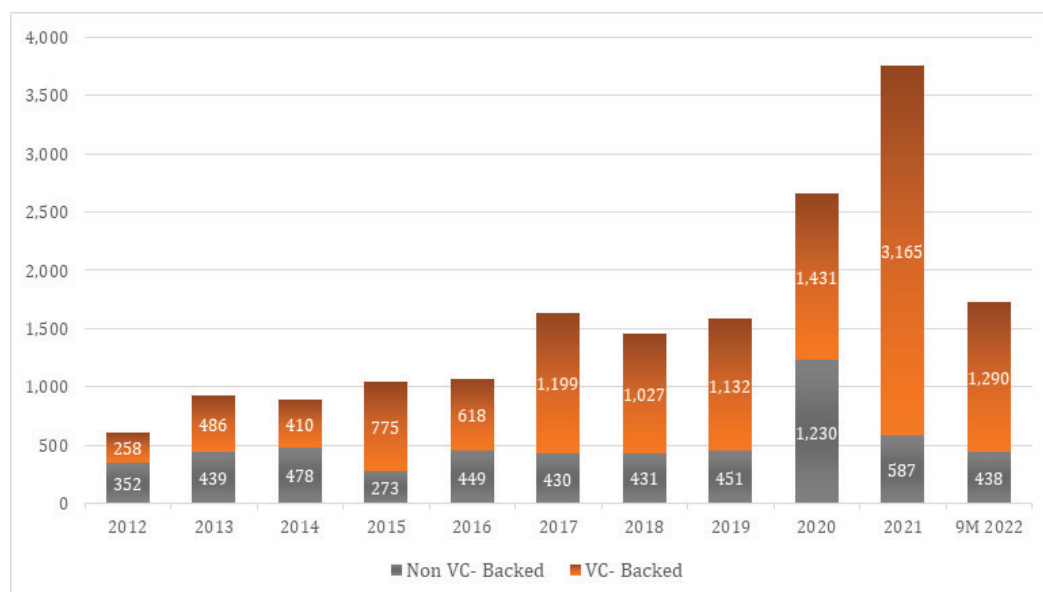
Figure 20 - Capital Invested in Israeli Life Science Companies: Israeli vs. Foreign Investors (2012 - Q3 2022) - \$ millions



Source: IVC-Online Database
IATI Database

In the last decade, the source of the financing of Israeli life science companies was mainly from venture capital funds. In 2021, VCs contributed \$3.2 billion, representing 84% of total investments in Israeli life sciences companies this year and the highest amount raised from VCs in one year. The first three quarters of 2022 have demonstrated a cooldown after the robust activity of VC-Backed financing in 2021 and the capital raised from VCs is down by 33% compared to the first three quarters of 2021 (Figure 21).

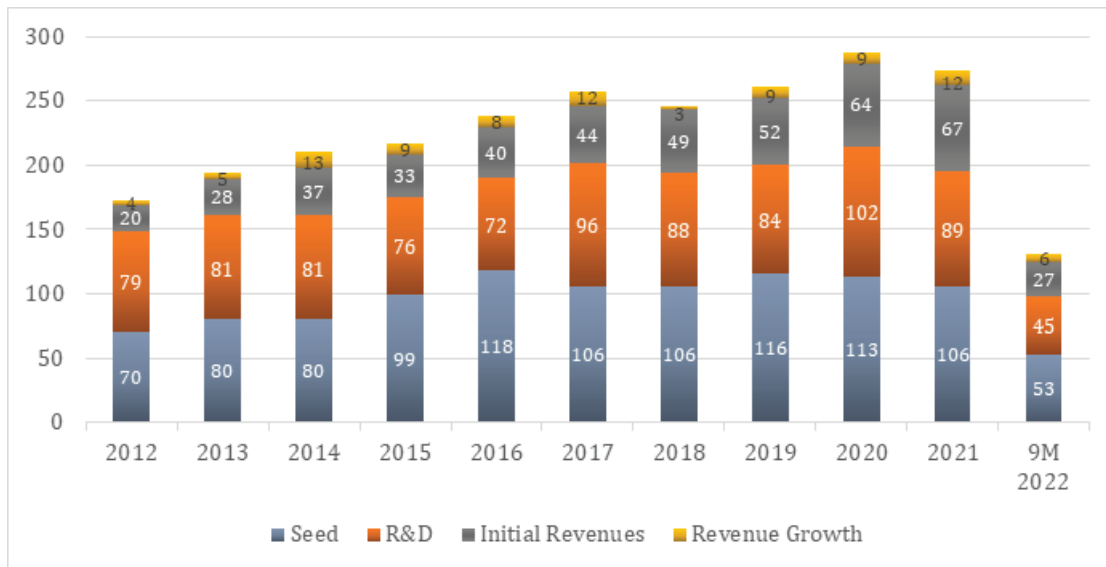
Figure 21 - VC-Backed vs. Non-VC-Backed Life Science Financing (2012 - Q3 2022) - \$ millions



Source: IVC-Online Database
IATI Database

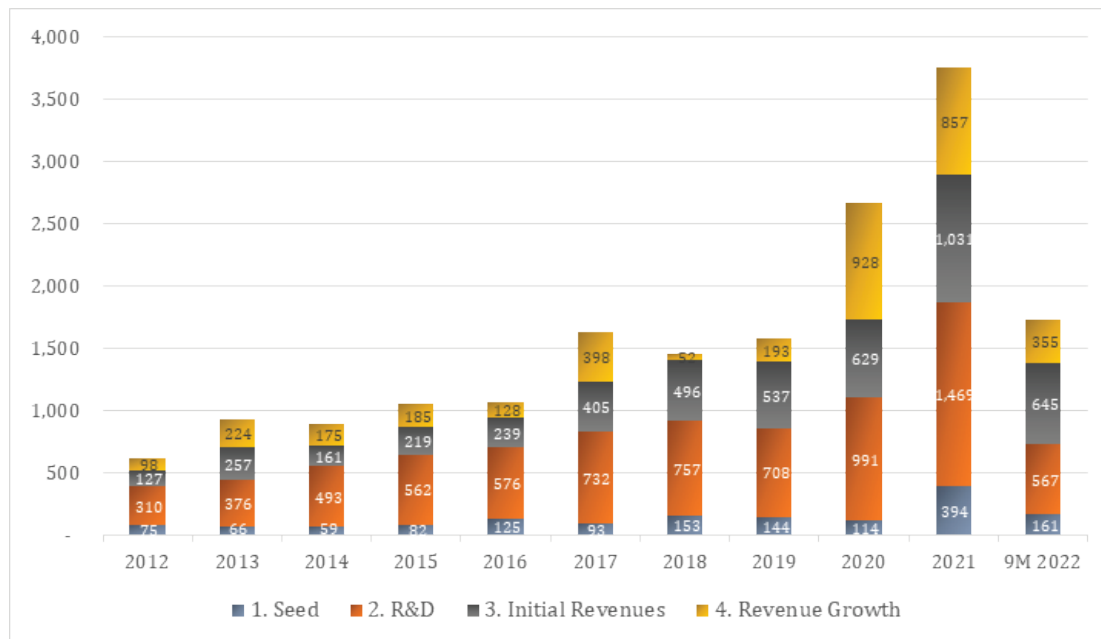
Throughout 2021 the number of deals in R&D stage companies remained stable, however the amount of investments in this stage increased compared to 2020, which represents an increase in an average investment amount per deal from \$9.7 million to \$16.5 million in 2021 (Figure 24). In addition, we see an increase in the average investment amount per deal in initial revenues companies that almost doubled in 2021 compared to 2020. We observed an interesting trend in the amount invested per deal in seed investments which steeply increased to more than \$3 million in 2021 and in the first three quarters of 2022 compared to approximately \$1 million in 2020 and the years before. In 2022 the amount of investments and the number of deals have dropped compared to 2021 and 2020 due to negative effects on economic activity in the world.

Figure 22 - Capital Raised by Israeli Life Sciences Companies by Stage (2012 - Q3 2022)
- # of deals



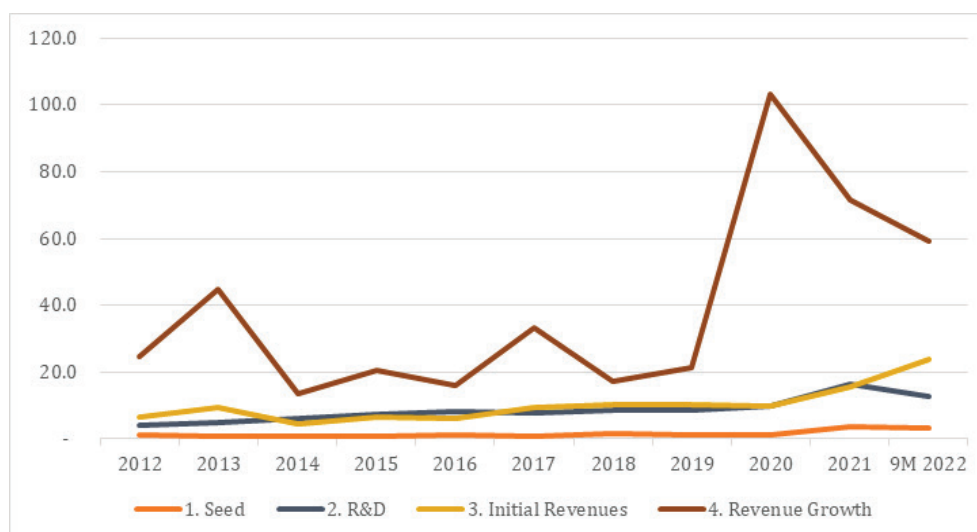
Source: IVC-Online Database
IATI Database

Figure 23 - Capital Raised by Israeli Life Sciences Companies by Stage (2012 - Q3 2022)
- \$ millions



Source: IVC-Online Database
IATI Database

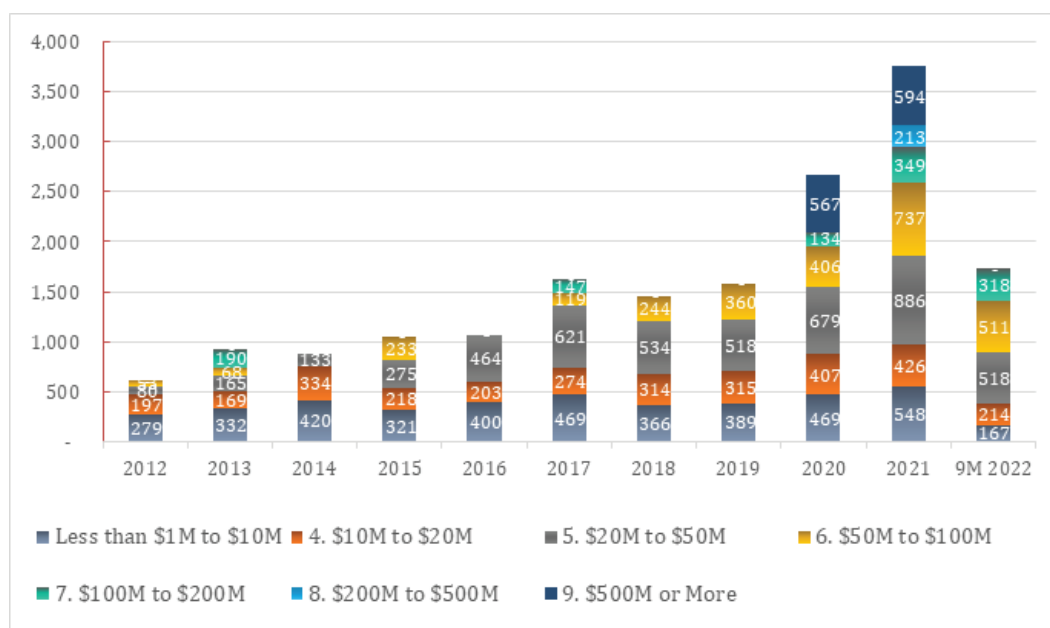
Figure 24 - Average Deal Size in Israel Life Sciences Financing by Stage (2012 - Q3 2022) - \$ millions



Source: IVC-Online Database
IATI Database

2021 shows not only an increase in total funding, but also more investments in deals of over \$20 million compared to 2020. The fourth quarter of 2021 was the strongest quarter in the last decade contributing \$1.5 billion, including two mega-rounds of \$0.6 and \$0.2 billion. This trend hasn't continued in 2022, and the top investment deal was \$0.15 billion only. The drop in total funding in the first three quarters of 2022 had a significant effect on the smaller size funding rounds (up to \$10 million) compared to the amount raised in such rounds in the last decade.

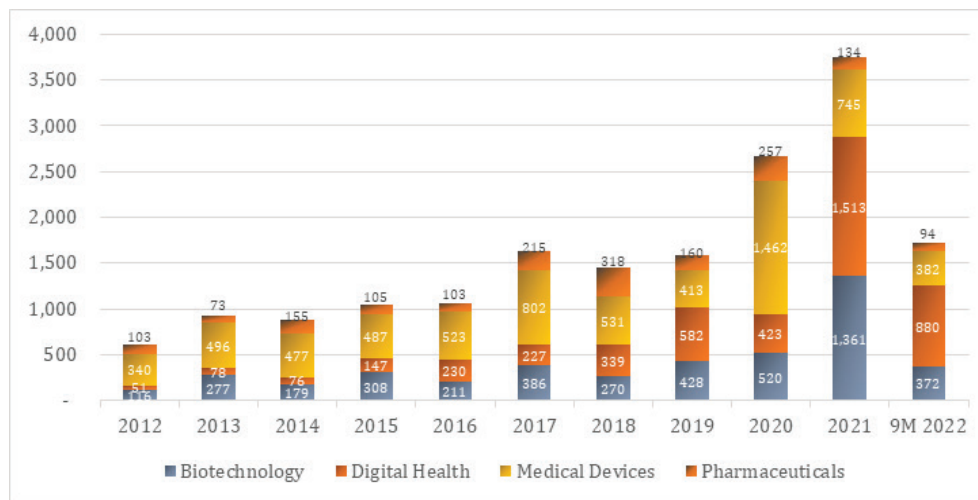
Figure 25 - Capital Raised by Israeli Life Sciences Companies by Deal Size (2012 - Q3 2022) - \$ millions



Source: IVC-Online Database
IATI Database

When it comes to investment per sub-sector, for the second time only in the last decade the medical devices sub-sector is not the leading sub-sector in terms of investments. It can be seen that in 2021 the digital health sub-sector soared with \$1.5 billion and 50% of the total life science investments, replacing the medical devices sub-sector which led the amount of investments until then. Furthermore, in 2021 there is an outstanding investment in the biotechnology sub-sector of \$1.3 billion, mainly in Q4 2021 and due to one mega-round of \$0.6 billion dollar raised by Ultima Genomics. The slow-down in investments in 2022 affects all sub-sectors and none of the sub-sectors was immune to the decline in the investments amounts and number of financing deals (Figures 26).

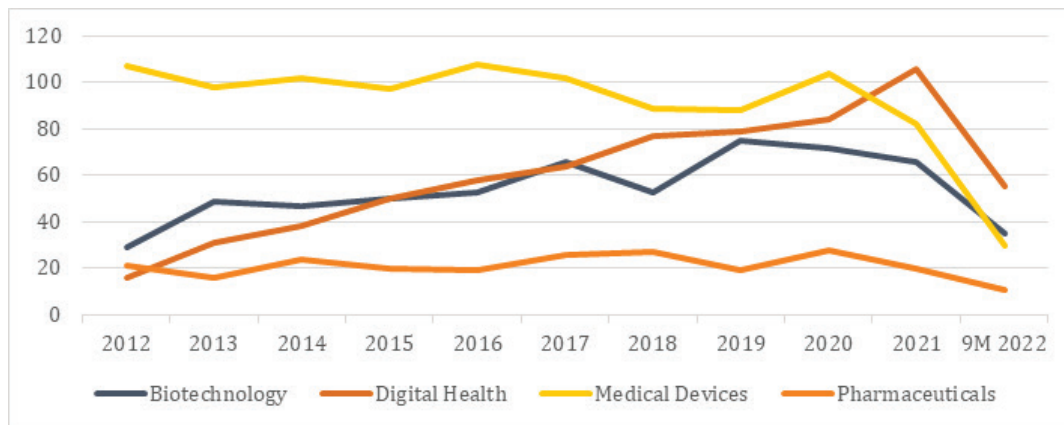
Figure 26 - Israeli Life Sciences Capital Raised by Sub-Sector - \$ million



Source: IVC-Online Database
IATI Database

From 2012 to 2021 there is a trend of increase in the number of deals in the digital health sub-sector, from 16 deals in 2012 to 106 deals in 2021, a phenomenal growth of more than 650% over the decade. While the number of deals related to biotechnology and pharmaceuticals sub-sector has remained stable over the last decade, the number of deals in the medical device sub-sector continues to slowly decrease, with 82 deals in 2021, the lowest number of deals in the last decade (Figure 27).

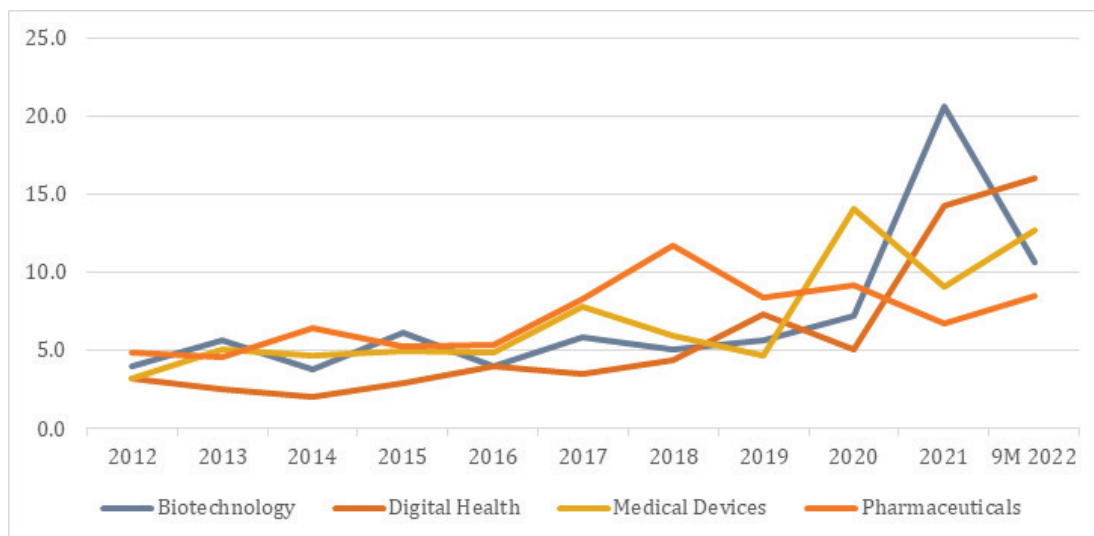
Figure 27 - Israeli Life Science Capital Raising Deals by Sub-Sector



Source: IVC-Online Database
IATI Database

It can also be seen that there was a step increase in the average deal size in the digital health sub-sector from \$5 million in 2020 to \$14.3 million 2021. The volatility in the average deal size in medical device and pharmaceutical sub-sectors are due to outstanding investments in 2020 and 2021, respectively. While the total investments and the number of financing deals declined in 2022, the average deal size remained robust.

Figure 28 - Average Deal Size in Israel Life Sciences Financing by Sub-Sector (2012 - Q3 2022) - \$ millions



Source: IVC-Online Database
IATI Database

Most Active Life Sciences Investors in Israel

According to the IATI database, IVC Research Center and other publicly available data, in the first three quarters of 2022 eHealth Ventures was the most active life sciences investor in Israel. The second most active investor in that period was Insight Partners, followed by LionBird. In 2021, the most active investor was OurCrowd, followed by NFX and Welltech.

Table 1 - Top Life Science Investors by Year, # of First Investments & Total # of Investments

Year	Investor Name	Investor Type	of First # Investments	of Deals in # Participation
9M 2022	eHealth Ventures	Incubator	6	6
	Insight Partners	VC Fund	3	5
	LionBird	VC Fund	3	3
2021	OurCrowd	Crowdfunding platform	8	11
	NFX	VC Fund	7	9
	Welltech Ventures	VC Fund	5	6

Source: IVC-Online Database
IATI Database

The following is a list, in alphabetic order, of investors in Israel with a complete or partial focus on life science and healthcare:

- 10D - founded in 2018, 10D invests in early-stage Seed and Series A rounds in High-tech startups including life-science companies. According to a survey conducted by IATI, throughout 2020-2022 10D invested in 9 companies in initial investments and follow-on investments in total of \$27 million, all of the investments are in Seed, R&D and Initial revenues stages companies.
- Accelmed - Co-founded by Mori Arkin and Uri Geiger, the Herzliya-based venture capital firm is concentrating on medical device companies which have already reached the revenue stage. Accelmed's portfolio includes 20 companies.
- ALIVE - Israel Healthtech Fund - founded in 2020, ALIVE Israel Healthtech Fund is a mid-late stage healthtech fund focused on mature companies in the fields of medical technology, medical equipment, and telemedicine. According to a survey conducted by IATI, throughout 2020-2022 ALIVE invested in 9 companies in initial investments and made 2 follow-on investments in total of \$72 million.

