

# HUMAN CAPITAL SURVEY REPORT 2018





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## FOREWORD – PROF. EUGENE KANDEL

CEO, START-UP NATION CENTRAL



The shortage of tech professionals in Israel represents a challenge to the tech sector and to the Israeli economy as a whole. To estimate the extent of the problem, Start-Up Nation Central, in collaboration with Israel Advanced Technologies Industries (IATI), initiated a survey in 2017 that established the initial framework about various aspects of the

human capital shortage in Israel's tech industry. The survey was carried out by Zviran, a consultancy with an extensive expertise in surveying the Israeli tech workforce. The first-time process was challenging, however the resulting 2017 Human Capital Report has provided a useful benchmark.

This year, Start-Up Nation Central, in partnership with the Israel Innovation Authority (IIA) analyzed the 2017 survey process, drew important conclusions and implemented methodological and content changes in the current survey, which was again expertly executed by Zviran. The survey, distributed to respondents in June 2018, covers somewhat different issues relative to the 2017 report. We succeeded in increasing the sample size of this year's survey four-fold to 362 companies, offering a much better representation of small companies, which was lacking in the 2017 survey. The survey still has a relative overrepresentation of large companies – altogether the responding companies employ over 82,000 people, which is almost 40% of the Israeli tech sector as defined by Start-Up Nation Finder.<sup>1</sup>

The insights in this report are derived from the survey, as well as from Zviran's extensive database of compensation data and a 30-year analysis of the Israeli tech labor market. The report was produced with the continuing financial support of the JPMorgan

Chase Foundation, which aims to facilitate the understanding of skills shortages, and improve access to demand-driven skills training for diverse populations.

The tech sector is the main potential driver of the growth of the Israeli economy for the next decade. However, it is becoming increasingly clear that the required growth will not be possible if the country's supply of tech workers is inadequate. Tech companies are struggling to find tech professionals, with many already finding it overseas. At the same time, many tech companies only hire proven experienced employees, largely avoiding juniors, women, Arabs and the Ultra-Orthodox.

The obvious conclusion is that the current efforts to scale up the relevant training at universities and attract a much larger number of schoolchildren and young adults into tech education must be intensified. Yet, without a massive integration of women, Arabs and the ultra-Orthodox into the sector, there is little chance of attaining the needed human capital. The industry must start actively pursuing much wider pools of untapped talent. These steps will take time, so in the meantime, shorter retraining courses as well as bringing tech talent from abroad are crucial supplemental measures. In addition, in the longer run, degree-based higher education may not be the only option to get trained for the tech market – instead a sequence of certified shorter modules will be a preferred way for many people to get training and education.

The goal of this report is to continue providing the overall picture on the open positions in tech, and to focus on possible corrective actions. Through these insights, we hope to empower policymakers and operators of intervention programs to better address this challenge. We also hope that continuous monitoring of the human capital need will facilitate additional research and analysis to enable smarter policies and help the industry be better prepared.

<sup>1</sup> Start-Up Nation Finder – a free online platform that collects and organizes comprehensive information on the Israeli innovation ecosystem.



## FOREWORD – AHARON AHARON CEO, ISRAEL INNOVATION AUTHORITY



2018 has been an excellent year for Israeli high tech. The growth of the sector – new companies, more MNCs, scaling up of start-ups – as well as the growing need for tech professionals in non-tech industries, means that demand for skilled tech workers is on the rise. This significant report confirms this: the number of employees in high-tech has grown significantly, from

240,000 in 2013 to 280,000 in 2017. Yet despite this, demand continues to outpace supply.

While this is overall a positive sign, it also requires our response. How do we increase the supply of relevant graduates entering the workforce, and attract more talent from abroad? Additionally, as new professions are created faster than the ability to train for them, and as the dynamic nature of the industry means that academic training is consistently losing some of its relevance, how do we adapt?

We need to train more people – and especially to tap into the unrealized potential in women, the Arab population and the Ultra-Orthodox community. The change has already begun: Israeli academia launched a 5-year plan to increase tech graduates by 40%, and we are seeing a dramatic change with minorities: over 2,200 Arab students were enrolled in high-tech academic studies in 2016, compared to 1,600 graduates in the entire 1985-2014 period. Hundreds of Ultra-Orthodox women complete associate degrees in computer engineering each year. We now need to bridge the gap to their successful integration into the workforce.

But academic studies are not the only answer. The Innovation Authority recognized the potential of coding bootcamps as an elite training (or re-training) route, providing 20% of entrants to the tech industry in the US annually. In 2018, we launched a national pilot to support bootcamps for coding as well as data science and machine learning. We were overwhelmed by the response. Seven institutions received our stamp of approval and support, and over ten other players have chosen to operate in Israel. We believe this can be a game-changer – but it requires industry partnership and open minds.

The Israeli ecosystem can also benefit from talent from abroad, and the diversity it brings. Working with partners across the government, we helped launch and operate the new Foreign Tech Expert Visa in 2018. The route to bringing foreign talent is now open and efficient.

We see our role in creating infrastructure, incentivizing innovative activities and lowering barriers. Together with our many partners in the government, industry and NGOs, we are proud to lead, innovative solutions for the mitigation of the tech talent shortage. While none of these are quick fixes, they do lay the foundation for a permanent increase in the numbers of tech professionals entering the sector, and provide an opportunity to connect all parts of our society to the Start-Up Nation. All parts of the ecosystem must work together open-mindedly to make the change. I hope you will join us.

## PARTNERS

### START-UP NATION CENTRAL

Start-Up Nation Central is an Israel-based non-profit whose mission is to help ensure that the Israeli tech sector grows and makes a bigger impact on the world. An authoritative source on the Israeli innovation ecosystem, it leverages its in-depth knowledge to help identify the best solutions for demanding corporate and government challenges. Start-Up Nation Central, an organization funded entirely by philanthropy, convenes thought leaders to help shape supporting policies for companies to grow. Together with partners, Start-Up Nation Central designs and tests innovative scalable programs addressing the shortage of talent.

### ZVIRAN Compensation & Benefits Solutions

Zviran is the leading HR, compensation and benefits consulting firm in Israel. Zviran is the only company combining benchmark data, in-depth knowledge of compensation and benefits, and expertise regarding pension and employee risk benefits. Zviran provides data and professional advice for more than 450 employer customers, including many tech companies. Zviran's services include salary and benefits surveys; compensation and benefits consulting for employers; HR, payroll and relocation consulting; pension and employee risk benefits consulting for employers; advice on pensions and finances to high net individuals. Zviran has a strategic alliance with Mercer, the world's largest HR data and consulting firm.

### רשות החדשנות Israel Innovation Authority

The Israel Innovation Authority, responsible for the country's innovation policy, is an independent and impartial public entity that operates for the benefit of the Israeli innovation ecosystem and Israeli economy as a whole. Its role is to nurture and develop Israeli innovation resources, while creating and strengthening the infrastructure and framework needed to support the entire knowledge industry. The Israel Innovation Authority provides a variety of practical tools and funding platforms aimed at addressing the dynamic and changing needs of the local and international innovation ecosystems.

### J.P.Morgan

J.P. Morgan is a leading global financial services firm. In the United States, the firm provides millions of private and corporate clients its services under the Chase trademark. As J.P. Morgan, the firm is active in more than 100 countries worldwide and a leader in investment banking, asset management, private banking and financial transaction processing. The firm and its foundation invest approximately \$200 million annually in non-profit organizations around the world while leveraging its resources, expertise, global reach and access to capital. In Israel, the JPMorgan Chase Foundation has been supporting projects that focus on job creation, skills training and work placement for underprivileged people, as well as entrepreneurship promotion.

We would like to thank Evyatar Kirschberg and Tal Enselman Kazav from the Israeli Central Bureau of Statistics, for their ongoing support and significant contribution to this report.



