

# HIGH-TECH HUMAN CAPITAL REPORT 2019



רשות החדשנות  
Israel Innovation  
Authority

**START-UP  
NATION  
CENTRAL**

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# CONTRIBUTORS



The Innovation Authority is the statutory public entity responsible for Israel's innovation policy. The Authority was established in 2016 under the Office of the Chief Scientist in the Ministry of Economy. Its mission is to promote innovation as a tool for overall sustainable economic growth, with the view that innovation is the most significant growth engine for the Israeli economy.

The Authority works to strengthen the infrastructure on which the Israeli knowledge economy is built by constantly examining the ecosystem's barriers and opportunities. The Authority offers entrepreneurs and innovative companies in Israel a range of financing tools, as well as other forms of support designed to help them face the changing needs of the modern innovation world. Within the Innovation Authority, efforts to grow human capital for the high-tech industry are led by the Societal Challenges Division.

## START-UP NATION CENTRAL

Start-Up Nation Central is an independent nonprofit organization that builds bridges to Israeli innovation. We connect business, government, and NGO leaders around the world to Israeli innovation; we help develop technological sectors with high-growth potential; and we accumulate knowledge and generate in-depth insights about Israel's innovation sector.

Start-Up Nation Central is philanthropically funded, operating through partnerships with the government, industry, and civil society. In its support of human capital in high-tech, Start-Up Nation Central operates through a nonprofit organization called Scale-Up Velocity, which specializes in the design and implementation of exclusive programs with the goal of significantly expanding their scope.



Zviran is one of Israel's leading companies for consulting on salary data, benefits, pensions, employer insurance, and human capital processes. For over three decades, Zviran has served hundreds of local and global employers of all sizes and across a wide range of industries, from both the public and private sectors.

Zviran uniquely combines in-depth knowledge of Israel's labor market, including wages, pensions, insurance, labor law, taxation, unions, and capital compensation, with its collection and analysis of salary data, benefits, and employment conditions for hundreds of companies, spanning more than 30 years. Zviran is the Israeli partner of Mercer, the world's largest human resources consulting firm.

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Special thanks to Michal Milo and Hadas Ben-Yehuda of Zviran, as well as to Evyatar Kirschberg and Tal Enselman from the Central Bureau of Statistics for their ongoing support and significant contribution to this report.



# FOREWORD: PROF. EUGENE KANDEL, CEO, START-UP NATION CENTRAL

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The Israeli high-tech industry continues to be an unprecedented success story, frequently producing groundbreaking companies and technologies. The upward trend of recent years continued in 2019, with Israel leading in fields such as cyber, digital advertising, and business software solutions, all while making breakthroughs in innovation-based business models in the finance, food and agriculture, and industry sectors.

This success has prompted a large number of multinational corporations to open research and development centers in Israel over the past decade. This influx has in turn had a major impact on the industry, representing the most prominent phenomenon in high-tech in recent years. In particular, it has increased competition for skilled human capital.

Another phenomenon that has intensified in recent years is the emergence of Israeli growth companies which have chosen to grow as “whole” international companies while keeping their core base of operations in Israel. A third phenomenon we have witnessed in recent years has been that of Israeli companies relocating their headquarters abroad, frequently at the encouragement of foreign investors, leaving only their R&D centers in Israel.

These three trends have led to a sharp increase in demand for Israeli engineers and developers. It is important to emphasize that increasing demand is not a negative phenomenon; on the contrary, it demonstrates the robust nature and continued growth of the high-tech industry. However, as the supply of engineers – experienced ones in particular – cannot be increased overnight, the competition for tech workers intensifies. This results in a steady increase in employee wages, impairing the competitiveness of Israeli companies and widening economic gaps. In this report, we will present several examples of these phenomena.

Despite this complex situation, we in government, academia, and civil society must not despair. The same innovative thinking that has led Israeli high-tech to its impressive achievements can also assist in solving the industry’s human capital challenge. We must tackle this issue for two reasons. The first is simple: without providing a solution to the shortage in technological human capital, the Israeli high-tech industry will not be able to grow at a satisfactory rate, and this growth engine will lose its driving force.

The second reason pertains to the Israeli economy as a whole: the high-tech industry is the country’s most productive sector, and without the inclusion of dozens of thousands of new workers from diverse populations and geographies, this industry will continue to disengage from the Israeli economy – an outcome whose potential damage to the Israeli socioeconomic fabric cannot be underestimated – to the point where the high-tech industry would be a foreign element in Israel.

If this is the case, what can be done? First and foremost, we must have our fingers on the pulse of the matter and continuously track any changes. To this end, Start-Up Nation Central and the Israel Innovation Authority have decided to issue an annual report, which is being published in this format for the second year running. We find it of great importance to do so, as the shortage of high-tech engineers is a complex, multidimensional phenomenon.

High-tech companies face different forms and magnitudes of recruiting challenges, varying by the company’s size, geographical location, sector, and technology used. Attempts to incorporate this phenomenon into one figure are specious and may lead to the wrong policies. In addition, on the supply side it is crucial to diagnose the challenges of integrating underrepresented populations into the high-tech industry and to derive applicable solutions.

And indeed, there are solutions to these issues, some of which are presented throughout this report. A wide and diversified range of solutions is crucial due to the multidimensional nature of the issue, which requires room for trial and error. We believe that only a combination of standard steps, such as increasing the number of university graduates, along with innovative approaches that create alternative entrance channels to high-tech, will provide sustainable long-term solutions.

This is where we must call on high-tech companies to adopt innovative approaches to managing and recruiting their employees. The “bring a friend” referral method was an efficient way to recruit employees in the early decades of Israeli high-tech, but now there is a clear need to break past familiar boundaries and recruit employees from diverse backgrounds as well, beyond 8200 Unit or university graduates. Such efforts will pay off in the long term, as inclusiveness contributes to the creation of a more fruitful and efficient work environment. Companies that fail to adopt this approach will restrict themselves to a limited supply of employees and miss out on quality talent pools. The report shows that it is in fact the large companies and multinational corporations that are leading in recruitment from diverse populations, as well as in hiring and training workers at the start of their careers.

On a personal note, I take great privilege in leading our excellent team which deals with this matter, through which we are exposed to the many layers of Israeli society with all of its complexity. We have formed partnerships with people and organizations that, despite their geographical proximity, are far away from our day-to-day lives and worldview. Along the way, we have learned that mutual respect and common goals make an excellent foundation for partnership. We are very proud of our partnership with the Innovation Authority, which since its inception has chosen to deal head-on with the human capital challenge.

Finally, I would like to thank all who participated in putting together this report: Start-Up Nation Central’s research department, Scale-Up Velocity’s employees, Zviran, and the Central Bureau of Statistics. A special thanks goes, of course, to the Israel Innovation Authority, led by my colleague Aharon Aharon.

# FOREWORD: AHARON AHARON, CEO, ISRAEL INNOVATION AUTHORITY



2019 was a year of achievement and maturation for the Israeli high-tech industry, which relies heavily on its high-quality workforce. It is therefore more important now than ever to analyze the industry's current state and the challenges it faces.

It was a record year for high-tech private capital fundraising. We have also seen a continuation of the welcomed trend of

"whole" growth companies (companies that conduct a variety of business operations in Israel, not just R&D). There are 30 Israeli "unicorns" to date, four of which have joined the list this past year. Nonetheless, this year saw a significant decline in early-stage investments and the number of new companies.

One can certainly take pride in the growth of the industry, which employs so many individuals in various fields and positions, and its contribution to the Israeli economy. However, the signs of a slowdown in early-stage companies must be addressed with concern, and we must act together with the private sector in order to breed startups, which are the anchors of innovation and Israel's relative advantage in the world.

It has been three years since the passing of Government Resolution No. 2292 to Increase Skilled Manpower for the High-Tech Industry. The resolution created a broad action plan, involving a variety of relevant governmental entities: the National Economic Council, the Planning and Budgeting Committee of the Council for Higher Education, the Israel Innovation Authority, the Director General of the Division of Labor in the Ministry of Labor, Social Affairs and Social Services, the Population and Immigration Authority, the Ministry of Aliyah and Integration, and more.

The working assumption of the program is that there is no silver bullet for the issue, but that it will require extensive work in various fields. The program includes long-term efforts, such as setting a national goal of a 40% increase in the number of undergraduates in high-tech studies in subsidized higher education institutions, particularly universities. The program also includes short- and medium-term efforts as well, to realize existing potential (particularly among women and underrepresented populations in high-tech), broaden the entrance channels to high-tech, and optimize the use of a skilled workforce from abroad.

It is important to emphasize, as shown in this report, that we face a shortage as much in quality as in quantity. This is why the emphasis in most programs is on maintaining a high level of quality, which will provide clear solutions for the industry's needs. It is therefore crucial that the high-tech industry continue and even increase its involvement in these programs.

This year, after much effort, we have seen a significant increase in the number of high-tech employees: as of the end of 2019, there were 321,000 employees in high-tech, accounting for 9.2% of all Israeli employees and representing an 8% increase (24,000 employees) compared to the previous year. This increase reflects the high demand for workers and the growth the industry is experiencing, as

well as the fruits of combined efforts made by multiple government agencies to increase the supply of skilled workers in the high-tech industry. Examples of these efforts include the Council for Higher Education's multiyear program to increase the number of graduates in high-tech professions in academia, programs such as coding bootcamps, She Codes, visas to foreign experts, and more.

I applaud the continued positive trend in the integration of engineers from the Arab community into the industry. Between 2017 and 2018, 1,700 Arab employees joined the high-tech industry and the number of Arab students in academic institutions is on the rise.

Meanwhile, the percentage of ultra-Orthodox employees in high-tech has approached 3% in 2018, but many of them are not in R&D positions. The challenge will be to increase the percentage of ultra-Orthodox employees in higher-paying technological positions – a national mission that the Innovation Authority and other entities have set as a goal for upcoming years.

This past year, a variety of programs were launched by the Israel Innovation Authority (through its Societal Challenges Division) and governmental partners to realize the potential of underrepresented manpower in various respects, from dealing with the failure to integrate new graduates into high-tech companies, to programs to encourage female tech entrepreneurs (currently only 7% of entrepreneurs in Israel), to other programs to integrate women into high-tech. The issue of women's representation in the high-tech industry requires ongoing focus, as their share of technological roles has remained fixed at approximately 22%.

We continue to develop an innovation-based economy in the periphery, believing there is high unrealized potential. The high-tech industry is currently concentrated in the center of the country, (73% of startups), while in the peripheral regions there is a talented workforce, albeit often with gaps with regard to the industry's needs. To this end, the Innovation Authority has launched a new program to establish entrepreneurial incubators in the periphery that rely on local anchors, and in 2020 they will start operating in Karmiel, Yeruham, and the Northern Negev regions. In addition, a program was launched to incentivize large companies to open R&D branches in the periphery, as well as a technology entrepreneurship program in Haifa.

The Innovation Authority will continue to work to preserve Israel's position as a global leader in innovation, all while connecting the high-tech industry's growth engine to all parts of Israel's society and economy in terms of employment and incorporation of innovation. I invite the industry to continue to engage with us in an open discourse on future challenges, combining efforts and mutual cooperation to achieve these goals, particularly in adopting programs and initiating projects to increase the supply of workers and diverse employees in the Israeli innovation industry.

Finally, I would like to thank Start-Up Nation Central, under the leadership of Prof. Eugene Kandel and his team, as well as Zviran for their comprehensive joint work in publishing this important report for the second consecutive year. Wishing us all a fruitful and successful year in 2020.



# EXECUTIVE SUMMARY

This report is based on data from the Central Bureau of Statistics (CBS), the Israel Innovation Authority, the Planning and Budgeting Committee at the Council for Higher Education, Start-Up Nation Central, and a survey sent to a sample of high-tech companies in July 2019 in collaboration with Zviran. Participating in the survey were 341 high-tech companies with more than 90,000 employees, constituting about one-third of the industry's employees. The report also incorporates data from other surveys conducted by Zviran.

The Israeli high-tech industry continued to grow in 2018, with first indications from the CBS Labor Force Survey showing that the growth trend continued in 2019. The number of high-tech employees in 2019 was estimated at 321,000, constituting about 9.2% of employees overall in the Israeli economy. These figures show a 7% and 8% increase in the number of high-tech employees in 2018 and 2019, respectively. Along with the increase in high-tech employees, 2018 marked an increase in their share of the economy's total number of employees, a trend that continued in 2019 as well. These increases reflect the high demand for these workers and the increase in the supply of qualified workers in this industry. The demand for high-tech employees grew as well, with an estimated 18,500 open tech positions in the industry as of July 2019 – an increase of 8% compared to July 2018.

In addition, the data indicates that the high-tech industry has undergone a process of “technologization,” in which the ratio of tech employees to the total number of employees in the industry has increased over the years. According to 2019 survey results, 7 out of 10 employees in the high-tech industry were in tech positions, with an even higher figure among multinational corporations that mainly employ tech workers. These figures mean that as the high-tech industry grows, it presents fewer opportunities for non-tech employees.