- Almeda Ventures - founded in 2020, Almeda Ventures invests on a global basis while focusing on Medical devices, Digital health and Bio-convergence. According to a survey conducted by IATI, throughout 2020-2022 Almeda Ventures invested in 9 companies in initial investments in total of \$16 million, all of the investments ranged from R&D stage to Revenue growth stage.
- Alpha Capital - founded in 2001 by a prominent private investor involved in venture capital investments. Alpha is serviced by LH Financial Services Corp with offices in New York and Tel-Aviv and is focusing on the life sciences and technology sectors. Alpha is investing in venture and startup from pre-seed to Round B, and in recent years has made several investments in public and private Israeli companies. Alpha Capital is also the founder and largest shareholder of the InNegev incubator.
- aMoon Partners Fund - founded in 2016 and managed by Dr. Yair Schindel, aMoon is the biggest venture capital fund operating in Israel today as well as the largest life sciences and healthcare fund ever set up in Israel and one of the largest outside of the US. aMoon's portfolio includes 30 companies out of them 4 are post-IPO.
- Arkin Bio - a joint venture between insurance and finance company Phoenix Group (49%) and Arkin Holdings (51%). Managed by Dr. Pini Orbach, the Herzliya-based venture capital identifies, invests in innovative early and mid-stage companies with game-changing breakthroughs in areas such as immunotherapy, cancer, metabolism, microbiome, central nervous system, autoimmune diseases, orphan diseases, and drug-delivery platforms. Arkin Bio's portfolio includes 15 companies out of them 3 are post-IPO.
- Biomed 100-ShizimXL Ltd - founded in 2014, and part of the Shizim Group. Led by Tamir Pardo, ShizimXL is an accelerator for start-ups in early stages. ShizimXL's portfolio includes 13 companies in life science sector mainly in the fields of medtech, pharmaceutical, medical device and medical cannabis.
- Clal Biotechnology Industries (CBI) - operates from Tel-Aviv and Boston, CBI is a public company traded on TASE and invests in companies ranging from seed to maturity, both public and private. Its major stockholders are Clal Industries Ltd., one of Israel's leading investment companies and Access Industries, a privately held industrial group Founded by Len Blavatnik. CBI's portfolio includes 11 companies in biotechnology and medical device fields.
- Elron Electronic Industries - based in Tel-Aviv, Elron is an Israeli technology holding company traded on TASE and a subsidiary of IDB Group. Founded in 1962 by Uzia Galil and currently managed by Yaron Elad. Elron's portfolio includes 4 companies in the life science sector.

- Entrée Capital – founded in 2009, Entrée Capital provides multi-stage funding to innovative seed, early and growth-stage companies all over the world. Entre Capital manages over \$1 billion and has invested in High-tech startups. Entrée Capital's portfolio includes 7 Israeli life-science companies.
- ExitVally Ltd - founded in 2015 , a crowdfunding platform for start-ups in early stages, mainly operating in technology, food-tech and life science fields. ExitVally's community consists of over 24,000 investors.
- Guangzhou-Israel Biotech Investment Fund (GIBF) - founded in 2016, operating in Tel-Aviv and in Guangzhou, China, and focusing on life science investment. The purpose of GIBF is to bring Israel biotech into Guangzhou to be commercialized and industrialized. GIBF's portfolio includes 12 companies.
- Israel Biotech Fund (IBF) - based in Rehovot, founded by Yuval Cabilly, David Sidransky and Ido Zairi. IBF invests exclusively in Israeli and Israeli related biotechnology and pharmaceutical companies. IBF's portfolio includes 13 companies. According to a survey conducted by IATI, throughout 2020-2022 IBF invested in 12 companies in initial investments and made follow-on investments in 3 companies in total of \$42 million, all of the investments are in Seed, R&D and Initial revenues stages companies.
- Joy Ventures - founded in 2017, based in Herzliya, Joy invests in companies operating in developing science-backed consumer products that help people experience everyday moments of joy and improve emotional wellbeing. Joy's portfolio includes 11 companies.
- Koch Disruptive Technologies - the venture capital arm of Koch Industries Inc., focuses on partnering with high-growth companies that disrupt current market alternatives with demonstrated technology. According to a survey conducted by IATI, throughout 2020-2022 Koch's invested in 5 Israeli life science companies in initial investments and follow-on investments in total of \$252 million.
- LionBird - founded in 2012, based in Tel-Aviv and Chicago, invests in early-stage healthcare, commerce and enterprise startups. LionBird's portfolio includes 18 healthcare companies. According to a survey conducted by IATI, throughout 2020-2022 LionBird invested in 12 companies in initial investments and made follow-on investments in 12 companies in total of \$25 million, the investments ranged from Seed stage to Revenue growth companies.
- Mediterranean Towers Ventures - based in Ganei Tikva and Part of Mediterranean Towers Group, a retirement community chain in Israel, and led by Dov Sugarman and Yael Benvenisti. Mediterranean Towers Ventures is the first fund in Israel dedicated to investing exclusively in technology companies developing disruptive solutions for aging. The fund's portfolio includes 5 companies.

- NFX - founded in 2015 and focused on pre-seed & seed stage startups. NFX's portfolio includes 19 healthcare companies. According to a survey conducted by IATI, throughout 2021-2022 NFX invested in 7 companies in initial investments and made follow-on investments in 2 companies in total of \$21 million.
- OrbiMed Israel Partners - founded in 1989 in New York City and opened an office in Herzliya in 2010, OrbiMed invests across the global healthcare industry, from seed-stage venture capital to large publicly-traded companies. Investments are made in one of three strategies: public equity, private equity, and royalty opportunities.
- OurCrowd - founded in 2013, located in Jerusalem with offices spanning eleven branches. OurCrowd is a global equity crowdfunding platform. OurCrowd healthcare portfolio includes 24 companies. According to a survey conducted by IATI, throughout 2020-2022 OurCrowd invested in 29 companies in initial investments and made follow-on investments in 100 companies in total of \$157 million, ranged from seed to revenue growth companies.
- PeakBridge – founded in 2017 and focused on food-tech companies. PeakBridge's portfolio includes 16 food-tech companies. According to a survey conducted by IATI, throughout 2020-2022 PeakBridge invested in 17 companies in initial investments and made follow-on investments in 14 companies in total of \$45 million, the investments ranged from R&D stage to Revenue growth companies.
- Peregrine - founded in 2001 by Boaz and Eyal Lifschitz, located in Or Yehuda. Focused on investing in early-stage High-tech companies with a strong emphasis in life sciences. Peregrine's portfolio includes 48 life science companies. According to a survey conducted by IATI, throughout 2020-2022 Peregrine invested in 38 companies in initial investments and made follow-on investments in 46 companies in total of \$248 million, all of the investments are in Seed, R&D and Initial revenues stages companies.
- Pitango Venture Capital - founded in 1993, based in Herzliya. Pitango invests in core technology across all stages, via two funds - Pitango Early Stage and Pitango Growth. In the healthcare space, Pitango pursues investment opportunities in Digital Health, Diagnostics, Healthcare Information and Therapeutics. Pitango's portfolio includes 17 healthcare companies. According to a survey conducted by IATI, throughout 2020-2022 Pitango invested in 13 companies in initial investments in total of \$69 million, the investments ranged from seed to revenue growth companies.
- Pontifax Venture Capital - founded by Eli Hurvitz in 2004, based in Herzliya with an additional office in California. Pontifax is a healthcare-dedicated venture capital firm seeking transformative, cutting-edge life sciences technologies at all development stages. Pontifax's portfolio includes 54 companies.

- RMGP Biopharma - located in Herzliya and managed by RM Global Healthcare Fund Management, RMGP Biopharma investment fund is focused on early stage innovative therapies in areas of high unmet need. Through its partnership with OrbiMed, Johnson & Johnson and Takeda, RMGP provides an opportunity to invest in companies operating in Israel's FutuRx incubator. RMGP's portfolio includes 14 companies.
- Sanara Ventures - located in Ra'anana and founded in 2014 by Philips Healthcare & Teva Pharmaceuticals partnership, Sanara Ventures investment fund invests in early-stage startups in the areas of medical devices and digital health technologies. Seed investments are performed through Sanara's incubator and its portfolio includes 17 companies.
- SBI Japan-Israel Innovation Fund - located in Herzliya, founded in early 2017 as a partnership between SBI Holdings of Japan and Vertex Israel. SBI is a venture capital focused on investing in Israeli (or Israel-related) venture-backed biopharma companies across different development stages. SBI's portfolio includes 10 companies.
- Shavit Capital Fund - founded in 2007 and focused on late-stage investments in Israeli-related companies. According to a survey conducted by IATI, throughout 2020-2022 Shavit invested in 9 companies in initial investments and made follow-on investments in 1 company in total of \$1.3 billion, the investments ranged from R&D stage to Revenue growth companies.
- Tal Ventures - founded in 2016, Tal Ventures is an Israel-based Venture Capital focused on Israel high-tech ecosystem. According to a survey conducted by IATI, throughout 2021-2022 Tal Ventures invested in 3 companies in initial investments in total of \$10 million, the investments are post seed stage.
- Triventures - founded in 2010, located in Herzliya with an office in California. Triventures invests in early stage life science companies such as cardiovascular, orthopedics, robotics, ophthalmology, women's health and digital health. Triventures' portfolio includes 23 companies.
- Vertex Ventures Israel – founded in 1997 and invests in Israeli companies in the early stages. Vertex's portfolio includes 4 digital health companies. According to a survey conducted by IATI, throughout 2020-2022 Vertex invested in 2 companies in initial investments and made follow-on investments in 4 companies in digital health field in total of \$32 million. The investments are in seed and initial revenues stage.

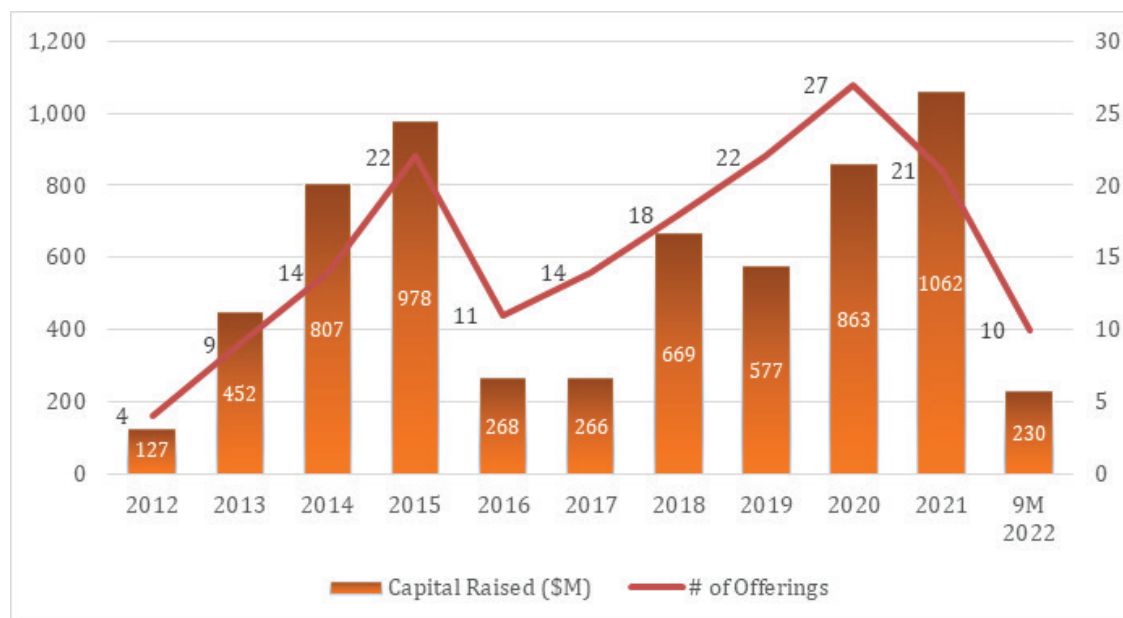
- VLX Ventures - founded in 2013, located in Jerusalem and managed by Ori Choshen, invests in early-stage startups in the areas of computational biology and drug development companies. Seed investments are performed through VLX's technological incubator in Jerusalem and the venture capital fund also does follow-on investments. VLX's portfolio includes 10 life sciences companies out of a total of 12 companies.
- Welltech Ventures - founded in 2019 and focused on investing in the health and wellness space. The fund is focused on early stage startups. Welltech's portfolio includes 13 companies.

➤ Israeli Life Sciences Companies Listed in the US Stock Markets

For more than a decade, the US stock markets has been the Israeli Life Sciences companies' main source for public raisings, and according to public information, about 50 out of the more than 190 Israeli companies listed on the US stock markets are life science companies. Approximately \$6 billion were raised on the US stock markets by Israeli life sciences companies throughout the last decade⁴¹, mainly in two periods of time. While the first period lasted for only two years (2014-2015) in which almost \$1.8 billion were raised, the window that was opened in 2018 continued for four years and was enhanced in 2020 and 2021 due to macro-economic conditions, bringing the total amount raised in this period to more than \$3 billion. In 2021, not only the capital amount invested in life sciences companies raising capital through IPOs and follow-on offerings was the highest in the last decade, but also the amount of the capital raised per deal was the highest as well.

Unlike the year of 2021, in 2022 we see a different story. Due to macro-economic changes and stock-markets high fluctuations, capital raising through public offerings has become more selective and in a much lower volume than the years before, coming to an almost full stop.

Figure 29 - Public Offerings by Israeli Life Science Companies on Nasdaq 2012 - Q3 2022 (\$ million, # of offerings)



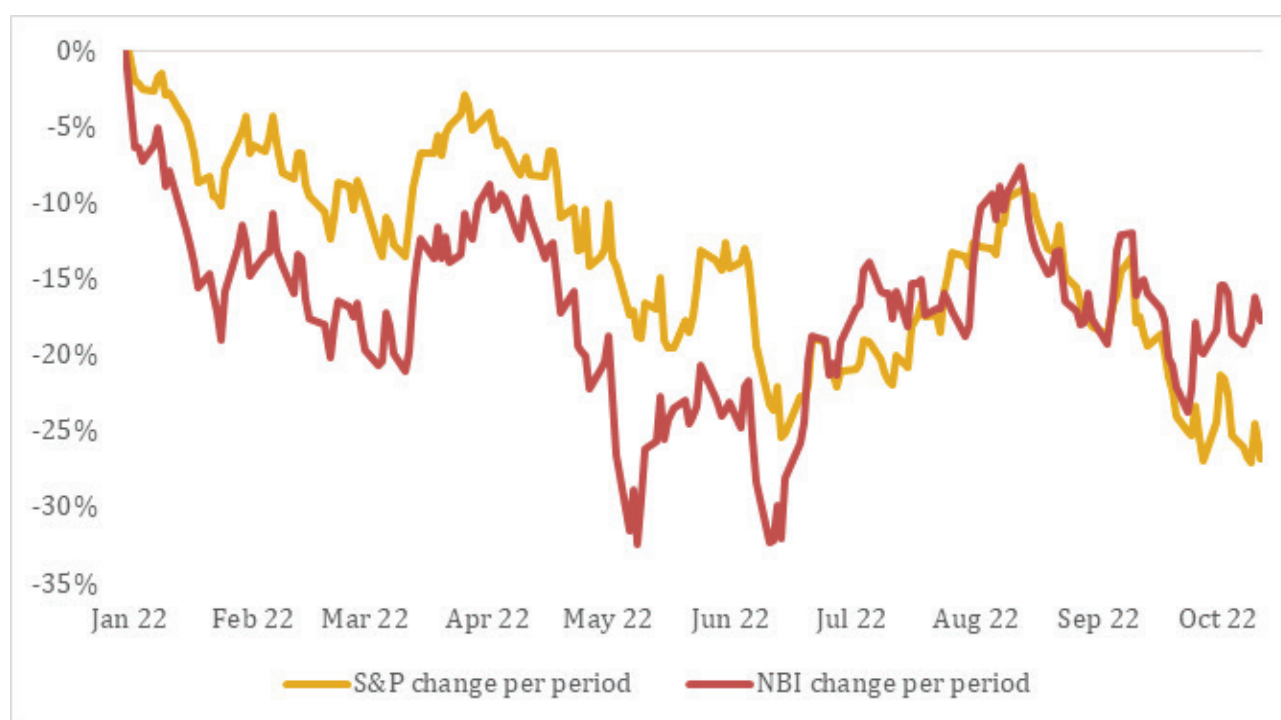
Source: IVC-Online Database
IATI Database

⁴¹ Excluding Private Investment in Public Equity (PIPE)

According to PwC's Capital Markets Outlook 2022⁴², there were 121 IPOs of life-science companies in the US stock markets throughout 2021, raising approximately \$20.6 billion.

Looking at the Nasdaq Biotech Index (NBI), which represents the change in stock prices of approximately 200 top pharmaceutical companies traded on Nasdaq, it can be seen that the NBI return is lower than S&P 500 index and even has negative YTD return. It seems that after the restrictions of the corona-pandemic were reduced, investors have returned to focus on stocks in other fields besides the life sciences stocks that were considered immune to fluctuations in the stock markets during the pandemic.

Figure 30 - NBI Performance vs. S&P 500 Index (January - October 2022)



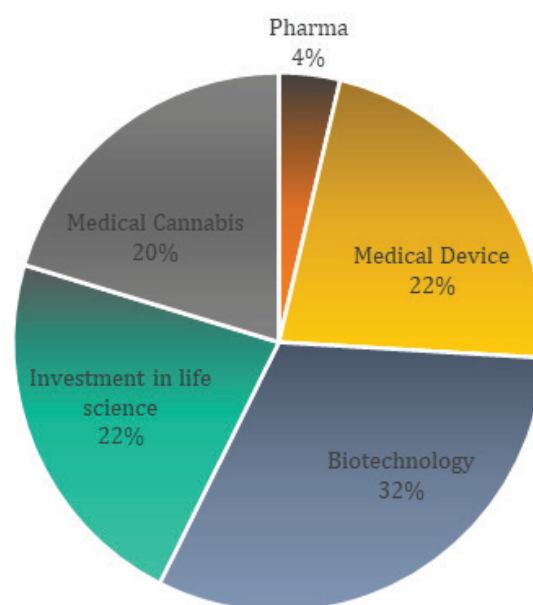
Source: Yahoo Finance

⁴² <https://www.pwc.com/us/en/services/consulting/deals/library/us-capital-markets-outlook.html>

➤ Tel Aviv Stock Exchange (TASE)

54 life sciences companies are listed on Tel Aviv Stock Exchange (Figure 31), of them 15 are dually listed on foreign markets⁴³. We noted in the past that Israeli life sciences companies see the TASE mainly as a steppingstone on the way to the US stock market at a later stage. This trend continued this year with IceCure Medical Ltd. and InterCure Ltd. shares are now being dual listed on TASE and Nasdaq.

Figure 31 - Number of Public Life Science Companies on TASE by sector*



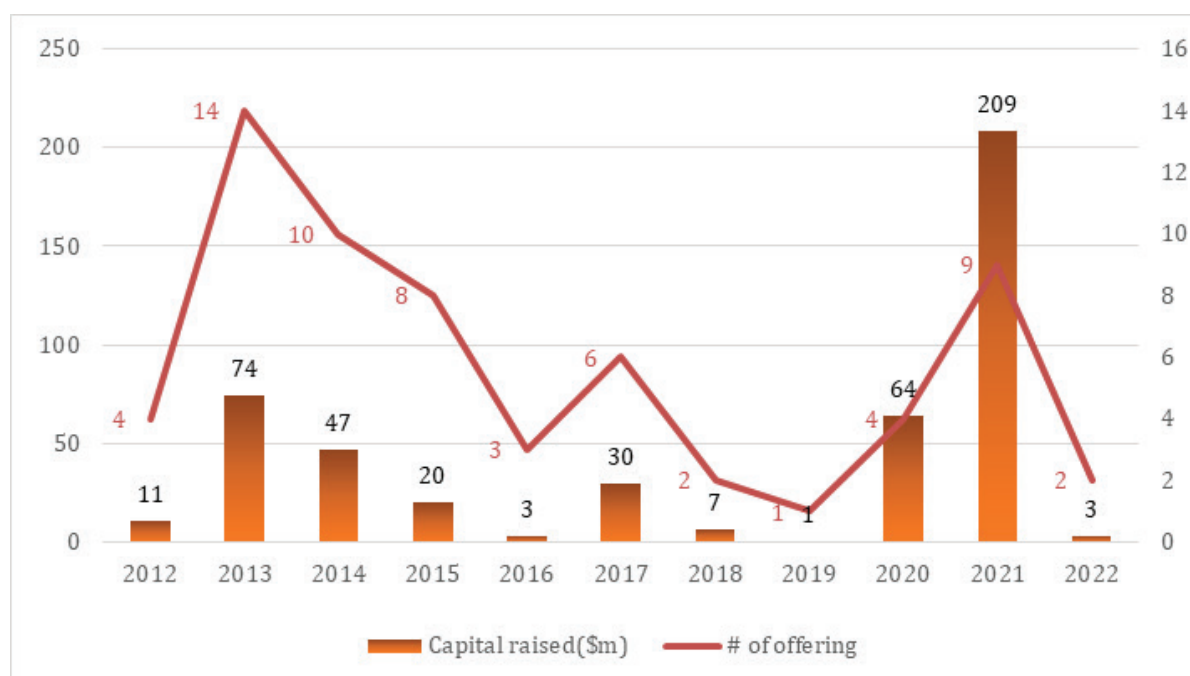
Source: Tel Aviv Stock Exchange

There may be differences between sub-sectors definitions in this figure compared to the other chapters in this (*) .report

2021 was another outstanding year in the Tel-Aviv stock exchange for life sciences companies. The capital raised through IPOs and follow-on offerings of life science companies more than tripled compared to 2020. In 2022, due to economic activity slow-down and valuations decline, the capital raised and number of deals sharply declined, and is similar to the years before 2020.

