

Global Talent Mobility, Innovation and Growth

Case Study **‘Silicon Wadi’ – Israel** **(Tel Aviv and Haifa)**

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Ottawa
January 2023

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Focusing on the empirical case of the technology cluster of Tel Aviv and Haifa ("Silicon Wadi"), this profile examines Israel's high-technology sector, the country's development and existing migration policy programs, the current opportunities, as well as the barriers in the recruitment and retention of foreign professionals.

The aim of this study is to foster a deeper understanding of the role that policy programs and industry strategies play in attracting and retaining migrant professionals in STEM (Science, Technology, Engineering and Mathematics).

This study was made possible thanks to generous funding support provided by the Government of Ontario (Early Researcher Award, 2017-2022) and Mitacs (Globalink Research Award, 2018).

The authors of this report wish to acknowledge and thank all other members of the Global Mobility of Talent (GMT) research group who assisted in this research project and the publication of this report, in particular Olivia Dale, Juanita Molano and Erin Wilkins who contributed to different work processes leading to this report.

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Key Messages

➤ **The state of Israel faces persistent shortages of high-skilled professionals in sectors related to Science, Technology, Engineering and Mathematics (STEM)**

Despite a downward trend in 2010, the gap in the demand and supply of STEM skills remains a long-term challenge for the Israeli labour market. In 2017, Israel's Minister of Economy and Industry affirmed the country's need to double its high-tech workforce to 1 million workers within the next decade to remain globally competitive. Despite ongoing efforts, Israel's local supply of skilled STEM professionals is unable to maintain pace with Israel's innovative and growing technology sector.

➤ **Restrictive immigration policies pose significant barriers for companies to address their growing labour demands with the help of foreign STEM professionals**

While professionals with a Jewish background can permanently immigrate to Israel under the country's 'Law of Return', migrant professionals with a non-Jewish background are provided with virtually no pathways for permanent immigration. Work visas for non-Jewish migrant professionals are extremely rare, and most are only provided on a temporary or time-limited basis, are occasionally subject to quotas, and do not offer any pathways to permanent residency or citizenship.

➤ **Israel's government has only recently started to relax and liberalize some of its visa and immigration requirements to facilitate the entry and employment of non-Jewish skilled workers**

From 2017-2018, Israel announced new visa rules to permit a greater, but still limited number of experts and entrepreneurs in computer programming, engineering, and mathematics. Revisions to existing visa regimes leading to the 'Foreign Tech Expert Visa' provided more flexibility and transparency, but did not have a sufficient impact to resolve ongoing skills shortages.

➤ **Recruiting foreign talent is still not seen as a viable option to mitigate skills shortages**

From the start-up to the multinational level, recruiting from abroad is seen as almost impossible due to costly and opaque bureaucratic requirements. Recruiting from abroad is often not considered while hiring. Israeli companies are uncertain, reluctant, and wary of new or revamped visas for foreign talent recruitment, limiting the effects of these existing policy changes on the innovation ecosystem.

➤ **Despite these limitations and the COVID-19 pandemic, Israel's innovation ecosystem thrived**

Notwithstanding the frictions around foreign talent recruitment and the COVID-19 pandemic, the Israeli innovation ecosystem thrived, with several years of upward growth. Funding set new records, including venture capital and mergers and acquisitions, and more companies, including unicorn start-ups, emerged during the pandemic. This upward trend is predicted to continue in the coming years.

➤ **Resolving skills shortages depends on further changes to visa rules, and promotion thereof**

For Israel's persistent skills shortages to be resolved through foreign talent, visa and immigration processes must be simplified further, and these changes should be communicated clearly to companies. Poor understanding of visa rules and changes thereto have heavily influenced companies' reluctance to recruit abroad, indicating a clear need for awareness and promotional efforts by the Israeli government.

I. Economic Basis and STEM Sector

Prior to the emergence of the novel coronavirus (hereafter COVID-19), Israel had the highest per capita number of start-ups globally¹, and was frequently labelled as the world's leading 'start-up nation.'² In 2019, one year before the initial outbreak and global spread of COVID-19, Israel placed 20th on the World Economic Forum's Global Competitiveness scale.³ Israel's strong venture capital (VC) industry attracted twice the number of VC initiatives achieved by all of Europe combined.⁴ This strong performance continued during the pandemic. In 2020, VC initiatives increased 40% compared to the first half of 2019, demonstrating a quick resurgence.⁵ The upward trend continued further into the pandemic, with 2021 VC funding reaching a record high of almost triple the total in 2020.⁶

On average, 13% of Israeli firms develop new technological innovations each year.⁷ Israel has a culture of creative and progress-oriented thinking, reduced hierarchies, and normalized risk-taking, which makes it an attractive destination for innovation and entrepreneurship. Israel's innovation sector has drawn international attention, with large multinational corporations acquiring 15 to 30 Israeli start-ups per year to gain access to Israel's innovation sector and the country's local supply of innovators and professionals in the fields of Science, Technology, Engineering and Mathematics (STEM).⁸ While in 2020, the first year of the pandemic, Israel observed a downward trend in mergers and acquisitions (M&A) activity, this period of decreased activity was short-lived. As early as the first quarter of 2021, M&A activity in Israel had recovered, although the overall 2021 numbers did not match the pre-pandemic 2019 peak.⁹ Moreover, despite the pandemic and its associated significant economic challenges, more than 16 new Israeli companies emerged as 'unicorn'¹⁰ start-ups in 2020, representing 10% of all unicorns that emerged globally

¹ European Commission (2017a), European Innovation Scoreboard. Internal Market, Industry, Entrepreneurship, an SME, European Commission, https://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en.

² Senor, D. & Singer, S. (2009), *Start-Up Nation: The Story of Israel's Economic Miracle*. Hachette Book Group: New York, 16.

³ World Economic Forum (WEF) (2019), *The Global Competitiveness Report 2019*, 15, http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf.

⁴ Maune, A. (2017), "Developing Competitive Advantage Through Startups and Venture Capital in Emerging Markets: A View from Israel," *Risk Governance & Control: Financial Markets & Institutions* 7(3): 85.

⁵ Press, G. (2020), "Defying Covid-19, VC Funding of Israeli Startups Accelerates," *Forbes*, <https://www.forbes.com/sites/gilpress/2020/07/22/defying-covid-19-vc-funding-of-israeli-startups-accelerates/#212662472639>.

⁶ Meitar Law Offices (2021), *Israeli Tech Review 2021*, 10, <https://www.ivc-online.com/LinkClick.aspx?fileticket=eWRPYkVwBA%3D&portalid=0×tamp=1641128815294>.

⁷ Central Bureau of Statistics (CBS) (Israel) (2014), Findings from the Business Innovation Survey 2010-2012, http://www.cbs.gov.il/reader/newhodaot/hodaa_template_eng.html?hodaa=201412181.

⁸ Lopez-Claros, A., & Mia, I. (2006), Israel. Factors in the Emergence of an ICT Powerhouse, in: World Economic Forum (ed.) *Global Information Technology Report 2005-2006*, Palgrave Macmillan: Basingstoke et al, 100.

⁹ Meitar Law Offices (2021), "Israeli Tech Review 2021," 24; IVC - Meitar (2021), *The Israeli Tech Review Q1 2021: IVC* – Meitar, 2, 4, <https://online.fliphtml5.com/yrxoc/dvfl/#p=1>.

¹⁰ Unicorn describes a private startup company with a value of over \$1 billion.

that year.¹¹ Similar to VC initiatives and other activity, there was a continued upward swing in unicorn companies in Israel in 2021, with a record-breaking 33 Israeli companies emerging as unicorns.¹²

Since the turn of the millennium, Israel's economy has experienced an average annual growth rate of 3.8%.¹³ A major contributor to this success, Israel's main competitive advantage is unquestionably its high-tech sector and strong innovative capacity, driven by strong start-up activity. Israel is strongly export-oriented; exports account for 34% of the country's gross-domestic-product (GDP), with pharmaceuticals, high-technology, and agricultural equipment as leading products.¹⁴ Products generated by the country's large Information and Communication Technology (ICT) sector alone accounted for \$48.5 billion worth of exports in 2019, the equivalent of approximately 46% of all of Israel's exports. The mentioned products include high-tech goods, software, and other research and development-intensive (R&D) products (17% and 26% respectively of Israel's total exports in 2019).¹⁵ The importance of high-tech exports has grown continuously as the industry has developed in Israel, with high-tech exports making up over half (54%) of the country's total exports in 2021.¹⁶

Before the COVID-19 pandemic, multinational companies played a vital role in Israel's innovation ecosystem. Israel's per capita research spending was also among the highest in the world, at 5.4% of the country's GDP, double the average rate of other OECD countries.¹⁷ Foreign investments in Israel's R&D sector accounted for 49.2% of all business R&D expenditures in 2021.¹⁸ In 2010, approximately 220 multinational companies were operating in Israel, with the number of multinational companies reaching 362 by 2019, including *Google*, *Amazon*, *Facebook*, and other world-leading multinational technology companies.¹⁹

According to the European Innovation Scoreboard, Israel's strengths in innovation lie in company investments, employment impacts, and linkages.²⁰ However, the COVID-19 pandemic negatively impacted

¹¹ Zaken, R. (2021), "Israel Churns Out Tech Unicorns," *AI Monitor*, <https://www.al-monitor.com/originals/2021/04/israel-churns-out-tech-unicorns#:~:text=No%20fewer%20than%2016%20Israeli,a%20valuation%20of%20%241.4%20billion.>

¹² Ben-David, R. (2021), "33 Unicorns and \$25b in Funding," *Times of Israel*, <https://www.timesofisrael.com/33-unicorns-and-25b-in-funding-israeli-tech-sector-sets-new-records-in-2021/>.

