Silicon Valley to Silicon Wadi

California's Economic Ties with Israel

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Executive Summary

California's economic ties with Israel are unique. For a nation of only 9.3 million people, Israel has an extraordinary record of generating technology and startups, a bridge that connects it deeply with Silicon Valley. The California connection is also built on shared values, aligned interests, and a foundation of research, investment, and entrepreneurial flows that contributes to innovation and competitiveness in both economies.

Israel's Economy

While small, Israel's economy is technology led and globally connected. GDP in 2020 was $375.3 billion or $40,732 per capita. Over time, the economy has evolved from an agricultural base to one with technology at its core. Until the 1970s, most investment was directed to basic infrastructure and agriculture. Industrialization followed, with a strong focus on developing weaponry for the country's defense. That investment produced capabilities that would later become the foundation for Israel's technology industries and for innovations in electronics, telecommunications, computer hardware, and software.

This transition is reflected in Israel's trade today. In 2020, services accounted for 47% of exports, and 23% of exports were software. A cornerstone of Israel's relationship with the United States is the 1985 US-Israel Free Trade Agreement, the first FTA signed by the United States. In 2019, two-way trade in goods and services totaled $47 billion, with US exports of $20.2 billion and imports of $26.9 billion. Two-way investment

is also strong. The United States is the top global investor in Israel, and Israel is an important investor in the United States. It is also a significant investor in California, with 140 Israeli foreign-owned firms that support 6,248 jobs amounting to $615 million in wages.

Foundations of Innovation: Israel's Technology Ecosystem

According to the World Bank analysis of the most recent available data, Israel invested 4.95% of its GDP into research and development (R&D) in 2018, giving it the highest R&D investment-to-GDP ratio in the world. It has had extraordinarily success in applying that investment to create new companies and products.

Israel now counts 1,900 startups, 1,600 of which are located in Tel Aviv. As of mid 2021, Israeli founders have produced 29 unicorns (privately-held startup companies valued at $1 billion or more) with headquarters located in the country, and including all Israeli-founded unicorns regardless of their headquarters locations, Israel's unicorn count rises to 71. As the number of Israeli companies that have succeeded in attracting later-stage funding has grown, the "startup nation" term coined to describe the country's prolific production of startup companies is being replaced by "scaleup nation."

This did not happen by accident but is the product of policies, developed over decades by Israel's government, that leverage national assets in areas of

competitive strength and project them globally. The nation's turn toward technology can be particularly traced to the wave of Jewish immigration from the former Soviet Union (FSU) that took place between 1990 and 2000, when 875,000 FSU citizens emigrated to Israel. That wave brought an influx of highly trained and educated talent that over time came to populate Israel's universities, research centers, and eventually its ranks of entrepreneurs.

In the early 1990s, the Israeli government launched Yozma, an initiative financed by the Ministry of Finance that invested $100 million to create 10 new venture capital funds which later became the core of a domestic venture capital industry. The government's current investment in innovation includes initiatives by the Office of the Chief Scientist and the Israel Innovation Authority. Start-Up Nation Central, an independent nonprofit organization, serves as a connector to sources of Israeli innovation, working with overseas businesses, governments, NGOs, and Israeli founders. Through the nonprofit Israel Innovation Institute, Israel has also created a suite of sector-oriented innovation communities, including HealthIL (for healthtech), GrowingIL (for agritech), CatalystIL (for innovation management), EcoMotion (for smart mobility), DeserTech (for sustainable living in arid climates), and PLANETech (for climate change technology), to advance innovation and the digital economy in specific fields. Israel's innovation system is also anchored in a number of leading universities and research institutes: Technion, The Hebrew University of Jerusalem, Tel Aviv University, Ben-Gurion University of the Negev, the University of Haifa, IDC Herzliya, and the Weizmann Institute of Science.

Israel's success in generating technology and startups can't be explained by its research base alone. A key factor that sets it apart from other economies is the requirement of military service for most Jewish citizens, both male and female, and for some minorities—a shared experience that produces founders and technologists who are more seasoned than in other countries, can work in teams, are technically trained at a high level, and are oriented toward results. Service in the Israel Defense Force (IDF) also produces networks of alumni that serve to connect founders and technologists with each other and with employers at a high level.

Silicon Valley in Israel

Technology connections to Israel can be found throughout California but are intensely concentrated in Silicon Valley. This forms a bridge linking the world's leading innovation center, the Bay Area, with what is sometimes referred to as Silicon Wadi (a term used to denote Israel's technology and innovation cluster). Drawn by the search for engineering talent, Silicon Valley companies began their migration to Israel in the mid-1970s, a movement that has continued to the point where today California R&D centers are pervasive.

Silicon Valley's footprint can be seen most deeply in its concentrated investment in software and IT services. From January 2003 to February 2021, California companies undertook a total of 147 foreign direct investment (FDI) projects in Israel. Of those investments, 127 were by companies in the greater Bay Area, primarily in R&D. Software and IT Services was the leading field followed by Semiconductors, Financial Services, and Communications. According to fDi Markets, the value of investment by 103 California companies between 2003 and 2021 totaled $22.4 billion. Of the top 20 California companies investing in Israel, 18 were headquartered in the Bay Area.

For many, their presence in Israel began with the acquisition of an Israeli company. While the list of Silicon Valley companies in Israel is long, several—Applied Materials, KLA Corporation, IBM (which has a major research laboratory in San Jose), Oracle, Cisco, Salesforce, and Intel—stand out as examples of the role that Israel plays in the global R&D and business strategy of multinational companies. Intel, with 14,000 employees, is both Israel's largest technology company and its largest private employer.

Out of 402 multinational companies with an innovation presence in Israel, 96 are California headquartered, and of those, 80 are from the Bay Area. By comparison, there are 13 multinationals with an innovation presence from the UK, 14 from France, 15 from Germany, 10 from China, 7 from Japan, and 6 from India.

California-based companies are responsible for 20% of all acquisitions of Israeli companies globally and for 42% of all acquisitions by US-based companies. This pattern

of acquisition accounts for $76 billion in value, or 50% of the global total for acquisitions in Israel and 70% of the US total. Three of the five largest Israeli acquisitions to date and seven of the top fifteen acquisitions have been made by California companies, with Bay Area companies the top acquirers. Of the three acquisitions over $1 billion that were made in 2019 alone, all were made by California companies. Acquisitions such as Mobileye by Intel and Waze by Google have contributed substantially to the competitiveness and revenue of California companies.

The Bridge to California

Israel, its institutions, its companies, and its technologies are deeply embedded in Silicon Valley. The scale and depth of that connection is remarkable for a country with a population only slightly larger than the Bay Area itself.

Faculty from Israel can be found across California universities, working in fields such as AI, health, and data science. Israeli postdoctoral researchers are connected to each other and to Israel through the nonprofit organization ScienceAbroad, which supports PhD and postdoc Israeli researchers as a community. Large alumni groups from Israel's leading universities—Technion, Tel Aviv University, The Hebrew University of Jerusalem, and Ben-Gurion University of the Negev—connect to their campuses and support academic and research exchanges. Many include well-known Bay Area company founders.

Today there are 350,000 members of the Jewish community in the Bay Area, constituting the fourth largest concentration of Jewish people in the United States. The Jewish population in the Los Angeles metropolitan area numbers 617,000, making it the second largest Jewish community in the US after the New York metro area and the third largest in the world after Israel and the US as a whole. Overall, 1.17 million Jewish people live in California. Jewish philanthropy has a long history and, in addition to supporting communities locally, often focuses on building ties to Israel. This can include support for universities in Israel, research exchanges between California and Israeli universities, or bridging Jewish communities to Israel through civil society exchanges.

Three bilateral institutions jointly funded by the United States and Israel—the Israel-US Binational Industrial Research and Development Foundation (BIRD), the US-Israel Binational Agricultural Research and Development Fund (BARD) and the US-Israel Binational Science Foundation (BSF)—play key roles supporting binational technology research:

■ The Israel-US Binational Industrial Research and Development Foundation (BIRD) supports industrial R&D between US and Israeli companies and organizations. California is by far the largest recipient of BIRD grants in the United States, with 286 projects funded and a total investment of $34,240,635.

■ Similar to BIRD but focused on agriculture, the US-Israel Binational Agricultural Research and Development Fund (BARD) helps US and Israeli scientists address agricultural challenges of concern to both countries. With the largest agricultural economy in the United States, leading research universities, and a climate similar to Israel's, California is BARD's largest US partner with 302 grants awarded through 2019. Funded California institutions include nine campuses of the University of California, Stanford University, Carnegie Institute of Washington-Stanford, Scripps Research Institute, California State University, Caltech, and the USDA Forest Service, with the top three awardees being UC Davis (139), UC Riverside (65), and UC Berkeley (26). The relationship with Davis particularly stands out, with The Hebrew University campus in Rehovot sometimes referred to as "Davis East" due to the depth of faculty and postdoc exchanges.

■ The US-Israel Binational Science Foundation (BSF), founded in 1972 and the oldest of the three organizations, focuses on theoretical (basic) science. Its core program supports approximately 100 projects each year based on joint applications by US and Israeli researchers, with funding directed to both US and Israeli investigators on binational research teams. A second program, created in 2012, is a partnership with the National Science Foundation (NSF), in which the NSF receives proposals from US scientists for binational projects; if the NSF recommends a project for an award, BSF will match it. Since 1999, universities in California have received

nearly $16 million in research funding, making the state the largest recipient of BSF support. Of 881 total grants, the leading recipient campus is Stanford (234), followed by UCSD (126), UCLA (106), Caltech (94), UC Berkeley (79), UC Santa Barbara (51), UC San Francisco (50), USC (38), UC Irvine (37), UC Santa Cruz (25), UC Davis (22), UC Riverside (17), UC Merced (1), and Humboldt State University (1).

In business, non-governmental organizations such as The California Israel Chamber of Commerce (CICC) and ICON (which connects Israeli founders with corporate and venture decision makers) support two-way business development, startup development, and information exchanges. Israel21c publishes extensively on economic, cultural, and social life in Israel.

At its most fundamental level, the relationship between California and Israel is built on human capital. In addition to universities, institutions such as NASA Ames Research Center in Mountain View have active ties, and senior executives from Israel can be found throughout the ranks of Silicon Valley technology companies.

Investment is symbiotic, with Bay Area venture capital flowing to Israeli startups, enabling them to scale in US and global markets. Acquisitions of Israeli startups produce a flow of technology and intellectual property to Bay Area and California companies that contributes to their competitiveness and revenue. The intensity of this interaction is remarkable for its concentration in a number of key technologies, the large number of Israeli-founded companies that have been acquired or have received venture funding, and the large number of Israeli-founded companies that are now headquartered in the San Francisco/Silicon Valley Bay Area.

Fifty-seven California headquartered investors, of which 54 are from the Bay Area, have invested in 750 Israeli startups. Fifty-eight percent of all investment rounds of $30 million and above had California investors. At the end of 2020, 478 Israeli startups had offices in California, the second highest of any state. California is home to 22 Israeli-founded technology unicorns, the most of any US state; all but one are based in the Bay Area.

Bay Area venture firms such as Andreessen Horowitz, UpWest, Zeev Ventures, J-Ventures, GGV Capital, Citi

Ventures, Maven Ventures, DTCP, and corporate venture arms such as Salesforce Ventures (the top corporate venture firm operating in Israel measured by investment value) are active, as is Silicon Valley Bank. Israeli banks such as Bank Leumi and Mizrahi-Tefahot also support business with a California presence.

The relationship between startups in Israel and California follows an established pattern, but one that is evolving. Due to the country's small domestic market, Israeli startups have historically looked to be acquired, often at an early stage. Because the US is the leading market for Israeli companies, most focus on acquisition by companies from the Bay Area as well as New York and Boston. Their operating model is a hybrid where engineering is done primarily in Israel but the founders and the non-tech team (sales and marketing) move to California or other US locations to be closer to the market and to their customers. While this continues to be the dominant pattern, a shift is occurring in which more founders are choosing to defer acquisition and grow their companies for longer periods in Israel, believing they can build large stand-alone companies at home. While the US will remain Israel's key market and most Israeli companies will continue to have a critical US presence, future investment is likely to flow to companies with both business models.

While venture activity and technology development are primarily concentrated in Northern California, Israel's presence in Southern California is also significant, anchored in sectors such as agricultural technology, water management, health, biotech, and, particularly, in entertainment. Israeli writers and producers of creative content are active in the Los Angeles media market and responsible for a range of popular shows on Netflix, Showtime, and other outlets. Key startup accelerators and business connectors include the Merage Institute and Fusion LA, and the Southern California-Israel Chamber of Commerce serves as a platform for connecting companies on both sides to business opportunities. The Milken Innovation Center, supported in part by the Santa Monica-based Milken Institute and based at Israel's Jerusalem Institute, supports research collaborations under the California-Israel Global Innovation Partnership and develops financial innovation

models involving collaboration between California and Israeli researchers.

In San Diego, the Leichtag Foundation builds ties by organizing delegations of civic leaders to Israel, facilitating exchanges of faculty between San Diego and Israeli universities, supporting civic development initiatives in Jerusalem, and showcasing Israeli agtech startups at its Leichtag Commons campus in Encinitas (North San Diego County).

Israel's economic presence contributes significantly to California's economy. Water treatment engineering company IDE operates the Carlsbad desalination plant in Southern California, which produces 10% of the water used in San Diego County. In addition to providing technologies and services that benefit consumers, high-impact Israeli-founded companies such as Gusto (500), Hippo Insurance (200), Uber Freight (350), Houzz (600), JFrog (200), Palo Alto Networks (3,000), and other emerging companies employ thousands in the Bay Area and across the state. These six companies alone employ nearly 5,000 Californians directly and, including jobs that are indirectly supported by their activity, account for almost 10,000 jobs across the state economy.

Cooperation in New and Emerging Technologies

Israel's technology expertise is concentrated in several key sectors that also constitute the bridge for trade, investment, and research cooperation with California. Many grew out of Israel's defense solutions and from its innovations in water technology. Technologies in these sectors are both the foundation for current ties and the most likely focus of future research and business development:

- Israel is a global leader in the field of **cybersecurity**, with its expertise stemming from its defense and intelligence establishment and domestic security needs. Elite intelligence units in the military such as Unit 8200 produce alumni that lead and staff many private companies.

- Israel's **fintech** industry has established itself as a frontrunner in financial innovation, supported by

cross-over technologies such as cybersecurity, big data analytics, and AI. As of 2021, there were 497 active Israeli fintech companies in Israel, including 13 unicorns.

- Israel is a global leader in **healthtech** innovation, with more than 1,500 companies in the health and life sciences sector. Approximately 70% of those companies are concentrated in medical devices and digital health.

- Israel is an active player in the field of **mobility**, with large tech companies like Mobileye and automotive chip maker Valens Semiconductor and service providers such as Waze and Gett, all of which began in Israel. Its particular strength is in smart mobility, built on depth in semiconductors and AI.

- For decades, Israel has been at the forefront of **agtech** innovation that helps farmers optimize crop yield and management. In mid 2021, there were more than 400 AgriFood-tech companies in Israel. The industry builds on expertise developed from the need to maximize the efficiency of water use and food production in an arid and water-limited environment. Many innovations coming from Israel are digitally based, stemming from innovations in the fields of Data and Computation and Sensing. Applications extend to crop yield and harvest management, pathogen and pest management, and alternative (non-meat) food sources.

- Closely related to agtech, Israel is a global leader in **water technology and water management**, particularly in drip irrigation, the use of brackish water for agriculture, water recycling, and desalinization. A good example is Netafim, a leading producer of drip irrigation systems, that now holds more than a 30% share of the global market in the field.

Israel has developed impressive strength in the underlying technologies that support these sectoral advances, particularly AI. The CB Insights 2021 list of the world's 100 most promising AI startups includes 10 that are from Israel or have R&D centers there.

Israeli startups in these and other fields can be found throughout California, bringing innovative solutions to a range of technology challenges.

Conclusion

Israel sits on a short list of countries that are first-tier global hubs for technology and innovation. The scale of its impact globally and in California is remarkable, given its small size and population.

California and Israel share core interests that have enabled the two economies to uniquely align. With that, California has become a key source of investment and a base for Israeli startups as they grow in US and global markets. Israel, for its part, has become an important base for R&D and a source of technology and innovation that contributes to the bottom line of California companies, to their competitive capacities, and ultimately to employment.

Promising fields for future cooperation include biotech, data science, and security, particularly advanced cryptographic systems such as post-quantum cryptography. Embedding intelligence at the edges of computing—through intelligent vehicles and highway systems, for example—is creating new security vulnerabilities. With more intelligence in the grid, there is a growing question of how to secure it, and with the world at an inflection point between data-enabled connectivity and systemic vulnerability, a rich opportunity exists for collaboration with Israel in fields such as AI and cybersecurity.

Recommendations

Closer cooperation at the state level can support California's priorities in fields ranging from agriculture and water to energy and climate change and enable the deeper long-term engagement of Israeli and California businesses and universities.

In March 2014, then Governor Jerry Brown and former Israeli Prime Minister Benjamin Netanyahu signed an agreement to develop joint projects and conduct mutually beneficial research in California and Israel. In it, the two sides agreed to (1) convene bilateral interagency and interministerial working groups to coordinate initiatives; (2) facilitate collaborations between Israeli and California entrepreneurs; (3) support exchanges and cooperation in key sectors including water conservation and management, alternative energy and clean energy technologies, health and biotechnology, cybersecurity, arts and culture, education, and agricultural technologies; and (4) encourage collaboration between California and Israeli universities and public and private research institutions.

Implementation of the MOU has been uneven, with the California Department of Food and Agriculture (CDFA) actively promoting exchanges, but other government agencies less engaged. The steering committee established to oversee the MOU's implementation should be reconvened and revitalized. One option to consider is the convening of a California-Israel technology conference which, if successful, could be repeated annually.

In particular, California and Israel confront deep issues relating to water, agriculture, and sustainability. As drought and water scarcity grow, California would benefit from a deeper dialogue with Israel on issues including water recycling, water conservation, the use of brackish water for agricultural applications, desalination, and precision agriculture—fields where Israel's experience could be applied. Deeper technology connections around the challenge of climate change should also be a priority.

Beyond research, universities can contribute to deeper entrepreneurial connections. UC Berkeley's SkyDeck accelerator, for example, has begun discussions with Tel Aviv University, The Hebrew University, and other universities in Israel that also have incubation programs. These exchanges should be pursued. As SkyDeck extends its program globally through initiatives such as model curricula and boot camps, SkyDeck programs can be brought to Israel and entrepreneurs from Israeli incubators can spend time at SkyDeck.

Finally, both the California-Israel Global Innovation Partnership launched in 2015 to implement the 2014 Brown-Netanyahu MOU and the 2017 MOU on research cooperation between the University of California and the Israel Innovation Authority lack designated public funding. Strengthening these exchanges will require investment. A proposal by the Jewish Caucus in California's legislature would fund the implementation of the cooperative MOUs that California has signed with three overseas partners—Israel, Mexico, and China's Jiangsu Province—to support competitively chosen applied research partnerships in clean energy. This kind of support, if matched by Israel, could advance the shared US-Israel research and technology agenda, and should be expanded to cover the broader range of initiatives covered in the MOUs.

Israel's Economy: Dynamic Evolution

While small, Israel's economy is technology led and globally connected. GDP in 2020 was $375.3 billion, or $40,732 GDP per capita.[1] While its 3.4% economic growth in 2019 was among the highest in the OECD, where the average among member countries was 1.6%,[2] Israel, like other economies, was affected by COVID-19, and its growth rate dropped to -2.5% in 2020,[3] the first year since 2002 that its economy shrank.[4] Even so, with an average 2020 growth rate of -4.8% in the OECD, Israel's GDP growth was among the highest in the 37 member countries at that time.[5] Growth is expected to rebound to 5.1% in 2021,[6] supported by a national vaccination program that many consider the most effective in the world. Factors explaining that success include Israel's compactness, its centralized and technologically advanced national health system, and a deal with Pfizer that locked in an early supply of Pfizer-BioNTech vaccines in exchange for a very rapid rollout and the medical data that would provide.[7]

Over time, Israel's economy has evolved from an agricultural base to one with technology at its core. Measured by estimated value added as a percent of GDP, composition by sector in 2018 was dominated by services at 69.77%, followed by industry at 19.42% and agriculture at 1.09%.[8]

With an extremely limited water supply and only 20% of the land in Israel being arable,[9] following Israel's creation in 1948, agricultural development was a priority. Since then, Israel has become a global leader in sustainable agriculture, in part due to its successful investment in water technology, a topic that will be discussed later in this report.