⁴³ According to the TASE website - www.tase.co.il

Figure 32 - Public Offerings* by Israeli Life Science Companies on TASE (2010 - Q3 2022) (\$ million, # of offerings)

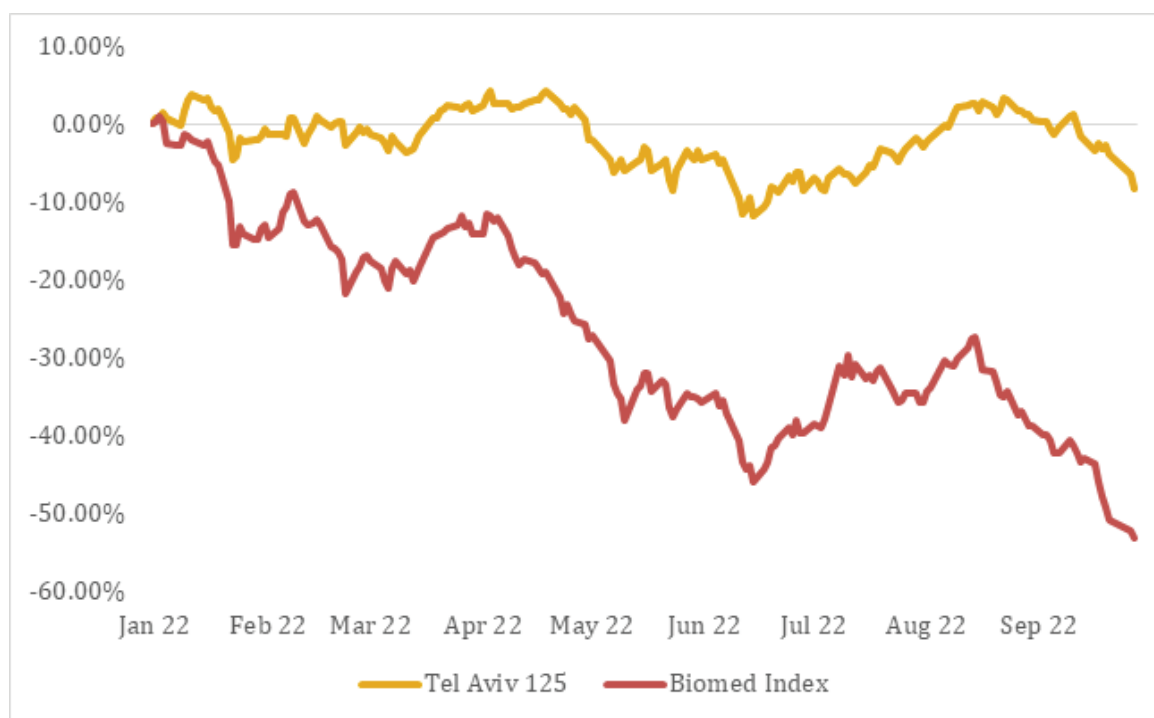


Source: IVC-Online Database
IATI Database

*Including IPOs and follow-on offerings

The TASE Biomed Index, launched in March 2010, continues to grow and currently includes 32 life sciences companies. Unlike TA-125 Index, the Biomed Index fell in 2022, bringing its year-to-date return to negative 50% (Figure 33). This trend and the reasons for that are similar to the US stock market (see Figure 30 above).

Figure 33 - TASE Biomed Index vs. TA-125 Index Performance over the course of 2022 (January - September 2022)



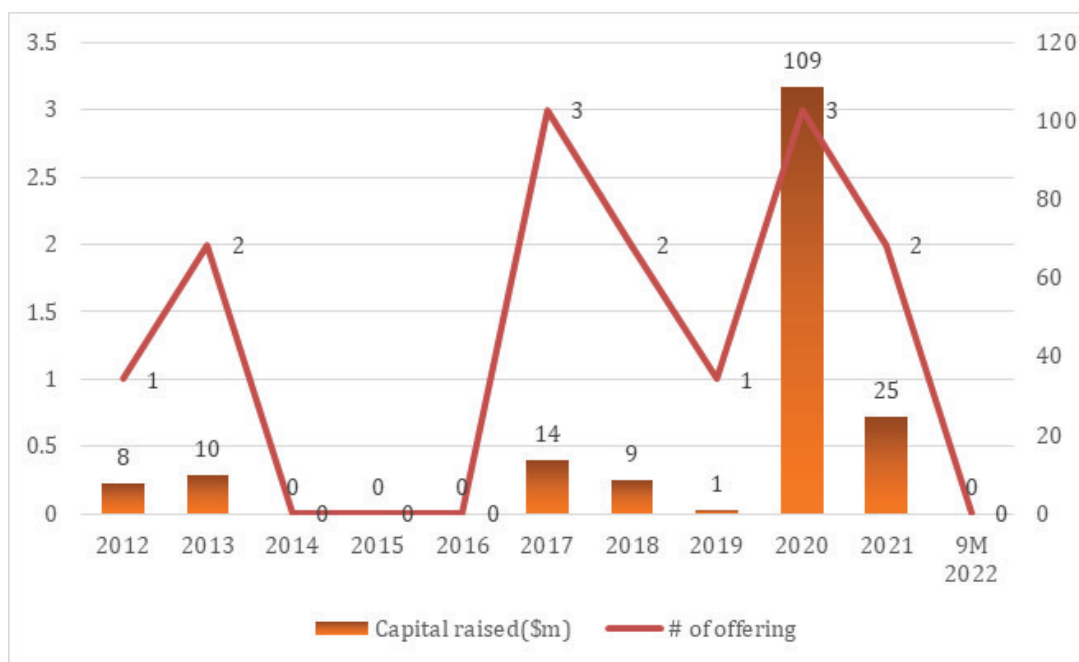
Source: Tel Aviv Stock Exchange

➤ Other Stock Exchanges

There are a few Israeli life sciences companies traded on stock markets other than TASE or the US, such as AIM or LSE (London), Frankfurt SE or Xetra (Frankfurt), SGX (Singapore), TSX (Toronto) and ASX (Sydney). \$25 million were raised through 3 initial and follow-on offerings on these stock exchanges in 2021 (Figure 34).

There are several reasons why Israeli life science companies choose to raise capital through a foreign stock market other than the US. Companies prefer to raise capital where their major market is located in order to maximize their value and relief in regulations and compliance requirements are also significant variables.

Figure 34 - Public Offerings* by Israeli Life Science Companies on Other Stock Exchanges 2012 - Q3 2022 (\$ million, # of offerings)



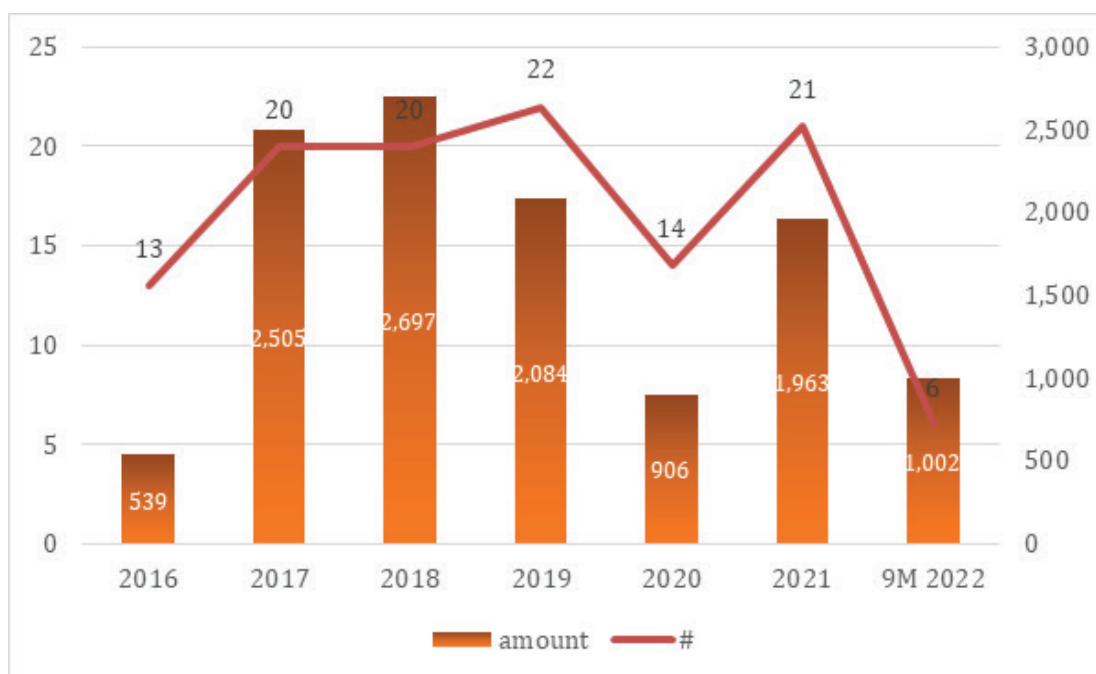
Source: IVC-Online Database
IATI Database

*Including IPOs, reverse mergers and follow-on offerings.

➤ Acquisitions of Israeli Life Sciences companies

More than 100 Israeli life sciences companies have been acquired in the last 7 years for a total of more than \$11 billion. Throughout 2021, 21 companies were acquired in an aggregate amount of \$2 billion dollar, reflecting an average amount of approximately \$100 million per deal. In 2022, six companies were acquired in an aggregate amount of \$1 billion dollar while half of this amount resulted from Shamir Optics-EssilorLuxottica deal.

Figure 35 - Acquisitions of Israeli Life Sciences Companies - \$ millions, # of Companies (2016 - Q3 2022)



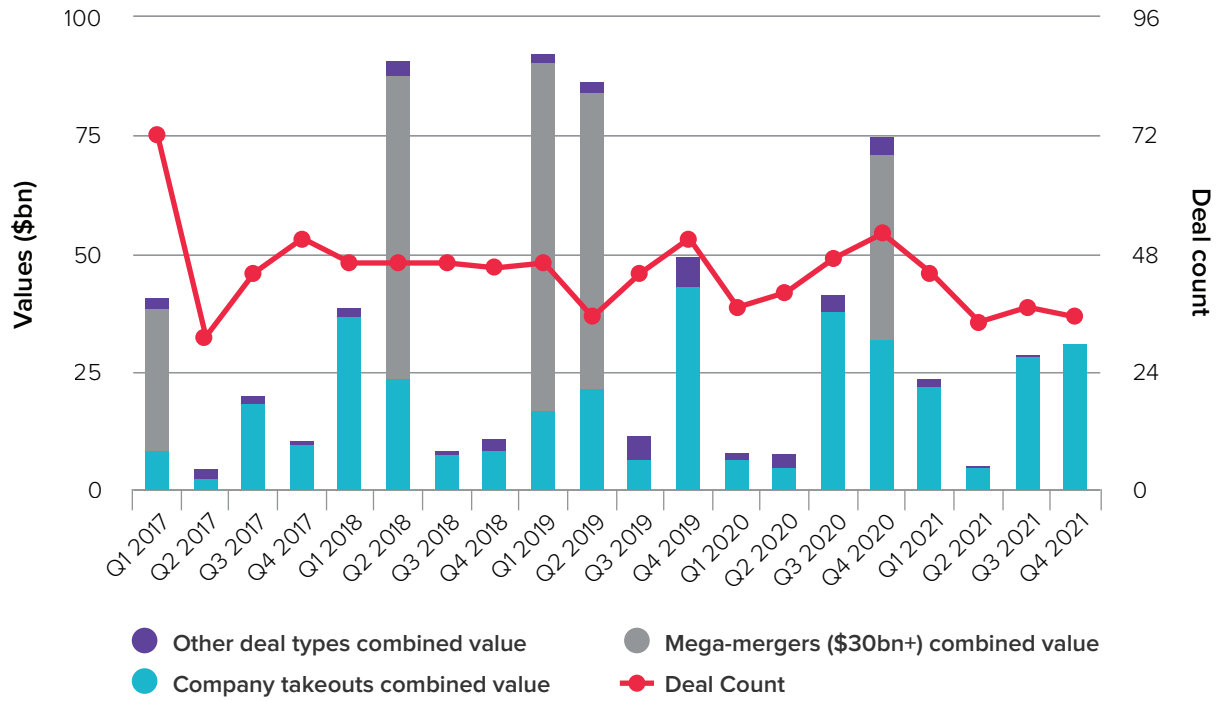
Source: IVC-Online Database
IATI Database

According to Biopharma and Medtech Review⁴⁴, published by Evaluate Pharma, life science companies M&As worldwide in 2021 totaled to \$87.8 billion, a 33% decrease compared to 2020 (Figure 36).

⁴⁴ <https://info.evaluate.com/rs/607-YGS-364/images/jn371-vantage-2021-review-44report.pdf>

Figure 36 - Global Pharma and Biotech M&A Activity

Quarterly M&A deals



Source: Evaluate.

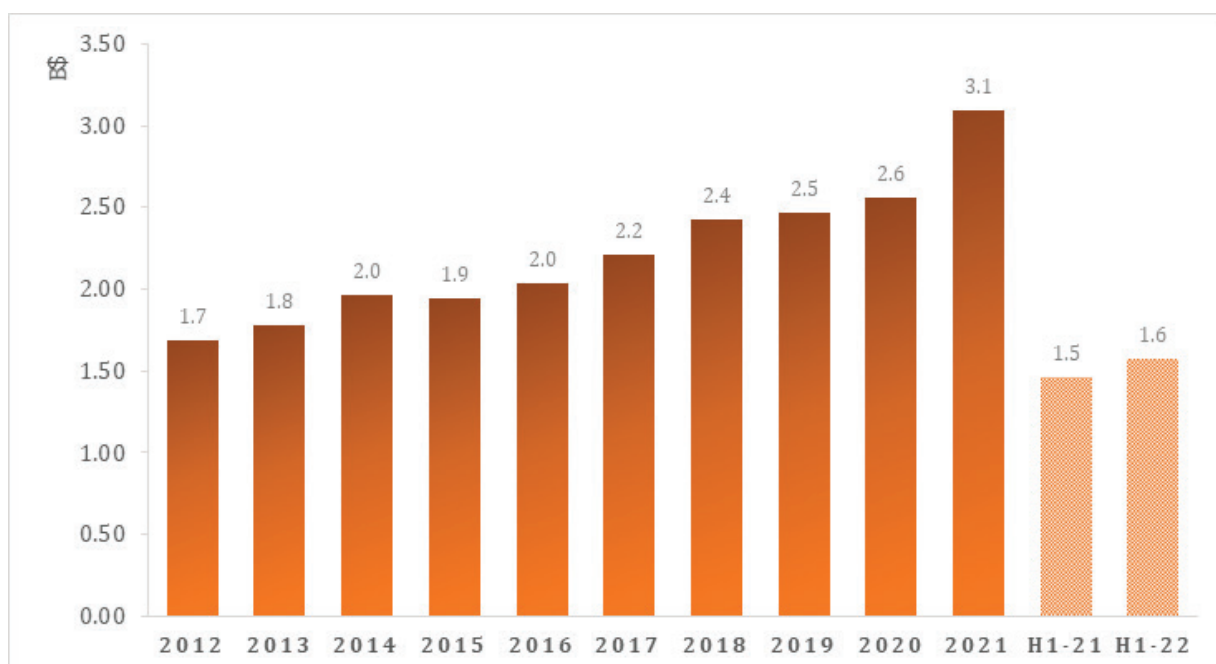
Source: Pharma, Biotech & Medtech 2021 in review, February 2022

Export of Israeli Life Sciences Products

According to the Israel Export and International Cooperation Institute (IEICI), pharmaceutical and medical equipment product exports from Israel in 2021 reached \$5.2 billion, representing approximately 4% of the total exports of goods and services from Israel and approximately 7% of the hi-tech exports from Israel. In 2021 there was an increase of \$0.9 billion compared to prior year, representing a change in the trend as opposed to previous years. Despite the quantitative increase, there was no significant change in the ratio of the total exports of goods and services from Israel compared to prior year.

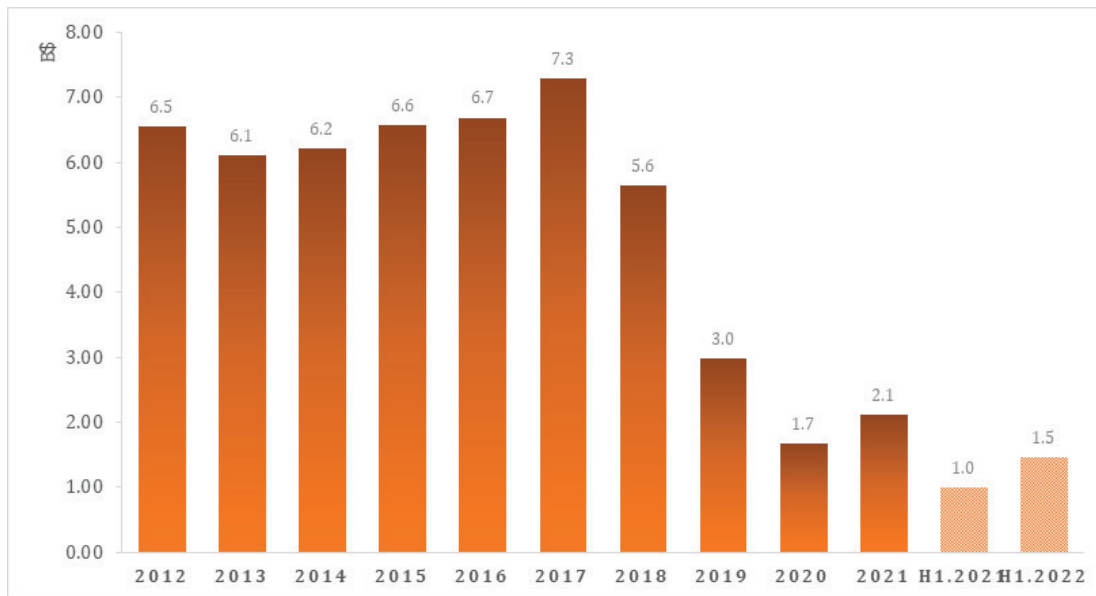
The industrial hi-tech exports, which includes life sciences products, increased by 20% in 2021. The medical equipment exports continues to grow (Figure 38) and has reached a peak in 2021 to \$3.1 billion with growth rate of 21%, similar to the general growth of industrial hi-tech exports. When it comes to Pharmaceutical exports, there is a change in trend, and for the first time since 2017 there is an increase in in 2021 of the export of Pharmaceutical products. Reaching to \$2.1 billion, it represents an increase of 24%, higher than the general growth of industrial hi-tech exports.. The first half of 2022 shows better results than the comparative period in 2021, and if the second half of the year would keep that trend, we can expect another record year for the medical equipment exports.

Figure 37 - Medical Equipment Product Exports From Israel 2012 - H1 2022 - \$ in million



Source: The Israel Export and International Cooperation Institute

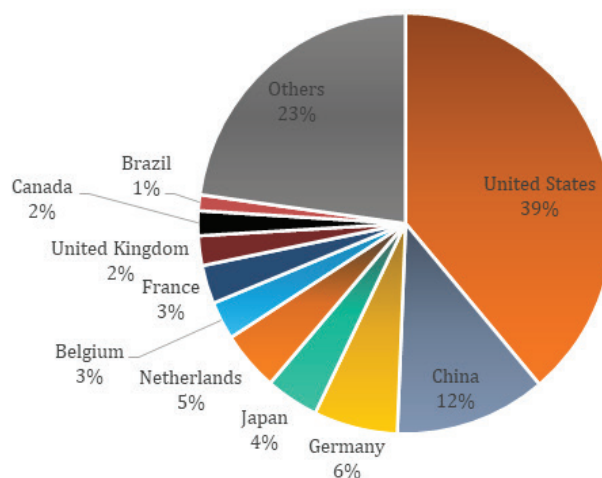
Figure 38 - Pharmaceutical Exports From Israel 2012 - H1 2022 - \$ in million



Source: The Israel Export and International Cooperation Institute

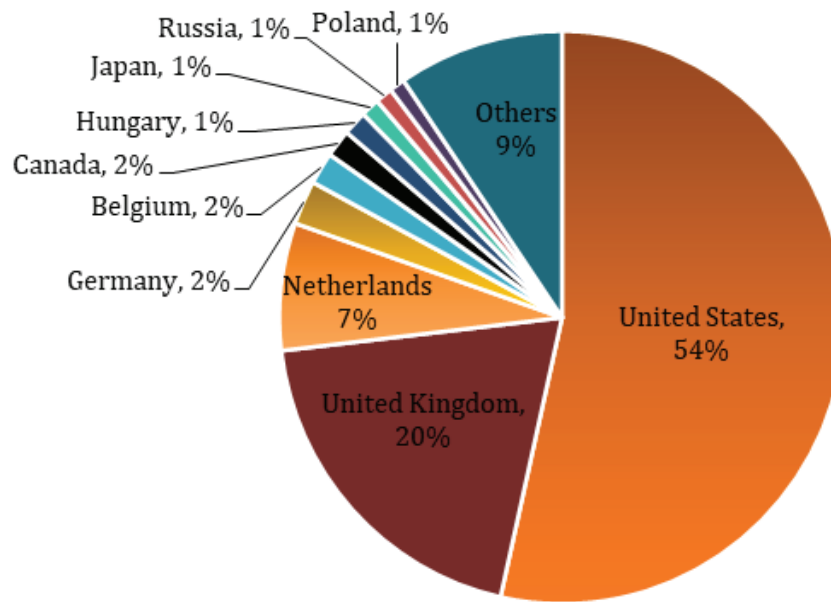
Looking into the distribution of the export of Israeli life sciences products, we see that the US continues to be the biggest market for the exports of medical equipment (Figure 39), with China being the second biggest single country as an export destination for medical equipment. The US is also the biggest market for pharmaceuticals exports, followed by the UK (Figure 40).

Figure 39 - Medical Equipment Product Exports Distribution by Trade Regions (2021)



Source: The Israel Export and International Cooperation Institute

Figure 40 - Pharmaceutical Exports Distribution by Trade Regions (2021)

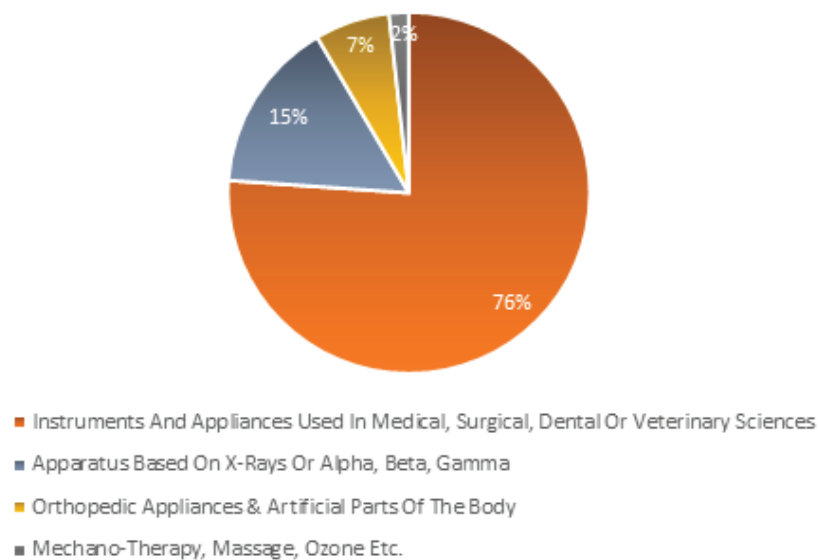


Source: The Israel Export and International Cooperation Institute

According to the IEICI, pharmaceuticals exports to the US, increased by 2% in 2021. Despite the quantitative increase, there was a decrease of approximately one percent in the ratio of total goods exported to the US compared to prior year.

Looking into the five segments of the export of Israeli life sciences products, we see that the main segment with 76% of the total medical equipment product exports is the instruments and appliances used in medical, surgical, dental or veterinary sciences (Figure 41).