# REPORT HIGHLIGHTS



This year's survey focuses only on positions open at the time of the survey. As of July 2018, the number of open positions in the tech sector (as defined by Start-Up Nation Finder) is estimated to be between 14,100 and 16,500, averaging at around 15,300. While we now believe that the comparable numbers in 2017 (around 12,000) were underestimated due to the absence of small firms, the increase is still substantial.



362 companies completed this year's survey, compared to only 91 last year – a fourfold increase. The most significant change in coverage is of small companies (under 50 employees): 200 completed the survey in 2018 compared with only 18 in 2017.



Given the CBS estimate of an almost parity between tech and non-tech workers in the sector, open positions represent 12–16% of the tech workforce in the sector (as defined in this study, which does not include the demand for the same tech professionals from outside the sector).



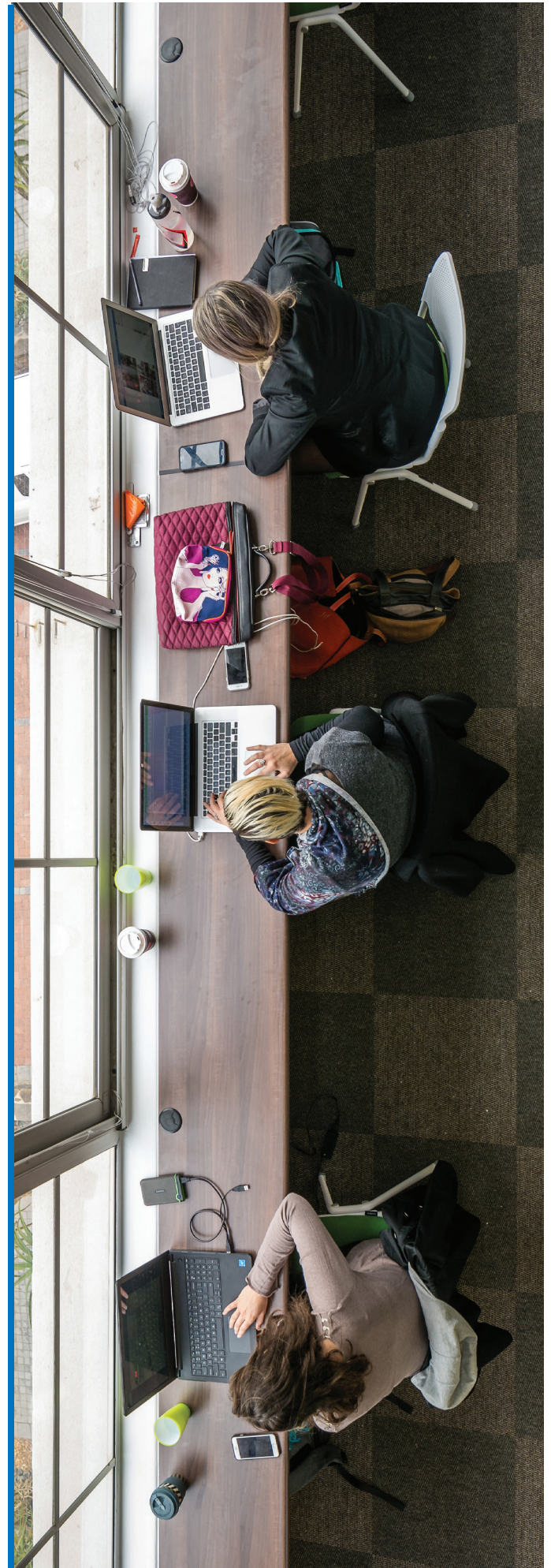
As the demand for tech talent is rapidly increasing, it is not being matched by the supply of programmers, scientists, and engineers, creating a growing shortfall.



To date, significant parts of the industry have hired mostly university-trained, experienced, Jewish male candidates, which is not a long-term sustainable strategy for a growing sector.



Every fourth company reports having an overseas development team, Ukraine being the most favored location. Those companies employ about 25% of their entire workforce overseas.



## DESCRIPTION OF THE SURVEY AND THE SAMPLE

The survey was sent to 4,245 firms, from more than 6,000 firms in the Start-Up Nation Finder database for which CBS had employment data in 2017. This year's sample of respondents is far more representative than that of 2017, due to a much higher willingness of companies to participate. Overall, 362 firms responded to the survey – almost 4 times more than the 91 firms in 2017. There is also a much higher representation of smaller firms with fewer than 50 employees – 200, compared to only 18 in 2017. This provides a hard-to-obtain view on the small firms segment.

Collectively all these companies employ over 82,000 people, or almost 40% of the total number of employees in 2017 (representing almost 10% of the employees in small firms, and over 60% in large ones).

**Table 1: Representativeness of the sample by size sector and origin**

		By number of companies		By number of employees	
		Sample	Population (Finder)	Sample	Population (Finder)
<b>SECTOR<sup>2</sup></b>	<b>Internet – Software</b>	53%	48%	70%	44%
	<b>Life Science – Clean Tech</b>	23%	31%	4%	20%
	<b>Manufacturing – Industrial</b>	16%	15%	15%	27%
	<b>Mobile and Telecom Technologies</b>	8%	6%	11%	9%
	<b>TOTAL</b>	<b>100% (362)</b>	<b>100% (4,245)</b>	<b>100% (82,062)</b>	<b>100% (211,177)</b>
<b>SIZE<sup>3</sup></b>	<b>1-10</b>	32%	54%	1%	4%
	<b>11-50</b>	25%	30%	3%	14%
	<b>51-200</b>	24%	12%	11%	22%
	<b>201-500</b>	11%	3%	17%	16%
	<b>500+</b>	8%	1%	68%	44%
	<b>TOTAL</b>	<b>100% (362)</b>	<b>100% (4,245)</b>	<b>100% (82,062)</b>	<b>100% (211,177)</b>
<b>ORIGIN</b>	<b>Stand-alone firm</b>	76%	93%	60%	75%
	<b>Multinational Corporation</b>	24%	7%	40%	25%
	<b>TOTAL</b>	<b>100% (362)</b>	<b>100% (4,245)</b>	<b>100% (82,062)</b>	<b>100% (211,177)</b>

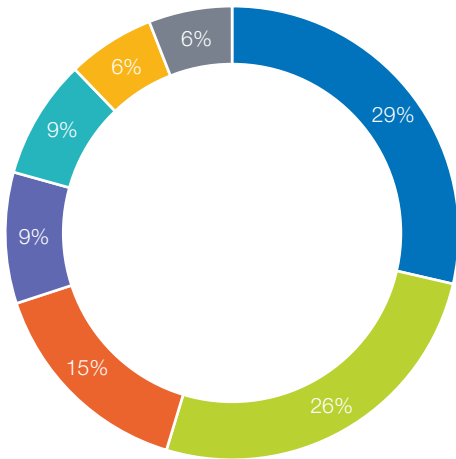
Of the companies that answered the survey, 87 are multinational companies, while the rest are stand-alone companies. The two largest subsectors by the number of companies in the sample are Product Hardware/Software and Product/Service Software. Measured by the number of employees, the two largest sectors are Product Hardware/Software and Semiconductors.

2 In this table and figures 3 below we use 4 sub-sectors categories according to Start-Up Nation Finder's definitions. In subsequent survey analysis we used a different sub-sector categorization per Zviran's definitions: Product hardware/software, Semiconductor, Product/service software, Internet, Gaming, E-commerce, Cybersecurity and Information security, Biomedical Medical device, Fintech.

3 In this table and figure 4 below we use five size categories according to CBS definitions. In subsequent survey analysis we used a different five size categories per Zviran's definitions: 0-50, 51-150, 151-500, 500-1000, 1000+.

