

Israel Innovation
Authority's

2021

Innovation Report

Foreword, Innovation Authority Chairman

The Israel Innovation Authority is proud to present this year's annual Innovation Report for 2020-2021. This was no ordinary year - the State of Israel is currently in the early stages of recovery from a deep economic crisis that began in early 2020 as the result of the global health crisis of Covid-19. The Israeli high-tech industry was not immune to this crisis. Many high-tech companies experienced a cashflow crisis due, on the one hand, to the suspension of investments and, on the other hand, to the cessation of sales, that threatened the continued existence of startups and small and medium-sized companies.

At the same time, the lockdowns and other restrictions that countries imposed on movement at local and global levels dramatically altered living habits and led to changes in lifestyle, including working and studying from home and using online services. These restrictions led to accelerated development of different digital companies in all areas of life which, within six months, boosted the consumption of digital services by enormous proportions equal to several years' worth of growth.

Nevertheless, during the initial months of the crisis (March-July 2020), the nature of the process of change we are witnessing today was not yet apparent. At the beginning of the pandemic, many quality companies were faced with an immediate short-term cashflow crisis. In a joint effort together with the Budgets Division at the Ministry of Finance, the Innovation Authority implemented the government's policy to support high-tech during the crisis via the Fast-Track Grants Program. Over a 7-month period, a total of NIS 650 million was awarded to 280 companies as part of this program during which they simultaneously raised supplementary funding from the business sector. This process enabled the companies to traverse the crisis and contributed to the return of investors to the market.

Another measure implemented during the financial crisis, and that was aimed at aiding the infusion of capital to the high-tech industry was the launch of the program to encourage institutional capital market entities' investment in Israeli high-tech companies. As a result of this program, operated in conjunction with the Budgets and Accountant General's Divisions at the Ministry of Finance, the Israel Securities Authority, and the Capital Market Authority, the institutional capital market entities – who had avoided investing in Israeli high-tech since the 'Dot.Com' crisis in 2000 – renewed these investments on a large scale.

As mentioned, Israeli high-tech successfully leveraged the change brought about by the Covid crisis, which contributed to a sharp increase in the use of digital applications in all areas of life and even began with an incline in the scope of funding rounds. High-tech seems to be one of the factors that mitigated the adverse economic impact of the Covid crisis on the Israeli economy and helped the country recover from the crisis at an accelerated rate. Nevertheless, it is important to mention that despite the infusion of capital, primarily from private and foreign sources, Israeli high-tech is exposed to intense global competition from new innovation trends accompanied by huge investments by countries and giant corporations. This situation may critically impair Israel's ability to compete and bring about resultant fatal damage to employment and the economy in Israel. These trends necessitate direct government investment in and support for extra-government investment in the realms of future technologies in order to safeguard the long-term success of Israeli high-tech. Doing so will prove critical in preserving the country's national resilience and ensuring that Israel does reach a scientific and technological disadvantage that will be difficult to bridge.

I want to thank the Economy and Research Department for preparing this report and to all the Authority employees for their strenuous and quality work throughout the year. I would be remiss if I did not take this opportunity to thank the dozens of Authority personnel who demonstrated great devotion to their jobs by working from home during lockdowns and who helped the Innovation Authority reach unprecedented achievements. I would also like to thank the team of professional evaluators and the members of the research committees, especially the public representatives, for their dedication and professionalism. I thank my friends on the Authority Council for their important work in designing our policy and all the Authority's partners, both in government and elsewhere, for their endeavors in advancing innovation in Israel.

Dr. Amiram Applebaum

Chief Scientist in the Ministry of Economy and Industry
Chairman of the Board, Israel Innovation Authority

Contents



6

**Executive Summary
High-Tech During
Covid – Innovation
Authority Report
2020-2021**



14

**Is this the end of
the Israeli "Start-Up
Nation" era?**



26

**What Will the
Future High-Tech
Generation Look
Like?**



40

**How can Israeli
High-Tech Help
Rehabilitate the
Economy?**



58

**Appendix 1 - Activity
of the Israel
Innovation Authority's
Divisions**



77

**Appendix 2 - Results
of the High-Tech
Index Indicators**

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Charts' List

Executive Summary

1. High-Tech's Contribution to the Israeli Economy	7
2. Total Yearly Investments in Israeli High-Tech Companies.....	9
3. Investment in R&D in Israel and Overseas	11

Is this the end of the Israeli "Start-Up Nation" era?

1. Total Yearly Investments in Private Israeli High-Tech Companies.....	16
2. Yearly High-Tech Exports from Israel	17
3. Trends in Startups' Activity in Israel.....	18
4. Number of Investors According to Round Each Year	19
5. Fewer New R&D Centers Alongside More Israeli Companies' IPOs	21
6. State Investment in R&D as a Percentage of GDP	24

What Will the Future High-Tech Generation Look Like?

1. High-Tech Employees' Share in the Economy	28
2. Ratio of Employees in High-Tech Industrial and Service Sectors	29
3. Covid's Impact on High-Tech Employees.....	30
4. High-Tech Employees' Characteristics	31
5. Number of Multinational Development Centers in Israel.....	32
6. Ratio of Employees at Multinational High-Tech Development Centers out of all High-Tech Employees.....	33
7. Ratio of Women and Men in Technology Professionals and in High-Tech Overall.....	36
8. Ratio of Students in STEM Subjects out of all Bachelor's Degree Students	37
9. Projected Number of Students in Science and Technology (STEM) Subjects....	39

How can Israeli High-Tech Help Rehabilitate the Economy?

1. High-Tech's Output and Share of GDP	44
2. Ratio of Auxiliary to Core-Technology Employees in High-Tech Sectors	46
3. Average Monthly Traffic to E-Commerce Sites in Israel.....	47
4. Investments in Israeli Technology Companies in 2020, according to field.....	48
5. Changes in Leading and Technology Stock Exchange Indices, from January 2020 .	49
6. The NIS-USD Representative Rate	51
7. Companies' Potential Runway According to Source of Funding.....	53
8. Biology students in Israel 2018-2020.....	55
9. Rates of Work from Home in High-Tech and Overall Economy	56

Appendices

1. Distribution of Companies Submitting a First Request for Support to the Innovation Authority in 2020, according to division.....	60
2. Innovation Authority High-Tech Indices	77

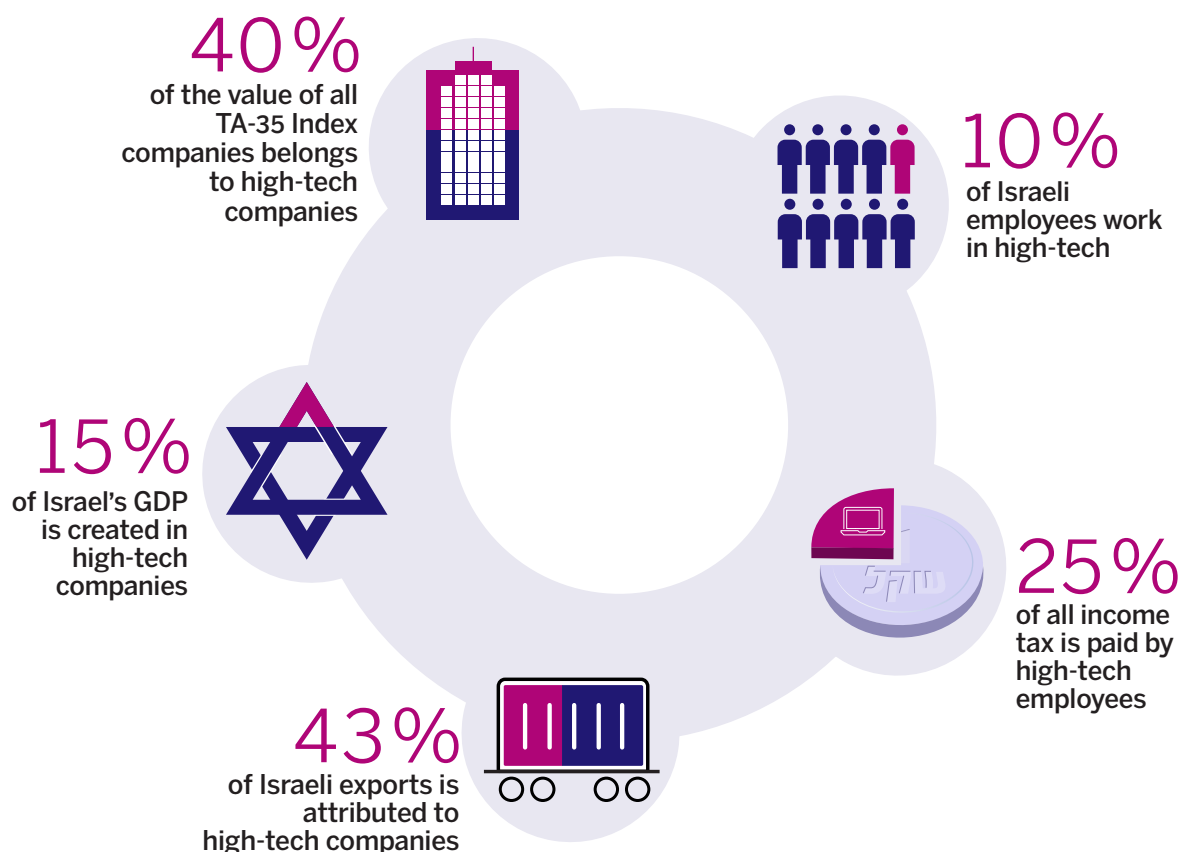


Executive Summary

High-Tech During Covid – Innovation Authority Report 2020-2021

From many perspectives, Israeli high-tech has never enjoyed a better period. The industry seems to be constantly growing and Israeli startups are attracting increasingly large investments and achieving significant commercial success. High-tech employees continue to be a strong group and benefit from excellent employment conditions compared to their counterparts in other industries. Nevertheless, it is specifically the Covid pandemic and resultant global economic-health-social crisis that has highlighted the challenges faced by the industry which has immense importance for and makes a significant contribution to the Israeli economy. Furthermore, the need to contend with these challenges stresses the need to ensure high-tech's long-term global success because of the extent to which the Israeli economy depends and is based on this sector. Crises in Israeli high-tech may cause critical damage to employment, state revenue from taxation, pension incomes, and the stability of the Israeli economy at large.

01 High-Tech's Contribution to the Israeli Economy



Source: Innovation Authority adaptation of CBS, Bank of Israel, National Economic Council, and TASE data

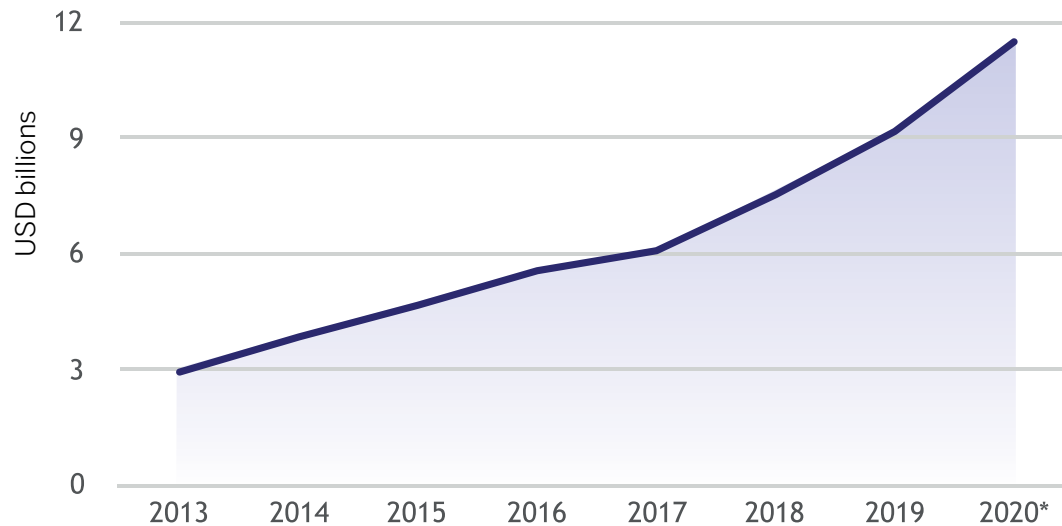
In the "High-Tech During Covid" 2020-2021 Report published by the Innovation Authority (hereinafter: "The Authority"), we present the high-tech industry's central finance and human resources challenges. The report also examines the industry's opportunities to contribute to the economic recovery from the Covid crisis by connecting it to the business and public sectors of the economy in order to accelerate digital transformation and the implementation of technological progress in Israel. Covid has highlighted the gaps that exist between high-tech and the rest of the State of Israel with regard to how to contend with crises, a quick transition to working from home, adaptation of the work environment, and utilizing the new business opportunities that have been created.

Israeli high-tech demonstrated substantial resilience to the Covid crisis thanks to its ability to react quickly to the new work environment and conditions of uncertainty. High-tech indices continued to rise, including the Innovation Authority's High-Tech Index that presents an aggregated situation report of the Israeli high-tech industry and the changes it has undergone. For more details on the High-Tech Index, [see Appendix 2](#). This contrasts with the other sectors of the economy in which the economic shockwaves had a more severe impact. At the same time, the demand for employees in technology professions remained high throughout the crisis – even though the shortage in employees declined from 19,000 to 13,000 available high-tech jobs, as can be seen in the Human Capital Report published by the Authority. The ratio of unemployment benefits recipients in high-tech reached a record level during the Covid period of almost 14% during the first lockdown. This is 7 times higher than the parallel ratio prior to the Covid crisis which stood at only 2% as of January 2020. In the other sectors of the economy, the ratio of unemployment benefits recipients during the first lockdown was however double. The rate of unemployment in high-tech also rose during subsequent lockdowns although the gap compared to the economy in general narrowed. With the economy's return to normal activity, the rate of unemployment in high-tech as of April 2021, stands at 8.2% - still 4 times higher than that prior to the crisis. Nonetheless, given the rise in the number of total employees in the high-tech industry, concern exists that these unemployed high-tech professionals are not expected to find employment in the near future.

Most high-tech employees who lost their jobs during the Covid crisis earned relatively low salaries compared to the industry i.e., less than NIS 15,000 a month. As a result, it can be concluded that most of the harm in high-tech employment was to young employees ("juniors") and auxiliary employees who generally earn less than the average high-tech salary that, in 2020, stood at NIS 25,300. Experienced employees in core-technology high-tech professions were impacted less than the generally severe economic effect of the crisis and its influence on the general economy. The primary characteristic of the current period for Israeli high-tech is the industry's maturation. More Israeli startups than before are choosing to preserve their independence and to grow as complete companies with large numbers of employees, leading significant business activity worldwide. The capital raised by Israeli startups more than quadrupled within a decade and stood at USD 11.5 billion in 2020, 20% more than the total raised in 2019, while the average funding round for startups rose by 10% in 2020 compared to 2019. Most of the growth in investments is in the sums raised by advanced-stage startups with some unprecedented sums of hundreds of millions of dollars in each investment round. Within just 5 years, the number of investments exceeding USD 100 million has grown almost seven-fold from 3 such investments in 2015 to 20 in 2020. Furthermore, in Q1 2021 alone, 20 investments exceeding USD 100 million were finalized.¹

¹ Innovation Authority adaptation of IVC data, The Israeli Tech Review Q1 2021.

02 Total Yearly Investments in Israeli High-Tech Companies (USD billions)



Source: Innovation Authority adaptation of IVC data

The leading fields in Israeli startups investments are cyber and FinTech which attracted the largest amount of capital in 2020. Against the backdrop of the Covid crisis, the sector with the next highest number of funding rounds after the cyber sector was that of startups in the field of digital health – a field characterized by growing global demand. Furthermore, companies using Artificial Intelligence (AI) technologies raised more than USD 4 billion in 2020. High-tech exports also rose consistently and reached almost USD 50 billion in 2020 – more than 40% of total Israeli exports. The number of stock offerings by Israeli startups that are growing and maintaining their independence, reached a record of 31 IPOs in 2020, primarily on the Tel Aviv and Wall Street stock exchanges. Compared to 2019, the number of stock offerings by Israeli technology companies in 2020 rose by more than 50%. The Israeli companies are utilizing the opening of the global stock offerings window and several other Israeli companies are preparing to raise capital on the stock exchange, an indication that, considering the 23 stock offerings held during the first quarter of 2021, this trend is set to continue in the foreseeable future.² At the same time, since the record levels of 2015, there has been a consistent decline in the number of new development centers opened by multinational companies that generally locate their activity in Israel following acquisition of or merger with a local startup. In 2020, only 4 new centers were opened. As for mergers and acquisitions, the number of transactions dropped from 148 in 2019 to 109 in 2020.³

Nevertheless, it is important to monitor several worrying indices and examine their long-term significance. Following the growth in entrepreneurial activity in Israel a decade ago, recent years have seen a significant decline in this important metric which checks the number of new startups established each year. This decline raises the question as to whether Israel is at the end of the startup nation era. Within five years, the number of new startups established in Israel has plummeted from 1,400 in 2014 to approximately 850 new companies in 2019, and about 520 in 2020.⁴ The number of new startups established in the last two years is similar to the levels recorded in Israel a decade ago, this despite the subsequent growth and development of the local innovation ecosystem. The number of new startups established each year will have an influence on Israeli high-tech in the future and the question arises as to the minimum number

² Innovation Authority adaptation of Startup Nation Central data.

³ Innovation Authority adaptation of IVC data, The Israeli Tech Review Q1 2021.

⁴ This estimate will be updated and is expected to increase in the near future. However the decline trend will probably continue and is expected to be lower than that of 2019.

of companies needed to preserve Israel as a startup nation. As of now, the number of seed investments – investments directed at new startups – has not declined further, while there has been a significant increase in investments attracted by growing startups at more advanced financing stages. The number of investors participating in investment rounds of early-stage startups has declined over the previous two years, especially in seed stages. [The first chapter](#) of the report – “Is this the end of the Israeli ‘Startup Nation’ era?” – addresses the issue of financing and presents extensive details regarding the issues described above.

As mentioned, the competition over human resources in high-tech continued throughout the Covid crisis when, despite the rise in unemployment among low salaried high-tech employees, there was a continued shortage of experienced employees sought after by high-tech companies. The large sums raised by Israeli startups are also, to a large degree, intended to increase the companies' personnel in a range of jobs. High-tech professionals make a significant contribution to the rehabilitation of the economy, which needs to recover from the economic-social-health crisis and to create new sources of income to lower the budget deficit. The employees in the high-tech industry, who earn more than double the overall average salary and who comprise less than 10% of all employees in Israel, are responsible for one quarter of all tax revenues from salaried employees. The employees in multinational companies' development centers are responsible for tax payments more than six times higher than their relative share of the Israeli labor market.

This report also discusses in detail several other long-term trends related to high-tech human resources. The first is the increase in age of high-tech employees which reflects the industry's maturation. In contrast to high-tech's image as a young industry, in recent years there has been an increase in the employees' average age that is now even slightly higher than the average for the whole economy. The average age of high-tech employees in 2019 stood at 40.1 compared to the average employee age of 39.6 in the overall economy. A second trend is the rise in the rate that university graduates are entering the industry, a trend that should lower the shortage of high-tech employees. The most popular course of study in Israel during the current academic year is a bachelor's degree in engineering studied by more than 18% of all Israeli students. In total, one of every three students in Israel is studying for a bachelor's degree in STEM subjects (science and high-tech), 64% of whom (55,000 students) at Israeli universities. One in every four students in Israel is therefore studying for a bachelor's degree in a technology-oriented subject such as engineering or computer science.

On the one hand, this is excellent news for the high-tech industry that suffers from a chronic shortage of employees. On the other hand, the flow of fresh graduates may exacerbate the existing problem of juniors and makes it difficult for them to find work without prior experience in the field. In the years to come, tens of thousands of new employees with academic technological training will take their place in the high-tech workforce but with only limited, if any, experience. If a third of the students in Israel continue to choose science subjects, more than 20,000 employees with limited experience will join the high-tech industry every year by 2030. To contend with this problem and ensure that the fresh graduates do not remain unemployed, high-tech employers, including mature Israeli startups, will need to develop avenues for hiring and training inexperienced employees. Today, the companies are interested in experienced employees and many of them are unprepared for training young employees. Coupled with this problem, are the high salaries in high-tech that are increasing sharply with the strengthening of the shekel against the dollar. These salaries make Israeli employees expensive and increase companies' expenditures, compared to solutions such as outsourcing that enable the employment of experienced employees at low costs. With respect to the makeup of the industry's employees, Israeli high-tech continues to preserve its status as a homogeneous and relatively closed circle based primarily on non-ultra-Orthodox Jewish men who comprise two thirds of all high-tech employees. The ratio of ultra-Orthodox and Arab employees in the high-tech industry remains low at 3% and 2%, respectively. With respect to women, it is noteworthy that although the number of women students choosing to study computer science has risen by approximately 130% since 2010, and those choosing to study engineering has increased by 50%, they still comprise only a third of all science degree students, similar to their share of the high-tech workforce. As a result, the ratio of women in technology jobs in the high-tech industry is also expected to remain steady at about one third in coming years.

An extensive discussion of high-tech human resources, including the importance of cultivating complete Israeli high-tech companies with employees from a range of roles, is presented [in Chapter 2](#) – “What Will the Future High-Tech Generation Look Like?”

How Can We Guarantee High-Tech's Continued Success?

The government laid the infrastructures that has enabled the growth of high-tech since the 1970s, and especially, in the early 1990s. Since then, high-tech has grown and evolved into an important sector of the Israeli economy, and growth in recent years has occurred almost without government intervention. High-tech's share of GDP increased from 10% in the 2000s to 15% in 2020, with most of this growth occurring in the last 3 years. The latest Bank of Israel report stated that high-tech's significant share in the Israeli economy is one of the factors that led to the moderate adverse impact of the Covid crisis in Israel compared to its influence in other developed countries. Another angle of this picture is a study conducted by the Innovation Authority revealing that if Israeli high-tech companies that are traded on foreign stock exchanges would register on the Tel Aviv Stock Exchange, the total value of all the companies comprising the Tel Aviv-35 Index would jump by more than 70% and the weight of the index's high-tech companies would stand at approximately 70%, compared to 40% today. Therefore, although it seems that high-tech is successful and thriving, the government's role is to ensure that the industry's resilience and stability remain intact. The question arises as to the areas that require government intervention because the future of the Israeli economy depends, to a large degree, on the future of high-tech.

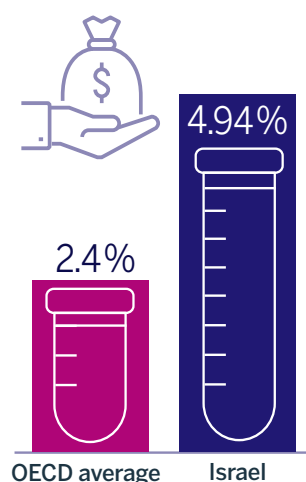
Today, Israel continues to maintain its leading position in the metric of R&D investments as a percentage of GDP. Nonetheless, high-tech is currently contending with several challenges that could influence its global competitiveness. Israel's global competitive status as the 'Startup Nation' is being gradually eroded, and in recent years Israel has been dropping down global innovation indices. For example, for the second year running, Israel has dropped in the Global Innovation Index published by Cornell University, the World Intellectual Property organization, and the INSEAD Business School – in 2018 Israel was ranked 10th, in 2019 – 11th, and in 2020 – in 13th place. With respect to government support for the high-tech industry, the Innovation Authority's budget as a percentage of the state budget has dropped sharply, from 1% in the early 2000s to less than 0.5% today. This support equates to 0.15% of GDP, while the scope of government support for innovation in the EU and other countries such as Korea and the US stands at between 0.6%-1% of GDP. The shortage in personnel and the strong shekel make it difficult for high-tech employers and these are also fields in which the government can play an important role.

03 Investment in R&D in Israel and Overseas

Strengths and Weaknesses of Israeli Innovation - A Global Comparison



Investment in R&D as a Percentage of GDP compared to OECD (2018)



Source: Innovation Authority adaptation of OECD and Global Innovation Index data

Government departments need to digitize and adapt themselves to the new era, and regulation must place technological progress at the forefront of its considerations. The third chapter of the report – “How can Israeli High-Tech Help Rehabilitate the Economy?” – discusses several operative directions in which the government can aid the future of high-tech and continue to lay foundations for national infrastructures that will allow it to flourish, as it did in the past. These efforts must focus on all relevant fronts: continuation and expansion of quality personnel training in outstanding world-class academic institutions; adapting regulation to support implementation of the future generation of technologies in fields such as drones and autonomous vehicles; and the building of a set of incentives to grow “complete” companies, including the creation of competitive tax laws that will encourage Israeli and multinational companies to manage, operate, and produce in Israel and thereby continue to hire and increase the number of their employees in Israel, despite the high costs involved.

Among others, the government in general, and the Innovation Authority in particular, must continue to identify the fields of the future technology the world is headed for and that require heavy investment in the creation of national research infrastructures, the training of quality human capital, providing advanced-technology infrastructure, and in long-term planning. A prominent example is the field of Bio-Convergence (multidisciplinary research that combines engineering and biology), in which the Authority is investing substantial effort to fully utilize the resources of knowledge and personnel that are under-represented in biology fields.