Figure 41 - Medical Equipment Product Exports Distribution by Segments (2021)



Source: The Israel Export and International Cooperation Institute

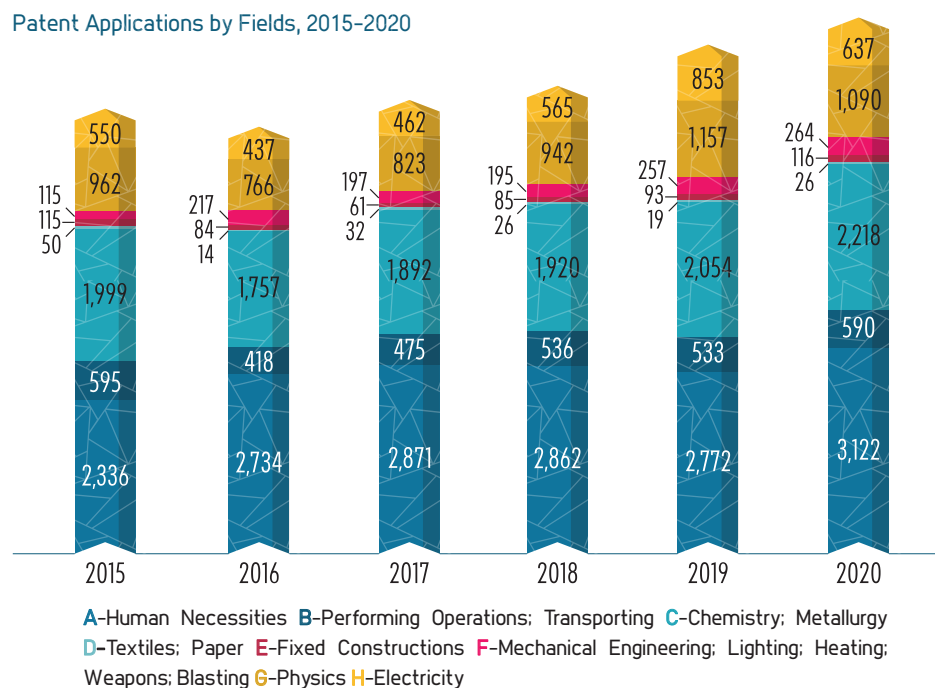
Commercialization Companies in Israel - Technology Transfer Offices (TTOs)

Public institutions such as hospitals universities, utilize commercialization companies (TTOs) to seek out, develop, and market the knowhow accumulated by them in order to turn patents into commercial products. Commercialization companies with these activities substantially contribute to the growth of the economy by increasing the income of the institutions they represent.

TTOs play a major role in the life sciences industry in Israel, as many patents, new start-ups and licensing agreements in the field originated from the research universities and research institutes and hospitals located across the country. The Israeli TTO industry is a role model for many technology transfer organizations in the world and it is considered to be one of the leading tech transfer communities in the world.

According to Israel Patent Office's annual report 2020⁴⁵, most of the patent's application between the years 2015-2020 are related to life sciences. 8,063 patent applications were filed in 2020 in total, compared to 7,738 patents in 2019, an increase of 4%. The dominant fields of new patent applications were human necessities (39%), chemistry and metallurgy (28%) and physics (14%) (Figure 42).

Figure 42 - Patents Patent Applications by Field (2015-2020)



Source: Israel Patent Office

⁴⁵ https://www.gov.il/BlobFolder/reports/new-annual-reports/en/annual-reports_eng_main-annual-report-2020-eng.pdf

In the past decade we have seen the development of funding and business development vehicles which emerged with the goal of interfacing directly with Israeli TTOs and researchers. These vehicles deploy diverse models as it pertains to institutional affiliation, projects sourcing, research areas and funding support. The mission of these vehicles is one - to offer early projects a secure runway for commercialization by facilitating access to funding and commercialization and industry knowhow, out of the belief that all too often, innovative research projects fail to reach the market despite having a commercial potential. Following is a list of TTOs and supporting vehicles established by them:

- Afeka Yissumim Ltd: Established in 2011, a fully owned subsidiary of Afeka Tel Aviv Academic College of Engineering as its TTO and commercialization arm.
- Ariel Scientific Innovations (ASI): The technology transfer office for Ariel University. ASI is a central location for the technology development initiatives, entrepreneurial activities, industry collaborations and commercially oriented innovations across the university. ASI's core mission is to facilitate the transfer of inventions from academic research labs to the market for the benefit of society.
- BIRAD - Research and Development Company Ltd.: Was established in 1974 to facilitate commercialization and translation of academic knowledge and intellectual property of Bar-Ilan University (BIU). BIU generates a pipeline of innovative technologies in diverse disciplines including engineering, bio-engineering, cyber security, chemistry agriculture, pharma and biotech. In addition, integrative centers such as the center of nanotechnology and brain research, provide fertile grounds for innovations in the field of bio-convergence. BIRAD also promotes academia-industry alliances through collaborative research programs or contract services, utilizing cutting edge technologies & equipment, and highly experienced personnel operating under the Scientific Service Division.
- Carmel - Technology Transfer Office of the University of Haifa (TTO): Carmel Haifa University Economic Corporation Ltd. serves as the commercialization and business arm of the University of Haifa and is responsible to protect, nurture and commercialize its knowledge and intellectual property as well as advance collaboration with the industry and ecosystem. Carmel-Haifa collaborates with various partners and establishes ventures and funds with the goal of maximizing the business potential of commercializing research and knowledge developed at the University of Haifa. Carmel established the Carmel Innovations Funds, providing seed funding to companies established by Carmel, for innovative projects based on IP of the University of Haifa. Together with the Fund, Carmel-Haifa establishes companies that have large market potential and nurtures them to the stage where global companies or other partners will be interested in collaborative agreements or acquisition.

- SPARK HUJI is a biotechnology accelerator based in the Hebrew University in Jerusalem, and focuses on technologies that promote personalized medicine, digital health, drug repurposing and drug reformulation.
- Yisssum - the technology transfer company of The Hebrew University of Jerusalem: Yisssum is the largest of the University TTOs in Israel. It serves as a bridge between cutting-edge academic research and a global community of entrepreneurs, investors, and industry. Yisssum's innovations span a wide variety of scientific fields including, but not limited to, Life Sciences, AgTech, and Computer Science. Since 1964, Yisssum has registered over 10,875 patents globally; licensed over 1,140 technologies and has spun out more than 191 companies.
- Integra Holdings - Hebrew University: Founded in 2012 by Yisssum, Integra invests in projects coming out the Hebrew University, and it holds an exclusive right to first examine the most promising innovations and IP emerging from the institution. Integra focuses on biopharmaceuticals and medical diagnostics and devices. Integra employs multidisciplinary teams of experts who work alongside inventors and take a hands-on approach to achieving commercial success. The fund provides know-how and support to its portfolio companies from inception to commercialization, while leveraging its extensive industry network cultivated over decades. Integra Holdings holds a diversified portfolio of eleven companies in early to late stages, with established partnerships with leading investment funds such as Orbimed, Pontifax, Lundbeck fund, SROne, CBI and Biolight LifeSciences, as well as private investors.
- A.Y.Y.T - Technology Transfer and Innovation at Holon Institute of Technology (HIT): A.Y.Y.T is the link between HIT and the Industry, being responsible for the commercialization of know-how, inventions and patents of HIT's researchers. A.Y.Y.T works closely with HIT researchers to identify the right commercial opportunities for their invention/innovation. In order to ensure successful technology transfer, A.Y.Y.T's experienced business team works in close collaboration with the researchers whose knowledge, contacts and technological understanding are important to the success of the commercialization process. In addition, researchers' steady involvement in the product development by the licensing partner is crucial to the development of the end-product.
- T3 - Technion Technology Transfer: The commercialization arm for all Technion generated technologies. T3's mission is to link the unparalleled wealth of knowledge found at the Technion with market opportunities as to generate high-impact technologies for the future. T3's primary activities include licensing out of technologies and establishing start-up companies, collaborating with the industry, facilitating sponsored research, managing the Technion's extensive patent portfolio and overseeing on-going investments placed.

- T3's reflection of the innovative strength of Israel's top institute of technology is demonstrated in over 100 affiliated companies established based on the intellectual property generated at the Technion's ecosystem.
- TRDF - Technion Research & Development: Foundation Ltd. TRDF is the commercialization arm of the Technion (via T3), offering access to the Technion's cutting edge scientific and technological intellectual property and expertise. TRDF focuses on granting licenses to Technion based innovations, and also functions as the focal point for the Technion's investment arms, which pursues investments in early stage Technion technology-based spinoff companies.
- Alfred Mann Institute - Technion (AMIT): AMIT is the Technion's longest standing incorporated investment vehicle. Formed in 2006, AMIT has to date placed investments in diversified technologies stemming from the Technion, or that engage Technion personnel. AMIT's mission statement has been to aid early-stage innovative technologies bridge the funding desert encountered during the initial development phase and until market interest of financial investors or strategic partners is achieved. AMIT's portfolio is focused on the life science arena, with companies engaging in medical device, digital health, data analytics and more. To date, AMIT has enjoyed an exit in two of its portfolio companies.
- Technion Investment Opportunities Fund LP (TIOF): Founded in 2011, TIOF was formed for the purpose of investing in early-stage spinoff companies based on technology developed by Technion researchers and graduates. TIOF aggregate investment in a company may be up to \$1 million and is generally utilized to maintain the TRDF's preemptive rights.
- The Technion Drive Accelerator LP (Drive): The Drive Accelerator LP is a 9-month funding and acceleration program for pre-seed and seed companies, with a focus on deep technology. Companies at the Drive benefit from the Technion's unique eco-system for entrepreneurs and innovators.
- Ramot - The technology transfer company of Tel Aviv University (TTO): Ramot bridges the gap between academia and industry, bringing scientific discoveries made at the University to the commercial market. Ramot manages all the University's commercialization activities, is the owner of intellectual property created by the University's researchers and is responsible for filing and maintaining patent applications and patents claiming such intellectual property. Ramot creates new business opportunities for University researchers and their technologies through establishing start-up companies and creating collaborations with industry entities. As of 2020, Ramot has filed more than 5,000 patent applications and has taken the lead in the establishment of more than 100 start-up companies. Ramot established the Technology Innovation Momentum Fund in partnership with the TATA Group and Temasek Holdings and TAU Ventures in partnership undergraduate students

and alumni of Tel Aviv University.

- SPARK Tel Aviv - Founded by Prof. Dan Peer, VP of Research and Development at Tel Aviv University, SPARK is a mentoring program that was created to support the academic efforts of translating discoveries into therapeutics that address unmet medical needs. The most valuable asset of SPARK is the unique partnership between the University, affiliated hospitals and industry experts. SPARK provides education, mentorship and funding and works closely with Ramot to identify, select and advance the technologies that are accepted to SPARK.
- ALYNnovation - an innovation track for the development and commercialization of pediatric assistive technologies and rehabilitation medical devices, set up in ALYN, Jerusalem's leading pediatric rehabilitation hospital. The hospital treats children and adolescents with a broad range of congenital and acquired conditions. ALYNnovation is a one-stop shop for technology entrepreneurship and brings together, for the first time under one roof, all of the elements required for innovation in this field: a physical work space with a state-of-the-art laboratory for prototyping and initial manufacturing, access to Israel's leading experts in pediatric rehabilitation, partnership surrounding clinical trials, and the opportunity for product testing with target audiences by interacting with the children at ALYN in a controlled and safe environment.
- Assuta Medical Centers- Assuta Medical Centers recently established an innovation department, focusing on development and early adoption of new technologies – medical and others. The department is leveraging Assuta's main assets, including large and unique databases and medical facilities.
- Hadasit - the technology transfer company of Hadassah Medical Center in Jerusalem (TTO). Hadasit transform the cutting-edge research coming out of Hadassah into marketable medical technologies, turning ground-breaking ideas into viable products and services that can change the world and better humanity. Hadasit identifies, protects, nurtures and commercializes the discoveries made at Hadassah Medical Center. The company assists physicians and researchers in identifying unmet medical needs, aligning inventions with market and regulatory expectations, and raising funds to support proof-of-concept development. Hadasit also handles the contractual aspects of all services offered to the industry, as well as pre-clinical studies conducted at Hadassah. Hadasit boasts a rich portfolio of over 250 patent families, covering a wide variety of novel therapeutics, diagnostics, and medical devices. It has also established dozens of research, license, and option agreements with strategic partners around the world. To date, Hadasit had spun off over 60 companies, including the publicly traded Hadasit Bio-Holdings (TASE: HDST), and is managing Hadassah Accelerator for digital health companies together with IBM Alpha Zone. Hadasit Bio-Holdings Ltd. (HBL, TASE: HDST) was founded and floated on the Tel Aviv Stock Exchange in 2005 in order to allow public participation

in the highly-promising field of biotechnology, and for the purpose of promoting and commercializing the intellectual property (IP) and R&D capabilities generated at Hadassah, aimed at finding solutions to problems faced by modern medicine. HBL serves as a precedent in biotechnology financing – for the first time, public investment could participate in companies based on IP generated by Israel's foremost medical research facility, Hadassah Medical Center.

- Rambam MedTech - the technology transfer office for Rambam Healthcare campus (TTO). Established in 2014 and it serves as Rambam's industrial liaison to bring medical innovations to market. Rambam MedTech supports the pioneering and innovative research of Rambam's physicians and scientists, transforming novel ideas into world class medical products.
- Madait - the technology transfer office for Shaare Zedek Medical Center. Established to promote the development and commercialization of novel medical technologies and to bridge between Shaare Zedek and industry.
- Tel Aviv Sourasky Medical Center - the technology transfer office for Tel Aviv Sourasky Medical Center (TASMC), presenting a growing technology portfolio ranging from Novel therapeutics to diagnostics and medical devices, the result of innovative research into the mechanism of diseases conducted in TASMC research laboratories.
- Ichilov Tech - launched in January 2020, Ichilov Tech is the innovation and tech transfer company of the Tel Aviv Sourasky Medical Center (Ichilov). Ichilov Tech acts as a bridge to industry - a design partner for the most innovative HealthTech technologies, empowering them with the clinical expertise of over 1,500 entrepreneurially minded physicians alongside agile and clear methodologies for designing, developing, and deploying biomedical innovations. In addition, its tech transfer arm promotes, develops, and commercializes the inventions, research results, and intellectual property of the Hospital. The Hospital also offers access to I-Medata, the data science center, a sandbox for Israeli startups in the digital health space. The center uses the data collected to develop data-driven products that boost medical care quality, help predict and identify medical conditions as early as possible, prioritize and optimize treatment options, and enhance decision support systems.
- Tel Hashomer Medical Research, Infrastructure and Services Ltd. Promotes the transfer of technologies, innovation and professional know-how generated by hospital employees to the biomedical industry. All resources generated by the company are used to support research and education at the hospital. Its IP portfolio spans diverse medical fields, including therapeutics, diagnostic tools, imaging modalities, drug delivery systems and medical devices. The Company serves as a lateral technology transfer for additional 10 public hospitals and additional government offices.

Table 2 - Most active Tech Transfer Offices in Israel, by institutions:

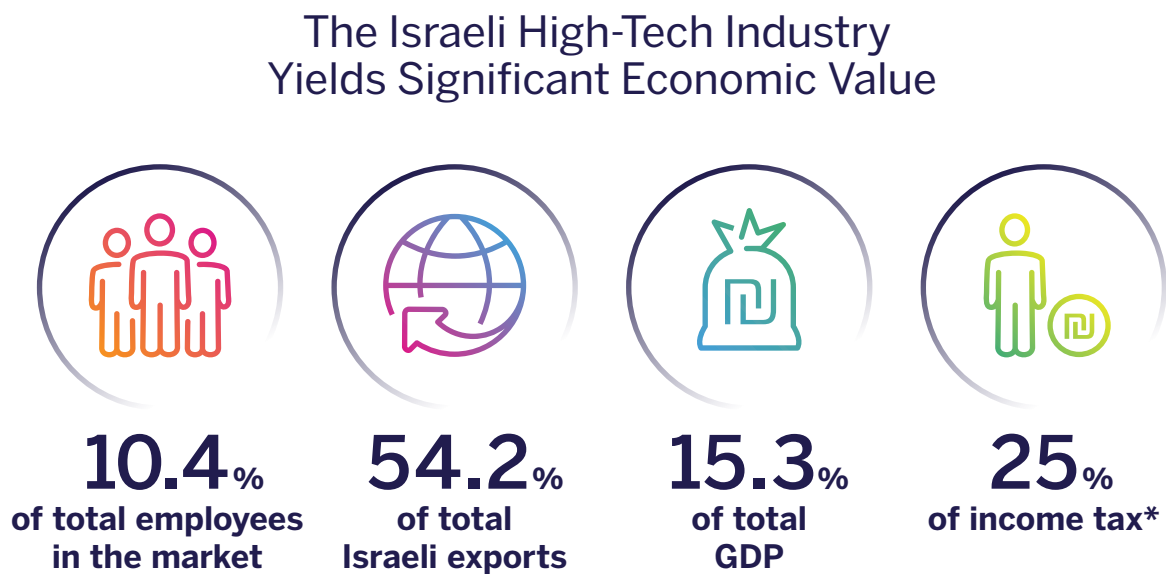
Institution Type	Institution Name	Tech Transfer Office
Universities	Ariel University	Ariel Scientific Innovations, Ltd.
	Bar Ilan University	Birad
	Haifa University	Carmel
	Hebrew University	Yissum
	Holon Institute of Technology	A.Y.Y.T
	ORT Braude College	Ofek Eshkolot Research & Development Ltd.
	Afeka Tel Aviv Academic College	Afeka Yissumim ltd
	Technion	T ³
	Tel Aviv University	Ramot
	Weitzman Institute	Yeda
Medical Centers	Alyn Hospital	ALYNnovation
	Assuta	Ventures and innovation department
	Hadassah University Medical Center	Hadasit
	Rambam Medical Center	MedTech
	Shaare Zedek Medical Center	Madait
	Tel- Aviv Sourasky Medical Center	Innovation and Tech Transfer Office
	The Chaim Sheba Medical Center at Tel Hashomer	Tel Hashomer Medical Research, Infrastructure and Services Ltd
Research Institutions	Clalit Health Services	Mor Research Applications
	MIGAL	Gavish – Galilee Bio applications Ltd
Health Maintenance Organizations	Clalit Health Services	Mor Research Applications
	Maccabi Healthcare Services	MaccabiTech

Government Support and Regulations

➤ Government Initiative

Fueled by vibrant entrepreneurial culture, robust technological infrastructure, and a highly-skilled human workforce that produces the highest venture capital investments deals and \$billions per GDP⁴⁶, innovation is one of Israel's most valuable natural resources. At the same time, Israel is today home to about 400 R&D centers of multinational corporations, many of them Fortune 500 companies.

Figure 43 - The Israeli High-Tech industry significant economic value



Source: Central Bureau of Statistics 2021. *CBS 2018

For many years now, the Israeli government is strongly focused on creating an R&D support network through various grants and incentive programs. The Israel Innovation Authority, an independent governmental publicly funded agency, was thus created to provide a variety of practical tools and funding platforms aimed at effectively addressing

⁴⁶ Global Innovation Index Database, WIPO, 2022

the dynamic and changing needs of the local and international innovation ecosystems. This includes early-stage entrepreneurs, mature companies developing new products or manufacturing processes, academic groups seeking to transfer their ideas to the market, global corporations interested in collaborating with Israeli technology, Israeli companies seeking new markets abroad, and manufacturing factories and plants seeking to incorporate innovative and advanced manufacturing technologies into their businesses.

After many years of large-scale investments in the pharmaceutical industry by the Israeli government and the Israel Innovation Authority, which did not yield a significant pharmaceutical industry in Israel, the Innovation Authority initiated a comprehensive study to identify the reasons and provide tools that can contribute to the establishment of pharmaceutical related industry in Israel and encourage emerging technologies in the life sciences sector.

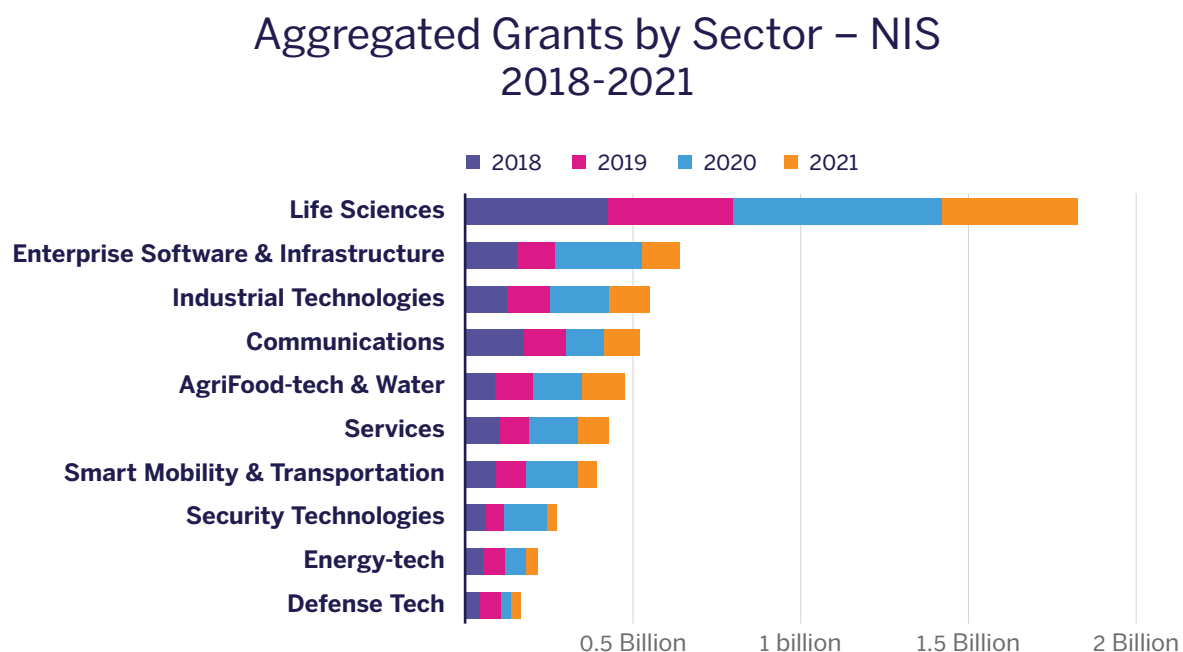
The research included an analysis of the contribution of the innovative pharmaceutical industry to the Israeli economy, compared to the funds invested in the sector over the years, as well as identifying other emerging technologies that may be a future industrial growth engine for the sector. The Innovation Authority also analyzed the advantages and strengths of the successful Israeli High-tech industries to locate optional multi-disciplinary capabilities that may be synergized with the Life Science sector to enhance the emergence of new fields of industrial innovation and excellence.