While agriculture is highly advanced in its techniques and the basis for a technology export industry, its importance in the overall economy has fallen over time. In terms of value added by the agricultural sector as a percent of GDP, Israel's average for the period between 1995 and 2018 was 1.44%.[10]

Until the 1970s, most resources were directed to basic infrastructure such as agriculture and food processing, providing employment for many of the unskilled immigrants that were arriving. Industrialization followed, including a strong focus on developing and manufacturing weaponry for the country's defense. That investment in the aviation and defense industries produced new technologies that would later serve as the foundation for Israel's high-technology industries and for innovations in electronics, telecommunications, and computer hardware and software.[11]

Population and Immigration

Key features distinguishing Israel and its economy are its mixed Jewish-Arab population, the continuing role of immigration, and Israel's connection to the global Jewish diaspora. Israel's population is small—only 9.3 million as of June 2021.[12] Close to 74% are Jews (of all backgrounds), slightly over 21% are Arabs (of any religion), and the remaining 5% (defined as "others") are primarily Christian non-Arabs, Muslim non-Arabs,

and Druze.[13] Compared to other advanced economies, Israel has a young population with roughly 50% of its inhabitants being under 30.[14] Of the 37 member countries composing the OECD in 2020, it has the highest fertility rate,[15] and it ranks 12th globally in life expectancy.[16]

A pivotal event in Israel's technological development occurred in the 1990s, when the country welcomed a new wave of immigrants that included large numbers of highly educated scientists and workers from the former Soviet Union.[17] The collapse of the Soviet Union in 1989 had led to a change in the country's emigration policy that lifted restrictions and allowed citizens to emigrate freely. Israel's Law of Return, which dates from 1950, affirms the right of Jews to live in Israel and become Israeli citizens;[18] with the definition of who is a Jew subject to interpretation, a 1970 revision extended the right to people with Jewish ancestry (a Jewish parent or grandparent) and people who are married to Jews.[19] From 1990 and over the next ten years, 875,000[20] Soviet Jews emigrated to Israel, accounting for roughly 20% of the Israeli population. This group developed very high levels of labor market participation (90%).[21] Many came from urban areas, were highly educated, and brought technological and other skills. Their arrival is widely credited with accelerating Israel's shift toward a technology-led economy.

Another important component of Israel's governance, tied to demographics, is the requirement that all Israeli citizens, both male and female, over the age of 18 who are Jewish or Druze (only males) serve in the military. Ultra-Orthodox Jews who are engaged in studies at Jewish seminaries—a number in the tens of thousands—are exempted, as are Arab citizens (who can enlist if they choose).[22] As will be discussed later in this report, this near-universal service in the Israel Defense Force (IDF) has impacted the trajectory of Israel's technology and innovation economy.

Trade and Investment

Israel's transition from an agrarian economy to one led by technology is reflected in its trade. Roughly 66% of Israel's exports in 1949, shortly after independence, consisted of citrus fruit. In 2020, food and agriculture accounted for only 5% of Israel's exports, while machinery and electronic equipment accounted for 26%, chemicals and pharmaceuticals accounted for 24%, optical and medical equipment for 12%, rubber and plastic for 6%, and miscellaneous other goods for 19%. Israel is a global trading center for diamonds, which made diamonds its fourth largest 2020 goods export category at 8%. However, because diamonds enter and leave the country with little or no value added and have a marginal net impact on trade, they are not emphasized in Israeli trade statistics. Overall, goods (including diamonds) made up 53% of Israel's exports in 2020. The percentage of services in its export profile is growing; in 2020 services accounted for 47% of exports, compared to 39% in 2015. Significantly, of those 2020 services exports, almost half consisted of software, which accounted for 23% of total goods and services exports in that year.[23] In future years, Israel expects service exports to exceed goods exports.

The United States is Israel's number one trading partner and export destination, followed by China and the UK. In 2020, Israel's exports of goods (excluding diamonds) to the US amounted to $10.9 billion, or 25% of Israel's total goods exports. In 2019, Israel exported $21.6 billion in business services (including software) to the US, accounting for 58% of its total services exports. Europe followed, receiving 31% of Israel's business services exports.[24]

A cornerstone of Israel's trade relationship with the US is the 1985 United States-Israel Free Trade Agreement, the first such FTA ever entered into by the US.[25] Under its provisions, the US and Israel implemented phased tariff reductions which led to the elimination of all duties on manufactured goods in 1995. Although some agricultural import restrictions remained, roughly 90% of US agricultural exports by value enter Israel duty free.[26] Since the FTA was signed, US goods exports to Israel

have more than quintupled, reaching $14.4 billion in 2019.[27] Exports of services in 2019 were an estimated $5.8 billion. Two-way trade in both goods and services combined totaled $47 billion in 2019, with US exports of $20.2 billion and imports of $26.9 billion.[28] In 2020, California exported $1.3 billion in goods to Israel, making it the state's 25th largest export destination.[29]

Two-way investment is strong. The United States is the top global investor in Israel,[30] while Israel is an important investor in the US and the twentieth largest source of foreign direct investment in California, with 140 Israeli foreign-owned firms that support 6,248 jobs and $615 million in wages.[31]

Israel – Main Investing Countries	2019
USA	19.3%
Netherlands	7.8%
Cayman Islands	7.5%
Canada	3.2%
Luxembourg	2.3%
Singapore	1.9%
United Kingdom	1.7%

Source: OECD statistics, latest available data, reported by Santander Trade, September 2021, https://santandertrade.com/en/portal/establish-overseas/israel/foreign-investment

Israel – Main Invested Sectors	2019
Manufacturing	24.3%
Information and communication	22.4%
Professional, scientific and technical activities	14.7%
Finance and insurance activities	12.3%
Administrative and support service activities	4.6%
Real estate	4.1%
Mining and quarrying	1.7%
Wholesale and retail trade; repair of motor vehicles and motorcycles	1.5%

Source: OECD statistics, latest available data, reported by Santander Trade, September 2021, https://santandertrade.com/en/portal/establish-overseas/israel/foreign-investment

To further strengthen their relationship, each year the two countries convene a Joint Economic Development Group to discuss possible bilateral initiatives.[32] Economic, educational, and scientific ties are also supported by a number of binational initiatives—the Binational Science Foundation (BSF), the Binational Agricultural Research and Development Fund (BARD), the Binational Industrial Research and Development Foundation (BIRD), and the United States-Israel Educational Foundation (USIEF)—several of which are discussed later in this report.

Foundations of Innovation: Israel's Technology Ecosystem

"Entrepreneurship is the locomotive that drives the Israeli train.**"**

Moshe Zviran, Dean, Coller School of Management and Chief Entrepreneurship and Innovation Officer, Tel Aviv University

According to the World Bank analysis of the most recent available data, Israel invested 4.95% of its GDP into research and development (R&D) in 2018, giving it the highest R&D investment-to-GDP ratio in the world.[1] It has also had extraordinary success in applying that investment to commercial applications and new company formation. Reflecting that as of mid 2021, Israeli founders have produced 29 unicorns (privately-held startup companies valued at $1 billion or more) with headquarters located in the country, and including all Israeli-founded unicorns regardless of their headquarters locations, Israel's unicorn count rises to 71.[2]

This did not happen by accident but instead is the product of policies, developed over decades by Israel's government, that leverage national assets in areas of competitive strength and project them globally. Those assets, in turn, grow out of the historical challenges that Israel has faced as a small nation in a physically and politically hostile environment. The strategy has been documented in the seminal book by Dan Senor and Saul Singer, *Start-Up Nation: The Story of Israel's Economic Miracle.*

As described by Senor and Singer, the first leap that followed independence in 1948 was in agriculture. Kibbutzim (communal agricultural settlements) were created around the principles of equality and shared ownership. The early kibbutzim, which were established throughout Israel but particularly in the Negev desert, faced the lack of water in a country that is 95% arid or semi-arid. Innovative water strategies, supported by investment in R&D at research centers such as Ben-Gurion University of the Negev, produced innovations such as drip irrigation and advanced water recycling that have subsequently converted large swaths of desert land to agricultural and forest use.

Industrially, much of the economic focus in Israel's first thirty years was on centralized government solutions to basic challenges such as infrastructure development, defense, and the absorption of large numbers of immigrants. The nation's strong turn toward technology and private sector growth can be traced to the wave of Jewish immigration from the former Soviet Union (FSU) that took place between 1990 and 2000, when 875,000 citizens from the FSU emigrated to Israel.[3] Accounting for 86% of total immigration in the period,[4] that wave constituted about 20% of the Israeli population[5] and brought an influx of highly trained and educated talent that over time came to populate Israel's universities, R&D centers, and eventually its ranks of entrepreneurs.
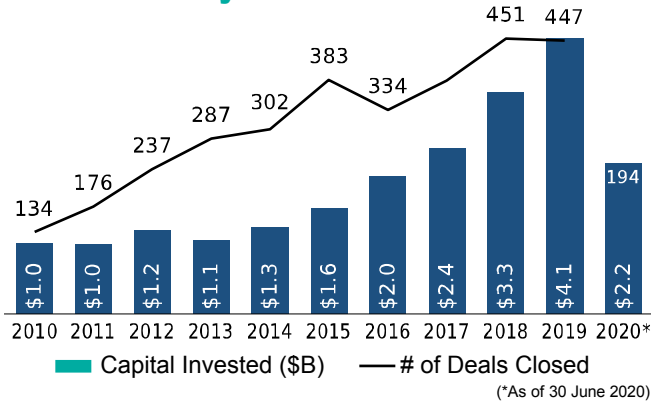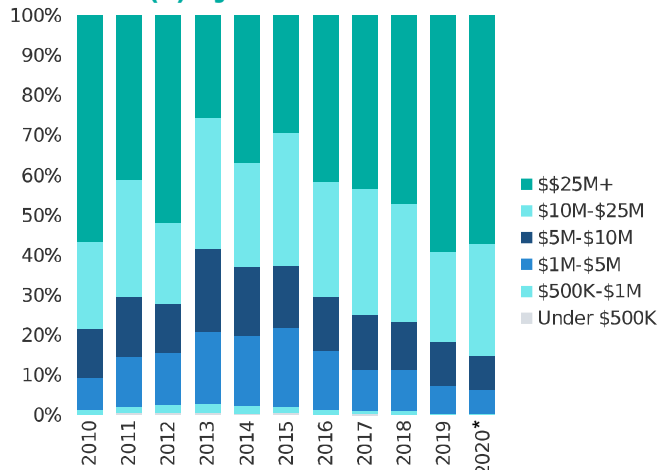
EXHIBIT 1
Israel's venture capital investment levels have grown steadily in the last ten years.
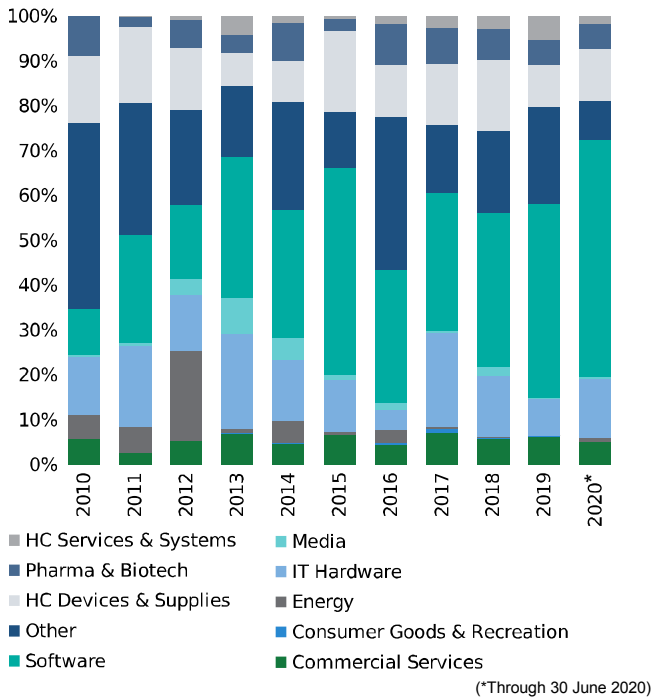
Israel's Venture Capital Ecosystem, 2010–2020

VC deal activity

134, 176, 237, 287, 302, 334, 383, 451, 447, 194

$1.0, $1.0, $1.2, $1.1, $1.3, $1.6, $2.0, $2.4, $3.3, $4.1, $2.2

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020*

■ Capital Invested ($B) ── # of Deals Closed

(*As of 30 June 2020)

VC deals ($) by size

■ $25M+
■ $10M–$25M
■ $5M–$10M
■ $1M–$5M
■ $500K–$1M
■ Under $500K

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020*

(*Through 30 June 2020)

VC deals ($) by Sector

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020*

■ HC Services & Systems   ■ Media
■ Pharma & Biotech   ■ IT Hardware
■ HC Devices & Supplies   ■ Energy
■ Other   ■ Consumer Goods & Recreation
■ Software   ■ Commercial Services

(*Through 30 June 2020)

VC deal activity with US investor participation

48, 66, 81, 100, 96, 150, 125, 165, 183, 182, 92

$0.9, $0.7, $0.6, $0.5, $0.7, $1.0, $0.9, $1.5, $2.2, $3.2, $1.6

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020*

■ Capital Invested ($B) ── # of Deals Closed

(*Through 30 June 2020)
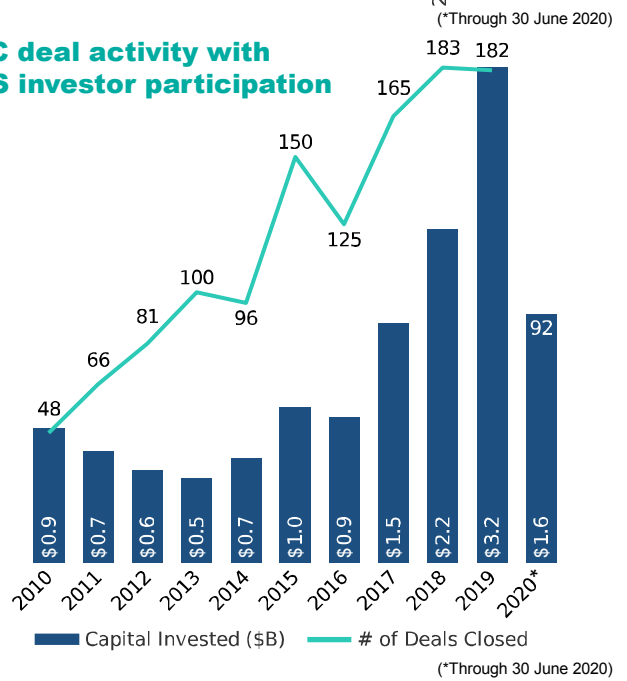
Source: PitchBook | Geography: Israel | Israel Private Capital Breakdown 2020

Fortuitously, that talent arrived as the 1990s technology boom was getting underway and global companies were searching for new engineering resources. This also solved the problem of how to generate employment for large numbers of immigrants in what was still a small economy. With a high percentage of FSU immigrants being scientists, engineers, or technicians, technology offered a pathway.

Creating a Venture Industry

Capitalizing on that opportunity, the government invested in what would soon become an Israeli venture capital industry. Matching grants had been available for startups from the Office of the Chief Scientist (OCS) at the Ministry of Industry, Trade and Labor, but with

their small sizes and the lack of follow-up funding, most enterprises failed. Part of the government's effort focused on research, with BIRD, the Israel-US Binational Industrial Research and Development Foundation, providing larger but still-modest grants for joint US-Israeli research with commercial potential.

In 1991, the government established the Israeli Technological Incubators Program (administered by the OCS), which created 24 technology incubators[6] that provided support and financing through payments of up to $300,000 for early-stage R&D projects that could be developed into businesses bringing innovative products to market.

With expertise at starting and running companies still lacking, Israel looked to Silicon Valley and its venture industry as a model for how to bridge the gap between R&D and the development of commercial products. The result was Yozma (Hebrew for "initiative"), an initiative financed by the Ministry of Finance[7] that invested $100 million to create 10 new venture capital funds. Under the Yozma arrangement, which leveraged public money to attract private investment,[8] each of the 10 public/private funds needed three parties: an overseas venture firm, an Israeli investment company or bank, and a potential Israeli venture capitalist. A separate Yozma fund of $20 million invested public money directly in companies. When the new venture funds proved popular, the initial one-and-a-half-to-one government match became a one-to-one-and-a-half match. Much of the early private money came from Jewish business leaders in California and from Silicon Valley venture funds such as Advent and Walden. The government retained 40% of the equity in the public/private funds, but the partners could buy it out at low cost if the fund was successful. When some funds saw early success, other venture investors joined the market without government support, and over time all 10 Yozma funds were privatized.[9]

Today, Israel's venture community includes 103 funds.[10] Investment levels have grown steadily in the last ten years, led by seed and early-stage deals but with growing later-stage activity, reflecting the system's increased maturity. With that, Israel-based startups are attracting larger funding rounds from an expanding pool of domestic and global investors.

Expansion in the pool of venture capital is paralleled by supporting infrastructure for startups, including nearly 80 accelerators. Israel now counts 1,900 startups, 1,600 of which are located in Tel Aviv.[11]

Reflecting this, the "startup nation" term, coined by Senor and Singer to describe Israel's prolific production of startup companies, is being replaced in the lexicon by "scaleup nation" to denote the growing number of startups that have succeeded in attracting later-stage funding and higher employee counts. According to a 2021 report by Wakefield Research, investments in scaleups in Israel between 2015 and 2019 increased 66% compared to the previous five years. In that period, Tel Aviv became the 15th largest global scaleup hub by funding growth, with 290 scaleup funding rounds.[12]

Investing in Innovation

Israel Innovation Authority

Government investment in innovation includes a range of other initiatives that stem from the Office of the Chief Scientist, which in 2016 was replaced by the Israel Innovation Authority, a new statutory public agency that is independent but has a board comprising a majority of government employees.[13] Its mandate is to support technological innovation, focusing on inclusive and sustainable growth using both policy and R&D tools. Investment in advanced applied R&D is spread across universities, industry, consortia between industry and universities, SMEs, and entrepreneurs. The strategy particularly targets investment where the market can't function and/or the development stage of an emerging technology before it is a viable candidate for private investment. Investment in 2020 totaled approximately $700 million, with more than 4,000 applications reviewed by subject matter experts both for the innovativeness of their technology and its potential for commercialization, and 45% approved.[14] Criteria include the technology itself, the founding team, whether the product will be manufactured in Israel, and whether the intellectual property will stay in Israel.

The Innovation Authority's investment takes the form of conditional loans of $50,000 to $15 million to support R&D, which are awarded per product line and cover up to 50% of a product's research budget. If the product

generates revenue, the company repays 3–5% of the revenue from that product annually until the loan is paid off, but if the product fails to produce revenue, the loan is forgiven.[15] (The Authority doesn't take equity or board seats.)

Start-Up Nation Central

Start-Up Nation Central, an independent nonprofit organization, operates as a connector to sources of Israeli innovation, working with overseas businesses, governments, and NGOs, and with Israeli founders who are bridging into global markets. In addition to serving as a source of deep expertise on the Israeli innovation ecosystem, Start-Up Nation Finder, a free online platform, provides detailed profiles of thousands of emerging companies, serving as a gateway for corporations, investors, NGOs, governments, and entrepreneurs to connect to and navigate through the ecosystem. Key areas of focus include digital health, agritech, cybersecurity, industry 4.0, fintech, and watertech.[16]

Israel Innovation Institute

Through the nonprofit Israel Innovation Institute, Israel has also created a suite of sector-oriented innovation communities (HealthIL, GrowingIL, CatalystIL, EcoMotion, DeserTech, and PLANETech) to advance innovation and the digital economy in specific fields. Founded in 2011 to support Israeli entrepreneurs who are addressing global challenges, the Institute aims to foster open innovation and promote the structured process of innovation management in organizations. Three of the innovation communities are operated in collaboration with the Israeli government: HealthIL, which focuses on the digital transformation of healthcare and healthcare innovation; GrowingIL, which deals with global food challenges while promoting innovative agritechnologies; and EcoMotion, which brings together more than 600 startups and 10,000 members in the smart mobility sector. In 2018, the Institute founded CatalystIL, a first-of-its kind professional community focused on developing innovation management knowledge within both public and private organizations and on a regional level. The other two communities joined the Institute in 2020: DeserTech, which is a collaboration with Mirage Foundation Israel to promote

the development and commercialization of technologies that enable sustainable living in arid climates; and PLANETech, which is a joint venture of the Institute and Consensus Business Group to connect organizations and companies that bring innovative technologies to the challenge of climate change[17]

SPOTLIGHT
HealthIL

A nonprofit joint venture of the Ministry of Economy, the Digital Israel National Initiative, the Israel Innovation Authority, and the Ministry of Health, HealthIL aims to bridge the gap between Israel's technology community and the public health sector through digital transformation—in Israel and globally. It particularly links digital health startups with companies and organizations that need technology such as hospitals, HMOs, healthcare providers and pharmaceutical companies, and medical device companies, with the goal of integrating digital technology more deeply into healthcare.[18]

SPOTLIGHT
GrowingIL

An initiative of the Israel Innovation Institute, the Ministry of Economy, the Ministry of Agriculture and Rural Development, and the Israel Innovation Authority[19] and 50% funded by government, GrowingIL engages 500 agritech companies and a broader community of 4,000 members. With a model similar to HealthIL, it works within an ecosystem of startups, multinational corporations, government agencies, and service providers to support the growth of Israel's agritech sector, inside and outside Israel, by providing a supportive environment of startups and accelerating the implementation of agritech technologies. In its ecosystem role, GrowingIL organizes conferences, meetings, and open innovation events such as hackathons; engages with an average of five startups each week to foster their understanding of the startup pipeline and the solutions it offers; connects startups with mentors; develops "investor maps" that connect investors with opportunities; and develops pilot marketplaces to connect startups with farmers in order to deploy and test emerging technologies.[20]

Other national level technology initiatives are supported by Israel's Ministry of Defense, Ministry of Science and Technology, and Ministry of Finance, with a focus on emerging technologies such as artificial intelligence, data science, bio-convergence (biology linked with engineering) and quantum mechanics (in fields such including sensors, computing, and communication).