The funding needs of startups and their ability to raise capital changed immediately with the outbreak of the Covid crisis. The Innovation Authority immediately took on this challenge and offered new solutions suited to the new reality. One of the prominent examples of a government solution developed in response to the crisis is the Fast-Track Program created by the Authority together with the Ministry of Finance. This program is intended to help startups traverse the initial crisis period that was characterized by a decline in the injection of private market capital to innovative technology companies, the investment in which involves high risk. The program awarded NIS 650 million during its seven months of operation, with 283 requests being approved (out of 578 submitted). Approval of the requests was conditional on the company recruiting matching funding and contributed to the speedy return to the market of early-stage investors. This solution illustrates how swift government intervention can create growth, in this example via investments, even in times of crisis. It also serves to teach of how further government solutions can be offered and suggests that it is worthwhile examining how this approach can be adopted routinely.

Another example is the program to encourage institutional entities' investment in Israeli high-tech companies in early sales and growth stages via the Israeli capital market. As part of the program, the Innovation Authority's Investment Committee approved the securing of NIS 2 billion worth of investments in high-tech companies. Further initiatives and legislative changes are currently awaiting Innovation Authority attention. These are aimed at supporting current challenges and opportunities related to funding of innovation and Israeli high-tech companies, and include the new Angels Law, an easing of regulation pertaining to the acquisition of foreign companies by Israeli companies, and a change in tax regulation on foreign loans for high-tech companies.

The next central question on a national level relates to connecting high-tech to the Israeli economy, especially to the public sector, government departments, and other highly regulated sectors, in order to revive the economy after the Covid crisis. Israeli technology companies are developing innovative technologies on a global level, while Israeli citizens, employed in those same companies and responsible for the innovative developments, receive state services that are inefficient, not sufficiently digital, and not of the standard expected in the 21st century. The Covid crisis has now created an opportunity to lead a change in regulatory perception to ease the implementation of technologies in the public sector and in highly regulated and regulation-oriented sectors.

During the Covid crisis period, the public sector underwent a rapid and significant quantum leap which in other circumstances would have taken years to achieve. This included the adaptation of services and products to the digital age and a transition to a work environment out of the office or one adapted to the conditions of social distancing. To enable the public sector to take this same necessary step forward and to close the gap that widened during the crisis, government departments must digitize and adapt themselves to the new era. In turn, regulation must place technological progress at the forefront of its considerations. The question is how high-tech can assist the economy's recovery following the Covid crisis. One example of how updating regulation enables the creation of a new market is the National Drone Delivery Network Initiative that is aimed at creating a national network of autonomous drones to deliver cargo in an urban area, that will be ready for commercial use within 3 years.

Government departments need to digitize and adapt themselves to the new era, and regulation must place technological progress at the forefront of its considerations.

Covid adversely affected many sectors of the economy where activity was suspended or severely limited, such as tourism and aviation, due to global restrictions on movement. Nevertheless, the crisis also created new opportunities for the Israeli economy and reinforced pre-existing trends. One such quantum leap on a national level is the transition to a digital economy and e-commerce. The closing of stores led many businesses to offer their wares online for the first time, while consumers also increased their use of digital services. A new point of equilibrium has now been created where the number of users of e-commerce sites is higher than it was prior to the crisis. The government must take the opportunity created by this trend which has only been accelerated by the Covid crisis, to increase businesses' productivity and support business opportunities made possible by e-commerce, including opening Israeli businesses, that until now had focused on the local market, to international trade. The growth of Israeli businesses is fundamental to the economy's recovery following Covid, to the creation of new jobs, and to improving the services Israeli consumers enjoy today.

A further example of a national quantum leap forward that would not have been possible without Covid and which the state profits from is the transition of organizations from all sectors of the economy to working from home. Covid forced organizations that had never previously considered this option or even objected to it, to experience a new work environment. Now, many of them are considering or have already decided to move to a hybrid work model that combines work in the office and working from home, even after Covid. A first positive sign of regulation encouraging this direction came from the Wages Commissioner's Division in the Ministry of Finance and the Civil Service Commission who allow employees in the public sector to work from home one day a week. The hybrid work model preserves several advantages for the economy of working from home that were highlighted during the Covid period. For example, it allows to reduce traffic on the roads and for employees to live in areas far from centers of employment. Adopting a hybrid work model requires a fast high-quality internet infrastructure throughout the country that the state will be responsible for laying, to address cyber security issues, to resolve taxation and work relations issues pertaining to working from home, and to examine the adjustments and training necessary in human resources to enable this change in the long-term.

We invite you to read the in-depth discussion of these and other issues presented in the report that are expected to shape and influence the Authority's policy and activity.





Is this the end of the Israeli "Start-Up Nation" era?

Israeli high-tech continued to break investment records even during the Covid crisis. Alongside the industry's maturation, the number of new startups is declining sharply, the number of seed rounds is stagnating, and the Innovation Authority's budget has been eroded. How will these changes influence the industry's future and what can the government do to preserve Israel's competitive advantage?







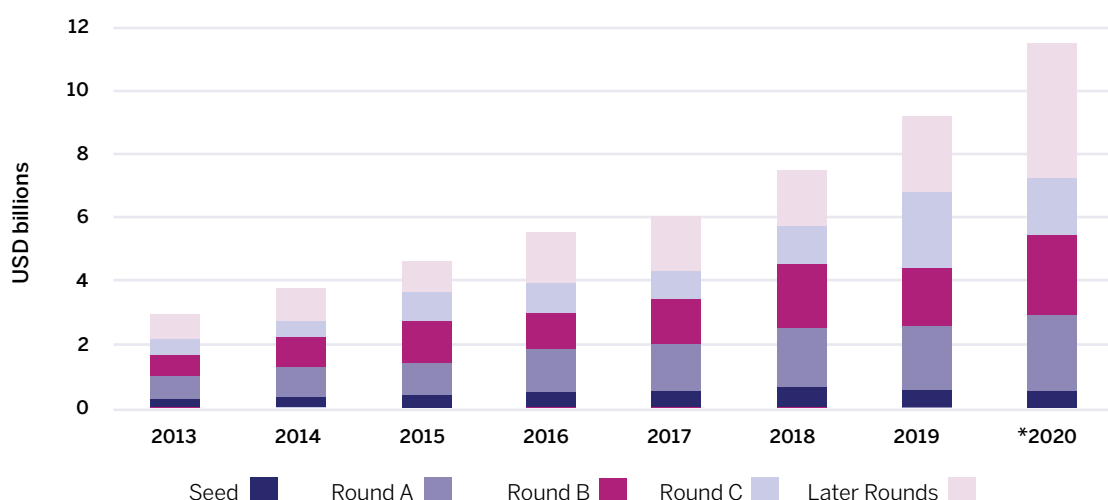
Is this the end of the Israeli "Start-Up Nation" era?

The Israeli high-tech industry has enjoyed significant growth and prosperity in recent years. Among others, this trend is reflected by the level of capital raised successfully by local startups, the scope of exits, and in the sector's contribution to Israeli exports and to employment. The outbreak of the Covid-19 pandemic in early 2020 was accompanied by concern that the global crisis would also have an adverse impact on the Israeli high-tech industry. However, despite the pandemic, the industry continued to grow, evidence of its resilience and its ability to respond rapidly to emerging opportunities. Although a slight decline was registered in the overall capital raised by Israeli high-tech companies during Q2 2020, the industry recovered later in the year, eventually growing by 20% compared to 2019.

Investments in Israeli startups totaled USD 11.5 billion in 2020 – four times the level of only a decade previously.¹ In 2020, the average and median size of Israeli technology companies' funding rounds grew by 10% and 8%, respectively. Nevertheless, most of the growth in Israeli startup investments stemmed from an increase in late-stage funding rounds, some startups raising unprecedented amounts of several hundred million dollars in every round. Cyber and FinTech were the sectors of Israeli startup attracting the most investment in 2020, raising capital of USD 2.9 billion and USD 1.7 billion, respectively.

The digital health sector – as a direct result of the Covid crisis – held the second-largest number of funding rounds (after the cyber sector). This sector became especially popular and showed marked global demand. Another noteworthy field attracting investment interest in 2020 was that of smart mobility where approximately 60 companies raised USD 1.3 billion.² It should also be noted that Israeli companies in all high-tech sectors using AI-based technologies raised over USD 4 billion in 2020, in keeping with the recent growing trend of investing in these technologies, as well as their integration in a wide variety of other fields.³

01 Total Yearly Investments in Private Israeli High-Tech Companies (in USD billions)



Source: Innovation Authority adaptation of IVC data

¹ According to IVC data.

² According to SNC data.

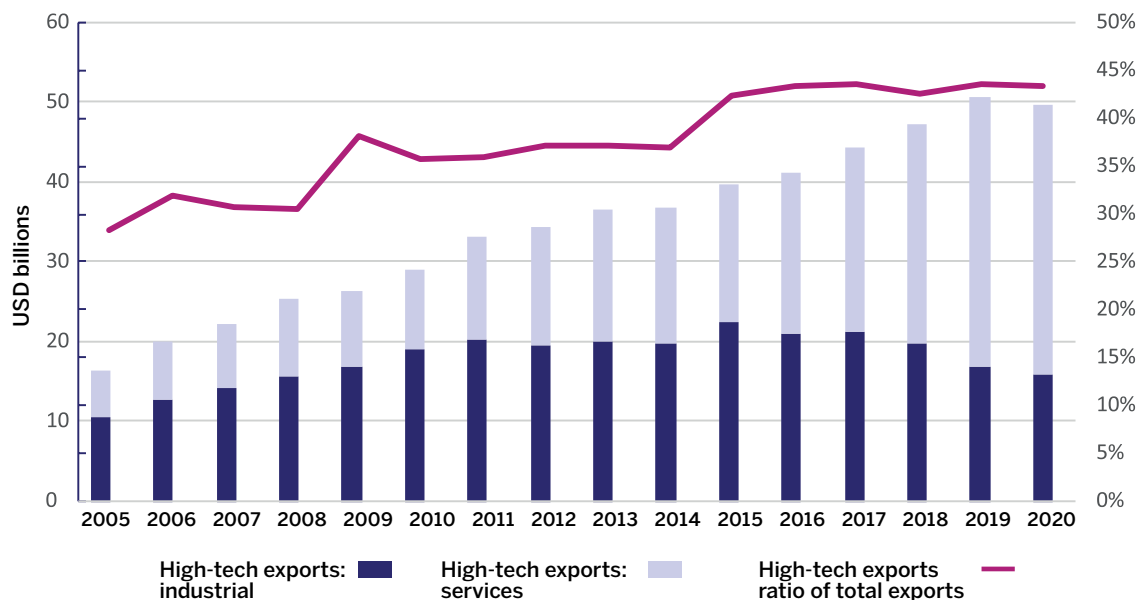
³ According to IVC data.

The state of the Israeli high-tech industry during the Covid-19 pandemic also compares favorably from a global perspective. In the US, for example, while the total scope of capital raised by high-tech companies increased by 10%, the total number of funding rounds dropped significantly in comparison to 2019, particularly during 'seed' and 'A' rounds – 18% and 10%, respectively. Europe also experienced a significant decline in the number of early-stage investment rounds in 2020, with a 6% decrease in seed rounds and a 12% decrease in the number of 'A' rounds across the continent.⁴

Macro-economic data substantiates the significant role that the Israeli high-tech industry continued to play in the country's export activity, estimated at roughly 43% of all Israeli exports (45% when excluding diamond exports). The data pertaining to the high-tech sector itself clearly reveals that export of services such as software, was not adversely impacted by the Covid-19 crisis, while the industrial sector's 2020 exports decreased by USD 1 billion.⁵ The differences between the diverse types of high-tech companies will be discussed in greater detail in the next chapter.

Investments in startups have quadrupled within a decade. Cyber and digital health were the leading fields in the number of funding rounds in 2020.

02 Yearly High-Tech Exports from Israel (in USD billions)



Source: Innovation Authority adaptation of CBS data⁶

⁴ Innovation Authority adaptation of CB Insights.

⁵ High-tech services sectors include programming, data analysis, and R&D, while industrial sectors include pharmaceutical, electro-optic, aerial, and outer space companies.

⁶ Plates: Exportation of commodities according to their technological strength (Israeli foreign trade, January 2021, Plate 17); Exports of services, December 2020 (Plate 2); Summary of Balance of Payments (Plate 1); and a foreign trade presentation (from the Israel Foreign Trade Announcement, Commodities in 2020).

➤ Is this the end of the Israeli "Start-Up Nation" era?

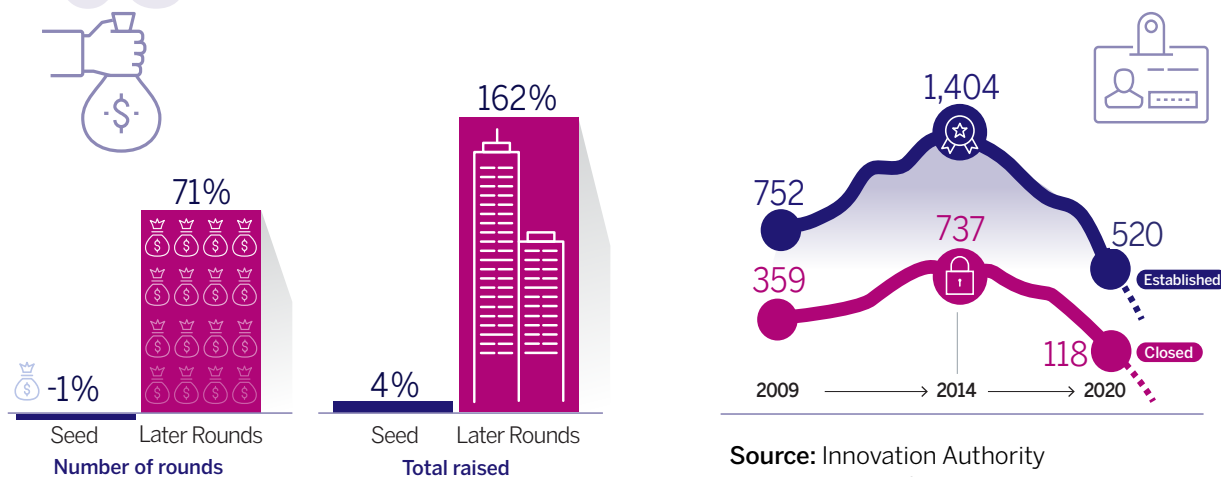
Fewer new startups and stagnation in seed investments

From 2010 to 2014, the number of new startups established in Israel grew markedly, a phenomenon which stemmed from several factors. During those years, significant obstacles in the process of establishing startups were either removed or reduced, including a significant reduction in costs, ongoing improvements in cloud computing capabilities, and the deployment of cellular internet infrastructure that is faster than some of the more advanced "generations". The growth of the mobile application market and the launch of various accelerator programs designed to help new startups grow have also influenced this trend.

This important metric has declined significantly in recent years however, raising the question as to whether the Israeli 'Startup Nation' era has come to an end. Within five years, the number of new startups being established in Israel has decreased from approximately 1,400 in 2014 to about 850 in 2019, and it is estimated that only 520 new startups were established in Israel during 2020. A significant amount of the opening and closing data is received late, sometimes years later. In light of this fact and given the possibility that the corona period led to changes in entrepreneurs' behavior, it is difficult to precisely estimate the number of companies established in 2020, therefore the known data is presented rather than the forecast. However, according to estimates, there is an expected decline in the number of new companies established in 2020 compared to 2019. Specifically, the number of new startups established in Israel during the past two years is similar to that of a decade ago although the country's local innovation and technology ecosystem has grown and developed over this period. It is important to note that we still do not have complete data about the effects of Covid-19 on the number of new companies established during a year that was characterized by high unemployment rates across the Israeli economy. Once complete, the findings will also reflect trends pertaining to disruptive innovation-seeking sectors, such as tourism and retail.

In addition to the decline in the number of new startups, the number of funding rounds in seed stage startups and the average investment in these companies have also stagnated since 2015. In contrast, during the same period, the number of Round A investments in startups doubled from 220 rounds in 2015 to approximately 400 rounds in 2020 and the average scope of each investment round increased. The growth in Round A investments and the parallel decline in the number of startups going out of business each year may be an indication that although fewer new companies were established, the quality of those companies established led to an increase in the number of companies that succeeded in raising later-stage funds after the seed round.⁷

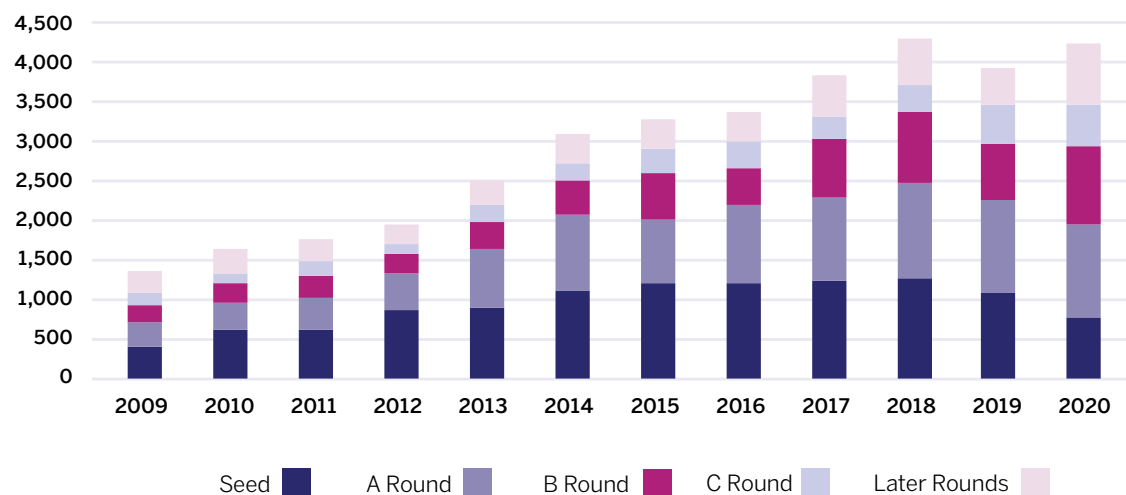
03 Trends in Startups' Activity in Israel



⁷ Details on government response to the challenge of investments in early-stage companies which encountered hardships due to the Covid crisis, appear in the 'Fast-Track' Grants Program Box (Chapter 3).

A closer examination of early-stage funding rounds reveals a decline in the number of investors taking part in these rounds in the past two years, especially in the seed stage. This finding, along with the ongoing stagnation in the number of seed rounds presented above, has led the Authority to launch its 'Hybrid Seed' program. The goal of this program is to increase the number of potential investors involved in the seed stages, to increasingly focus the R&D Fund's resources on early-stage funding of accelerator companies, and to encourage quality investors to participate in earlier stages via the Angels Law that will be discussed below.

04 Number of Investors According to Round Each Year



Source: Innovation Authority adaptation of IVC data

When seeking to discern the various reasons for the declining rate of new Israeli startups, it is important to note that the decline in the number of new companies being established preceded the decline in the number of companies that closed and the lower number of investors. Accordingly, an examination of entrepreneurial activity is also worthwhile. The rise in average salary in the high-tech sector creates an incentive for employees to continue working in senior managerial roles rather than taking a risk in the world of entrepreneurship.⁸ In addition, the growth in the number of international development centers in recent years (close to 400), enables employment in challenging fields at the forefront of worldwide technological innovation, and at higher pay levels than the average high-tech salary.⁹ With regard to the startups themselves, this increase in salary leads to competition that is difficult to contend with at early stages of their lifecycles, especially when up against other companies with significant resources.

⁸ According to CBS data, the average salary across high-tech sectors grew by approximately 44% between 2010 and 2019, while the average salary across the general Israeli economy increased by only 28% during that same period (Plates depicting salaried positions and average salaries in high-tech).

⁹ An examination held by the Finance Ministry's Chief Economist found that in the high-tech sector in Israel, the average salary of employees working for foreign companies was roughly 8% higher than for those working for Israeli companies. See: [The Contribution of Multinational Enterprises to Labor Productivity: The Case of Israel](#), OECD Productivity Working Papers, No. 11, OECD Publishing, Paris.

➤ Is this the end of the Israeli "Start-Up Nation" era?

In recent years, investments in more mature, advanced-stage startups have also increased. We are starting to witness the growth of Israeli unicorns.¹⁰ These startups are the product of existing companies that have now reached maturation. While a welcome phenomenon, the sector's maturation raises the question as to whether the downturn in the rate of new Israeli companies is causing the start of a "funnel" problem: Is the number of new growing and developing startups in Israel sufficient to sustain the country's current levels of entrepreneurial and technological activity? Considering the high-tech sector's importance to the Israeli economy, a sharp decline in the number of new startups is too large a risk. In light of the change in the high-tech sector's mix of companies, the Authority is currently examining which supportive tools and policy changes are necessary, both at the Authority specifically and in government departments in general, to ensure that Israel continues to be both a startup and a growth company nation.

More mature Israeli high-tech companies are enjoying larger stock issuing and funding

The decline in new startups has, in recent years, been accompanied by a parallel trend: the maturation of the local high-tech industry. Data indicates that more Israeli high-tech companies are raising increasingly larger sums, that their revenues are steadily growing, and that they are hiring increasingly more employees. If Israeli start-ups were previously sold while employing a few dozen employees or after raising a USD 20-50 million, and generally became development centers for a multinational corporation, today's startups continue to grow as private companies with the help of significant capital raised from investors.

This most significant expression of this trend is the increased investments in advanced-stage startups. The total capital raised during later-stage funding rounds (from Round D onwards) grew significantly from approximately USD 1 billion in 2015 to USD 4.3 billion in 2020 – quadrupling in just five years. Most of the growth was concentrated in mega-deals: the number of transactions in which Israeli technology companies raised over USD 30 million grew from less than 20 in 2015 to approximately 100 in 2020. Over the same period, the number of transactions in which Israeli technology companies raised over USD 100 million in the private market grew from 3 a year to 20, with the highest growth in the frequency of these transactions occurring over the last 2 years.¹¹

This trend has been reversed in the past year with an increase in the number of Israeli technology companies issuing stock. In contrast, the number of merger and acquisition (M&A) deals – previously the most common exit option for Israeli startups – has declined. According to IVC and PwC data, 20 Israeli companies held share IPOs in 2020, primarily on the Tel Aviv Stock Exchange (TASE) and on Wall Street. During that period, 14 Israeli technology companies issued shares on the TASE and five R&D partnerships were issued.¹²

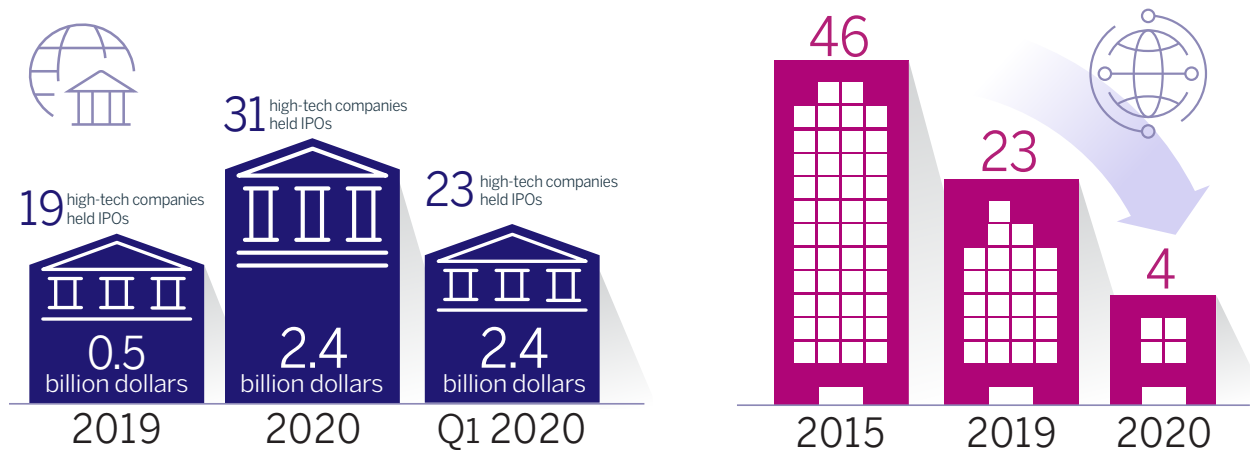


¹⁰ A private company worth over USD 1 billion.

¹¹ According to IVC data

¹² [The Tel Aviv Stock Exchange's website](#)

05 Fewer New R&D Centers Alongside More Israeli Companies' IPOs



Source: Innovation Authority adaptation of SNC data

As the above graph clearly shows, the number of Israeli technology companies' IPOs rose by more than 50% in 2020 compared to the parallel figure for 2019. Furthermore, the total capital raised by the companies during these IPOs rose five-fold, reaching approximately USD 2.4 billion, resulting in 2020 being a record year for capital raised by Israeli exits, despite the drop in the scope of mergers and acquisitions. The findings also reveal that 23 Israeli high-tech companies issued stock in the first quarter of 2021. Israeli companies are taking advantage of the global stock offering window and several other Israeli companies are already engaged in the IPO process and preparing to register and raise capital on various stock exchanges, indicating that this trend will continue in the foreseeable future.¹³

With respect to mergers and acquisitions, PwC reported a decline in the number of deals – from 67 in 2019 to 41 in 2020.¹⁴ At the same time, the number of acquisitions made by Israeli high-tech companies has remained stable. Approximately 40 technology companies in Israel were bought each year by an Israeli buyer over recent years, thereby enabling Israeli startups to grow and expand, yet another sign of the industry's recent maturation.