In the last 3 years, the Innovation Authority has been operating both by adapting the support policy as well as establishing a new vision that draws from the strength of Israel's high-tech advancements as well as from the Life sciences sector's accumulated knowledge - Bioconvergence.

Innovation Authority in Numbers

In 2021, the Innovation Authority's divisions implemented a wide range of efforts and programs aimed at advancing the growth of the Israeli innovation ecosystem. This chapter presents the investments of the innovation Authority in the Life Science industry⁴⁷ by leading programs during the last 4 years (2018-2021)⁴⁸.

Figure 44 - Aggregated Grants by Sector (2018 - 2021) - NIS



The life sciences sector is the most supported sector by the Innovation Authority over the years. In the last four years (2018-2021), the Innovation Authority has invested in the life science sector NIS 1.83 billion (approximately \$529 million and 33% of the total grants) and in the agricultural, food, and water technologies sectors NIS 0.47 billion (approximately \$136 million and 9% of the total grants).

⁴⁷ Life Science sector includes Pharma, Medical devices, Digital Health & other life science companies. For some analysis, we have also included also Ag/Food Tech. There may be differences between certain definitions in this chapter compared to the other chapters in this report.

⁴⁸ During the COVID-19 pandemic in the year 2020 the Innovation Authority launched special programs dealing with the pandemic and its consequences for Israeli companies and received special budget for those programs. During this year numbers of applications and approvals were exceptional high hence we didn't include the year 2020 in most of the analysis.

Table 3 - Summary of the Approved Grants for the Life Science Sector During 2021, by Program.

2021 Grants by Program

Program	Number of approved LS* grants	% of LS* out of the total approved grants	LS* approved grants (M NIS)	% of LS* out of total approved grants (NIS)
Tnufa	59	59%	7	62%
Incubators	51	60%	106	72%
R&D Fund	104	42%	206	43%
Pilots	20	32%	14	21%
Magnet Consortia			60	34%

The percentage of approvals for Life Science companies is decreasing for companies in later development stages. Tnufa and the Incubators programs are programs for projects and companies in the early stages. In these stages, the percentage of Life Science-approved grants is very high, with 60% in 2021. While the approval percentage of the R&D Fund program, which is a program for later stages, is substantially lower and was 40% in 2021. In the advanced development stages, and especially in the clinical phases, Life Science companies require much larger funds and the contribution of the Innovation Authority is less significant in these stages.

Applications

During the years 2018, 2019, and 2021, the Life Science sector submitted 1,500 applications for grants, an average of 500 applications per year, and the Agri-food-water tech 518, an average of 173 applications per year. The two sectors together submitted 2,018 applications representing 39% of the total applications to the different programs of the Innovation Authority.

Approvals

During the years 2018, 2019, and 2021, 49% of the Life Science applications and 45% of the Agri-food-water applications were approved.

Figure 45 - Number of Approvals by Sectors

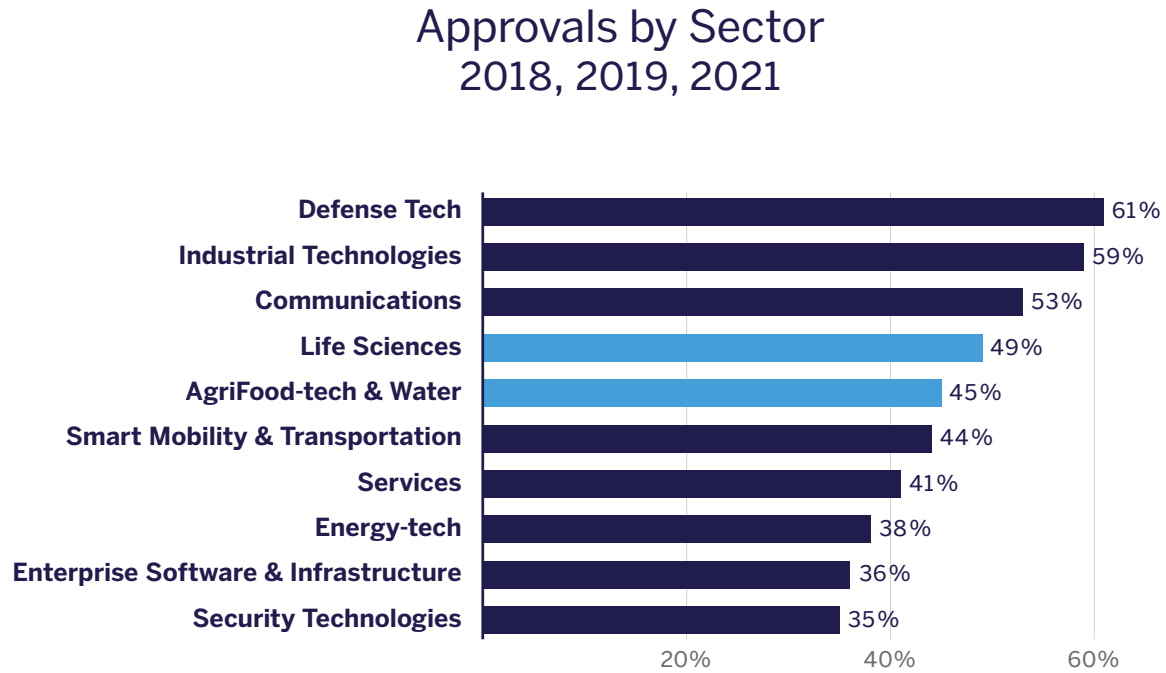
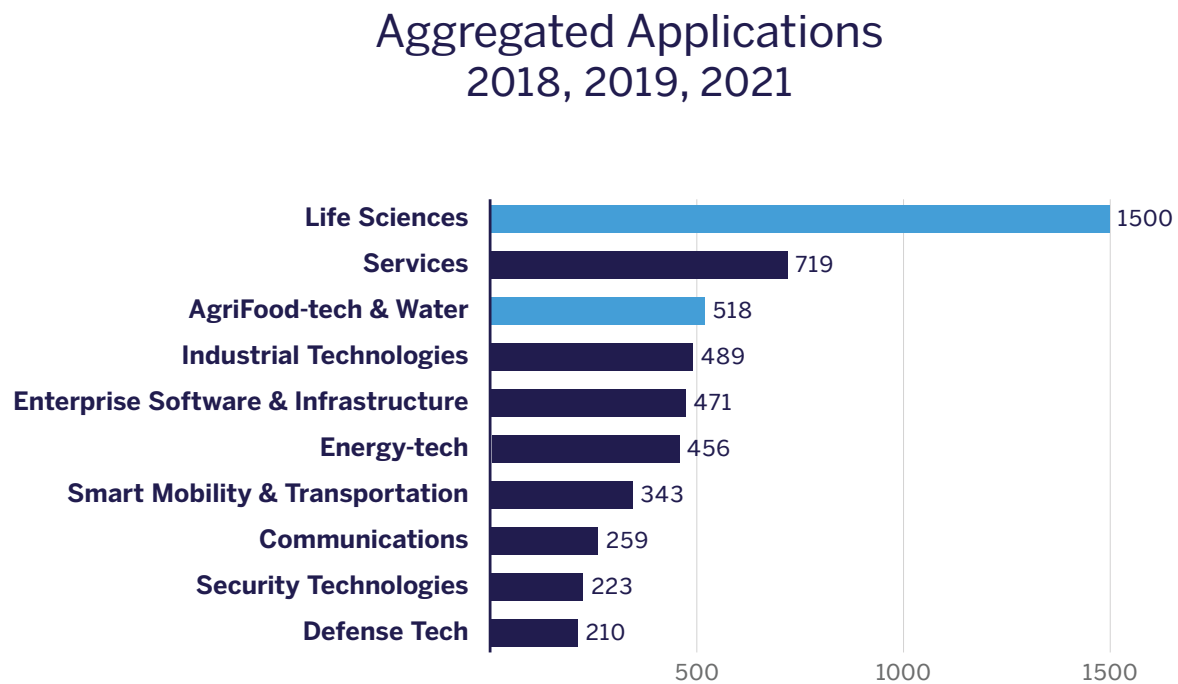


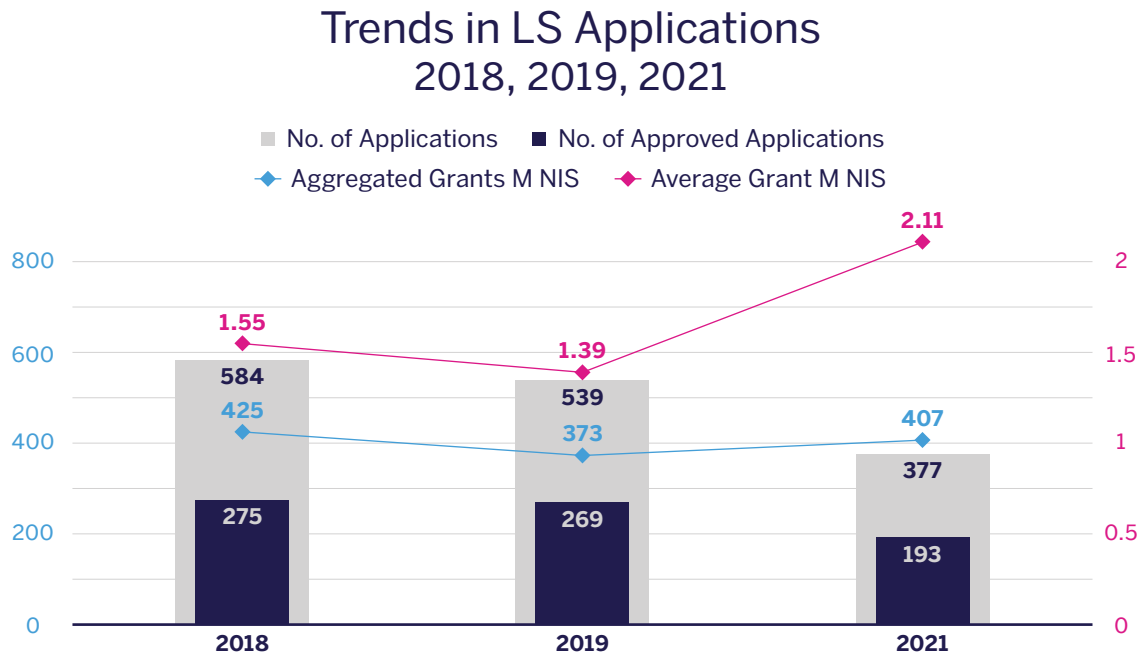
Figure 46 - Aggregated Number of Grants



Trends:

There is a clear trend of fewer applications during the last 4 years and consequently, a lower number of approvals. While the total aggregated grants for the Life Science were increased and the average grant per approved application has increased substantially.

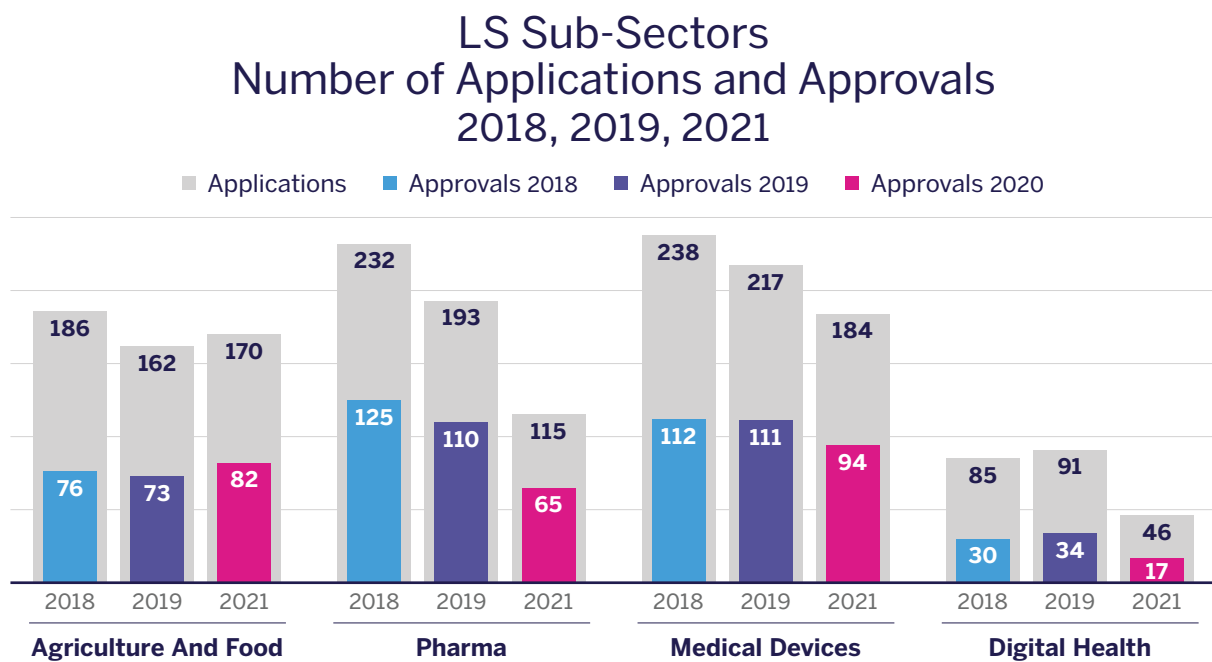
Figure 47 - Trends in Life Science Applications



➤ Analysis by Life Science Sub-Sectors

Analysis of the number of applications by Life Science sub-sectors indicates a constant decrease from 2018 to 2021. The decrease exists across the sectors. There is no substantial change in the percentage of approved grants in the different sectors (data is not shown). On contrary, we see a dramatic decrease in the number of approved applications, especially in pharma (59% compared to 2018) and in digital health (52% compared to 2018 and 50% compared to 2019). In the medical device sector, we see a slight decrease between 2019 to 2021.

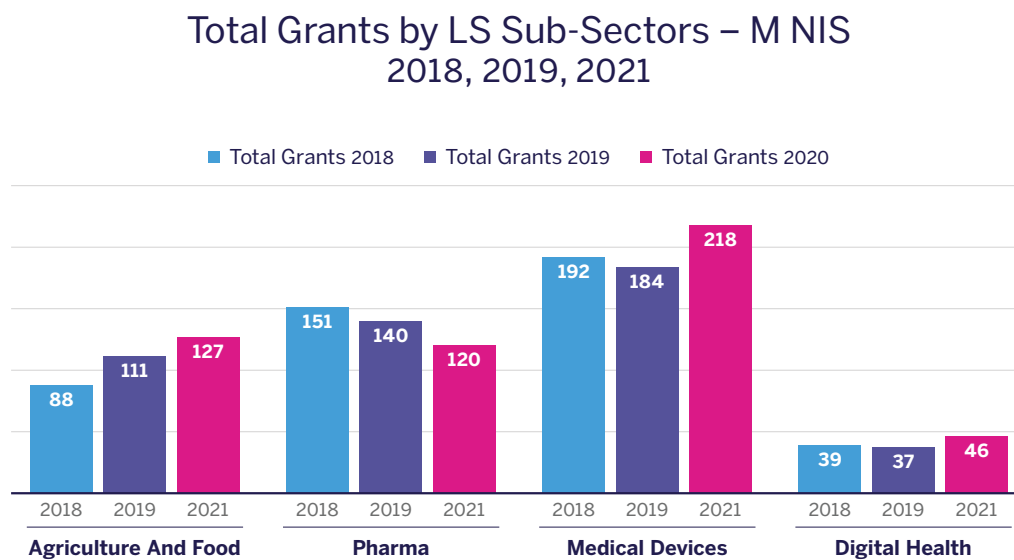
Figure 48 - Life Science Sub-sectors Number of Applications and Approval



Total grants

The total grants for all sectors, except pharma, are increasing over the years. The total grants for pharma decreased from NIS 151 million in 2018 to only NIS 120 million in 2020, a decrease of 20%.

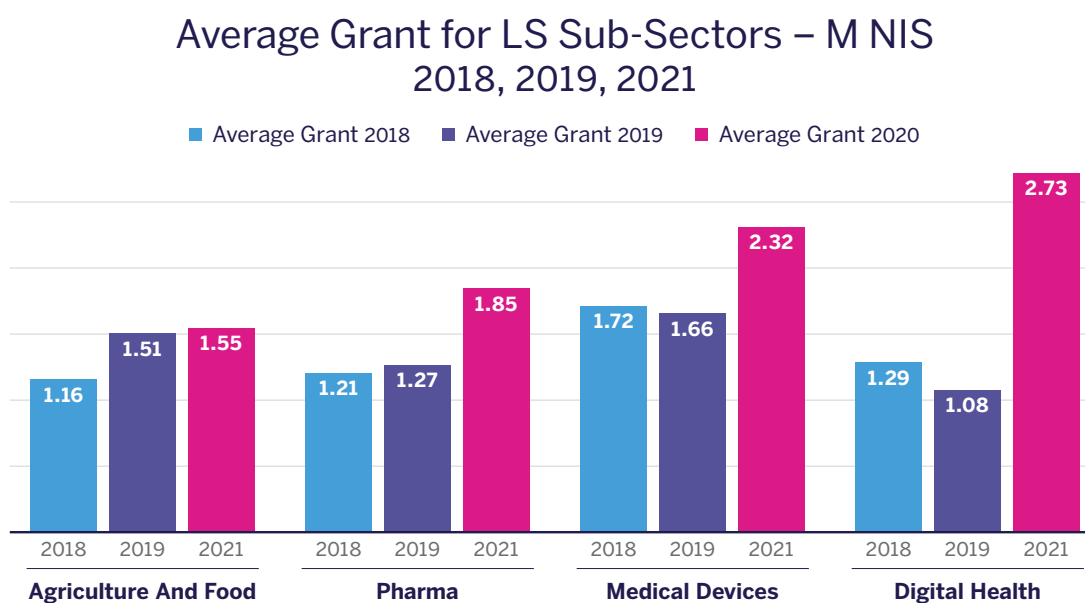
Figure 49 - Total Grants by Life Science Sub-sectors (NIS in million)



grant Average

The average grant in all sectors increased over the years and especially in the year 2021.

Figure 50 - Average Grants for Life Science Sub-sectors (NIS in million)



Summary:

The life science sector is the most supported sector by the Innovation Authority over the last 4 years (2018-2021). The Innovation Authority has invested during these years NIS 1.83 billion in the life science sector (33% of the total grants) and NIS 0.47 billion in the agricultural-food-water technologies sectors (9% of the total grants). The number of applications was the highest, by far, among all other sectors: 1,500 applications during the years 2018, 2019 & 2021, which is over twice the second sector. On the other hand, there was a constant decrease in the number of applications and approvals while the average grant for an approved application increased.

- Although this is not the only driver to the changes discussed above, and further analysis should still be made, we believe that the changes that have been taken over the past few years by the Innovation Authority are a key driver: Giving more money to fewer companies and raising the bar of overall excellence, in addition to technological innovation.
- Supporting companies that the Innovation Authority's funding can help them achieve a "fundable milestone" that will enable raising the next round.
- Supporting mainly companies that have most of the value chain required for the development of an active "holistic" company in Israel.
- Reducing the funding for advanced clinical studies, assuming that good results in early-phase will enable to raise the required funds from other sources. In addition, the funds that the Innovation Authority can allocate to advanced clinical phases are void relative to the amount of money required for those stages.

These changes have been implemented over the years and might lead companies that do not meet the new policy to reduce submissions, and eligible companies to focus their submissions only on early-stage projects and reduce the number of late-stage applications. Under this new policy, fewer companies receive larger grants.

Innovation Authority Programs

Startup Programs

Ideation (Tnufa) Program: The Ideation (Tnufa) program is intended for fledgling entrepreneurs with the goal to assist in the project's technological POC and commercial applicability, there-by enabling it to raise private funding and/or recruiting a business partner for further development. The program provides a maximum grant of up to 85% of the approved budget, with a maximum grant of NIS 200 thousand for up to 2 years (or up to double for innovative solutions in the field of Bioconvergence).

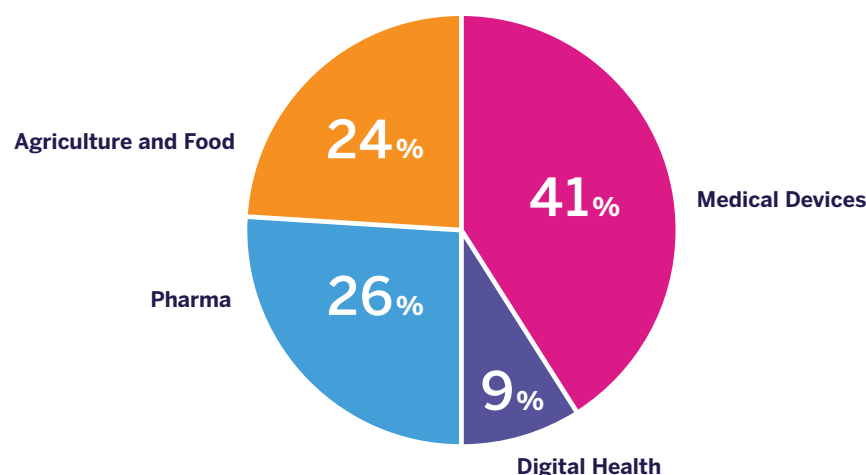
Co-investment opportunity: The goal of this program is to increase the number of seed-stage investments and to incentivize more experienced, venture capital investors to invest in the young, early-stage startups operating at high risk. Early-stage Israeli startups that have a signed term sheet with an experienced venture capital investor will receive up to NIS 3.5 million in grants from the Innovation Authority. The VC will be able to exercise a warrant for a period of up to 3 years

Technological Incubators Programs: The program aims to support investment in technology companies in their early stages. The technological incubators, that provide support and assistance to early-stage initiatives, are operated by local and international commercial companies and by venture capital investors with the ability to provide quality added value. No financial investment is required by the entrepreneur as part of the program - 85% of the budget is funded by the Authority and 15% is funded by the incubator operators.