Key Universities and Research Centers

A cluster of key universities and research institutes anchors Israel's technology and innovation system.

Technion

Established in 1912, 36 years before Israel declared independence,[21] Technion–Israel Institute of Technology is the country's oldest university. With a main campus on Mount Carmel in Haifa, Technion has approximately 14,000 students and 620 faculty members,[22] 4 of whom have won Nobel Prizes in chemistry.[23] To date, the university has produced more than 111,000 graduates.[24]

Technion is consistently ranked as one of the world's top universities for science and research, and its alumni have played a key role in the development of Israel's high-tech sector. The university holds the #12 spot in the world in PitchBook's 2020 ranking of top universities producing entrepreneurs who go on to attract venture funding.[25] Technion graduates make up a high percentage of Israel's scientists and engineers, as well as founders and managers of high-tech companies.

Since its founding, Technion has developed strong programs in fields ranging from biotechnology to stem cells, space, computer science, nanotechnology, and energy.[26] Notable inventions by graduates and faculty include the USB memory stick, invented by Dov Moran,[27] and the Lempel-Ziv-Welch international standard for data compression, created by Professors Abraham Lempel and Jacob Ziv[28] as well as Terry Welch (not associated with Technion). The university is also home to Israel's only academic department of aerospace engineering and plays a significant role in Israel's aerospace industry. Recent plans call for

expansion of the department's faculty, students, and programs with a particular focus on five application areas: autonomous aviation, air traffic management, and future aircraft design; microsatellites and nanosatellites; hypersonic and high-speed air vehicles; underwater vehicles and platforms; and high-efficiency energy systems in propulsion.[29]

Other initiatives are underway to focus and integrate the university's research capacity in key fields. A Technion Human Health Initiative launched in August 2020 combines the expertise of its research and teaching hospitals with multiple Technion faculties and industry partners in pharma and biomedicine.[30] In June 2021, Technion and Doral Energy-Tech Ventures signed a memorandum of understanding (MOU) for strategic cooperation to promote research, development, and commercialization on projects in the fields of renewable energy, energy storage, agro-solar, hydrogen production, carbon capture, waste treatment, water, and environmental infrastructure, including promotion of the Technion DRIVE Accelerator program to support startups related to projects.[31] A third initiative, an advanced manufacturing R&D center, builds on a track record of collaboration between academia and industry in areas such as robotics, computer-aided design, and manufacturing, to promote joint research in industrial IoT, augmented reality, simulation, and generative design software.[32]

Technion's footprint extends internationally, the foremost example being the Jacobs Technion-Cornell Institute at Cornell Tech in the heart of New York City. Established in 2011, the Jacobs Institute makes Technion the first international university to provide accredited degrees on US soil.[33] Offerings include master's degrees in connective media, urban technologies, and health technologies,[34] as well as the Runway Startup Postdoc Program for recent PhD graduates to transform their research into companies.[35] Also overseas, the Guangdong Technion-Israel Institute of Technology in Shantou (China) aims to bring Israeli innovation in environmental, civil, and materials engineering to Asia. Other noteworthy global endeavors include a partnership on human health with the University of Michigan and the Weizmann Institute of Science,[36] and a new venture with Carnegie Mellon University for artificial intelligence research.[37]

The Hebrew University of Jerusalem

Founded in 1918 and opened officially in 1925, The Hebrew University of Jerusalem is the second oldest institution of higher education in the country. Albert Einstein and Sigmund Freud were among the members of its first Board of Governors[38] and since its establishment the university has counted eight Nobel Prize winners. With seven faculties and 14 schools across seven campuses (with the main campus in Jerusalem), it serves 23,000 students from Israel and 65 other countries. The university's three campuses in Jerusalem include the Mount Scopus campus for the humanities and social sciences, the Edmond J. Safra Givat Ram campus for exact sciences, and the Ein Karem campus for medical sciences.[39] Outside of Jerusalem, the Rehovot campus is home to the Faculty of Agriculture, Food and Environment; its Koret School of Veterinary Medicine is Israel's only veterinary school and a major referral center for veterinarians in the Middle East. Other campuses include the Veterinary Teaching University Hospital in Rison Le Zion[40] and the Interuniversity Institute for Marine Sciences in Eilat.[41] The Hebrew University is ranked 24th in the world for mathematics in the ShanghaiRanking 2021 global ranking of academic subjects.[42]

Founded in 1964 and the third company of its kind ever created, Yissum is the technology transfer company of The Hebrew University of Jerusalem. It has registered more than 10,750 patents for more than 3,030 inventions, has licensed more than 1,050 technologies, and has produced more than 170 spin-off companies.[43] Noteworthy products and companies include the Alzheimer's disease treatment drug Exelon and computer vision vehicle collision warning company Mobileye.[44] The Hebrew University of Jerusalem holds the #32 spot in the world in PitchBook's 2020 ranking of top universities producing entrepreneurs that go on to garner venture funding.[45]

Tel Aviv University

The need for an additional university (after The Hebrew University of Jerusalem) in Israel's growing central region was foreseen in 1953 by municipal leaders who decided to transform an existing small institute at Abu Kabir in southern Tel Aviv into the core of the future Tel Aviv University (TAU). Formally incorporated in 1965, TAU is now Israel's largest, most comprehensive institution of higher learning with more than 30,000 students studying across nine faculties, 29 schools and 98 departments.[46] That includes a strong research base. Significant technology programs include Israel's largest biomedical research and teaching program, with 1,400 scientist-clinicians at 17 affiliated hospitals serving over 2 million people.[47] The university's newest science initiative, announced in 2019, is the Center for Quantum Science and Technology, which connects more than 20 research labs from different faculties on the campus.[48] TAU's commercialization arm, Ramot at Tel Aviv University Ltd., has registered more than 1,200 patents, averaging 75 new patent applications per year. That activity has supported the establishment of 65 startups and over 200 licenses and option agreements with commercial partners.[49]

TAU's Coller School of Management aims to teach undergraduates the language of entrepreneurship, to enable them to start companies. In addition to offering a course in entrepreneurship campus-wide, it teaches "entrepreneurship as a second language" with the aim of helping would-be entrepreneurs gain the skills to launch their ventures, but also providing non-entrepreneurs with the language and skills that will enable them to be employed at and support entrepreneurial enterprises. Localized innovation programs have also been established within different university schools such as engineering, management, and law, with plans for future centers at the schools of biomedicine and computer science.[50]

In 2017, the Coller School of Management launched the annual Coller Startup Competition, in which 50–70 teams, each with at least one current student or recent alumnus, apply to compete for the first place prize of a $100,000 investment[51] from Jeremy Coller, the school's leading donor, and an option for later funding. The second place winner is awarded $25,000[52] and all winners get space and mentoring from TAU Ventures. TAU Ventures, the university's early-stage venture capital fund, was created in 2018 to invest initial pre-seed funding into new ventures created by TAU students and alumni.[53] The first fund, announced in April 2018, raised a total of $20 million and has invested in more than 20 companies.[54] A second fund is being raised now.[55] TAU holds the #8 spot globally in PitchBook's 2020 ranking of top universities producing entrepreneurs who go on to garner venture funding.[56]

Ben-Gurion University of the Negev

Established in 1969 as a development engine for Israel's southern Negev region, Ben-Gurion University of the Negev (BGU) is home to 20,000 students across three campuses in Be'er-Sheva, Sde Boker, and Eilat. The second campus in Sde Boker is home to the Jacob Blaustein Institutes for Desert Research, a leading center for research on water and its use in desert settings. Eilat, at the northern end of the Red Sea, has strong programs in marine biology and hospitality.[57]

The university has become a major technology hub with a strong focus on cybersecurity. Cyber @ BGU (the Cyber Security Research Center @ Ben-Gurion University of the Negev), a project with the Israel National Cyber Bureau, drives R&D on cyber security technologies through a state-of-the-art facility inaugurated in 2017[58] that houses a Cyber Attack Simulation Lab, Malware Analytics Lab, Mobile Security Lab, Embedded Systems Security Lab, and Secure Cyber Lab (designed for confidential research).[59] Future plans include a School of Sustainability and Climate Change[60] and a new 57-acre North Campus now under construction that will more than double the university's footprint in Be'er-Sheva. Facilities will include a Homeland Security Institute with lab space devoted to fields such as remote sensing, imaging, satellites, and electro-optics.[61] Yazamut 360°, BGU's entrepreneurship center, has launched its new Oazis accelerator program which helps researchers find partners for establishing companies to turn research into successful startups.[62]

These advances have catalyzed a growing R&D and commercial technology sector in Be'er-Sheva, which describes itself as the "cyber capital of Israel." CyberSpark—an initiative of the Israel National Cyber Directorate in the Prime Minster's office, Be'er-Sheva Municipality, BGU, and leading companies in the cyber industry—coordinates joint activities.[63] The Advanced Technologies Park, adjacent to the campus, is home to multinationals such as Oracle and IBM.[64] With the Soroka University Medical Center within walking distance and the new IDF (Israel Defense Force) $6.44 billion telecommunications and cybersecurity campus also coming to Be'er-Sheva,[65] the city's technology cluster strategically bridges academia, industry, and defense. Be'er-Sheva has been designated Israel's first official Innovation District,[66] with core areas of focus

that include digital health, desert technology, and cyber security, anchored by BGU.[67]

University of Haifa

Founded in 1963, fully accredited in 1972, and with 18,000 students today, the University of Haifa is the largest research university in northern Israel. With six faculties, 59 departments, 10 schools and 57 research centers and institutes, including 18 international graduate programs, the university is particularly recognized for its programs in public health, security studies, cancer research, neurosciences, bioinformatics, and marine sciences.[68]

Bar-Ilan University

Founded in 1955, Bar-Ilan University is home to 19,000 students.[69] Building on faculties of medicine and engineering, and exact sciences departments of mathematics and computer science, its Leslie and Susan Gonda Multidisciplinary Brain Research Center is home to 44 brain science laboratories.[70] The Institute of Nanotechnology and Advanced Materials (BINA) collaborates extensively with Israeli and overseas research institutions including the Israel Center for Advanced Photonics at the Soreq Nuclear Research Center (on quantum sensing and bioconversion)[71] and the University of Sydney's Nano Institute (on energy, health and quantum). In California, BINA is a research partner with the California NanoSystems Institute (CNSI) at UCLA.[72]

IDC Herzliya (recently renamed Reichman University)

IDC (Interdisciplinary Center) in Herzliya is the first and only private university in Israel. Founded in 1994 by Professor Uriel Reichman as a law school with 360 students, it has grown since then to 8,300 students in nine schools and a tenth that is international. Most programs are in social sciences, but the university (which was recently renamed to honor its founder[73]) is also home to a well-regarded School of Computer Science, a multidisciplinary Innovation Center, and three programs that focus in depth on entrepreneurship.

The Zell Entrepreneurship Program, funded 21 years ago by Chicago entrepreneur Sam Zell, is tailored for

undergraduates in their final year of study and open to students from across the campus. With a rigorous selection process, only 20–24 participants are accepted each year. Its core offering is a one-year course on Venture Creation where students form teams that go through ideation to market research, validation, competitive analysis, and product design to create the business model for a new company. Throughout the year, teams interact with venture capitalists, entrepreneurs, and business leaders in a process that has proven highly productive. Over 20 years, 138 companies have been founded by alumni, of which 84 are active, 22 have been sold or merged and 2 have done IPOs, together raising $1.2 billion.[74] Successful companies include ironSource (which completed a SPAC merger valued at $11 billion),[75] Monday.com (which completed a $6.8 billion IPO),[76] and Similarweb (with a $1.6 billion IPO).[77] Other successful graduate-founded companies include HoneyBook (now headquartered in San Francisco), Hippo Insurance (a Bay Area company founded by Assaf Wand), and AppsFlyer (currently valued at $2 billion).[78]

A related program is the IDC Entrepreneurship Club, a student-founded and student-run organization with approximately 70 members and as many as 2,000 annual participants in competitions, meetings, and classes.

The university's latest initiative, which ties these pieces together, is the Adelson School of Entrepreneurship. It is the first and only school in Israel dedicated to entrepreneurship and today is the foundation for IDC's entrepreneurship program, going beyond the small and highly selective Zell program to extend entrepreneurial education to all students. To provide depth, its BA program requires a double major with another field—computer science, economics, or business administration.[79] IDC also has the largest internship program in Israel focused on startups, a program that is becoming international as interns are placed in the UAE, Germany, and soon other countries.[80]

Weizmann Institute of Science

Another anchor for Israel's technology and innovation complex is the Weizmann Institute of Science. Founded in 1934 by Dr. Chaim Weizmann, a chemist and later the first President of the State of Israel,[81] the Weizmann Institute today comprises 3,800 scientists, graduate

students, and skilled research technicians,[82] organized around 250 experimental and theoretical research groups in five faculties: biology, biochemistry, chemistry, mathematics and computer science, and physics.[83] More than 60 groups operate in the field of cancer research, representing 40% of the Institute's life sciences research.[84] Scientific advances from its basic research include foundational amniocentesis development, blockbuster drugs, nanomaterials and compounds for industrial and medical uses, advanced computer technology, and breakthroughs in data storage options. Other research has led to protein-enriched wheat that provides a 40% greater yield, and increased water supply through the treatment of brackish water. In addition to a Nobel Prize in Chemistry won by Dr. Ada Yonath, three of its computer scientists have won the Turing Award, considered the Nobel Prize of mathematics.[85]

Two milestones in bridging research to market were the Weizmann Institute's establishment in 1959 of a technology transfer company, Yeda Research and Development, which has subsequently registered more than 2,000 families of patents, and the establishment of Israel's first hi-tech park, Kiryat Weizmann, adjacent to the campus.[86]

Immigration and Education

As noted in the previous chapter, Israel's environment for innovation has benefitted from large-scale immigration. This was particularly the case for emigration from the former Soviet Union (FSU) in the 1990s when approximately 875,000 Soviet Jews emigrated to Israel. That wave included large numbers of highly-trained engineers and scientists who brought their skills to Israel at the same time as the economy began its turn toward technology and engineering and its scientific foundation was being laid.

Also since the late 1980s, Israel has invested in the teaching of technical skills, and of computer science in particular, in its high schools, producing a pool of talent on which its military, research centers, and technology companies can draw. Math skills, for example, carry over to software, a critical and growing segment of the economy. Israel now plans to introduce STEM fields into the school curriculum as early as kindergarten, to encourage scientific thinking and prepare students for

potential high-tech careers. Pilot programs in computer science and robotics are being introduced into middle school curricula in the 2021–2022 school year.[87]

Military Service:
The Secret Sauce

Israel's success in generating technology startups can't be explained by its research and scientific base alone. A key factor that sets it apart from other countries and economies is the requirement of universal service in the Israel Defense Force (IDF) by all Jewish citizens with the exception of Arabs and the ultra-Orthodox.[88] Israelis, both male and female, enter the military at age 18, and after service of 30 months for men or 24 months for women according to current rules,[89] many enter a university. At that point in their careers they are more mature than students in other countries, with life experiences that have prepared them for entrepreneurship. Military experience imparts discipline and a capacity to give and take direction. As one Silicon Valley executive with long experience in Israel notes, "it's easier for a startup to mobilize quickly and get everyone facing in the same direction. They can hit the ground running."[90] Another notes that "Everyone has served in the army and understands risk. After you've risked your life before you're 21, there's nothing particularly intimidating about risking money."[91]

The shared experience of military service also serves to build relationships, particularly in elite units that focus on technology. Best known is Unit 8200, the IDF unit (roughly comparable to the US National Security Agency) that is responsible for signals intelligence and code decryption and, more recently, cyber security.[92] Promising candidates with computer skills are recruited from high schools for these units and assigned challenging roles, absorbing technical and command skills at a young age. An alumnus describes the experience this way: "At age 18 you enter the Israeli intelligence corps and have access to the best technology in the world. The investment is overwhelming and you have the best equipment and human capital anyone could wish for. You don't go to classes—you dive into tech and have to come up with solutions to complex problems, as fast as you can, and are given the resources to get the job done."[93]

Many alumni of 8200 and similar defense units start technology companies, building on the networks created by their former military ties. A corporate observer describes Unit 8200 as "the equivalent of Harvard and Yale in the competitiveness and desirability of its alumni, who by the age of 24 have both life experience and a background solving problems. When technology companies in Israel hire, they may ask first about the applicant's military unit before their university."[94]

Lacking those networks, Arabs and ultra-Orthodox Jews who do not serve in the military are at a disadvantage in Israel's startup ecosystem, a gap the government is endeavoring to address. A recently announced plan ("Impact") calls for a $100 million five-year investment to help the Arab community develop the skills to work in tech, through educational programs, vocational training, technology incubators for entrepreneurs and startups, and technology and science centers for Arabs. With a commitment of equal opportunity for all, the plan calls for an incubator hub with seed funding for minority entrepreneurs and two new R&D centers, one specifically for the Bedouin community. Today, Arabs account for around 20% of the population but only about 2% of tech workers, while ultra-Orthodox Jews make up 12% of the population but only 3% of tech workers. Success would increase those numbers and support the government's goal of increasing the share of Israelis working in tech from its current 10% to 15%, adding about 200,000 people to the tech workforce.[95]

Global from Day One

Another defining characteristic of Israeli startups is that they are global from the outset. Israel's home market population of 9.3 million is too small to support growth beyond an early stage, so founders need to think globally the moment an enterprise is created. Technologies and business models created in Israel may be piloted domestically, but founders must immediately look overseas for growth and markets. As they do, they focus principally on the United States, with California a key destination. As Oded Cohn, Director of IBM's Haifa Research Lab (2005–2021) comments, "You can't afford to target your technology on the Israeli market. Here, a weakness becomes an advantage."[96]

Silicon Valley in Israel

> "Israel is a global hub of innovation because of its greatest natural resource—its amazing and diverse human talent."
>
> Marc Benioff, Chair and CEO, Salesforce

Drawn by the search for engineering talent, Silicon Valley technology companies began their migration to Israel in the mid-1970s—a movement that has continued to the point where today R&D centers of California-based companies are pervasive. Acquisitions of Israeli startups by Silicon Valley and other California companies have deepened the scope of cooperation beyond R&D to include technology commercialization and enterprise development, leading to a relationship between the two ecosystems that is complementary and collaborative, supporting technological development, revenue generation and employment in both.