The Israeli high-tech industry is undergoing a transformation. More Israeli companies are preserving their independence rather than becoming R&D centers for multinational corporations as was customary in the past. These changes may alter the mix of companies and employers in Israeli high-tech. Israeli companies growing globally need administration, sales & marketing, operations, and production departments to maintain their growth. These roles are generally made redundant following acquisition of an Israeli startup and this shifting trend may therefore help retain these roles and provide new employment opportunities for Israelis. Although no such data has yet been gathered, it is possible that the ratio between core and peripheral technology employees in Israeli companies will rise in coming years as the result of the companies' preference to maintain their independence and avoid acquisition.

A decline in the number of M&A transactions led to a sharp drop in the number of new R&D centers. At the same time, there was a rise in the number of IPOs and SPAC transactions.

¹³ Some of the companies enter the capital market via a SPAC mechanism that enables them to merge into a designated check company.

¹⁴ [PwC Exits Report](#)

The high-tech industry is maturing – does Israeli regulation also need to move up a grade?

The maturation of the Israeli high-tech industry, reflected among others by the wave of Israeli growth companies' stock offerings, is a positive sign for the economy. Nevertheless, it also raises a series of questions that the government will need to contend with: the mature companies newly registered on the stock exchange will have new needs or such that existed previously on a much smaller scale.

Among others, the companies will want to continue growing inorganically i.e., by acquiring companies in Israel and overseas to obtain access to their intellectual property and their technological talent. This may require the financial and banking systems in Israel to make changes and adjustments in order to offer lines of credit, loans, and other financing products that are suited to global companies growing rapidly, whose risk levels are still high, and that may not yet be profitable. Furthermore, it will be necessary to ensure that the M&A activity of Israeli and foreign companies is subject to transparent regulation, including aspects related to taxation and competition. Some of the companies' needs e.g., the ability to easily transfer employees and employ foreign experts in Israel, have already been addressed in recent years.

The Israeli capital market and its various financial players will also need to take the next step and broaden their expertise in this field. For example, the institutional entities will need to ensure that their analysis departments specialize in relevant areas so that they can invest in the public technology companies which will become part of the financial portfolio of Israeli savers. Banks too will need to develop expertise and learn how to evaluate risk so they can offer loans to the Israeli companies. Furthermore, as more technology companies are listed for trade in Tel Aviv, the more the Israeli capital market will be exposed to shockwaves in the worlds of technology, thereby raising the risk of adversely affecting the local stock exchange where the mix of companies traded is increasingly changing. This in turn, may also affect the pension savings of Israeli citizens, increasing their exposure to fluctuations should the pension and insurance entities increase their investments in this field.

As this trend continues, questions may arise regarding Israeli labor laws and their compatibility to management of global public companies. This is especially pertinent for Israeli companies that become large multinational corporations obligated to act with transparency towards investors and which are required to guarantee business continuity and the focus of their activity, or those whose activity is in Israel. There are also general economic ramifications for the employees of these companies. For example, Israel currently has the opportunity to become a world pioneer in enforcing transparency with employees possessing stock options who today receive only minimal information from their employers. In addition, a new wave of people getting rich from high-tech may lead to increased inequality in the economy. Such a development could cause negative sentiment towards employees and senior managers in high-tech and influence decisionmakers when deciding future policy.

At the same time, this recent trend, most of which was characterized by fewer openings of new R&D centers alongside an increase in the rate of Israeli companies' stock offerings, has had no unequivocal short-term influence on state revenue from corporate tax. Indeed, an analysis conducted by Deloitte for the National Economic Council showed that the rate of tax paid by R&D centers according to the 'Cost-Plus' method does not fundamentally differ from corporate tax paid by Israeli companies.¹⁶ Nevertheless, the impact of the Biden administration's Acceleration Program, and the G7 declaration calling for a minimal global rate of corporate tax may change this situation.

The change in the mix of Israeli companies, and their reliance on mature Israeli technology companies, will require the Innovation Authority and the government to examine the variety of existing supportive tools for encouraging R&D. Today, most of the Authority's support programs are focused on early-stage companies. Nevertheless, economic theory indicates that a stock offering generally leads to a decline in the level of a company's innovation and there may be room for expanding the Authority's support for companies' R&D that is considered high-risk.

Ultimately, Israeli regulators and legislators must examine the ramifications of the high-tech situation on their field. The more the government accompanies the industry and is attentive to the regulatory aspects of its needs, the more the industry can continue growing and prospering, thereby recontributing to economic growth. On the other hand, difficulties posed by the government for the high-tech companies that are global by nature may cause them to transfer activity to overseas markets offering more attractive or comfortable conditions that will enable them to sustain their growth.

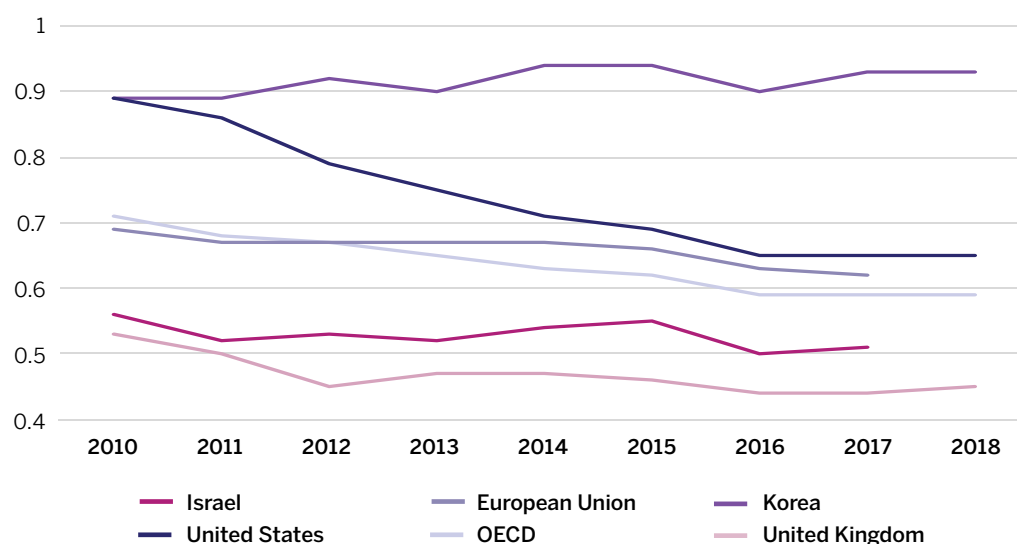


¹⁶ See a summary of study conducted by Deloitte, slide 42.

Government support for innovation is critical to the maintenance of Israel's significant economic leadership position

Israel continues to lead the world in R&D investment as a percentage of GDP. According to the OECD, this ratio stood at 4.94% in 2018, positioning Israel first in the world, followed by South Korea with 4.53%. In contrast, the level of state funding for innovation in Israel is lower compared to other countries – approx. 0.5% of GDP – and it is clear that most of the investments in the industry come from private funding sources within the business sector. In the EU and other countries, such as South Korea and the US, state investment in innovation stands at 0.6%-1% of GDP.

06 State Investment in R&D as a Percentage of GDP



Source: OECD data

Moreover, the current erosion of the Innovation Authority's budget in relation to the state budget, from a level of 1% at the beginning of the century to less than 0.5% today, equating to approx. 0.15% of GDP, is a worrisome trend. This long-term trend must be reversed if Israel is to maintain its position as a global leader in the field of innovation. Despite the maturation and prosperity of Israel's high-tech industry, the market failures that characterize the industry are becoming more complex and there is greater need for private market participation in the risks inherent in seed and early stages, especially against the background of increased later stage investment. As mentioned above, other countries invest significantly in R&D. In the long-term, these countries may prove to be better prepared to navigate changes expected with future technologies and better equipped with R&D infrastructure suitable for their implementation.

In the past year, the Innovation Authority began using several new tools aimed at increasing sources of state funding for Israeli innovation. As part of the economic program for coping with the Covid-19 crisis and to help high-tech companies at growth and marketing stages contend with the period's financial challenges, the Authority launched a new program in October 2020. The program, established in conjunction with the Finance Ministry, the Capital Market, Insurance,

and Savings Authority, and the Israel Securities Authority, aims to encourage the institutional entities active in the local capital market to invest in Israeli high-tech companies in initial sales and growth stages. As part of the program, state guarantee is given to the investment portfolio of any institutional entity investing in Israeli technology companies.

The Innovation Authority's investment committee decided to guarantee 2 billion shekels worth of investments in high-tech companies out of requests for total guarantees of 3.25 billion shekels for 10 institutional entities in the Israeli capital market. At the same time, a further program was launched during 2020, to help institutional investment entities set up technology research and investment departments and to develop high-tech investment skills.

These measures, pertaining to the Israeli institutional capital market, were implemented with a long-term objective of resolving the market's failure to disconnect the Israeli capital market from the local high-tech sector. This program's impacts are already evident with institutional entities increasing their direct investments, collaborations with venture capital funds, and investments in Israeli technology companies on local and foreign stock exchanges. This program may be a central factor in altering the structure of the local capital market and in diverting its focus towards technology fields (creating a "home bias" that characterizes local stock market over-investment in local activity).

The Innovation Authority is planning further initiatives and legislative changes aimed at supporting opportunities and existing challenges related to the funding of innovation and Israeli high-tech companies. Some of these were presented as part of proposals for a government resolution published by the Ministry of Finance in July 2020 and address existing market failures in Israeli high-tech with the aim of assisting the creation of new companies and the growth of whole companies in Israel:

The New Angels Law: A proposed amendment to the existing Angels Law. The proposal added a new incentive program that will enable the alteration of share capital and the deferment of capital gains tax payments by investors for exits, so long as they funnel their exit profits into new investment in R&D companies. The goal of this proposal is to encourage additional investors from the high-tech sector to take a risk and invest their personal capital in startups. In many cases, it is private investors (angels) who invest in seed stage companies and this proposal aims to stimulate investor activity and investments during the seed stage using "smart and well-connected" capital.

Easing acquisition of foreign companies by Israeli corporations: As mentioned above, a large part of the growth experienced by Israeli high-tech companies operating as independent global corporations is facilitated by their acquisition of Israeli startups. The current proposal is to assist Israeli corporations interested in acquiring foreign companies in order to encourage inorganic growth and to attract resultant intellectual property, employment, and tax income to Israel.

Amendment of tax regulations on foreign loans to high-tech companies: The leverage ratio of Israel's high-tech industry is significantly lower than that of other countries. Furthermore, loans are generally borrowed from a foreign lender and using a foreign entity owned by an Israeli company. Amendments are therefore required in tax regulations on foreign loans to enable Israeli high-tech companies to expand their activities in Israel, increase their available funding options, and build a significant local credit market.



What Will the Future High-Tech Generation Look Like?

Israeli high-tech is undergoing a transformation – its employees are not as young but are still based in Tel Aviv. One tenth of employees in Israel work in high-tech and pay a quarter of the country's total income tax. One in every four students is studying a technology subject and will soon attempt to integrate into the high-tech industry, however the Covid crisis has made the industry tougher for women and inexperienced juniors. Will they find work after completing their studies?



רשות החדשנות
Israel Innovation
Authority



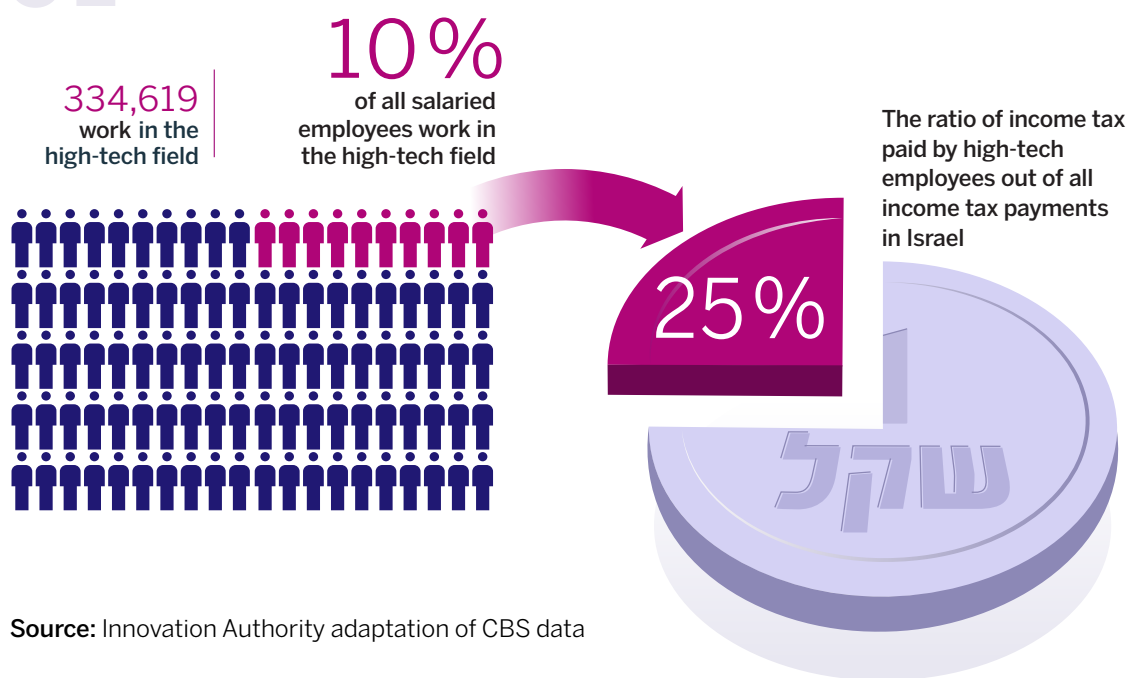


What Will the Future High-Tech Generation Look Like?

The Effect of the Covid Crisis on the High-Tech Human Resource

In a year during which the Israeli economy suffered from high levels of unemployment, its high-tech sector also sustained setbacks and job losses, although these were moderate compared to the rest of the economy and were primarily sustained by low salary employees. Despite the job losses, the total number of salaried employees in the high-tech industry increased during the year by 4%, compared to an increase of 7%-8% during the each of the two years prior to the crisis. The high rate of unemployment throughout all sectors of the economy due to the Covid crisis that led to reduced participation in the workforce, resulted in an increase in the relative share of high-tech employees out of the total number of employees. In 2020, the number of high-tech employees stood at 334,619, comprising 9.8% of all salaried employees. In total, the ratio of high-tech employees has grown from 7.6% to 10% over the last decade.

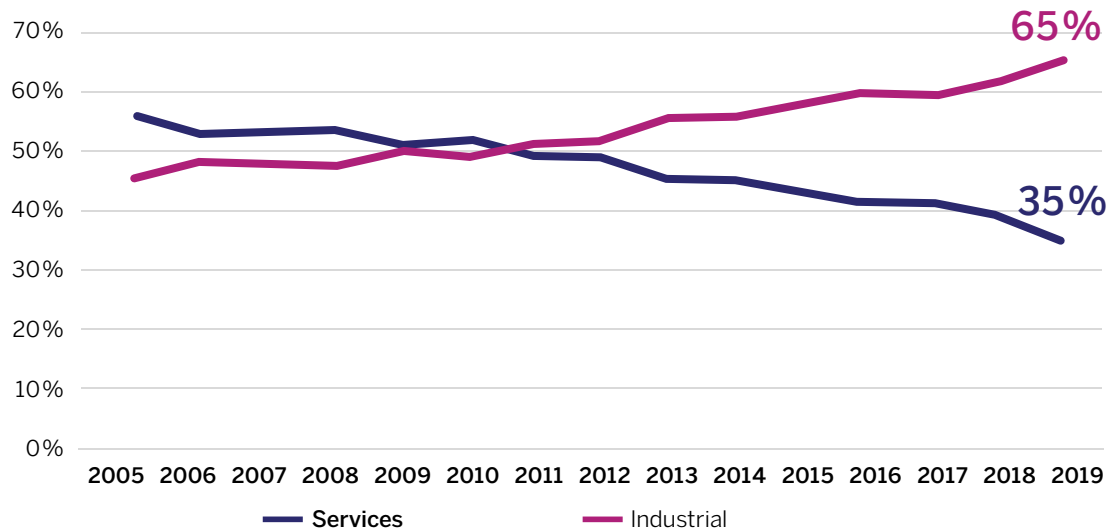
01 High-Tech Employees' Share in the Economy



Source: Innovation Authority adaptation of CBS data

Regarding the internal makeup of high-tech employees, this year saw the continued increase in the ratio of employees in high-tech's service sectors, software, and research and development. This occurred parallel to a decline in the ratio of employees in the industrial sectors working in pharmaceutical and electro-optics manufacture etc. In fact, since the beginning of 2011, the ratio of employees in these service sectors has been higher than those working in industrial sectors and this gap has continued to expand.

02 Ratio of Employees in High-Tech Industrial and Service Sectors



This trend has significance for the variety of high-tech employment. An examination of the characteristics of employees in the different companies reveals that high-tech industrial sectors employ relatively more employees with training that is not necessarily technological such as marketing, finance, human resources etc. for every core technology employee compared to the high-tech service sectors. In other words, high-tech industrial companies are better, from an overall economy perspective, at leveraging R&D employees, and expand the circle of highly productive employment. Accordingly, the salaries of non-technology professionals working at these companies are higher than they would be if they worked in other sectors that are less high-tech oriented and with less intellectual property. Nevertheless, the ratio of auxiliary employees to those working in technology professions in industrial high-tech sectors has declined during recent years: from a ratio of two auxiliary employees to one technology employee in 2014 to a ratio of 1.46 in 2019.¹ These two trends – the decline in the proportion of industrial companies in the high-tech sector and the lower ratio of auxiliary employees to the core technology employees in these companies – signifies a consistent long-term decline in the ratio of salaried high-tech employees with non-technological expertise. This decline, from 50% in 2005 to approx. 40% in 2019, reinforces the perception that high-tech is a 'members only club'.

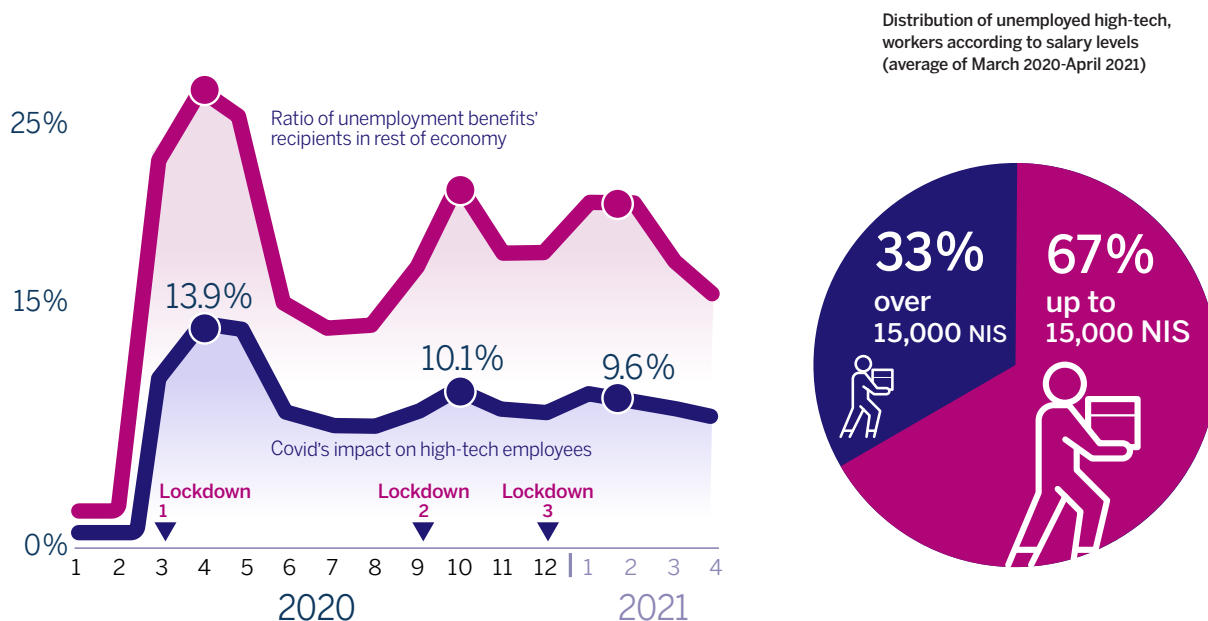
Alongside the rise in the number of high-tech employees following the Covid crisis, there was also a sharp increase in the number of people receiving unemployment benefits, primarily among those earning lower than average high-tech salaries. The level of unemployment benefits' recipients who had been previously employed in high-tech sectors jumped from 2% prior to the crisis in January 2020 to a record level of almost 10% of all high-tech employees during the first lockdown period. Over the Covid year, the level of people receiving unemployment benefits remained at an average of 10%, significantly higher than the figure for previous years and, as of April 2021, this figure stands at 8.2%. Nevertheless, throughout 2020, the level of high-tech personnel receiving unemployment benefits remained significantly lower than other industries where it exceeded 25% during the first lockdown period.² As can be seen in the graph below, the level of high-tech personnel receiving unemployment benefits increased during each of the lockdowns imposed on the economy – in March, September, and January.

¹ Innovation Authority adaptation of CBS data, "Salaried Employees in High-Tech According to Occupation (1994 Classification) and Sex, 1995-2012 (Plate 19) and "Salaried Employees in High-Tech, Excluding the Communications Sector, According to Occupation (2011 Classification) and Sex, 2012-2018 (Plate 20).

² Unemployment benefit recipients are defined as those unemployed or employees on unpaid leave.

➤ What Will the Future High-Tech Generation Look Like?

03 Covid's Impact on High-Tech Employees



Source: Innovation Authority adaptation of NII data³

The graph above presents a segmentation of high-tech unemployment benefits recipients by salary levels and shows that those earning lower than average high-tech salaries (less than NIS 15,000 a month) comprised the majority of those losing their jobs. It can be deduced therefore that most of those affected in high-tech were young employees ("juniors") or auxiliary employees who generally earn less than the average high-tech salary which stood at NIS 25,300 a month in 2020. It seems that senior employees in technology professions were relatively less impacted during this period relative to the severity of the economic crisis. Furthermore, an Authority study revealed that the ratio of unemployment benefits recipients at high-tech companies in industrial sectors is lower than their share of the total high-tech industry.

Over the past year, the average salary in the general economy rose by 7% due to the high unemployment rates of employees earning low salaries. The average high-tech salary increased by 6% in 2020, from a monthly average of NIS 24,000 in 2019 to NIS 25,300 in 2020.⁴ It is reasonable to assume that part of this increase can also be attributed to the high rate of job losses of those earning lower than average high-tech salaries.

The picture emerging from a survey of the long-term trends which were intensified by the Covid crisis, highlights the importance of supporting the creation of complete high-tech companies. These companies enable additional employees, not necessarily possessing academic technology training suited to core high-tech positions, to join the industry, thereby increasing both the economy's general level of productivity and its tax revenues, as will be presented below.

³ The unemployment rate is calculated as a percentage of all salaried employees, in high-tech and other sectors as of the end of 2020.

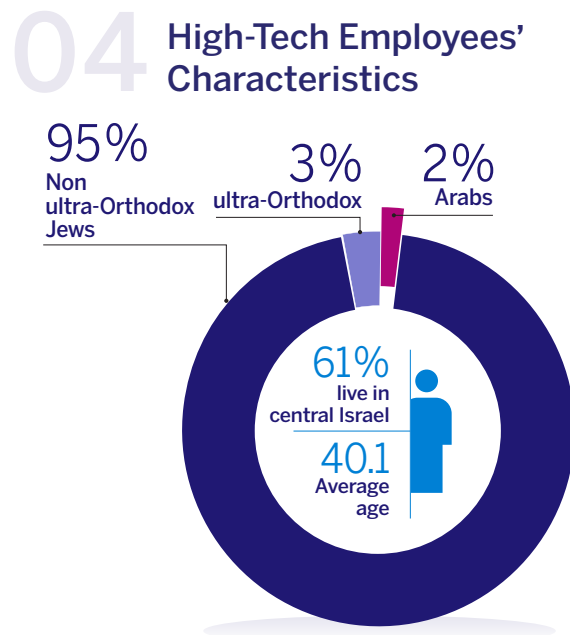
⁴ Innovation Authority adaptation of CBS data, Salary and Employment Journal – December 2020, "Salaried Jobs and Average Monthly Salary According to Primary Economic Sector, Yearly Averages".

The Israeli High-Tech Professionals: Still based in Tel Aviv, Not So Young

Israeli high-tech continues to maintain its standing as a relatively closed and homogenous circle, based largely on non-Haredi (ultra-Orthodox) Jewish men. CBS data reveals that 98% of high-tech employees in Israel are Jewish (1.9% are Arabs), of which 3.4% are ultra-Orthodox.⁵ Furthermore, this industry is characterized by an especially high ratio of male employees – two thirds of all those working in this field.⁶

When examined geographically, most high-tech employees are concentrated in central Israel. Figures of the Ministry of Welfare's Labor Branch⁷ reveal that 61% of the high-tech industry's employees live in central Israel, even though the overall population of salaried employees in the Tel Aviv metropolitan area comprise only 45% of the country's workforce.⁸ In contrast, 11% of high-tech employees live in northern Israel where the total share of salaried Northern employees from all sectors stands at 15%. Only 6% of high-tech employees live in Jerusalem even though the relative share of Jerusalem employees out of the total workforce stands at 9%.