This report highlights clear indications of a shortage in tech employees and the difficulties in recruiting them. The first indication is the widening gap between the average salary in the high-tech industry, which stood at NIS 22,479 per month in 2018, to the average salary for the rest of the economy outside of the high-tech industry, which stood at NIS 9,345 per month. In addition, the growth rate of high-tech salaries rises at a greater rate than other industries, increasing by 27% over the past six years compared to 15% for rest of the economy.

The shortage of employees has turned the Israeli high-tech industry into an “employees’ market,” where experienced workers are aware of their high demand and know they will not find it difficult to find work in similar if not better conditions than their present ones. As evidence, there is an increase in voluntarily job departures; in 2018, more than 10% of high-tech employees left their positions voluntarily. An analysis conducted by Zviran found there is a premium for new employees, with the average gap between the salaries of newly hired workers compared to those of existing employees in the same position reaching up to 8.6% among high-demand professions.

An additional indication of the difficulty in recruiting workers is reflected in the low ratio (1.05) between the number of tech recruitments made between January and June 2019 compared to the number of open tech positions in July 2019, which indicates the tightness of the market. This figure suggests that high-tech companies find it more difficult to recruit tech employees and therefore attempt to recruit large numbers of these employees at any given time out of a desire to recruit whenever possible.

A further illustration of the shortage of tech employees and the pressure mounted on the local high-tech industry to find alternative solutions is seen in the intensification of the offshoring phenomenon. Of local companies that participated in this year's survey, 27%

reported an overseas R&D/QA center abroad, compared to 22% in the previous survey. Most of this activity is focused on R&D and not just QA. This phenomenon is concerning, as the moment a company launches an R&D center abroad, that center becomes a relatively convenient alternative to employing tech workers in Israel.

The main solution to this shortage is to increase the supply of employees, first and foremost by training additional tech employees. Academic institutions remain the primary gateway to the high-tech industry: about 75% of junior tech employees (employees with up to two years of practical experience) who were recruited in the first half of 2019 and whose institution was reported in the survey came from universities or colleges. Accordingly, the Council for Higher Education is now conducting a program that provides incentives to encourage an increase in the number of college and university students enrolled in high-tech studies. The number of students is projected to reach 11,000 by 2022 – an increase of over 40% compared to 2016.

However, the survey showed variances in junior tech employment depending on the type of academic institution. Almost 60% of junior tech employees are university graduates, compared to 26% who are college graduates, despite a similar number of graduates in high-tech studies in both types of institutions. The analysis of training institutions has also shown a burgeoning openness to hiring employees from alternative training channels, such as coding bootcamps.

However, data indicates that despite the shortage of tech employees, recruiting inexperienced employees is not simple. Only 45% of the companies surveyed that answered the juniors question reported recruiting junior tech employees during the first half of 2019. In addition, survey data shows significant variations in the recruitment of junior tech workers depending on the size of the company; the larger the company, the more open it is to the possibility of hiring inexperienced employees. During the same period, the percentage of large- and medium-sized companies that recruited juniors – 72% and 57% respectively – was significantly lower than that of giant companies, 92% of which had recruited employees with little experience. These figures show that there is still unrealized potential in the hiring of inexperienced employees.

Another significant area of potential lies in the integration of women and diverse populations that are currently underrepresented in the industry. CBS data indicates that in 2018, the share of Arab and ultra-Orthodox employees increased by 0.5 and 0.1 percentage points, respectively, compared to the previous year. The growing share of Arab employees, which showed a significant increase between 2017 and 2018 due to the entry of 1,700 new Arab employees into the high-tech field, is expected to be one of the main pillars in addressing the shortage of tech employees in the coming years. This is due to the increasing number of students from the Arab community in high-tech studies in academia, which has more than doubled between 2012 and 2018.

Women are another underrepresented population in the industry. Despite an increase in the total number of female employees, their share of employment remained the same, consisting of about one-third of high-tech employees overall. Survey results indicate a lower representation, with women accounting for 22% of tech positions and 18% of tech management positions, along with a further decrease in representation as women increase in age.

Alongside a snapshot of the human capital in high-tech and the challenges that characterize it, this report will present the main efforts and programs conducted by government agencies and civic organizations aimed at providing solutions to the shortage in human capital

# METHODOLOGY

This report is based on data from the Central Bureau of Statistics (CBS), the Israel Innovation Authority, the Planning and Budgeting Committee at the Council for Higher Education, Start-Up Nation Central, and a survey sent to a sample of high-tech companies in July 2019 in collaboration with Zviran. Participating in the survey were 341 high-tech companies with more than 90,000 employees, constituting about one-third of the industry's employees. The report also incorporates data from other surveys conducted by Zviran.

In this report, we will refer to companies listed in the Start-Up Nation Finder database as the population of high-tech companies, and will note whenever data has gone through further adaptation. As a general rule, unless stated otherwise, all data contained in the report is based on analysis made by Start-Up Nation Central and

the Innovation Authority of the survey mentioned above.

We have excluded findings that were based on questions with very low response rates, or where the composition of responses did not adequately represent the population of high-tech companies in Israel. In order to draw the population's figure from survey data, we used a weighted system based on the number of employees in different groups according to CBS data.

The following table compares the survey sample representation against that of high-tech companies (listed in the Start-Up Nation Finder database) by presenting the segmentation of the companies and employees according to sector, size, and ownership.

**Table 1: Survey Sample Representation by Sector, Size, and Ownership<sup>1</sup>**

		Number of Companies		Number of Employees	
		Population (Finder)	Sample	Population (Finder)	Sample
Sector	Internet / Software / Enterprise Solutions	50%	50%	39%	38%
	Life Sciences – CleanTech	31%	25%	17%	5%
	Manufacturing – Industrial	14%	18%	37%	46%
	Telecommunications	5%	7%	7%	11%
Size	1-10	55%	30%	4%	1%
	11-50	30%	25%	13%	2%
	51-200	11%	22%	21%	9%
	201-500	3%	12%	16%	14%
	500+	1%	11%	46%	74%
Ownership	Standalone Local Firm	94%	73%	80%	60%
	Multinational Corporation	6%	27%	20%	40%
	TOTAL	100% (5,214)	100% (341)	100% (280,843)	100% (90,736)

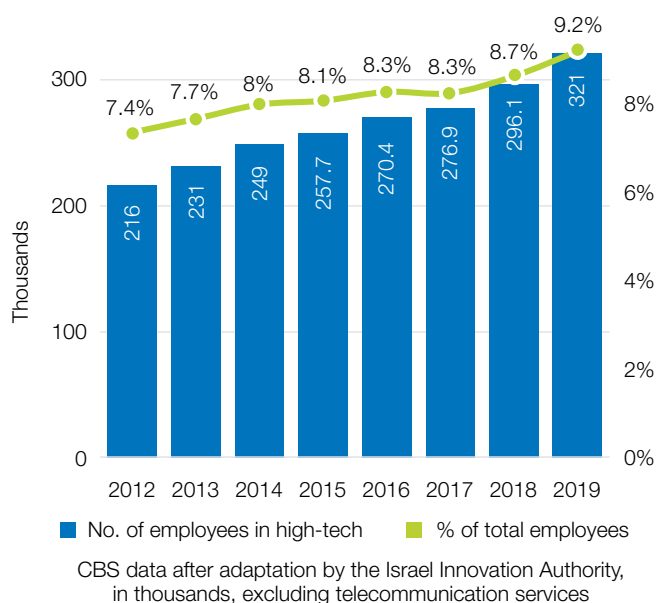
<sup>1</sup> The increase in the number of high-tech employees compared to last year, as reflected in the in Start-Up Nation Finder data, derives from two factors: the organic growth of the high-tech industry (as presented later in the report) and an increase in the scope of companies covered in this database.

# HIGH-TECH HUMAN CAPITAL: CURRENT STATE

## High-Tech Employees

The Israeli high-tech industry continued to grow in 2018, with first indications from the CBS Labor Force Survey showing that the growth trend continued in 2019. The number of high-tech employees in 2019 was estimated at 321,000, constituting about 9.2% of employees overall in the Israeli economy. These figures show a 7% and 8% increase in the number of high-tech employees in 2018 and 2019, respectively. Along with the increase in high-tech employees, 2018 marked an increase in their share of the economy's total number of employees, a trend that continued in 2019 as well. These increases reflect the high demand for these workers and the rise in the supply of qualified workers in this industry.

**Figure 1: Number of High-Tech Employees and Their Share of the Labor Force**



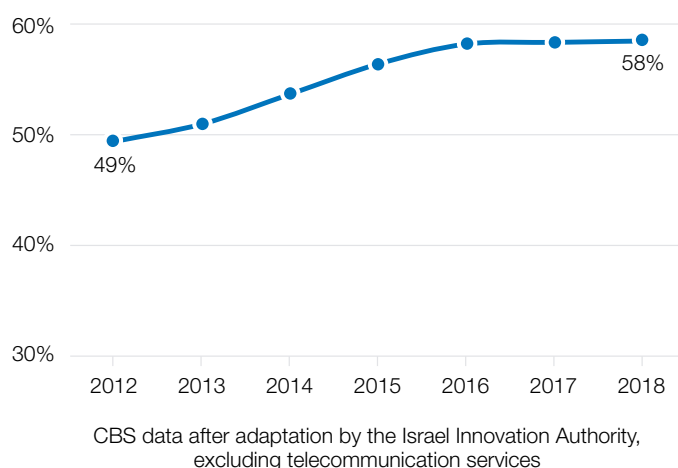
When examining the breakdown of the industry by sector, the large number of companies in the internet/software/enterprise solutions sector stands out, making up about half of all high-tech companies (Table 1). However, these companies are for the most part smaller than average, and therefore comprise only 39% of high-tech employment. In contrast, high-tech manufacturing companies make up about 14% of the companies but employ 37% of the industry's employees. Telecommunications companies, once the core of the high-tech industry, are now a very small part of the industry.

Another significant trend the high-tech industry has experienced in recent years is the increase in the number of tech employees in proportion to the industry's overall employment (Figure 2A). The emergence of multinational R&D centers, where the vast majority of employees are technological, contributes to their increasing weight. However, while the growth of R&D centers is on an upswing, it is evident that there has been a moderation in the weight of tech employees since 2016.

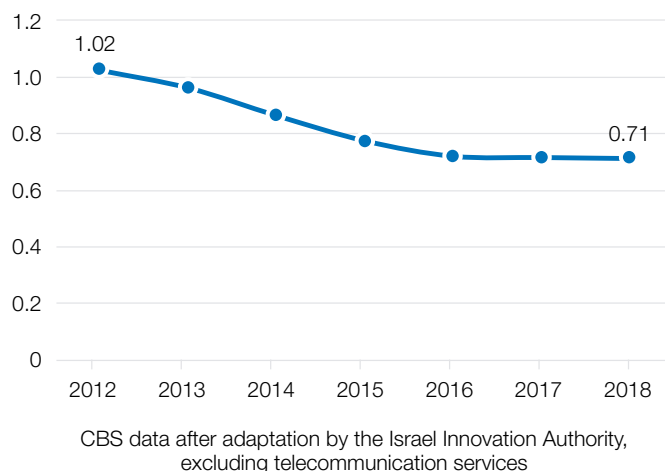
One possible explanation for this moderation is the existence of an "upper threshold" in the supply of tech employees, which the industry has reached and now struggles to surpass due to a shortage of engineers. Another explanation, however, is the rise of growth companies in recent years. These companies, in contrast to R&D centers, are "whole" companies that employ a variety of positions, making the weight of technological workers lower (an effect that balances the increase caused by the growing number of multinational companies).

Another way to look at the data presented in Figure 2A is by the tech employment multiplier – that is, the number of non-tech employees added due to the addition of a single tech employee. This figure has great significance, particularly in the high-tech industry, as its driving force is R&D activity based on the technological workforce. Figure 2B illustrates well the process the industry has gone through to become more "technological," by showing the decrease in the tech employment multiplier over the years. If in the past every tech employee leveraged one non-tech employee, today a tech employee leverages only 0.7 non-tech employees.