California's outsized footprint in Israel is reflected in the membership of the Israel-America Chamber of Commerce, which includes Chevron (San Ramon), Google (Mountain View), Facebook (Menlo Park), Intel (Santa Clara), Netflix (Los Gatos), Cisco (San Jose), HP (Palo Alto), Intuit (Mountain View), and Western Digital (San Jose).[1] Chevron holds significant stakes in and operates both the Leviathan and Tamar gas fields off Israel's coast, the largest and second largest natural gas fields in the eastern Mediterranean;[2] in addition to domestic supply, the fields support gas exports to neighboring Egypt and Jordan.[3]

Out of 402 multinational companies with an innovation presence in Israel, 96 are California headquartered, and of those, 80 are from the Bay Area. By comparison, there are 13 multinationals with an innovation presence from the UK, 14 from France, 15 from Germany, 10 from China, 7 from Japan, and 6 from India.[4]

Though small by global standards, Israel constitutes a significant market for Silicon Valley and other technology companies. In May 2021, it was announced that Google and Amazon Web Services had been awarded a more that $1 billion project to provide cloud services for Israel's public sector and military. This is happening as the government starts moving its data to the cloud under the multi-year Nimbus project.[5] The creation of a cloud region in Israel is also expected to support Israel's technology ecosystem by encouraging the establishment of local companies that work on cloud technologies and export cloud services.[6]

California Foreign Direct Investment in Israel

Silicon Valley's footprint is seen most deeply in the concentration of California's investment in the field of software and IT services.[7] From January 2003 to February 2021, there were a total of 147 foreign direct investment (FDI) projects by California companies in Israel. Of those, 127 were from companies in the greater Bay Area, with the largest concentration from Santa Clara County.[8]

Foreign Direct Investment Projects by California Companies in Israel, 2003–2021

Greater Bay Area Counties	No. of Projects	Other California Counties	No. of Projects
Alameda	6	Ventura	1
Contra Costa	0	Los Angeles	11
Marin	1	Orange	2
Napa	0	Not Specified	6
San Francisco	18		
San Mateo	20		
Santa Clara	81		
Santa Cruz	1		
TOTAL	127	TOTAL	20

Those investments were functionally concentrated in R&D (62) followed by sales and marketing (40).

Leading Reasons for Investment (All of California)

Investment Purpose	No. of Projects
R&D	62
Sales, Marketing & Support	40
Business Services	21
Manufacturing	13
ICT/Internet Infrastructure	5
Headquarters	3
Maintenance & Servicing	1
Recycling	1
Customer Contact Center	1

Software and IT Services (67) was the dominant field for investment, followed by Semiconductors (19), Financial Services (17) and Communications (10).

Key Sectors for Investment

Sector Receiving Investment	No. of Projects
Software & IT Services	67
Semiconductors	19
Financial Services	17
Communications	10
Business Machines & Equipment	9
Industrial Equipment	6
Automotive OEM	5
Business Services	4
Chemicals	2
Biotechnology	2
Consumer Products	1
Electronic Components	1
Medical Devices	1
Non-Automotive Transportation	1
Renewable Energy	1
Minerals	1

According to fDi Markets, the value of that investment by 103 California companies between 2003 and 2021 totaled $22.4 billion.

Of the top 20 companies investing in Israel, 18 were headquartered in the Bay Area.

Top 20 Companies Investing in Israel, ranked by number of projects, 2021

Rank	Company
1	Intel
2	Apple
3	Facebook
4	Google
5	HP (Hewlett-Packard)
6	Intel Israel
7	Nvidia
8	Oracle
9	Tesla Motors
10	Better Place
11	DCG Systems
12	Juniper Networks
13	Sentinel Labs
14	ZipRecruiter*
15	Accel Partners
16	Adallom
17	Agilent Technologies
18	Applied Materials Israel
19	AFEX (Associated Foreign Exchange) acquired by FLEETCOR June 2021**
20	Autodesk

*ZipRecruiter is headquartered in Santa Monica

**AFEX is headquartered in Los Angeles; FLEETCOR is headquartered in Atlanta

Recent California Investment Projects

Recent California investments in Israel reflect these broader patterns:[9]

- Stock option marketplace **EquityBee** (February 2021) is expanding its existing office in Tel Aviv, creating 30 new jobs in the US and Israel following completion of a $20 million Series B funding round.

- B2B customer data platform **Leadspace** (February 2021) is expanding its software and IT services R&D presence in the city of Hod Hasharon, having recently raised $46 million from an angel investor.

- **Apple** (November 2020) is investing $64.8 million to consolidate and expand its R&D operations in Haifa. The company has signed a lease for a 28,000 square meter facility located in the Matam Park high-tech and business center.

- **Intel Israel** (September 2020) is expanding its operations in Haifa, with a new 90,000 square meter R&D center in the Matam Park high-tech and business center that will eventually house more than 3,000 employees.

- Palo Alto's **Next Insurance** (September 2020), a provider of digital insurance solutions to help small businesses eliminate the need for agents, is expanding its office in Kfar Saba. The company plans to hire 200 employees across its current offices by the end of 2021.

- Santa Clara-based computer security platform **Netskope** (August 2020) has opened a new data center in Tel Aviv to serve the domestic and African markets.

- **Facebook** (July 2020) invested in software and IT services R&D.

- **Google** (April 2020) invested in ICT and internet infrastructure R&D.

- Cupertino-based **Seagate Technology** (February 2020), a producer of disc drives, opened its Lyve Labs innovation center in Tel Aviv.

- **Oracle** (February 2020) opened a cloud data service center that will support the company's newly-created Israel cloud region and serve the domestic market.

- **Tesla Motors** (January 2020) opened an R&D office to scout local startups and technologies. This follows the opening in December 2019 of an automotive service center in Tel Aviv.

R&D Centers

> ❝Ideas that come from Israel have incredible impact worldwide.❞

Safra Catz, CEO, Oracle

As these investment patterns suggest, California companies' presence can particularly be seen in research and development centers that integrate with their global operations. For many companies, that presence began with the acquisition of an Israeli company, an anchor that then grew to become a full-scale R&D center. While the list of Silicon Valley companies with R&D centers is long, several stand out as examples of the role that Israel is playing in multinationals' global R&D and business systems.

SPOTLIGHT
Applied Materials

Established in 1997, Applied Materials' R&D center initially grew from the company's search for talent and lower costs. That started with the acquisition of two Israeli companies—one a startup and the other public—intended to advance the company's capacity in semiconductor testing equipment. Those acquisitions later formed the core of Applied Materials Israel. Dan Maydan, who was president of the company at that time, recalls "Our secret was to create groups of people and give them incentives as if they were a startup. Being a small country with high technical capabilities, Israel was the perfect place to do that."[10]

Located in Rehovot, close to the Weizmann Institute of Science, the Applied Materials Israel main campus is now home to 1,000 employees who focus on machine learning and computer vision-based metrology (measurement) and inspection products that are essential to wafer fabrication. The Israel site is Applied Materials' largest research center outside the United States. Optics, lasers, scanning electron microscopy, image processing, algorithms, machine vision mechanics and robotics, and software and user interfaces are its leading areas of focus. With a large share of its employee base in R&D roles, the Rehovot campus also includes a 4,000 square meter manufacturing cleanroom. Two other customer service and support facilities that focus on installation and maintenance—at Kiryat Gat and Migdal HaEmek—bring the employee count in Israel to 1,800. With more than a thousand registered patents,[11] Applied Materials Israel as a stand-alone business unit generates more than $1 billion in revenue.[12]

SPOTLIGHT
KLA Corporation (formerly KLA-Tencor)

KLA's presence in Israel dates to 1986,[13] when KLA Instruments was still a young company.[14] Like Applied Materials, it was initially looking for lower taxes and talent. Ken Levy, KLA's founder and then-CEO, notes that among the locations the company considered, "Israel won hands down. We could have gotten much better deals on tax incentives, but the human capital was far above what was available elsewhere." The catalyst was Dan Vilenski, an executive with another company at that time, who proposed creating an Israel team. That started with a pilot project that brought technology from Silicon Valley for the local team to perfect and convert into products. When the effort was successful, more products were sent to Israel for development, with the team there given full responsibility for the product lines, from R&D to manufacturing, marketing, and product support. Vilenski went on to become General Manager and Vice President of KLA Israel.

The company's Israel arm now has 350 employees, generates $46.8 billion in sales, and hosts one of the company's two global manufacturing centers (the other being in Singapore). Graduates of its local operations are running many of Israel's semiconductor capital equipment companies. Levy states that "KLA Israel has the best record of any overseas unit in sales and productivity."[15]

SPOTLIGHT
IBM

IBM Research–Haifa, part of IBM's global network of research centers that includes its Almaden lab in San Jose, was established in 1972.[16] Dr. Josef Raviv, a research scientist working at IBM's

T.J. Watson Research Laboratory in Yorktown Heights,[17] close to IBM's headquarters in New York, wanted to return to Israel. Haifa's Technion was already known as a center for technology, and he was encouraged to open a science center for the company in Haifa. From an initial research group of four, the staff has grown to more than 300, making Haifa IBM's largest research center outside the United States. Today, a combined staff of 1,000 operates in five locations including Haifa, Herzliya, Rehovot, the Jerusalem Technology Park, and Givatayim near Tel Aviv,[18] with a focus on AI, hybrid cloud data services, healthcare informatics, and image and video analytics, alongside mobile, security, and quality.[19]

Activity in Haifa is rooted in research, but also focuses on spinoffs from the research to business development units. Leading fields include security, hybrid cloud computing and data services, AI, quantum computing, and healthcare information analytics. Current projects include the use of neural networks for automatic speaker diarization (the process for recognizing "who spoke when")[20] and the IBM Blockchain Transparency Supply (BTS) platform, which in an early application allows users to track the entire spectrum of textile manufacturing from sources to sales in order to verify the roles of contributors at every stage of the process.[21] The IBM Project Debater, an AI system developed in Israel, helps businesses to better identify, understand, analyze, and synthesize human language; that technology had its debut in a computer face-off with a debating champion in 2019.[22]

Healthcare is also a focus. That work is tied to Israel's healthcare ecosystem. Israel offers a conducive laboratory because of its compact size and a health system that is centralized and digitalized, allowing access to a level of data not available in the US. That capacity supports machine learning for healthcare[23] and life sciences which, in turn, has enabled more advanced AI research.

Laboratory director (2005–2021) Oded Cohn attributes Israel's high-tech sector and IBM's success in Israel to several factors: the large scale presence of multinationals ("everybody is there: both old tech and new tech"); robust venture investment; top universities such as Technion, The Hebrew University of Jerusalem, and Tel Aviv University; and a compact, open society where, as in the Bay Area, people readily move between universities, startups, and large companies. "Innovation is still a very local phenomenon," he says, and "Israel is a society that's well connected and where people meet and engage easily." There's also a cultural factor: "Israelis are impatient and don't wait for someone else to fix things. Usually they'll do it themselves."[24]

SPOTLIGHT
Oracle

In addition to hiring talented technologists, Oracle has grown in Israel through acquisitions both of companies that had a presence in Israel, and of others such as cloud computing software maker Ravello Systems, marketing software company Crosswise, and IT training startup Iridize, that were founded there. In addition to being a source of research and development, Israel remains a significant market, with customers such as EL AL Israel Airlines and leading companies in the defense sector. Israel's Ministry of Defense is also a client.

The company's presence includes sites in Petah Tikva, Herzliya Pituach, and Be'er-Sheva, which is home to a cybersecurity center. In 2021, Oracle opened the first public cloud data center based in Israel to support work in fields such as artificial intelligence, big data analysis, and autonomous mobility technology. Underlying that growth, CEO Safra Catz says, is Israel's strong connection to Silicon Valley: "Silicon Valley is a place where new ideas are born every day and where people are inspired to solve hard problems that others aren't thinking about. Israel is similar. Startup companies that begin in Israel often go worldwide."[25]

SPOTLIGHT
Cisco

Cisco's R&D presence in Israel began with a leading Israeli engineer, Michael Laor, who wanted to return home in 1997, which led to the opening of an R&D center with 15 people.[26] The company now has four offices in Israel, all

of which do engineering. Head count in the country includes approximately 700 engineers, with core areas of focus including silicon, cyber, and core networking. Its Caesarea facility and engineering center focused on hardware was built on the acquisition of Leaba Semiconductor in 2016. Leaba's co-founder and CEO, Eyal Dagan, subsequently became a member of Cisco's executive leadership team, reporting to the CEO and overseeing all silicon, hardware systems, and optics for the company's switching, routing, optical, cable access, and IoT portfolios. Its three other facilities are a Tel Aviv engineering center, focused primarily on cybersecurity and networking, and another engineering center in Netanya, which is also home to the company's sales, marketing and headquarters team.

An Israeli company was Cisco's first acquisition outside the US in 1998, and since then its R&D presence has continued to grow through acquisitions, with fifteen made to date. Including those acquisitions, other non-acquisition investments (38), and investment in five venture funds, Cisco has invested more resources in Israel than any other location outside the United States—more than $2 billion—which in addition to technological benefits have produced venture exits valued at over $4 billion. Recent portfolio companies include Habana (acquired by Intel for $2 billion) and Gong.io (currently valued at $7.2 billion).

Daniel Karp, director of investments and corporate development for the company says "We view Israel as a critical resource for market, technology, and business innovation and as a strategic center for Cisco," noting that the company's global strategy builds on disruptive technology in markets. That is overlaid with a geographical focus on areas of the world that could contribute to its success by accelerating business and technology growth. In 2014, the company announced an "Israel Innovation" investment theme focused on Israeli startups developing products and services in key areas such as IoT, data center systems, enterprise software, cloud, mobility, networking, video, collaboration, and security. "One of the theses we had as a team," he notes, "was that

there was unique talent in Israel around silicon and networking. Israel was one of the best in the world in these fields and we felt we could build a team who could be leaders for the company that we couldn't find elsewhere."

Those investments have paid off. Particularly significant was Cisco's strategic investment in Qumranet, the company that developed KVM— the leading open source technology that powers most modern cloud platforms including Oracle Cloud, Google Cloud, and AWS[27]—which "has delivered tremendous value." Over time, its presence in Israel has helped to deepen and extend Cisco's depth in cybersecurity, cloud, and IT, with personnel continuously moving between Silicon Valley and Israel. Karp notes that "Israel and Silicon Valley share a common focus on deeply rooted technical problems that need to be resolved in an innovative way." As the relationship has deepened, 35 Israeli companies have been founded by former Cisco employees.[28]

Intel

In Israel since 1974, Intel Israel is a major presence on Israel's economic landscape. With 14,000 employees,[29] it is the largest technology company and private employer in the country and in 2020 accounted for $8 billion in exports, or 2% of Israel's GDP,[30] with 10% of the technology workforce in Israel working either directly or peripherally on projects associated with Intel.[31] Through the years, it has invested $43 billion locally, through the development of facilities and acquisitions of more than 20 Israeli companies.[32] Those facilities are spread across five locations: four design centers—in Haifa, in Petah Tikva near Tel Aviv, in the coastal town of Yakum north of Tel Aviv, and in Jerusalem— and a manufacturing center at Kiryat Gat in the south between Tel Aviv and Be'er-Sheva.[33] This broadly reflects its focus, where approximately two-thirds of its employees are involved in design (with pillars in computing, communications, cybersecurity, and AI) and the other third are engaged in manufacturing.[34]

That presence started with a team of five, which grew organically at first and later through acquisitions of companies that develop silicon or support today's technology pillars, including the largest acquisition in the history of the country—autonomous driving company Mobileye.[35] The main force in the founding of Intel Israel, Dov Frohman, was an early employee and leading engineer at Intel's Bay Area headquarters. When he returned to Israel, he was empowered to launch Intel's operations there.[36] The first locally-developed product—the 8088 processor used in IBM PCs—appeared in 1979, followed by

- the MMX chip used to power Pentium II computers and the precursor to the Centrino and other processors used in desktop and laptop computers;

- the Sandy Bridge family of processors that was responsible for 40% of Intel's sales worldwide in 2011 and was the fastest-selling product in Intel's history;

- the Sky Lake microprocessor that enabled computers to connect to power and be linked to printers and other peripherals without wires or cables in 2014;

- the 7th and 8th generation Intel Core processors in 2018; and

- in 2021, key IP for the third-generation Xeon processors that will power the world's largest cloud service providers including Google, Microsoft, Amazon, and Dell.[37]

In other milestones, the first Intel fab (semiconductor fabrication plant) outside the US opened in Israel in 1985.[38] Additional fabs that have opened since then produce chips across the full-service platform, from PCs and data centers to the cloud. Acquiring the talent necessary to support activity at that scale is very competitive, but Intel Israel General Manager Yaniv Garty says, "It's a good problem to have."[39]

Other California companies with major R&D operations in Israel include Apple, which is developing LiDAR sensors for iPhone and autonomous vehicle applications; San Diego-based Qualcomm; Nvidia, which is recruiting 600 programmers; and Marvell

Technology, whose facility employs approximately 600 engineers. Google is planning a major development operation, and Facebook is also planning a chip development fab.[40]

The growth of multinational R&D centers in Israel has produced intense competition for engineers, a phenomenon familiar in Silicon Valley. This is leading the government to reduce the priority placed on attracting new R&D centers and devote new attention to developing untapped sources of talent such as Arab citizens and ultra-Orthodox Jews. With an increasingly constrained pool of local talent, companies have also started to outsource engineering outside Israel to other countries, particularly in Eastern Europe.

Venture and Acquisition Footprint

The Bay Area and Israel are the world's two densest hubs of startup activity, with Tel Aviv claiming the highest number of startups per capita in the world after Silicon Valley.[41] The scale and depth of the Bay Area presence in Israel has produced a unique dynamic with a two-way flow of people and ideas. Intel Israel General Manager Yaniv Garty, who also serves as chairperson of the 230-member Israel-America Chamber of Commerce, observes that "When you're here, it feels like an extension of Silicon Valley, with all of the top names present. There's a single degree of separation between the two places and a very similar mindset."[42]

That connection includes venture capital. Fifty-seven California-headquartered investors, of which 54 are from the Bay Area, have invested in a total of 750 Israeli startups—constituting a major contribution to the development of Israel's innovation ecosystem. Those investors have been particularly active in larger and later-stage investment rounds. Fifty-eight percent of all investment rounds of $30 million and above had at least one California investor, while 47% of all rounds at Stage C or above had a California investor. This suggests the central role played by California investors in enabling Israeli startups to scale.[43]

This startup connection and the bridge that links the Bay Area with Israel are analyzed in depth in the chapter that follows.

The Bridge to California

❝Every Israeli is thinking about Israel.**❞**

Dan Maydan, President Emeritus, Applied Materials

Israel, its institutions, its companies, and its technologies are deeply embedded in Silicon Valley. The scale and depth of that connection is remarkable for a country with a population of just 9.3 million, only slightly larger than the Bay Area itself.

At the bedrock of the relationship is a rich web of human capital.

University Connections

Faculty from Israel can be found across Bay Area universities and at universities across the state, working in fields from health to AI and data science. Israeli researchers at Bay Area universities are connected through the nonprofit organization **ScienceAbroad**, which supports postdoctoral Israeli researchers as a community.[1] Branches, each with its own volunteer manager, have been established at universities around the world and particularly in the US. There are four branches in the Bay Area—at UC Davis, UC San Francisco, UC Berkeley, and Stanford. Other branches in California are active at UCLA, UCSD, and Caltech (California Institute of Technology). Postdocs come through individual arrangements, not institutional agreements. Approximately a dozen Israeli scholars are currently conducting research at UCSF, 20 at UC Davis (where plant biology is a major focus), 20 at Berkeley, and 70 at Stanford (not including spouses).[2]

Beyond serving as an away-from-home network, the ScienceAbroad branches ensure an active two-way connection between researchers living abroad and in Israel. One important function is to encourage the return of Israeli scientists to Israel to continue on industry-based research tracks or develop entrepreneurial opportunities. Tools include meetings with key figures from Israeli industry, academia, and government; information on sources of employment in Israel; job fairs with Israeli employers that may include subsidized flights for events or job interviews; entrepreneurship and industry workshops; and a website that allows Israelis with PhDs to search for industry-related academic positions. After completing their programs, many researchers do return to Israel, but others stay to become part of the US science ecosystem, taking positions in the private sector or academia.

All of Israel's leading universities have large alumni groups in the Bay Area. Most support active ties with their home campuses and prominent leaders in the Bay Area's business community.