In contrast to the common perception of high-tech as a young industry in which employees are expelled from the workforce at age 45, during the last 20 years there has been a steady rise in the average age. This process is also reflected in the age of high-tech employees. Today, the industry is characterized by an average employee age that is slightly higher than the overall labor market's average employee age. As of 2019, the average employee age in high-tech stood at 40.1 while the economy's overall average age was 39.6. At the beginning of the millennium, when large numbers of young people joined the industry, there was a sharp decline in the average age in high-tech, from 37.5 in 1999 to 36 in the year 2000. Nevertheless, as mentioned above, this figure has risen steadily over the last two decades. The estimated average entry age of new employees into high-tech varied between 27 and 31.⁹ Gender differences are also prominent in the different average ages in high-tech: As of 2019, the average age of men employed in high-tech stood at 41.1 while the average age of women in the industry during this year was 37.7.¹⁰ The average age of male employees throughout all sectors of the economy is also higher than that of women. This difference would seem to stem from the different retirement age of men and women. However, the difference in average age over all sectors of the economy which stands at 1.78 is lower than that in high-tech where it stands at 3.4 years.¹¹



⁵ Innovation Authority adaptation of CBS data, "High-Tech Employees, Excluding the Communications Sector, Ultra-Orthodox and Arabs, 2001-2020.

⁶ Innovation Authority adaptation of CBS data, "Salaried Employees in High-Tech According to Occupation (1994 Classification) and Sex, 1995-2012 and "Salaried Employees in High-Tech, Excluding the Communications Sector, According to Occupation (2011 Classification) and Sex, 2012-2018.

⁷ High-Tech Employment Survey, Roi Levanon, Ministry of Labor, Welfare, and Social Services.

⁸ Innovation Authority adaptation of CBS data, Statistical Journal 71, The Labor Market, "Employees, According to Economic Sector, District, and Residential Area".

⁹ Innovation Authority adaptation of CBS data. The average age is calculated as a weighted average adapted to the distribution of the population's ages in 2015. The calculation of the estimated entry age is based on two possible scenarios – one according to which 2% of the existing high-tech personnel retire or lose their jobs each year, and the second according to which this figure stands at 5%.

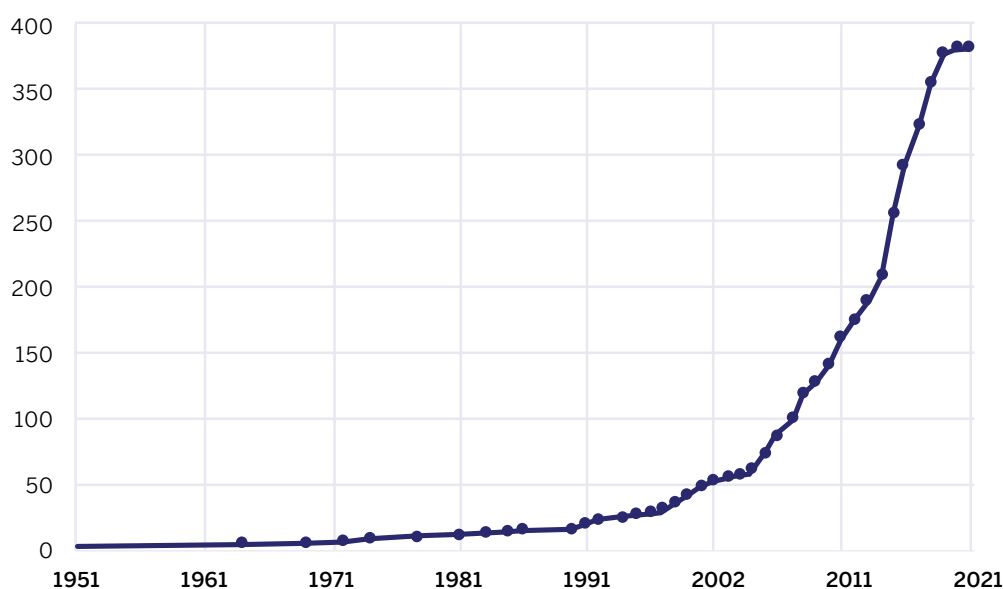
¹⁰ Innovation Authority adaptation of CBS data, Salaried Employees in High-Tech According to Age and Sex, 1995-2019.

¹¹ Innovation Authority adaptation of CBS data, Statistical Journal 71, The Labor Market, "People Aged at Least 15 and the Workforce, According to Years of Education, Age, Sex, and Religion.

High-Tech Employees are Responsible for One Quarter of Israel's Tax Revenues

One of the prominent trends in Israeli high-tech during recent years is the moderation in the rate at which multinational corporations are opening new development centers in Israel. While 46 new international development centers were opened in Israel in 2015, only 23 such centers were opened in 2019 and only 4 in 2020. This trend reflects the decline in the number of Israeli startups' M&A (mergers and acquisitions) deals and the increase in the number of initial offerings (IPOs) of Israeli companies on the stock exchange, as detailed in the previous chapter. This is because most of the multinational development centers in Israel were set up following the acquisition of a local startup company by an international corporation.

05 Number of Multinational Development Centers in Israel



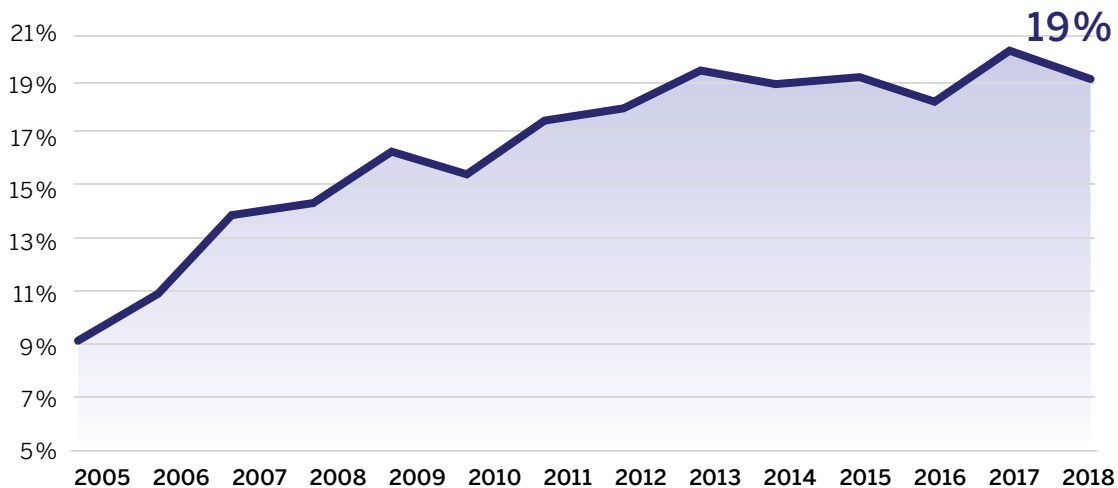
Source: Innovation Authority adaptation of 'Startup Nation Central' data

As can be seen in the graph above, the sharp increase in the number of international development centers operating in Israel over the last decade was relatively consistent with the growth in the number of high-tech workers in recent years. As a result, the percentage of employees in the development centers out of the total number of people employed in high-tech has remained stable since 2013 at a level of 20%. As of 2018, there were 57,000 employees working at the international development centers, of which 36,000 worked in technology professions.¹² In light of the downturn in the rate of new development centers in Israel, that is part of the maturation of the Israeli high-tech industry described in Chapter 1 of the report, it is possible that the proportion of employees at Israeli-owned companies out of the total number of those employed in the industry will gradually increase in coming years.

At the same time, according to the High-Tech Human Capital Report issued by SNC and the Innovation Authority, the multinational development centers operating in Israel demonstrated greater stability during the Covid crisis compared to local companies, thereby constituting a mainstay of employment relative to local companies during that period. The report also reveals that the multinational development centers utilized the crisis to enhance their workforce by replacing employees with less technology experience (up to 2 years) with other, more experienced employees. As a mirror image of the multinational corporations, local startups, in light of the harsh ramifications of the Covid crisis, were forced to dismiss even experienced technology employees.

¹² Innovation Authority adaptation of CBS data, from "R&D in Startup companies and Multinational Corporations' Development Centers, 2018", R&D expenses and R&D positions in R&D Centers.

06 Ratio of Employees at Multinational High-Tech Development Centers out of all High-Tech Employees



Source: Innovation Authority adaptation of CBS data

The more moderate rate at which multinational development centers are being opened in Israel raises the question as to whether, considering salary expenses and changes in the exit model in Israel and in global corporations' acquisitions models, the R&D centers have reached the limit of their growth in Israel. Therefore, is there a need to re-examine the policy of state incentives and taxation for R&D centers?

The answer depends on two central factors: the level of state revenue from taxation and the contribution to the growth of the Israeli ecosystem.

In general, the high-tech industry is extremely important to state revenue. The average salary in high-tech is more than double the economy's overall average salary. An analysis of the National Economic Council reveals that in 2018, the average monthly salary in a foreign-owned company was 50% higher than that in a local company and stood at NIS 32,500 a month compared to NIS 21,700. It should be noted that part of this gap stems from the internal makeup of the companies' employees which, in a foreign-owned company, tends more towards research and development jobs characterized by higher salaries.^{13,14}

Accordingly, high-tech employees account for a high proportion of the total income tax collected in Israel, relative to their share of the labor market. In 2018, high-tech employees comprised 8.65% of all employees in Israel but accounted for 24% of the total income tax paid. In other words, high-tech employees are responsible for income tax payments approximately three times higher than their relative size of the workforce. Furthermore, high-tech employees at multinational corporations comprised 1.47% of Israel's total number of employees while paying 8.3% of all income tax payments i.e., almost 6 times their share of the population, and 1.8 times their relative proportion of all high-tech employees.

Although corporate tax paid by high-tech companies constitutes a significant part of national revenue, its ratio is lower than the income tax paid by high-tech employees and is estimated at a rate similar to the industry's share of GDP, i.e., approximately 15%.¹⁵

International corporations have a mixed influence on the local ecosystem. On the one hand, as mentioned in the previous chapter, the development centers' importance is rooted in the fact

¹³ According to National Economic Council adaptations of CBS data.

¹⁴ A study conducted by the Chief Economist Division in the Ministry of Finance based on 2005-2010 data found that international companies pay a monthly salary that is 8.4% higher than that earned by an employee with similar characteristics at a locally owned company. OECD et al. (2018), "The Contribution of Multinational Enterprises to Labor Productivity: The Case of Israel", OECD Productivity Working Papers, No. 11, OECD Publishing, Paris.

¹⁵ Innovation Authority adaptation of Ministry of Finance and National Economic Council data.

➤ What Will the Future High-Tech Generation Look Like?

that they enable employment at the forefront of global knowledge and technology and expose Israeli employees to advanced international management methodologies. On the other hand, the multinational development centers employ large numbers of employees with high technological skills while the Israeli high-tech labor market suffers from a chronic shortage of such employees. The Israeli high-tech industry is maturing and has a growing number of locally owned companies. If the downturn in the opening of new development centers continues, local companies may find themselves in a position to benefit, with proficient and skilled technology employees being able to integrate into Israeli companies, thereby contributing to their growth and transformation into complete local companies. This, in turn, will widen the circle of high-productivity employment, including auxiliary workers not employed in core technology roles, who will then also pay higher rates of income tax.

Covid Has Made the High-Tech Industry Less Friendly for Women and Inexperienced Employees

One of the central and most-discussed obstacles to the expansion of the Israeli high-tech industry over the past decade is the constant shortage of experienced technology employees. The State Comptroller's Report from March 2021 termed the high demand for technology employees "a chronic shortage of skilled employees in the Israeli high-tech industry" and defined it as "a strategic threat to the technology sector in particular, and to the Israeli economy in general".¹⁶ The Israeli high-tech industry is contending with additional challenges in the field of human capital. These challenges, which intensified during this last year against the background of the Covid crisis, are related to the limited circle that comprises Israeli high-tech, primarily consisting of non-Haredi Jewish men and in which women and minorities are under-represented. Furthermore, the difficulty in recruiting and employing young employees without practical experience (juniors) has intensified over the last year. Nevertheless, it is too early to evaluate the extent of the damage that can be attributed to the Covid crisis. A further issue that may influence the demand for Israeli employees in the near future, on the part of both multinational and local corporations, is the strengthening of the NIS/USD exchange rate that is raising corporate expenditure due to increased salary expenses of Israeli employees.

The demand for technology workers has remained high this last year, despite the Covid crisis: as of January 2021, there were 9,106 vacant job positions for employees in high-tech professions, compared to 9,368 in January 2020.^{17,18} By comparison, the overall job market registered a total of 60,500 vacant jobs in January 2021, compared to 99,000 in January 2020. According to the Human Capital Report of the SNC and the Innovation Authority, although the Covid year led to a certain decline in the demand for technology employees, a severe shortage remained. For example, while demand for technology employees was estimated to stand at 18,500 in 2019, by December 2020 this figure was estimated to be approximately 13,000.¹⁹ The shortage in employees persisted because most high-tech employees who lost their jobs were from low pay brackets i.e., inexperienced or from non-technology professions, while the high demand that exists is for experienced employees in technology professions. It is possible that Covid restrictions intensified this trend, including the transition to working from home, which made it significantly more difficult for companies to recruit and mobilize new and inexperienced employees.

As mentioned, it is still early to evaluate the Covid year's long-term impacts on women and on gender equality in the labor market at large, and specifically, on women employed in high-tech. Although a study conducted by the Chief Economist Division at the Ministry of Finance revealed no widening of the average employment disparities between men and women during the Covid period, such disparities were registered during lockdown periods.²⁰ For example, 94,000 new job seekers registered during the second lockdown imposed in September 2020 due to second or more periods of unpaid leave, 63% of whom were women.²¹ One of the main reasons for

¹⁶ Annual Report 71b, State Comptroller, "[National Action to Increase the Number of Workers in the High-Tech Industry](#)", March 2021.

¹⁷ Innovation Authority adaptation of CBS data, "[Number of Vacant Jobs, November 2019-January 2020](#)".

¹⁸ Innovation Authority adaptation of CBS data, "[Number of Vacant Jobs, November 2020-January 2021](#)".

¹⁹ [Human Capital in the High-Tech Industry Report 2020](#).

²⁰ See [Gender Gaps in the Labor Market and the Covid Crisis Report](#), April 2021.

²¹ The Gender Index – [Gender Inequality in Israel 2020. A Special Spotlight – Gender Ramifications of the Covid Pandemic](#), Van Leer Institute.

this is the lack of children's educational frameworks that exacerbated gender role disparities and the performance of transparent childcare-related work by women.²² Adverse employment ramifications for women are not an exclusively local phenomenon. In September 2020, a survey published by 'Lean In' and McKinsey revealed that 2 million women in the US are considering taking unpaid leave or leaving their job entirely as a result of Covid.²³ The strongest influence was seen among women with children aged under 10 years. 23% of these women reported that they are considering leaving the labor market because of Covid. The long-term ramifications are severe because this reality will result in less women advancing to management positions and to wider gender disparities in the labor market.

Although there has not been a significant drop in the number of female high-tech employees during this last year, women's under-representation in Israeli high-tech, already a significant challenge prior to the Covid crisis, persisted throughout 2020. Israeli high-tech is characterized by a large male majority, especially in the technology professions. As of 2020, women comprised just 34% of those employed in Israeli high-tech, a rate that has remained almost unchanged for two decades. As evidence, while the number of men employed in high-tech increased by 10,000 over the past year, the number of women working in the industry rose by only 3,000.²⁴

The Government Solution for Covid Unemployment: NIS 145 Million Investment in High-Tech Training

Throughout the past year, the Israeli economy faced a widescale economic and employment crisis, raising the question – how can the high-tech industry assist in recovery from the employment crisis? During the Covid crisis, the Innovation Authority launched two designated programs for training quality high-tech personnel, with a total two-year budget of NIS 145 million.

The first is the High-Tech Human Capital Fund. This program aims to incentivize the creation of innovative solutions originating from the field and the expansion of the entry routes into high-tech, in order to upgrade or enhance the existing high-tech human capital in R&D jobs. This incentive will be carried out via financial support for programs to develop human capital for technology positions in high-tech. As part of the first call for proposals, 18 different programs were chosen for advancing populations under-represented in the high-tech industry – women, Arabs, ultra-Orthodox, and residents of Israel's periphery – alongside programs for integrating new immigrants and returning citizens with global high-tech experience into the local high-tech sector. The programs were awarded a total grant of NIS 19 million and are expected to train 2,800 participants in the next two years.

The second program is the Emergency Program for Rapid Training and Placement of Human Capital in High-Tech Professions. As a response to the economy's employment crisis that broke out following the Covid pandemic, the Innovation Authority, together with the Ministry of Finance and the Ministry of Economy, created an emergency program to finance widescale and rapid training and placement in a variety of positions, both technological and non-technological, in high-tech professions. As part of the program, grants were approved for training entities and companies that implement a process combining training for and placement in high-demand technology and business positions. The emergency training program approved the participation of more than 6,200 people, split between development positions and technology and business positions that support development with a total budget of NIS 125 million. The training programs will also be conducted in periphery areas and will be adjusted for under-represented populations, with emphasis on the ultra-Orthodox and Arab sectors. The training will be conducted by 29 training entities and 18 employers who undertook to take care of the graduates' training and placement.

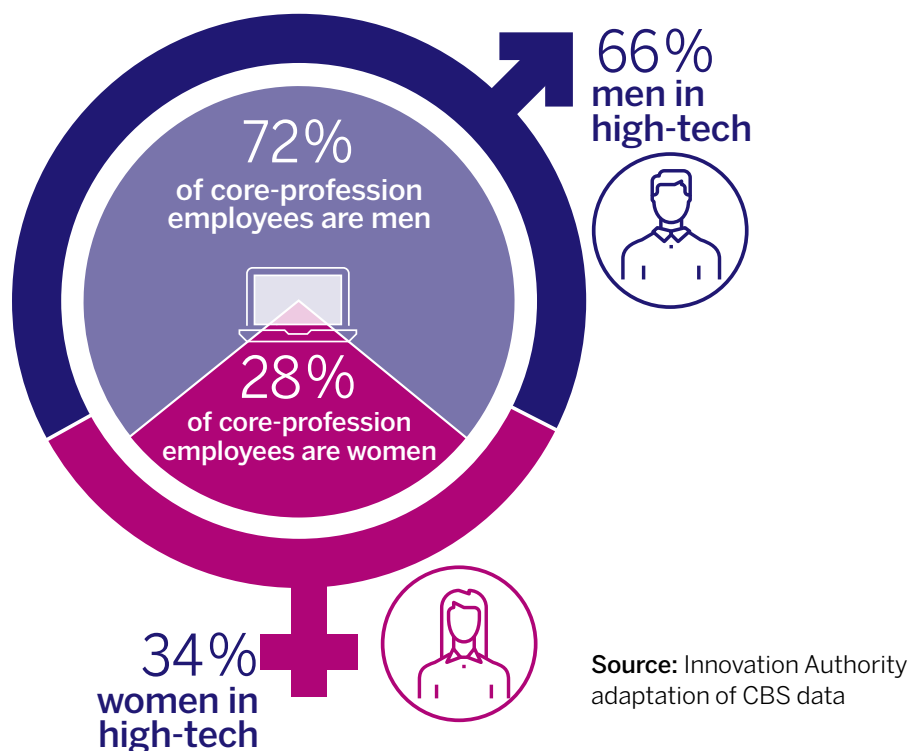
²² The Gender Index – [Gender Inequality in Israel 2020, A Special Spotlight – Gender Ramifications of the Covid Pandemic](#), Van Leer Institute.

²³ Lean In and McKinsey "[Women in the Workplace 2020](#)" Report.

²⁴ Innovation Authority adaptation of CBS data "Salaried Employees in High-Tech According to Economic Sector (2011 Classification) and Sex".

➤ What Will the Future High-Tech Generation Look Like?

07 Ratio of Women and Men in Technology Professionals and in High-Tech Overall



As of 2019, women constituted only 28% of all technology professionals in high-tech, even lower than their share in the industry.²⁵ Furthermore, during this year, less than half the women employed in high-tech worked in technology professions, compared to 65.6% of the men.²⁶ Although the number of women in high-tech technology professions has been steadily increasing since 2013, significant gender gaps remain. Moreover, large gender gaps also exist in the field of entrepreneurship. According to SNC, only one of every 10 entrepreneurs establishing a startup company in 2020 was a woman – a ratio that has remained almost without change over recent years.²⁷ A similar ratio can be seen in the number of female CEOs of high-tech companies in Israel.²⁸



²⁵ Innovation Authority adaptation of CBS data "Salaried Employees in High-Tech According to Economic Sector (2011 Classification) and Sex".

²⁶ Innovation Authority adaptation of CBS data, "Salaried Employees in High-Tech According to Occupation (1994 Classification) and Sex, 1995-2012 and "Salaried Employees in High-Tech, Excluding the Communications Sector, According to Occupation (2011 Classification) and Sex, 2012-2018.

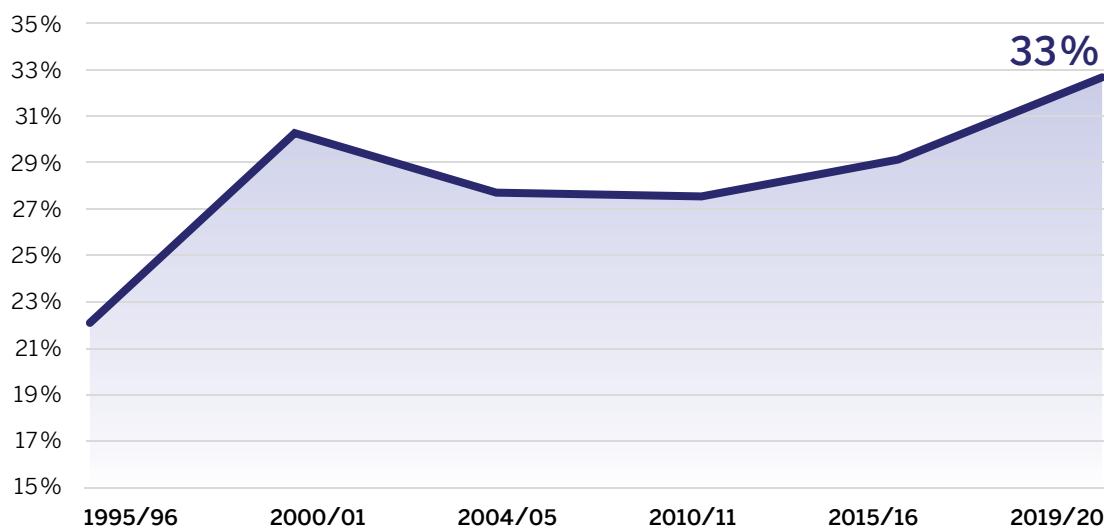
²⁷ "Human Capital in the High-Tech Industry 2020" Report.

²⁸ [IVC Report published for International Women's Day 2021.](#)

One in Every Four Students in Israel Studies a Technology Profession. What Will the Industry's Future Look Like?

An examination of the future high-tech professionals, influenced by the number of students in high-tech study courses, shows that there has been a significant increase in the number of students acquiring higher education in technology subjects in recent years. In the current 2020-21 academic year, 18.4% of all bachelor's degree students are studying engineering subjects – the most popular study course in Israel. Furthermore, the number of students studying mathematics, statistics, and computer science has doubled over the last decade, from 9,122 in 2020 to 18,243 in the current academic year. In other words, as of 2020, one in every four students in Israel is studying for a bachelor's degree in a technology study field such as engineering or computer science. Moreover, one of every three students in Israel today is studying for a bachelor's degree in a science (STEM) subject,²⁹ an increase of 22% since 1995.³⁰

08 Ratio of Students in STEM Subjects out of all Bachelor's Degree Students



Source: Innovation Authority adaptation of PBC data

At the same time, the number of female students studying for a bachelor's degree in computer science, including mathematics and statistics, has more than doubled from 2,622 in 2010 to 6,144 in 2019. A significant increase was also registered in the number of women deciding to study engineering, from 8,581 in 2010 to 12,241 in 2020. In total, the number of women studying for a bachelor's degree in science subjects in 2020 stands at approximately 23,000. Nonetheless, as of 2020, the ratio of women out of all students studying for science degrees stands at 36%, and only 33% in computer science and engineering.³¹ In other words, the increase in the number of female students in science subjects is consistent with the general rise in the number of students in these subjects. It is possible that this is the reason that the ratio of women in technology jobs in the high-tech industry is expected to remain constant at approximately one third in the years to come.

²⁹ STEM subjects are science, technology, engineering, and mathematics.

³⁰ Innovation Authority adaptation of PBC data, "Opening of the 2020-21 Academic Year with Covid".

³¹ Innovation Authority adaptation of Planning and Budgeting Committee (PBC) data, "Students in the Higher Education System, According to Degree, Type of Institution, and Sex, 2019-20 Academic Year.

➤ What Will the Future High-Tech Generation Look Like?