¹³ World Bank (2021), GDP Growth (Annual %) - Israel, World Bank, <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=IL>.

¹⁴ World Trade Organization (WTO) (2018), *Trade Policy Review Israel*, 6-10, https://www.wto.org/english/tratop_e/tptr_e/tp476_e.htm.

¹⁵ Israel Innovative Authority (2020), *Israel Innovative Authority's 2019 Innovation Report*, 15, <https://innovationisrael.org.il/en/report/innovation-israel-2019-innovation-report>.

¹⁶ Jeffay, J. (2022) Israeli high-tech dominant export industry, but investment needed, *Israel21c*, <https://www.israel21c.org/israeli-high-tech-becomes-dominant-export-industry-but-uncertainty-looms/>.

¹⁷ Organisation for Economic Cooperation and Development (OECD) (2020), *Research and Development (R&D) - Gross Domestic Spending on R&D - OECD Data*, <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>.

¹⁸ OECD (2021), Main Science and Technology indicators database, www.oecd.org/sti/msti.htm.

¹⁹ IVC Research Center (2020), *The Israeli Tech Ecosystem – Social Network Analysis*, City: IVC, 3, <https://economy.pmo.gov.il/councilactivity/documents/ivc100121.pdf>.

²⁰ European Commission (2020), *European Innovation Scoreboard, Country Profile: Israel*, 70, <https://ec.europa.eu/docsroom/documents/41895>.

investment channels for many small high-tech companies, reducing funding received or causing delays to the funding process. A survey conducted by *Israel Innovative Authority and the Israel Advanced Technology Industries* (IATI) showed that about 90% of surveyed companies reported a delay in receiving financing, and 40% underwent a total freeze of their funding process.²¹

Another area of friction is the many contrasts in Israel's economy: it has a high rate of knowledge-intensive production, which masks low rates of productivity and levels of competition in its traditional manufacturing sectors, and to some extent agriculture as well.²² As is typical of many high-income and developed countries, services in Israel contribute over 71% to the country's GDP.²³ Meanwhile, Israel's industry and agricultural/extractive sectors accounted for 18.6% and 1.2% respectively in 2020.²⁴

The Tel Aviv-Haifa cluster is considered Israel's leading innovative cluster, specializing in biotechnology and high-tech manufacturing, along with related ICT industries, including data communications, software and hardware design, internet technologies, and military equipment.²⁵ Part of this broad coastline cluster of activity and innovation includes sub-clusters found in smaller cities such as Herzliya and Rehovot, among others.²⁶ These smaller cities are situated in between Tel Aviv and Haifa, at approximately 15-kilometer intervals, representing a dense swathe of available talent along the Tel Aviv-Haifa cluster. This region has also been named 'Silicon Wadi', representing its status as a global centre for technology as an analog for Silicon Valley in California, and includes offices for major multinationals such as *IBM, Intel, Microsoft, Qualcomm, Apple* and many more. The government of Israel has also implemented several incentives to build tech and STEM industry activity in cities outside of the Tel Aviv-Haifa corridor, such as Be'er Sheva, which it has declared the "cyber capital" of Israel alongside moving relevant technological divisions of the *Israeli Defence Forces (IDF)* to the city.²⁷ This initiative has seen significant success in expanding the representation of cities outside the Tel Aviv-Haifa corridor, in no small part because of vastly lower operating costs for companies and similarly lower costs of living for employees compared to the Tel Aviv cluster, and companies such as *Mastercard, Oracle, Dell* and *Microsoft* have since established R&D

²¹ Israel Innovative Authority and IATI (2020), *A Survey by the Israel Innovation Authority and IATI Small Businesses during the Coronavirus Crisis*, 2: https://innovationisrael.org.il/en/sites/default/files/High%20Tech%20Companies%20During%20Corona%20Crisis%20-%20May2020_English.pdf.

²² WTO (2018), 2-6.

²³ World Bank (2020), "Services, Value Added (% of GDP) - Israel | Data," <https://data.worldbank.org/indicator/NV.SRV.TOTL.ZS?locations=IL>.

²⁴ World Bank (2021), "Industry (Including Construction), Value Added (% of GDP) - Israel | Data," <https://data.worldbank.org/indicator/NV.IND.TOTL.ZS?locations=IL>; World Bank (2020), "Agriculture, Forestry, and Fishing, Value Added (% of GDP) - Israel | Data," <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=IL>.

²⁵ European Commission (2017a); Bresnahan, T. (2004), *Building High-Tech Clusters: Silicon Valley and Beyond*, Stanford: Stanford University Press, 5-10.

²⁶ Wonglimpiyarat, J. (2016), "Government policies towards Israel's high-tech powerhouse," *Technovation*, <http://dx.doi.org/10.1016/j.technovation.2016.02.001>.

²⁷ Spiro, J. (2022), "'If Beer Sheva Was Once the Backyard of the Innovation Scene, It's Now Coming to the Forefront,'" *Calcalist Tech*, <https://www.calcalistech.com/ctech/articles/0,7340,L-3929423,00.html>.

facilities in Be'er Sheva. This is just one example of how strong, targeted government intervention with a consistent approach and support for Israel's innovation and tech sectors has resulted in growth.

Israel's leadership in innovation can be traced back to the 1960s. Israel has strong academic institutions, and the importance of its military in its investment and training of highly skilled individuals in cutting-edge technologies cannot be overstated.²⁸ By the 1990s, Israel's high-tech industry was growing at an astounding annual rate of 15%. This was evidenced by the number of Israeli-developed patents registered in the United States (US), which almost doubled from 312 to 613 between 1991 and 1995.²⁹ In parallel, Israel's high-tech exports grew from \$4.5 billion in 1990 to \$9 billion in 1999.³⁰ This expansion was strengthened by the growth of a sizeable VC industry.³¹

The Israeli VC industry refers to both the VC industry and the VC market, which comprises the investments in the industry.³² For instance, the *Yozma Venture Capital Ltd.* was a 100 million USD publicly-held investment fund created in 1993 that aimed to encourage foreign VC financing.³³ This was implemented by providing matching funds to investors, which included measures to further reward investments that prove to be successful.³⁴ Moreover, the program included changes to the legal framework for VC that were more appealing to foreign investors through the provision of a 10-year fund life and standardization of practices with the US.

²⁸ Offenhauer, P. (2008), *Israel's Technology Sector*, Washington, Library of Congress, 2; Breznitz, D. (2005), "Collaborative Public Space in a National Innovation System: A Case Study of the Israeli Military's Impact on the Software Industry," *Industry & Innovation* 12(1): 45.

²⁹ Trajtenberg, M. (2001), "Innovation in Israel 1968-1997: A Comparative Analysis Using Patent Data," *Research Policy* 30(3): 369.

³⁰ Stone, R. (1999), "Israel Hits Rich Seam in Ex-Soviet Immigrants," *Science* 284(5416): 893.

³¹ Wonglimpiyarat, J. (2016), "Government Policies Towards Israel's High-Tech Powerhouse," *Technovation* 52-53: 19.

³² Avnimelech & Teubal (2006), "Creating venture capital industries that co-evolve with high tech: Insights from an extended industry life cycle perspective of the Israeli experience," *Research Policy*, 1477.

³³ Wonglimpiyarat (2016), 23.

³⁴ Lerner, J. (2010), "The Future of Public Efforts to Boost Entrepreneurship and Venture Capital," *Small Business Economics* 35(3): 260.

II. STEM Workforce

In the late 1990s, due to the rapid development of Israel's technology sector, the country had already started experiencing a shortage of skilled labour in its high-tech sector.³⁵ Immigration in the 1990s and 2000s helped mitigate the problem of skill shortages to some extent. Between 1990 and 2009, Israel admitted 1.25 million Jewish immigrants, of which 80% originated from the former Soviet Union. Many of these immigrants were well-educated high-skilled workers, with an average of 14.5 years of education as of 1999, and more than 100,000 of them were reported to hold degrees as scientists or engineers.³⁶ However, despite this extreme influx and other, far less significant inflows of non-Jewish talent, Israel experienced and, to this day, continues to experience a significant out-migration of high-skilled professionals, particularly with relevant degrees and/or professional experience in the STEM field. Many Israelis with undergraduate degrees in STEM tend to continue their education abroad, with 14% of those who complete their degree in the US remaining abroad for more than 3 years following their graduation on average.³⁷ In 2021, Israel's *Central Bureau of Statistics* estimated a shortfall of 14,000 employees in Israel's tech sector, including 10,000 in the software development sector.³⁸

Further complicating the availability of skilled labour in the tech sector are high rates of economic inequality that persist along ethnic, religious, and geographic lines, with continued annual growth in average salaries at the national level affecting some groups more strongly than others.³⁹ Arab Israelis, for example, account for 20% of the population but are largely underrepresented in STEM industries, along with Haredi (ultra-Orthodox) Jews, meaning that they are underrepresented in those industries which command the highest salaries.⁴⁰ Arab Israeli professionals with the same level of knowledge as Jewish Israeli professionals are significantly less likely to be hired for a well remunerated position in the high-tech sector than their Jewish counterparts.⁴¹ Disparities also exist along gendered lines, as Israeli women are less likely

³⁵ Globes (2000), "How Israeli High-Tech Happened," *Globes*, <https://en.globes.co.il/en/article-258771>.