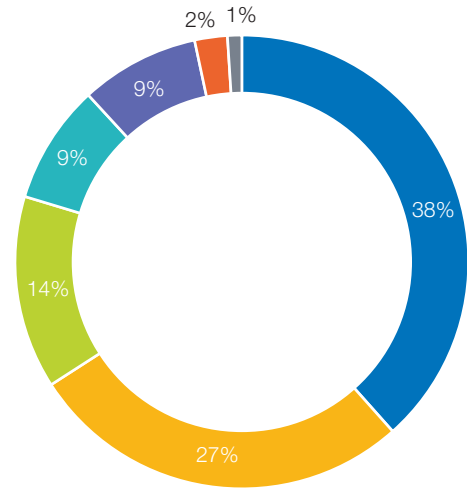


**Figure 1: Sample composition by subsector (number of companies)**



■ Product hardware/software   
 ■ Product/service software   
 ■ Semiconductor   
 ■ Fintech  
■ Cyber, Information security   
 ■ Internet, Gaming, E-commerce   
 ■ Biomedical, Medical device

**Figure 2: Sample composition by subsector (number of employees)**



## OPEN POSITIONS

This year we chose to focus only on the positions for technology professions that were open in the responding companies at the time of the survey. This eliminates potential differences in interpretations by companies when asked about the future recruitment plans, which we encountered in 2017. The main differences from the last year are as follows:

1. In 2017, some of the companies included in the population we used did not belong in the tech sector. This problem was corrected in 2018, making the population far more representative of the tech sector.
2. The 2018 sample has a much better representation of smaller companies, indicating that the demand for tech employees for small companies is significantly higher in percentage terms than in larger companies. Consequently, we restrict our attention to estimates that consider the differences in the intensity of opening positions across firm sizes and categories of firms/professions. In retrospect, we know that the 2017 estimates that did not take size differences into account were biased downwards, as they assumed similarities in hiring propensity across all firm sizes.
3. Consequently, the range of estimates this year is higher as well as much tighter than last year: 14,100 to 16,500 averaging around 15,300 (See Table 2). The methodology is described below. We performed several robustness tests – all the estimates fall within the same range.
4. This is a sizably larger estimate than the last year’s 12,000. We believe that the actual increase is smaller, as the last year’s estimate was biased downwards due to considerations described in # 3 above. Still, there seems to be a significant increase in open positions, potentially indicating higher demand for employees in a growing industry, and a consequently more significant difficulty in attracting talent.

As of Q2 2018, the number of open positions in the tech sector is estimated to be between 14,083 and 16,495, as detailed in table 2 below.

**Table 2: Estimation of open positions**

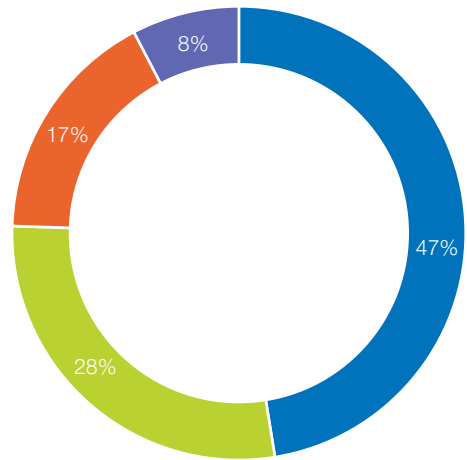
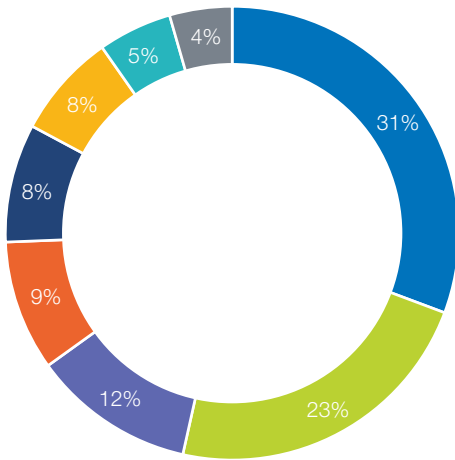
Estimation method	Number of open positions
Estimation by professions and company size	14,083
Estimation by sectors and company size	16,495
<b>Average</b>	<b>15,289</b>

Figure 3 indicates that the largest number of open positions (31%) are in Software and Product Infrastructure – specialties that include Dev Ops, Front-End and Back-End. The second largest (23%) is in Other Technological Professions, and the third largest category is Machine Learning, Algorithm, and Data Scientists with 12%.

Partitioning by sector, Internet-Software is the largest, with almost half of all openings.

**Figure 3: Open positions by profession**

**Figure 4: Open positions by sector**

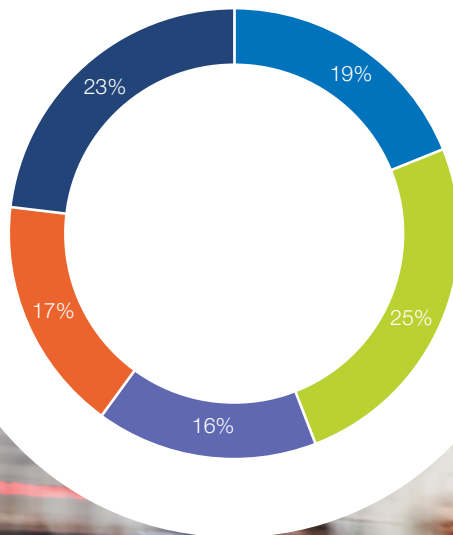


- Software and Product Infrastructure
- Software/Hardware Testing
- Technological Professions - Other
- Information Systems
- Cyber and Information Security
- Hardware/Electronics
- Technological Support for Sales
- Algorithms, Data Scientist, Machine Learning

- Internet - Software
- Life Science - Clean Tech
- Mobile and Telecom Technologies
- Manufacturing - Industrial Technologies

Partitioning by the firm size, we can see significant hiring effort in all firm size categories, and the distribution is fairly even. The largest number of openings are in growing companies of 11-50 employees, and in the larger companies of more than 500 employees.