**Figure 2A: Percentage of Technological Occupations Among High-Tech Employees**



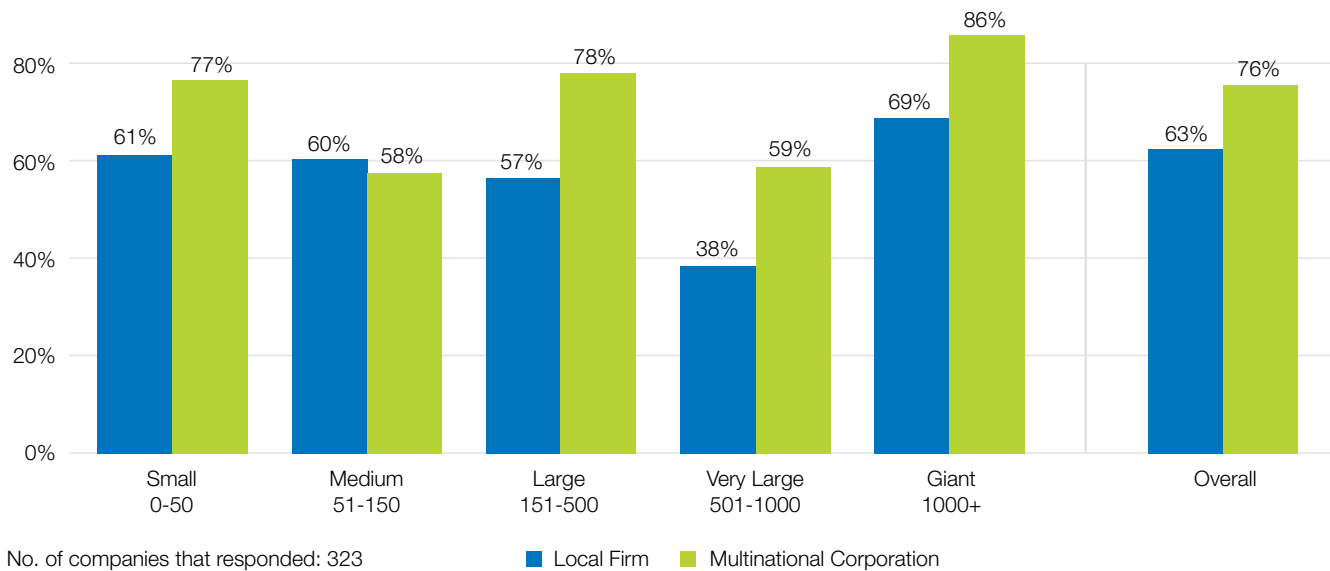
**Figure 2B: High-Tech Employment Multiplier – Ratio of Non-Tech to Tech Employees**



The findings in Figure 2A relate to the data emerging from the survey, which shows the percentage of tech employees by company size and ownership. As shown in Figure 3, while no clear trend can be identified with regard to the share of tech employees when segmenting by company size, we can point out a clear tendency of multinational corporations to employ a higher percentage of tech employees compared to local companies, with the exception of medium-sized companies. This data corroborates the hypothesis that the factor of company ownership has a major impact on the employment multiplier (the number of non-tech employees per tech employee).



**Figure 3: Percentage of Tech Employees by Company Size and Ownership - June 2019**



## DEMAND FOR EMPLOYEES IN THE HIGH-TECH INDUSTRY

The demand for high-tech employees, and technological employees in particular, is on the rise. Table 2 shows estimates both for recruitments during the first half of 2018 and 2019 and for open positions reported by the sampled companies at the beginning of the second half of these years. According to the table, from 2018 to 2019 there was an increase of about 4,500 recruitments in the first half of the year and about 1,500 open positions at the beginning of the second half.

It is important not to conflate the high demand for employees and the shortage of employees. The rising demand for employees represents the strength of the growing Israeli high-tech industry,

and should not be seen as a reflection of high-tech human capital recruiting challenges. For example, an examination of the volume of tech employees that high-tech companies were willing to recruit during the year (the combined total of the number of open positions and recruitments made) shows that their percentage out of the overall number of high-tech employees remained similar between 2018 and 2019, at about 12%. However, the high demand for technology positions at any given moment – reflected both in the open positions in the second half of the year relative to the recruiting made in the first half, and in additional data presented throughout this report – clearly indicates a sharp shortage of tech employees, which might even be worsening.

**Table 2: Estimates for Recruitments and Open Positions**

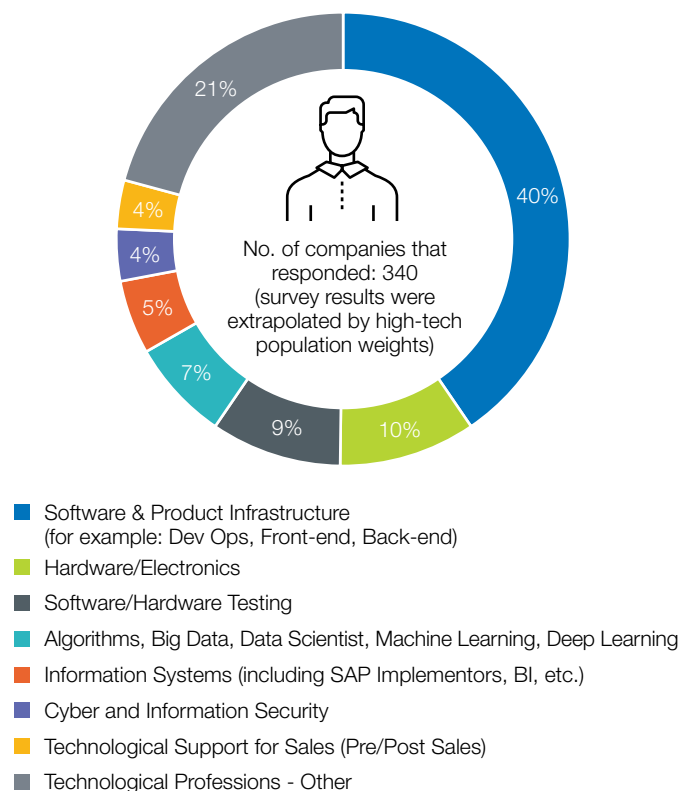
	Recruitments made between January and June			Open Positions in July		
	Tech	Non-Tech	% of Tech	Tech	Non-Tech	% of Tech
2018	16,736	12,002	58%	17,132	4,584	79%
2019	19,431	13,779	59%	18,443	4,784	79%
Growth between 2018 and 2019	2,695	1,777	60%	1,311	200	87%
% of Growth	16%	15%		8%	4%	

- In last year's Human Capital Survey Report 2018, we provided an estimate of approximately 15,000 open tech positions in July 2018. The current estimate for 2018, which incorporates more recent data on companies and employees in the high-tech industry that were not available at that time, estimates approximately 17,000 open tech positions.<sup>2</sup>
- The Finder database population for 2019, from which survey results were extrapolated, is based on 2018 CBS figures for number of employees, extrapolated for the 2019 forecast using the growth rate of number of employees in recent years.
- All figures shown in Table 2 represent an average of several estimates derived by different extrapolation methods based on company size, sector, ownership and profession.

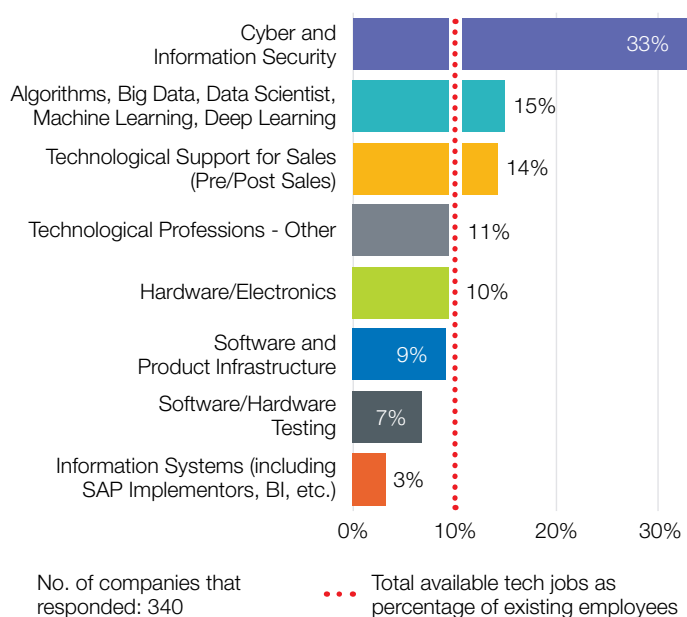
<sup>2</sup> It is expected that the 2019 data will also be updated in the 2020 report.

As seen in Figure 4, software and product infrastructure professions accounted for 40% of open positions in July 2019, the largest portion by far. While cyber and algorithms/data scientist professions did not account for a large share of overall open positions (7% and 4% respectively), they led in the percentage of open positions per existing employees in the position (Figure 5), indicating a relatively high demand for these professions.

**Figure 4: Distribution of Open Tech Positions by Profession, July 2019**

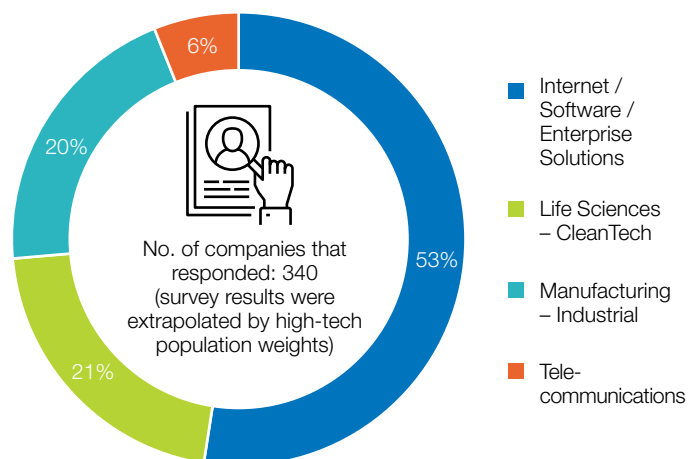


**Figure 5: Percentage of Open Tech Positions Compared to Current Employees in the Profession**



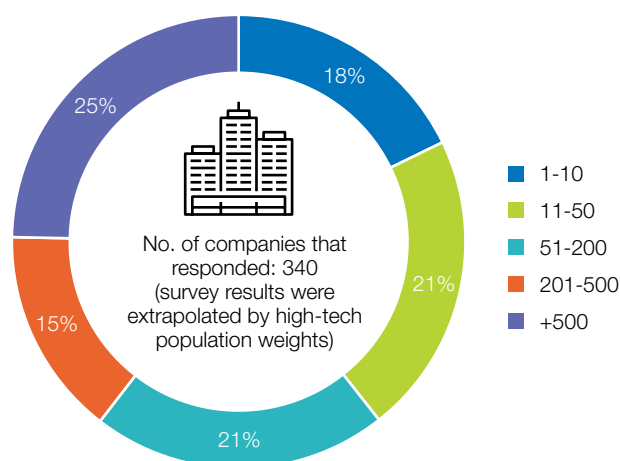
The growing trend in software positions is apparent in Figure 6 (particularly in comparison with Table 1), with 53% of open positions belonging to that sector, while comprising only 39% of overall high-tech employees. Conversely, the share of manufacturing companies shows a decline, comprising 20% of open positions while employing 37% of current high-tech employees.

**Figure 6: Distribution of Open Tech Positions by Sector, July 2019**



Examination of data by company size shows a relatively equal distribution in demand among different company sizes (Figure 7), similar to data from last year's survey.

**Figure 7: Distribution of Open Tech Positions by Company Size, July 2019**



Examination by geographical location indicates that the bulk of the high-tech industry is still concentrated in the center of the country (Central and Tel Aviv Districts). According to CBS data for 2018, 73% of startups and 79% of their employees were concentrated in the Tel Aviv and Central Districts.<sup>3</sup>

3 Source: CBS, "Startups in Israel 2011-2018: Findings from Startups Database," 2019.

# INDICATIONS OF SHORTAGE OF SKILLED TECHNOLOGICAL HUMAN CAPITAL IN HIGH-TECH

This section of the report examines a number of indicators, stemming from the results of the survey and data from other sources, regarding the human capital shortfall in the high-tech industry, especially with regard to technology workers.

## The Gap Between Open Positions and Actual Recruitment of Tech Employees

The scarcity of human capital is apparent in Table 2, in the low ratio of technology workers recruited in the first half of the year to the number desired in the beginning second half of the year, indicating the tightness of the market. Assuming that the conduct of the companies is similar in both halves of the year, the ratio of the estimated volume of recruitments made during one half of the year to the estimated number of open positions at any given time serves as an indication of the difficulty in recruiting new employees.

For example, looking at recruiting numbers for non-technology positions, the number of recruitments made between January and June 2019 was 13,779 employees, while in July 2019 the companies offered only 4,784 non-technology open positions. The high ratio of recruitments to open positions at a given point in time

(2.9) indicates that non-technology roles in the high-tech industry are relatively easily filled. Companies only recruit when they need employees, and accordingly spread their recruitments throughout the second half of the year.