³⁶ Ben-Yakov (2006), "Russians in Israel: Problems with Adaptation," [English translation] *CouHc (Sociological Research)*, 79, http://ecsocman.hse.ru/data/588/762/1219/Sotsis_3_06_p78-84.pdf; Getz D. et al. (2016), *Best Practices and Lessons Learned in ICT Sector Innovation: A Case Study of Israel*, World Development Report (WDR) 2016 Background Paper, 21, <https://openknowledge.worldbank.org/handle/10986/23644>.

³⁷ OECD (2018b), *Research and Development*, https://www.oecd-ilibrary.org/industry-and-services/researchers/indicator/english_20ddfb0f-en.

³⁸ Cohen and Gilead (2021), "Israel to Bring Foreign Professionals to Fill Tech Vacancies," *Globes*, <https://en.globes.co.il/en/article-israel-to-bring-foreign-professionals-to-fill-tech-vacancies-1001387752>.

³⁹ OECD (2018c), *OECD Economic Surveys: Israel*, <https://www.oecd.org/eo/surveys/Israel-2018-OECD-economic-survey-overview.pdf>; Taub Center for Social Policy Studies in Israel (2017), *State of the Nation Report*, <http://taubcenter.org.il/state-of-the-nation-report-2017-pr/>.

⁴⁰ Yashiv, E., & Kasir, N. (2015), *The Labor Market of Israeli Arabs: Key Features and Policy Solutions*, London: Centre for Economic Policy Research, 78, <https://cepr.org/publications/policy-insight-78-labour-market-israeli-arabs-key-features-and-policy-solutions/>; Ben-David, R. (2022), "Average salary in Israel falls slightly; tech wages hold steady," *Times of Israel*, <https://www.timesofisrael.com/average-salary-in-israel-falls-slightly-tech-wages-hold-steady/>.

⁴¹ Taub Center for Social Policy Studies in Israel (2019), 227.

to enroll in STEM disciplines and thus less likely to emerge into the tech labour supply.⁴² While Israel performs strongly on a global level, placing 21st for women's participation in STEM occupations in 2020, women still represented less than half (42%) of those employed in those occupations.⁴³ This disparity is further compounded by a disparity in the proportion of women in management positions, which earn higher salaries: in 2017, across the whole of the Israeli economy, only 34.6% of managerial positions were held by women in Israel, placing it 49th globally.⁴⁴ Similarly, in 2022, only 3.1% of firms were majority female-owned in Israel, meaning that women received proportionately less venture capital and other investments.⁴⁵ In this sense, although Israel performs well in terms of women entering the STEM workforce, the distribution of benefits from the STEM sector's performance is not as evenly distributed. Increasing the participation of women in this workforce, as well as resolving structural disparities in leadership, remains an area where further improvements can occur.

These kinds of severe disparities have resulted in proactive initiatives from certain stakeholders and organizations aiming to ameliorate the situation. For example, the independent non-profit organization *Start-Up Nation Central* has set in motion several programs aimed at helping underrepresented graduates in mathematics and computer science acquire necessary practical experience, and thus become more competitive and be able to secure a position in Israel's high-tech, start-up and innovation sector.⁴⁶ They have also launched programs targeting female Haredi students and other young women meant to promote high-tech academic studies and raise enrolment in those programs.⁴⁷ Similarly, the IDF have launched pre-enlistment programs to attract more young women to its cybersecurity training and eventual private sector STEM careers, reflecting the disparity between men and women in this field.⁴⁸

The presence of foreign, non-Jewish high-skilled professionals in Israel's workforce is very low, largely a result of the highly restrictive policy on foreign workers in the country. In 2020, for example, approximately 26,000 individuals entered the country on a work visa.⁴⁹ Of those 26,000, the majority (68%) came from countries in Asia, notably India (13.5%), and 29% from European countries, primarily the former Soviet

⁴² OECD (2017), *OECD Science, Technology and Innovation Outlook 2016*, https://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-innovation-outlook-2016_sti_in_outlook-2016-en

⁴³ International Labour Organization, *ILOSTAT*, "How Many Women Work in STEM?," February 11, 2020, <https://ilostat.ilo.org/how-many-women-work-in-stem/>.

⁴⁴ International Labour Organization, *ILOSTAT*, "Proportion of Women in Managerial Positions," https://www.ilo.org/shinyapps/bulkexplorer17/?lang=en&segment=indicator&id=SDG_T552_NOC_RT_A

⁴⁵ World Economic Forum, "Global Gender Gap Report 2022," July 2022, https://www3.weforum.org/docs/WEF_GGGR_2022.pdf, 203.

⁴⁶ Start-Up Nation Central (2022), Excellenteam, https://suvelocity.org/?page_id=3998.

⁴⁷ Start-Up Nation Central (2022), Adva, https://suvelocity.org/?page_id=4007; Start-Up Nation Central (2022), DevelopHer, https://suvelocity.org/?page_id=4440.

⁴⁸ Ben-David, R. (2021), "Pre-IDF Program Seeking Young Women to Train in Cybersecurity Skills," *Times of Israel*, <https://www.timesofisrael.com/pre-idf-program-seeking-young-women-to-train-in-cybersecurity-skills/>.

⁴⁹ Central Bureau of Statistics (2021), *Foreign Workers Who Entered Israel, 2020*, State of Israel, https://www.cbs.gov.il/he/mediarelease/DocLib/2021/363/20_21_363b.pdf.

Union (24%). Given the limited number of immigrants entering the country on work visas, their numbers in the tech sector are unsurprisingly small. In 2015, there were only 3,196 non-Jewish foreign experts working in Israel,⁵⁰ whereas in the same year nearly 30,000 Jewish immigrants came to Israel as newcomers under the country's 'Law of Return'.⁵¹ According to a survey conducted by the *Israel Innovation Authority* in 2019, non-Jewish foreign professionals account for less than 1% of Israel's work force in high-tech companies, and about 73% of surveyed companies stated that they did not see any real need to hire foreign professionals. This trend is reflected in 2020's cohort of work visa holders, the majority of whom were employed in construction, agriculture, or nursing depending on their countries of origin (Turkey and China, or Nepal and the Philippines, respectively).⁵² Meanwhile, the phenomenon of transferring some jobs and tasks abroad (outsourcing, offshoring) has increased over the years and has highlighted a correlation between the size of the company and its shortage of employees: large companies are more likely to hire offshore workers than smaller companies which, in turn, are likely to rely almost exclusively on local talent (i.e., local Jewish professionals).⁵³ Considering the significant presence of large multinationals in the Israeli high-tech sector, this may have potential implications as the trend continues to emerge.

In the 2000s, the high-tech and ICT bubble in Israel and elsewhere in the world suffered an unexpected crisis, resulting in a much weaker global demand for ICT products, and a slightly reduced demand for skilled workers in Israel's ICT and high-tech sector. However, it did not take long for Israeli start-ups and start-up culture to re-emerge, renovating the pressure on the demand for high-skilled workers.⁵⁴ In 2013, with a population of almost 9 million, only approximately 9% of Israel's workforce was employed in Israel's high tech sector.⁵⁵ Three years later, in 2016, a report published by the World Economic Forum ranked Israel only 17th in the world in ease of finding enough skilled professionals for its economy.⁵⁶ In the year that followed, Israel's government identified STEM sector skills shortages as a significant challenge for high-tech industries,⁵⁷ and determined that there was a need to double Israel's high-tech workforce to 1 million within the next decade.⁵⁸

⁵⁰ Data provided by the Department of Policy Planning in PIBA, as of 30 September, 2015.

⁵¹ Sokol, S. (2015), "Nearly 30,000 Jews immigrated to Israel in 2015," *Jerusalem Post*, <https://www.jpost.com/Israel-News/Nearly-30000-Jews-immigrated-to-Israel-in-2015-438409>.

⁵² Central Bureau of Statistics (2021).

⁵³ Israel Innovation Authority and Start-Up Nation Central (2019), 23, 13.

⁵⁴ Stakeholder Interview, *Start Up Nation Central, Israel*.

⁵⁵ Drori, G., & Netivi, A. (2013), *STEM in Israel: The Educational Basis for 'Start-Up Nation. Preliminary Report*. Jerusalem: The Hebrew University of Jerusalem, 18.

⁵⁶ World Economic Forum (WEF) (2016), *Human Capital Report*, 296, <http://reports.weforum.org/human-capital-report-2016/economics/#economy=ISR>.

⁵⁷ Israel Innovation Authority (2017), *Innovation Visas for Foreign Entrepreneurs (pilot)*, <http://innovation-visa.org.il/en/>.

⁵⁸ Ministry of Economy and Industry (2017), *Israel's Innovation Authority Report 2017*, State of Israel, <http://economy.gov.il/English/NewsRoom/PressReleases/Pages/Israel-Innovation-Authority-Report-2017.aspx>.