There are 13 incubators across the country, 12 out of the 13 invest also in the different sectors of Life Science.

Figure 51 - Total 2021 Grants in the Incubators Program

Total 2021 Grants in the Incubators Program



Entrepreneurial Incubators in the Periphery Program aimed at promoting the development and strengthening of innovation systems, technological entrepreneurship, and employment in Israel's geographical periphery via collaboration between specially designated incubators and higher education institutions, students, entrepreneurs, and startup companies.

Technological Innovation Labs: This program is intended for entrepreneurs in the preliminary stages of a project, who need unique infrastructures and expertise to prove the feasibility of a technological idea. The program is also intended for corporations interested in collaborating with Israeli startups. The assistance to entrepreneurs is provided through innovation labs operated by the industry's leading corporations via an open innovation model. The program enables startups to access unique technological infrastructures, market insights, and unique channels of marketing and expertise. There are Three active labs, one in the fields of Digital health and computational biology.

Growth Programs

R&D Fund: This program supports commercial companies currently developing new products or upgrading existing technology. The program offers the largest financial incentive awarded by the State of Israel for Israeli corporations' R&D activity and is offered to all sectors to strengthen and advance the Israeli economy. The fund's activity also includes designated programs to support startup companies owned by members of Israel's minority populations and/or ultra-Orthodox and/or women and another designated program supporting break-through generic research and development in R&D-oriented companies.

Joint Government Support for High-Tech Technological Innovation (Pilots): This program allows technology companies to conduct pilots (including R&D and adaptation), in operational pilot sites, including scenarios with rigorous regulation and with governmental influence, while enhancing the perception of the economic value created in Israel. This program includes sub-programs specifically designated life science and healthcare sector as below:

Pilots in Digital Health: Israeli Ministry for Social Equality, the Ministry of Health, and the Israel Innovation Authority Approved 30 million Shekels for Initial Pilots. The companies accepted to the program will receive between 20% to 50% of approved R&D expenditures, with funding of up to 60% to 75% for proposals that show potential to significantly advance the public healthcare system in Israel and around the world, or that promise a breakthrough in their field.

Pilot in SMART on FHIR (Fast Healthcare Interoperability Resources)

Pilot – Employee burn-out in healthcare – a joint program of the Israeli Ministry for

Social Equality, Ministry of Health, and the Israel Innovation Authority for promoting the health and public health system in Israel and around the world through pilots in Israel, which will reduce the burden on health system workers, and prevent their erosion. Assistance to the industry in Israel in the process of examining and proving the feasibility of innovative technologies to reduce burdens on healthcare workers, and to reduce the attrition of medical staff and healthcare workers.

Pilots in Agriculture: The Ministry of Agriculture and the Israel Innovation Authority awarded grants totaling approximately NIS 9 million to six selected start-ups that will ensure the continued regular supply of agricultural products. From drones helping control pests to a patent that will help clean fishponds and other promising technologies.

Technological Infrastructure programs

The Technological Infrastructure Division is responsible for advancing the development of groundbreaking generic and pre-product technology, commercialization and transfer of knowledge from academia to industry, the establishment of R&D infrastructures, and for supporting the development of dual civilian-defense technologies. The Division's programs are open to entrepreneurs, companies, and research institutions for individual or collaborative research.

MAGNET Consortiums Program: Consortiums of Israeli industrial companies and academic research groups working together to realize a common vision of groundbreaking pre-product technology building blocks. The technology focuses on fields of importance in the global market in which Israeli industry already has or may have a competitive advantage. The program enables the distribution of knowledge and cooperation between the consortium partners, which may be otherwise difficult to achieve. The program enables the formation of different consortiums for 3 years, via a broad-based partnership of industry entities, that are focused on a limited number of companies or those aiming to build an infrastructure of knowledge via research institutions that are directed by the industry.

BIO Convergence MAGNET Consortia: The Bio Convergence program led by the Innovation Authority combines biology with disciplines from engineering fields such as electronics, AI, physics, computation, nanotechnology, materials science, and integrative technologies (such as a combination of cellular and genetic therapy). Combining different disciplines as mentioned, will address challenges in the field of medicine and other fields such as agriculture, energy, and defense.

CRISPRIL Consortia: Focuses on combining artificial intelligence technologies and CRISPR technology to develop advanced computing tools for genomic editing to

increase the efficiency and accuracy of editing tools and implement them quickly and efficiently in the industry. The consortia include 9 Israeli companies and leading researchers from several Israeli research institutions.

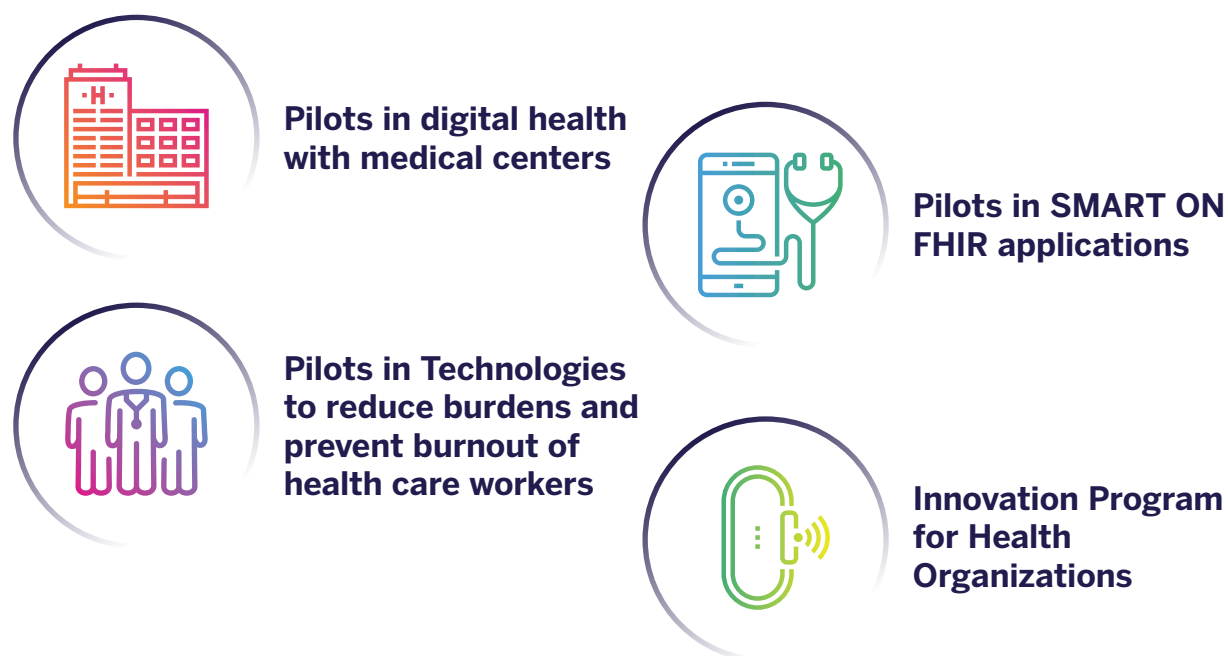
IGBTC Consortia (Israel Generic Biochip Technology): Develops generic technologies for diagnostics using bio-chips, which will be accessible to the Israeli biomedical industry and will enable accelerated and innovative development of a variety of applications based on flow control, optical sensing, electrical, chemical and electrochemical, integration of biological systems and subsystems to the molecular level. The consortia includes 6 Israeli companies and leading researchers from several Israeli research institutions.

Liquid Biopsy Consortia: developing a technological infrastructure that includes sensors, molecular tools, and intelligent software based on deep learning (AI), which will enable a customized and early assessment of health status, by examining various biological markers (biomarkers) physiological, metabolic, immunological and genomic. The consortia will demonstrate the technologies developed for 3 different diseases: hepatitis (NASH), Alzheimer's, and pancreatic cancer. The consortium includes 5 Israeli companies and leading researchers from several Israeli research institutions.

Cultivated Meat Consortia: developing technologies necessary to remove most of the essential technological barriers in the field of cultured meat to enable the gable of the production process, while significantly lowering production costs so that they are suitable for the food industry. Beyond that, the activity of the consortia is supposed to establish the leadership of Israeli industry in the field of cultured meat production per se, and especially of an industry that produces and exports the components required for the production of cultured meat in the world; Growth factors (GF), growth medium, scaffolds, bioreactors and more. The consortium includes 10 Israeli companies and leading researchers from several Israeli research institutions.

Innovation Program for Health Organizations

Figure 52 - Innovation Program for Health Organizations



The Israeli Ministry of Health, Israel Innovation Authority, and the e National Digital Israel Headquarter in the Ministry of Economy allocated approximately NIS 55 million to health organizations for the establishment of infrastructure to promote research and development in the field of digital health. The health organizations will receive the support of up to NIS 8 million each for programs that will establish and/or expand the digital infrastructure in health organizations designed to promote research and development in the field of digital health. The new support program is intended to promote innovative health services in the Israeli health system and to significantly expand the scope of collaborations based on health data and information that could be used for research and development purposes.

- Pilots in digital health with medical centers
- Pilots in Technologies to reduce burdens and prevent burnout of healthcare workers
- Pilots in SMART ON FHIR applications

Other Programs

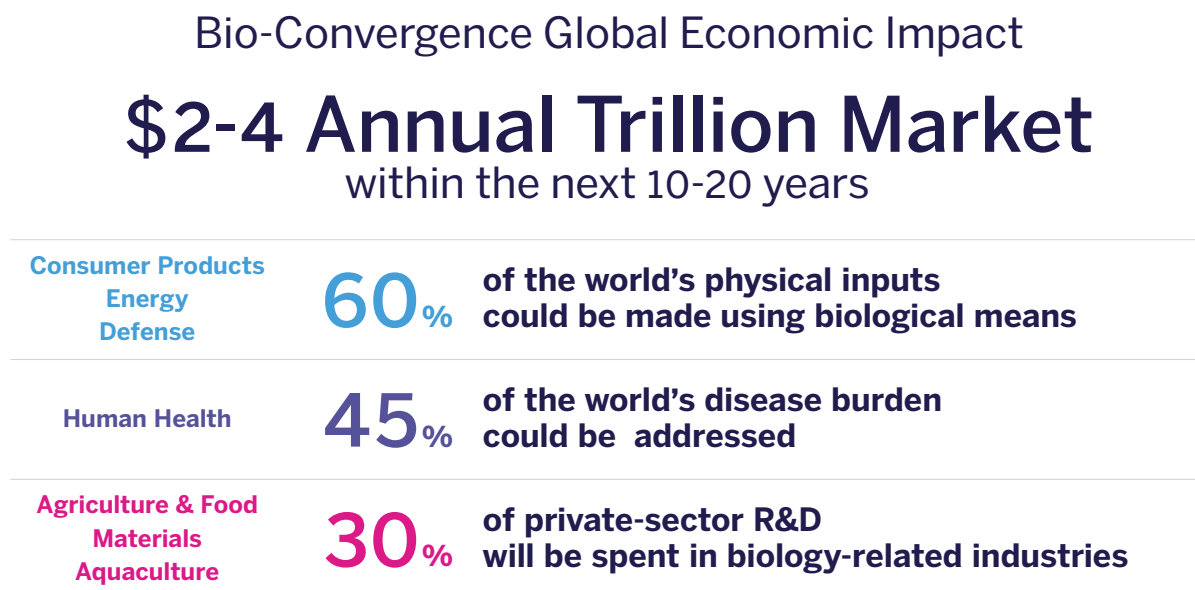
Assistive Tech ("Ezer-Tech"): This program has been operating since 2011 and is the result of collaboration between the Innovation Authority and the National Insurance Institute funds. The program's goal is to encourage the R&D of industrial products that provide technological solutions for the disabled and thereby enabling them to integrate into society and the labor market. Assistive technologies possess the potential to generate dramatic change in the lives of people with disabilities and to enable them to conduct healthy, independent, and respectable lives enabling them to contribute to all spheres of life: employment, education, leisure, etc.

Transition from R&D to manufacturing - the program is designed to help companies and factories succeed in the transition phase from development to production, and to promote the establishment of factories and production lines in Israel for innovative products at the world level. About 65% of the applications are in the field of medical equipment and pharmaceuticals.

Emerging Field - Bioconvergence

Bioconvergence global market:

Figure 53 - Bio-Convergence Global Economic Impact



Source: The Bio revolution Report, McKinsey May 2020

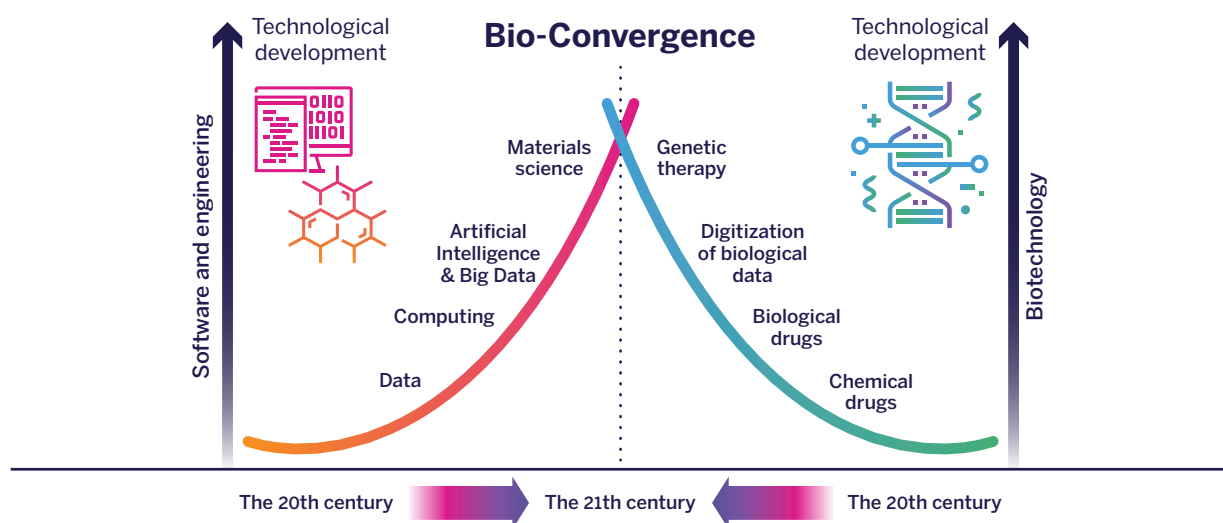
Bioconvergence is rapidly developing & growing and is finding use cases in agriculture, food, energy, climate, security, and various other industries apart from healthcare. According to the 2020 McKinsey report, as much as 60 percent of the physical inputs to the global economy could, in principle, be produced biologically, and with a direct economic impact of up to \$4 trillion a year over the next 10 to 20 years. The full potential could be far larger if we take into account potential new applications yet to emerge, and additional scientific breakthroughs. In the future, the estimation is that almost half of the global disease burden will be addressed through bio-convergence applications.

In recent years, global health and medicine have been undergoing a revolution driven by two main factors: first, the global health systems and biopharma industry crisis caused by a sharp increase in health expenditures and the development costs of new medicines. The second factor relates to recent technological breakthroughs in the fields of engineering, biology, and medicine. This revolution is fostering a new multidisciplinary industry that is based on the synergy between different technologies from the fields of biology and engineering mathematics, physics, and computational sciences, creating

a sum far greater than the total of all its parts. It is also a combination of completely different methodologies of development practiced in the world of engineering along with research methods customary in the world of life sciences.

Figure 54 - Technological Breakthroughs in Biotechnology and Engineering Paving the Way for Bio-Convergence

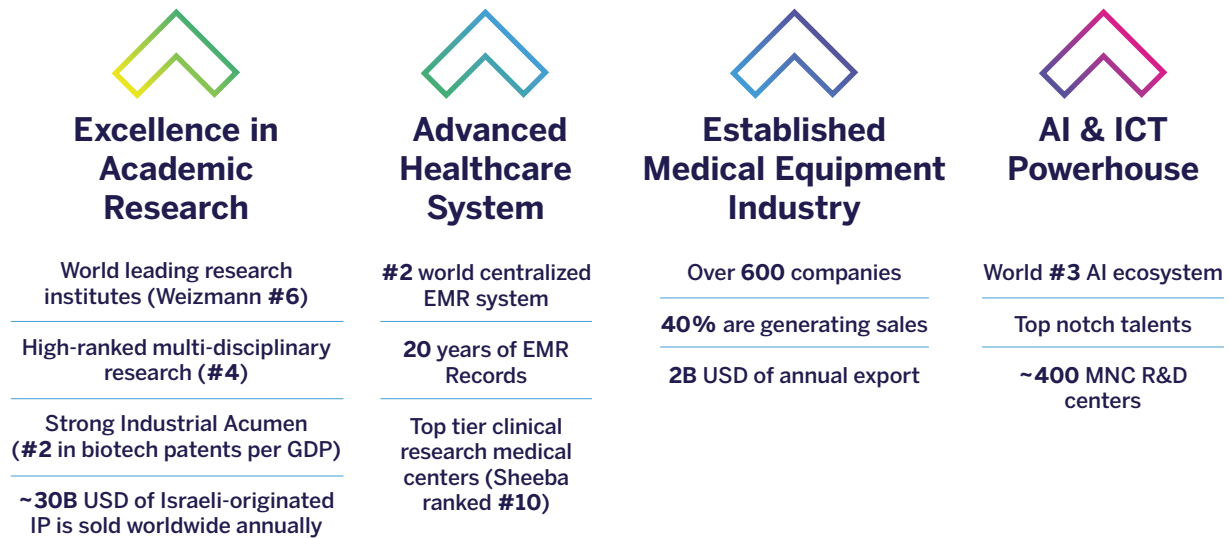
Technological Breakthroughs in Biotechnology and Engineering Paving the Way for Bio-Convergence



Bio-convergence is also a combination of talents and capabilities of two industries: the Hitech industry, which is very successful in Israel, can bring talented managers and the ability to raise substantial funds, and the experience of growing up startups to unicorns. Together with Biology scientists, Engineers, and Medical technologies and knowledge, from the Israeli Life Science industry and academia, to build sustainable companies and a new successful industrial sector in Israel. An Innovation Authority research revealed that the Israeli innovation eco-system is well-placed to assume a leading role in this field. The figure presents the main strengths of the Israeli innovation ecosystem, which places Israel in an excellent starting position to become a world leader in this field.

Figure 55 - Israel's Strengths in Bio-convergence

Israel has comparative strengths in Bio-Convergence

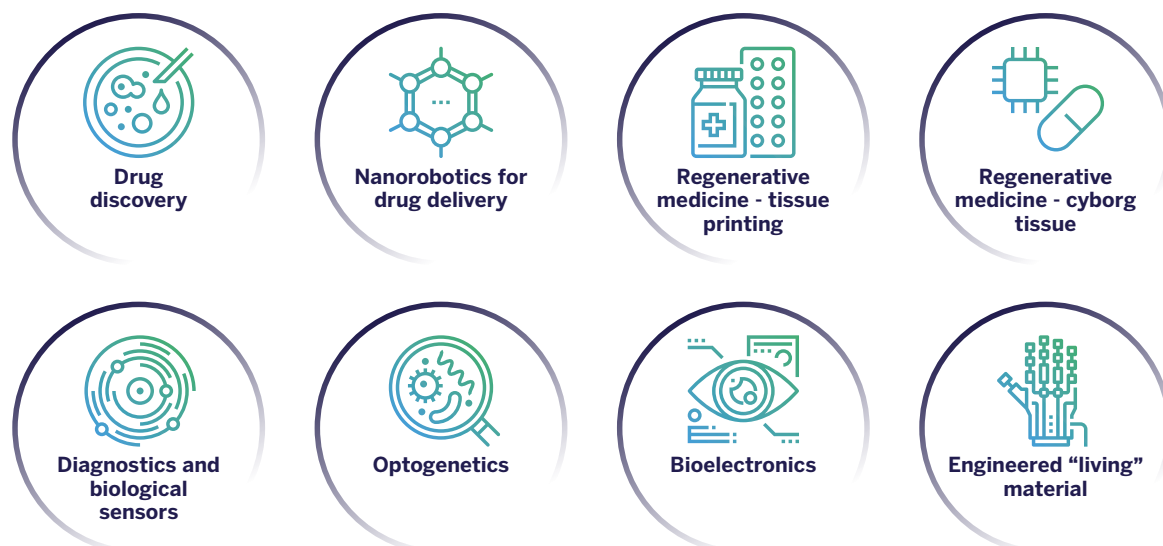


We believe that the Israeli innovation ecosystem has substantial potential to transform the country into a world leader in this developing field. Over the next ten years, Israel will build a leadership position in the emerging convergence-driven innovation ecosystem to create a strong competitive and sustainable Bio-Convergent industry focused on health-tech and other relevant fields such as defense, agriculture, and energy.

Innovation Authority Programs in Bio-Convergence

Figure 56 - Examples of Multidisciplinary Bio-Convergence

Examples of Multidisciplinary Bio-Convergence



The Innovation Authority has a broad range of collaborations with other entities including the Council for Higher Education, the Ministry of Defence, the Ministry of Health, The Ministry of Science and Technology, and Digital Israel H.Q. This cooperation, which creates a competitive ecosystem supporting the advancement of the bio-convergence field in Israel.

The core principles of the program are to accelerate technology transfer to the local industry, attract foreign companies to Israel, support startups, and establish additional collaborations with the local industry. An important part of the program is strengthening and focusing on applied (and basic) multidisciplinary and transdisciplinary research in Israeli academia to preserve a global scientific advantage and advance the local innovation ecosystem toward the field of Bio-convergence.

Programs:

- Telem national program - Telem Forum is a voluntary organization that strives to promote R&D programs and projects in scientific and technological fields through the establishment of national R&D infrastructures and inter-organizational, inter-departmental, and international collaborations. The goal of the program is consultation and coordination between the Forum's member entities on issues relating to R&D; initiation, coordination, assessment, pooling of resources (from the budgets of the forum's member entities and other relevant bodies), and assignment of responsibility for implementation and supervision of the establishment and operation of national R&D infrastructures.
- The Forum has approved the initial phase of a national Bio-Convergence program amounting to approximately NIS 435 million to promote the field of Bio-Convergence in Israel. The Innovation Authority intends to invest another NIS 720 million independently to promote the field. Accordingly, the total activity that will leverage the amount that the State of Israel will invest in the field of bio-convergence over the next five years is expected to reach close to NIS 2 billion. The program will focus on building infrastructure and developing capabilities in areas such as bioengineering devices, bioprinting, tissue engineering, environmental microbiome, synthetic biology, and more.
- "MAGNET" Consortia - "MAGNET" incentive program provides grants for R&D collaboration as part of a consortium (a group of industrial companies and research institutions developing technologies together). The Innovation Authority established 2 consortia in the field of Bio-Convergence (more information appears in the Innovation Authority programs chapter below). The Innovation Authority plans to

establish additional consortia in the coming years.