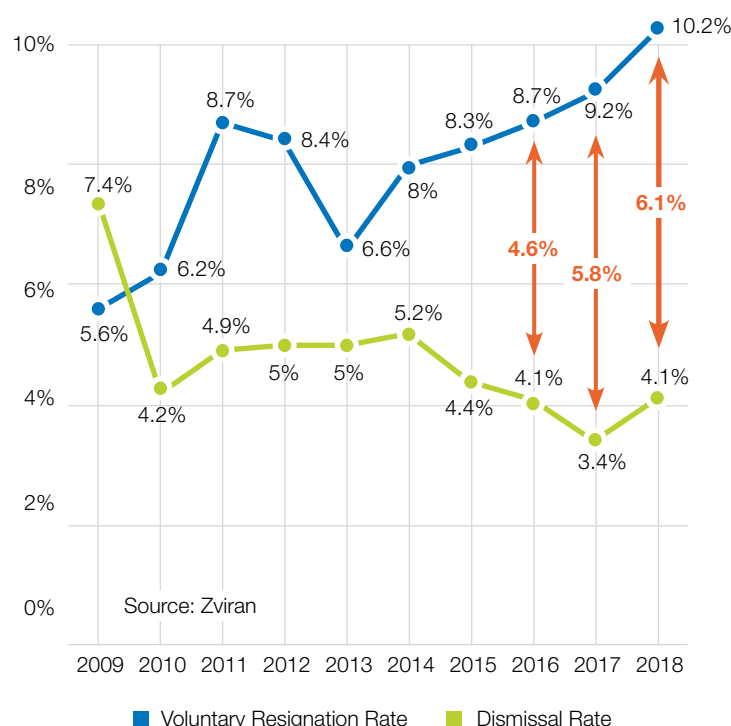
By contrast, the low ratio of the volume of technological recruitments carried out between January to June 2019 (1.05) to the number of open technology positions in July 2019 indicates that companies in the high-tech industry have difficulty recruiting technology workers due to high competition over these employees. Therefore, at any given time these companies are trying to recruit a large number of technology workers instead of spreading their recruitments over an extended timeframe.

## “Employees’ Market”: High Voluntary Departure Rates

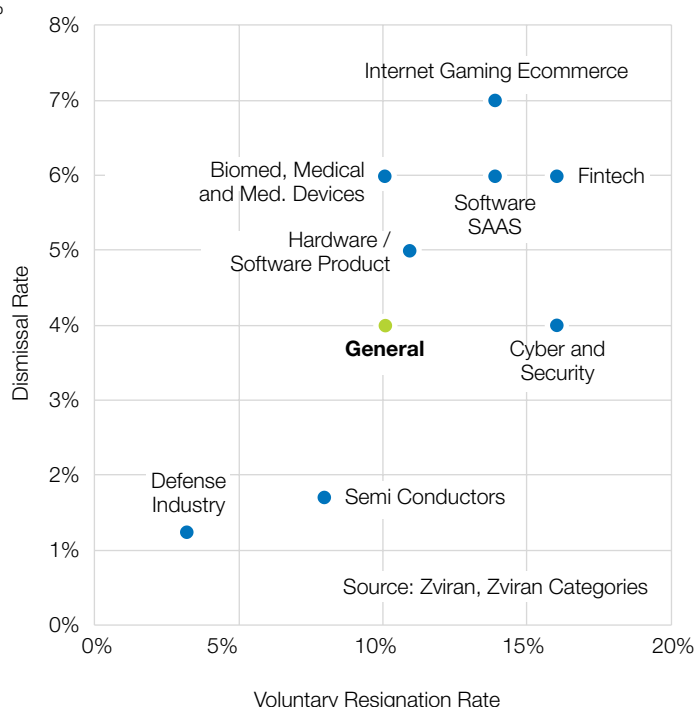
Figure 8 shows the high rate of voluntary turnover among high-tech employees, reaching 10.2% of high-tech employees in 2018 – an increase of 1 percentage point from the previous year. A high turnover rate due to voluntary resignations is a sign that employees

expect to find work that is similar to or better than their current roles. However, it is also worth noting that in 2018, an increase in the percentage of layoffs was first recorded after a few years of a downward trend.

**Figure 8: High-Tech Turnover – Voluntary Resignations vs. Dismissal Rates**



**Figure 9: 2018 Turnover - Voluntary Resignations vs. Dismissal Rates, by Sector**



An examination of this data by sector is presented in Figure 9. This analysis shows that internet/gaming, FinTech, and software companies have high levels of employee turnover, both in terms of voluntary resignations and dismissals. The cyber sector is the most prominent example of the existence of an employees’ market, with a high rate of voluntary departures and a low rate of dismissals.

At the other end of the scale are companies from the defense industry, where employee departures are a relatively marginal phenomenon. A possible explanation for these sectoral differences may be age-related variations, as the areas of FinTech, gaming, and cyber have a younger worker pool than that of semiconductor and defense industry companies.



## “Employees’ Market”: Wage Premium for New Employees

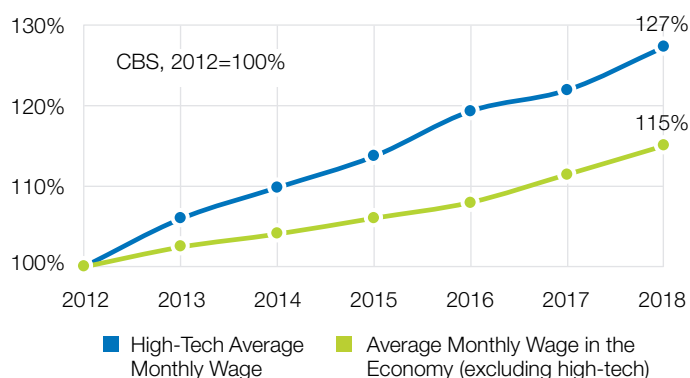
The high demand for high-tech workers and their ability to move relatively easily from one job to another means that companies are compelled to pay relatively high wages when hiring new employees (it is important not to conflate new company hires and inexperienced workers). According to an analysis conducted by Zviran into the most sought-after high-tech professions (see Table 3), there is a premium – at times a significant one – for recruiting new employees. In other words, there is a positive gap between the wages of newly recruited employees and those of existing employees in identical positions. This is particularly evident in front-end professions, mobile development, ATE, and DevOps, and further nurtures the phenomenon of voluntary employee departures.

Table 3: New Employee Premium in 2019	New Employee Premium in 2019
Front End Application Software Engineering	8.6%
Mobile Development	6.0%
Automatic Test Engineering (ATE)	5.7%
DevOps	5.4%
Information Security & Cyber	5.1%
Infrastructure / Back End Software Engineering	4.5%
Algorithms, Research & Data Scientist	2.0%
Big Data	1.5%

## Disparity Between High-Tech Wages and the Rest of the Economy

Another prominent indicator of the worker shortage is the escalation of wages in the high-tech industry. Figure 10 shows the disparity between the average rates of wage growth in the high-tech industry and in the rest of the economy. As of 2018, there was a 12 percentage point gap favoring the increase in high-tech wages compared to 2012. In absolute terms, in 2018 the average salary in the high-tech industry (including both technological and non-technological roles) was NIS 22,479 per month, compared with an average wage of NIS 9,345 in the rest of the economy, excluding the high-tech industry.

**Figure 10: Wage Growth – High-Tech vs. Rest of Economy**



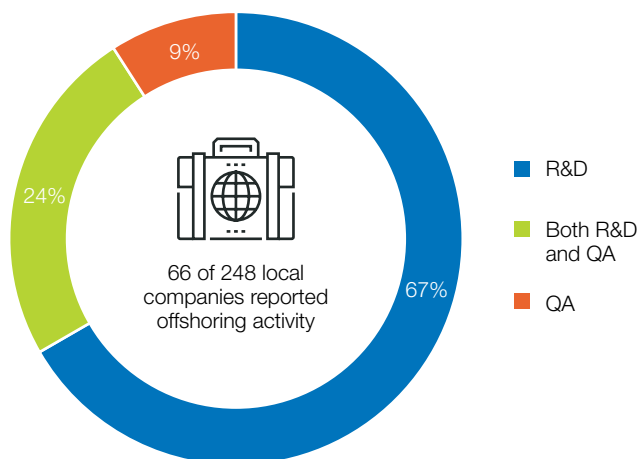
Methodological note: The data presented in this chart reflects wages only, and does not include additional benefits such as stock options, which are common in high-tech employment. This is in contrast to the corresponding chart in last year's report, which included data on all salary components.



## Intensification of the Offshoring Trend

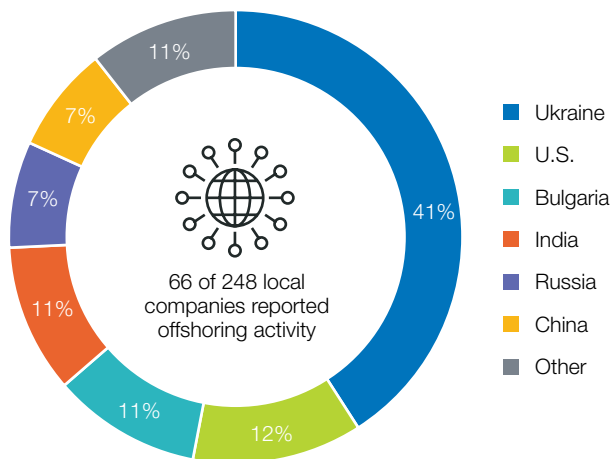
Another indication of the shortage of high-tech workers is the pressure exerted on local companies to find alternative solutions, reflected in the phenomenon of offshoring: transferring jobs to external parties in other countries. Of the local companies that participated in this year's survey, 27% reported offshoring centers, compared to 22% in the previous survey. Similar to last year, half of the companies that reported offshoring activities had established them in the last two years, which seems to indicate that this phenomenon is intensifying.

**Figure 11: Purpose of Offshore Presence**

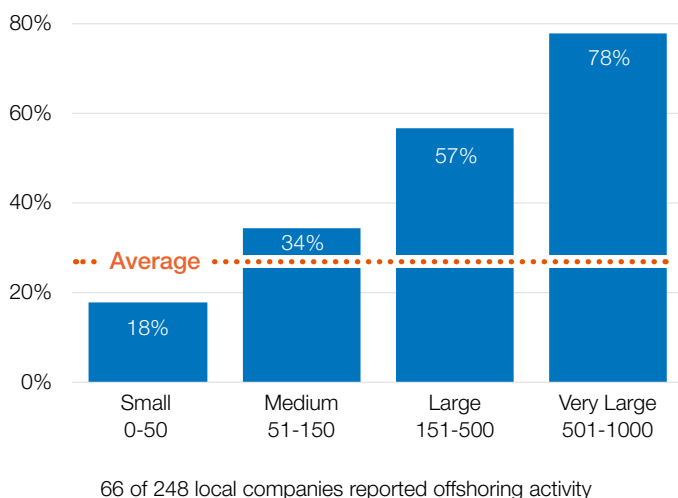


Furthermore, when examining the purpose of offshore activities, we can see that for most companies the focus is on R&D and not just QA (see Figure 11), making it an alternative to employing skilled technology workers in Israel. The larger the companies, the greater the need for employees, and the more severe the shortage. Correspondingly, Figure 12 shows the correlation between company size and offshoring activity.

**Figure 13: Offshoring Locations**



**Figure 12: Percentage of Companies Reporting Offshoring, by Size**



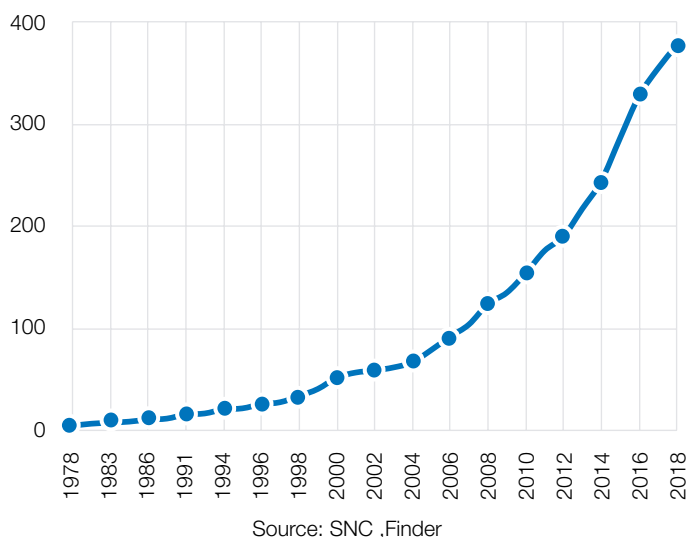
Methodological note: Giant companies were not included in the analysis due to limited survey response rates.