Despite the constant and significant increase in the number of students in technology subjects in recent years, the State Comptroller's report published in March 2021 warns of two central long-term obstacles to increasing the number of university graduates in high-tech subjects:

1. Shortage of senior academic personnel in faculties of high-tech subjects in general and particularly, computer science.
2. High dropout rate of students in these subjects.³²

According to the report, 22% of the students who began their studies for a university degree in computer science, failed to complete their studies within six years. Furthermore, 20% of the students who began studies in this subject eventually graduated with a degree in another subject.³³ It is possible therefore that some of the students who met the stringent criteria for studying high-tech subjects at university will fail to integrate into the high-tech industry, or at least into a job that requires a relevant academic degree. The significance of this is that the potential human capital suited for the high-tech industry is not fully utilized, as also mentioned by the Chief Economist in the Ministry of Finance.³⁴

Considering the ongoing increase in the number of students studying science subjects, tens of thousands of young workers with academic technology training but with only limited (if any) experience, are expected to join the high-tech industry each year. If a third of the students in Israel continue to turn to science subjects, more than 20,000 employees with limited experience will join the high-tech industry in 2030, compared to approximately 15,000 today. Moreover, if the ratio of students in academic high-tech subjects reaches 40% in 2030, in accordance with the target designated by the government,³⁵ more than 25,000 new employees will join the industry in that year. As a result, the supply of young technology employees in high-tech is expected to grow significantly in the years to come and may alter the industry's patterns of employing and employment, such as a decline in initiated transitions between jobs and even a potential drop in salaries.

In 2030, between 20-30 thousand high-tech graduates are projected to join the workforce, and the problem of juniors is expected to intensify.



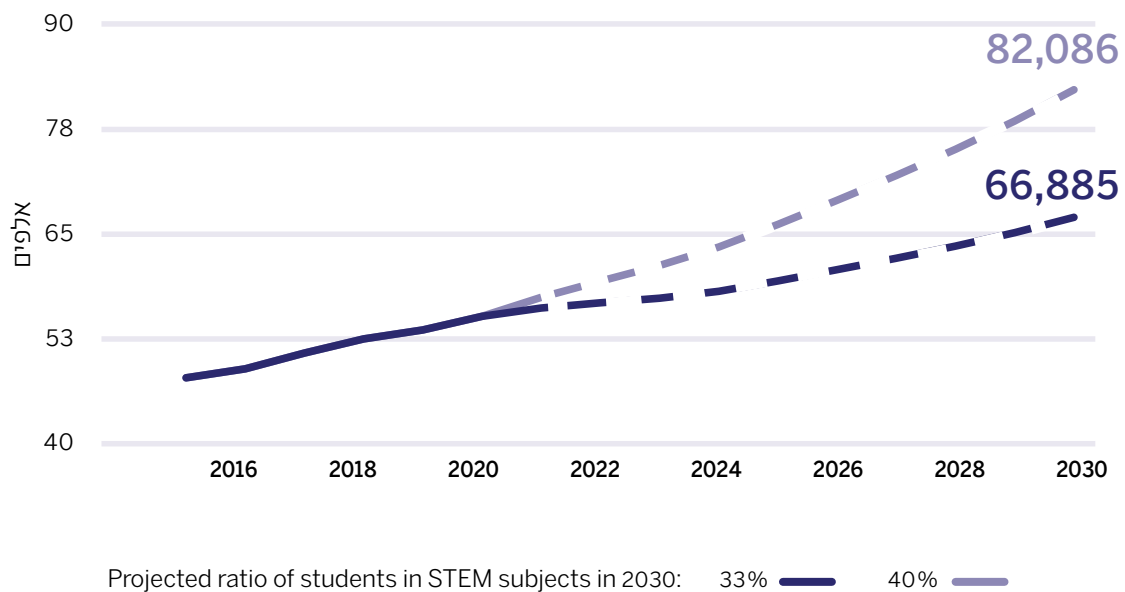
³² Annual Report 71b, State Comptroller, "National Action to Increase the Number of Workers in the High-Tech Industry", March 2021.

³³ Innovation Authority adaptation of CBS data, "Students at The Open University, According to Degree, Study Year, Subject, Sex, Age, Population Group, and Area of Residence".

³⁴ See publication from January 2021, "Who becomes a startup professional?"

³⁵ National Program for Increasing Skilled Human Capital in the High-Tech Industry, Government Resolution No. 2292, 2017.

09 Projected Number of Students in Science and Technology (STEM) Subjects



Source: Innovation Authority adaptation of CBS and PBC data³⁶

The significant increase expected in the number of young employees without vocational experience who will soon join the labor market will intensify the problem of the juniors who today constitute only 11% of employees in the industry.³⁷ There is therefore a significant and urgent need to find a solution for the difficulties involved in recruiting the young employees in the high-tech industry. Alongside the problem of the juniors is the strength of the shekel that leads to an increase in the expenses associated with all high-tech employees, but which make the Israeli juniors especially expensive compared to markets to which companies transfer development jobs via outsourcing. Over time, the market may "adjust itself" and lower employees' salaries, leading to better congruency between companies' demand for inexperienced employees and the number of new graduates from academia in coming years.

Today, the Innovation Authority operates designated training programs for high-tech employees that include emphasis on placement in companies for employees completing the training. Furthermore, it is proposed to consider supporting specialization programs and student jobs in different high-tech companies during academic studies. In light of the great economic importance of creating well paid jobs and of improving digitization in the public sector, there is also room to consider other avenues aimed at harnessing the initial jobs offered by the public sector. These steps will have several benefits: the creation of opportunities for employees to acquire experience, improved digital service provided to the citizens, and enhanced efficiency in government departments that will hire employees with high-quality academic education.

³⁶ The calculation models two scenarios whereby the ratio of students in these subjects will stand in 2030 at the current level of 33%, and at 40% via a process of gradual change.

³⁷ Human Capital in the High-Tech Industry Report 2020.

A woman with dark hair in a ponytail, wearing black-rimmed glasses and a white earbud, is shown in profile, smiling. In the background, a young child is visible, also smiling. The image has a soft, bright lighting, suggesting an indoor setting with a window. A large, stylized green and yellow arrow graphic points upwards from the bottom left corner.

How can Israeli High-Tech Help Rehabilitate the Economy?

Guaranteeing the Israeli economy's continued prosperity and the leading global position of its high-tech industry depends on several key factors. One of these is a state policy that supports the creation of infrastructures necessary to develop innovative technologies and train the next generation of high-tech employees. At the same time, significant changes in the government's policy and regulatory perception will aid Israel's recovery from its largest ever economic crisis by implementing Blue & White technology solutions.





How can Israeli High-Tech help Rehabilitate the Economy?

Like most countries, Israel's economy has been dramatically impacted by the Covid crisis and its ramifications. However, when closely examining Covid's influence on the different sectors of the local economy, it is clear that the crisis has only emphasized existing gaps between high-tech and the economy in general. This polarity is reflected in the way in which the high-tech sector was affected by and contended with the crisis compared to the other hard-hit sectors which suffered from reduced demand and continued to suffer from high levels of unemployment relative to the pre-Covid period.

As we have shown, high-tech was adversely affected by the crisis and high-tech employees, primarily those earning less than NIS 15,000, did lose their jobs or were sent on unpaid leave during the first lockdown period, however the reaction was swift. The flexibility that characterizes the high-tech sector was reflected in the quick drop in salaries and almost no use was made of the option to send employees on unpaid leave. CBS surveys conducted in May-June 2020 reveal that on average, 22% of high-tech employers instituted salary cuts while in the other sectors of the economy, only 10% of employers on average adopted this measure.¹ Furthermore, CBS surveys conducted at the beginning of the Covid crisis in March-April 2020 reveal that only 2.6% of high-tech employers sent their employees on unpaid leave compared to 11% of employers in the economy as a whole.² Evidence of this can be seen in the fact that at the height of the first lockdown period, the overall ratio of unemployment benefits' recipients was double that of the high-tech sector, 28% compared to only 14% in high-tech.³ The Covid crisis continued to impact the other different sectors of the economy during subsequent lockdown periods more than the high-tech sector although the disparities in these impacts gradually declined.

In summary, Covid caused a rise in the level of inequality in Israel. The adverse impact of Covid was concentrated in those sectors of the economy typified by low productivity, with the younger and less-qualified employees generally being the most affected in each sector.⁴ Another prominent difference between high-tech and the other sectors relates to the move to working from home. High-tech succeeded in making the transition from work at the office to working at home smoothly and relatively quickly. In organizations in which numerous teams of employees are scattered throughout the world and most of the work is performed via computer, the ongoing disruption to work was relatively small. In contrast, in other sectors in both the public and private sectors, organizations encountered greater difficulty in making the transition from office to home.

There are various reasons for these difficulties: first, there are some sectors of the economy in which the workplace itself is the focus of work, therefore precluding a move to the home. A CBS survey conducted in January 2021 revealed that most employees who lacked the option of working from home worked in construction and retail sectors – work that is based at a specific physical location.⁵ Second, it seems that, apart from high-tech, few of the other sectors which

¹ Results of the "State of Businesses during the Covid Virus Outbreak" survey, waves 4, 5, 6.

² Results of the "State of Businesses during the Covid Virus Outbreak" survey, waves 2 and 3.

³ Innovation Authority adaptation of NII data.

⁴ See for example, [Chapter 1 of the Bank of Israel Report, 2020](#).

⁵ Results of the ["State of Businesses during the Covid Virus Outbreak" survey, wave 10](#).

had the option to adopt digital services and make the move to working from home, such as building an online store, indeed took this step. Non-high-tech sectors were thus quick to return to working in the office between lockdowns. A CBS survey conducted in June 2020, immediately after the first lockdown, revealed that the ratio of high-tech employees working from home remained high at 37%, while this figure dropped to just 3% in the other sectors of the economy.⁶ A more detailed discussion of the transition to a hybrid work model that combines work from the office and home following Covid is presented below.

As the economy gradually reopens and begins its revival, the question arises as to how the high-tech sector and the introduction of innovative solutions can help economic recovery and what the other sectors of the economy can learn about how to contend with global economic crises. Furthermore, in this chapter we will examine how the implementation of Israeli technological solutions can be utilized to improve services provided to the citizens and to streamline the Israeli public sector.

High-Tech's Large Contribution to the Economy – How can we Ensure its Continued Growth?

Public expenditure in Israel increased significantly during the Covid crisis as the result of the support provided to affected sectors of the population, aid given to ensure continued business activity in an economy that was partially closed, and the support provided to the health system and to the formation of the mechanism required to deliver the vaccine. Now, with the beginnings of economic recovery and return to routine, the need to reexamine public spending has become more acute, especially in light of a sharp increase in the Debt-GDP Ratio and in the development of broad growth engines that will enable its rehabilitation. This need emphasizes high-tech's importance to Israeli economic growth and the central role it will play in its recovery following the Covid crisis. It is important therefore to ensure the preservation of Israeli high-tech resilience and its global competitiveness.

The high-tech industry has formed itself in recent decades as one of extreme importance to the Israeli economy. High-tech's share of GDP has increased from 10% in the year 2000 to 15% in 2020 with most of the growth taking place in the last 3 years. Among others, a recent Bank of Israel report stated that the Israeli high-tech industry's important role in the local economy is one of the factors in the moderate adverse economic impact of the Covid crisis in Israel compared to other developed countries.⁷ In general, the high-tech industry's contribution to a variety of economic indices is larger than its relative share of the economy, among others, in exports, tax payments and other indices. High-tech's importance to the Israeli economy cannot be overestimated. As presented in previous chapters, the high-tech industry's share of all Israeli exports stood at 43% in 2020 (or 45% excluding diamond exports). Both its share of exports and absolute size are increasing consistently. Examination of the public high-tech companies reveals further evidence of the growing significance of the high-tech industry to the local economy. According to an Innovation Authority study, if the Israeli high-tech companies traded on overseas stock exchanges would join the Tel Aviv Stock Exchange, the total value of the companies comprising the Tel Aviv-35 Index would jump by more than 70%, and the weight of high-tech companies in the index would stand at 70% compared to 40% today.⁸

The high-tech industry's important role in the Israeli economy is one of the factors in the moderate adverse economic impact of the Covid crisis in Israel compared to other developed countries.

⁶ Results of the "State of Businesses during the Covid Virus Outbreak" survey, wave 6.

⁷ See Chapter 2 of Bank of Israel Report 2020, p. 25.

⁸ Israeli high-tech companies were defined broadly as those with a connection to Israel. Among the companies on the list: Palo Alto Networks, Wix, Check Point, SolarEdge, Playtika, Fiverr, Compass, Varonis Systems, Cyberark, Lemonade, Coursera, Kornit Digital, Jfrog, and Verint. The value of the companies was calculated as of 25.4.2021 and in shekel terms.

➤ How can Israeli High-Tech help Rehabilitate the Economy?

01 High-Tech's Output and Share of GDP (NIS billions)



Source: Innovation Authority adaptation of CBS and Bank of Israel data

As far as their contribution to tax payments is concerned, we have shown that although the level of high-tech employees in 2018 was less than 9%, they accounted for approx. 25% of all income tax payments. In other words, high-tech employees are responsible for income tax payments that are almost 3 times higher than their relative share of the labor market. The number of high-tech employees is expected to continue growing in coming years, partly because one in every four students in Israel today is studying a science or technology subjects, and a marked proportion of them are expected to find work in the high-tech industry.

The central role of the high-tech industry in the Israeli economy together with the importance of rehabilitating the economy and creating additional revenue from taxation and other sources to reduce the Israeli debt-GDP ratio, have emphasized the need to ensure that the necessary efforts are being made to safeguard the industry's global standing and competitiveness. These efforts must focus on all relevant fronts including the continued expansion of quality personnel training in world-class academic institutions, adapting regulation to support implementation of future generation technologies in fields such as drones and autonomous vehicles, and creating competitive taxation laws that will encourage Israeli and multinational companies to continue employing in Israel and to increase the number of their employees despite the high costs involved.

Furthermore, the government as a whole and specifically, the Innovation Authority, must continue identifying future fields and directions of the technology world requiring heavy investment for the creation of national research infrastructures and long-term planning. Examples of these fields are nano-technology – a field in which two national programs have been created⁹ – and the field of Artificial Intelligence (AI) in which Israel lagged behind other countries in presenting a national program. According to a report issued by the Artificial Intelligence and Data Science Committee there is "a worrying gap between Israel's leading position in R&D and trade, and its low ranking in the infrastructures required and in government policies, which casts doubts

⁹ See a survey conducted by the Knesset Research and Information Center, 2017: "Nanotechnology in Israel – Information and Figures".

on Israel's progress and on its ability to reinforce its standing in this field"¹⁰ The committee presented a multi-year work plan with a budget of over NIS 5 billion. The first segment of this budget (NIS 500 million) was approved for investing in the creation of super-computerization infrastructure, generic R&D with an emphasis on Natural Language Processing (NLP), and the training of manpower and procurement of advanced equipment in academia. A further field is that of Bio-Convergence (multidisciplinary research that combines engineering and biology – more details are presented below) in which the Authority is investing considerable resources.

Another central issue is how to expand the circle of high-tech employees. Although the absolute number of employees in high-tech has risen for more than two decades, their ratio of the total number of employees in Israel has not exceeded 10%. As we have shown, the ratio of high-tech employees does not include diverse populations that could benefit from its advantages. On average, high-tech employees earn more than double the average salary and in turn generate high tax revenues for the state economy. Nevertheless, there are significant hurdles to integrating into the core technology jobs that require relevant academic and professional training. The potential growth and expansion of high-tech is therefore limited to the number of university graduates in science and technology degrees and those serving in IDF technology units.

The efforts to preserve high-tech's standing must focus on training, identifying future technological directions, and advancing innovative regulation.

Another way to expand the circle of high-tech employment relates to increasing the number of employees in non-core technology jobs such as sales, marketing, human resource management etc. Among those suitable for these positions are employees in sectors that have suffered significantly and in which employment has become uncertain during the Covid crisis such as tourism, aviation, and retail. As discussed in Chapter 1, the maturation of the Israeli high-tech industry is reflected in the growth of Israeli companies which have become "complete" and independent companies that are not sold off in the short term and which employ many employees in a variety of jobs. These companies also offer potential employment in non-core technology jobs, thus explaining the importance of supporting the creation of complete companies that will fully utilize the diverse range of available employees in Israel.

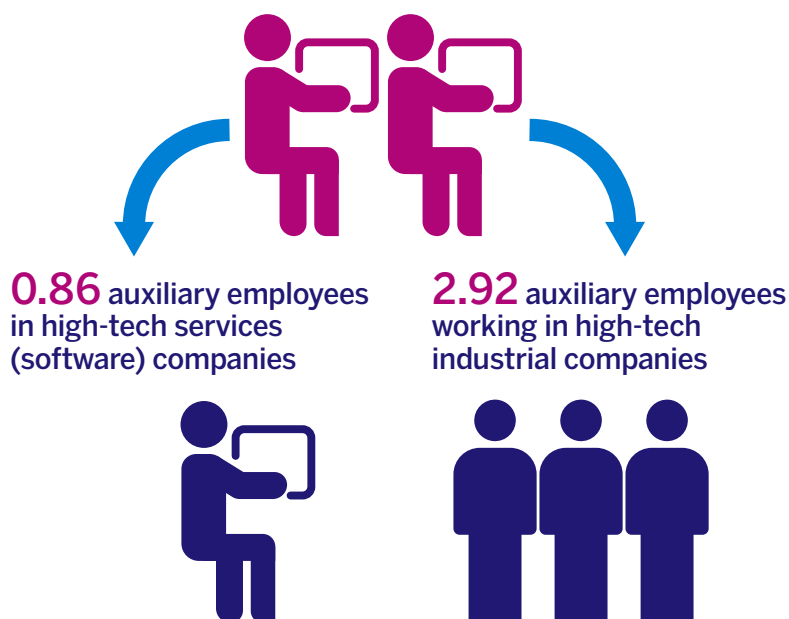
It is important to clarify that high-tech is not a uniform field and that the creation of "complete" companies focusing on software differs from high-tech companies that produce tangible products. The latter category of companies, where the production processes themselves generally constitute a complex technological development, requires broader government support, including in areas of regulation and taxation. The greater support for companies manufacturing a tangible product is coupled with larger potential for the economy in general. First, as mentioned in Chapter 1, these companies employ three times the number of employees in non-core technology jobs out of the total number of employees compared to software companies. Second, establishing a sophisticated production plant, usually after recognizing the importance of proximity of the development and production systems, constitutes a local mainstay that connects the company to Israel and makes it difficult to close or downscale local activity, even if the company is bought by an international corporation. Third, these worlds include an accompanying industry of subcontractors, some of which are advanced and significant industries in themselves. A growth in the local high-tech production industry is expected to support growth in the subcontractors' industry and to expand the scope of high-tech influence.

¹⁰ See [Artificial Intelligence and Data Science Committee Report, December 2020](#).

➤ How can Israeli High-Tech help Rehabilitate the Economy?

02 Ratio of Auxiliary to Core-Technology Employees in High-Tech Sectors

For every **2** core employees working in high-tech companies, there are:



In summary, there are several ways to widen the circle of high-tech employees, from increasing the potential manpower suited to core professions by encouraging populations under-represented in high-tech, expanding high-tech's borders to additional worlds of content such as biology, identification of and support for future technology waves, and creating a system of incentives aimed at supporting the growth of "complete" companies.

Online Commerce and Remote Medicine: Business Opportunities Created by the Covid Crisis

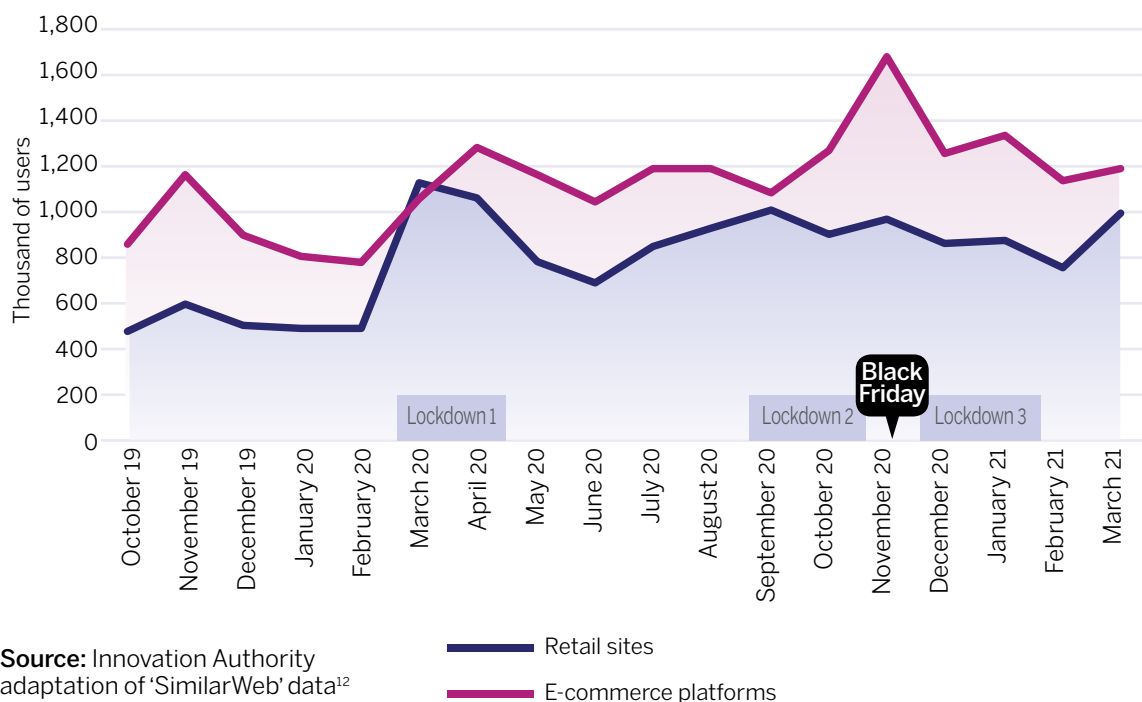
The Covid crisis has impacted many sectors of the economy which were forced to suspend or severely downscale activity, notably tourism and aviation, due to global restrictions of movement. However, the crisis also created new opportunities for the Israeli economy and strengthened pre-existing trends related to digital transformation and a move to online commerce. A CBS survey from October 2020 revealed that 45% of Israeli businesses lack any digital interface and another 30% made no changes or improvements to their digital interface during the crisis.¹¹ At the same time, during the year of the Covid crisis, many businesses in Israel had their first experience of online trade and deliveries and, due to Covid-related constraints, took the leap to the digital age. With the return to normal routine, these businesses now have an opportunity to continue in this direction and expand their portfolio of products and services and their geographical deployment.

Lockdown restrictions impacted the Israeli population which increased its use of online commerce e.g., the elderly population, which for the first time gained practical experience in online shopping. This influence did not end after lockdown, however. Findings' analysis of the Israeli company SimilarWeb which monitors website traffic, shows that there has been a rise in the number of Israelis visiting prominent e-commerce sites throughout the Covid period, with an emphasis on retails sites, especially during the first and subsequent lockdowns.

¹¹ Results of the "State of Businesses during the Covid Virus Outbreak" survey, wave 9.

Among the sites on which user traffic increased are online supermarkets, electric products, housewares, fashion, and pharma. Of special interest is the new point of equilibrium that has been created with the number of those using online commerce sites now higher than before the Covid crisis. In other words, Israelis who had their first experience of online shopping during the Covid crisis or who increased their use of these sites during lockdown, continued using the e-commerce sites after regular retail, street shop and shopping malls reopened. The rise in online traffic grew approximately 80% during the long months of Covid compared to the preceding period and about 40% on e-commerce platforms.

03 Average Monthly Traffic to E-Commerce Sites in Israel (in thousands)



The State of Israel must utilize the opportunity that this accelerated trend offers to increase business productivity and support business opportunities made available by online commerce, including opening Israeli business that have focused until now on the local market to international trade. The growth of Israeli businesses is essential for economic recovery, the creation of new jobs, and for improving the services that Israeli consumers enjoy. To enable this, steps must be taken to ensure that businesses apply the different e-commerce technologies and that the local logistical services are efficient because, as mentioned by the Innovation Authority, these are characterized by significant advantages of scale.¹³

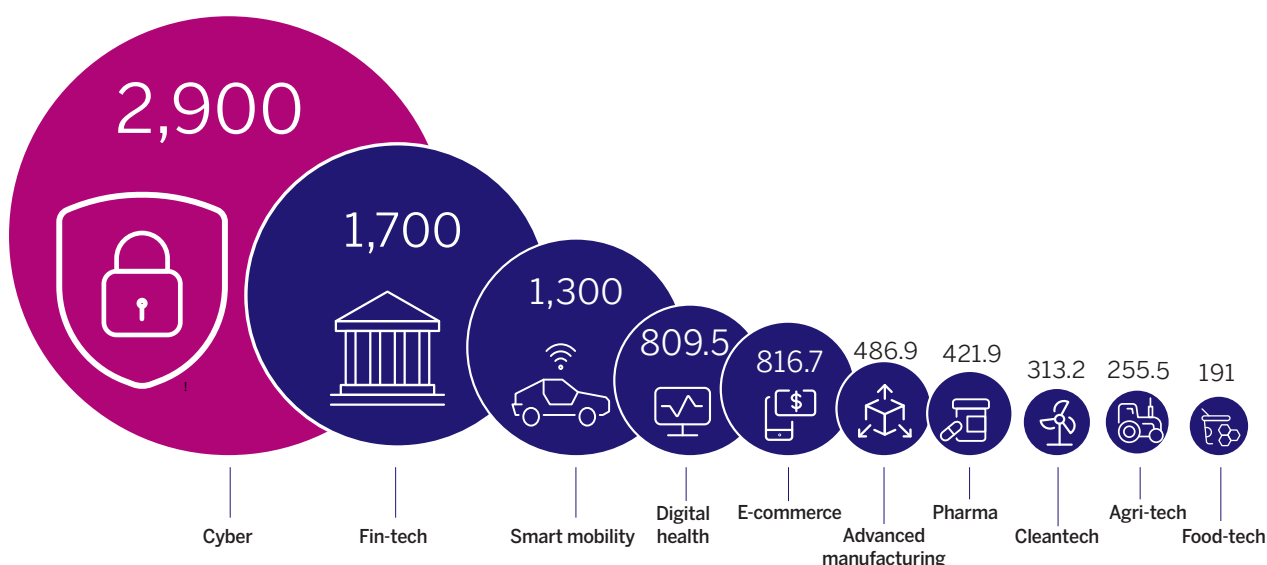
¹² Average online traffic was calculated as the total online traffic on several prominent websites in the relevant commercial category, divided by the number of websites chosen. Among the retail websites are those of Quik, ACE, Shufersal, Mega, Rami Levy, Victory, and Yeinot Bitan. The e-commerce sites included Walla Shops, Azrieli, Super Pharm, Marmelada Market, and Terminal X.