Although the Israeli innovation sector continued to exhibit strong growth – for instance, the number of multinational R&D centers active in Israel grew by 65% between 2010 to 2019, (from 220 to 362) the persistent lack of high-skilled talent has equally continued to pose a challenge.⁵⁹ In July 2019, just over half a year prior to the global outbreak and spread of COVID-19, Israel’s ‘High-Tech Human Capital Report’, released by *Israel’s Innovation Authority* and ‘Start-Up Nation Central’, stated that there were about 18,500 positions open in the tech industry, 8% more than the previous year. The same report also cited shortages of engineers, programmers, and scientists, and indicated that 27% of companies surveyed were already outsourcing particular jobs and tasks to skilled professionals based abroad. Most vacant positions were in software and product infrastructure (40%), other technical professions (21%), and hardware and electronics (10%).⁶⁰

Even in the face of the impacts of the COVID-19 pandemic and an overall downturn in economic conditions in that period, labour demand and the number of employees in Israel’s innovation industry continued to grow. In 2020, their number grew by yet another 8.2% compared to the previous year, another strong and remarkable indicator of Israel’s continued demand (and at the same time, persistent lack of) for skilled innovation and knowledge-workers.⁶¹ In April 2022, even after the onset of the Russia-Ukraine conflict with its impacts on public tech companies’ share values, the demand for labour continued to spike, with tech companies setting a new record of 32,900 open positions, of which two thirds were for tech roles.⁶² Moreover, difficulties in finding high-skilled talent appear to be worsening. In a recent survey of Israeli high-tech firms, while the majority (84% of surveyed firms) reported that they were actively hiring in 2021, 85% of firms reported difficulties in recruiting R&D employees, 20% more than in the previous year.⁶³

To address these continuous skill and talent gaps, *Israel’s Council for Higher Education* has put in place a multiyear program to increase the number of Israeli undergraduates in high-tech disciplines by 40%, compared to 2016.⁶⁴ As part of the same multiyear plan, it has also established a program aimed at increasing the number of foreign students in Israel. The forecasted target of international students in Israel

⁵⁹ Israel Advanced Technology Industries (2019), *Multinational Companies (MNC) – Contribution to the Israeli Tech Ecosystem*, 4, <https://www.iati.co.il/files/files/IATI%20MNCs%20Report%202019.pdf>.

⁶⁰ Israel Innovation Authority and Start-Up Nation Central (2020), *High-Tech Human Capital Report 2019*, 6 and 10: https://innovationisrael.org.il/en/sites/default/files/High%20Tech%20Human%20Capital%20Report%202019%20-%20English_25.02-compressed.pdf.

⁶¹ Israel Innovation Authority and Start-Up Nation Central (2021) *High-Tech Human Capital Report 2020*, 19: <https://innovationisrael.org.il/en/sites/default/files/2020%20Human%20Capital%20Report%20-%20For%20Press%20Release%20-%20English.pdf>.

⁶² Start-Up Nation Policy Institute and Israel Innovation Authority (2022), *Israeli High-Tech Human Capital: A Snapshot*, https://www.storydoc.com/ee95ba65ce2b62c1/1ef75f45-05cb-4e84-a0b9-b8f9e24e4d0e/62cbb890b5f0e7000a399460?utm_source=storydoc&utm_medium=hp&utm_campaign=HC2022_ENG_%20media%20source%20innovation&utm_content=00ub8zmf0WUPaRsOA5d6.

⁶³ Start-Up Nation Policy Institute and Israel Innovation Authority (2022), *Israeli High-Tech Human Capital: A Snapshot*.

⁶⁴ Council for Higher Education (Israel) (2018), *Multiyear Plan 2017-2022*, 31-32, <https://online.anyflip.com/cdkp/akak/mobile/index.html>.

for 2022 was set to approximately 24,000, compared to 11,000 in 2017.⁶⁵ Despite this increase, only 1.4% of Israel's students were from outside the country as of 2019, compared to an OECD average of 6%.⁶⁶ Overall, notwithstanding these programs, the total number of students enrolled in STEM degrees in Israel (including Israeli nationals) has remained relatively stable over the last decade, with a steady growth amounting to a 2.51% increase in the 2020-2021 academic year over the previous year and approximately 100,000 students in total across all levels of post-secondary education.⁶⁷

In addition to the education lens, the acquisition of professional experience and recruitment are also challenging areas where proactive measures have proven necessary, since the market's demand for skilled labour has grown consistently, including during the pandemic. One such proactive measure is the *Israeli Innovation Authority's* program called 'High-Tech Specialization for First Job Employees (Juniors)', which provides companies with financial incentives to train and hire junior job-seekers with limited professional experience in order to advance the supply of skilled talent.⁶⁸ This reflects the need for mechanisms to support the development of juniors (employees with up to two years of experience) to meet the demand for higher-skilled labour. Juniors made up 20% of employees in the internet and software sector in 2020, compared to 4% in telecommunications and 7% in industrial manufacturing, making them a major contributor to the labour pool.⁶⁹ During the COVID-19 pandemic, juniors experienced noticeable employment shifts in the Israeli tech sector. In 2020, there was an increase in juniors employed by companies that benefited from the pandemic (37%).⁷⁰ This may have been a result of an increasing difficulty in hiring during this period, as more experienced employees were not as mobile and less likely to voluntarily resign.⁷¹ However, this trend was short-term and quickly reversed, with entry-level employees falling from 32% of new recruitment in R&D in 2020 to 22% in 2021 as more experienced employees began to change jobs at higher rates.⁷² Difficulties in junior hiring reflect the need for additional development resources to make the most of the available labour supply.

Another unique element of the Israeli STEM labour market that is interwoven through all stages – including education, initial recruitment, and career-building – is the country's mandatory military service of two years for women and three years for men. The first major consideration in terms of its effects on the Israeli STEM

⁶⁵ Council for Higher Education (Israel) (2019), *International Students*, <https://che.org.il/en/program-goals-average-increase-118-percentage-international-students-accepted-israel/>.

⁶⁶ Council for Higher Education (Israel) (2019).

⁶⁷ Central Bureau of Statistics (2021), *Higher Education in Israel 2009/10 – 2020/21*, State of Israel, 3. <https://www.cbs.gov.il/he/Statistical/ascala189.pdf>.

⁶⁸ Israel Innovation Authority, *High-Tech Specialization for First Job Employees (Juniors)*, <https://innovationisrael.org.il/en/program/high-tech-specialization-first-job-employees-juniors>.

⁶⁹ Israel Innovation Authority and Start-Up Nation Central (2021), *High-Tech Human Capital Report 2020*, 6, <https://startupnationcentral.org/wp-content/uploads/2021/04/2020-Human-Capital-Report-Eng.pdf>.

⁷⁰ Israel Innovation Authority and Start-Up Nation Central (2021), *High-Tech Human Capital Report 2020*, 6.

⁷¹ Israel Innovation Authority and Start-Up Nation Central (2021), *High-Tech Human Capital Report 2020*, 6.

⁷² Start-Up Nation Policy Institute and Israel Innovation Authority (2022), *Israeli High-Tech Human Capital: A Snapshot*.

workforce is that mandatory service in some ways functions as a delay on young Israelis' entry into the workforce, by several years. This is compounded by post-secondary education, meaning that any impacts of changing populations of youth in Israel will lag in their mitigation on the shortfall of workers in the STEM sector.

However, the strong influence of the IDF also significantly expands the perception and desirability of STEM careers among Israeli youth beyond what is found in other countries, with highly impactful results. Describing the Israeli entrepreneur "lifecycle," the former Commander of the *Israeli Communication and Cyber Defence School* (the institution responsible for training all serving personnel headed to cybersecurity and communications units of the IDF) noted that entrepreneurs in the STEM sector are made in childhood, with early emphasis on studying computing and math and extracurriculars to reinforce this priority.⁷³ The desirability of these careers is such that youth undergo significant preparation for the IDF screening test in order to achieve admittance to a high-intensity training program followed by a professional placement in a complex applied technological role.⁷⁴ The role of this competitive process in producing highly-skilled tech experts at relatively young ages is well understood, with the most selective units becoming a "start-up machine" whereafter serving in the IDF, members go on to found start-ups worth billions.⁷⁵ Companies resulting from this IDF-to-private sector pipeline include *Wix*, *Waze*, *NSO*, and many others.⁷⁶

On the whole, although IDF service represents 2-3 years of time during which domestic labour is delayed from entry into the market, the strong supports and systematic training it provides contributes heavily to the disproportionately high number of high-tech experts, founders, and companies in Israel.

⁷³ Nir, S. (2022), "Cyber Security Conference in the Danish Parliament," (Presentation, Center for Science and Commercial Diplomacy, Copenhagen, Denmark, June 24, 2022).

⁷⁴ Nir, "Cyber Security Conference in the Danish Parliament."

⁷⁵ Behar, R. (2016), "Inside Israel's Secret Startup Machine," *Forbes*, <https://www.forbes.com/sites/richardbehar/2016/05/11/inside-israels-secret-startup-machine/>.

⁷⁶ Tendler, I. (2015), "From The Israeli Army Unit 8200 To Silicon Valley," *TechCrunch*, <https://social.techcrunch.com/2015/03/20/from-the-8200-to-silicon-valley/>.