**Figure 5: Open positions by company size (estimation by sectors)**

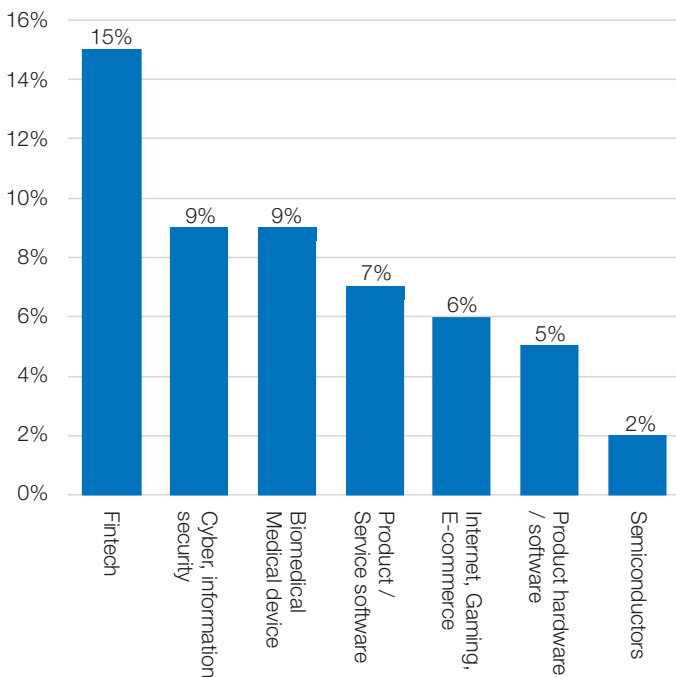


- 1-10
- 11-50
- 51-200
- 201-500
- 500+

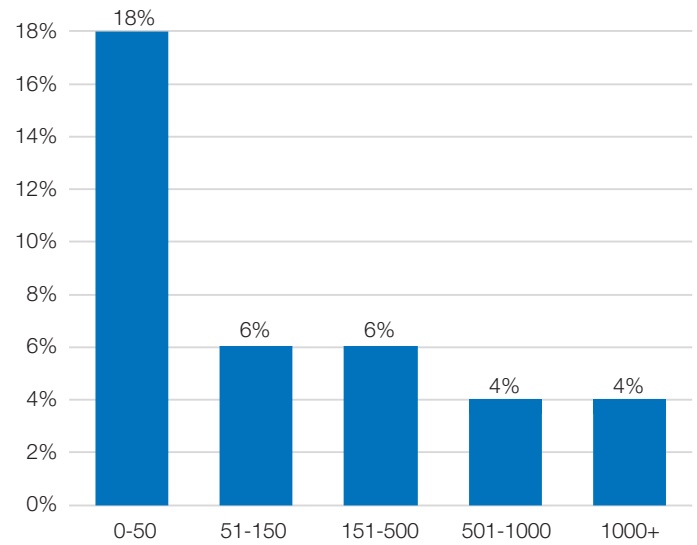


Figures 6 and 7 show that there is a quite significant variability in our sample, in terms of the percentage of open positions relative to employment by sector and company sizes. Fintech and Cybersecurity show a significantly larger percentage, and small companies also exhibit a much higher percentage, presumably due to their small size. This indicates that size and sector are important factors when calculating the total estimate of open positions.

**Figure 6: Percentage of open positions in the total employment in subsectors**



**Figure 7: Percentage of open positions in the total employment, by firm size**



## METHODOLOGY

We have used two main estimation procedures:



### Estimation by sector and company size

The sample was divided into five company sizes and four sub-sectors. In each sub-sector/size bucket we calculated the aggregate number of open positions, and the percentage of the employment of surveyed firms in this bucket, out of the total population (i.e. the companies listed on the Start-Up Nation Finder platform). Under the assumption that the surveyed firms in the bucket are representative of the population firms in the bucket, we derived the number of open positions in the entire population.



### Estimation by profession and company size

The same exercise was performed using partition into buckets of eight profession groups and three company sizes. The total employment by profession is available only for firms that are Zviran's clients, and not for the entire sample. Consequently, the multiplier for each bucket in this methodology is based on the assumption that the proportion between the professions for Zviran's clients is identical in all the companies within the population.



# AUXILIARY SHORTAGE INDICATORS

The growing estimates of open positions may indicate an increasing shortage of tech professionals but could also be the sign of an increasing turnover of workers. In this section, we provide several auxiliary statistics, indicating that the market for tech prospects is indeed characterized by demand-driven shortage that grows much faster than the talent supply.

**Figure 8: High-tech employment<sup>4</sup>**

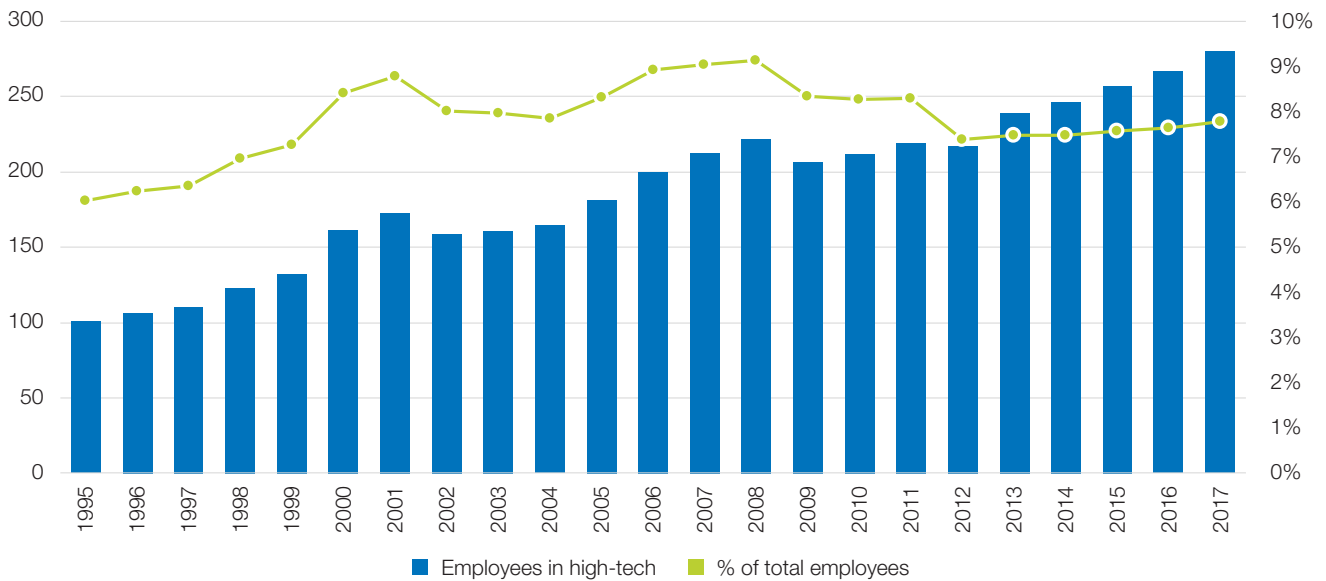
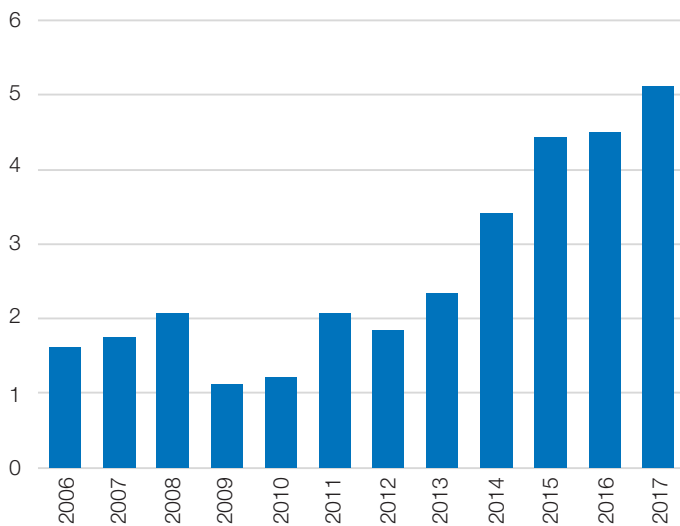
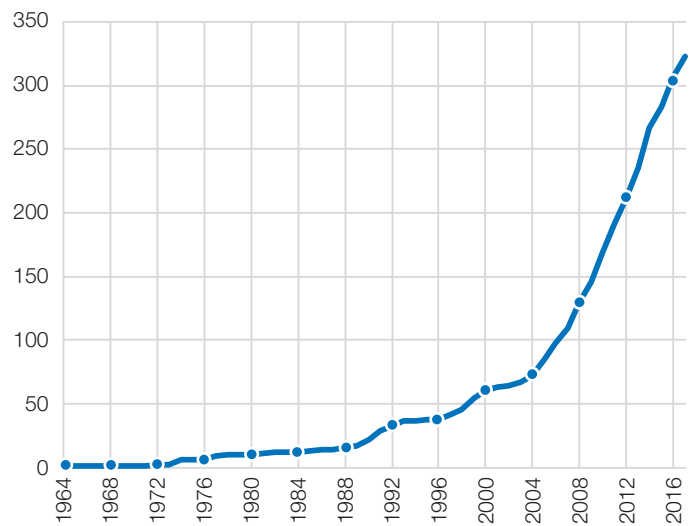


Figure 8 shows that over the last five years, the number of people employed in tech is growing, yet their percentage in the labor force is stagnant. This means that the number of employees in this sector grew at the same rate as the employees across the rest of the economy. This trend is surprising if one considers the substantial increase in the invested capital in Israeli tech companies during this period (figure 9), and the increase in the number of MNC R&D centers established in recent years (figure 10). This trend does not indicate the potential for a much higher rate growth of the tech sector in Israel, which may position Israel in the future as less competitive, given that the tech hubs elsewhere grow much faster.