¹³ See the Recommendations Chapter in the Innovation Authority Report "Personal Import as a Tool for Advancing Competition".

➤ How can Israeli High-Tech help Rehabilitate the Economy?

New opportunities have also been created for Israeli technology companies developing and exporting solutions in fields with increased demand, and which produce the technological infrastructure for digital transformation. The changes in global demand have naturally also benefitted the Israeli technology companies that are developing solutions in areas with increased need. One such example from the past year was the clearer need for and resultant removal of hurdles related to implementation of technologies in the field of digital health, including technologies providing remote medical services (tele-medicine). Opportunities also arose for companies that develop technologies used as infrastructure for telecommuting. Furthermore, to enable global companies to implement rapid digital transformation during the Covid crisis and to support demand for e-commerce platforms, technological developments were needed that enable clearing, secure trading infrastructures etc. Consequently, the demand for cyber and fin-tech technologies – two fields that we have shown to be the leaders in raising capital for high-tech – remained high.

04 Investments in Israeli Technology Companies in 2020, according to field (USD millions)

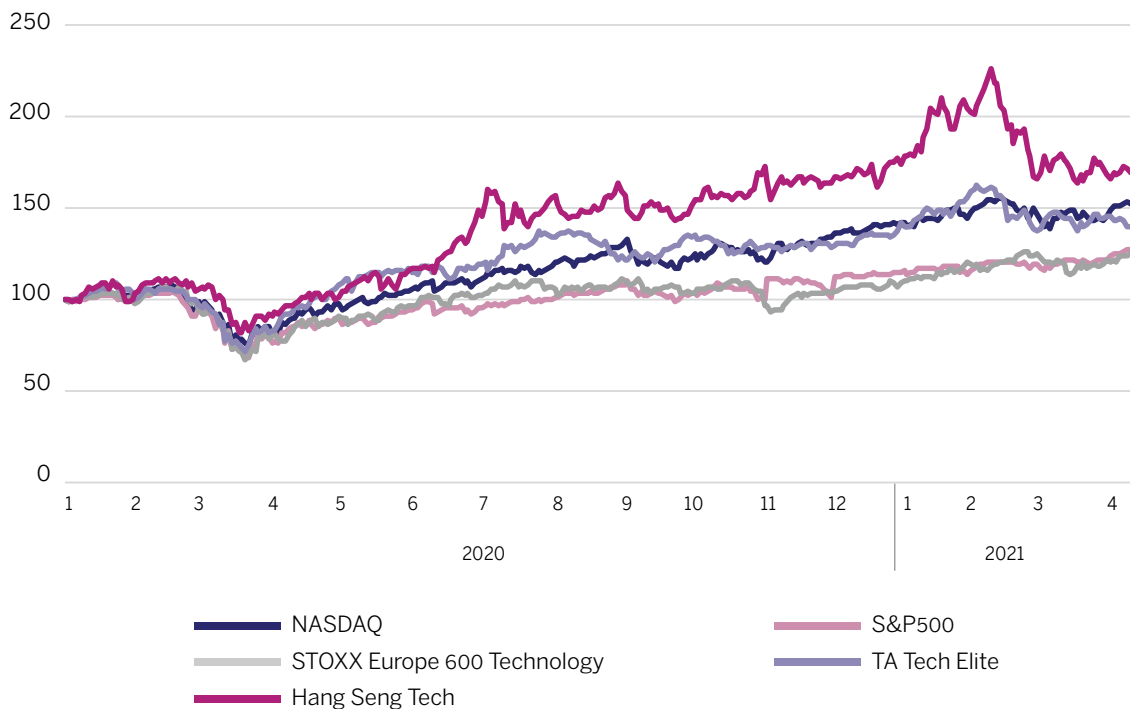


Source: Innovation Authority adaptation of SNC data

The Israeli economy, like that around the world, is expected to change after Covid. At the new point of equilibrium, some economic sectors will experience growth in demand while others, it seems, will decline. Nevertheless, and despite the uncertainty, one of the trends about which there is relatively broad consensus is, as mentioned above, the rapid growth in the information technology economy. A survey of various global share indices reveals that, as a rule, the more a country's index is weighted towards technology, the better its performance. The rise in the various technology indices reflects an expectation of the demand for technology and Israeli high-tech must take advantage of this trend, not just for rounds of capital raising but also to expand the diversity of clients and network of connections. For example, global companies that are not necessarily in the high-tech industry, are reorganizing the structure of their supply chain to lower risk and are striving to expand their range of suppliers and their geographical deployment. This development is an opportunity for companies to create new connections.¹⁴

¹⁴ See for example: ["Business Beyond Covid-19: The Future of Global Supply Chains."](#)

05 Changes in Leading and Technology Stock Exchange Indices, from January 2020



Source: Innovation Authority adaptation of Yahoo Finance & Investing.com data

When will High-Tech Reach the Public Sector?

The next main question on a national level concerning high-tech's connection to the Israeli economy for bolstering its recovery relates to the public sector. Israeli technology companies are developing innovative technologies on an international level whereas Israeli citizens, employed in those same companies and who are responsible for the innovative developments, receive state services that are inefficient, not sufficiently digital, and not of the standard expected in the 21st century. According to the UN E-Government Survey, the government digital services index is dropping and Israel's position in the E-Government Index has dropped from 16th in the world in 2012 to 30th in 2020.¹⁵ In practice, a situation has arisen whereby "the shoemaker walks barefoot" and a dissonance exists between the Israeli technologies available in Israel and their implementation in the local public sector. The Covid crisis has created an opportunity to lead a change in regulatory perception aimed at easing the assimilation of technologies in the public sector.

During the Covid crisis, and within a short period of time, the private sector made a significant quantum leap forward which, in other circumstances, would have taken years to achieve. This included the adaptation of products and services to the digital era and a transition to a work environment out of the office or to one that was adapted to the restrictions of social distancing. The economy in general, and specifically government departments, can learn from the experience of the high-tech sector and the Innovation Authority to advance assimilation of existing technologies in the economy's various other sectors, including government departments. To enable the public sector to take the necessary steps forward to close the gap that has widened during the Covid crisis, the government departments must become digital and suited to the modern era. The question is how high-tech can aid the economy's recovery as it exits the Covid crisis.

¹⁵ UN E-Government Knowledgebase, [Online Service Index](#).

➤ How can Israeli High-Tech help Rehabilitate the Economy?

One of the possibilities to reduce the disparity between the private and public sectors is by harnessing local high-tech to digitize Israel, and its government departments, and prepare them for the post-Covid world. To achieve this, government departments must make an effort to adopt technological solutions, including those in the pilot stage, that will enable the public sector to take the necessary leap forward and transform the government into an 'Early Adopter' i.e., for the government to become a client of the high-tech sector via a transition to digital services. One of the primary changes that will facilitate this process is updating the government procurement process and increasing its flexibility e.g., changing the method of tenders and creating new regulations to address the transfer of government data to suppliers while safeguarding privacy. In the field of digital health, for instance, there is an increasing trend of proving product feasibility based on real figures known as 'Real World Evidence', beyond proof of concept that is based on controlled clinical trial data. The health system in general, and the health funds particularly, are in possession of vast data and, via collaborations with Israeli digital health companies and the health system, can guarantee a global advantage for Israeli technology companies that will lead the health system to the forefront of technological progress. A change in regulatory perception in the area of procurement will make the state more innovative and efficient, one that provides better service to its citizens via cooperation of both the private and public sectors.

Another aspect of harnessing high-tech to economic recovery is related to utilization of human resources and restoring the unemployed to the workforce. The Covid crisis emphasized employees' lack of occupational stability and the need to allow them to move between sectors and transfer their services to digital avenues. For example, employees in the tourism, hotel, aviation, and retail industries were prominent among the those adversely affected. Some of these sectors are also exposed to risks other than Covid. The tourism industry, for example, is influenced by geo-political events and its employees suffer from occupational instability. The employees in these industries, who are used to customer service and in many cases speak other languages, may have opportunities in the mature high-tech companies developing in Israel (and which were analyzed in the Financing Chapter) that need employees in a variety of non-core technology jobs. It is possible to retrain employees from sectors other than high-tech and place them in these jobs e.g., human resources management, sales, and customer relationship management.

However, high-tech retraining is not a simple process. As detailed in the Human Capital Chapter, inexperienced employees (juniors) have difficulty finding work in high-tech companies and a concern therefore exists that even those employees from other fields retraining in high-tech will still encounter difficulties in finding work. Therefore, every such training program must also be accompanied by a detailed plan addressing placement of the participants and finding them employment in the field in which they are trained. One possible solution to this problem is to employ retrained juniors in the public sector, as we described in the Human Capital Chapter.



A Stronger Shekel – Weaker High-Tech

Alongside the Covid crisis, Israeli high-tech is currently contending with an old-new challenge that raises its head every few years – the strengthening of the shekel in relation to the USD. During 2020, the exchange rate dropped from 3.5 shekels per dollar to 3.2 shekels per dollar – its lowest level since 2008 – where it has remained almost unchanged since. From the perspective of the Israeli industry, a stronger shekel means weaker high-tech due to higher expenses: Israeli high-tech companies typically sell and raise capital in dollars while their salary, rent, and other expenses are, largely, in shekels. As an export-oriented sector, a stronger shekel therefore leads to higher company expenditures without a parallel growth in activity, purely as the result of currency exchange rate fluctuations.

For Israeli high-tech companies, the stronger shekel impairs its profitability and thus weakens their global competitiveness. Many company directors and senior executives have recently expressed concern at the sector's impaired competitiveness however a multi-year analysis of the NIS/USD exchange rate reveals a cyclical pattern. Over the last decade, the shekel has alternatively weakened and strengthened in value against the USD while there has been a parallel consistent increase in high-tech productivity. During previous periods of a strong shekel, senior high-tech personnel also expressed concern about its ability to maintain its competitive advantage. Nevertheless, data presented in this report shows that Israeli high-tech has gained in strength and grown despite the warnings and concerns, breaking records in capital recruitment and other indices.

One of the primary significances of the stronger shekel is the higher expense of employing Israeli engineers, already high by international standards.¹⁶ A survey conducted by Deloitte for the National Economic Council in 2018 found that the salary of Israeli R&D employees in multinational high-tech companies operating in Israel was similar to the average salary of R&D employees in the US (except in Silicon Valley) and approximately 20% higher than the parallel figure in Canada. If the shekel continues strengthening in relation to the dollar, some companies, especially those that also have development centers in other countries, will transfer jobs from Israel to countries in which salaries are lower. The long-term question is whether the chronic shortage of Israeli engineers and higher employment costs will result in companies deciding to leave Israel. Is it more likely that companies leave, or for them to decide that there is no replacement for local talent?

06 The NIS-USD Representative Rate¹⁷



¹⁶ See the Deloitte report: 'An Examination of the Activity of Multinational Development Centers and Innovation Centers in Israel'.

¹⁷ Innovation Authority adaptation of Bank of Israel data.

Government Tools for Advancing High-Tech as a Growth Engine

The Covid period emphasized the need to quickly formulate and implement state solutions during crises as a response to a changing reality. At the beginning of the Covid crisis, the expectation for an extended period of low interest rates and investors' moderated propensity for risk highlighted the limitations of Bank of Israel interest rates as a tool for increasing demand and the importance of state support for the economy, both by injecting money and via regulation. Two examples illustrating the potential of implementing government supportive tools in high-tech are presented below.

One of the examples for the way in which updating regulation can facilitate the creation of a new market is the **Israeli Drone Initiative (National Drone Delivery Network)**. The NAAMA Initiative was established in January 2020 in conjunction with Ayalon Highways, the Civil Aviation Authority, the Ministry of Transport, and the Smart Mobility Initiative as part of the activity of the Authority's Center for Regulation of Innovative Technologies that advances regulation to develop and implement innovative technologies.¹⁸ The aim of the project is to create a national network of autonomous drones for the delivery of cargo transportation in urban areas that will be ready for commercial use within three years. As part of the initiative, the center, together with Ayalon Highways, the ICAA, and the Ministry of Transport created a unique regulatory framework within a designated geographical area that will enable test flights of drones in the Hadera region which are fully monitored by an integrative control system. This is a groundbreaking development on a global scale, both in essence and scope, because operating a drone in an urban environment also constitutes a regulatory challenge for the European Aviation Authority and the American Aviation Authority together with NASA. More than 2,400 real flights were conducted in Israel during the Covid period by six companies as part of the program's final demonstration stage. Seven further demonstrations are expected in the future as part of the joint Initiative-Innovation Authority pilot and more will be conducted throughout the country in conjunction with the health system. This activity is just one example that illustrates the potential that exists when creating "regulatory sandboxes" as a foundation for collaboration between state entities and the private sector. Creating such collaborations is one of the Authority's central areas of activity and is carried out both via the Center for Regulation which supports the regulatory aspect and the incentive programs that support the pilots.

Adopting innovative regulation for the Drone Initiative positions Israel as a global pioneer in urban area flights.

The most striking example of the way in which swift state intervention via investment can create growth in response to a need created by a crisis is the Authority's **Fast Track Incentive Program** launched together with the Ministry of Finance. The initial Covid period was characterized by a decline in the injection of capital investment from the private market to innovative technology companies which were considered high risk.

At the outset of the crisis, it was decided to create a solution for innovative technology companies that had already accumulated fundamental assets, and which were in early growth or R&D product development stages, had good long-term success prospects, but that faced a short-time funding crisis (a short 'runway' of up to 12 months¹⁹). The Fast-Track Program enabled to check these companies and provide an answer within only four weeks, each company able to submit a request for support of R&D programs of up to NIS 15 million.

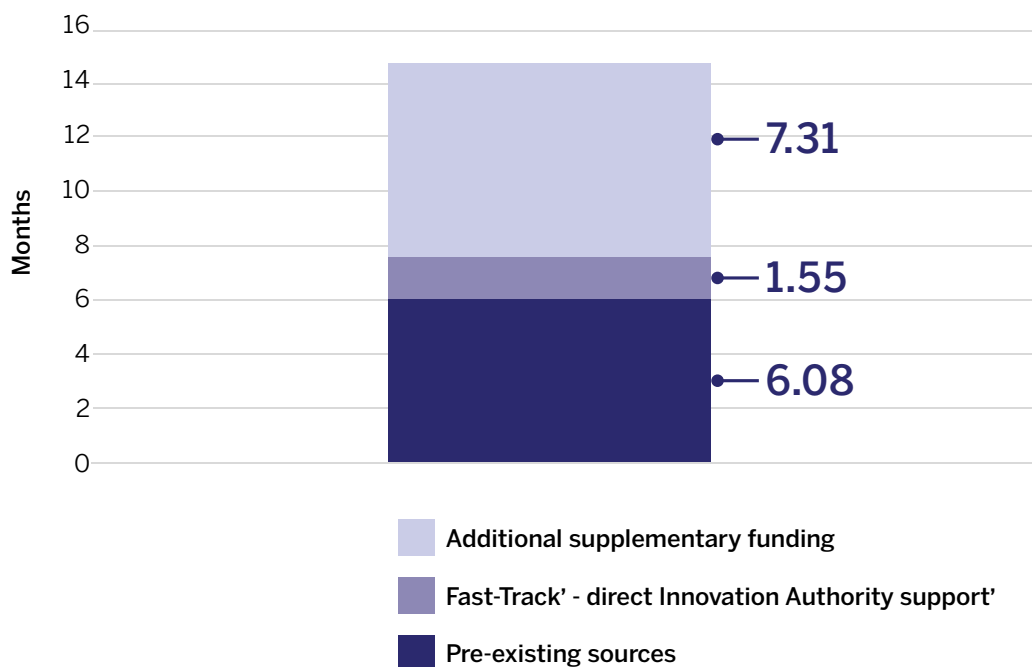
¹⁸ The Center for Regulation of Innovative Technologies was established at the Authority in 2019 together with the World Economic forum (WEF), based on Government Resolution No. 4481 from January 2019.

¹⁹ The term "Runway" refers to the period in which a company can continue operation and is calculated by the relation between the pace of expenditures and cash balance.

The program awarded NIS 650 million during its seven months of operation, with 283 requests being approved (out of 578 submitted) at an average support rate of 46% of the approved budget. Receiving a grant from the program was conditional on the company recruiting matching funding from private investors.

Analysis of the companies' "runway" after receiving funding via the Fast-Track Program showed that it achieved its objective: the companies' average runway grew from 6 months before receiving the funding to approximately 14 months after funding. The Fast-Track Program's success is highlighted when comparing the Israeli venture capital market's performance and the scope of capital raised by early-stage high-tech companies to parallel figures in the US and in Europe where a decline in the number of funding rounds was recorded. The swift intervention of the Innovation Authority and the conditioning of its support on supplementary funding contributed to the speedy return to the market of early-stage investors and to the accelerated growth of startups during the crisis. The program's success raises the question as to whether high leverage state tools should also be provided during non-crisis periods, a question that is currently being examined by the Innovation Authority.

07 Companies' Potential Runway According to Source of Funding (in months)



With a look to the future, there is also room to examine the support tools provided to the manufacturing industry in Israel. This industry has matured and is no longer at the stage where there is a need to provide it access to the worlds of innovation. Most production plants today realize that without introducing significant innovation into their products or production lines, they can expect to struggle and even perish in the face of global competition, whether their activity includes export or is restricted to the local market and contends with competition from imports. Considering the local market's growth, manufacturing plants must find the niches in which they can produce and export unique and innovative products from Israel. Adopting technologies from the world of Industry 4.0 is perhaps a prerequisite for survival, however because this is a global trend with investments on a scale which Israeli industry cannot meet, extra innovation is needed either in the products themselves or in their production technologies.

Science Without Work: How can the Biology Graduates' Problem be Solved via Innovation?

About 1,500 Israeli biology students complete their studies every year, 75% of whom continue to a master's degree in Biology. A third of the students completing a bachelor's degree will continue to a doctorate in the field – comprising a quarter of all doctoral students in Israel.²⁰ The fact that a significant portion of biology students choose to continue to more advanced degrees, stems primarily from the lack of suitable employment for biology graduates. Although these graduates constitute high-quality human capital, only one third of those receiving biology education work in this field in Israel and even these are typically in low productivity jobs compared to employees with similar experience in other professions. The average salary difference between biology graduates and graduates of fields with similar psychometric (SAT) averages such as economics, law, and engineering is between 30%-80%.²¹ The lack of local employment opportunities leads a significant proportion of biology graduates to turn to teaching (approx. 12%) or to choose to move abroad because of the higher salaries paid there – biology positions in the US pay salaries 30% higher than those in Israel.²²

Bio-Convergence – a multidisciplinary field of research that combines biology and engineering – therefore constitutes an interesting employment opportunity for many biologists. Although this field has existed for many years in the academic world in Israel and abroad, recent years have witnessed an acceleration in the establishment of research institutions and the development of new models at various centers in countries such as the US, Korea, and the UK.²³ A study conducted at the Innovation Authority in 2019 identified that because this is still a relatively young field without a distinct center of global leadership, Israel has a real opportunity to become a global leader in this developing industry. The connection between biology and engineering constitutes a relative advantage for Israel in relation to the other global bio-tech centers, and will, in the medium-term of a few years, enable the employment of high-quality available personnel numbering 20,000 scientists in life sciences fields at important high-tech companies characterized by high productivity. Furthermore, because Bio-Convergence is actually a combination of disciplines, this sector is expected to absorb a wide range of graduates, thereby helping to widen the high-tech employment circle, both in core and auxiliary professions.

The Covid crisis has created a "perfect storm" – the strengthening high-tech industry, an intensification of the global healthcare revolution, and the maturation of government measures that supplement the Bio-Convergence Program such as investment in digital health, completion of the vaccination program, and the quality and availability of medical data have all created conditions that enable Bio-Convergence to become the State of Israel's next economic growth engine. Accordingly, the Authority allocated NIS 150 million during 2020 to support companies in this field. As part of the National Infrastructure Forum for Research and Development (Telem), the Authority is also currently striving to formulate a comprehensive national program aimed at creating a competitive ecosystem in Israel that will include the construction of infrastructures and which will strengthen the connection between academia and industry in this field.

²⁰ Sources: The Planning and Budgeting Committee (PBC) – 'Opening figures for the 2020-21 Academic Year', CBS – 'New bachelor's Degree Students in STEM Subjects, according to selected study courses and gender', and a study by the Chief Economist's Division in the Ministry of Finance – 'Not all Degrees are Born Equal', Zeev Krill, Asaf Geva, and Tzili Aloni.

²¹ Sources: CBS data – 'University Students Studying for a bachelor's Degree', Bank of Israel study – 'Over Educated and Disparity Between Occupation and Studied Profession Among University and College Graduates', Noam Zusman, Idan Liper, and Dror Rosfeld, and a study by the Chief Economist's Division in the Ministry of Finance – 'Not all Degrees are Born Equal', Zeev Krill, Asaf Geva, and Tzili Aloni.

²² As of 2018, about 11% of university graduates who lived overseas for more than 3 years were from biology science subjects. Sources: CBS data – 'Salaried Employees, according to selected occupations', 'New bachelor's Degree Students in STEM Subjects, according to selected study courses and gender', a study by the Chief Economist's Division in the Ministry of Finance – 'The Influence of the Degree of Selectivity of an Educational Institution on the Salaries of Young Academics', Zeev Krill, Yuval Fischer, and Yona Hekt, and a study by the Knesset Research and Information Center – 'Israeli Academics Overseas and Activity to Bring them Back to Israel'.

²³ For more details, see the 2019 Innovation Authority Report.

08 Biology students in Israel 2018-2020

Number and percentage of biology students out of all students in each degree



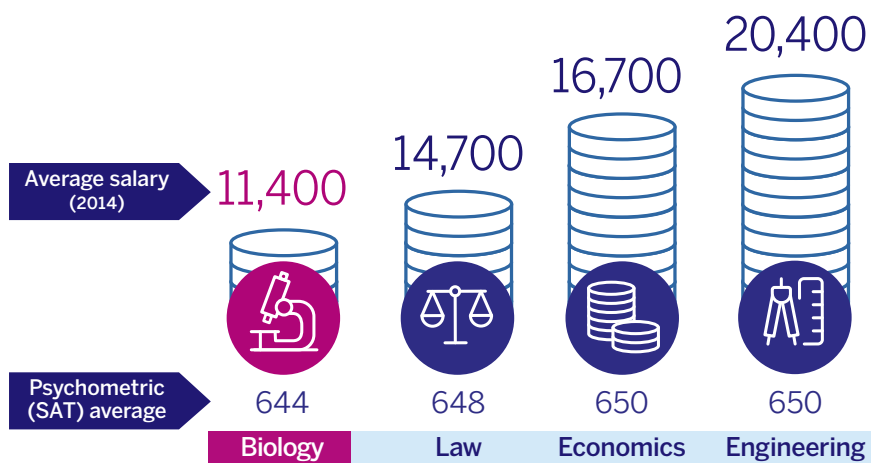
bachelor's degree students 1,580 2.5%

76%
continue to a
master's degree

master's degree students 1,200 4.5%

42%
doctoral degree
students

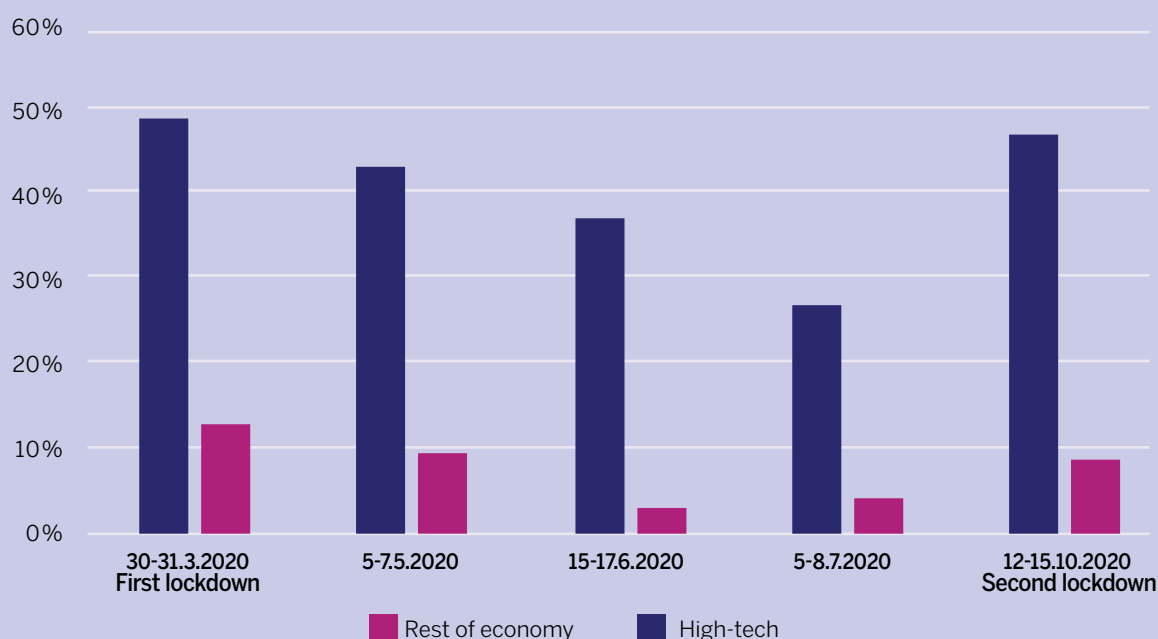
doctoral degree students 500 25%



The New Labor Market – Working from Home After Covid?