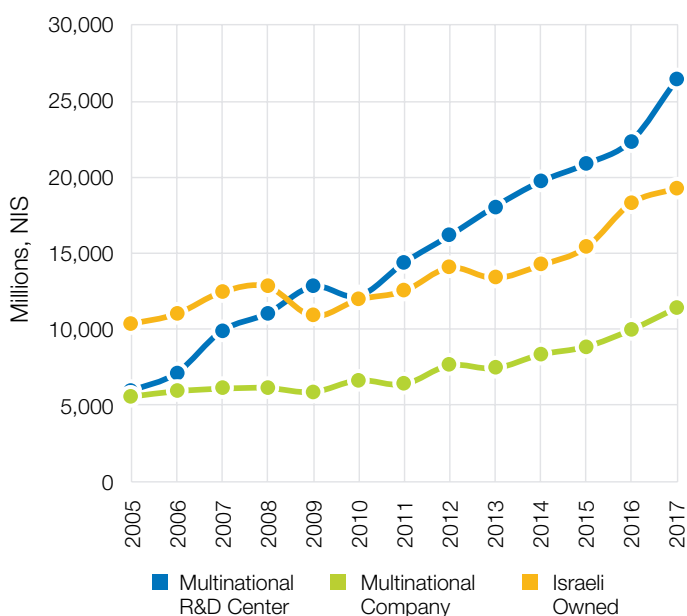
# ANALYSIS OF DEMAND BY MULTINATIONAL CORPORATIONS' R&D CENTERS

The growth in multinational corporations R&D centers' share is the most prominent phenomenon in the Israeli high-tech industry over the last decade. Figure 14 shows the increasing number of these centers over the years: from 2010 to 2018 their number jumped from 155 to 378, a 143% increase. Figure 15 reflects the corresponding increase in the share of multinational companies and multinational R&D centers compared to the overall business R&D expenditure in Israel.

**Figure 14: MNC R&D Centers in Israel**



**Figure 15: Business R&D Expenditure by Ownership**



Naturally, the increase in the share of multinational R&D centers leads to a sharp increase in demand for skilled technology workers. These centers increase the competition for business R&D workers in Israel due to the prestige and advancement opportunities offered by multinational companies, as well as their ability to pay higher wages. As shown in Figure 16, employer expenses for a full business R&D position at multinational R&D centers were about 40% higher than in other companies.

**Figure 16: Average Monthly Employer Expenses for a Full Business R&D Position – MNC R&D Centers vs. Rest of Business R&D**

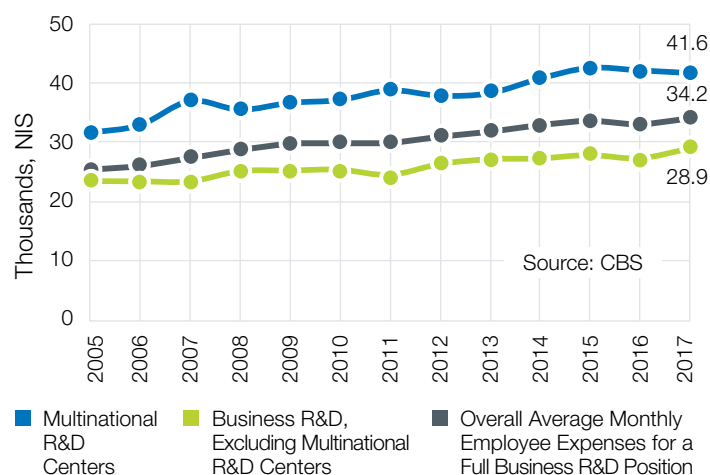
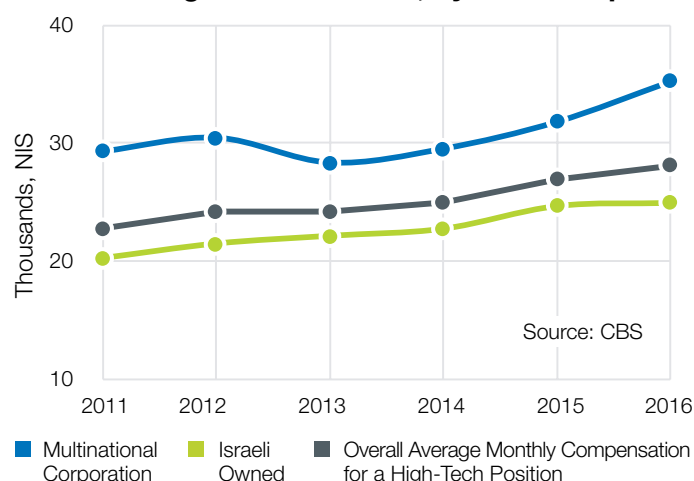


Figure 17 provides an indication of the impact of multinational corporations on the competition for the overall human capital in the Israeli high-tech industry, showing that the average compensation per position by employers in these companies is about 40% higher than by domestic companies. This is a significant gap, as the analysis includes the total expenses associated with employment, including stock options for employees – a phenomenon more common in local companies.

**Figure 17: Average Monthly Compensation for a High-Tech Position, by Ownership**



One possible factor in this disparity is the smaller ratio of non-technology employees per tech employees in multinational corporations and multinational R&D centers in particular. As seen in Figure 3, survey data shows that the percentage of tech employees (out of total employees) in multinational companies is significantly higher than in the case of domestically owned companies (76% compared to 63%).

Therefore, the increase in multinational R&D centers makes the industry more technological, thus reducing the ratio of non-technological workers to technological workers. This explanation notwithstanding, in the following section of the report we note the important role of multinationals in showing a greater willingness to recruit and train inexperienced employees.



# SOLUTIONS TO EMPLOYEE SHORTAGE

## Training Inexperienced New Employees – Juniors

The key to solving the employee shortage is to increase the supply of employees, first and foremost by training more technology workers. In addition to academic training programs, which we will expand upon later, alternative training channels have also emerged in recent years.

However, as many high-tech companies prefer to hire experienced employees, the hiring of juniors – employees with up to two years of practical experience – is not necessarily straightforward. In the survey, 131 companies (representing 45% of the 290 companies that responded to the juniors’ question) reported recruiting 1,351 tech juniors during the first half of 2019. However, this section will clearly show that this data varies significantly depending on the company’s size and ownership.

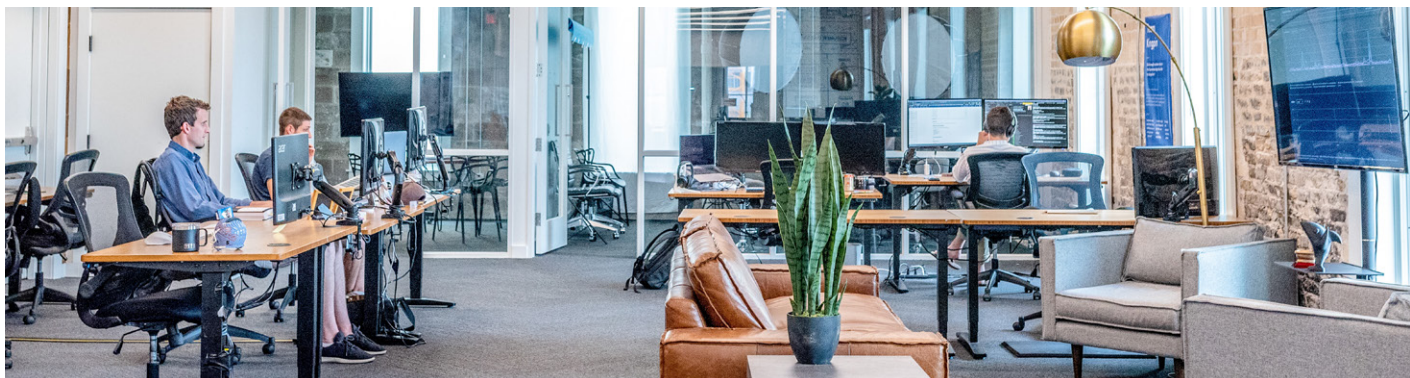
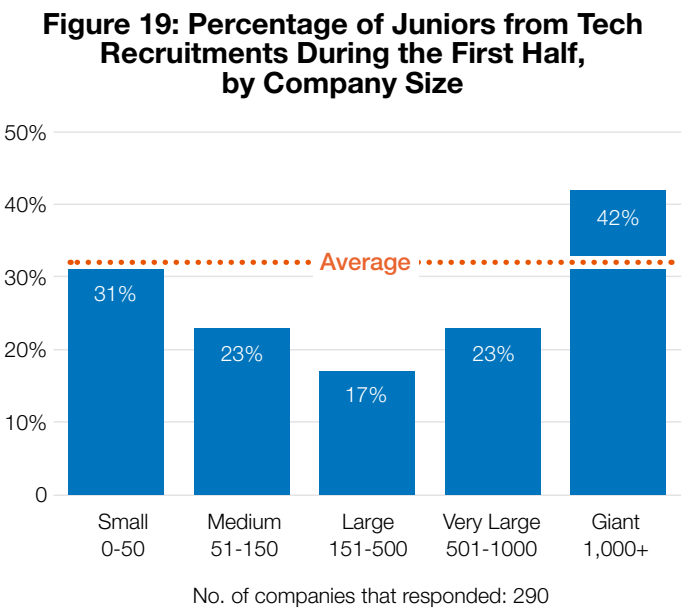
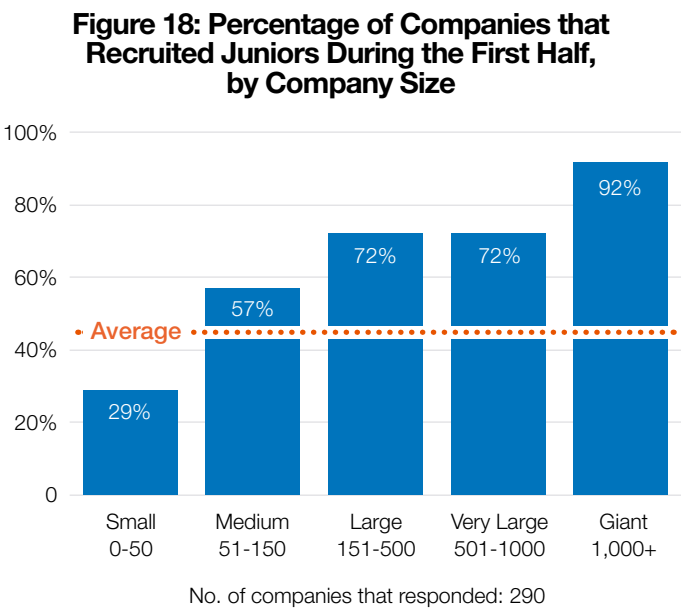
When recruiting inexperienced employees, a company must devote considerable resources to their training in order to benefit from them in the long term. Naturally, larger companies have an advantage in this, and small companies in particular find it more difficult to allocate relevant resources and dedicate managerial attention to the training of inexperienced employees.

Figure 18 supports this explanation and shows that the larger the company, the more open it is to the possibility of recruiting inexperienced employees. However, it is also important to consider the fact that a third of small companies reported not recruiting at all during the first half of 2019 – unlike other companies, almost all of which reported recruiting during this period – thereby further contributing to the low rate of junior recruitment.

Figure 19, which examines the percentage of juniors out of overall technological recruitments during the first half of 2019, indicates that the companies responsible for the highest percentage of junior recruitments were the smallest and the largest companies. In the case of the small companies, there are several possible explanations for this. The first, most simple and mechanistic reason is that very small companies are recruiting on a smaller scale, thus each recruitment is valued more significantly.

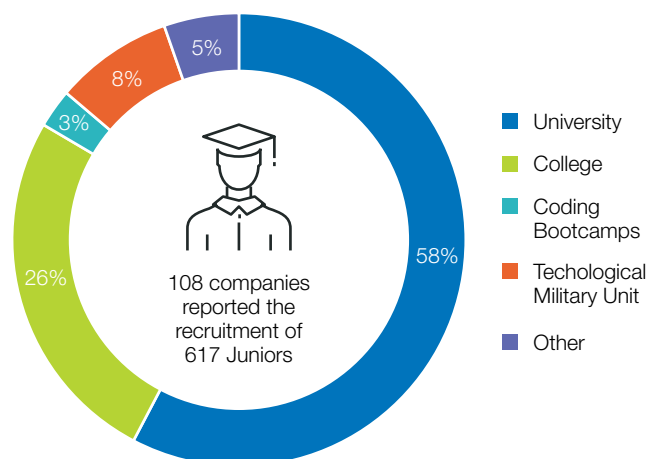
Another possible explanation is economic: smaller companies are unable to compete with larger companies’ resources in recruiting skilled workers, and are therefore more willing to recruit inexperienced workers. It is important to note that many companies also emphasize the benefits of recruiting juniors: introducing “new blood” with motivation and energy into the company, the ability to hire talented employees at earlier stages of their careers, the ability to shape employees according to organizational culture and practices, creating long-term loyalty, and of course, the economic consideration of employment costs.

On the other end of the scale, the reasons are much clearer. Giant companies, including the R&D centers of multinational corporations, recruit a large number of employees each year and therefore appeal to a wide range of audiences. To do so, these companies have the channels and resources needed to hire, train, and professionally develop inexperienced workers.