III. Recruitment and Retention of Migrant Professionals in STEM

The *Law of Return* of 1950 and the *Citizenship Act* of 1952 form the backbone of Israel's immigration policy framework. This legislation effectively allows any Jewish person, as well as the child or grandchild of a Jewish person, to immigrate to and gain citizenship in Israel. Though Israel's immigration policy is thus mostly limited to ethnic Jewish immigrants who enter under the Law of Return, there are some temporary migration flows of non-Jewish foreign workers according to demand and legislative approval. In addition, Israel records a certain level of irregular migration and visa-overstayers.⁷⁷ These inflows, both on valid work permits and otherwise, are subject to constraints on their ability to engage with the labour market and their earnings potential. For non-Israeli citizens in the country, labour market access has been almost completely limited to the sectors of agriculture, construction, and care-work.⁷⁸ Furthermore, most foreigners without Jewish background are limited to temporary work, leaving them almost no possibility to find permanent employment, including in desirable sectors such as high-tech, innovation, and STEM.

In the immediate lead-up to and in the aftermath of the dissolution of the Soviet Union in 1991, more than 1 million Jews from the former Soviet Union migrated to Israel.⁷⁹ This wave of immigration increased the number of engineers in Israel from 30,000 to 110,000 and physicians from 17,000 to 30,000 in a relatively short time span.⁸⁰ This influx of labour was a boom to Israel's high-tech industry during the 1990s. However, after this wave ended, and most high-skilled workers from the former Soviet Union had immigrated to Israel, the in-flow of professionals of Jewish background fell significantly. While the possibility of recruiting foreign, non-Jewish professionals was considered in policy and industry circles since the dramatic decrease in suitable immigration, there had been no shift in policy until 2018, and actual inflows of high-skilled migrants have remained negligible throughout that period.⁸¹ As of October 2021, of

⁷⁷ Central Bureau of Statistics (Israel) (2022), *Foreign Citizens Who Entered Israel on a Tourist Visas Starting from 2008 and Remained in Israel After Their Licenses Expired Through the End of 2020*, <https://www.cbs.gov.il/en/mediarelease/pages/2022/foreign-nationals-who-entered-starting-in-2008-and-continued-to-stay-in-israel-after-visa-expi.aspx>.

⁷⁸ Rajman, R and Kemp, A. (2010), *The New Immigration to Israel: Becoming a De Facto Immigration State in the 1990s*. Oxford University Press: Oxford.

⁷⁹ Rajman and Kemp (2010).

⁸⁰ Razin, A. and Sadka, E. (1993), *The Economy of Modern Israel*, The University of Chicago Press: Chicago, 31.

⁸¹ Central Bureau of Statistics (Israel) (2017), *Job Shortages*:

http://www.cbs.gov.il/reader/newhodaot/hodaa_template_eng.html?hoda=201820107

Central Bureau of Statistics (Israel) (2018), *Percent of Unemployed Persons*:

http://www.cbs.gov.il/reader/cw_usr_view_SHTML?ID=417; Stakeholder Interview, *Start Up Nation Central, Israel*; Cohen, T. and Rabinovitch, A. (2016), "Israel's High Tech Boom Threatened by Shallow Labour Pool," *Reuters*, <https://www.reuters.com/article/us-tech-israel-employment-idUSKCN0ZK0ZF>

the 128,122 foreign workers in Israel, only 6% were categorized as ‘experts’ or high-skill migrants, compared to 55% in nursing, 16% in construction, and 23% in agriculture.⁸²

3.1. Return migration strategies and policies

Despite Israel’s persistent insufficient talent supply, it has become a major global source country for high-skilled migrants.⁸³ Many graduates and skilled professionals continue to leave Israel and find jobs in other innovation clusters, including first and foremost Silicon Valley (US). Israel has tried to address this continued loss of talent by developing measures to actively encourage and facilitate the return of its high-skilled workers abroad. The first so-called ‘maintain/return’ policy was developed in the early 1980s.⁸⁴ More recently, in 2009, Israel introduced the ‘brain return program’, and both Israel’s *Ministry of Immigrant Absorption* (MOIA) and Israel’s *Innovation Authority* tried to encourage and facilitate returns by adopting a “proactive policy of repatriation” and setting up initiatives to preserve and strengthen contacts of Israel expat professionals with Israel’s high-tech industry and their Jewish identity abroad.⁸⁵

	Benefits
1968 – late 1970	Gave potential returnee migrants the same economic and social benefits that were previously reserved only for Jewish immigrants newly relocating and settling in Israel. ⁸⁶
1977	Created a time-limited opportunity in which high-skilled returnee migrants received economic incentives to return. This program was not implemented due to public criticism. ⁸⁷
1998	Offered returnees with financial incentives/grants, and focused on repatriates with a particular need for economic help (e.g., single mothers). The program was not particularly focused on high-skilled returnees and received strong public criticism. ⁸⁸
2008 – present	“Back to Tech Program” – Focuses on returning skilled Israelis and encouraging them to seek employment in Israel’s high-tech sector. ⁸⁹

Table 1

⁸² Fox et al. (2022), Labor Market Report (2021), *Ministry of Economy and Industry - Labour Branch*, 91, https://www.gov.il/BlobFolder/news/employment-report/he/news_employment-report2021.pdf

⁸³ Gould, E. and Moav, O. (2007), “Israel’s Brain Drain,” *Israel Economic Review* 5(1): 1-22, 3.

⁸⁴ Cohen, N. (2013), “From Nation to Profession: Israeli State Strategy Toward Highly-Skilled Return Migration, 1949-2012,” *Journal of Historical Geography* 42(1): 14.

⁸⁵ Cohen, N. (2016), “A Web of Repatriation: The Changing Politics of Israel’s Diaspora Strategy,” *Population, Space, and Place* 22(3): 288-300.

⁸⁶ Cohen, N. (2009), “Come Home, Be Professional: Ethno-nationalism and Economic Rationalism in Israel’s Migration Strategy,” *Immigrants & Minorities* 27(1): 12-14.

⁸⁷ Cohen, N. (2009): 14-15.

⁸⁸ Cohen, N. (2009): 18.

⁸⁹ Israel Innovation Agency (2019), *Back to Tech Program*, <https://innovationisrael.org.il/en/program/back-tech-program>

In total, four short-term policies were actioned between 1968 and 2008 (*see table*), which aimed to bring back high-skilled Israeli migrants. Israel's return programs sought to offer social and economic incentives such as tax relief, job search assistance, and language programs for overseas-born children. However, not all were successfully implemented.

3.2. Recruitment of non-Jewish migrant professionals

To be invited to Israel as a non-Jewish foreign expert, both the employer and the future worker must undergo a three-step procedure. The first step is getting an Employment Permit that only authorizes the invited expert to work for the initial sponsoring employer. The success of the application depends on the quality of the prepared documents and can take up to 45 days. Any rejection might negatively impact not only the foreign applicant, but also the employer in future applications, increasing the potential cost. The second step is obtaining Israel's B-1 Entry and Residence Visa. This step usually takes up to 45 days and can be extended if additional security checks are required. The third and last step for foreign applicants is getting their visa physically stamped in their passport upon arrival in Israel, which converts the temporary, single-entry visa issued at the earlier stage into a multi-entry visa allowing them to freely enter/exit the country for the duration of the visa.⁹⁰ Overall, the minimum period required to obtain a visa for foreign experts in Israel is thus approximately three months, but can be significantly longer, and delays accumulate easily due to the many steps and processes involved.

Until very recently, there was no program that specifically targeted non-Jewish high-skilled migrants. However, a new 'Innovation for Entrepreneurs Visa' and a 'High Tech Visa' were launched in 2017 and 2018 respectively; both targeted non-Jewish, non-Israeli skilled professionals and entrepreneurs, although the latter also targeted foreign professionals eligible under the Israeli Law of Return and students currently studying in STEM programs in the country.⁹¹ In the 2019 budget, Israel's parliament made it easier for firms to hire foreign workers, though employers are still required to offer double the average salary of an Israeli professional to be able to recruit a non-Jewish and non-Israeli expert.⁹²

The *Israel Innovation Authority*, mentioned earlier, was created in 2017 and given government jurisdiction over all aspects concerning Israel's innovation ecosystem. Bureaucratic responsibilities were re-drawn, additionally giving the *Innovation Authority* jurisdiction over programs aimed at addressing skill shortages in the tech sector.⁹³ The *Innovation Authority* spearheaded the release of Israel's new 'High Tech Visa' in

⁹⁰ Kan Tor and Acco, *Frequently Asked Questions: FAQ B-1 Work Visa*, Global Corporate Immigration Law, <https://ktalegal.com/practice-areas/israel-immigration/b-1-work-visa/faq-about-b-1-visa-to-israel/>.

⁹¹ Cohen and Gilead, "Israel to Bring Foreign Professionals to Fill Tech Vacancies."

⁹² Rubin, E. (2018), "Israel Plans Measures to Ease Way for More Foreign Tech Workers," *Haaretz*, <https://www.haaretz.com/israel-news/business/israel-plans-measures-to-ease-way-for-more-foreign-tech-workers-1.5630267>.

⁹³ Stakeholder Interview, *Bar-Ilan University, Israel*.