One of Covid's most significant ramifications for the labor market is the transition made by many organizations to working from home, especially during lockdown periods. Prior to Covid, most companies and employers did not allow their employees to work from home, either fully or partially. However, after a period of about a year during which organizations were required to experience this form of work, many are now considering or have already decided to move to a model of hybrid work that combines work in the office and working from home, even after the Covid restrictions are lifted. A positive sign in this direction came from the Wages Commissioner's Division in the Ministry of Finance and the Civil Service Commission who allow employees in the public sector to work from home one day a week.²⁴

09 Rates of Work from Home in High-Tech and Overall Economy



Source: Innovation Authority adaptation of "State of Businesses during the Covid Virus Outbreak" surveys, waves 2-9

²⁴ [Instruction issued by the Civil Service Commissioner is valid for a year subject to performance evaluation.](#)

The hybrid work model preserves some of the advantages of working from home highlighted during the Covid period. For example, it allows to reduce traffic on the road and lower air pollution, enables employees to live far from centers of employment, and allows the flexibility needed by parents in the labor market in a way that supports greater gender equality. A transition to the hybrid work model can create new employment opportunities in geographical and social periphery areas, reduce economic and social gaps, and facilitate the integration of people with disabilities. In particular, an experts committee report on a transition to working from home written before the outbreak of Covid with the support of the Ministry of Transport and the Ministry of Environmental Protection found that a public sector transition to working from home for 15% of working hours is expected to benefit the economy by NIS 850 million a year.²⁵ Nevertheless, it must be remembered that not all sectors of the economy are suited to working from home.²⁶

With respect to the organizations and the state, the hybrid model creates several managerial challenges related to the creation of new policy. To enable and encourage the adoption of a hybrid work model, the state must be responsible for deploying suitable infrastructure e.g., internet infrastructures must be improved in periphery areas including for 700,000 Arab citizens. Currently, more than a third of Israel's Arab population lack access to the HOT internet infrastructure. Another issue requiring attention to enable businesses to continue operating while employees work from home, including provision of digital services, is the speed of the internet bit rate in Israel. According to a test conducted by 'Speedtest', Israel is positioned in 19th place out of the 37 OECD countries in speed of wired internet networks. According to the findings, the average speed of wired internet in Israel in June 2020 was nearly 100 Mbps, compared to speeds of over 140 Mbps in countries such as Spain, the US, France, Korea, and others.²⁷

In this context, it is worth mentioning a program run jointly by the Ministry of Communications and the Innovation Authority as part of the Innovation Authority's Pilots Program, to implement advanced communications applications aimed at supporting the expanded use of the G5 network in Israel.²⁸ The program awards financial and regulatory support to technology companies conducting pilots at operational work locations and at Ministry of Communications test sites. In particular, the Ministry of Communications allowed technology companies a dedicated regulation framework in which permits for users and frequencies can be received for trials. As part of the program, five pilots are being conducted at test sites with critical infrastructures, such as hospitals and local authorities, that make use of the technology's unique attributes – the swift supply of data and short delay times.

In addition to addressing the internet infrastructures as a condition for adopting a hybrid work model and preserving Israel's competitive global position, it must be ensured that the new work model does not create breaches of cyber security. Furthermore, there are also taxation issues related to working from home that must be regulated to enable organizations in Israel to adopt a hybrid work model. For example, tax benefits for work in an area of national priority or questions concerning the recognition of employees' work-related expenses. All these raise the question as how ready state regulation is to support widespread adoption of a hybrid work model, both in the private and public sectors. Finally, it must be ascertained whether adjustments or training of manpower are needed to enable a long-term change.

²⁵ See: [Implementation of a Working from Home Policy in Israel, Summary and Insights of an Experts Committee, 2020.](#)

²⁶ Source: [Ability to Work from Home Among Employees in Israel, Taub Center Report, 2020.](#)

²⁷ See: [Fixed Internet Infrastructures and Bit Speed on Internet and Periphery Settlements.](#)

²⁸ The Pilots Program enables private companies to operate pilot test facilities in a variety of innovation systems, including those that are regulation-intensive and influenced by government, while involving the relevant state entities. This is aimed at increasing the latter's impact on strengthening innovation systems under their responsibility, providing the private sector with access to regulation, and the public with access to state assets and public infrastructures, and to improve the levels of knowledge and professionalism of the Innovation Authority and the government in advancing these innovation systems.



Appendix 1 - Activity of the Israel Innovation Authority's Divisions

The Israel Innovation Authority strives to provide solutions for the various challenges facing the Israeli innovation ecosystem via six operative divisions. Each division is focused on specific tasks and clients and offers a unique set of tools for contending with the different challenges throughout the technology lifecycle.



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Israel Innovation
Authority

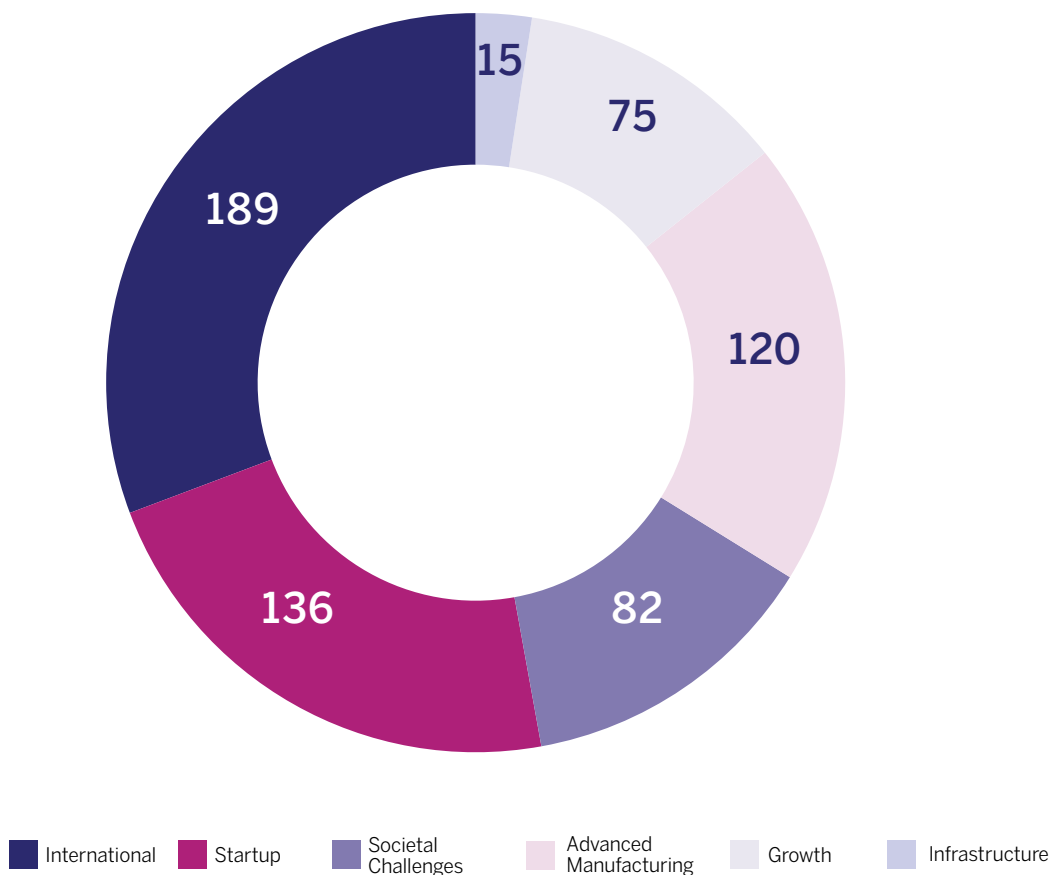




Activity of the Israel Innovation Authority's Divisions

In 2020, the Innovation Authority's divisions implemented a wide range of measures aimed at advancing the growth of the Israeli innovation ecosystem. Specifically, during 2020, it approved 615 requests submitted by new companies requesting support for the first time.

01 Distribution of Companies Submitting a First Request for Support to the Innovation Authority in 2020, according to division



This chapter presents the main activity of the various divisions during 2020 and the way in which they translated the Authority's policy into action and specific policy tools.



Startup and Business Development Division

The Startup and Business Development Division supports early-stage businesses and startups in the ideation stage and corporations interested in exposure to open innovation via partnership in technology incubators and innovation labs. The Division assists the ideation process – from development of an initial technology idea to productization – and in advancing the initiative with the aim of reaching advanced stages of capital raising and sales.

The Division's Incentive Programs:

Ideation (Tnufa) Program: The Ideation (Tnufa) program is intended for fledgling entrepreneurs who are interested in formulating and advancing an innovative technological concept to the initial R&D stage, in preparation for Proof of Concept (POC) and/or construction of an initial prototype. The program's goal is to assist in the project's technological POC and commercial applicability, thereby enabling it to raise private funding and/or recruit 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 100,000 for 12 months (or double for innovative solutions in the field of Bio-Convergence).

Seed Program: The program is intended for startups in the seed stage that are developing technologies in fields with stringent regulation, an extended timeframe until implementation, or technologies that are part of an evolving market. The support will be awarded to companies that have not raised more than NIS 3.5 million (before making their submission to the program) and that have already signed a memorandum of understanding with a venture capital investor experienced in high-risk investments who is interested in making an initial seed investment in the company. Find more details below.

Technological Incubators Programs: A technological incubator constitutes an entrepreneurial center, the role of which is to invest in companies in their early stages. The incubator provides a framework that supports the establishment of the company and the development of the idea into a commercial product. The Incubators Program aims to support initiatives with an innovative technological idea in the early R&D stages, that is having difficulty raising private capital and needs the incubator's support to reduce the risks and enable it to reach a significant funding milestone.

The comprehensive support offered by the incubator includes: a physical site and infrastructures, administrative services, technological and business guidance, legal advice and access to partners, additional investors, and potential clients. No financial investment is required by the entrepreneur as part of the program – 85% of the budget is funded by the Authority (up to a maximum sum of NIS 3.5 million for two years, according to the type of project and geographical location of the incubator) and 15% is funded by the incubator operators.

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 to which they currently lack access, with the aim of proving feasibility on the way to transforming a technological idea into a commercial product. The program provides a grant of up to 85% of the approved budget, up to a maximum grant of NIS 1 million for up to a year. A grant of up to 50% of the approved budget, up to a maximum sum of NIS 1 million will be awarded for a further period of 1 year.

Advancing Technology Entrepreneurship in Haifa: This program is aimed at reinforcing and strengthening the city of Haifa's status as a focal point of high-tech industry in the Israeli ecosystem. The program's goal is to increase the number of startup companies and technological initiatives in Haifa, with emphasis on its Lower City neighborhood. The program encourages synergy and collaboration between principal city focal points such as City Hall, academia, industry, the business sector, and the non-profit sector, with the aim of bolstering urban infrastructures and the use of the city's strategic assets, encouraging independence of entrepreneurial parties, and strengthening the Haifa entrepreneurial community while integrating populations such as ethnic minorities, Ultra-Orthodox, women and Ethiopian Israelis.

Young Entrepreneurship: The Authority is working in conjunction with the Ministry of Education to promote an entrepreneurship incentive program that will constitute an efficient tool for encouraging and educating young people in business, scientific, and technological entrepreneurship. The participants in the program will gain experience in developing knowledge and products while utilizing Ministry of Education scientific and technological infrastructures such as 'Eshkol' (Cluster) and 'Tapuah' (Apple) science centers and science museums as part of their initiative to transform a technology idea into a product of economic value.

New Projects:

Seed Program: This program, which began operating at the beginning of 2021, aims to encourage investment by experienced venture capital investors in high-risk startup companies, thereby encouraging the establishment of further startups in these fields. The Innovation Authority will finance 40% of a seed round up to a maximum grant of NIS 3.5 million for startups that have signed a term sheet with an experienced venture capital investor or 50% of the round up to a maximum grant of NIS 3.5 million for startups located in Israel's geographical periphery or of entrepreneurs from population sectors under-represented in high-tech. The startup will issue the investor an option for the sum of the Authority's grant, to be exercised up to 3 years after approval of the request. When exercising the option, the investor will transfer the proceeds to the company plus yearly interest of 5%, upon which the company will repay this entire sum to the Authority.

The New Technological Incubators Program: The goal of this program is to encourage investments in the early stages of technological initiatives by creating a framework that supports and spurs the transformation of innovative technology ideas in initial stages of development into advanced startup companies suitable for follow-on investments. The

program also aims to encourage technological entrepreneurship and commercialization of breakthrough technologies from research institutes to industry in complex and high-risk fields, to strengthen Israel's technological innovation environment in seed investment, and to assist startup companies in unique and sophisticated technological industries to formulate and test products, prove technological feasibility, conduct pilots and more. The technological incubators, which provide the assistance and support to the initiatives in their early stages, are located and operated by local and global commercial companies and by venture capital investors capable of offering high-quality added value and supporting early-stage startups and other initiatives. The incubators are selected in competitive procedures for a 5-year franchise period with the option of a 3-year extension. Investors and commercial companies that are awarded a franchise will benefit from leveraging up to 85% of their investments in startups from the Innovation Authority when establishing the incubator's infrastructure.

Entrepreneurial Incubators in the Periphery Program: This program is 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. This collaboration is achieved via research activity, development, and commercialization of incubator companies that are based on local initiatives. As part of the program, a local project operating within the incubator will be entitled to a grant of 85% of approved budget from the Innovation Authority, up to a maximum budget of NIS 1 million, to supplementary funding from the incubator, and to follow-on funding. In a competitive process conducted by the Authority, three new incubators were chosen – in Karmiel, Bnei Shimon, and Yerucham – to promote different fields of technological entrepreneurship in these areas such as Industry 4.0, Ag-tech, plastics, and medical cannabis.

The Division's Numbers in 2020:

- > 90 requests were submitted to the various incubator programs during the year, of which 80 were approved for total grants of NIS 150,776,000.
- > 539 requests were submitted to the Thufa (Ideation) Program of which 152 were approved for total grants of NIS 16,308,000.
- > 12 requests were submitted to the Innovation Labs programs of which 11 were approved for total grants of NIS 8,633,000.
- > 1 request was submitted to the Advancing Technology Entrepreneurship in Haifa program in 2020 and a grant of NIS 7,500,000 was approved.
- > 5 requests were submitted to the Renewable Energy Program of which 2 were approved for total grants of NIS 4,250,000.
- > As part of the Young Entrepreneurship Incentive Program, the 'Unistream' NGO, via a dedicated joint NIS 1.25 million budget from the Innovation Authority and the Ministry of Education, also operates technological entrepreneurship training programs for youths aged 14-18 in schools and designated centers around Israel, with an emphasis on the geographical and social periphery.



The Growth Division supports startups and companies in growth stages, mature companies, and R&D centers operating throughout Israel. The division helps to advance companies' competition and technological leadership with the aim of increasing the pace of their growth and their potential.

The Division's Programs:

R&D Fund: This program supports commercial companies currently developing new products or upgrading an 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 with the aim of strengthening and advancing the Israeli economy. The fund's activity also includes specially designated programs to support startup companies owned by members of Israel's minority populations and/or ultra-Orthodox and/or women and another specially designated program supporting breakthrough 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 R&D, including programs for operating pilot sites in a variety of innovation systems, including those with rigorous regulation and with governmental influence, while enhancing the perception of the economic value created in Israel. Collaborating with government entities via the incentive programs increases their influence in strengthening innovation systems in fields under their responsibility, provides the public with better access to regulation, state assets, and public infrastructures, and improves the level of knowledge and professionalism of both the Innovation Authority and government in advancing these innovation systems. This incentive program is intended to support research or development and to provide a response to market failures that exist in new and growing innovation systems, including those resulting from regulation and government impact. These market failures are expressed by high levels of technological risk, complex implementation, limited access to pilot testing sites, or difficulty in receiving regulatory approval.

Support Program for Space Innovation: This program, operated jointly by the Innovation Authority and the Israel Space Agency in the Ministry of Space and Technology, encourages support in R&D for finding technological solutions and developing advanced products in the different fields of space, with the aim of strengthening the knowledge and technological development ability of Israeli industry in the field of space. The support is also intended to increase Israeli industry's use of scientific knowledge in the fields of space technology at Israeli research institutions and of their research capabilities, to encourage the growth of startups in space technology fields, to reduce the knowledge gaps vis-à-vis global space markets, and to enhance the competitiveness of Israeli industry in these areas.

New Projects:

Two new programs were launched during the second half of 2019 to increase the involvement of capital market and institutional entities:

1. **Promotion of Analysis Capabilities for Investment in the High-Tech Industry by Institutional Capital Market Entities:** The goal of this program is to assist institutional entities operating in the Israeli capital market to build the capability to identify and analyze investments in Israeli high-tech companies and incentivize them to broaden the trend of growing investment, both direct and indirect, of Israeli institutional investors in the local high-tech industry. In so doing, the program seeks to accelerate the expansion of total investments by institutional investors in the Israeli high-tech industry. This support is provided via a variety of avenues and investment tools and is intended to strengthen the connection between the Israeli capital market and the local high-tech industry.
2. **Encouraging Institutional Entities' Investment in the High-Tech Industry:** As part of this program, the Innovation Authority secures the investments of Israeli institutional investment entities in Israeli high-tech companies. This policy is aimed at encouraging short and long-term research and development in the local high-tech industry.

The Israeli Center for the 4th Industrial Revolution (WEF), C4IR Israel: The center operates alongside local regulators and policymakers to advance the development and assimilation of innovative technologies while safeguarding public interests (such as safety and privacy) by adopting flexible regulation suited to technological developments. The center's primary areas of operation are autonomous vehicles, drones, assimilation and development of AI tools in various fields, state procurement of innovative technologies that will serve the government and facilitating access to government information in order to advance challenges of public systems, with an emphasis on information in the health field.

In 2017, the WEF formed the network of C4IR Centers (Centers for the 4th Industrial Revolution) to assist the adaptation of government regulation to rapidly changing technology. The network's members include parties from the private sector, governments, and civilian experts. The goal of the network is to create and share knowledge and best practices related to regulation of innovative technologies. The Israeli Center for Regulation of Innovative Technologies was established in Israel as part of a Government Resolution No. 4481 adopted in January 2019 and in collaboration with the World Economic Forum (WEF).

The Division's Numbers in 2020:

- > 13 requests were submitted to the Encouragement of Institutional Investment in Knowledge-Intensive Industry Program of which 10 were approved for secured investments totaling NIS 800,000,000.
- > 1,097 requests were submitted to the R&D Fund Program (including the Fast-Track Program) of which 521 were approved for grants totaling NIS 1,164,510,417.
- > 15 requests were submitted to the special support program for innovation in the field of space in 2020 of which 8 were approved for grants totaling NIS 15,000,728.
- > 547 requests were submitted to the Pilots Program of which 75 were approved for grants totaling NIS 72,887,541.
- > 87 requests were submitted to the sub-program supporting core technology in companies with extensive R&D operations under the R&D Fund of which 48 were approved for grants totaling NIS 53,131,017.
- > 5 requests were submitted to the program advancing capital market institutional entities' analysis capabilities for investment in the high-tech industry. All 5 were approved for grants totaling NIS 7,137,763.



The Societal Challenges Division strives to develop expert human capital to lead future technologies and to increase the skilled human capital in high-tech, as part of a governmental effort in this field. The division operates incentive programs and harnesses the market to advance these efforts. In addition, the division is responsible for advancing impact innovation: encouraging developments that provide a solution for challenges in social and public fields and support for entrepreneurs and companies with solutions in these areas.

The Division's Programs:

Human Capital Programs

Coding Bootcamps Program: In response to the shortage of skilled high-tech personnel, the Authority has been operating a program since 2018 that supports extra-academic courses (coding bootcamps) aimed at increasing the supply of programmers and data science graduates in Israel. These intensive and practical programs locate candidates with significant potential, provide them with the necessary theoretical and practical knowledge, and train them, in a short period of time, for work in the high-tech industry. The graduates can therefore make a real and immediate contribution to the company. The program's goal is to increase the number of graduates acquiring relevant practical training who are placed in high-tech development jobs at salaries of over NIS 14,000 (within 15 months of completing the course). The bootcamps were chosen in a competitive procedure for a period of three years.

The Advanced Technology Studies Workshop (HaSadna) Program: The huge demand for experts in advanced technology professions requires innovative models for training experts in this field and for upgrading skilled professionals already employed in the high-tech industry. The Workshop Program focuses on support of a joint advanced training framework for engineers in high-tech companies, led by the industry, in advanced development professions. Proficiency in algorithmics in the field of Artificial Intelligence (AI) has become vital and relevant in almost every field of technology. The Innovation Authority's initiative to assist high-tech companies in training their employees stems from the need for high-quality expert personnel and is aimed at enhancing the important activity taking place in academic institutions and providing training in further AI areas that are required by the industry.

High-Tech Specialization Program: In response to the challenge of recruiting inexperienced workers in the high-tech industry, this program offers grants to high-tech companies that create employee specialization programs. As part of these programs, new graduates with a university degree or a degree in practical engineering in technology professions ("juniors") will be accepted and trained for entry-level development roles. The company will receive a grant of NIS 50,000 for every candidate they hire for a minimum of six months with a monthly salary of at least NIS 15,000 and who receives on-the-job training. The juniors' training model will be adapted to each company's needs and may be based on the company's internal resources and/or external organizations and trainers.

Human Capital for High-Tech Fund: The Human Capital Fund is a unique program aimed at encouraging the creation of innovative solutions coming from the market, to expand entry routes to high-tech employment and to upgrade or improve the existing high-tech human capital in R&D positions.

The fund offers grants for budget requests according to the following rungs:

- > For budget requests of up to NIS 1 million – 50%, 60%, or 70% of the approved budget.
- > For budget requests of NIS 1million-15 million – 30%, 40, or 50% of the approved budget, according to the committee's decision.

Emergency Training and Placement Program: As a response to the high-tech employment crisis that developed as the result of the Covid pandemic, the Innovation Authority, in conjunction with the Ministry of Finance, and the Ministry of Economy and Industry, launched an emergency program to finance the immediate large-scale training and placement of workers in a variety of high-tech professions. The program offers grants to training entities and companies implementing a process that combines training for and placement in in-demand technology and business jobs. Preference will be given to requests that emphasize high-percentage placement, employers' involvement in defining the training program, and the provision of practical specialization.

Impact Programs

Gov-Tech ("Mimshal-Tech"): This program has been operating since 2016 and is the result of collaboration between the Innovation Authority and the national "Digital Israel" project. The program is intended to encourage and assist companies and NGOs offering innovative technological solutions for public sector challenges in the fields of education, health, welfare, economy, law, local government, human capital, and others. The program intends to improve government service to the public, to streamline and enhance processes in the public sector and public services, provide the public with access to information, protect the public sector databases and more. The program creates an initial meeting between companies and public sector entities and encourages Design Partnership aimed at resolving different social and public challenges prior to advancing pilots and assimilation.

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. 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 as well as integrating into all spheres of life: employment, education, leisure etc. The program's goal is to encourage R&D of industrial products that provide technological solutions for the disabled and thereby enabling them to integrate into society and the labor market.

Grand Challenge Israel ("Etgar"): This program is the joint initiative of the Innovation Authority and 'Mashav' (Israel's Agency for International Development Cooperation at the Ministry of Foreign Affairs) as part of the global Grand Challenges Initiative that aims to develop technological solutions for health, water, and food security challenges in developing countries. The program's goal is to assist the funding of R&D directed at finding innovative technological solutions in developing countries, to encourage Israeli technological innovation in this field, and to enable entry to new markets. At the same time, the program expresses the State of Israel's commitment to participate in the global effort to advance sustainable development goals (SDGs).

New Projects:

18 different programs were chosen as part of the first call for proposals in the Human Capital Fund Program. Most of them focus on advancing populations underrepresented in the high-tech industry – women, Arab society, ultra-Orthodox, and residents of Israel's geographical periphery. The programs were awarded total grants of NIS 19 million and will train 2,800 participants over the next two years. In addition, 3 operating entities were chosen to integrate new immigrants and returning Israelis with R&D experience. For the next two years, these entities will operate programs to locate, select, and place these participants in the local high-tech industry while providing them with technology training and soft skills workshops.