**Figure 9: VC funding of tech firms (USD, billions)<sup>5</sup>**



**Figure 10: Evolution of multinational corporations presence in Israel<sup>6</sup>**

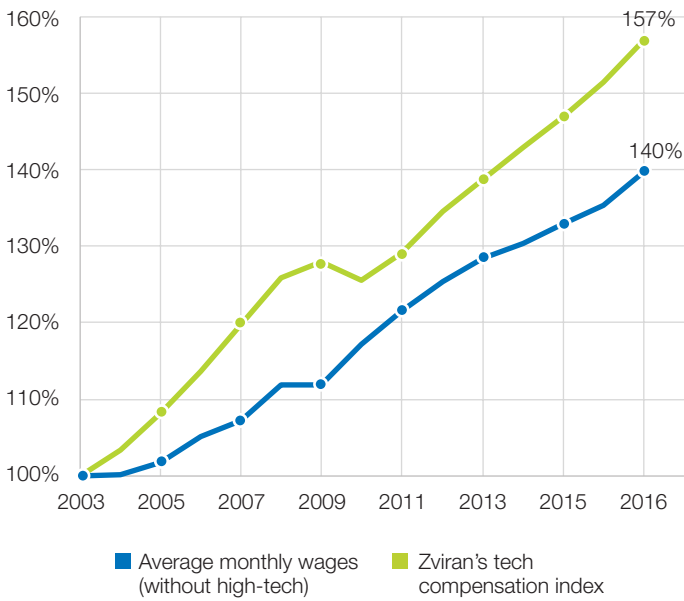


4 Source: Employees in the Tech sector, CBS 2018. These numbers differ somewhat from the CBS statistics, since we exclude telecom companies from the definition of the tech industry.  
 5 Source: Start-Up Nation Finder 2017, IVC Research Center.  
 6 Source: CBS, 2017.

Labor costs are usually a good indicator of the tightness of the market. In this case, as mentioned above, the effect of the shortage on labor costs is significantly dampened by the export of open positions to the countries where Israeli companies establish development centers (more about this below). Despite this effect, labor costs in the industry are growing more rapidly than in the rest of the economy.

Figure 11 indicates a higher growth rate of tech salaries, relative to that of average salaries in the economy, which is consistent with a significant surplus of demand over supply in tech professions. This also contributes to an increase in wage inequality in the Israeli economy.

**Figure 11: Salary growth—high-tech vs. market (100%=2003)<sup>7</sup>**

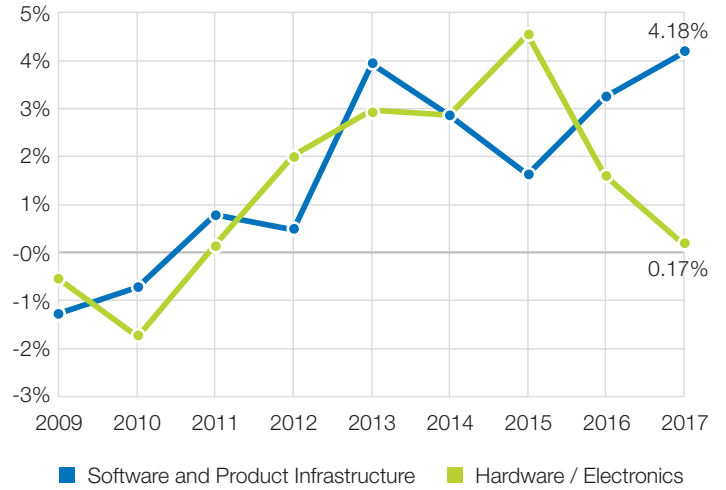


It is important to note that Figure 11 is based solely on salary data and does not include other forms of compensation, which are substantial in this sector.

Figure 12 reveals the continuing trend over the last five years of new hires' salaries in software professions increasingly exceeding those of incumbent employees holding the same positions. Firms tend to compete more aggressively for new hires than for the incumbent workers, and the difference is likely to intensify with the tightness of the market. In 2011 the difference was negligible, however, in 2017, it reached over 4% for software developers, rising over the last two years.

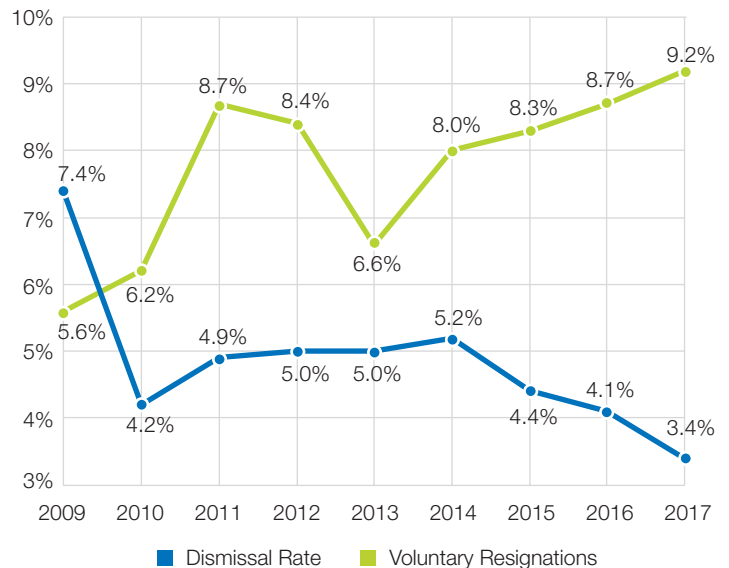
The same trend was observed in Hardware professions until last year and seems to have reversed in 2017. Almost all the open positions in Hardware in our survey are from a small number of large semiconductor and hardware companies, which have the lowest turnover of employees. These may have a dampening effect on competition.

**Figure 12: The difference between salaries of new hires and the incumbent employees in the same positions<sup>8</sup>**



The Israeli tech market has traditionally exhibited a significantly lower voluntary turnover (higher loyalty) of employees, compared to norms elsewhere. This has always been considered an advantage for companies setting up shop in Israel. As the competition for tech professionals became more intense, and salaries have risen, this pattern has begun to change, as shown in Figure 13. Companies seem hesitant to dismiss employees, while the latter are more inclined to change jobs. The period is characterized by a higher rate of voluntary resignations, together with a notable decrease in dismissal rates, both demonstrating the shift in power from employers to employees. The trend intensified quite significantly in 2017, bringing the difference between the two lines to 5.8% from 4.6% in 2016, and 1.6% in 2013.

**Figure 13: Turnover rate (voluntary resignations and dismissal rate)<sup>9</sup>**



7 Source: Average monthly wages per employee (current prices) – excluding high-tech, CBS 2018; Zviran 2018.

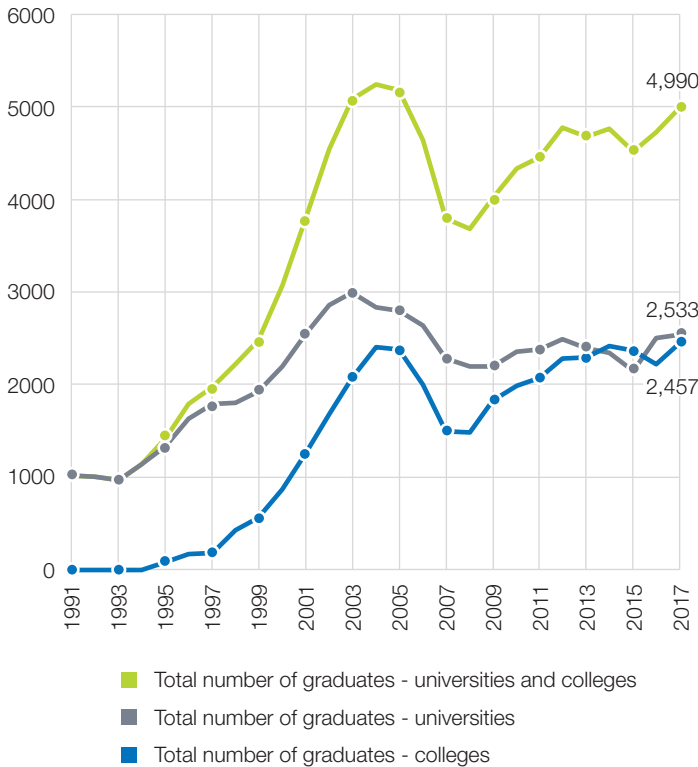
8 Source: Zviran, 2018.