Technion

More than 1,300 Technion alumni reside in the Bay Area, including founders and industry leaders Johny Srouji (senior vice president of hardware technologies at Apple), Oren Zeev (founder of Zeev Ventures), Tomer London (co-founder of Gusto), and Andi Gutmans (co-founder of Zend Technologies, since acquired by Rogue Wave Software).[3] Bay Area programs and events are organized by the American Technion Society–Silicon Valley/San Francisco.[4]

The Hebrew University of Jerusalem

The Hebrew University is believed to have at least 1,700 alumni in the Bay Area and California and enjoys a particularly strong relationship with UC Davis through its school of agriculture and veterinary hospital, the only facility of its kind in Israel.[5]

Tel Aviv University (TAU)

The American Friends of Tel Aviv University, with 2,000 alumni in the Bay Area, facilitates partnerships[6] between TAU and Bay Area universities and research institutions. Current programs include a research collaboration with Stanford on smart cities and a research collaboration with UCSF, the Buck Institute for Research on Aging, and the Gladstone Institutes on neurodegenerative diseases. The project on neurodegenerative diseases is supported by San Francisco's Taube Foundation, and both programs are supported by San Francisco's Koret Foundation. Another collaboration focused on COVID-19 is underway between TAU and UCSF. Researchers and scientists move in both directions.[7] Most recently (pre-COVID-19) 42 representatives of UCSF and TAU participated in a joint symposium on Computational Biology and Drug Discovery in Tel Aviv in December 2019,[8] and in January 2020 a delegation from Stanford, UCSF, the Gladstone Institutes, and the Buck Institute traveled to Tel Aviv for a joint symposium on Personalized Diagnosis and Drug Screening.[9] In the private sector, in April 2021 Google and TAU announced a three-year joint program to promote AI-related multidisciplinary research to address global social, economic, and environmental challenges, operating through the TAU Center for Artificial Intelligence and Data Science.[10]

Ben-Gurion University of the Negev

More than 1,000 alumni of Ben-Gurion University of the Negev reside in the Bay Area. Leaders in the region's technology community include Shlomi Ben Haim (co-founder and CEO of JFrog), Dor Abuhasira (CEO and co-founder of autonomous drone developer Percepto), Itamar Arel (vice president at McD Tech Labs, the McDonald's innovation office in Silicon Valley), and Dror Berman (founding partner of Innovation Endeavors, a venture fund co-founded with Eric Schmidt which has invested in more than 100 companies to date including SoFi and Uber). Bay Area programs and events are coordinated by Americans for Ben-Gurion University.[11]

Community and Philanthropy

Academic and other connections are also supported by an active philanthropic component rooted in the Bay Area's Jewish community. Jewish immigrants first found success during the Gold Rush, building thriving businesses serving the miners. San Francisco offered a tolerant environment where they could prosper. Levi Strauss built a clothing empire and Walter Haas found success in dry goods, while German Jews established the city's leading department stores, including Gump's and I. Magnin.[12] By the 1870s, a dozen leading families, nearly all from Bavaria, had become prominent in San Francisco's community. More than 16,000 people of Jewish ancestry lived in the city, making it the second largest Jewish community in the United States.[13] Today, the Jewish community counts approximately 350,000 people in the Bay Area, constituting the fourth largest concentration of Jewish people in the United States. Forty percent have visited Israel.[14] The Jewish population in the Los Angeles metropolitan area numbers 617,000, making it the second largest Jewish community in the US after the New York metro area[15] and the third largest in the world after Israel and the US as a whole.[16] Overall, 1.17 million Jewish people live in California.[17]

Philanthropy at a high level began early and has continued to the present. As a few examples,

- Levi Strauss endowed a dozen scholarships at UC Berkeley;

- Isaias Hellman donated a wing to Mount Zion Hospital;

- Rosalie Meyer Stern donated the land to the city for what is now Stern Grove and helped create the San Francisco Museum of Modern Art;

- Ignatz Steinhart gave the city the Steinhart Aquarium, which became the California Academy of Sciences;

- the family of Walter Haas Sr. endowed the business school at UC Berkeley;

- Warren Hellman endowed the Hardly Strictly Bluegrass Festival; and

- Richard and Rhoda Goldman endowed the Goldman Environmental Prize.[18]

This broad-based philanthropy extends to Israel. Major donations have included $50 million given by Nancy and Stephen Grand in 2013 to support the National Center for Personalized Medicine at the Weizmann Institute of Science.[19]

Donations particularly flow from Silicon Valley to universities. In December 2020,[20] Americans for Ben-Gurion University received the second largest single gift commitment in its history—$25 million—from Silicon Valley technology entrepreneur Nahum Guzik to build a cultural center on the new North Campus of Ben-Gurion University of the Negev (BGU). That followed an earlier donation that established the Guzik Family Building for Biotechnology Engineering at the university.[21] Another Silicon Valley business donor, Business Wire founder Lorry Lokey, funded the state-of-the-art Lorry I. Lokey Chemistry Building, which opened at BGU in February 2021.[22]

Political consultant Sam Lauter observes, "The relationship with Israel is unlike any other I've seen in San Francisco. People in the Jewish community consider this their home, but Israel their homeland. When you couple that with people having been engrained with the importance of giving and contributing, it creates a very strong connection. The connection is visceral, since other communities that at some point came from other countries don't have to worry about their people being wiped off the map. So it's natural that funders here want to support and protect the homeland."[23]

Of the Bay Area's many Jewish foundations, the **Koret Foundation** is most actively connected to Israel. In addition to supporting community and educational institutions in the region, Koret is one of the largest philanthropic funds in the country with an active Israel focus. Bridge-building, particularly at the institutional level, is a priority.

University research projects it has recently supported include

- a collaboration with Stanford University on smart cities;[24]

- a collaboration between UC Berkeley and Tel Aviv University on bioinformatics;

- a collaboration between Stanford Hospital and Rambam Hospital on emergency medical treatments;

- a collaboration between Stanford University and Tel Aviv University on neurodegenerative diseases; and

- a collaboration between Stanford University and the Weismann Institute of Science on childhood leukemia.[25]

Koret also supports programs that link the region's Jewish community to Israel, including

- a program that sends young American Jews to Israel;

- a partnership with Shalem College in Jerusalem that brings Israeli students to the US to study Jewish communities in America and experience a week-long immersive visit to the Bay Area; and

- an initiative with a non-governmental coalition of Israeli organizations working in disaster relief and international development, IsraAID, which has engaged thousands of young adults and drawn on more than 120 Bay Area professionals as participants in IsraAID missions.[26]

Other major foundations that contribute to Israel include the Lisa and Douglas Goldman Fund,[27] the Taube Foundation for Jewish Life and Culture,[28] and the Helen Diller Family Foundation, which in addition to being the private largest donor to UCSF (with grants totaling $1.1 billion) and a patron of the arts through gifts to the de Young Museum, SFMOMA, the Contemporary Jewish Museum, and the Legion of Honor (where it has endowed an annual Israel Antiquities Series), has supported the Helen Diller Center for Quantum Science at Technion, the Israel Institute of Technology, and the Israeli Rhodes Scholars program.[29]

Jewish community organizations with a significant Bay Area presence that actively support connections to Israel include the Jewish Community Relations Council, the Jewish Community Federation and Endowment Fund, AIPAC–American Israel Public Affairs Committee, A Wider Bridge (which advocates for LGTBQ rights in Israel), the New Israel Fund (which supports a liberal society and partnership with Arabs in Israel), and FIDF (Friends of the Israel Defense Forces). Most synagogues in the region have Israel Committees that also serve as bridges.

Technology and Innovation

Overall, Israel's unique relationship with the San Francisco/Silicon Valley Bay Area is built on technology, innovation, and a circular flow of entrepreneurs, acquisitions, and venture investment. That flow benefits both sides, including Israeli entrepreneurs, whose technologies and ideas are brought to US and global markets, and California companies that access Israel's human capital and strength in key technologies.

Governmental Connectors

Three institutions jointly supported by the Israeli and US governments play key roles: the Israel-US Binational Industrial Research and Development Foundation (BIRD), the US-Israel Binational Agricultural Research and Development Fund (BARD), and the US-Israel Binational Science Foundation (BSF).

SPOTLIGHT
BIRD

The Israel-US Binational Industrial Research and Development Foundation (BIRD) is one of two binational research entities established in 1977 by the US and Israeli governments to support mutually beneficial industrial R&D between US and Israeli companies and organizations.[30] Since then (through 2020) $327 million in grants have been awarded for the joint development of innovative technologies and products. A total of 1,018 projects have been approved, leading to $113 million in repayments from successful projects and approximately $10 billion in cumulative sales from BIRD-supported activities. Projects cluster (in rank order) in several key fields: energy, water and the environment; life sciences; electronics; communications; homeland security/cybersecurity; software; healthcare IT; and agrotechnology.[31]

Any two companies, as long as one is registered in Israel and the other in the United States, may jointly apply for BIRD support. Projects, which undergo external review, are expected to show both innovation and commercial potential,[32] with approximately 20 supported annually.[33]

Approved joint development projects may receive up to $1 million in funding to cover up to 50% of each company's associated R&D expenses. Repayment is required if a project leads to commercial revenue, but the foundation doesn't take equity or intellectual property rights.[34]

California is by far the largest recipient of BIRD grants in the United States, with 286 projects funded to date and a total investment of $34,240,635.[35] Recent projects with California companies cover a broad spectrum including

- a commercial service to enable users to seamlessly design and order DNA or other biological products—Amyris, Inc. (CA) and Genome Compiler Israel Ltd. (ISR);

- discovery of novel modes of biological seed and plant protection for drought resistance—Marrone Bio Innovations, Inc. (CA) and Groundwork BioAg Ltd. (ISR);

- development of a cost-effective green solar thermal heating system for dairy farms—Free Hot Water (dba Gemtech Sales Corp) (CA) and TIGI Ltd. (ISR);

- an electrode coating for high-efficiency solar cells—Integrated Photovoltaics Inc. (CA) and Cima Nanotech Israel Ltd.(ISR);

- development of a therapy for patients with presently untreatable gout—Mountain View Pharmaceuticals, Inc. (CA) and Savient Pharmaceuticals Inc. (formerly Bio-Technology General Ltd.) (ISR); and

- business continuity for websites, enabling constant availability during malfunctions, cyber attacks, or heavy loads—Net Optics, Inc. (CA) and Sentrix Web Technologies Ltd. (formerly foresight Information Security Technologies Ltd.) (ISR).[36]

Two sector-specific programs support joint research in clean energy technology—BIRD Energy, created in 2009,[37] and Homeland Security Technology (BIRD HLS),[38] created in 2016—with new funding that supplements BIRD's original endowment:

- Energy proposals are particularly welcomed relating to renewable energy and energy efficiency, advanced vehicle technologies and alternative fuels, smart grid, storage, the water-energy nexus, advanced manufacturing, and AI for energy management. The US-Israel Center of Excellence for Energy, Engineering and Water Technology supports energy R&D undertaken by consortia of US and Israeli companies, universities, and research institutions,[39] with grants of up to $10 million.[40] Launched in 2018, the Center is a five-year program specifically focused on four topics: fossil energy, energy storage, energy cyber, and energy-water nexus.[41]

- Fields for homeland security projects include security for critical infrastructure and public facilities, safe and secure cities, border protection, unmanned aerial systems, and advanced first responder technologies.

Between 2009 and 2020, fourteen projects in California were funded by BIRD Energy,[42] including most recently

- a collaboration between Polaris Energy Services (San Luis Obispo) and Netafim Irrigation (Tel Aviv) to develop an integrated irrigation and energy management system;

- a project between Solaria Corporation (Oakland) and FSIGHT Energy (Tel Aviv) to develop capabilities in Distributed Energy Resource (DER) management and energy trading; and

- a project between Vepco Technologies Inc. (Chino) and VisIC Technologies Ltd. (Nes Ziona) to develop a dual motor drive power inverter for both plug-in and battery electric vehicles.[43]

SPOTLIGHT
BARD

Similar to BIRD but focused on agriculture, the US-Israel Binational Agricultural Research and Development Fund (BARD) was created with a $110 million endowment by the governments of the United States and Israel in 1977 to enable US and Israeli scientists to address agricultural challenges of concern to both countries.[44] With $1 million

jointly contributed to the fund each year since then, it awards $7 million annually in research grants and fellowships to binational teams of US and Israeli scientists, spread over 20–25 projects.[45] Based on a competitive application process and scientific peer review, recipients receive grants of $310,000 over a three-year period.[46]

Over its first forty years, BARD has invested in over 1,330 research projects, with participation by more than 900 researchers from the US and 630 from Israel. Most (73%) are drawn from public universities, with the balance from USDA and public and nonprofit research institutions. These research projects are supported by a large number of postgraduates, many of whom go on to academic appointments and positions in industry. This shared research has led to approximately 200 new agricultural practices, 40 commercial engagements, and 100 patent-series and breeding rights licenses. Sixty-five percent of the projects generated practical applications for agricultural practice and policies, and 35% generated significant environmental impacts (such as increasing global protein availability at affordable costs).[47]

BARD's priorities include increasing the efficiency of agricultural production, protecting plants and animals against biotic stress, protection against challenges such as drought and increased salinity, food safety, water quality and quantity (including water recycling for agriculture), genomics and proteomics, sensors and robotics (including precision agriculture), and sustainable bio-energy systems (including renewable resources and biofuel production).

With the largest agricultural economy in the United States, leading research universities, and a climate similar to Israel's, California is BARD's largest US partner with 302 grants awarded through 2019 (followed by New York with 152, Florida with 98, and Texas with 72). Funded California institutions include nine campuses of the University of California, Stanford University, Carnegie Institute of Washington-Stanford, Scripps Research Institute, California State University, Caltech, and the USDA Forest Service, with the top three awardees being

UC Davis (139), UC Riverside (65), and UC Berkeley (26).[48] The relationship with Davis stands out, with The Hebrew University campus in Rehovot sometimes referred to as "Davis East" due to the extent of faculty and post-doc interaction.[49]

Joint projects with UC Davis cover a broad range of research. Jorge Dubcovsky at UC Davis and Tzion Fahima at the University of Haifa have identified genes that increase the protein and micronutrient content and strengthen resistance to rust in wild wheat, enabling their transfer to domesticated wheat varieties. Another project, led by Alan Bennett at UC Davis, Mason Pharr at North Carolina State University, and Ari Schaffer at Israel's Volcani Center, studied the biochemical basis for sucrose accumulation in melons and wild tomatoes, enabling their transfer to domestic cultivars and the production of sweeter tasting tomatoes. The technology was subsequently purchased by Syngenta, which plans to produce five commercial varieties of tomatoes, including the Nebula tomato that is now grown in California.[50]

In 2020, 3 of the 22 research projects awarded grants were in California and of 10 post-doctoral fellowships awarded, 4 were in California. Those projects include a study co-led by Professor David Zilberman at UC Berkeley, on how microalgae can be managed for agricultural purposes, and research co-led by Maciej Zwienicki at UC Davis to predict orchard bloom time in relation to climate change, helping farmers to make short-term decisions and long-term plans.[51]

Spotlight
BSF

The US-Israel Binational Science Foundation (BSF), founded in 1972 and the oldest of the three binational research organizations, is focused on theoretical (basic) science. In that sense, it is different from BIRD and BARD, which are mission-oriented organizations that focus more on applications. Its grantees include 47 scientists who are now Nobel laureates[52]—the second highest number for any research institution in the world after the National Science Foundation (NSF).[53]

The core BSF program is supported by an original 1972 endowment of $100 million,[54] which generates $18 million in income per year. This supports approximately 100 projects each year based on joint applications by US and Israeli researchers, resulting in about 350 grants that are active at any time. As the costs of research have risen over the years, BSF's project focus has shifted toward creating the conditions for establishing long-term research collaborations. That typically includes support for collaborations that can generate preliminary results, enable scientist and student exchanges, and advance high-quality publications. Funding is directed to US as well as Israeli principal investigators on the binational research teams, with a special window available for scientists who are early in their careers.

Its second program is a partnership created in 2012 with the NSF,[55] in which the NSF receives proposals from US scientists for binational projects and reviews them under a Lead Agency model. If the NSF recommends a project for an award, BSF will match it on the Israeli side. This differs from the core program, as collaboration is supported at a more substantial level, but money doesn't cross borders and both sides leverage resources already in place.

Since 1999, universities in California have received close to $16 million in research funding through BSF programs, making the state by far the largest recipient of support. Of 881 total grants, the largest recipient campus has been Stanford (234), followed by UCSD (126), UCLA (106), Caltech (94), UC Berkeley (79), UC Santa Barbara (51), UC San Francisco (50), USC (38), UC Irvine (37), UC Santa Cruz (25), UC Davis (22), UC Riverside (17), UC Merced (1), and Humboldt State University (1).[56]

Two California projects serve as examples of advances enabled by BSF support:

- The discovery of a system of protein degradation that governs major cell functions has led to life-saving drugs including a treatment for multiple myeloma bone marrow cancer, with other applications expected for diseases including

asthma, arthritis, multiple sclerosis, Alzheimer's, and Parkinson's. Supported by BSF for 15 years, the team of Professors Avram Hershko and Aaron Ciechanover at Technion and Professor Irwin Rose at UC Irvine were awarded the 2004 Nobel prize in Chemistry for their work.[57]

- ■ Highly sophisticated infrared optical fiber technology, which will be used by NASA in its search for extra-solar habitable planets, has been developed by Professor Avraham Katzir of Tel Aviv University and Professor Amnon Yariv of Caltech. The technology helps enable the identification of habitable planets through the detection of pairs of stars and planets similar to Earth and the Sun and the detection of oxygen, water, and carbon dioxide through infrared color detection.[58]

The three US-Israel binational foundations are starting to work together. A joint initiative was recently launched on AI, and US Senators Marco Rubio and Maria Cantwell have proposed legislation to create a US-Israel AI Institute to advance the collaboration. BSF is separately developing partnerships with the US Department of Energy's national laboratories, and DOE has appointed an energy attaché at the US embassy in Jerusalem to further develop relationships. On the Israeli side, a committee of experts has been established to determine the value of such a partnership and the communities it would serve. Fields for collaboration in the future are likely to include quantum computing, materials science (semiconductors, chip designs), condensed matter and solid-state materials, and nuclear physics.[59]

Non-Governmental Connectors

Private nonprofit organizations also provide important linkages.

Founded in 2000 by Zvi Alon, **The California Israel Chamber of Commerce (CICC)** was the first organization established as an industry-based bridge between the business communities of California and Israel. Its focus has evolved over time. As Executive Director Sharon Vanek describes its development, in the beginning the Chamber was oriented toward large Silicon Valley companies, primarily in the semiconductor industry, and the leveraging of offshore Israeli talent. Many of its early leaders had come from Israel to work

in the industry in the 1980s and 1990s and saw the need for a platform to help companies coming from Israel to connect with both business and government. Other Israeli engineers and programmers arrived later, with many becoming entrepreneurs, investors, and long-term residents. They too worked to welcome newcomers. From semiconductors, the Chamber's focus expanded to embrace the digital economy, and most recently to support the transmission to California of advanced technologies and innovations developed in Israel in fields such as cybersecurity, health, and agtech. Other activities connect companies with universities and research centers, with resources such as BIRD and BARD, and with other grant opportunities.

One early initiative from the Chamber was to organize a series of delegations from California designed to highlight innovation coming out of Israel. Since the first organized visit in 2004 of Silicon Valley venture capitalists to Israel, more than 250 California participants have made the trip. Most delegations have been built around specific sectors and organized with California partners. Silicon Valley Bank and Lightspeed Venture Partners partnered on the first venture trip, while PG&E partnered on an energy and cleantech delegation. Google, Yahoo, and eBay have partnered with the Chamber on delegations focused on e-commerce and digital payments, while Apple and Sequoia Capital have focused on mobile technology.

The trips to Israel also exposed the Chamber to the challenges that young Israeli companies have, which led to the development of new programs to showcase their capabilities in Silicon Valley. That produced trips in the reverse direction, with several groups of companies coming to California each year for meetings organized around sectors such as solar, water, agriculture, cybersecurity, health, telecommunications, energy, and mobility. Organized with Bay Area partners, these meetings aimed to focus, vertical by vertical, on sectors where Israel had developed a critical mass of companies that were producing innovations from which California companies could benefit. An early example was the mobile navigation app developer Waze, which when it first visited California was a small company in Israel with approximately two million users. When the closing of the 405 freeway in 2010 produced massive congestion in Los Angeles, the company achieved a breakthrough,

and since its acquisition by Google has acquired 140 million monthly active users.[60]

Over the years, the CICC has worked closely with hundreds of companies in an effort to provide tailor-made services ranging from market research to fundraising and connections with potential clients and partners. Alongside its networking activities, the Chamber also organizes educational programs that provide guidance and support to members on topics such as taxation, market structure, and fundraising. Annual conferences, often with dedicated themes such as healthtech, cybersecurity, agtech, medical cannabis, fintech, or education regularly attract hundreds of industry leaders.[61] Lately, the Chamber has expanded the scope of its networks beyond the Bay Area to include all of California.