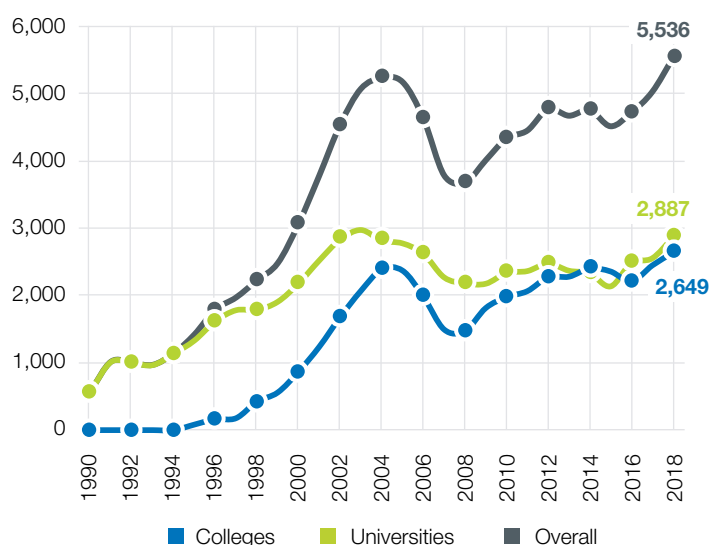
Of the 131 companies that reported recruiting juniors, 108 also reported on the training institutions they came from. Alongside the standard training institutions, namely universities and colleges, this year's survey also reported juniors coming from nonacademic training, such as technological military units and, for the first time, coding bootcamps. This provides an initial indication of the establishment of alternative training models, especially those focusing on retraining from other academic disciplines. The majority of junior employees, however, are still trained in the academic system. In this context, it is interesting to examine the gap between universities, from which almost 60% of juniors were recruited, and colleges, from which only 26% of juniors were recruited (Figure 20).

**Figure 20: Junior Recruitment During the First Half of 2019, by Type of Training Institution**



This gap between universities and colleges is significant, as the number of high-tech studies graduates in both types of institutions is similar, as shown in Figure 21. Our hypothesis is that a significant share of college graduates in these professions do not enter high-tech, but instead work in technological roles in other industries, such as banks, insurance companies, and government institutions.

**Figure 21: Number of Graduates from Academic High-Tech Studies**



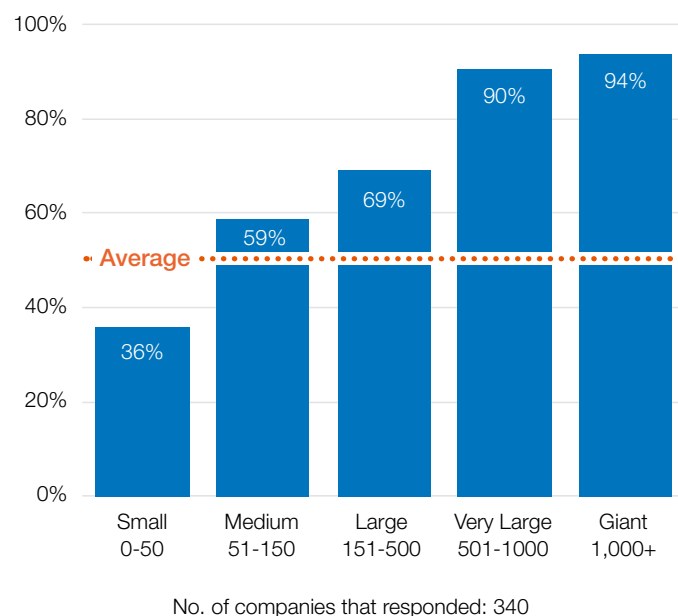
Source: The Council for Higher Education in Israel

Due to the great importance of training students in the academic system, and as part of the 2017 Government Resolution No. 2292 to Increase Skilled Manpower Supply for the High-Tech Industry, the Planning and Budgeting Committee (PBC) at the Council for Higher Education launched a broad program to increase the number of students in high-tech studies. The program includes tens of millions of NIS in incentives dedicated to academic staff quality, the expansion of teaching and research infrastructure, student support, and retention. The program also focuses on increasing the representation of women and underrepresented populations.

The program set a target of a 40% increase in enrollment, which would bring the number of students beginning their studies in high-tech fields to 9,952. Despite the fact that the program's closing date has been set for 2022, it has already brought a significant increase in the number of students in engineering and computer science studies. Accordingly, the PBC has updated its multiyear forecast to a projected 11,000 freshmen in high-tech studies in 2022.

One of the most promising avenues for integration at the junior level is for students to start working in high tech while they are still in school. The survey data shows that 58% of high-tech students are hired by the same company upon graduation. Similar to the recruitment of juniors, it is evident that larger companies are more likely to recruit students (Figure 22). This supports the argument that the need for large companies to recruit a wide range of employees, along with possession of the necessary resources and channels for the training and development process of juniors, enables these companies to recruit young talent at an earlier stage of their careers.

**Figure 22: Percentage of Companies Employing Students, by Company Size**



## Programs to Expand Skilled Workforce by Creating Alternative High-Tech Entry Channels

An interesting phenomenon in terms of the challenges surrounding high-tech human capital (and one that attracts wide public attention as well) is the apparent paradox between the significant shortage of skilled personnel and reports of difficulties integrating into one's first role in high tech. This is especially the case for graduates of colleges and alternative training courses, as well as those from academic institutions who have not gained practical experience during their studies.

On the employer side, this issue reflects a certain degree of conservatism or overcautiousness, but also a genuine fear of the risk involved in hiring an employee with no track record, who requires significant inputs for training and apprenticeship. Small and medium-sized companies sometimes lack the resources required for such training. Below are some of the programs that address this challenge.

### Government Programs

#### Government-Supervised Coding Bootcamps (Israel Innovation Authority)

In mid-2018, the Innovation Authority picked seven civic entities to operate elite, non-academic training programs in data science and computer programming. Aimed at expanding the supply of skilled personnel through a focus on retraining people with high abilities but without academic backgrounds in high-tech fields, these programs place an emphasis on training that combines theory and practice, including hands-on projects within the industry. The support model is based on a “pay-for-results” approach that includes increased incentives for the integration of women and underrepresented populations in high tech.

The program's first pilot has just ended, meeting the goal of 280 trainees, with high placement rates (over 70% at the time of writing). In addition, the coding bootcamp market in Israel has grown significantly, to about 20 frameworks and approximately 1,000 graduates per year. This year, agreements were made to use veteran grants to fund their studies, and Ministry of Labor benefits entitling students who are parents to subsidies for daycare or other state-supervised child care programs. Evidence from the field show the beginnings of a significant change in companies' perception of the potential for developing employees coming from diverse fields of study and training.

#### On-ramp to High Tech Program (Israel Innovation Authority)

In response to the challenges involved in recruiting juniors and the investment required to facilitate it, the Israel Innovation Authority launched its On-ramp to High Tech Program in 2019. The program provides funding for the recruitment and training of college graduates or practical engineers with no practical experience in high tech toward their first development positions. The goal for the first pilot year is to integrate 200 juniors.

#### Government Incentives for Employers who Offer High-Paying Positions (Program 4.18 - Authority for Investments and Development of the Industry and Economy)

The program offers companies located in national priority regions and in Jerusalem financial grants for employee recruitment, including in the high-tech industry and high-paying positions. The program is operated by the Ministry of Economy and Industry's Authority for Investments.

### SNC and Scale-Up Velocity Programs

Understanding the need to provide high-quality, scalable solutions for talent development, Start-Up Nation Central initiated the creation of Scale-Up Velocity, a nonprofit organization that specializes in developing innovative models to tackle the shortage of quality human capital. Scale-Up Velocity operates in close partnership with high-tech companies and provides solutions tailored to the industry's needs. Key programs have been developed in collaboration with Mobileye, Google, IBM, ExLibris, Lightricks, 40Nuggets, and JP Morgan, focusing on training juniors from underrepresented populations in the industry for development positions in core teams, with an emphasis on practical projects and additional skills required for R&D teams. Two pilot programs for trainees from ultra-Orthodox and Arab populations have been operating since 2018:

#### Adva

Adva is a unique program in mathematics and computer science that trains ultra-Orthodox women, who do not study in institutions of higher education, for development positions in core teams in the high-tech industry. The program is at the academic level, under the guidance of senior faculty members from leading universities, and is designed to be equivalent to two-thirds of a computer science degree. A significant part of the training process involves practical experience in technological projects led by the partner companies. The two-year program is designed for outstanding high school seniors in seminaries, and replaces the software engineering programs at ultra-Orthodox seminaries. The pilot is running at three leading ultra-Orthodox seminaries, with the first cycle ending in the summer of 2020.

In collaboration with the Ultra-Orthodox High-Tech Forum, under the leadership of the Haredi Institute for Public Affairs, a plan is currently taking shape to expand the program to other seminaries at the national level.

#### Excellentteam

This training program is aimed at computer science bachelor's degree graduates and operates through two separate courses: a track for female graduates from the ultra-Orthodox community, and a track for female and male graduates from the Arab community. Throughout the program, the graduates undertake practical experience for a period of four months, in combination with projects with the industry. The first cycle of the program concluded in February 2019, with 88% of its graduates placed in high-tech development positions with high starting salaries. Dozens more students will be trained in the program in 2020-2021.



# Diversification and Inclusion of Populations Underrepresented in High Tech

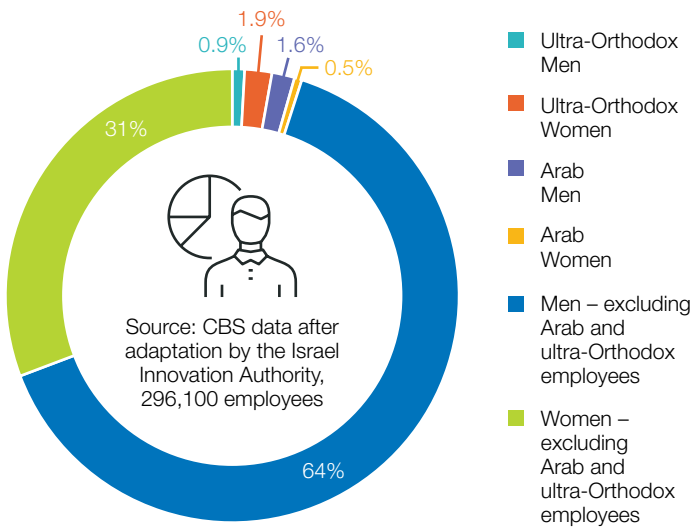
The high-tech employee population is quite homogeneous, as shown in Figure 23. Approximately two-thirds of employees are men and there is an absolute majority of non-ultra-Orthodox Jews, with ultra-Orthodox and Arab employees comprising only 5% of the population.

It is important to note that the total number of high-tech employees refers to all positions, including non-technological positions. As reflected in past research, such as “Route to High-Tech Industry,” when the distribution of populations among technological roles is examined, underrepresentation increases.<sup>4</sup>

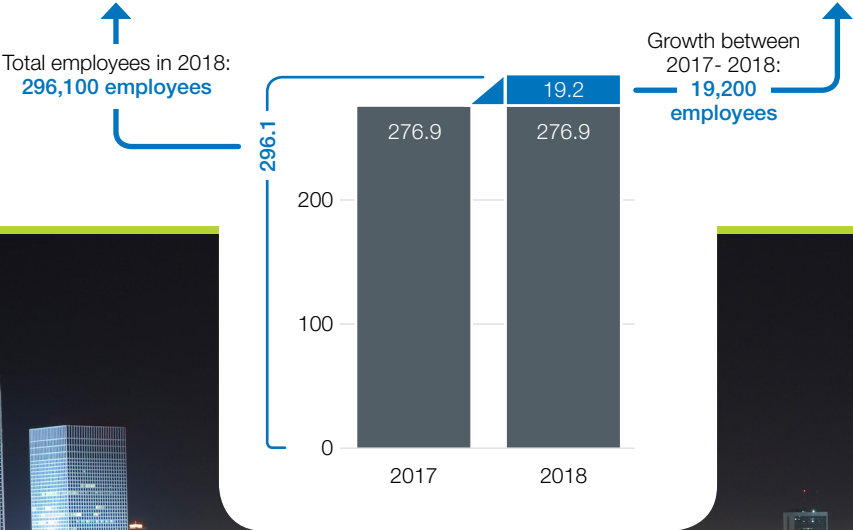
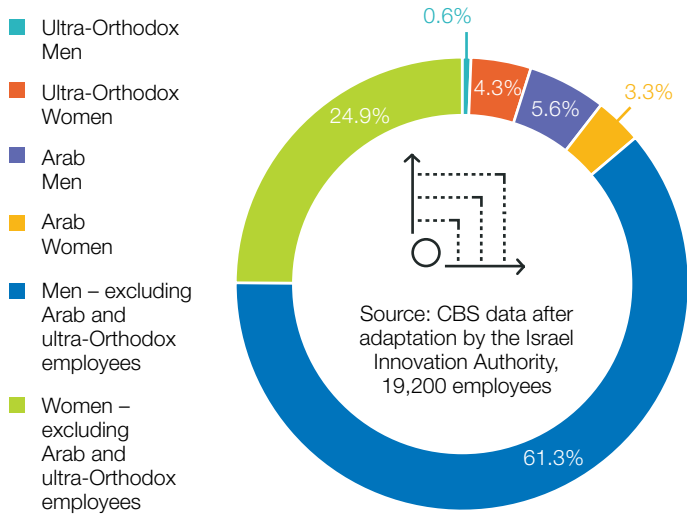
Between 2017 and 2018, the high-tech industry grew by approximately 19,200 employees. An examination of the

distribution of this growth by population (Figure 24) provides an indication of the industry’s future trends in human capital, as well as its preparedness to increase inclusivity for underrepresented populations. Ultra-Orthodox and Arab employees comprised nearly 14% of the industry’s growth compared to 5% of overall employees. This dramatic change was apparent in the Arab population, which grew from 2% of high-tech employees in 2018 to nearly 9% of the growth between 2017 and 2018. The growth that ultra-Orthodox women (but not ultra-Orthodox men) experienced in the industry was greater than their representation in the population, indicating the potential for future growth in their share of overall employees. In general, however, the proportion of women in the high-tech industry remained the same, reflecting a lack of improvement in their representation.