- A new computational biology innovation lab, Aion Labs, was established in 2021 by 4 big pharma: Pfizer, AstraZeneca, Merck, Teva & AWS, IBF to create and promote new AI/Pharma ventures. AION Labs is a first-of-its-kind alliance of global pharma and technology leaders and investors that have come together with one clear mission: to create and adopt gateway AI and computational technologies that will transform the process of drug discovery and development for the betterment of human health.
- New synthetic biology lab - The Israel Innovation Authority will fund the first synthetic biology applied R&D infrastructure in Israel. Funding will be a total of around NIS 18 million during the first year and is expected to reach NIS 40 million subjects to the project achieving its pre-defined targets.
- 2 new Bioconvergence incubators - Israel Innovation Authority launches a new incubators program in the fields of Health with an emphasis on Bio-Convergence, Climate, Foodtech, and Space. Five groups were selected to operate the new technology incubators. Two incubators in the field of Bio-Convergence. The incubators are expected to support the establishment of about 150 innovative and disruptive startup companies in sectors that will further develop Israel's innovation ecosystem, at a total budget of about NIS 500 million.
- Tnufa - Increased funding of ILS 400,000 for individual entrepreneurs developing health-tech solutions combining engineering & biology
- Human capital in Bioconvergence

Looking Into The Future

In the sections above we provided you with an in-depth view of the Israel life sciences industry in the last year and decade - geographic location of the companies, leading sub-sectors, rising sectors, funding trends and the programs supported by the Israeli government. We would like to take the opportunity and share with you some forward looking discussions and ideas, suggest a fresh look new approaches, and what we think the coming trends are.

The Next Great Leap Forward in Health⁴⁹

We are in the dawn of a new era in healthcare that is leading to revolutionary paradigm shifts. We envision a world where healthcare is no longer reactive, but predictive and preventative. Less generic, more personalized. Less episodic, and more continuous. From unsustainably costly hospital care to more accessible, equitable, home-based, and decentralized care.

Disruptive Innovation is the main driver fueling this paradigm shift at a speed and scale that is turning the \$10 trillion healthcare industry on its head⁵⁰, and we believe these are the forces shaping the next great leap forward in health.

Multi-Omics: Genes are Only the Beginning

The multi-omics revolution is transforming the way we diagnose, treat and cure disease. Deciphering the human barcode at scale unlocks an unprecedented level of prevention, early detection, and personalized care. Today when we perform a screening or diagnostics test, like a mammography, colonoscopy, or a low dose lung CT scan to diagnose cancer, we are trying to find a lump or a mass which is cancerous. We are satisfied when we can discover this mass when it is still very small - This is considered early detection. However, in reality, it is much too late. Most illnesses begin to develop two, three, even four years before there is a lump, mass, or lesion. With multi-omics, we can diagnose or assign a cancer risk score based on molecular changes before there is a visible tumor: now *this* is early detection.

⁴⁹ With the support of Yair Schindel, Co-Founder & Managing Partner of aMoon

⁵⁰ The Economic Intelligence Unit, Data Tool accessed on 16 August 2018

To date, multi-omics approaches have been applied to determine the mechanisms of disease at the DNA (genomics), RNA (transcriptomics), Protein (proteomics), and Metabolites (metabolomics) levels. The vast quantities of rich data layers collected through analysis of lab samples have opened the door to identifying new and improved diagnostic and prognostic biomarkers, and ultimately generating a specific molecular signature of each human illness, for an early diagnosis and a more optimal treatment selection. The main barrier to wider adoption of these tools has traditionally been cost. For example, to produce a whole genome sequence and access someone's entire barcode used to cost millions of dollars. Eventually that price went down to tens of thousands. In the last couple of years, the cost has plummeted to a thousand dollars and even less, and these days Ultima Genomics is introducing for the \$100 genome. This cost reduction is a game-changer. When prices drop so dramatically, it's much like Moore's Law and the price of computer chips, making available to the masses what was once accessible to a very small group of people. As genomics prices go down, we're beginning to run population studies on tens of thousands of people to augment at scale the clinical information needed to catapult predictive and precise insights.

The traditional method of trial and error upon which clinical practice relies today is starting to make way for a smarter, evidence-based, and more impactful method of care. Rather than playing a guessing game with people's lives, we will be able to know in advance whether a treatment will be right for them. It's only a matter of time before **true** early detection and informed choice of treatment become the universal standard of care.

Harnessing the power of biology: Working with the body rather than fighting it

So much of the way we treat disease today is by fighting *against* biological phenomena, when really, we need to be harnessing its power and complexity to fight disease *with* it. The treatment of cancer is a perfect example. Traditionally, doctors have worked to kill cancer either by cutting it out with surgery, eradicating it with chemotherapy, or destroying it with radiation. Yet in the process of trying to kill cancer cells in the body, we were sacrificing many healthy cells, and generating new clones of mutant cancer cells that returned with a vengeance.

Today we have changed this formula. Instead of fighting the body using relatively non-specific toxic agents, we are directing the body's own immune system to identify and kill it. Cancerous mutations occur naturally and randomly in our cells all the time. Under normal conditions, our immune system identifies these cells as different, and destroys them so they can't grow into a tumor. But as we age, or when we develop other medical conditions, our immune system cannot kill those cancerous mutations on its own. This is where immunotherapy, cell and gene therapy, and tissue therapeutics come into play to leverage the biological capabilities that are naturally found in our

bodies to heal.

Scientists have developed numerous techniques to preserve and augment the body to heal itself. One example is from a company called CartiHeal, in the field of OrthoBiologics. CartiHeal uses a unique mineral extracted from corals to treat degenerative cartilage defects in people's knees, specifically the disease of osteoarthritis. Say someone has osteoarthritis, instead of removing their knee and putting in a prosthesis (an invasive surgical procedure called Total Knee Replacement), doctors implant a coral aragonite scaffold, which the body dismantles, using the minerals to build brand new hyaline cartilage, as well as new subchondral bone underneath it.

Satellite Bio is another innovative example. They are implanting human liver cells to perform the function of an auxiliary liver, the same way a normal liver would. First, they build and grow a 3D organ in a lab, and then implant it into patients with severe liver disease. The small and flexible satellite implant goes under the abdominal muscles and secretes the liver enzymes the body needs.

Another way doctors are leveraging the body's inherent biological mechanisms is with CAR-T Cells, a procedure in which T cells (one of the immune system "killer" cells) are removed from the body, exposed to cancer cell, and are taught to attack it. The T cells are then multiplied and returned to the body, where they latch onto the cancer cells and destroy them. One example of innovation in this field is Adicet Bio, a cell therapy company, which helps T cells identify a tumor and kill it.

Now, instead of killing healthy cells with chemo and radiation, we are assisting the body to heal itself. When we can better enable our own immune system to police the body and remove the cancer and kill it, then we can eliminate cancer cells wherever they are in the body- including distant cancerous metastasis - without harming non-cancerous cells. That's a much more efficient way of treating cancer.

Data-fueled innovation: Unlocking big data, AI and machine learning to enable better care

Data is fueling innovation in healthcare by unlocking exponentially growing datasets to get ahead of disease. Unprecedented computational power, open-source algorithms and cloud resources coupled by the digitization of historical data and accumulation of new data streams have opened the door to rapid disruption in the healthcare space.

A key example is how google and deep mind revolutionized biology in 2021 by releasing al-phaFold as open source – a tool to visualize and study the potential structures of >200K proteins, that opened the door to structure-based design of new drugs.

This breakthrough proves the power of sharing and interconnecting data and the disruption to research and discovery processes that new technology can bring.

Although the availability and pooling of rich data sources to create data networks and make predictions is useful, it is not without its challenges and regulatory limitations. The sharing of patients' medical data comes with both technological complexities of data harmonization, as well as deep regulatory moats around privacy and safety of medical information. Some of the most exciting, and valuable technologies in the space today aim to solve these exact challenges.

A great example is MDClone's synthetic data platform, enabling the mass sharing of data between countries and medical centers without jeopardizing patient privacy, and without posing a cybersecurity risk. MDClone is building a global network where doctors and researchers in large hospitals around the world can share massive amounts of data, search it and discover new insights on better patient care and more efficient healthcare costs without sacrificing privacy.

The ability to share and integrate heterogenous health datasets has huge potential for faster learning and implementation of best practices across countries and between countries. Covid-19 accelerated that process. For example, MDClone, whose software is now used by every Israeli hospital and HMO, made it possible to quickly collect, analyze, and publish data from almost four million vaccinated patients very early in the pandemic. This data was the basis for several publications in the New England Journal of Medicine and in other high impact medical journals.

AI is also making an impact on how care is delivered. The growth of AI-powered care is also revolutionizing the way we treat patients. And in the words of Prof. Lloyd Minor, Dean of Stanford Medical School and venture advisor at aMoon: "AI is not going to replace doctors. Doctors who use AI will replace doctors who don't use AI. Machines will not replace people. But doctors who take advantage of machine learning and big data will be the doctors providing revolutionary care." Indeed, decision support tools and robotic interfaces are emerging as the new tools in the doctor's medical bag.

This paradigm shift toward data-driven care is powered by hyper-efficient hardware with unprecedented processing power and constantly evolving software solutions, areas in which Israel has been punching above its weight for the last three or four decades. Israel has always been very strong in the field of Hi-Tech. Now that healthcare and biology are converging with technology, many leading tech entrepreneurs and investors are crossing their disciplinary boundaries, hoping to make a difference in healthcare and life sciences. That wasn't the case just ten years ago. Yet they have come to realize this unique opportunity to make a positive impact on people's lives. Not just to do well, but to do good. This is why we are seeing so many brilliant minds transition from Hi-Tech to HealthTech.

Another factor is that HealthTech no longer has geographical or thematic boundaries. Science used to be siloed, with slow and inefficient exchange between different countries and different industry verticals. Today HealthTech is crossing borders and disciplines. Establishing and expanding these bridges is the best strategy for Israeli HealthTech to rapidly grow. The more we enable talent, capital, technology, data sharing and insights to flow freely between global HealthTech hubs, the faster we can get ahead of disease and accelerate cure.

It will take a bit more time and more funding for these innovations to become the norm. Yet we are already seeing the early signs of a massive revolution in the \$10 trillion industry of HealthTech. For some of these advancements, such as true early detection and choice of treatment via Multi-Omics biomarkers, or big data and artificial intelligence in radiology, pathology and other specialties, we'll start to see these become more prevalent in three to five years, and then in ten years they will be widespread.

One Step Backwards - Advancing Towards Preventive Medicine in Childhood⁵¹

Since the majority of deaths in adults is linked to conditions or behaviors in childhood, any discussion around wellness and prevention of chronic illness must go back to the child. Despite its easy-to-grasp importance, the large-scale incorporation of preventive medicine into western medical establishment is relatively new. In addition to generally promoting the adoption of healthy habits, healthcare systems now execute well designed prevention strategies by offering a myriad of routine screenings (e.g blood pressure, cholesterol, colorectal and breast cancer), and by intervening even before disease appears, in cases where risk is identified (e.g post-exposure prophylaxis for HIV, statins to prevent heart attack and stroke, vaccination campaigns).

We reached a point in societal development in which we expect our healthcare systems to actively use their resources to not only treat, but also prevent our diseases, even when they afflict a thin slice of the population pie. In addition to preventing human suffering, healthcare systems also calculate the reduction in the likelihood of health emergencies and additional costs of chronic care. This important shift in the medical paradigm was brought about by increased predictive and interventional capabilities, enabling a proactive approach.

Using this rationale and expanding the time axis backwards, considering that biological and pathological processes take time to unfold, one can see that everything we do (or do not do) to promote health in children, will affect 100% of the adult population to some extent. Remember: 100% of us living adults were once children.

Through the elucidation of new molecular mechanisms and better understanding of patho-physiology, evidence-based knowledge has been accumulating as larger numbers of adult diseases emerge as having their origins in childhood. In fact, even during embryonal development, does the diet of the pregnant mother influence the epigenetic markings in our DNA with potentially life-long effect in gene expression and protein synthesis⁵². Nutritional recommendations to the mother can thus have a huge impact in the child and future adult's health.

This effect dependency is also clearly seen in Adolescents and Young Adults (AYA, 15 to 39 year group) in whom there is a rising incidence of chronic diseases, including cancer, obesity, hypertension, diabetes, metabolic syndrome, ischemic stroke, irritable bowel syndrome, and all mental health conditions. These conditions have all been linked to childhood events, or down-right started back then.

⁵¹ With the support of Mel Larrosa, CEO of Schneider Innovation Center

⁵² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4663595/>

When speaking of children, developmental disabilities come to mind as long-term conditions, the negative effects of which may span across adulthood. This is the case indeed. In the US, about 17% of children have one or more developmental disabilities, reflecting as 1 in 6 adults presently living with such conditions.⁵³ Worldwide, the numbers vary significantly among countries, but the global burden has not significantly improved since 1990.

A pattern of continuity from childhood to adulthood health has consistently emerged throughout a great variety of communicable and non-communicable diseases, including those with well-documented clinical and epidemiological links (e.g tuberculosis, hepatitis B, typhoid fever, cirrhosis/liver cancer, rheumatic heart disease, diabetes, respiratory infections/bronchitis).

Another extremely important aspect is mental health. The consequences of failing to address mental health conditions in childhood are recognized in adulthood, impairing not only mental, but also physical health and limiting the ability to lead fulfilling lives. Globally, one in seven 10-19 year olds experiences a mental disorder, accounting for 13% of the global burden of disease in this age group⁵⁴.

With such high numbers, one would expect a booming field of research, and associated investment, aiming at diagnosing and treating children better not only to alleviate their ordeal, but also to avoid the life-long suffering and medical bills. Nonetheless, this is not yet the case. Even though there are almost 2 billion children in the world, around 27% of the total population, only around 10% of total investment in medical innovation goes to the pediatric field. Why are we lagging behind?

Investing in pediatric health-tech has unique features. In a strictly financial sense, research and development are more complex and, therefore, more expensive. For every new drug, device or digital tool devised for medical use, there is the need to assess any potential impact on growth and development. Informed consent to participate in trials, usually given by parents, can be sensitive when enrolling adolescents who might come to age during the clinical studies. Additionally to complying with these special ethical and regulatory protections, there is market stratification, since children are a very diverse group of patients in size (from a few hundred grams to 100kg or more), physiology, and pathology. One-size-fits-all is definitely not an option here.

⁵³ <https://www.cdc.gov/ncbddd/developmentaldisabilities/about.html>

⁵⁴ <https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health>

Despite these real, and some perceived challenges, societies are changing and impacting the moods of the market. A change in the paradigm can be observed and an inflexion point has now been reached, forcing us to decide, as a society, how to react to the impact of 'their' health (children's) on 'our' health (adults). Investors will always follow when markets are favorable and conditions appropriate.

Fortunately, markets are improving. Pediatric healthcare market forecasts predict an annual growth of over 5% in the upcoming decade, possibly with the medical devices segment continuing on the lead⁵⁵. Venture capital funding for digital behavioral health tools for children and teenagers reached \$919 million in 2021, up from \$54 million in 2017 and more than double the amount raised in 2020⁵⁶.

In recent years, the realization of the need to innovate in the pediatric space has given rise to the establishment of pediatrics-only accelerators and innovation centers under the auspices of children's hospitals, e.g. in Stanford, Boston, Philadelphia, Cincinnati, London, and many others. In Israel, Schneider Children's Medical Center of Israel has established the only Innovation Center fully dedicated to the whole spectrum of pediatric innovation, which supports the development of innovative drugs, novel medical devices and new digital tools. A further growing trend is the establishment of Parent-Tech companies, such as e.g. Greenlight, Cleo, LearnPlay, OgyMogy and many others, attracting rising investments.

Governments will continue to play a critical role in this fragile environment, tasked with offering incentives and reviewing potentially excessive regulatory limitations. The standardization of pediatric-specific knowledge among all stakeholders continues to be a necessity.

As we advance through the 21st century and technological breakthroughs are taking place at breathtaking speed, our focus is shifting from treatment to prevention enabling earlier and anticipatory intervention. Unmistakably, this approach will necessitate that stakeholder in the ecosystem redirect their attention and investments to the growing and promising field of child health.

⁵⁵ https://www.einnews.com/pr_news/567488298/global-pediatric-healthcare-market-is-estimated-to-witness-a-growth-rate-of-5-1-over-the-forecast-period-2021-2029

⁵⁶ <https://morningconsult.com/2022/03/31/digital-mental-health-children-teens-data/>

Global Trends

The COVID-19 pandemic and its implications has accelerated innovation in the health industry by a massive development of the digital health sector as well as emphasizing areas such as mental health and remote care. We believe that the following topics may create a significant impact on the healthcare industry in the upcoming years:

- Increasing use of AI - In the US, the average time-to-market for an experimental drug is 12 years. However, the first COVID-19 vaccines were developed, tested and approved in under a year, providing insights into how the process can be accelerated. AI has been central to the creation and distribution of the vaccines, and it will re-define the future of R&D in life sciences. The global AI in healthcare market is expected to reach USD 31.3 Billion by 2025. AI can process historical, competitor and third-party data, while learning and adapting in real-time. Through analyzing precedents, regulatory landscape, and competitors' development plans, life sciences companies can quickly identify viable drugs and shape their go-to-market strategies⁵⁷.
- Space health - Backed by the commercial Space travels launched in 2022, research of optimizing human health and medical management in Space has progressed. Space health challenge our knowledge of physiologic responses on earth, provide models of extreme environments and accelerated aging, and provide technological advances that enhance terrestrial health care.
- Sustainability - An increasing focus on sustainability and environmental, social and governance (ESG) factors will increasingly be of importance in digital health procurement and implementation. Organizations will be seeking to procure digital health solutions and infrastructure that is sustainable, ethical, considers social responsibility across the entire supply chain⁵⁸.

⁵⁷ <https://www.wns.com/perspectives/articles/article/detail/220/top-4-pharma-trends-in-2025>

⁵⁸ <https://www.pwc.co.nz/pdfs/2022/pwc-digital-health-trends-2022.pdf>

IATI Members Bring Their Personal Take on the Israeli Life Science Industry

Dr. Amiram Appelbaum, Chairman of Israel Innovation Authority

There is no doubt that life sciences are one of the next growth engines for the Israeli economy.

With the coronavirus pandemic highlighting Israel's enormous economic potential and its top position in global industry, the life sciences sector (Bioconvergence) offers an opportunity not to be missed.

The National Bioconvergence Initiative, led by Israel Innovation Authority, will invest in and support all aspects of Bioconvergence, from science to technological infrastructure to talent and the private sector.

A key objective of the initiative is to build on Israel's strengths: (1) Talent - bringing Hi-Tech experience to recruitment and funding in order to establish bioconvergence's companies in Israel. (2) Multidisciplinary - combining engineering and biological research and development methods. (3) Integration - the combination of biology with technologies that Israel has a competitive advantage in, such as AI, software development, and data mining, with engineering technologies such as chip development, and novel materials.

Amir London, CEO at Kamada

The main strengths of the Israeli life science industry are the strong scientific foundation in Israel, the close ties between the academia, the medical community, and leading entrepreneurs, and the innovative "out of the box" startup mindset of so many Israelis.

The past year has been tough for many of the Israeli biopharma companies, mainly the publicly-traded firms who rely on the stock markets for their funding. Companies should not be discouraged during these challenging times but use the opportunity to focus their resources on their main assets, strategize their business model, look for partnering opportunities and streamline their operations. This is a time to reflect on Winston Churchill's famous statement: "Never let a good crisis go to waste!"

Anat Cohen-Dayag, President & CEO, Compugen

Scientific excellence and an entrepreneurial spirit are two of the major strengths of the Israeli life sciences industry, and what make Israel an attractive innovation center. With this infrastructure we now need to build life science product development capabilities to facilitate the transition from early-stage product opportunities to a more advanced product development industry, leading toward a sustainable biotech model.

Arie Melamed Yekel, General Manager, ALYN PARC Research Center & ALYNnovation at ALYN Hospital

The strength and power of civil society is measured by the way it addresses the weakest part of it. I believe that it is our moral obligation as the leaders of the Israeli life science industry, to ensure that technologies that addresses the needs of people with disabilities will get ample priority and resources. Many of these technologies will eventually become a mainstream solution as happened to the e-mail, the multi-touch and the word-prediction that are now used by all of us. I believe that in the coming years we will see many more health-tech companies that are also measured by their social impact.

Avi Wener, Country Director, Thermo Fisher Scientific Israel

The main strengths of the Israeli life science industry are the strong scientific foundation in Israel, the close ties between the academia, the medical community, and leading entrepreneurs, and the innovative "out of the box" startup mindset of so many Israelis.

Dan Shwarzman, CEO, Mindup

We are excited about and investing in bioconvergence innovations on the cusp of data and biology to create new biomarkers for diagnostics and personalized therapy, data-driven precision medicine, and faster and more efficient lab testing methods. We also are very pleased to see an uptick in interest in Israeli healthcare innovation from the UK, Europe and the Nordic countries, expanding the potential for collaboration and commercialization.

Daphna Murvitz, Co Founder & CEO, 8400 The Health Network

The strength of the Israeli HealthTech industry lies not only in the high quality translational research and inventive technology that fuel innovative cures, but also in the collaborative nature of our HealthTech ecosystem, which unlocks industry opportunities and healthcare solutions. The cross-disciplinary 8400 Health Network amplifies industry growth by fueling talent and capabilities, national infrastructure, and ecosystem innovation, locally and globally.

David Abraham, Managing Director, Robert Bosch Technologies Israel Ltd

The unique coupling of prominent academic strength – 5 of Israel's 12 Nobel prizes are in Chemistry, related to Life Sciences (Technion & WIS) – and an innovation-driven culture. Amalgamated with a seasoned pharmaceutical industry, intensive operational experience of hospitals and HMOs, and with the entrepreneurial skills of the technology ecosystem, it leads to a vibrant and well-diversified cluster, on a global scale, that is focused on Pharma, Medical Devices, Biotech and Digital Health. In numbers the life science sector is responsible for 15% of export, 20% of VC capital, 30% of IIA budget, and 50% of Academic IP. While we engineers like to think of Israel as an ICT country, it is no less a (Pro) Life Science country.