9 Source: Zviran, 2018.

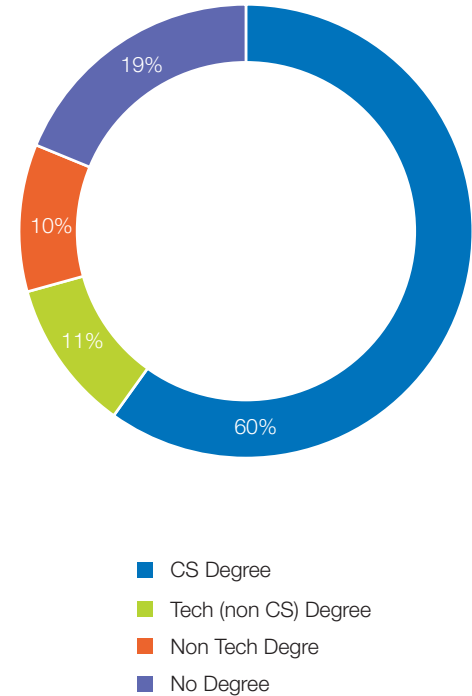
# LOCAL SUPPLY

Against the backdrop of both the current shortage and the growing demand for tech professionals, driven by investments and the potential growth of the sector, we need to evaluate the future sources of supply to provide an estimate of the future trends.

**Figure 14: Number of graduates – high-tech studies<sup>10</sup>**



**Figure 15: 2014 Status of all students that started computer sciences in universities in 2008<sup>13</sup>**



In 2017 the Israeli Government posted a target of a 40% increase in the number of students studying tech-related disciplines by 2022.<sup>11</sup> This is a very important milestone and is likely to be attained earlier, as we indicate below, but it now seems grossly insufficient for the industry trend. Moreover, an increase in the number of students may translate into a much smaller increase in the number of graduates who are employed in development positions in the tech sector, which is the important target. There are several challenges that need to be addressed.

The first challenge is the high attrition rate during the studies. As Figure 15 demonstrates, of all the students that started in the relevant disciplines in all the universities in 2008, only 60% completed their initial degree within 6 years, and only 70% got a degree in any high-tech relevant field.<sup>12</sup> It is imperative to reduce the attrition rate by utilizing a better selection process (including testing aptitude in addition to grades, as with medical schools), as well as investing resources (e.g. stipends, mentoring) to help students persevere during the tough course of studies. Some initiatives are already under way, but they must be scaled up.

The second challenge is that even when the graduates get their diploma, they may face difficulty getting a job in the tech sector (or not even bother applying). According to research by the Ministry of Finance and Ministry of Labor, on average only 75% of graduates enter the tech sector.<sup>14</sup> The rest presumably assume non-technical roles in the tech sector, fill tech demand in non-tech sectors (academia, finance, military, industry, government and so on), or transition to other occupations.

When calculating the required supply, these numbers must be taken carefully into account. The combination of the two factors implies that out of a class of 1000 first-year students, only about 525 end up working in technical professions in the tech sector six years later. It seems that there is an urgent need for additional policies that will increase the number of students, while reducing the attrition rate. Retraining graduates from adjacent fields is another route.

<sup>10</sup> Source: The Council for Higher Education of Israel, 2018.

<sup>11</sup> Source: Israeli Government decision 2292.

<sup>12</sup> Source: The Council for Higher Education of Israel, 2018.

<sup>13</sup> Source: The Council for Higher Education of Israel, 2018.

<sup>14</sup> Source: "Route to the Hi-Tech Industry",

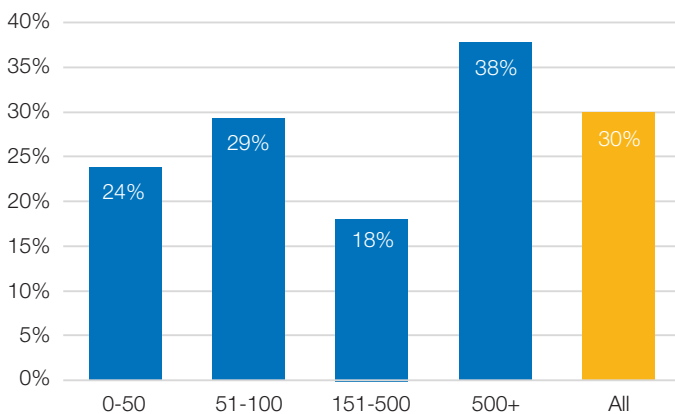
Yael Mazuz Harpaz and Zeev Kril, Ministry of Labor, Social Affairs and Social Services and Ministry of Finance, 2017.

## JUNIORS

Interestingly, some firms in the sector shy away from hiring juniors, particularly if they didn't study at a University, and show a strong preference for experienced workers. We have tried to estimate the extent of this phenomenon in the survey.

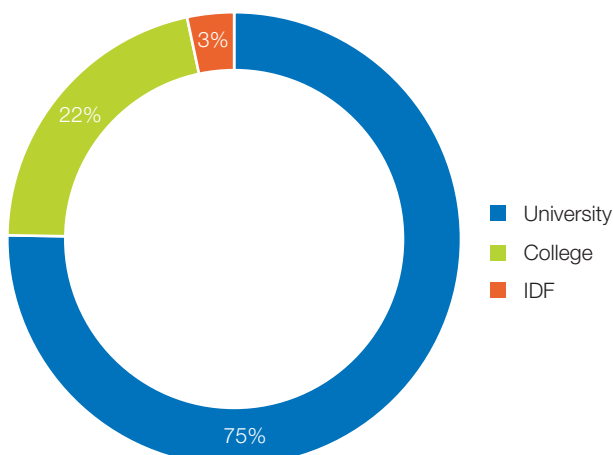
59% of companies reported hiring junior employees in the first 6 months of 2018, recruiting a total of 1,370 juniors into their ranks during this period. This represents about 30% of all the tech recruiting of these firms during that period. This percentage roughly increases according to firm size, and multinational corporations are somewhat more open towards juniors than stand-alone firms (33% vs. 26% of all new tech recruits, respectively).

**Figure 16: Percentage of juniors in H1 2018 tech hires, by company size**



We have asked companies about institutions whose graduates they hire. Only 101 companies responded to this question: out of 570 juniors these companies recruited in H1 2018, 75% are university graduates, 22% are college graduates, and 3% were hired directly out of the military. Since the number of students graduating from colleges roughly equals that of those graduating from universities, this means that there is a significant preference for university graduates, which further limits the effective supply of human capital to the companies. This finding is consistent with the anecdotal evidence that college graduates are more likely to be hired by firms and organizations outside the sector (financial institutions, government, industry, military, and so on).

**Figure 17: New recruitment, by training institute type**



We also asked which colleges companies favor, and only 32 companies responded. Their preferred choices were Tel Aviv-Yaffo Academic College (14) and Afeka College (9). Since most hiring companies (although not necessarily most hires) are located in Tel Aviv, to some extent these colleges are likely to be over-represented in this survey. We asked this question because we believe it is important to find out which institutions produce graduates that are highly valued by the sector. The correct way to answer this question is by comparing the data on actual recruiting and salaries across all training institutions in Israel. This will help the high-quality institutions to grow, and the lower quality institutions to improve. It will also allow potential candidates to enroll into institutions that can help them fulfill their dreams of working in core tech professions.