**Figure 23: Distribution of High-Tech Employees by Population in 2018**



**Figure 24: Distribution of Growth in High-Tech Employees by Population, 2017-2018**



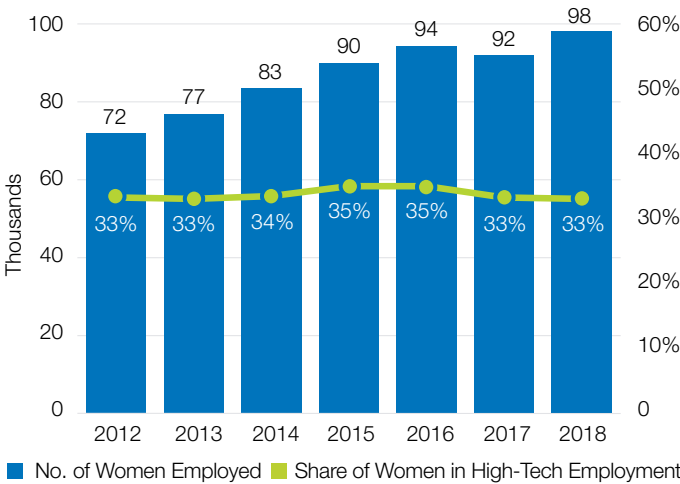
4 Source: “Route to the High-Tech Industry,” Yael Mazuz Harpaz and Zeev Kril, Ministry of Labor, Social Affairs and Social Services and Ministry of Finance, 2017.



### Inclusion of Women in High Tech

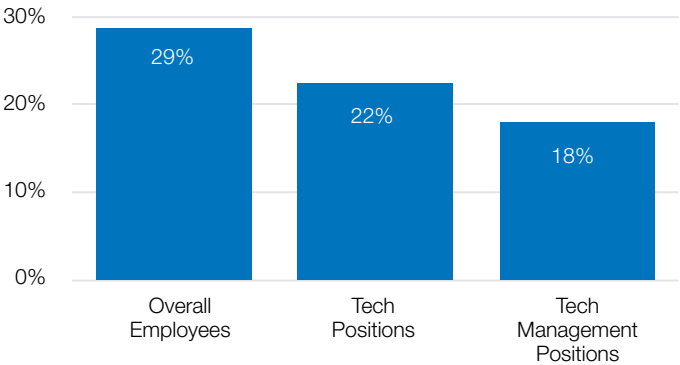
Despite the increase in the overall number of women employed in the high-tech industry, their share, which in 2018 stood at approximately one-third of all employees, has not risen in recent years and has even declined to some extent (Figure 25). It should be noted that the survey reported even lower figures.

**Figure 25: Number of Women and Their Share in High-Tech Employment**



A deeper examination of women's representation in high-tech roles, based on survey data, reveals an even more serious situation, with rates dropping to 22% for technology positions and 18% for technology management positions (Figure 26).

**Figure 26: Representation of Women in High-Tech, by Position**

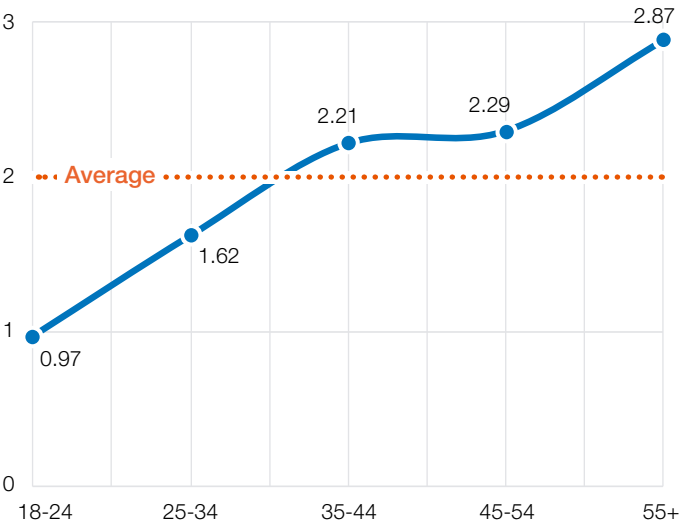


When analyzing women's representation in the high-tech industry overall, it is intriguing to examine the dynamics of their employment by age group. Figure 27 shows that the higher the age group, the smaller the share of women in high tech. The number of women working in high tech in their twenties is the same as the number of men. (It should also be noted that these are small numbers and that there is some bias in favor of women, as men have a longer military service and therefore enter the labor market later). The dominance of men increases in the 25-34 and 35-44 age brackets, the ages at which many women become mothers.

A certain stability in the ratio between genders exists in the 35-44 and 45-54 year age groups, indicating that women who remain in the high-tech industry after early parenthood are not more likely to leave the field than are men of the same ages.

At later ages, closer to retirement, the ratio of men to women again increases. One possible explanation for this dynamic is the option of earlier retirement for women than men. It is presumed, however, that there is also an intergenerational factor, as the 55+ age group belongs to a generation for which women's representation was low in the first place compared to the current day. Further in-depth research spanning several decades is required to assess the extent of this influence.

**Figure 27: Ratio of Men to Women in High Tech by Age in 2018**



CBS data after adaptation by the Israel Innovation Authority



## Efforts to Increase Representation of Women and Other Populations in High Tech

Numerous government entities and nonprofit organizations offer various training programs designed to facilitate entry to the high-tech industry, in particular for populations that are currently under-represented in this sector. Government entities involved include the Israel Innovation Authority and the Labor Division at the Ministry of Labor, Social Affairs and Social Services, which operate programs together with the business sector and civil society.

There are also independent programs run by various associations and organizations such as Start-Up Nation Central and Scale-Up Velocity, as well as organizations that operate specifically in the ultra-Orthodox sector (such as Bizmax and Kamatech), or in the Arab sector (such as Tsofen, Kav Mashve, Hasoub and Collective Impact).

### Government Programs

#### She Codes

The Labor Division at the Ministry of Labor, Social Affairs and Social Services operates a joint venture with nonprofit organization She Codes, to integrate and promote women in high tech. The tech community created as a result has over 20,000 members in 40 branches across the country. This venture offers women interested in working in the high-tech industry an opportunity to learn coding, get career mentoring, assistance in job placement, networking and more. In 2018-2019, more than 2,400 women participated in the venture, resulting in some 1,200 job placements.

#### Program for Women Entrepreneurs

This year, the Israel Innovation Authority launched a dedicated incentive program for women entrepreneurs under the framework of the Startup Division. The motivation was the very low rate of female entrepreneurs: only 7% of Israeli tech startups are led by women. This program offers preferential funding terms: During the first year, the offered grant amounts up to 75% of the R&D budget (of the project), and up to NIS 2.5 million; during the second year, up to 70% of the R&D budget and up to NIS 4.5 million. The terms and application criteria are similar to a program that has been running successfully for the past six years for ultra-Orthodox and Arab entrepreneurs. This incentive program launched during the second quarter of 2019 and already shows a substantial increase in the number of applications and project approvals.

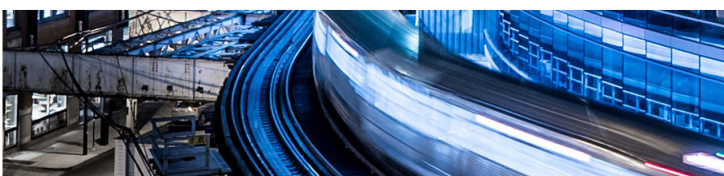
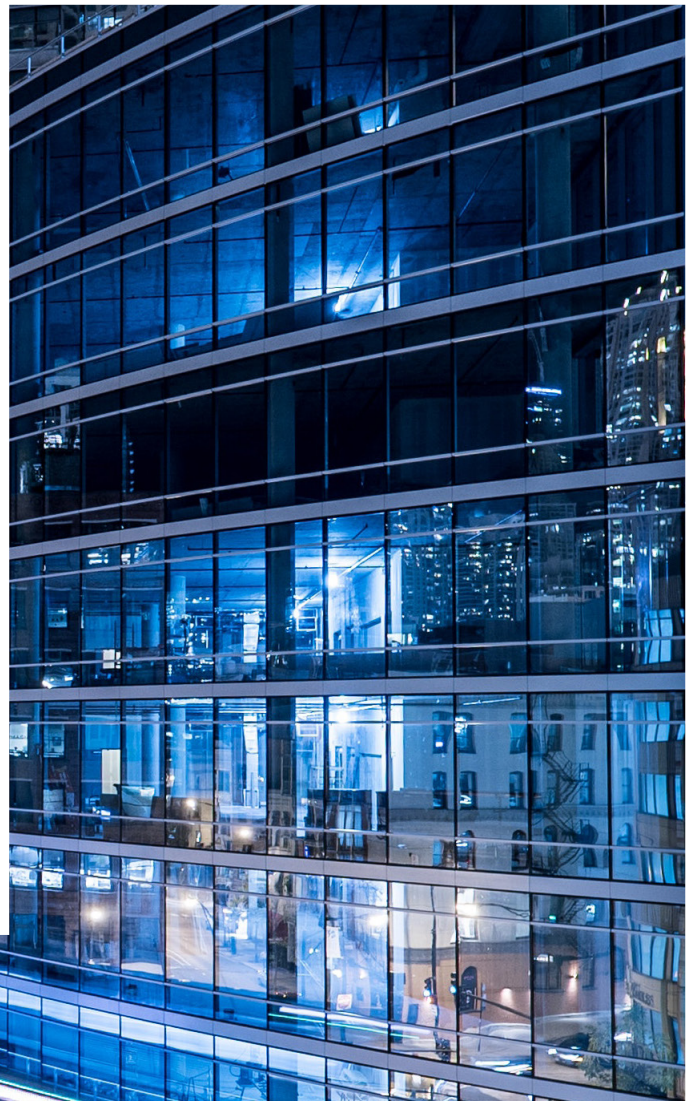
#### Forsatech

Forsatech is a program initiated by the Labor Division at the Ministry of Labor, Social Affairs and Social Services, aimed at integrating and promoting Arabs who graduated from college with tech-related degrees. The program is operated by Tsofen and Maof. In 2019, 560 individuals participated in this program, which included six vocational courses for supplementary training, two courses for management cadets (designed for individuals who already work in the high-tech industry), and over 300 successful job placements.

### SNC and Scale-Up Velocity Programs

#### Women of the Future

Scale-Up Velocity has set a goal to increase the number of women in academic engineering and computer science studies as part of a wider move to increase the number of women in technology positions in the high-tech industry. Through conferences and meetups with leading women in the industry, career consulting, and mentoring, the Women of the Future program is creating a conceptual change and encourages women in academic studies relevant to the high-tech industry to join its workforce.



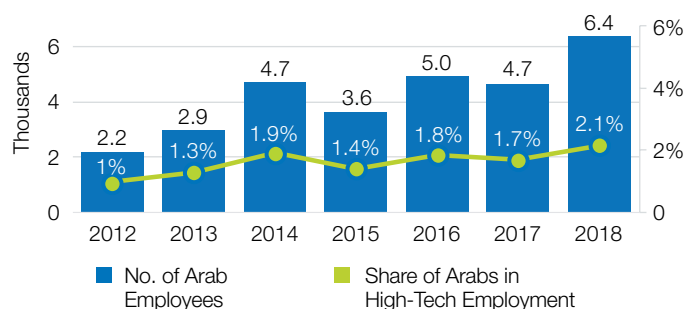


## Inclusion of Arabs in High Tech

A positive trend is evident in the number of Arab employees in the high-tech industry: a substantial increase was seen in 2017 through 2018, with the entrance of 1,700 Arab employees (Figure 28), and their rate crossing the 2% threshold. Despite this positive trend, their rate out of the overall number of high-tech employees is still low compared to their share of the general employment market.