Didier Toubia, Co-Founder & CEO at Aleph Farms

Over the years, Israel gained a global leadership position in Life-Sciences innovation thanks to noteworthy contributions to groundbreaking discoveries with everlasting impact on people and the planet. Many companies, including Aleph Farms, established their technological competitive advantage in Israel thanks to the fruitful collaboration between the industry, the government, and the academy. The local well-structured ecosystem enables us and our peers to stay ahead of the curve and lead an ever-greater positive impact on both the people health and planet health.

Dror Bin, CEO, Israel Innovation Authority

Israel is well-positioned to lead the bio-convergence revolution! With hundreds of life sciences companies, unparalleled expertise in fields from AI to digital health to nanotechnology, and some of the world's leading universities, research institutes, and medical centers, the Start-Up Nation is incubating some of the most promising developments in bio-convergence and health-tech in general. It is our strong belief that using the local ecosystem relative advantages to diversify into a myriad of technology domains will help sustain Israel's leading position as a global innovation hub and ensure the high-tech's growth engine continue to benefit the local economy as a whole.

Prof. Dror Harats, CEO at vbl therapeutics

Our biotech ecosystem is mirroring Israel's unique mentality – highly educated people looking for innovative ideas by thinking outside the box, who are able to translate potential and vision into reality through commitment and perseverance spiced with some chutzpa.

Elad Maron, Country President, Novartis Israel

The Israeli life science industry is a strong driver of innovation. I strongly believe that via collaboration between all the relevant stakeholders – payers, technology companies, pharma companies & the patients themselves we can maximize the impact on patient lives.

Elka Nir, CEO , Carmel Ltd. and Carmel Innovations Ltd. (Haifa University)

The strength of the Israeli life science industry lies in the unique combination of leading innovative technologies (some of which are transformed from other fields), strong ecosystem (academy, hospitals, investors, large multinational companies) and most importantly talented and experienced people who are committed to advance game changing ideas in a very lean, entrepreneurial, and must-win spirit.

Dr. Eran Eden, Co-Founder & CEO at MeMed

The Israeli HealthTech industry benefits from a continuous influx of early stage life science innovation, generated by its leading academic and research institutes. Adding the Israeli cultural tolerance for risk taking and the healthy disregard of conventions into the mix, creates a fertile ground for early stage innovation and startups that have the potential to grow into meaningful sustainable companies.

Eyal Lifshitz, Co-Founder & General Managing Partner at Peregrine Ventures

Israel has long been recognized as a hub of ideation that creates ground-breaking technologies, especially in the world of healthcare. While global industry leaders acknowledge the country's innovative contributions through investments in Israeli companies, the establishment of local R&D centers and the purchase of Israeli technologies based on the quality of the product, speaks volumes. Over the last 30 years, almost all important new medical technologies that have entered the market have an Israeli connection. Israel should be proud of its unparalleled global life science contributions.

Prof. Eyal Zimilchman, Chief Transformation Officer and Chief Innovation Officer, Sheba Medical Center, Director and Founder of ARC

The strength of the life science industry in Israel lies on three causes: a strong research base stemming from leading Universities and Academic Medical Centers, an out-of-the-box thinking mentality that allows to overcome obstacles in development, and finally, high motivation to succeed and a "whatever it takes" mentality.

Frida Grynsman, Head of Lonza Collaborative Innovation Center, Israel

The major strengths of the Israeli Life Science Industry lie in: Tight ecosystem of academic researchers, entrepreneurs, start-up companies, investors and multinational biotech and pharma companies that encourage cross talk and fruition of ideas; A growing drive of academic scientists to apply basic research and innovative solutions to industrial and commercial challenges, leading to translational research and technology transfer; Unique funding structures and collaborative frameworks, of the Israeli Innovation Authority, which encourage and promote high risk projects and out of the box solutions to industry challenges including in the manufacturing of complex biologics.

Dr. Guy Ezekiel, MD-Co Founder & CEO- Zorro

Human capital is what makes the Israeli healthcare industry flourish. Researchers, engineers, clinicians and entrepreneurs – driven with a focused mission of changing the practice of medicine, creating groundbreaking inventions and companies.

Israel Makov, Chairman of BioLight Life Sciences Ltd., Chairman of Nextage Therapeutics and Chairman of QuantalX NeuroScience

The true potential of the Israeli life science industry lies in developing the competences needed to build start-ups into large and robust bio-pharma companies. These will become the industry pillars of sustainable growth and provide an ecosystem supporting the entire life cycle of innovation from bench to market.

Ittai Ben Zeev, CEO, Tel Aviv Stock Exchange

Israel is a key player in life sciences and technological innovation. This is reflected in the number of companies listed in TASE's Life Sciences Sector, which currently comprises 55 companies with a total market cap of NIS 47 billion. Over the past two years, 15 new biomed companies joined TASE, including 4 biomed R&D partnerships, raising a total of NIS 1 billion. It is only natural that the life sciences expertise and innovation offered by the Israeli companies is reflected at TASE, which is the natural venue for bringing together the Israeli public and Israeli life-sciences and high-tech companies. TASE is a significant milestone in the development of those companies in Israel, and it is the responsibility of the State of Israel to ensure that Israeli companies grow in Israel, growth that will enable both the State and the Israeli public to enjoy the fruits of success of the Israeli economy. TASE's outperformance of the world's leading exchanges, especially in these times of volatility in the global capital markets, highlights the advantages of listing on TASE and the protective blanket that TASE can offer to the listed companies

Dr. Itzik Goldwasser, President & CEO at Yissum Technology Transfer Company of the Hebrew University

Israel's life science industry remains at the forefront of impactful innovation with the support of academia. The world's greatest challenges are being investigated in Israel's top academic labs, where curiosity drives solutions. Here at The Hebrew University, our unique multidisciplinary research centers are at the core of disruptive science that influences the marketplace, with cutting-edge technologies, know-how and our diverse portfolio of startup companies, changing the world for the better.

Jonathan Berger, Passionate about creating FoodTech ventures, love to connect people and to build companies

Despite the challenges the financial markets are facing, it is clear that the food industry will need to go through a major change to enhance affordability, sustainability and to provide healthier products. Food security and stable supply chain of commodities, also provide vast opportunities to improve.

FoodTech has been playing a major role in addressing these needs and #FoodTechIL, the Israeli ecosystem, is well known by relevant partners around the world.

Keren Primor Cohen, CEO Ramot at Tel-Aviv University Ltd.

Academic research is the pillar of innovation in life sciences and the breeding ground for innovative ideas that disrupt the industry and the people who feed it. Keeping this foundation strong and fostering the relationship between academia and industry is critical, all players in the ecosystem must keep up their efforts toward this goal. Ramot will continue to support Tel Aviv University's ingenious and accomplished researchers by promoting their groundbreaking technologies.

Mati Gil, CEO, AION Labs

The bio-convergence revolution has fostered the ability to reimagine the way drugs are discovered and developed, utilizing advances in big data and advanced machine learning to push the boundaries of health innovation in a way not seen before. With investment, capital, talented scientists and great academic life-science research centers, Israel has all the necessary ingredients to become a world leader in developing the future of the bio-convergence space.

Michal Gindi, Head of Ventures & Innovation

These are special times. The post covid social changes as well as the Ukrainian war, brought work force dynamics and financial challenges to the entire world. On such circumstances Rise, the innovation arm of Assuta Medical Centers, is playing a key role in promoting collaborative work of health care providers ,academia ,technology industry and government helping to sustain the Innovative fostering environment ensuring that our future as a startup nation is kept

Dr. Miki Halberthal, Chief Executive Officer at Rambam Health Care Campus

Israel's life science industry is recognized worldwide for its impact on medical research and innovation. Core to its success is diversity and cross disciplinary collaboration, similar to those pursued at Rambam Health Care Campus. People are our, and Israel's, greatest resource. When every branch of the sciences works together for a common goal, great things can be achieved. In considering the needs of humanity with regard to healthcare, we have every right to have high expectations from the life science industry in Israel, because our ultimate goal is to develop timely answers to pressing clinical needs for all of humankind.

Miriam Shtilman Lavovski, Partner, Tal Ventures

Israel's flourishing life science industry enjoys a nourishing ecosystem of academic research and STEM education, teaching hospitals, a complementing software industry, multinational biotech companies and well-established governmental support programs.

This strong supportive and diverse ecosystem will allow Israeli biotech companies to overcome the challenges of the current economic climate.

Dr. Nadav Shimoni, Managing Director, Arkin Digital Health

2022 seems like a pivotal year for digital health, where the need for truly differentiated and scalable solutions who can help different stakeholders in the healthcare industry thrive is enormous. Per the massive tech talent in the Israeli industry, it can be a fruitful launch pad for such solutions as long as they will be developed for a clear business need.

Prof. Ofer Merin, Director General, Shaare Zedek Medical Center, Jerusalem

The strength of the Life Sciences field in Israel is in large part predicated upon the deep roots originating from our country's record of excellence in combining academic research with clinical medicine. Motivated by professionalism and innovation, we have succeeded in creating a globally-renowned climate for facilitating many groundbreaking research achievements. Leveraging an environment that promotes innovation, creativity and forward-minded thinking, we are witness to discoveries that are now benefiting people all around the world. So much of that success can be attributed to this close collaboration between healthcare and commercial industry, and in particular the more recent development of scientific incubators within our hospitals. These partnerships serve as a critical launch pad for further accomplishments that we know will benefit medical practice and research advancement for generations to come.

Ohad Cohen, Trade Commissioner and Director of the Foreign Trade Administration, Ministry of Economy and Industry

Israel's outsized life science sector has put the country on the global medical stage, bringing innovative solutions to the world. Such solutions provide healthcare personnel with tools to diagnose, monitor, personalize care, and treat patients with the most precision. Israeli medical products are found in many hospitals and health centers worldwide, improving and saving millions of lives each year.

The Foreign Trade Administration at the Ministry of Economy is at the forefront of the Israeli government's efforts to boost our industries in foreign markets. Our network of highly experienced Economic and Trade Missions provides a wide range of services, working to connect the international business community with Israel's innovative medical companies and promote investments into one of Israel's most developed and entrepreneurial industries.

Omer Gavish, Partner, Pharmaceuticals & Life Sciences Leader, PwC Israel

The strength of the Israeli life science industry lies in the highly skilled entrepreneurs who bring unique and innovative solutions to unmet needs. Together with a mindset of flexibility and the ability to think outside the box, that is the basis for the success and continuance growth of the Israeli life science industry.

Dr. Osnat Luxenburg, Head of medical technology, health information and research directorate, ministry of health

The past year has been characterized by a trend of recovery from the Covid-19 turmoil, which has brought forth many changes in our everyday life, from how we communicate to how we prioritize.

It has also made an impact on the Israeli health-tech ecosystem in general, and the Israeli health-tech regulator specifically.

We, at the Medical Technology, Health Information, Innovation and Research Directorate, have utilized this impact to enhance and promote our connections to the local ecosystem, allowing for a more direct and streamlined dialogue, but also understanding the need for a global presence – have generated and increased our global regulatory connections and partnerships. Joining more multinational work groups and international regulatory platforms, laying the foundation for information sharing and the exchange of best practices with world leading regulatory agencies, all the while using our local health-tech ecosystem as an example for the rapid evolvement of cutting-edge technologies.

We believe these partnerships with the local and international ecosystems will be one of the dominant driving forces behind positioning Israel as a world-leader in the health-tech sector

Prof. Ronni Gamzu, Director of the Tel Aviv Sourasky Medical Center

Post Corona the whole world face both a challenge and a threat as well as opportunity. To sink into recession or to 'tech-celerate' and achieve growth again. Israel should seize the moment with its knowledge and scholarship and the dynamic spirit of innovation and entrepreneurship.

All along conjoint with a startup ecosystem and proper public and private capital backbone. This is a propelling force for the Israeli economy and we must continue to put efforts to flourish it further.

Sagiv Lustig, Israel Open Innovation Manager, L'Oréal

Besides its scientific excellence, main pillar of Israel's high-tech leadership position, life science included, is its unique open culture specificities. Being diverse and nonhierarchical society, challenging and non-conformist ready to challenge conventions, grant autonomy, demonstrating permissive approach to risk and tolerance to failure; networking as a prime driver in general, with the Army's central role in particular.

Tsvika Ben Porat, CEO, BIRAD - Research & Development Company Ltd. Bar-Ilan University

The growth in big data and AI tools and innovations in the high-tech industrial sector, and their application in recent years in Biotech is a blessed process. Israel academic, industrial and governmental arenas have the right human resources, entrepreneurial spirit and innovative capacity to be a major partner in this process together with global colleagues sharing the same vision for healthcare improvement.

Yaacov Michlin, CEO, BioLight Life Sciences Ltd

The excellent academic research in the biotech field in Israel, together with superb engineering capabilities and its interplay with

Israel's entrepreneurial spirit are tremendous sources of potential in the Health Tech and Biomed fields in Israel. Over the years these factors have been supported

by government policy and private and public investments with a record year in 2021. The global trend of products and companies combining biology and engineering increase the attractiveness of Israel as one of the main global sources in these areas in various fields from cardiology to ophthalmology and others. The relatively lower cost and very efficient R&D in Israel combined with top level manpower in these areas will hopefully continue to attract global players to source products and technologies in Israel.

Yaky Yanay, CEO and President at Pluri

The Israeli life science industry thrives on a powerful combination of science, technology and innovation.

This combination, fueled by human dedication, can promote global wellbeing and sustainability, solving some of today's greatest challenges.

We are proud to take part in this inspiring process, leading our world towards a better tomorrow.

Yechezkel Barenholz, Head of Membrane and Liposome Research Lab, Hebrew University Hadassah Medical School

The advantages of the Israeli life science Industry lie in its strong qualities of innovation and entrepreneurship. But its biggest challenge is the lack of knowledge and personnel needed for companies to ripen from the stage of a start-up to a pharma company that get drugs approved by the FDA or EMA. This crucial shift involves turning from developing a prototype or reaching the start-up phase, to being a pharma / biomed company with strong abilities in regulation, patents and reimbursement. This traditional gap has to be closed in order for the Industry to grow up, and this can be done through business education of Israeli biomedical entrepreneurs.

Zohar Gendler, Managing Partner & CEO, NGT Healthcare II

The prediction of the trends of the world economy during 2022-2023 is challenging. The Israeli life-science industry needs to continue to build the companies, to create value but to be very careful and to keep low burn-rate.

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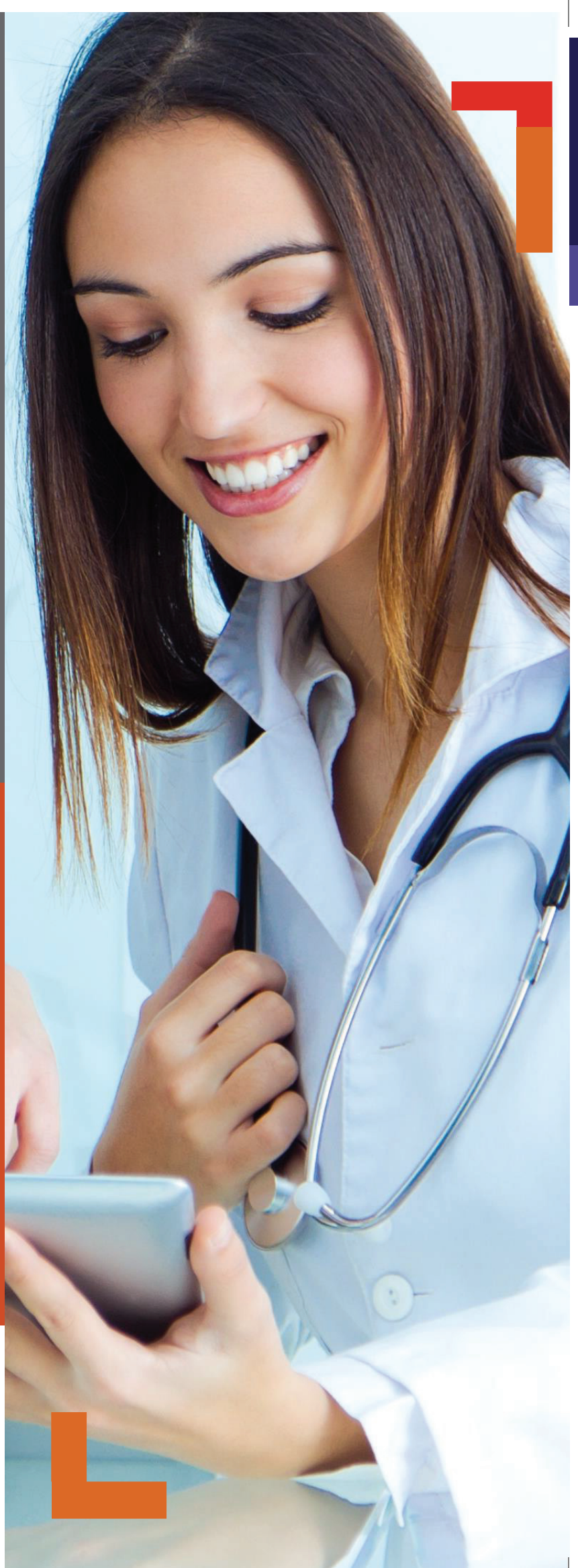


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Israel Innovation Authority

The Israel Innovation Authority, responsible for the country's innovation policy, is an independent and impartial public entity that operates for the benefit of the Israeli innovation ecosystem and Israeli economy as a whole.

Its role is to nurture and develop Israeli innovation resources, while creating and strengthening the infrastructure and framework needed to support the entire knowledge industry.

As such, the Israel Innovation Authority monitors and analyzes the dynamic changes taking place throughout the innovation environments in Israel and abroad. It seeks to further develop and support technological innovation in Israel through various support tools as its

The Israel Innovation Authority has been and remains an island of stability in managing our most valuable natural resource, responsible for 15% of our GDP, more than 50% of industrial export, more than 10% of all employees and about 25% of Internal Tax Revenues of all salaried workers in Israel.

Israel Innovation Authority's mission is to strengthen the innovation ecosystem and promote innovation, entrepreneurship, and disruptive technologies as a leverage for inclusive and sustainable economic growth. It has three key areas of responsibility:

The first is investing in the R&D of innovative products and groundbreaking technologies in new fields. The second, preparing the groundwork for future technologies and new ecosystems, such as quantum, artificial intelligence, bio-convergence, climate-tech and so forth. Lastly, it undertakes "Enabling" activities, designed to promote local High-Tech's competitiveness in the world via governmental, national, and international initiatives (an enabler for Israeli innovation in areas such as: human capital, regulation, expansion to international markets and so forth).

With deep knowledge and understanding of the unique challenges facing the Israeli companies and entrepreneurs, the tools and programs offered by the Authority are designed to meet the needs of the entire high-tech ecosystem.



For more information, visit our website: www.innovationisrael.org.il/en



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Google Health is committed to helping everyone, everywhere be healthier through products and services that connect and bring meaning to health information. We're building products to empower people with the information they need to act on their health. We're developing technology solutions to enable care teams to deliver more connected care. And we're exploring the use of artificial intelligence to assist in diagnosing cancer, preventing blindness and much more.

This is in line with Google's mission to organize the world's information and make it universally accessible and useful. It is our strong belief that AI can make healthcare more accessible, accurate, equitable and affordable for people around the world. To create new AI and advance the use of AI in healthcare our Engineering and Research teams work closely with health organizations, academics, communities, startups, care givers, and partners around the world.

Verily, an Alphabet company founded at the convergence of healthcare, data science and technology, also recently [established](#) a research and development center in Israel, led by Prof. Ehud Rivlin.

Google's global [Health AI](#) team is led by Prof. [Yossi Matias](#), Vice President Engineering & Research, who is also the managing director of [Google's Center in Israel](#), and sits on Verily's Advisory Board.

At Sullivan, we build business bridges for our clients, connecting them with the right players and the right resources to gain a competitive edge.

Our multilingual Israel practice team manages a substantial amount of legal work for Israeli companies and U.S. companies with Israeli interests. Our presence in Tel Aviv, the hub of Israel's high-tech economy, serves as a gateway for Israeli public and private companies, entrepreneurs, investors, funds and other professionals to gain entry into the U.S. market. Sullivan's innovative Capital Markets, Hi-Tech, and Litigation teams enable us to provide completely integrated, cost-efficient legal services, leveraging our expertise in the U.S. and in the Middle East to help advance our clients' objectives with maximum efficiency — whether it's forming a joint venture or listing a company on Nasdaq.

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Herzog's Hi-Tech practice is the first choice for Hi-Tech companies, funds and other players in the field who are operating or investing in Israel. With years of experience, our attorneys provide clients with high quality advice tailored to their needs, taking into account their business and stage of development. Our team continuously innovates and tackles complicated matters with creative solutions that embody the same entrepreneurial spirit as our clients. Herzog's Life Sciences and Health Technologies practice equally offers comprehensive regulatory and legal services to companies and entities acting in the field, with unparalleled expertise throughout all stages of technology and product development, from inception and regulatory classification, through registration and licensing, manufacturing and product distribution.

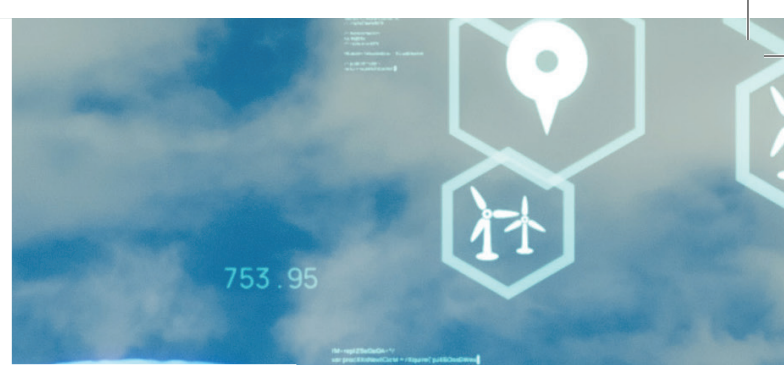
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For further information, visit our website: herzoglaw.co.il





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