Juniors require on the job training (OJT) to become productive, which can sometimes take up to six months. Small companies do not have the capacity to train juniors, while larger companies may shy away from training, as it raises the market value of the recruits, and they are subsequently often lured away. Some countries have adopted methods, such as training levies, that provide strong incentives for companies to train workers, reducing the free rider problem.

Moreover, the nature of training for tech jobs has changed dramatically over recent years. Academic training is mandatory for some jobs, but for others it is either insufficient or not required. Coding bootcamps existed in Israel on a small scale prior to 2016, and have increased four-fold since, particularly since the launch of the Innovation Authority's support program. Other innovative non-academic initiatives include She Codes; and We Code, both supported by the Ministry of Labor. This new trend will contribute more junior programmers to the ecosystem. Bootcamps provide more practical training; therefore, these juniors may require less OJT. It may also be useful to incorporate bootcamp-like programs at the end of the academic degree. Future OJT programs may further ease the entry of juniors into tech companies.

## STUDENT EMPLOYMENT

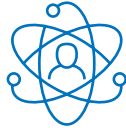
140 of the 299 companies (47%) that answered this question employ students, while they are still studying. This percentage grows significantly with size, reaching 90% of the largest companies. MNCs are much more likely to employ students (62%), partially due to their size, but also perhaps because of the tradition of internships in the parent companies abroad, which is a very good way to identify and retain employees early. Indeed, 60% of the students working in a company are retained after graduation as regular employees. Only 42% of local companies employ students. This may also be due to company size, as many local firms are small and have a limited ability to hire and train students. Nevertheless, this avenue should not be overlooked.

# SPOTLIGHT ON POSSIBLE SOLUTIONS

In this report, we spotlight three features of the tech employment market:



**Offshoring**



**Foreign experts in Israel**



**Diversity of the tech labor force**

## OFFSHORING BY ISRAELI COMPANIES

The industry has adopted a practice that allows it to cope with the shortage of local talent. Companies are increasingly establishing R&D offshore presence in locations which offer tech professionals at a lower cost. In fact, they are doing what many MNCs do when coming to Israel. In the short run, this is a positive development for Israel, as without this option many companies would have to relocate abroad. Moreover, this trend dampens the increase in tech wages in Israel. However, it is also clear that the Israeli economy would benefit more if these positions were created and filled in Israel.

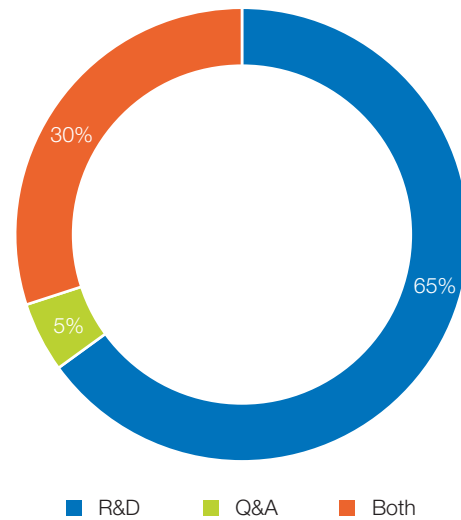
Of the 274 responding firms in our 2018 survey (this question was not asked of MNCs), 60 reported having a significant presence abroad (22%). Importantly, 30 of these companies established the presence over the last two years, indicating that the pressure is growing – due to the increasing difficulty to hire, higher wages and higher turnover. This substantial demand has created intermediaries who facilitate offshore alternatives and make offshoring easy to adopt even for small companies.

The tendency is less prevalent in small firms (17%), increasing to 44% in larger companies (200-500 employees), but then drops to 11% in firms that employ over 500 people. The latter (16 in total) are in part defense-related tech companies that have obvious difficulties in using offshore development centers.

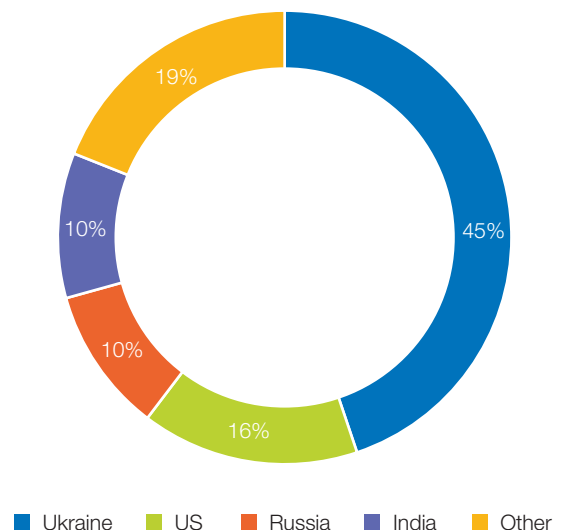
Figure 18 indicates that most firms with an offshore presence (65%) focus exclusively on R&D, while only 5% use it solely for QA purposes - 30% have both offshore R&D and QA operations. Firms that have an offshore presence on average employ 25% of their employees abroad. Clearly, once the presence is established, these outposts represent a significant alternative to hiring tech workers in Israel, which is becoming increasingly difficult and more expensive.

Figure 19 shows that the Ukraine, which in recent years developed this industry and positioned itself as a significant offshore destination, is the most prominent supplier among the polled firms. Interestingly, the US has become the second largest destination for firms that prefer having another development team closer to their market. India and Russia also feature prominently.

**Figure 18: Purpose of offshore presence**



**Figure 19: Offshoring destination (country)**





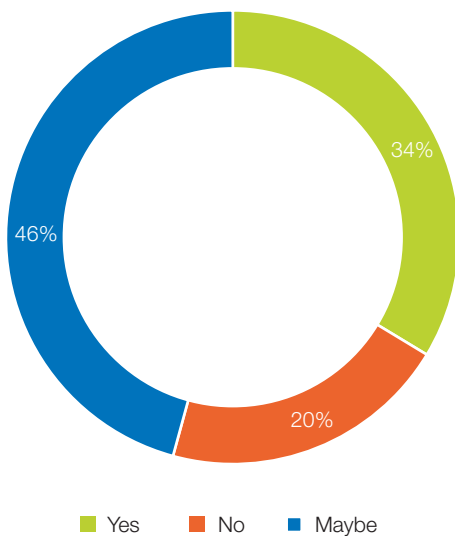
## FOREIGN EXPERTS

An alternative to hiring Israeli talent or establishing an offshore development center is to attract foreign experts to Israel. Until very recently the process of obtaining a permit was long, unpredictable, and costly. Consequently, only 10% of companies in the survey (38 in total, of which 22 are smaller) responded that they employ foreign experts, which represent about 1.5% of their total tech headcount. Figure 20 shows that 34% of the companies answered that they would definitely consider bringing foreign experts if there was a convenient and simple process. Another 46% said that they may reconsider, indicating that there might be a demand for foreign experts.

In the Spring of 2018 the Israeli Government took the unprecedented step of establishing a very convenient and rapid process for obtaining a special tech visa for tech companies recognized by the Innovation Authority. This change is being slowly recognized by the companies, and several dozen took advantage of the new procedure, bringing more than 120 foreign experts. While this a very important step, in our opinion, and based on discussions with companies, it is unlikely to create a massive inflow of tech personnel, as firms realize that it is easier and less expensive to hire large development groups in their countries of origin. This is especially true when a firm has already incurred the setup cost for such an operation. We expect this option to be used for attracting high-end specialists who are sought after by tech firms for their unique expertise.

Another source for talent is Israelis working abroad in tech companies. More than 500 tech professionals return to Israel every year. The Israel Innovation Authority created a value proposition and a (pilot) program to support their integration into tech companies in Israel.