2018, establishing the conditions and criteria for the employment of foreign experts in Israeli high-tech companies.⁹⁴ This visa currently regulates the employment of foreign experts in high-tech companies. It provides foreign experts with the possibility to work in Israel for one year on an initial permit, which can then be re-issued and extended for up to 5 years and 3 months. To be able to apply for this visa, Israeli employers are required to provide double the average salary to their foreign applicant. As a company, they are also required to officially register as a high-technology or cyber technology company with the *Israel Innovation Authority*. The processing time for the new visa was significantly reduced to only 6 working days. The new visa also provides an open work permit for spouses (EAB B-1), which is a general work visa, meaning that there are, for example, no minimum wage requirements or restrictions to certain employment sectors.

Another track of the same visa program targets international students currently studying technological subjects in Israel who wish to acquire experience in the sector before returning to their countries of origin. However, this track is currently limited to no more than 500 work permits at any one time for this class of applicants, limiting its total impact on the labour shortage.⁹⁵

In addition, as of April 10, 2022, the framework for visas for foreign tech experts was amended to reflect changing dynamics in Ukraine. Under the new visa rules, tech companies are able to recruit high-tech experts from Ukraine, including their families, for up to 90 days.⁹⁶ This visa process is exempt from minimum salary limitations otherwise applied to non-Jewish applicants under the Foreign Tech Visa rules, and also offers room for applications for 90-day extensions.

⁹⁴ Kan Tor and Acco (2019), *High Tech Work Visa (HIT)*, Global Corporate Immigration Law, <https://www.ktalegal.com/israel-immigration/b-1-work-visa/high-tech-work-visa-hit>.

⁹⁵ Cohen and Gilead, "Israel to Bring Foreign Professionals to Fill Tech Vacancies."

⁹⁶ Israeli Innovation Authority (2022), *Visas for Foreign High-Tech Experts Incentive Program*, <https://innovationisrael.org.il/en/program/visas-foreign-high-tech-experts-incentive-program>.

IV. Stakeholder Viewpoints

This section comprises a series of stakeholder viewpoints collected through semi-structured interviews and informal discussions with various relevant stakeholders, focused on recruiting high-skilled foreign talent in Israel, the governmental policies of attraction and retention, and possible solutions for mitigating existing labour shortages. The stakeholders who were consulted for this small study included technology and innovation sector companies, individuals employed in the sector, municipal entities, academics, immigrant settlement services, and employment agencies. Most interviews were conducted in Israel before the COVID-19 pandemic. While the viewpoints of the (anonymized) individuals representing specific stakeholders are not representative of the opinion of all other stakeholders in Israel, many similar themes emerged across these interviews.

4.1. Skill Shortages and Retention Mechanisms

Over the past few decades, the shortage of skilled STEM workers has regularly been a topic of significant attention, including from governments and companies themselves. For example, one stakeholder noted, *“Finding skilled talent that can actually do the work my team does is nearly impossible, and the second I find someone, someone else steals them and hires them first,”* demonstrating a fierce competition between companies for skilled experts. This shortage of labour is often attributed to the continued emigration of highly qualified Israeli experts, and the negative conditions that push them to leave. *“In general, Israelis leaving has to do with other quality of life factors such as there being too much corruption, high living expenses, or difficulty in purchasing a home, rather than the specific practices of the tech industry. There is also the security situation, the occasional rockets, which pushes people away.”*⁹⁷ Interestingly, these stated reasons match those given by skilled tech workers who left significantly earlier, from the mid-2000s onwards, many of whom named pay, an inaccessible housing market, and security concerns among the key reasons for their departure from Israel.⁹⁸ The persistence of these issues has seemingly continued despite significant changes and growth in the Israeli STEM sector.

⁹⁷ Stakeholder Interview, Pinzetta, Israel.

⁹⁸ Brion, Y. (2022), *The Second Promised Land: Exploring the Secondary Migration of Soviet Jews from Israel to Canada*, Unpublished MA/MRP thesis, 84, 69-70, <https://doi.org/10.22215/etd/2022-15020>.

The inclusion of financial issues is particularly notable given that salaries in the high-tech sector are, on average, double that of the economy as a whole: 25,812 NIS per month (7,445 USD) in the high-tech sector versus 11,277 NIS per month (3,253 USD).⁹⁹ In this circumstance, the high salaries found in the sector are seemingly inadequate to offset cost of living difficulties, and are clearly an insufficient factor to counter other external issues. In part, this may be due to the high mobility of skilled tech workers, who are able to relocate to more desirable markets due to the global demand for talent. The government and the industry should therefore not only focus on hiring new talent, who would be subject to these same pressures, but should also take action to entice local professionals to stay. In order to do this, retention practices should be reviewed and optimized to take into account the existing pressures on local labour.

Another reason identified for labour shortages in the Israeli high-tech sector is the lack of resources available to foster participation among populations that are under-represented in the high-tech labour pool. These populations notably include Arabs, the ultra-Orthodox, and women. One potential solution may include supporting the entry of these populations into STEM degree programs and STEM-related employment, which could significantly contribute to decreasing Israel's STEM worker shortage.¹⁰⁰ In their 'High-Tech Human Capital Report', *Israel's Innovation Authority* and *Start-up Nation Central* mentioned programs that were recently launched to bring under-represented populations into the high-tech industry, and can be seen as first steps towards the right direction.¹⁰¹ Expanding these programs to address both social and economic barriers to entry for these populations may enable the Israeli tech sector to leverage untapped labour reserves that are currently inaccessible.

4.2. Existing Policies and Regulations: Looking at Foreign Experts

While foreign experts have a preferential status over any other foreign worker, the laws, regulations, and procedures governing their employment and eligibility made little to no distinction between them for most of Israel's tech sector's history.¹⁰² This remained the case until the introduction of the High-Tech Visa by the *Israel Innovation Authority* in 2018. However, most of the stakeholders interviewed representing the employers' perspective expressed that there are still many hurdles to overcome. Many stakeholders expressed that they found it very challenging to recruit foreign experts, and some were entirely unaware of the changes made to visa policies that aim to make that process easier. For those who did know of these changes (including the implementation of the High-Tech Work Visa), there was some skepticism about the

⁹⁹ Glovermanm D, and Feld, D. (2022), "Hi-tech entry guide: this is how you will earn NIS 40,000 a month," *Mako*, https://www.mako.co.il/nexter-while_you_were_working/Article-672b7f392d70f71027.htm.

¹⁰⁰ Stakeholder Interview, *Start Up Nation Central, Israel*.

¹⁰¹ Israel Innovation Authority and Start-Up Nation Central (2020), *High-Tech Human Capital Report 2019*, 20.

¹⁰² Zari Hazan & Co, *Employing a foreign expert*, https://www.zarihazan.com/category_service/%d7%94%d7%a2%d7%a1%d7%a7%d7%aa-%d7%a2%d7%95%d7%91%d7%93-%d7%96%d7%a8-%d7%9e%d7%95%d7%9e%d7%97%d7%94/.

significance of these changes. One stakeholder working in high-tech sector recruitment stated that “[t]he company did not want to deal with the bureaucratic process. People like to complain about how hard it is to get talent, but when faced with a difficult process they are less keen to try. If it’s possible to bring people, it must be an easy process and they need to be able to verify the candidate.”¹⁰³ The perception of foreign recruitment as difficult and infeasible process has persisted despite policy changes. The innovation industry does not anticipate a sufficient easing of restrictions in these immigration policies to significantly favour workers. As a preferred option for dealing with the shortage, utilizing local talent, or outsourcing contracts abroad might be more effective.¹⁰⁴ Alternately, mitigating the lack of knowledge or skepticism by recruiters may be possible with an expanded information campaign targeting potential companies.

Companies such as *Google* are more likely to hire people within Israel or bring back talent with Israeli citizenship.¹⁰⁵ According to *Tel-Aviv Global*, hiring foreign experts is not popular in Israel due to the *unspoken* rule known as “friend brings friend”, which exists in the local work culture.¹⁰⁶ The “friend brings friend” approach has emerged for several contextual reasons. One of them is that Israel is a small country, thereby placing strong emphasis on society and social connections. Secondly, it is common practice among high tech companies to encourage their employees via monetary means to bring new workers to the company, providing incentives for personal networking. This approach to filling open positions in the company reduces the load on HR departments.¹⁰⁷ Among emerging start-ups, recruitment is even more heavily focused on individual connections since they lack robust HR frameworks and tend to be structured around project teams of only a few individuals. One industry stakeholder, who had recently launched a start-up and recruited a team, noted that “it was hard enough to find good people who I could trust when I could hear about them from people I knew already,” suggesting a reliance on word-of-mouth recruitment at the start-up level.¹⁰⁸ Considering Israel’s prominent share of start-ups in its STEM sector, this has significant implications for foreign recruitment, as foreign experts are not part of the tightly-knit domestic network. Mitigating this kind of barrier would require network-building initiatives to establish connections between foreign workers and domestic contacts.

In addition to the known challenges for smaller companies posed by the process of identifying foreign experts, myths about the difficulty of visa processes are also a significant factor, with the relatively widespread belief that an expert visa is impossible to acquire. However, the process of obtaining such a

¹⁰³ Stakeholder Interview, *Pinzetta*, Israel.

¹⁰⁴ Stakeholder Interview, *Start Up Nation Central*, Israel.

¹⁰⁵ Stakeholder Interview, *Google*, Israel.

¹⁰⁶ Stakeholder Interview, *Tel-Aviv Global*, Israel.