ICON, described by its founder Yasmin Lukatz as "a community of people who share a passion for Israeli technology and innovation," works to connect Israeli founders with corporate and venture decision makers. Participants from larger companies must be either a partner in a VC firm or a corporate executive at the director level or above who could potentially partner with a startup.[62] The group organizes Israeli Innovation Week, a 10-day event held each fall, as well as roundtables, small events that focus on particular verticals, and dinners with venture investors. It also provides office space for visiting startups at the Jewish Community Center in Palo Alto, brings Silicon Valley "insiders" to Israel for programs that help bring more entrepreneurs into the Silicon Valley conversation, and hosts SV101, a program that brings entrepreneurs from Israel to Silicon Valley for a two-week bootcamp. A "Women in Tech" program that specifically targets female entrepreneurs has expanded nationally. Lukatz believes that despite the recent willingness of investors to use online platforms such as Zoom to connect with companies around the world, Silicon Valley's role will remain central: "Silicon Valley is still the most important place for events. New York is second, but a distant second."[63]

Israel21c, a Bay Area-based nonprofit, was created in 2001 in the wake of the Second Intifada to convey information and perspectives on Israel that might not appear in the mainstream media. It currently publishes more than 13,000 originally researched articles and videos on contemporary Israeli topics including technology, culture, health, the environment, and civil society.[64]

R&D Partnerships – NASA Ames Research Center

❝Israel and the Bay Area are both unique. They are melting pots that attract people who challenge the system and how things are done. That's the foundation for a good partnership.❞

Jacob Cohen, Chief Scientist, NASA Ames Research Center

R&D partnerships between Bay Area research institutions and Israel are extensive. One example is NASA's Ames Research Center in Mountain View. Because Israel's research expertise spans a variety of technical disciplines, it has been able to engage with NASA Ames across the spectrum of the Center's eight core competencies: air traffic management, entry systems, advanced computing & IT systems (robotics), intelligent/adaptive systems, cost-effective space missions, aerosciences, astrobiology and life science, and space and earth science.[65] NASA Ames facilities have hosted tests for the Israel Innovation Authority, Israel's Ministry of Defense, and academia.

At any point in time, there are Israeli researchers working at the facility. Collaborations take place through the exchange of scientists and students, testing in the NASA Ames wind tunnel, and fundamental research in areas such as earth science, mission design concepts, and space science. The Israel Space Agency is the Center's governmental counterpart. In 2022, the private Houston-based company Axiom Space will launch an Israeli mission, Rakia (Hebrew for sky), which will fly to the International Space Station with a private astronaut crew that includes Israeli businessman and former IAF fighter pilot Eytan Stibbe.[66] NASA Ames is working with researchers at Technion on a payload that will fly with the mission. According to NASA Ames Chief Scientist Jacob Cohen, "Mission alignment is important and what stands out is that Israel aligns with all eight missions. Israel is making advances that are useful and is developing solutions we can apply. And it goes the other way: we can help them grow their focus on civil space. There is robust exchange of ideas from Israel to Ames and from Ames to Israel."[67]

Human Capital in Silicon Valley

For decades, senior Israeli managers and technologists have been an important part of the Bay Area/Silicon Valley ecosystem. Besides spearheading startups, business leaders from Israel are spread throughout the region's leading companies, often in positions concerned with innovation and technological advancement.

This dates to the 1970s when Silicon Valley first attracted Israeli talent to its growing semiconductor industry. An example of this journey is Levy Gerzberg who, following military service and a Master of Science degree in medical electronics from Technion, came to Stanford as an electrical and bioengineering student in 1972 to study signals processing and later earned a PhD.[68] He initially applied that technical background to the medical field, launching his new company Zoran in the Bay Area and Haifa in 1981. (The name Zoran is derived from the Hebrew word for silicon.) The idea was to develop new digital signal processors (chips) and software for large-scale applications in medical devices. Once its signals processing technology had found use in the military market, the company strengthened its focus on the design and production of integrated circuits for mass market consumer electronics.[69] After going public in 1995, Zoran grew to a presence in 10 countries, including a major research and operations site in Israel. Over the years, eight companies were acquired, including three in Israel.

Data compression, an interest dating back to Gerzberg's days at Technion, was central to this growth. Focusing on multimedia applications, Zoran helped produce the first consumer fully digital camera in partnership with Fujifilm, eventually claiming a leading position in the global digital camera market for its Camera on a Chip (COACH) chips. Working with the Joint Photographic Expert Group (JPEG), it also helped establish the first standard for digital images.

DVDs were a similar story. In the early 1990s, film projectors in movie theaters and audio receivers were designed around several chips on large printed circuit boards. Gerzberg wanted to bring compression technology for media applications to the masses through DVDs and DVD players: "Most companies thought it would take too long to develop a small enough chip, but I drove to San Francisco and convinced Ray Dolby at Dolby Labs that a chip could be developed for mass applications within a year, which we did. We took it from there to Hollywood and multiple consumer product manufacturers, where it became the standard chip for use in DVD players." The chip was designed between Silicon Valley and Israel. Zoran subsequently became a leading global provider of chips and software for DVD players as well as HDTVs, movie and home theater systems, color printers, and other markets.[70]

Today this pattern extends throughout Silicon Valley, including not just founders but also Israeli technologists and executives who lead corporate technology and innovation strategies, as exemplified below:

- Zack Rinat, a Technion graduate and early leader in Silicon Valley's entrepreneurial community, held senior management positions at Silicon Graphics and co-founded NetDynamics, which was later acquired by Sun Microsystems, and is currently a founder and Executive Chairman of Model N,[71] a cloud-based revenue management company that counts leading companies in 120 countries as its clients.[72]

- A former student of computer science at Ha'Universita Ha'Petuha in Israel, Amir Shevat, is an angel investor and former Chief Product Officer at Reshuffle (now part of Twitter). Previously, he was instrumental in the creation of Google Launchpad (a startup program first launched in Israel), managed scalable developer relations for Google worldwide, helped Slack grow its developer base, and served as Amazon's VP of Platform at Twitch, where he managed developer products, services, and adoption.[73]

- Before becoming General Manager of semiconductor manufacturer GlobalFoundries and a partner at Pitango Venture Capital, University of

Haifa graduate Amir Faintuch served as Senior Vice President and General Manager at Intel, managing worldwide R&D.[74]

- A graduate of Technion who now runs an incubator for early-stage Israel-connected companies, Miasnik Ventures CEO Guy Miasnik founded two companies (one each in the Bay Area and Israel) and later served as Chief Strategy Officer at BlackBerry.[75]

- Technion bachelor's and master's degree holder Johny Srouji is Senior Vice President, Hardware Technologies at Apple.[76]

- Investor Ran Makavy, who began his higher education at the Israel Defense Forces computer academy, has served as Chief Product Officer and EVP for Strategic Initiatives at Lyft.

- Tomer Cohen, who graduated from Ben-Gurion University of the Negev and received an MBA from Stanford Graduate School of Business before becoming an entrepreneur, is now Chief Product Officer at LinkedIn.[77]

- Hilik Kotler, an alumnus of IDF Unit 8200 with a long career in cybersecurity, is Chief Information Security Officer at SoFi.[78]

- Ben-Gurion University graduate and Stanford Graduate School of Business alumnus Dror Berman is the Managing Partner and Co-Founder with Eric Schmidt of venture firm Innovations Endeavors.[79]

This is a recurring narrative, suggesting the varied contributions of Israeli executives who are embedded at senior levels in Silicon Valley's corporate innovation environment. A search of LinkedIn shows 3,100 Israeli or Israel-connected executives engaged in technology activity in the region, spanning a range of positions including founders, CTOs, Directors of Product, Directors of Engineering, and venture capitalists.

It is also evident in the Unit 8200 alumni chapter in the region, which has several hundred members, divided equally between technical professionals (in engineering and data security) and product developers for technology companies.

Approximately 25% are entrepreneurs, with 10–15% leading venture-backed businesses they have founded.[80] As one senior Silicon Valley executive notes, "The innovation you see in startups can be beautifully translated in corporations, seen in thinking out of the box and a can-do approach. For many executives you can see that they bring a sense of urgency and ownership."[81]

Acquisitions, Venture Capital, and Startups

"For Israel, tech is the biggest industry. It accounts for more than 50% of exports. Despite the pandemic, 2020—when it rained money—was a record year for Israeli startups. Ninety percent of the investment in tech is foreign, with the vast majority coming from the US and much of that from California."

Eitan Sapir, Head of US Banking, Mizrahi-Tefahot Bank

Government and nonprofit initiatives serve as bridges that enable startups and technology providers in Israel to connect to Bay Area and California partners and investors. The relationship that these flows support is symbiotic. Bay Area venture investment flows to Israeli startups, which enables them to scale in US and global markets. Parallel with that, acquisitions of startups by Bay Area companies produce a sustained flow of technology and intellectual property to Bay Area and California companies. The intensity of this interaction is remarkable for the large number of Israeli-founded companies that have either received venture funding from or have been acquired by Bay Area companies and the similarly large number of Israeli-founded companies that are now headquartered in the region.

Acquisitions

California companies are responsible for 20% of all acquisitions of Israeli companies globally, and 42% of all acquisitions by US companies. New York-based companies by comparison are responsible for 5% of the global total and 10% of the US total. By value, California companies' acquisitions of Israeli startups total $76 billion, which is 50% of the global total and 70% of the

US total. Again for comparison, acquisitions by New York-based companies have a total value of $5 billion, which is 3% of the global total and 5% of the US total.[82]

Three of the five largest Israeli acquisitions to date and seven of the top fifteen have been made by California companies.[83]

Acquired Company	Deal Value	Buyer
CA Technologies	$18.9 billion	Broadcom
Mobileye	**$15.3 billion**	**Intel**
Mellanox Technologies	**$6.9 billion**	**Nvidia**
Chromatis Networks	$4.8 billion	Alcatel-Lucent
Mercury Interactive	**$4.5 billion**	**HP**
Playtika	$4.4 billion	Giant Interactive
ISCAR	$4.0 billion	Berkshire Hathaway
Orbotech	**$3.4 billion**	**KLA**
SodaStream	$3.2 billion	PepsiCo
ADAMA Agricultural Solutions	$2.8 billion	Adama
Galileo Technology	**$2.7 billion**	**Marvell**
Imperva	$2.1 billion	Thoma Bravo
Habana Labs	**$2.0 billion**	**Intel**
Mazor Robotics	$1.64 billion	Medtronic
M-Systems	**$1.5 billion**	**SanDisk**

Note: Bold type signifies acquisitions made by California companies.
Source: Start-Up Nation Central

Of three acquisitions over $1 billion made in 2019 alone, all were made by California companies.

Acquired Company	Deal Value	Buyer
Mellanox Technologies	**$6.9 billion**	**Nvidia**
Habana Labs	**$2.0 billion**	**Intel**
Click	**$1.35 billion**	**Salesforce**

Source: Start-Up Nation Central

Six of the top ten Israeli acquisitions in 2019 alone were made by California companies.

Acquired Company	Deal Value	Buyer
Mellanox Technologies	**$6.9 billion**	**Nvidia**
Habana Labs	**$2.0 billion**	**Intel**
Click	**$1.35 billion**	**Salesforce**
SafeCharge	$889 million	Nuvei
Demisto	**$560 million**	**Palo Alto Networks**
Attunity	$560 million	Qlik
ECI Telecom	**$463 million**	**Ribbon Communications**
Twistlock	**$410 million**	**Palo Alto Networks**
Samanage	$350 million	SolarWinds
Dynamic Yield	$300 million	McDonald's Corporation

*Bold type signifies acquisitions made by California companies.
Source: Start-Up Nation Central

Bay Area companies are the top acquirers.

■ **Intel:** 10 acquisitions, of which 9 totaled $18.8 billion (25% of total acquisitions by California companies)

Acquired Company	Deal Value
Cnvrg.io	$60 million
Habana Labs	$2 billion
IDesia Biometrics	Undisclosed
InVision Biometrics	$50 million
Mobileye	$15.3 billion
Moovit	$900 million
Neocleus	$1 million
Omek Interactive	$35 million
Replay Technologies	$175 million
Telmap	$300 million

Source: Start-Up Nation Central

■ **Apple**: 5 acquisitions, of which 4 totaled $815 million

Acquired Company	Deal Value
Anobit Technologies	$450 million
Camerai	Undisclosed
LinX Computational Imaging	$20 million
PrimeSense	$345 million
RealFace	$2 million

Source: Start-Up Nation Central

■ **Google**: 8 acquisitions, of which 5 totaled $1.485 billion

Acquired Company	Deal Value
Alooma	$150 million
Elastifile	Undisclosed
LabPixies	$25 million
LucidLogix Technologies	Undisclosed
Quiksee	$10 million
SlickLogin	Undisclosed
Velostrata	$150 million
Waze	$1.15 billion

Source: Start-Up Nation Central

■ **Facebook**: 6 acquisitions totaling $418.5 million

Acquired Company	Deal Value
Face.com	$55 million
Onavo	$120 million
Pebbles Interfaces	$60 million
RedKix	$100 million
Servicefriend	$13.5 million
Snaptu	$70 million

Source: Start-Up Nation Central

Salesforce

Salesforce, the world's leading customer relationship management (CRM) company, has been active in Israel since 2011, with operations in both R&D and commercial sales. Approximately two-thirds of its 700 employees work in R&D. Adding to R&D sites in Tel Aviv and Petah Tikva, a new development center was opened in Nazareth in 2020, building on the 2018 acquisition of Israel-based Datorama.[84]

For Salesforce, Israel is "a vital center for investment and growth," with an "incredibly educated workforce, a vibrant technology landscape, and dynamic entrepreneurs." The company's corporate venture capital (CVC) fund is the second largest in the world after Google Ventures and the most active CVC fund in Israel. To date, the company has done six acquisitions, focused on marketing intelligence and AI.[85] The most recent are

■ **ClickSoftware**, a cloud-based provider of field service management solutions that help employees in contact centers and in the field to connect to customers ($1.35 billion in 2019);[86]

■ **Datorama**, a provider of AI-based marketing analytics and intelligence ($800 million in 2018);[87] and

■ **Bonobo AI**, which uses conversational AI technology to extract insights from customer interactions (an estimated $50 million in 2019).[88]

Overall, the company has made 22 investments in Israel, including 14 in the past year. Five of those companies to date have registered exits. Alex Kayyal, Senior Vice President & Managing Partner at Salesforce Ventures, describes Israel as "the best market outside Silicon Valley."[89]

A study by IDC estimates that with its large footprint, the Salesforce ecosystem will create 11,620 jobs and $5.4 billion in new business revenue inside Israel between 2018 and 2024.[90] A range of corporate initiatives support STEM education and workforce diversity.

Venture Investment

Like acquisitions, the venture link between Israel and the Bay Area is a key enabler of innovation on both sides.

At the end of 2020, 478 Israeli startups had offices in California, the second highest of any US state[91] and an indicator of the desire of Israeli startups to be close to the leading US technology center and its large investors.

Israel's position in the ranks of unicorns and venture investment is particularly large relative to the country's small size. California is home to 22 Israeli-founded technology unicorns, the most of any US state. (Twenty-one Israeli unicorns are headquartered in New York.) All but one of the California-based companies are in the Bay Area, with eight in San Francisco (including human resources automation company Gusto[92])—the most of any US city after New York—followed by Palo Alto with seven (including insurance firms Hippo and Next Insurance, cloud cybersecurity firm Wiz, and home design company Houzz), Mountain View with three (Rapyd, SentinelOne, and Redis Labs), Santa Clara with two (big data company Dremio and LiDAR manufacturer Innoviz), and San Mateo with one (accounts payable and global remittance company Tipalti). Cloud cybersecurity company Orca Security is headquartered in Los Angeles.[93]

A network of venture capital firms that focus on Israel has developed in the San Francisco/Silicon Valley Bay Area.

UpWest is an early-stage cross-border fund with $80 million under management. Launched by The California Israel Chamber of Commerce's first executive director Shuly Galili, the firm invests in Israeli companies that can be brought to the US, including the following examples:

- **SentinelOne** is a cybersecurity company that has grown from two founders when it was based in Israel to 1,000 employees worldwide after coming to California. It achieved unicorn status with an IPO on the New York Stock Exchange on June 30, 2021.

- **BeeHero** is a pollination technology company that, by monitoring hives with sensors, helps farmers detect problems and improve the pollination process. Founded by a family of beekeepers in Israel who saw that farmers had no ability to predict the viability of the hives they depend on to pollinate their crops and

that hive failure was a growing concern, BeeHero developed technology that is now being used by almond growers in California's Central Valley to support their production.

- **Waycare** uses AI to improve traffic management by collecting data from infrastructure such as traffic lights and is currently working with San Francisco's Department of Transportation and with nine other cities across the US.

- **HoneyBook** is a business management platform that supports serviced-based small business owners and creative entrepreneurs. With a recent $155 million Series D round, it has a $1.1 billion valuation.

Asked why she requires her portfolio companies to come to the US even if their engineering stays in Israel, Galili says "I've met so many talented entrepreneurs who were testing their technology in Israel and learned to build a product there but found that the product didn't work when they came to the US because the experience of Israeli customers and US customers was different. As soon as they had an idea, they should have come here directly to build it around the real market. The problem isn't money, since there's plenty of money in Israel. It's knowing your customers here and building a company around them. You need to live and breathe your market, surrounded by both your clients and your competitors." Looking forward, she sees opportunities to bring Israeli and California capabilities together around big challenges where innovation can have an outsized impact such as climate change, transportation, food, and agriculture.[94]

Zeev Ventures, launched in 2007, has approximately $1 billion under management, with a high proportion of its portfolio composed of Israeli-founded companies. In its early years most were early-stage, but with the passage of time more of its investment is now later-stage. Of approximately 20 portfolio companies, three quarters today are Israel-related, including the following investments:

- **Tipalti** is a cloud-based global payments automation platform that streamlines how companies make payments to partners and suppliers and manage accounting and compliance. Headquartered in San Mateo and with $295 million in funding, the company

has a $2 billion valuation (September 2020), a transaction volume of $20 billion, more than 1,200 customers, and over 400 employees.

- An online insurance company serving entrepreneurs and small businesses, **Next Insurance** has $881 million in funding, a $4 billion valuation (early 2021), and 100,000 customers in 50 states. Its CEO is in the Bay Area while two co-founders and the engineering team are in Israel.

- **TripActions** is an AI-driven platform for managing business corporate travel including booking of flights, hotels, and rental cars as well as expense tracking. Started in the Bay Area in 2015 by Israelis Ariel Cohen and Ilan Twig and headquartered in Palo Alto, it has $1.3 billion in funding, a $5 billion valuation (early 2021), and 700 employees.

- **Hippo Insurance** is an insurtech company for homeowners. Launched in 2015 by Israeli co-founders Assaf Wand and Eyal Navon, it has $709 million in funding, a $5 billion valuation (early 2021), and several hundred employees.

Founder Oren Zeev observes that "There's an unprecedented explosion of companies coming from Israel—as much as 10X the number ten years ago. Their areas of focus are broad and not limited to specific fields. Those that grow here are American companies, often employing hundreds of people and manufacturing in the US. At the same time, while part of the tech ecosystem in the US, most continue to do their engineering in Israel. We're very intertwined."[95]

J-Ventures, an international and Jewish-focused community-driven venture capital fund, invests primarily in Silicon Valley. The firm's LP roster includes many of the Valley's most prominent Jewish investors and business leaders, forming the core of a community (described by Managing Director Oded Hermoni as a "capitalist kibbutz") of more than 300 LPs, including 98 past or current VCs representing large funds in the Bay Area and some in Israel, 80 serial founders, and approximately 150 director to C-level executives drawn mostly from larger companies. Now on its fourth fund, support for its first funds came mostly from family offices, particularly in New York. While the firm has largely invested in Jewish and Israeli-founded

companies, 40% of its portfolio companies are neither Jewish nor Israeli. Hermoni notes, "We don't look for Jewish or Israeli founders, just good ones."[96]

Other leading Silicon Valley venture capital firms with global portfolios are also significant investors.

GGV Capital, a global VC with $9.2 billion in capital under management, invests at every stage and has for the last two years dedicated resources to invest in Israeli companies, backing 10 to date.

Thematic in its approach, it invests principally in the consumer, smart tech, and cloud/enterprise verticals. Asked why Israel is attractive, GGV principal Oren Yunger points out that "historically, there have been acquisitions in Israel of $100–300 million, but now Israel is producing large-scale, global companies. In 2019, the country had fewer than 20 "unicorns" or companies that are valued at more than $1 billion, but today it has more than 60 unicorns, over 40 of them newly minted. Israeli founders know now that they're capable of building companies for the long term. That's exciting to a firm like GGV, which treats building for the long term as a sustaining objective. Also, virtually no one builds [just] for the Israeli market, so it's an advantage that Israeli companies are immediately global. If they're not already in the US, most Israeli founders will eventually relocate because the market is here."