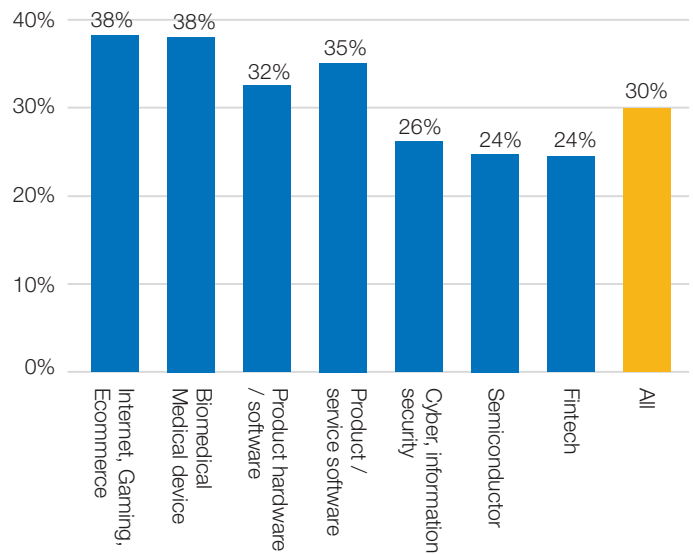
**Figure 20: Would you consider hiring a foreign expert if the process was simple?**



## DIVERSITY

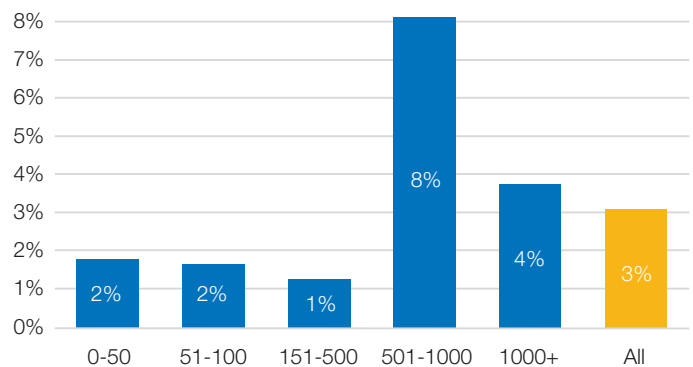
We asked the surveyed companies about their employment of women and Arabs, with responses from 357 and 325 companies respectively. While approximately 30% of all employees in the polled firms are women (Figure 21), they comprise only 23% of tech professionals and only 16% of tech management.<sup>15</sup> These numbers are aligned with the findings by the Ministry of Finance report that about 24% of women working in the Tech sector (see Figure 23).<sup>16</sup> 11% of responding companies report not having any women in tech positions, and 30% do not have women in tech management positions. Most of the latter companies are small, with fewer than 50 employees.

**Figure 21: Percentage of women in the total employment, by sub-sector**



While women are under-represented, in the case of the Arab population the situation is much more extreme: two-thirds of companies report of not having a single Arab tech employee (most of them are small companies of less than 50 employees). When they do, the average firm employs about 3% of Arab tech workers. Larger firms employ significantly more – about 8% (Figure 22). MNCs employ 4% versus 2.5% employed by stand-alone firms, which in some cases is a result of a targeted policy towards diversity.

**Figure 22: Percentage of Arabs in the total employment, by company size**



<sup>15</sup> The share of women in tech professions is estimated and based only on Zviran's database.

<sup>16</sup> Employees with a monthly salary of 16,772 ILS or more. Source: "Route to the Hi-Tech Industry", Yael Mazuz Harpaz and Zeev Kril, Ministry of Labor, Social Affairs and Social Services and Ministry of Finance, 2017.



Figures 23 and 24 present similar patterns based on CBS data: indicating the difference between the composition of the entire Israeli labor force and the labor force in the tech sector. As CBS includes telecommunication companies in the tech sector, the net differences are likely to be more drastic.

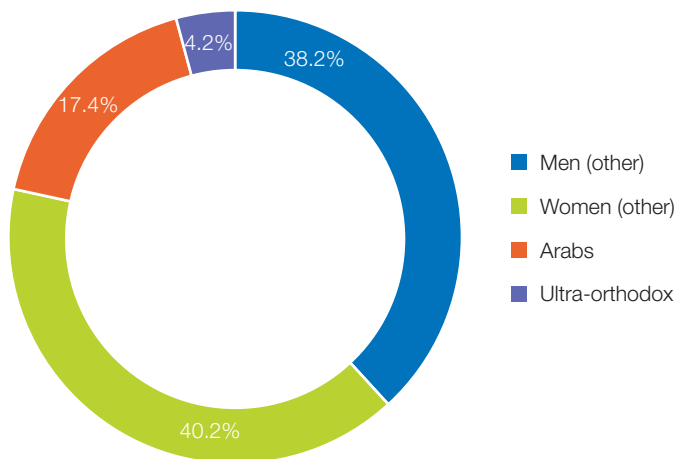
The spotlights indicate that while the tech sector is looking for creative solutions to alleviate the human capital shortage, it is not looking hard enough close to home. The resulting lack of diversity in its talent pool can potentially harm the industry.

There has been a dramatic trend reversal in recent years. In 2016 alone, there were more Arab tech-relevant students in academia than all the Arab graduates in over the previous 30 years – 1985-2014 (2,222 vs. 1,598 respectively).<sup>17</sup> Today, 18% of all Computer Science students in universities are Arab<sup>18</sup>, which is proportional to their share of the population.

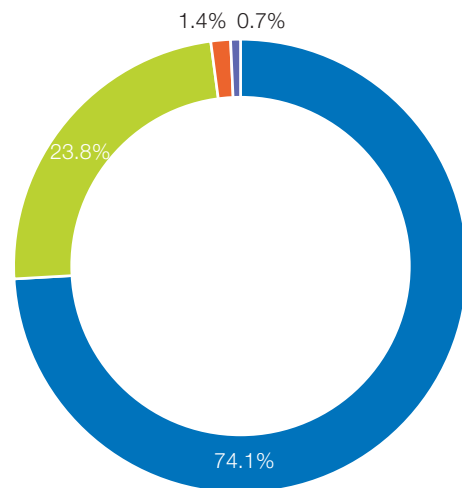
Similarly, Ultra-Orthodox women began studying software engineering at an associate degree level less than a decade ago and today there are nearly 600 new graduates every year. At the same time, they find it difficult to penetrate the core of the tech sector.

Tech companies must be shown that they can find tech professionals in the Arab and Ultra-Orthodox communities, which is a relatively new concept for many of them. Similarly, the graduates themselves need to be given hard and soft skills to help them fit into the core of the sector. Recent initiatives engage tech companies in prep courses for these populations to facilitate this process.

**Figure 23: Demographic composition of the general Israeli workforce<sup>19</sup>**



**Figure 24: Demographic composition of the high-tech workforce<sup>20</sup>**



17 Source: "Route to the Hi-Tech Industry", Yael Mazuz Harpaz and Zeev Kril, Ministry of Labor, Social Affairs and Social Services and Ministry of Finance, 2017.

18 The Council for Higher Education of Israel, 2018.

19 Source: CBS.

20 Sample population born in 1975-1985, as of 2014.

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

## SUMMARY

The number of open positions has grown to 15,000 in 2018, indicating what seems to be a growing gap between a rapidly rising demand for tech professionals that is not being matched by a similarly increasing supply. Auxiliary measures on the tightness of the tech talent market support this assertion.

Tech firms are looking for ways to alleviate this problem. The offshoring option, which has become increasingly available, seems to be the favorite, while longer-term solutions that require continuous investments to attract women, minorities, and juniors into the sector, still lag behind. We are also observing the emergence of innovative strategic approaches driven by NGOs and larger companies. These should be encouraged and expanded.

The Israeli government sees this issue as an utmost priority and has taken numerous steps to address it, including allocating sizeable budgets towards this. Some of these steps have been successful and are being scaled up. However, these measures take time, and more intense strategic approaches are needed to facilitate short-run remedies, as well as longer systemic solutions.





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