¹⁰⁷ Daniel J. (2014), “The ‘Friend-Brings-Friend’ Syndrome,” *Times of Israel Blogs*, <https://blogs.timesofisrael.com/the-friend-brings-friend-syndrome/>

¹⁰⁸ Stakeholder Interview, *Stealth Start-Up*, Israel.

visa is, in fact, comparable to that of other countries.¹⁰⁹ A stakeholder representing the *Haifa Economic Corporation* (HEC), one of the developers of the Northern high-tech park in Israel, *MATAM*, countered the myth by stating that “foreign multinationals in *MATAM* do not have trouble bringing in foreign workers. They also relocate Israelis within Israel. Foreign engineers are typically [t]here on a project basis. They are [t]here for the duration of the project.”¹¹⁰ It should be noted, however, that this concerns temporary project-based expert visas, rather than work visas with residency based on time; this may make these types of visas less attractive to companies looking to recruit talent on a longer-term basis rather than for a specific project. Start-ups, for instance, may not be interested in a short-duration visa based on a single project while building their core team of experts.

To avoid dealing with bureaucracy, many companies, especially in the high-tech sector, fill vacant positions through outsourcing to experts from other countries.¹¹¹ In 2022, for example, around half of Israeli tech companies offshored at least some of their business activities.¹¹² This trend is observed across all company sizes, but is particularly acute for mid-size companies, with 44% of companies between 200-500 employees having a significant offshore presence, compared to 17% for small firms and 11% for large firms over 500 employees.¹¹³ On the whole, Israeli companies find that hiring workers remotely is easier than going through the same process in the Israeli workforce market, where the supply of skilled labour is highly drained. Moreover, the wages paid to outsourced workers are generally considerably lower – around 30-40% less for remote employees from Eastern Europe and 50-60% less for workers from India.¹¹⁴ In the case of Eastern Europe, outsourcing is particularly effective, as shared time zones and the high numbers of immigrants from the region in Israel reduce the communication, collaboration, and cultural barriers that otherwise limit the effectiveness of outsourcing.¹¹⁵

As such, outsourcing is seen as a positive approach for mitigating labour market shortages in the short term. If not for outsourcing, wages would continue to increase, and companies could, in theory, be forced to relocate outside of Israel due to increased expenses. In the long term, however, outsourcing results in a loss of knowledge, lower tax revenues, and a lower overall impact on the Israeli economy.¹¹⁶ It may also be

¹⁰⁹ Stakeholder Interview, *Tel-Aviv Global, Israel*.

¹¹⁰ Stakeholder Interview, *Haifa Economic Corporation, Israel*.

¹¹¹ Israel Innovation Authority and Start-Up Nation Central (2020), *High-Tech Human Capital Report 2019*: 6.

¹¹² Start-Up Nation Policy Institute and Israel Innovation Authority (2022), *The Start-Up Nation Policy Institute and the Israel Innovation Authority Present the ‘Human Capital in Tech 2021-2022’ Status Report*, <https://innovationisrael.org.il/en/news/2021-2022-human-capital-high-tech-status-report>.

¹¹³ Israel Innovation Authority and Start-Up Nation Central (2018), *High-Tech Human Capital Survey Report 2018*, 16, https://innovationisrael.org.il/sites/default/files/SNC_2018_Human_Capital_Report_Final_0.pdf.

¹¹⁴ Netzer R. (2017), “Israeli high-tech cos look abroad when hiring,” *Globes*, <https://en.globes.co.il/en/article-israeli-high-tech-cos-outsource-work-abroad-1001170921>

¹¹⁵ Hennessey, Z. (2022), “Why are Israeli hi-tech companies bracing for conflict in Ukraine?,” *Jerusalem Post*, <https://www.jpost.com/business-and-innovation/article-696461>.

¹¹⁶ Stakeholder Interview, *Start Up Nation Central, Israel*

limited in its applicability for some sub-sectors of the Israeli STEM market, such as those focused on security, which explains the lower rates of outsourcing in larger firms, as a higher proportion of large tech enterprises in Israel do defense-related development.¹¹⁷ It also opens the Israeli tech sector to additional disruptions when crises occur beyond its borders: in 2022, 20% of Israeli tech companies had some form of outsourcing or offshoring activity in Ukraine, resulting in negative impacts to their labour supplies with the outbreak of the conflict in Ukraine.¹¹⁸

4.3. The barriers and solutions for attracting and retaining foreign experts

4.3.1. Focus on Jewish Diaspora

The migration process in Israel differs from other countries due to its core value of endeavouring to reunite the Jewish diaspora. For this reason, the question of bringing foreign experts to Israel has a cultural barrier that originates in the religious and ethnic aspect of the State of Israel, even as it affects all other forms of migration. One stakeholder, when discussing migration to Israel, noted “*[that] is a cross-cutting theme in everything that has to do with migration to Israel, not just skilled migration.*”¹¹⁹ The restricted nature of the Israeli border is conditioned by this strong commitment from the government, and in many cases from broader Israeli society, to facilitate “religious” migration rights, or migration rights based on religious or ethnic Jewish heritage.¹²⁰ This may be seen as a problem as it creates an ethnic prejudice that forces recruitment to solely focus on Jewish people or those with Jewish roots in order for it to be reasonably possible. Even the new High Tech Visa distinguishes pathways between those eligible under the Law of Return and those experts who are not, with different rules and allocations accordingly. Further revisions of migration law aiming to improve recruitment of foreign experts may have to consider the conflicting priorities of ensuring Jewish migration versus skilled migration in this case.

¹¹⁷ Israel Innovation Authority and Start-Up Nation Central (2018), *High-Tech Human Capital Survey Report 2018*, 16.

¹¹⁸ Start-Up Nation Policy Institute and Israel Innovation Authority (2022), *The Start-Up Nation Policy Institute and the Israel Innovation Authority Present the ‘Human Capital in Tech 2021-2022’ Status Report*.

¹¹⁹ Stakeholder Interview, Bar-Ilan University, Israel

¹²⁰ Stakeholder Interview, Via, Israel

4.3.2. The Israel “Brand”

Another barrier mentioned by stakeholders is the negative perception of Israel as a potential destination country. Poor advertising of Israel means that people around the world do not consider Israel as a country to relocate to for work. For instance, Israel’s profile of a ‘start-up’ nation with significant investment in the STEM sector may not be well known to those who are not already linked to its industries in some capacity. In addition, Israeli recruitment agencies appear to have limited success in targeting the right individuals abroad for recruitment, with poor fit and subsequent poor employment outcomes contributing to a negative perception of Israel as a hiring country among foreign experts.¹²¹ In combination, limited brand-building for the Israeli tech sector limits its recognition and attractiveness as a destination for skilled labour.

4.3.3. The Hurdle of Prerequisites

The most notable barrier to bringing foreign experts to Israel continues to be the eligibility requirements for the expert visa. One of the stakeholders interviewed, a founder of a law firm named Joshua Pex, specified some additional limitations to the expert visa that make it difficult to use. One of them is the age restriction: the visa cannot be issued to experts above the age of 60 unless special permission is obtained. This may be due to concerns about national pension eligibility, as eligibility is determined by residency rather than citizenship, and there is an overlap between the visa, which can be renewed annually for up to five years, and the Israeli age of retirement, which can be as low as 62 depending on gender and date of birth.¹²² Moreover, the invited foreign expert should “not have first-degree relatives in Israel”, otherwise the visa will not be approved even if their relatives have legal status in Israel.¹²³ These restrictions pose additional barriers to hiring foreign experts for Israeli companies, further restricting the pool of potential foreign experts that companies can recruit from. That being said, the application process for bringing a foreign expert to Israel has been improved for international (foreign) companies located in Israel. Foreign companies can ask for a fee exception for the expert visa, valued at around 10,000 NIS (2,884 USD), for up to two experts, mitigating at least some of the extra costs involved in foreign recruitment. In these cases, however, these individuals are generally already employed by the international company located outside of Israel.¹²⁴ This makes the applicability of the exception relatively low in terms of the pool of potential applicants.

¹²¹ Stakeholder Interview, *Tel-Aviv Global, Israel*.

¹²² State of Israel National Insurance Institute, First Age – Retirement Age, <https://www.btl.gov.il/English%20Homepage/Benefits/Old%20Age%20Insurance/Conditions/ageofentitlement/Pages/ARetirementage.aspx>; State of Israel National Insurance Institute, Conditions of Entitlement, <https://www.btl.gov.il/English%20Homepage/Benefits/Old%20Age%20Insurance/Conditions/coveredinoldage/Pages/Woman.aspx>.

¹²³ Pex J., *Local and Foreign Companies and Expert Workers in Israel*, <https://lawoffice.org.il/en/companies-and-expert-workers-in-israel/>.

¹²⁴ Pex.

4.3.4. Overcoming Barriers for Recruitment and Retention

In order to overcome these barriers and improve the economic ecosystem, one possible solution could be to change the approach of existing policies with the aim of attracting foreign experts for longer periods rather than shorter, individual project-based timelines. One potential redirection of the approach could look to bring cohorts of experts, instead of individuals. Initially, this would accelerate their integration into Israeli society by providing a group network based on shared timing and experiences, mitigating what can otherwise be a challenging transition, particularly for those coming from countries vastly different from Israel. Some programs that aim to achieve this type of integration already exist, such as one stakeholder's approach, that of *Tel-Aviv Global*, which aims to attract foreign experts from specific markets, including countries most like Israel in terms of climate and, to some extent, culture. Some of these countries include Spain, France, Portugal, and Italy.¹²⁵ This approach aims to assist in the integration of foreign experts, by preselecting them from environments that are similar to the new one they would join, thus reducing the challenges posed by the integration process. In doing so, the program may also be able to reduce the number of experts who wish to leave, and thus improve retention.