Furthermore, data from the “Route to High-Tech Industry” research attests that the rate of Arabs in development positions in high tech is even lower than that presented in the figure.<sup>5</sup> The study, which refers to 2014 data, found that the percentage of Arab high-tech employees at a relatively high salary (which characterizes development positions) stood at 1.4% – half point percent less than overall Arab high-tech employees that year, as shown in the figure below.

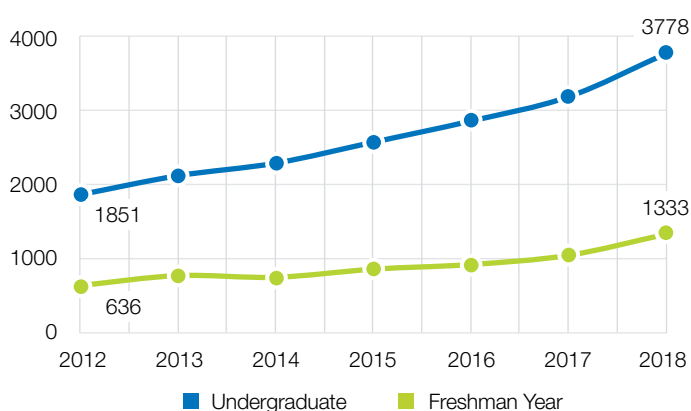
**Figure 28: Number of Arabs and Their Share in High-Tech Employment**



Source: CBS data after adaptation by the Israel Innovation Authority

However, the potential growth rate of Arab employees in technological roles in the high-tech industry is illustrated in Figure 29, which shows a significant increase in the number of Arab students in high-tech studies at academic institutions. Between 2012 and 2018, the number of undergraduate students enrolled in these majors has more than doubled. In the coming years, a rapid and proper integration of these graduates will be one of the core aspects of reducing the shortage of technological manpower in the high-tech industry.

**Figure 29: Number of Students from the Arab Community in Academic High-Tech Studies**

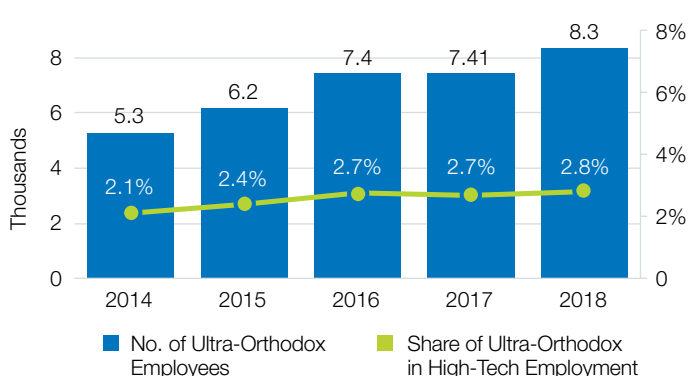


Source: The Council for Higher Education in Israel

## Inclusion of Ultra-Orthodox in High Tech

Despite an increase in recent years, representation of the ultra-Orthodox population in the high-tech industry remains low, standing at approximately 3%. In addition, it should be noted that this figure refers to all high-tech employment and, as with other underrepresented populations in high-tech, it worsens when examining the share of ultra-Orthodox in technological positions. A comparison of the number of ultra-Orthodox employees out of all of high-tech employees in 2014 (Figure 30) and data presented in the “Route to High-Tech Industry” study regarding their share out of high-salaried employees that same year demonstrates that only one-third of ultra-Orthodox employees – 0.7% out of 2.1% – are in development positions.<sup>6</sup> From this we can draw that the challenge with this population is twofold: increasing the number of employees participating in high-tech while also integrating them into tech positions with higher salaries.

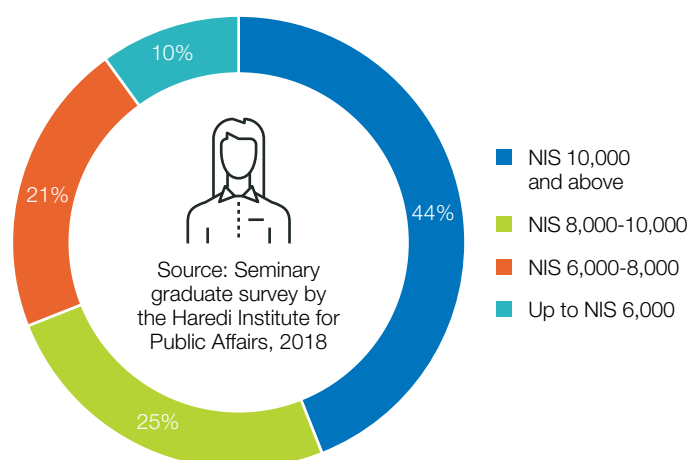
**Figure 30: Number of Ultra-Orthodox and Their Share in High-Tech Employment**



Source: CBS data after adaptation by the Israel Innovation Authority

To illustrate this, according to data by the Haredi Institute for Public Affairs, the number of women in high tech out of all ultra-Orthodox women was almost equal to the number of women employed in high-tech among non-Orthodox Jews.<sup>7</sup> However, a survey conducted by the Institute in 2018 found that less than half of seminary graduates in high-tech occupations earn NIS 10,000 or more.<sup>8</sup>

**Figure 31: Wage Level Distribution of High-Tech Seminary Graduates**



Source: Seminary graduate survey by the Haredi Institute for Public Affairs, 2018

<sup>5</sup> Source: “Route to the High-Tech Industry,” Yael Mazuz Harpaz and Zeev Kri, Ministry of Labor, Social Affairs and Social Services and Ministry of Finance, 2017

<sup>6</sup> Source: “Route to the High-Tech Industry,” Yael Mazuz Harpaz and Zeev Kri, Ministry of Labor, Social Affairs and Social Services and Ministry of Finance, 2017

<sup>7</sup> Source: The Haredi Institute for Public Affairs, Nitsa (Kaliner) Kasir, “Ultra-Orthodox to High-Tech – Trends, Opportunities and Required Steps,” 2019

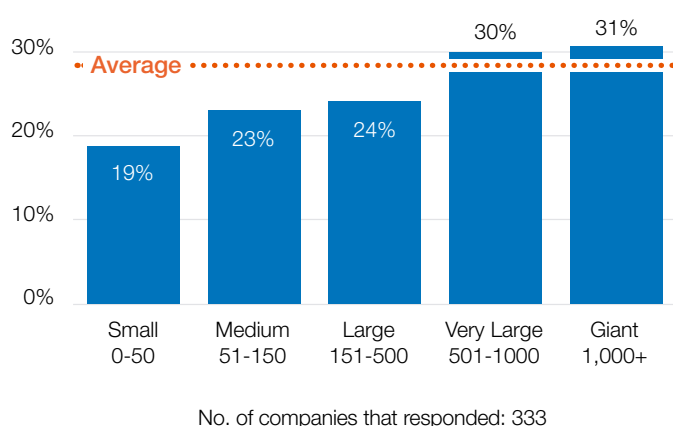
<sup>8</sup> Source: The Haredi Institute for Public Affairs, Nitsa (Kaliner) Kasir, “Ultra-Orthodox to High-Tech – Trends, Opportunities and Required Steps,” 2019

## High-Tech Employees over the Age of 45

On occasion, claims that the high-tech industry excludes older employees are heard, but according to adaptations of Israel Innovation Authority to CBS data, the representation of workers aged 45 and above among high-tech employees has not changed significantly over the past five years, remaining stable at a rate of 30% to 32%.

In keeping with this data, survey results for June 2019 show that employees aged 45 and above comprised 29% of all employees. In this case, too, it is evident that larger companies are more likely to employ a higher percentage of employees aged 45 and above (Figure 32). Possible explanations for this finding are the ability of large companies to provide long-term career planning, and the fact that some of these companies have been established longer and thus employ workers who started with them at an earlier stage of their careers.

**Figure 32: Number of Employees Aged 45 and Older and Their Share in High-Tech Workforce by Company Size, June 2019**

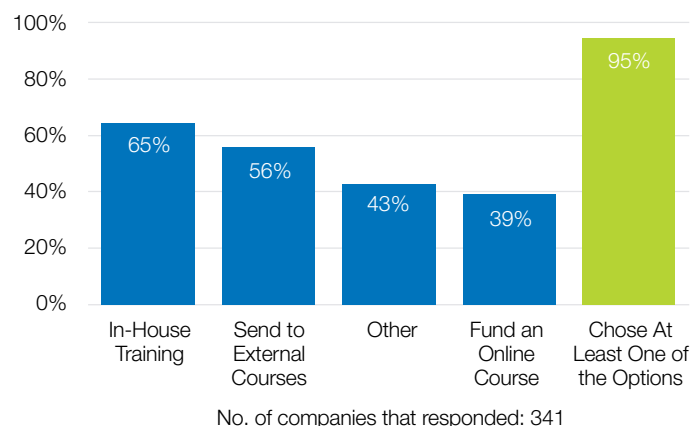


## Training and Retraining: Additional Models for Cultivating Expertise

The need for professional technological training in the high-tech industry, which relies on frequently changing technology and programming languages, is crucial. As a result, almost all companies in the industry for whom human capital is a primary resource invest in professional training for their employees.

Of the companies participating in the survey, 95% reported training their employees in one or more of the following ways: sending them to courses, holding in-house training sessions, funding online courses, and other methods (Figure 33). Moreover, 32% of the companies reported that in addition to offering training, they also see the development of new skills as being the responsibility of the employee – a trend which fits with the lifelong-learning concept taking root in the industry.

**Figure 33: Percentage of Companies that Reported on Professional Tech Training**





## Government Programs

### Expert Training: The Next Generation Advanced Technology Studies Association's Workshop

The high-tech world is advancing at such a fast pace that constant learning is required among practitioners, and there is a growing need for advanced technology experts – usually in greater quantities than academic institutions alone can provide.

In 2019, the Innovation Authority launched a new pilot model for advanced technology studies, enabling a group of high-tech companies to partner, and offer in-depth mutual training to their existing employees with significant funding from the Israel Innovation Authority. The first workshop will focus on artificial intelligence and will launch in 2020.

## Integration of Foreign Experts

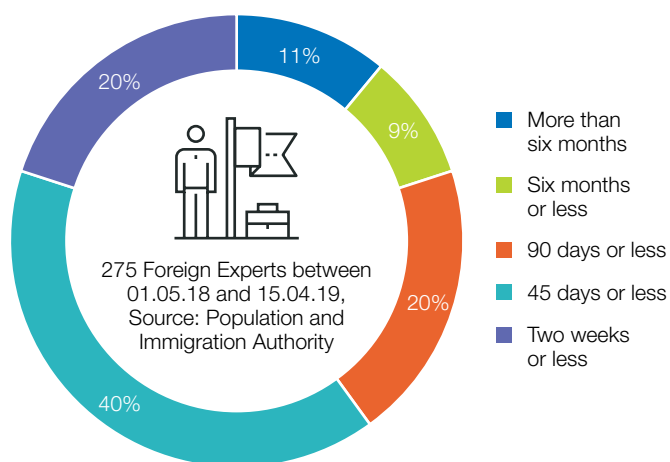
Of the companies participating in the survey, 12% reported that they collectively employ a total of 116 foreign experts, which accounted for less than 1% of the total workforce in these companies, while 73% of the companies reported that they did not recruit foreign experts because they did not need to.

In May 2018, the Innovation Authority launched an experimental procedure “for Handling Applications of High Tech and Cyber Companies to Employ and Regulate the Status of Foreign Experts in Israel,” through which more than 275 foreign experts arrived in Israel. This new procedure sets short time constants – 6 to 10 days in practice – for the entire procedure of handling a request to bring a foreign expert to the Israeli high-tech industry. According

to data by the Population and Immigration Authority, it appears that the procedure is mainly used by large companies to bring in personnel from their other sites for short-term project response needs (Figure 34).<sup>9</sup>

The data indicates that there is still no widespread practice of longer-term relocation to Israel, and therefore many companies may not experience such a need. It should be noted that Jews (including returning Israelis) who come to Israel for work, whether for short-term relocation or long-term immigration (Aliyah), are not usually included in this data because they come with a different visa or no visa at all. However, preliminary data relating to this process indicates that it provides an accessible option for companies that need experts quickly and for short periods of time.

**Figure 34: Foreign High-Tech Experts Arriving Through Experimental Procedure, by Net Time in Israel**



<sup>9</sup> Source: Population and Immigration Authority, “Foreign High-Tech Employees Arriving in Israel as part of the “ High-Tech Procedure ”: First Year to Implement the Procedure - Select Data”, 2019.





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