GGV portfolio companies with Israeli founders include

- **Vdoo**, a manufacturing and IoT application that provides device security for manufactured products across the device life cycle, making machines harder to penetrate and hack;

- **Orca Security**, a cloud security platform, now a unicorn;

- **Monte Carlo**, a data reliability platform;

- **Torq** (formerly StackPulse), an incident response automation platform;

- **K Health**, a digital healthcare unicorn; and

- **Hippo Insurance**, an insurtech unicorn.[97]

Citi Ventures, the venture arm of Citi, co-locates members of its investment team at the company's innovation lab in Israel, a 200-person facility operating

under the corporation's Chief Innovation Officer. While the lab focuses on innovation in fintech, cybersecurity, and data analytics, the Citi Ventures team aims to bridge innovative startups into the company, with performance measured both by return on investment and on the innovation and competitiveness that comes with it. Matt Carbonara, Managing Director of Citi Ventures, describes Israel as a "hotbed of innovation," particularly in cybersecurity. Fraud reduction is a key focus. Portfolio company BioCatch, for example, uses behavioral biometrics (how you use a mouse, how you type, or how long you're on a keyboard) to distinguish whether a communication is from a person or a machine.[98]

Maven Ventures, a seed-stage investor with $100 million under management, focuses 70% of its investment on consumer companies and 30% on transportation and autonomous vehicles (AV). The firm, which was an early investor in Cruise (acquired by GM) and Zoom, focuses on US companies. Israel is an exception. Maven was an early investor in Israeli healthcare company **Hello Heart** (a mobile solution addressing blood pressure and heart disease) and is now investing in its first company in the autonomous vehicle space—**Ottopia**, which produces software to improve AV safety—that is fully based in Israel. Israel is a global center for AV innovation and most global OEMs have a presence—product teams, tech teams, venture, or all three. "Name the brand," Founding Managing Partner Jim Scheinman observes, "they're all there." Scheinman also believes that while Israel is best known for enterprise, a nascent consumer software market is also developing that offers exciting possibilities.[99]

DTCP, an autonomous investment management group backed by Deutsche Telekom with divisions in Hamburg, Seoul, Silicon Valley, and Tel Aviv, focuses principally on digital transformation (enterprise software), with portfolio companies having sales of a few million dollars up to $100 million. In Fund 1, half of the portfolio companies were from Israel. In Fund 2, the focus is 60% on Europe and Israel and 40% on the US, and Fund 3 will have a similar distribution. The firm's portfolio companies in Israel are a mix of early-growth and growth stage, with half of the founders in Israel and half in the US. Key areas of investment include cyber, cloud, marketing and sales.[100]

Other significant Bay Area venture investors in Israel include **Andreessen Horowitz**, **Foundation Capital**, **Lightspeed Venture Partners**, **Bessemer Venture Partners**, **Battery Ventures** (a Boston-based global firm with two of its three US offices in San Francisco and Menlo Park), **YL Ventures**, and **Innovation Endeavors**. As the size and sophistication of Israel's venture sector has grown, Silicon Valley firms are partnering with Israeli venture firms such as Glilot Capital Partners, Cyberstarts, TLV Partners, Pitango Venture Capital, S Capital, Team8, F2 Capital, and Ibex Investors. Most are seed or early-stage investors drawing funds from leaders in private equity, family funds, and successful founders.

Complementing Bay Area venture firms, **Silicon Valley Bank** (SVB) has been active in Israel since the mid-90s, initially visiting and making small investments, but since 2008 with an on-the-ground presence supported currently by a team of almost 30. More than 1,000 Israeli companies have worked with the bank through its Israel office, and more Israeli companies have worked with the bank through its offices in the United States.

Silicon Valley Bank, which serves the technology and startup community with a variety of banking products including debt finance that often complements venture investment, doesn't directly compete with Israeli banks for local banking but instead offers banking services in the US through a local platform that provides $1 million to $100 million in debt finance, as early as the seed stage or as late as pre-IPO.

As part of its strategy, the office has brought several delegations from the US to Israel for multi-day visits that connect them with industry and VCs. The criteria is that those who come have never been to Israel but could become investors. SVB's Israel manager David Cohen explains that "it's important to see the magnitude of the technology here and how we do things. The goal is to connect people through the technology." Looking at the ecosystem, he's seeing change: "The big thing that's happening today is the ability of Israel to generate sector leaders, moving from being a generator of technology that is sold to global companies toward an ecosystem that pushes companies to create much more value from their technologies and become leaders themselves." Despite this, he believes that "the US will remain the key market for Israeli companies. Of 1,000

companies that are my clients, all 1,000 are looking to the US as their main market, and 99% have opened or will open US offices for sales and marketing. Most of the management goes there too. So while not as many companies may move to the US in the future, nearly all will establish US offices." The biggest challenge for companies in Israel, he notes, is talent. Some are compensating for the shortage of engineers by turning to places like Ukraine and Poland, but it's not enough: "The number of engineers isn't keeping up with what we need."[101]

Israeli banks such as Bank Leumi and Mizrahi-Tefahot also support business with a California presence.

Patterns of Startup Activity

The relationship between Israeli startups and Bay Area investors follows an established pattern but is evolving. Historically Israeli startups, because of Israel's small domestic market and the limited opportunities to grow there, have aimed to be acquired. Because the US is the leading global market, most startups focus on acquisition or investment by US firms in the Silicon Valley/San Francisco Bay Area as well as New York and Boston. Investor Guy Miasnik observes that "The local market in Israel is at best a place to pilot an idea, but not to grow a company. The market is in the US, and many Israeli startups move their leadership to the Bay Area, New York or other high-tech hubs in order to be close to it. While there's growing interest in Europe, China, India, and now the UAE, for the vast majority of Israeli companies, the US is the first market and the most important growth opportunity."[102] In this pattern, Bay Area investors flow funding to Israel, identify opportunities there, and bring those technologies and founding teams back to incorporate their innovations into national and global business models.

The operating model of these companies is a hybrid where engineering is done in Israel but the founders and the non-tech team (sales and marketing) move to the Bay Area and other US technology centers to be closer to the market and their customers. While this remains the dominant pattern, a shift is underway in which more founders are choosing to grow their companies in Israel, believing they can build large and stand-alone companies at home. The acquisition of Mobileye by

Intel for $15.3 billion showed that this was possible, and remote communication technologies such as Zoom have made online connections to investors and partners in the Bay Area easier and more accepted. This is reflected in the growing number of Israeli unicorns. Another factor behind later exits may be the currently high valuations for many Israeli companies. With more investment (venture, private equity, and hedge funds) in the system, many companies have become more expensive to acquire, leading both founders and investors to wait longer.

Future investment is likely to flow to companies with both business models. Maven Ventures founder Jim Scheinman observes that "companies in Israel are seeing so much success now that they're not always looking to be immediately acquired and are becoming more patient and more focused on building multi-billion-dollar companies at home. This is more exciting for an investor, because that's how you make money compared to $50 million or $100 million exits. Compared to ten years ago, more Israeli founders are also returning to Israel, where they serve as mentors and investors and are helping to build other companies."[103] As this occurs, networks of successful entrepreneurs who have worked together and support each other are starting to emerge, similar to the "mafia" of early PayPal employees who are spread throughout Silicon Valley. Even as more Israeli companies go public, however, and build larger companies in Israel, nearly all still look to Silicon Valley as a source for venture capital and to grow their client bases.

INSIGHT
Bridging Women-Led and Other Startups to Silicon Valley

Darya and Eyal Shaked bring young founders from Israel to the Bay Area to access its investment community, bridging the gap between Israeli entrepreneurs and the Silicon Valley ecosystem, which they see as synergistic. Israel brings technological capabilities (in fields such as cyber, drones, and fintech) and Silicon Valley enables their growth into corporations with the professional knowledge, markets, and funding that Israel still lacks.

Eyal Shaked says that "just by moving to the Bay Area, their chances of survival go up sharply. The

amount of venture capital that's available to deploy here is a game changer. The level of experienced talent that's available to startups here, and hard to find in Israel, is also important. Even if the engineering is done in Israel, the market is in the US and being in the Bay Area opens the door to working with key companies such as Facebook, Apple, YouTube, and Google."

Accessing the investment community can be particularly difficult for women entrepreneurs. Darya Shaked describes coming to the Bay Area in 2015 and meeting 300 people in three months. That experience made her realize how important it is for female founders to be able to work from the Bay Area, find customers and advisors, and raise money. To bridge that gap she founded WeAct (Women Entrepreneurs Act). In 2016 and 2017, WeAct brought three delegations with 50 female founders to the Bay Area to meet with experienced people in their fields, other entrepreneurs, and potential funders: "When I started I was told that there weren't even 20 female entrepreneurs in Israel, but when we organized the first delegation we received over 330 applications." This led to the creation of a WeAct community of 4,000 women entrepreneurs on Facebook, becoming a "ladies club" for opportunities in Silicon Valley.

Of the first 20 female founders that came, half have opened Bay Area offices, one has sold her company to Apple, one has signed a contract with Facebook, and several have attracted funding. One of the companies, Versatile (formerly Versatile Natures), moved to the Bay Area and recently raised $20 million in a Series A round, and another became the first female-led unicorn in Israel (Papaya Global). In 2018, a shared office space for female founders was opened in Los Altos so that any female entrepreneur from Israel can independently come to Silicon Valley and get the help and support she needs.

Recently, WeAct's focus shifted away from delegations when, after 2017, Darya Shaked concluded that a larger effort was needed to address the different journeys that female founders have to go through to raise funding. This led to **WeAct Ventures**, the first Israel-oriented fund of

funds to invest in women-led venture funds. In 2018, the firm raised $10 million from family offices and since then has invested in five funds that are led or co-founded by women. The approach reflects a strategic investment in female fund managers, with a long-term goal to diversify the investment industry from the top, with benefits passed on to female entrepreneurs.

Darya Shaked sees particular strength in Israel's female entrepreneurs: "Serving in the military gives women a sense of equality and relevant capabilities. Most women who joined our delegations had been officers and a number have PhDs. They have the self-confidence to build large companies."[104]

Israel Anchors in Southern California

While venture activity and technology development are primarily concentrated in Northern California, Israel's presence in Southern California is also important and anchored in sectors including agricultural technology, water management, health and biotech, fintech, smart mobility, and, particularly, entertainment and creative content.

Media and entertainment activity is distinctively connected to Israel. Focused in Los Angeles, it flows through software and intellectual property. Israeli writers and producers are active in the media market, where **Keshet International** CEO Alon Shtruzman describes Israel as producing billions in revenue for California's film industry. Israeli-created shows or shows based on work by Israeli writers include Showtime's Homeland, Shtisel (Netflix, 2018), the crime drama Our Boys (HBO, 2019), Lincoln Rhyme: Hunt for the Bone Collector (2020), and Netflix's Hit and Run (2021).

An Israeli-owned studio, Keshet brings Israeli-origin content to California, primarily for television.[105] The **Jerusalem Film & Television Fund**, an arm of the Jerusalem Development Authority, is working to establish an animation industry in Israel with the help of expertise brought from California by its Los Angeles-based North American Representative. The country's animation industry is young but growing, with a strong focus on creating IP (concepts, storyboards, writing, and design)

for the US market.[106] **New Legend**, a company which finances, develops, produces, and distributes commercial film and TV projects, launched in October 2020[107] and also works to bring Israeli content to California.

The **Southern California-Israel Chamber of Commerce**, a virtual organization, serves as a platform for connecting companies on both sides to business opportunities.

Business and startup connections are supported by organizations such as the Merage Institute in Orange County and Fusion LA.

The **Merage Institute** brings CEOs and corporate decision makers from Israel to California four times a year, with each cohort having 15–20 participants. Since 2004, more than 1,000 executives have participated in the two-week bootcamps, with faculty including university professors and successful business leaders. Key areas of interest include homeland security, medical devices, and digital technologies such as foodtech, fintech, insurtech, biotech, and smart cities. Israeli participants don't come to buy or sell but instead to meet with successful companies and build relationships. Many of the companies coming to Southern California for the program have been acquired, bringing with them thousands of Israelis and their expertise. To build the pipeline, the Merage 45+ entrepreneurs competition awards $100,000 to the winning pitch by male competitors over 45 and women competitors of any age. Second and third place pitches win a place in the Merage Institute Innovation Bridge Program, which includes all costs for participants except airfare.[108]

The inflow of technology and ideas has benefitted local companies as well. For example, by acquiring an Israeli company, heart valve and hemodynamic monitoring company Edwards Lifesciences was able to move into the field of minimally invasive surgery, a transition that was pivotal to their success in the face of rising competition in the medical devices field.[109]

Currently, the Institute is teaming with the US Department of Defense (DoD) and Israel's Ministry of Defense (IMOD) on a Mobile Standoff Autonomous Indoor Capabilities (MoSAIC) Challenge to identify innovative technological solutions for remote autonomous indoor maneuver. The challenge, launched in June 2021, will award cash and other prizes valued

at $600,000 to startups and innovators from around the world with cutting-edge hardware and software solutions to address the US and Israeli governments' technological gaps in this area.[110] The product of an MOU between the US DoD's Irregular Warfare Technical Support Directorate (IWTSD) and IMOD's Directorate of Defense Research and Engineering (DDR&D), the program will culminate in a physical test bed that will take place in the spring of 2022 in the Negev Desert town of Yeruham, a location that has developed a significant UAV (unmanned aircraft vehicle) ecosystem.[111]

A Santa Monica-based investor and accelerator, **Fusion LA** helps early-stage companies from Israel set up in the US market. The first cohort from Israel arrived in 2017 for what has become a structured four-month program that connects participants with local entrepreneurs, people in industry, and other partners who could help them build a business in the US. Connections are made in both the Bay Area and LA. Supported by 3,000 mentors and investors, Fusion LA is now on its eighth cohort (each cohort averaging 6–9 participants and rotating every six months). Fifty-five investments have been made so far, with a new fund coming. In the last four years, 55 startups have been supported, of which 70% raised post-seed funding totaling $150 million. The main investor is Silicon Valley venture firm GoAhead Ventures, a firm that isn't Jewish or Israeli but is active with Israel through Fusion LA.

Fusion's Investments started at the $20–50 thousand range but today approach $150 thousand. The Israeli founders it works with in Southern California are concentrated in media, consumer products, and health. One representative portfolio company is Uniper Care Technologies, a graduate of Fusion's first cohort. Los Angeles based, Uniper is an age-at-home, TV-based and mobile-based solution for care delivery and social engagement that helps seniors connect with peers, social workers, and others in the community, addressing the problems of disconnectedness, loneliness, and anxiety through interactive health and wellness content. Partners include the VA, local governments, medical organizations, and insurance companies. Israel's welfare and budget ministries and the country's leading HMOs are clients.[112]

In San Diego, the **Leichtag Foundation**, based in Encinitas (San Diego County) works to support a vibrant Jewish community in the San Diego

region, alleviate poverty by supporting economic opportunity through job training and workforce preparation, build connections between San Diego and Israel, and strengthen civil society in Jerusalem by developing talent, social enterprise, and innovation that builds on the city's communities and competitive advantages. For example, while most technology startups are in Tel Aviv, because Jerusalem is the primary home for Israel's arts organizations, design technology and new media are important areas of entrepreneurship focus.

In Jerusalem, grant recipients include New Spirit Jerusalem, a center that works for and with young adults to promote entrepreneurship, innovation, and a creative economy by providing facilities, professional support, and connections to strengthen civic life through an accelerator and cultural and other programs. Workforce participation in the Palestinian and ultra-Orthodox communities is another major focus. A pilot program launched by the foundation is currently being scaled by the government, while another program is under development to help ultra-Orthodox women increase their earning potential and help employers absorb them into the workforce.

In its focus on strengthening ties between San Diego and Israel, the Foundation organizes delegations of civil society leaders to Israel to expose them to the complexity of its society and has brought 25 Israeli professors from Israel to San Diego (to UCSD, San Diego State, CSU San Marcos, the University of San Diego, and California Western School of Law) to teach Israel Studies, develop long-term relationships, and create ongoing learning and travel programs.

Alongside its grantmaking, the Foundation has a campus on 67.5 acres in Encinitas on a site once used for commercial greenhouses. Leichtag Commons includes more than 900,000 square feet of space occupied by 12 agricultural tenants/partners. That includes a consortium of five Israeli agricultural startups in a greenhouse funded by Israel's government as a hub and showcase for Israeli innovation in technologies such as hydroponic farming, date palm farming, and subsurface irrigation. The facility is also used for water management training programs for city planners.[113]

Collaborative Economic Research

The **Milken Innovation Center**, supported in part by the Santa Monica-based Milken Institute and based at Israel's Jerusalem Institute, supports research collaborations under the California-Israel Global Innovation Partnership. Its major areas of focus include water, where strategies are being developed to introduce sustainable water technologies in California's farms, industry, and cities. In partnership with the NewTech office of Israel's Ministry of Economy, the Center also works with policy, industry, and research leaders on vehicles for financial innovation, a focus that is expanding to include agritech as a means to bring Israel's successes to the California market.[114]

Laboratories (convenings on how to address an issue) are an organizing framework, directed toward outcomes and solutions. Proposals from a lab on financial innovations for water sustainability, for example, have led to the formation of a policy group led by the California Governor's Office that is working to adjust farm and municipal financing programs to encourage the adoption of water-saving technologies. Other labs have focused on accelerating sustainable energy and cleantech growth through fuel substitutes and smart mobility, the commercial acceleration of green technologies through green buildings and green bonds, and identifying new sources of capital to finance the commercialization of health and biomedical technologies.[115]

Also at the Center, the Blum Lab for Developing Economies, part of a global network of Blum Centers based at UC Berkeley, works to enable interdisciplinary problem solving around sustainable development in fields such as energy, health, technology, food, and water. In Israel, the Center is home to a fellows program that develops applied research, supports the financial labs, and arranges internships with government departments and agencies.[116]

The initiative is closely connected to the University of California, which is an implementing agency for the MOU signed at the Computer History Museum in Mountain View in March 2014 by former Israeli Prime

Minister Benjamin Netanyahu and then California Governor Jerry Brown. The MOU reflects a broad agreement to develop and conduct joint research projects, with a particular focus on water conservation and management, agricultural technology, health and biotechnology, cybersecurity, and alternative energy. In addition to facilitating collaboration between California and Israeli entrepreneurs, the agreement encourages the creation of public-private partnerships between California and Israeli entities and of collaborations between California and Israeli universities and public and private research institutions.[117] A subsequent MOU on cooperation in the same fields was signed in 2017 between the University of California and the Israel Innovation Authority, with implementation planned through public-private partnerships.[118]

Industry Leaders with Israeli Founders

Many companies in the large cohort of Silicon Valley startups with Israeli founders have become industry leaders, employing thousands of Californians and positioning California for further innovation. The set of businesses profiled below is representative of a growing body of high-impact companies founded by Israeli entrepreneurs. These six companies alone employ nearly 5,000 Californians directly and, including jobs that are indirectly supported by their activity, account for almost 10,000 jobs across the state economy.

Gusto

Gusto co-founder Tomer London, after earning a bachelor's degree from Technion, came to the US 12 years ago to study for a PhD at Stanford and met his wife and business partners there. Already an entrepreneur in his home country, he had concluded that there were other places with more resources and greater depth for launching companies than Israel. Motivated by Steve Jobs's 2005 Stanford commencement speech and seeing an opportunity to be close to its iconic technology companies, he came to the region to start another company.

The Stanford experience, with its networks and support for entrepreneurs, exceeded expectations. His Gusto

co-founders Josh Reeves and Edward Kim were also at Stanford, and with a shared background in small business ("small businesses need to do everything") they chose HR as a key to small business success, with a focus on payroll automation. By serving as the client's HR base, Gusto's technology makes it easier to start and run a business and hire and support a workforce, using software that supports onboarding (e.g., offer letters and new hire paperwork), payroll (e.g., time tracking, benefit plans, calculating and paying payroll taxes), and financial tools for employees (e.g., automated savings, 529 college savings, and 401(k) retirement savings).

The founding team applied to and was accepted at Y Combinator, which validated their idea and helped them raise their first $6 million at its Demo Day. Fifty customers for its software followed. Since then, Gusto has raised $691.1 million[119] and today has 1,600 employees across three US offices (in San Francisco with approximately 500 employees, Denver, and New York), customers in all 50 states, and more than 100,000 business users.

On the Silicon Valley value proposition, London says that Israel's domestic ecosystem is much stronger today than it was ten years ago, with more talent and capital, but Silicon Valley continues to hold the key: "There's a brand around Silicon Valley. It's about the success of companies there. As an entrepreneur, your company has one shot and the Valley is still the best place to start a company. There's passion and enthusiasm, entrepreneurs are accepted and supported, and exits are celebrated."[120]

Hippo Insurance

After spending 4–5 years in the US pursuing an MBA at the University of Chicago and working at McKinsey in New York, Hippo's founder Assaf Wand returned to Israel to co-found two companies.[121] When his wife, whom he met there, also wanted an MBA and was accepted to an MBA program at MIT, he started another company, Sabi, to serve the Baby Boomer population with products to assist with everyday tasks like taking daily vitamins and medications.[122] When her program finished in 2015 and he sold the company, they saw the Bay Area as the best place to be an entrepreneur and moved there. She took a job at Google and he started

Hippo, which he describes as "an American company with a bad accent" in the same year. In the early days, Hippo had no footprint or affiliated entity in Israel, though there were some employees there.