Whatever form it would take, a program for attracting and recruiting foreign talent should thus be well thought out and focused on supporting and retaining foreign experts.¹²⁶ This is an important consideration for both recruitment and retention, with the latter particularly sensitive when a shock upon arrival is involved. Evidence from other countries suggests that, broadly speaking, highly-educated foreign experts are economically incentivized and likely to migrate accordingly.¹²⁷ Shocks and difficult transitions, therefore, may reduce the willingness of experts to stay for significant periods of time, or to return for additional projects, even when well remunerated. Given the acute labour shortage facing Israeli tech companies looking for skilled employees, failing to retain good candidates, and doubly so those already trained on those companies' projects and processes, represents a critical loss. Conversely, successfully retaining foreign experts would alleviate the pressures on the skilled labour market, enabling the Israeli high-tech sector to continue to innovate and grow.

4.4. COVID-19: Consequences and Post-pandemic Forecast

The coronavirus crisis has emphasized the government's need to focus more on the local population as a means to better equip the high-tech sector. The *Israel Innovation Authority* opened a "crisis High-Tech

¹²⁵ Stakeholder Interview, *Tel-Aviv Global*, Israel.

¹²⁶ Stakeholder Interview, *Via*, Israel.

¹²⁷ Newbold, B. (1997), "Primary, Return and Onward Migration in the U.S. and Canada: Is There a Difference?," *Papers in Regional Science* 76(2): 193-194; Liaw, K. (1990), "Joint effects of Personal Factors and Ecological Variables on the Interprovincial Migration Pattern of Young Adults in Canada: A Nested Logit Analysis," *Geographical Analysis* 2(3): 206.

Human Capital Fund Program”, starting in 2020, and has since allocated approximately 19 million NIS to 18 different programs aimed at training women, Arabs and the ultra-Orthodox and bringing them into the high-tech industry, “along with programs for integrating immigrants and returning residents with high tech experience in other countries.”¹²⁸ The program for increasing women in entrepreneurship, which was launched in 2019, has processed double the number of applications in 2020 compared with the first round in the previous year.¹²⁹ This indicates the potential for high uptake from these under-represented communities and could therefore suggest a strong mitigation of the labour shortage, should it be similarly prioritized going forward.

The high rate of unemployment observed in 2020 and 2021 caused by the consequences of the pandemic and quarantine measures, as mentioned earlier in this report, was mostly experienced among start-up companies in the high-tech industry. A co-general manager from *Start-Up Nation Central*, Udi Gabai, believes that this will not noticeably affect the labor market in the short-term; however, in the long-term it may cause a decrease in companies’ growth, and accordingly might lead to fewer vacant positions in the future.¹³⁰ However, another stakeholder noted that both their own start-up and those of their former colleagues and friends are extremely active in recruitment and expansion despite operating during the pandemic, suggesting that unemployment and financial difficulties were not distributed evenly among start-ups.¹³¹

While the crisis affected around one third of small companies, as their management was “more likely to have frozen recruitment, faced a decrease in the number of experienced technological employees, and reduced their demand for tech positions in relation to their workforce,” the Israel high-tech sector showed resiliency with its increased earnings.¹³² For example, despite early pandemic disruptions, 2020 proved to be a record year for the Israeli innovation ecosystem, as evidenced by an increase in tech capital, the establishment of more than 160 new tech companies, and the opening of several new research and development centres by multinational companies.¹³³ The Israeli tech sector continued through the pandemic with high levels of activity, although some slowdowns in funding and other metrics were observed.

With all this, the ongoing development and growth of the technology sector in Israel is predicted to remain steady in the coming years. It is unlikely that such a thriving industry will face a bubble-bursting crisis

¹²⁸ Israel Innovation Authority & Start-Up National Central (2021), 19; Israel Innovation Authority, *Winners of the Hi-Tech Human Capital Fund, 2020*, <https://innovationisrael.org.il/Chosen-44>.

¹²⁹ Israel Innovation Authority & Start-Up National Central (2021), 19.

¹³⁰ Solomon (2021).

¹³¹ Stakeholder Interview, *Stealth Start-Up, Israel*

¹³² Solomon S. (2021), “Tech jobs dip but still in demand amid COVID-19 economic downturn,” *Times of Israel*, <https://www.timesofisrael.com/tech-jobs-dip-but-still-in-demand-amid-covid-19-economic-downturn/>

¹³³ Stakeholder Interview, *Tel-Aviv Global, Israel*; Tel-Aviv Global (2020), *2020 Tel-Aviv Innovation Ecosystem Report: Resilience & Growth*, Tel-Aviv, 3, 14, 26.

scenario in the foreseeable future, due to the combination of its internal characteristics and the robust worldwide development happening in the high-tech sector in the face of the pandemic. Similarly, the upward trends in the employment and earnings of STEM workers observed thus far will likely continue to be observed in the long-term, bearing in mind any corrections that have not yet been made explicit, though to what extent remains to be seen.¹³⁴

¹³⁴ Solomon S. (2021), “Israeli tech surges with investors jumping in as COVID spurs digitalization,” *Times of Israel*, <https://www.timesofisrael.com/israeli-tech-surges-with-investors-jumping-in-as-covid-spurs-digitalization/>

Conclusions and Recommendations

Israel has clearly benefited from its ‘open door’ migration policy for those of Jewish descent, primarily following the collapse of the Soviet Union and the resulting influx of high-skilled professionals. However, in today’s context, Israel’s ethnic restrictions on migrants are a significant barrier to the immigration and mobility of high-skilled migrant professionals in STEM, at a time when high-tech industries are becoming increasingly more central to the country’s competitiveness and innovation. The low recruitment and retention of high-skilled migrant professionals in STEM – inadequate at the present time to address the shortage of STEM workers in Israel – is multiplied by high levels of societal inequity in the sector, and its resulting disenfranchised groups. However, in recent years, initiatives from the *Israel Innovation Authority* aimed at bringing minorities (e.g., women, Arab, and ultra-Orthodox populations) in greater numbers to the high-tech industry have started to emerge and have since begun to at least partially mitigate the shortage of high-tech workers. Although the Israeli government has made top-down efforts to relax requirements placed on firms for the recruitment and retention of global talent, and has provided some incentives to do so, it remains to be seen whether these changes will prove to be effective, as well as whether there is an ability or desire within the high-tech sector as a whole to recruit from abroad. At the present time, it is unclear that the changes made to the visa process for skilled high-tech workers are sufficient to enable the market to keep pace with growing demands for skilled labour.

The results of this preliminary study indicate that strict visa requirements are the primary barrier to facilitating the recruitment and retention of migrant professionals in STEM. However, the perception of strictness also plays an important role in facilitating or discouraging global talent recruitment to Israel. Facilitating recruitment and retention will take more than relaxing visa requirements; policymakers and relevant stakeholders need to make a concentrated effort to challenge perceptions of excessive bureaucracy and costliness both on the part of potential applicants (migrants) and recruiting companies themselves. Promotion and awareness-building exercises to disseminate information about reduced requirements or barriers to recruiting foreign talent to industry associations, networks, and companies are necessary to address the lack of understanding of existing rules. These types of campaigns are needed to challenge perceptions that the visa and immigration process is daunting and unachievable for foreign talent, and make it a more appealing option when compared to skilled labour shortages.

Moreover, the solution to attracting more foreign talent to Israel, as was expressed by *Tel-Aviv Global*, could be achieved by focusing on rebranding Israel in the world labour market. Similarly, minimizing the difficulty of labour and social integration for foreign experts may also serve to benefit retention. Some stakeholders, for example, identified a need to help foreign experts in their integration process in Israel by

providing them with support in exploring the Israeli culture and environment. A first step in this direction might be focusing on attracting experts from countries with similar environments and cultural backgrounds to better facilitate their integration, whereas a robust system of integrative supports could also be developed.

Israel has the potential to be an attractive destination for STEM professionals. High rates of VC initiatives provide a good climate for entrepreneurial activities, high public and private R&D spending supports scientific and industry innovation, and many multinational companies have situated their R&D facilities in Israel due to its positive history of innovation. However, to engage more foreign experts in Israel, government and industry stakeholders will need to take steps to globally advertise Israel as an attractive place to work. In the meantime, continuing the positive trend of recruiting more domestic labour from under-represented populations in the high-tech sector will help mitigate skill shortages.

Despite the impact of the COVID-19 pandemic, the Israeli high-tech industry has remained strong and has continued to thrive. Investment inflows were sustained, new companies continued to emerge, and more than 33 new unicorns surfaced. The labour shortfall, however, has continued throughout the pandemic, with recent numbers indicating the shortage significantly exceeds inflows. Government programs to manage unemployment rates will require further development to provide professional training to those experts who were terminated from their place of employment, as well as to implement subsidies for companies to rehire talent. This would help to improve retention rates, and in doing so mitigate at least some of the labour shortage experienced in those sectors.