Two large groups of leading companies were selected as part of the Workshop ("HaSadna") Program to train the participating companies' employees in Artificial Intelligence professions. The lecturers leading the programs will be senior high-tech personnel from the participating companies and the syllabuses will be submitted to, and approved by, the Innovation Authority. 800 employees will be trained in the two groups over a 3-year period with an investment of NIS 10 million and a funding rate of 66%.

More than 8,000 allocations have been made as part of the Emergency Training Program. These were distributed between development positions and development-supporting technology and business jobs. The training, with a budget of NIS 16 million, will also be conducted in periphery areas and will be adapted to underrepresented sectors of the population with an emphasis on the ultra-Orthodox and Arab sectors. The training will be conducted by 29 different entities and with the participation of 18 employers who have undertaken to train and later place the graduates.

The Division's Numbers in 2020:

Human Capital Programs

- 193 requests were submitted to the (regular and emergency) human capital programs of which 63 were approved for a total of NIS 138,447,549.
- 49 requests were submitted to the High-Tech Specialization Program of which 26 were approved for a total of NIS 4,900,000.

Impact Programs

- 89 requests were submitted to the Gov-Tech Program of which 15 were approved for grants totaling NIS 7,887,396.
- 53 requests were submitted to the Assistive Tech Program of which 17 were approved for grants totaling NIS 10,992,423.
- 46 requests were submitted to the Grand Challenge Israel Program of which 6 were approved for grants totaling NIS 3,080,615.



The International Collaboration Division helps create a competitive advantage for Israeli companies via international collaborations in fields of research and innovation. The Division strives to facilitate access to knowledge, partnership in global research and innovation and market pilots, as well as collaboration with multinational corporations, public entities, and leading research institutions worldwide. The Division is responsible for the Innovation Authority's global connections that advance research and innovation collaborations on strategic issues. Operating under the auspices of the division is the ISERD (Israel-Europe Research & Innovation) Directorate responsible for Israel's interface with European R&D programs.

The Division's Programs:

Bilateral R&D Incentive Program: This program provides support to Israeli companies working with foreign companies on commercialization-directed R&D projects to develop new technological products or to significantly upgrade an existing technology. The program also provides Israeli companies with an opportunity to work with foreign partners via a financial incentive that enables to share the risk in funding the project and helps with finding foreign technology partners.

Pilot Programs with Prominent International Beta Sites: This program supports Israeli companies' technology pilot programs in different fields that will be conducted at foreign companies or that will be based on their capabilities, data, or information. The program grants Israeli companies an opportunity to test their technologies in real conditions via a financial incentive that enables to share the existing risk in funding the project and assistance with finding international Beta sites for the pilots. Products submitted as part of this incentive program must be ready for testing (after proof of feasibility and development of most of the product) and without additional significant R&D content.

Bi-National Funds Incentive Program: This program provides support for Israeli companies collaborating with foreign companies in the US, India, Singapore, and Korea on R&D projects of new technology products or the significant upgrade of an existing technology. The program's financial incentive, financed by the bi-national funds, enables to share the risk of funding the project and offers support in the search for foreign technology partners.

There are currently four bi-national funds:

- I4F – Israel-India
- BIRD – Israel-United States
- SIIRD – Israel-Singapore
- KORIL – Israel-Korea

The ISERD Directorate - European Program for Research and Innovation – Horizon Europe:

The European Framework Program for Research and Innovation is the world's largest platform for collaborations in this field, with a total budget of EUR 95 billion. Israel is an associate member of the program and Israeli entities are entitled to submit requests for grants. ISERD – the Israel-Europe Research & Innovation Directorate is responsible for advancing Israeli activity in the European research arena and aims to provide Israeli entities with access to the European Framework Program. The program provides direct funding for a vast range of sectors and entities according to calls for proposals and strives to advance technological excellence in Europe. The program is intended for any organization or legal entity that would benefit from cooperation in international research, development, and innovation processes: companies, startups, corporations, research and academic institutions, government agencies, hospitals, municipalities, non-profit organizations, and others. A new program – the Accelerator EIC Program – has been opened for small- and medium-sized groundbreaking companies. This program offers grants and equity investment proposals. There are also several sub-programs in preferred fields in which the Authority is participating:

- The ECSEL Micro-Electronics Program
- The M-ERA.NET Program in materials science and engineering
- The MANUNET Program in advanced manufacturing
- The PRIMA Program for Mediterranean cooperation in fields of food and energy
- The QuantERA Program for research in the field of Quantum Technologies
- The Graphene Flagship for graphene and brain research
- The ICT AGRI Program for research in the field of precision agriculture
- The CHIST-ERA Program for collaborative research in ICT fields

New Projects:

Specially designated programs in the field of Bio-Convergence with Germany and Korea, that included focused B2B events aimed at helping Israeli companies find international partners.

A unique program together with the Inter-American Development Bank that enables Israeli companies to examine and integrate their technological solutions via pilots in Latin American water corporations. Three projects were approved for IDB funding in 2020 in fields of locating leaks in municipal water infrastructures and urban sewage treatment.

Covid and Green Technologies as Part of Horizon 2020: Two new programs in the field of Covid and green technologies were operated this year as part of the European program. Nine Israeli entities were awarded total funding of EUR 4.5 million in a call for proposals issued as part of Horizon 2020 to contend with the Covid outbreak. These entities were partners in 8 of the winning 23 global projects, as part of an urgent call for proposals for funding R&D and implementation of swift solutions for contending with the Covid pandemic. The submitting groups were required to propose solutions in four different fields that can be implemented quickly in response to the spread of the virus and its ramifications: immediate conversion of production lines to manufacture of critical medical equipment; medical technologies, digital tools and Artificial Intelligence for treatment, monitoring, and control; social and economic influences of the pandemic; construction of patients' databases to create new models for response to new health threats.

Green Deal: The European Green Deal Program is a European Commission "road map". Its objective is to advance the goals determined by the UN for achieving climate resilience by 2050. In order to reach this goal, the program defines specific challenges relating to climate change and damage to the environment. The strategy formulated by the Green Deal labels a course of fundamental economic and social changes in Europe which advance the efficient use of resources and transition to a clean circular economy, preservation of biological diversity, reduction of environmental pollution, and use of research and innovation to adopt equal and sustainable social changes that includes everyone.

To advance the initiative and contend with the challenges it identifies, the European Commission published initial calls for proposals in late 2020, for a total of EUR 1 billion. These calls for proposals invited groups of researchers, companies, and stakeholders to suggest relevant ways and solutions to contend with the challenges at hand. The Commission will continue to fund projects and advance the initiative for the duration of the new Horizon Europe Framework Program.

The Division's Numbers in 2020:

- > 142 requests were submitted to the Bilateral R&D Incentive Program of which 67 were approved for a total of NIS 42,000,000.
 - 117 requests were submitted to the first stage of a pilot program with 4 leading global health centers, 22 of which advanced to the second stage. Of these, 14 projects were approved for total support of NIS 8,640,438. The approved projects include innovative technologies for remote monitoring and control of patients, use of AI systems for issuing recommendations and supporting medical decisions, and software tools for streamlining cancer treatment.
- > 34 requests were submitted to the Bi-National Funds Program of which 14 were approved for a total of NIS 16,000,000.
- > 12,700 Israeli requests were submitted to the European R&D Horizon 2020 Program between 2014-2020. Of these, 1,596 grants totaling EUR 1.22 billion were approved (preliminary figures).
 - 2,286 requests were submitted in 2020 of which 216 were approved for grants totaling NIS 848 million (EUR 217 million).
 - Of these submitted requests, 16 companies were awarded grants as part of the EIC Accelerator Program for outstanding companies for a total of EUR 30 million and equity proposals worth EUR 60 million.
- > The Authority operates and finances a support fund aimed at providing Israeli companies with access to the European R&D Program. 264 requests were submitted as part of this program, of which 209 were approved for grants totaling NIS 6,196,092.
- > The Innovation Authority also finances collaborations with related programs in preferred fields: micro-electronics, advanced manufacturing, materials, and others. 5 Israeli requests were approved as part of the ECSEL Program in the field of micro-electronics for total grants of NIS 20,714,000.



The Technological Infrastructure Division is responsible for advancing the development of groundbreaking generic and pre-product technology, 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 interested in sharing knowledge in the field of pre-product R&D.

The Division's Programs:

MAGNET Consortiums Program – Consortiums of Israeli industrial companies and academic research groups working together to realize a common vision of self-development of groundbreaking pre-product technology in important fields on the global market, and in which Israeli industry 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 a period of 3 years, via 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.

Academic Knowledge Transfer Program: This program incentivizes biennial applied research with innovative technological feasibility originating in academia and its advancement to the stage at which an Israeli industrial company will adopt it to develop as a commercial product. The program's goal is to bridge the knowledge gap between academia and the industry's needs, with the option of leading a project that attracts the interest of business entities and, ultimately, achieve a commercialization agreement between the two parties. The program allows the project research to be accompanied by a corporation that envisions its subsequent commercial potential. Adding a corporation to the consortium will therefore be allowed at all stages of the project, to increase its chances for commercialization in Israeli industry. This program includes 3 sub-programs: Knowledge Transfer with an Accompanying Corporation, Knowledge Transfer without a Corporation, and Preferred Pharma Knowledge Transfer that allows for triennial activity.

Knowledge Commercialization Program: A program promoting cooperation between academic research groups and an Israeli industrial company, with the goal of proving technological feasibility of the preliminary academic research's achievements. The program is intended to enable a company to absorb the knowledge developed by the academic institution and to adapt it to its needs for developing groundbreaking products. The R&D program will include transfer of knowledge from an academic institution to a corporation, primarily via repetition of the research results, their validation, adaptations to industrial conditions, and industrial application.

The program includes three biennial sub-programs – MAGNETON, Knowledge Import, and Continued MAGNET:

- > **MAGNETON and Knowledge Import** – the R&D program will include the transfer of knowledge from one or more research institutes (Israeli or foreign respectively) to an Israeli industrial corporation, primarily via repetition of the research results, their validation, adaptations to industrial conditions, and industrial application.
- > **Continued MAGNET** – continued joint R&D activity of an industrial corporation member in the consortium and a research institution on a selected project conducted in the consortium.

MEIMAD – Dual Military, Defense, and Commercial R&D Program: This incentive program is a joint venture of the Innovation Authority, Ministry of Finance, and the Defense Ministry's Administration for the Development of Weapons and Technological Infrastructure. The program supports the development of creative pre-product solutions for military needs and commercial markets. The program's goal is to promote military and commercial R&D of dual use technologies, which on the one hand contribute to national security, and on the other hand possess commercial potential. This program includes three sub-programs: MEIMAD Academia (see Knowledge Transfer above), MEIMAD Industry (see Knowledge Commercialization above), and MEIMAD Pre-Product – groundbreaking pre-product technology developments with dual-use potential (the project is for up to 2.5 years).

R&D Infrastructure and Equipment Program: This program enables the establishment of collaborative infrastructures for innovative R&D based on inter-organizational collaborations or the subsidized procurement of designated R&D equipment for a single corporation providing R&D services. The program is relevant for R&D equipment that is currently inaccessible to Israeli industry, and which has the potential to significantly advance Israeli industry. The program enables to support establishment and long-term operation of R&D infrastructures – up to six years in the case of an association of users, and up to two years in the case of a single corporation (without the ongoing operational support).

New Projects:

CRISPR IL (Gene Editing) Consortium: CRISPR technology is identified by many as a scientific breakthrough that will change the worlds of medicine, biotechnology, and agriculture in the 21st century. This revolutionary technology enables to repair / turn off genes that are active in disease, to enhance genes that influence the quality of agricultural produce and food (plants, fish, livestock) and to make industrial manufacturing processes greener and more efficient. CRISPR technology is in its initial stages of development and therefore still faces significant challenges – increased efficiency, precision, safety, and wider accessibility to a range of spheres. The consortium, that includes companies in the fields of bioinformatics, biotechnology, and agriculture (both animal and vegetable) and Israel's leading research groups, aims to develop a generic, AI-based solution the goal of which is to increase the efficiency, precision, and safety of gene editing tools to levels that will in the future allow its commercial use.

NLP (Natural Language Processing) Union: The Union was established in conjunction with the national "Digital Israel" project and the Innovation Authority to advance the understanding of the Hebrew and Arabic languages by computerized systems. The Union's goal is to create an R&D infrastructure (primarily text corpora of tagged sentences) that will enable a foundation for not only identifying structural models and elements that make up the linguistic system but also to map the way in which they are used. This infrastructure will allow to advance the digital services currently provided in the State of Israel and enable Israeli companies to develop NLP-based applications and market them globally, based on pilots and POC in Israel. Approximately 20 companies and institutions are currently members in the Union, including developers and potential customers of products and services based on natural language identification technologies. The potential clients are from a diverse range of sectors such as high-tech, banking, insurance, communications, healthcare, education, tourism, placement agencies, government ministries, defense and intelligence systems, etc.

A joint project in the Knowledge Commercialization (MAGNETON) Program of Spring Biomed Vision and Sheba Medical Center: development of a method of spectral photography for imaging the oxidation in retinal tissue: A sensitive, non-invasive, and simple to perform technology has been developed at the Sheba Medical Center that enables to map the level of oxidation in biological tissue. The technology transferred to the company is based on acquiring and processing a multi-spectral picture based on a series of specially designated algorithms to form a map of tissue oxidation, similar to a topographic map. While the method for mapping oxidation in the retina's blood vessels exists in an expensive hyper-spectral device, this solution is low-cost as it can be integrated in multi-spectral device that include a fundus camera installed on a slit lamp. The technology will be examined, both on lab animals and in the company's diagnostic devices, to confirm its verity and to adapt it for clinical use. Spring Vision develops and manufactures ophthalmology imaging products that are based on multi-spectral technologies, and which will enable to diagnose eye disorders and systemic diseases earlier than was possible until now, via relatively simple and low-cost means. This project is the continuation of a project submitted as part of the Knowledge Transfer Program.

A joint project in the Knowledge Commercialization (MAGNETON) Program of Nurami Medical and Prof. Boaz Mizrahi from the Technion: development of a perishable synthetic sealant for preventing the leakage of pancreatic fluids following pancreatotomy. An innovative technology has been developed at the Technion for a biological adhesive that binds and seals living tissue. Nurami Medical, experts in the electro-spinning production of patches made from nano-/micro-fibers for the market of soft tissue substitutes. The MAGNETON project combines these technologies to produce a synthetic sealant aimed at preventing post-surgical leaks. The sealant will be inserted in the patient's body during surgery, is intended to remain in the area operated on, and its material is resistant to the extreme physiological conditions at the point of surgery. Moreover, there is no need to remove the sealant which dissolves naturally, thereby further encouraging the patient's recovery.

A Hebrew University project as part of the Knowledge Transfer Program, led by Prof. Lioz Etgar and prof. Haim Rabinowitz to develop an innovative technology that enables the production of photo-voltaic electricity on the roofs of existing greenhouses without impairing agricultural production: Researchers from the Hebrew University have developed an innovative technology that combines knowledge and research from the worlds of engineering, chemistry, and agriculture, aimed at producing electricity with unique solar panels developed by Hebrew University chemists. The panels will be placed on the roofs of existing greenhouses and will replace the existing roof surface. The research breakthrough enables optimal light absorption and the preservation of reasonably efficient energy transformation via both the solar panels and the plants. This in turn enables the land's continued agricultural use and the preservation of agricultural output while at the same time generating benefit for the farmer and maximizing the production of renewable energy.

The Division's Numbers in 2020:

- 11 consortiums' work plans were approved during 2020 as part of the Consortiums Program, for grants totaling NIS 178,001,587 (7 new consortiums and 4 follow-up programs). Furthermore, 12 projects were submitted to establish new consortiums. The decisions on these requests will be made during 2021.
- 411 new and follow-up requests were submitted to the Knowledge Transfer programs during 2020 (some of these were attributed to the R&D projects being conducted by several research institutions). Of these, 138 requests were approved (101 of them new requests) for grants totaling NIS 56,430,583.
- 56 new and follow-up requests were submitted to the MEIMAD Program of which 39 were approved (10 of them new requests) for grants totaling NIS 31,881,810.
- 2 new requests were submitted to the R&D Infrastructures Program (NLP Infrastructures Users Union and Smart Transportation Union). Both were approved for grants totaling NIS 3,008,318.



The Advanced Manufacturing Division assists companies from the manufacturing sector and factories interested in developing products and implementing innovative technologies. The Division strives to strengthen the manufacturing industry and enhance its competitiveness by applying R&D processes and innovation.

The Division's Programs:

R&D Preparatory Program: The program aims to create an innovation-oriented change in companies from the manufacturing industry sectors, with the goal of enhancing the competitiveness of the participating companies. The program is operated as a complementary tool for the manufacturing industry and is intended to assist companies with the initial stages of R&D. The program offers companies without prior experience in R&D and in leading innovation processes, or companies that require focus and guidance with their R&D activities, the assistance of technology experts to bolster their R&D programs. The program provides supportive tools including mapping and examination of possible R&D directions, testing of technological feasibility, resolution of engineering faults, improvements in the manufacturing process, and pre-manufacturing preparations for early-stage companies.

MOFET (R&D in the Manufacturing Industry): The MOFET Program leads technological R&D programs that have the potential to improve productivity of a company or factory, while at the same time creating technological differentiation that will achieve competitive advantages in the local and global markets. The MOFET Program is intended for industrial factories interested in implementing technological innovation processes by developing innovative products, improving and developing existing products, or developing and enhancing production processes. The program is for manufacture-oriented companies or companies preparing for manufacturing, and that meet the program criteria. As part of this program, a company may submit focused R&D programs including development of a new product, use of advanced materials, development of an innovative production process, or implementation of advanced manufacturing methods.

Transition from Development to Manufacture Program: This program aims to assist companies to successfully navigate the transition from development to production, with the aim of establishing production lines and factories in Israel using advanced technologies. The program constitutes a quantum leap for companies in developing a production process for advanced products, offers financial support, guidance, and assistance in removing obstacles during an early-stage company's transition from product development to that of mass production.

The program accepts requests in which two thirds of the budget is allocated to the development of production processes. The program is intended for companies and factories producing or preparing to produce in Israel and that are interested in developing innovative production processes or production processes for advanced products.

New Projects:

Breaking the Paradigm and Introducing R&D into the Manufacturing Industry: The manufacturing industry is entering the world of R&D, as can be seen by the 30% annual growth in the number of R&D submissions and approved grants. About 50% of the submissions in 2020 were from industry that had not previously engaged in R&D (plastics, metals, food, etc.). Surveys conducted among Israeli companies implementing Industry 4.0 solutions reveal that approximately 80% reported an increase in productivity; 70% reported a reduction in waste during production; and 60% reported a saving in energy expenses.

Establishing Factories in Israel with Advanced Technology: Two new programs were launched in 2020 to assist companies with a tangible product to successfully make the transition from development to production. The "Preparation for Production" Program within the R&D Preparatory Program enables early-stage companies yet to generate income to receive guidance from a technology expert with the product's optimization programs and to build a production portfolio. The "Transition from Development to Production" Program enables companies to develop production processes while setting up the factory and to strengthen its production activity in Israel. This program provides ongoing support for companies that have completed the product development stage and are developing the production processes, in fields such as medical devices, pharmaceuticals, energy, alternative proteins, and others. Approximately 80% of the submissions to the program related to the sectors of the economy with the highest levels of productivity (more than NIS 450,000 a year gross added value per job).

Client Survey and MOFET Programs Evaluation: Two processes were undertaken during 2020 to improve the precision of the government support programs for innovation in manufacturing industries, and to evaluate the impact of this support on the companies' growth. Some of the main conclusions drawn were that:

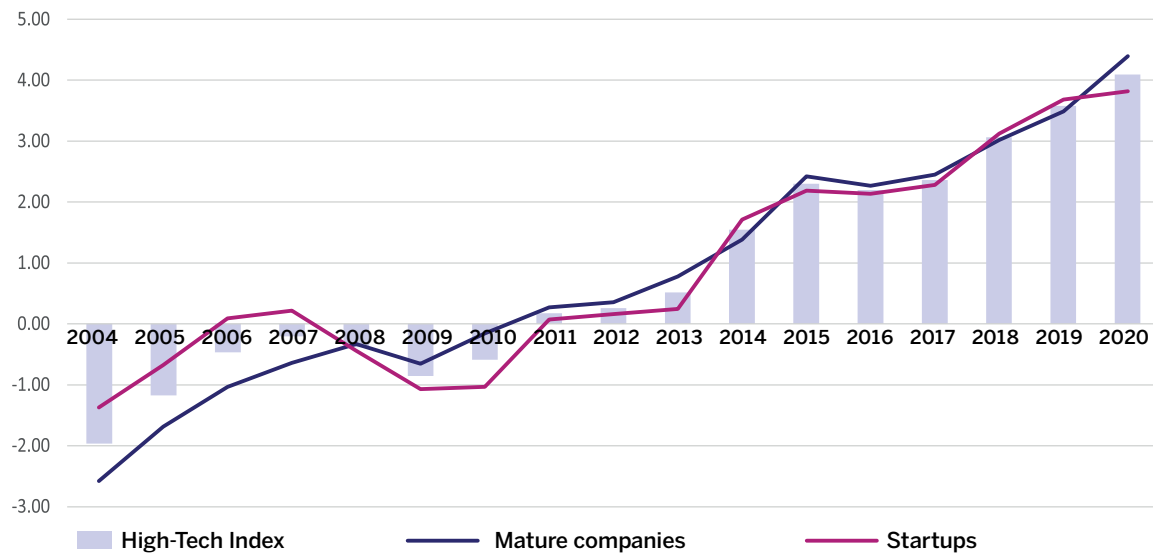
- The support for innovation in the manufacturing industry tripled the chance that a company would fully complete an R&D program.
- 40% of the companies approved for R&D programs reported an increase in sales and employment.
- 30% of the companies reported an increase in exports.
- The companies reported that after performance of the R&D program, they enjoyed more success in developing new products and that they increased the use of Israeli sub-suppliers and collaborated with other Israeli companies.

The Division's Numbers in 2020:

- 321 requests were submitted to the MOFET Program of which 209 were approved for grants totaling NIS 151,499,376.
- 90 requests were submitted to and approved by the R&D Preparatory Program for grants totaling NIS 5,742,994.
- 27 requests were submitted to the Transition from Development to Manufacture Program of which 16 were approved for grants totaling NIS 27,385,096.

Appendix 2: Results of the High-Tech Index Indicators

02 Innovation Authority High-Tech Indices



Source: Innovation Authority adaptation of CBS, SNC, IVC, and TASE data

Startup Companies Sub-Index:

1. Net new companies: This sub-index represents the net change in the number of Israeli companies operating in the high-tech sector i.e., the number of new Israeli high-tech companies opened less the number of Israeli high-tech companies that closed.
2. Number and value of capital raised by companies: The value and number of financing rounds that Israeli high-tech companies raised from all investors – venture capital funds, angel investors, and others.
3. Number and value of exits: The monetary value and amount of exits by Israeli high-tech companies after deducting exceptional deals. An exit is defined as an IPO (Initial Public Offering) or an M&A (Merger and Acquisition).
4. Capital raised by funds: The total capital raised each year by Israeli venture capital funds. This figure constitutes an indicator of projected future investments by those funds in Israel

Year Indicator	Actual Value			Normalized Value		
	2018	2019	2020	2018	2019	2020
Net new companies	403	548	320 ¹	-0.56	0.87	-1.37
Value of capital raised (USD billions)	7850	9075	11503	8.64	10.73	14.88
Number of financing rounds	1147	1096	1339	3.05	2.67	4.46
Value of exits (USD billions)	4.59	10.26	5.74	-0.55	1.77	-0.08
Number of exits	123	136	109	0.92	1.73	0.03
Capital raised by funds (USD millions)	3811	2569	2851	7.21	4.26	4.93
Startup Companies Sub-Index	-	-	-	3.12	3.67	3.81

¹ According to March 2021 data

Mature Companies Sub-Index:

5. High-tech employees: The number of salaried employees in the high-tech sector, excluding those employed in the communications services sector.
6. High-tech exports: Total exports of high-tech services and industry sectors.
7. Blue-Tech Index: The Tel Aviv Global-Blue-Tech Index, which includes all shares in the technology and biomed sectors. The index is calculated as the average of the daily closing indices for each year.
8. Value and number of secondary offerings: The number and scope of public funding rounds enacted by Israeli high-tech companies whose securities are listed on the stock exchange (secondary offerings). These variables depict the continued growth in value of Israeli public companies.
9. Value and number of high-tech acquisitions: The number and value of merger and acquisition (M&A) transactions enacted by Israeli high-tech companies where the acquired company is not necessarily an Israeli or a technology company.

Year Indicator	Actual Value			Normalized Value		
	2018	2019	2020	2018	2019	2020
High-tech output (NIS millions, current prices)	173,231	177,227	198,824	3.27	3.52	4.86
High-tech employees	296	321	335	5.59	7.38	8.37
High-tech exports (USD millions)	47,015	45,765	49,497	2.99	2.78	3.41
Blue-Tech Index (Yearly Average)	373.1	371.6	447.7	1.05	1.02	2.27
Number of secondary offerings	22	16	14	0.78	0.08	-0.16
Value of secondary offerings (USD millions)	483	514.5	705	-0.45	-0.42	-0.24
Number of high-tech acquisitions	54	69	85	-0.10	1.23	2.65
Value of high-tech acquisitions (USD millions)	3144	1690	3963	-0.23	-0.66	0.00
Mature Companies Sub-Index	-	-	-	3.02	3.48	4.39