Wand's idea was to rethink home insurance. As he saw it, insurance agents were ageing out and few were entering the profession, so the industry was ripe to move online with sales direct to the consumer. He also believed that traditional insurance was out of date and didn't always cover the right things—for example, china and silver might be covered more than computers or bikes. Another angle was that between the issuance of a policy and a claim, insurance companies have little contact or relationship with their policyholders. That led to the idea of "proactive insurance," to make the relationship less adversarial and more a partnership. To do that, Hippo works to avoid claims through the use of smart home kits and a home maintenance platform to provide customers with assistance. Tailored policies are available for home insurance, condominium insurance, and investment properties. Written premiums have grown from $142 million in 2018 to $405 million in 2020 and are forecasted to reach $544 million in 2021 and $2.28 billion by 2025.[123]

Today, the company has more than 600 employees (including 200 working in California) and 350,000 customers in 37 states, working with customers both directly and through independent agents. Having raised more than $700 million from investors,[124] it went public in March 2021 with a valuation of $5 billion[125] and established an office in Israel to develop machine learning technology and work on user acquisition. Wand finds the connection seamless and says, "Israel is like the 51st state of the US." He notes that with its ten-hour time difference, California has its challenges compared to New York or Europe, but direct flights have helped. Europe requires customization: in addition to language and cultural differences, there's no unified market and insurance products need to be customized from country to country. In the United States, he says, besides some Israeli companies going to Boston in fields like biotech and to New York for fintech, California offers Israeli startups the strongest base.[126]

Uber Freight

Lior Ron's family was in the logistics business, so transportation was something he knew. While in Israel's military, he led a software signals intelligence unit of 100 engineers, which provided a different kind of hands-on experience ("the military is always five years ahead of the commercial market"). After completing both bachelor's and master's degrees in computer science at Technion, he came to Stanford University in 2006 to pursue a PhD in computer science but switched to the Stanford Graduate School of Business (GSB) when he saw the opportunities that Silicon Valley offered to scale and innovate. The Valley he saw was "a unique place of ideation and incubation" with extraordinary opportunities to start and grow a company. While at Stanford he launched two startups, one bringing to market a medical device to help Parkinson's disease patients improve their walking and balance. Intel founder Andy Grove, who suffered from Parkinson's, was a professor at the GSB and hearing about the technology after a class, saw its commercial potential and invested. The second startup was a geo-search engine developed from Ron's experience as CTO of the Israeli army's intelligence mapping and search unit. Google CEO Eric Schmidt was also a professor at the GSB and convinced him to build out the technology inside Google. With that, in 2006 Ron became Google's second project manager for Google Maps. At that time, Google Maps had a few million users, mostly in two countries; by the time he left as Google Maps product lead in 2016, the service was in 215 countries and had 1 billion users.

After he left Google Ron co-founded Otto, a company making self-driving kits to retrofit big-rig trucks which, in the same year as its founding, was acquired by Uber. He then went to work at Uber to lead Uber Freight, the company's new commercial trucking arm for which he had helped lay the groundwork.[127] Ron's goal was to make an impact at scale by creating a new market in a sector that had not yet been transformed by technology. Uber Freight is built on a business model similar to the company's core passenger business, using independent drivers linked to corporate clients through contracts for specific trucking services, with Uber Freight providing capacity and flexibility through a single platform. Ron observes that 92% of trucking companies have five trucks or fewer: "If you're Pepsi or P&G, you have to

deal with thousands of small truckers in different states, and on the other side of the equation those carriers need to connect efficiently to large shippers." Today, Uber Freight is a major commercial marketplace for trucking and the largest digital freight network in the US, with 1 million drivers using the app and 150 Fortune 500 companies and more than 10,000 small businesses using the platform. The company currently has 1,000 employees (including 350 based in California) and 2020 revenues reached $1 billion.

Though it will take time, the next big transition is toward autonomous trucks. Ron notes that "there aren't enough drivers, it's a hard job with time away and costs to health and family life, and the average age of truckers is going up as boomers age and younger people don't want the job. But demand for road freight is at an all-time high and will continue to grow. The future model will probably be a hybrid, with autonomous trucks covering long highway distances and trucks with drivers, who can stay closer to home, handling short-haul traffic."[128]

Houzz

Houzz founder Adi Tatarko moved from Israel to New York City with her husband Alon Cohen twenty years ago, both to work in tech. Attracted by its energy and opportunity (and despite the collapse of the dot-com bubble) in 2001 they moved to Silicon Valley. Tatarko, having decided to step back from the tech industry, worked at a boutique investment firm while Cohen worked at eBay. Houzz was started in 2009 after they bought a house and discovered that the renovation process was a "nightmare," with manual processes and lots of friction. The answer was to modernize and streamline the process by making it easier to find ideas and to connect homeowners with design and construction professionals. Although Houzz at the time was a side project, with both working at their respective jobs full-time, its base of users expanded to other states and after one year Houzz had added 200,000 users—all organically.[129]

The company's trajectory changed in 2010 when, at an event for her son's preschool, Tatarko met Amos Wilnai, the founder of MMC Networks, which had recently sold for $4 billion. Wilnai asked why they weren't raising money and introduced Tatarko to venture capitalist and fellow Israeli Oren Zeev, which led to Zeev's initial

$2 million investment in Houzz. Tatarko and her husband quit their day jobs, with Tatarko becoming CEO, and started to build the company.

Over time, Houzz has raised over $600 million and has become a global company with 65 million homeowners and design enthusiasts and 2.7 million professionals who engage through its platform. With 11 offices around the world, including a Palo Alto R&D center, it now has more than 1,200 employees, including 600 in California and 100 at its R&D center in Tel Aviv.

In April 2020, the company introduced Houzz Pro, a comprehensive SaaS platform that helps home remodeling and design professionals manage their entire project lifecycle in one place: including building estimates and proposals, invoicing and collecting payments online, and building 3D models for clients. In addition to Houzz Pro, which offers marketing and business management tools for the professional community, the company supports a complimentary e-commerce platform that lets homeowners and professionals "shop the images" to purchase over 5 million products from more than 5,000 vendors and sellers.

Reflecting on her experience and that of other Israelis who come to Silicon Valley, Tatarko says, "There is something special in Israel's founder ecosystem in the Valley which makes it unlike any other here. With organizations like ICON and WeAct, and the support readily available from others who arrived earlier, if you're an Israeli startup coming to Silicon Valley, you'll get so many introductions. It's all for one and one for all. That's the way we grow up in Israel and when we're outside the country we're there for each other. It's an attitude that has helped founders connect, raise money, and grow their businesses."[130]

JFrog

Launched in Israel in 2008, JFrog is the creator of a platform that automates software releases and updates on the edge. With clients that include Apple, Netflix, Macy's, Target, and PG&E, its competitive advantage is in the speed of its continuous software release management. Started with seed funding from the office of Israel's Chief Scientist and a Series A from Gemini Israel Ventures ($3.5 million), the company moved to Silicon Valley to be close to its large developer

community. Subsequent venture rounds raised $10 million in 2014, $52 million in 2016, and $165 million in 2018, giving the company a valuation of more than $1 billion. In 2020, JFrog went public, raising more than $300 million in an oversubscribed IPO, leading to a market valuation of more than $4 billion.

While its CEO and co-founder is in the Bay Area, JFrog's engineering continues to be done in Israel. With approximately 300 employees (of which 200 are in California), expansion has led to three offices in North America, including Seattle, Atlanta, and the company's headquarters in Sunnyvale, and overseas offices in India, China, France, Japan, and Spain. Most of the company's revenue and its 6,000 customers are concentrated in North America due to its large developer base. More than 75% of the Fortune 100 are customers.[131]

Palo Alto Networks

Palo Alto Networks founder Nir Zuk moved to the Bay Area from Israel in 1997 with his employer Check Point Software. His perception when starting the company in 2005 was that the cybersecurity market is fragmented, with companies often using 30–50 different vendors. Palo Alto Networks was designed to change that, consolidating cyber services on a single platform. Headquartered in Santa Clara, the company today is the largest in the industry measured by sales, with 82,000 customers in more than 150 countries. Annual revenue in 2020 totaled $3.4 billion. Palo Alto Networks has a workforce of over 10,000, approximately 3,000 of which are at its Silicon Valley headquarters. Nearly all of the company's manufacturing is done in Santa Clara, accounting for roughly $1 billion per year in hardware revenue.

Palo Alto Networks has made 7 acquisitions in Israel, investing roughly $1.5 billion. R&D is done in the Bay Area, its principal site, and at a second site in Israel with a staff of more than 500 that is continuing to grow. Each location has a distinct role, with Silicon Valley focusing on network security and part of cloud security and the Tel Aviv facility focusing half on the other part of cloud security and on security operations automation (replacing hard-to-find cybersecurity operators with software and AI). A large part of the company's next-generation technology is being built in Israel, and most nation-state attacks on computer systems supported by Palo Alto Networks are being stopped by technology designed in Israel. Technology produced in Israel also represents the fastest growing segment of company revenues.[132]

Potential Cooperation in New and Emerging Technologies

As suggested earlier in this analysis, Israel's technology strengths are concentrated in several key sectors that also constitute the bridge for trade, investment, and research cooperation with California. These technologies constitute both the foundation for current ties and the most likely direction for future research and business development.

Cybersecurity

Israel is a global leader in the field of cybersecurity, with expertise stemming from its defense and intelligence establishment and domestic security needs. Threats of terrorism and existential security challenges drive innovation and investment in research.[1]

EXHIBIT 2

Israel is a global leader in the field of cybersecurity.

Number of Active Cybersecurity Companies in Israel by Subsector, 2019–2021
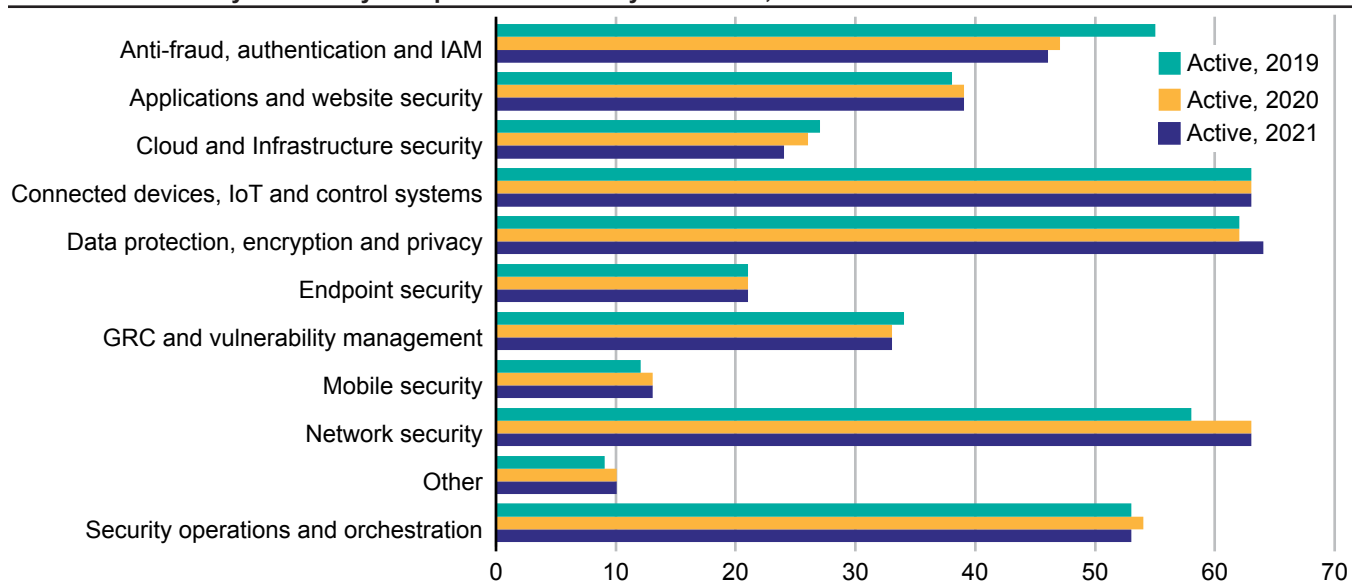
Source: Startup Nation Central

EXHIBIT **3**

Israel's fintech sector is a large and diversified ecosystem.

Number of Active Fintech Companies in Israel by Subsector, 2019–2021
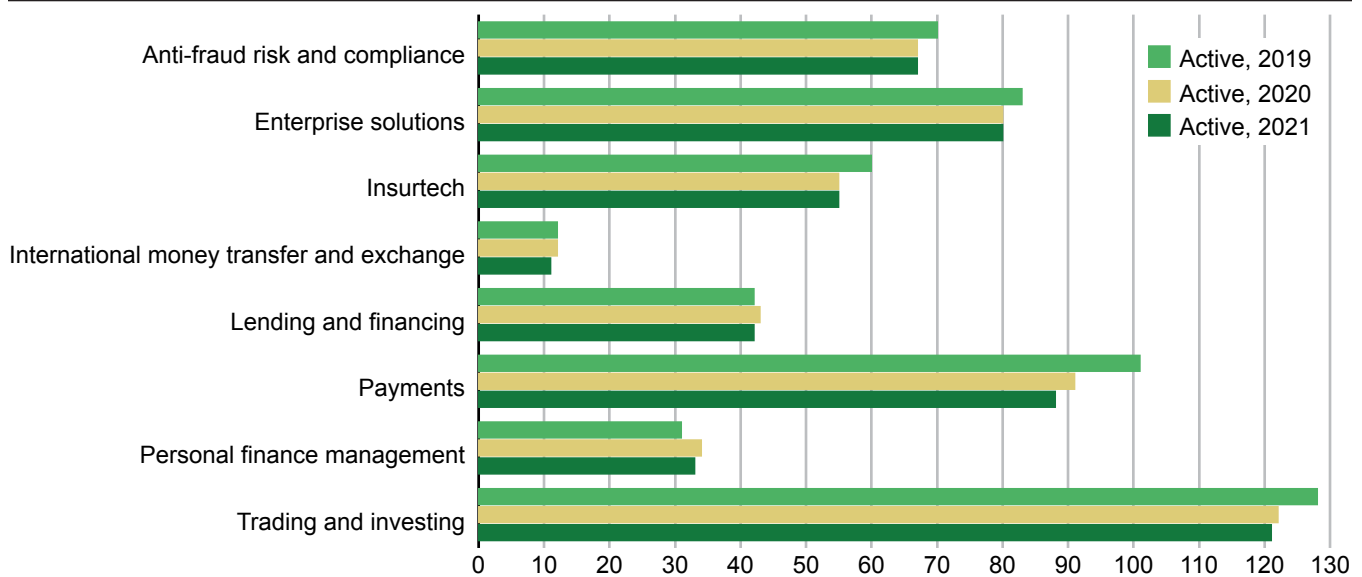
Source: Start-Up Nation Central

The National Cyber Directorate, the government agency responsible for ensuring national cyber defense, reports that pre-IPO investments in domestic cybersecurity firms totaled $2.9 billion in 2020, up 70% from the previous year. Israeli cyber exports totaled an estimated $6.85 billion in 2020, up from $6.5 billion in 2019. A remarkable 33% of the cyber unicorns in the world are Israeli, with the creation of 5 new cyber unicorns in 2020 alone.[2]

Unit 8200, the largest intelligence unit of the Israel Defense Forces (IDF), is an important incubator of cybersecurity startups. Cyber professionals leaving military service populate companies, universities, think tanks, and government agencies, driving the cross-pollination of experience and perspective.

The largest subsector in cybersecurity as of 2021 is Data Protection Encryption and Privacy, consisting of 64 companies. Connected Devices, IoT and Control Systems is another key subsector, with 63 active companies, accounting for 14.6% of the cyber sector.[3]

Perhaps the best-known Israeli company in the field is Check Point Software Technologies, considered the pioneer of Israel's cybersecurity firms. Founded in 1993 and now one of Israel's largest tech companies, Check Point introduced FireWall-1, the IT industry's first stateful inspection firewall technology[4] and currently claims all of the Fortune and Global 100 companies as customers.[5] Its ZoneAlarm antivirus and anti-ransomware products for small businesses and consumers have nearly 100 million users worldwide.[6] Headquartered in Tel Aviv, Check Point has offices in more than 75 locations worldwide.[7]

Leading Israeli-founded cybersecurity companies in the Bay Area, discussed in the previous chapter, include Palo Alto Networks and SentinalOne.

Fintech

Israel's fintech industry has established itself as a frontrunner in financial innovation, supported by depth in crossover technologies such as cybersecurity, big data analytics, and AI. FinTech-Aviv, Israel's largest association community that supports and networks companies in the fintech ecosystem, counts more than 30,000 members.[8]

As of 2021, there were 497 active Israeli fintech companies in Israel, up from 284 in 2014,[9] including 13 unicorns.[10] Most equity investment concentrates in a small number of companies, with 12 raising over $100 million, or 58% of the sector's total equity investment between 2014 and 2019.[11] Equity investment in fintech companies in 2021 totaled $3.54 billion (as of August), already a 97% increase in investments over full-year 2020 and a 297% increase over a five-year period.[12] Interest is growing in AI-based solutions that can utilize large datasets to improve efficiency and customer experience. In 2020, 162 AI-focused fintech startups raised a total of $1.07 billion, a 65% increase compared to 2019.[13] Israel accounts for 5% of all global venture stage investment in fintech,[14] ranking it fifth in the world.[15]

Success stories include the trading app eToro—which was valued at $800 million after its Series E round in 2018[16] and in March 2021 announced plans to go public via a $10.4 billion SPAC merger transaction expected to close in the third quarter[17]—payment platform Melio, and AI-powered insurance company Lemonade. Other leading companies among the 12 that raised over $100 million in equity in 2019 include Fundbox—an AI-powered financial platform for small business that offers fast access to business credit and serves over 300,000 small business clients—and Rapyd, which provides an API-based "fintech-as-a-service" platform covering payments, banking services, fraud protection, and more.[18] Rapyd's customer base includes 5,000 businesses and in January 2021 was growing by 500 new customers per week.[19]

Leading Israeli-founded fintech companies in the Bay Area, discussed in the previous chapter, include Gusto and Tipalti.

Healthtech

Israel is a global leader in healthtech innovation, with more than 1,500 companies in the health and life sciences sector. Approximately 70% of those are in medical devices and digital health.[20] According to the US International Trade Administration, Israel's healthcare technology market is valued at $6.2 billion.[21] Its success in the healthtech and medical devices field builds on a foundation of leading research universities and medical

centers that support the development, testing, and application of new technologies.

In the medical devices field, Israel has the highest number of patents granted per capita in the world and the fourth largest absolute number of patents. The sector accounts for roughly 50% of Israel's life sciences industry, attracting the majority of its investment,[22] and more than 100 new medical technology companies launch annually.[23] Startups receive particularly strong support, with new medical device companies eligible to have as much as 100% of their budget covered for the first 3 years, with 85% coming from the Israeli government. This strong government role is explained in part by the reluctance of private investors to invest in the financing of high-risk early-stage companies in the field; government support, on the other hand, provides stability that has attracted private sector interest. To date, 40% of Israeli medical device startups have matured into revenue generating businesses.[24]

In the field of digital health, perhaps the most important development from a patient's perspective has been the shift towards solutions offering patient empowerment. AI has enabled a growing range of applications, including decision support tools for doctors, medical imaging analysis through computer vision, and big data analytics for health management.[25] Machine learning is also becoming a core technology for the industry.

Notable Israeli healthtech companies include INSIGHTEC, a medical device company that produces magnetic resonance (MR) guided focused ultrasound equipment for image-guided acoustic surgery.[26] Its incisionless neurosurgery platform is the first of its kind to gain US FDA approval for two movement-related neurological indications related to tremors caused by disorders such as Parkinson's disease. Other significant ventures include Todos Medical Ltd., a company developing blood tests for the early detection of cancer and neurodegenerative disorders, Bluewind Medical Ltd., which has developed an implant for the treatment of overactive bladder,[27] and Immunai, a New York-based startup that has leveraged single-cell technologies and machine-learning algorithms to build the largest proprietary dataset in the world on immunological data for the detection, diagnosis, and treatment of disease.[28]

Surgical Theater

Israeli-American company Surgical Theater was founded in the US in 2010 by two Israeli former military pilots, Alon Geri and Monty Avisar, who had helped to develop a flight simulator for the F-16 fighter. Applying that experience to the medical field, the company developed a 3D virtual reality medical visualization platform that moves beyond two-dimensional CT and MRI scans by using them to create a 360-degree virtual reality construct that helps surgeons to refine their techniques, more effectively engage with patients about planned procedures, and increase their situational awareness from every angle.[29] Its Surgical Navigation Advanced Platform carries forward to the operating room, enabling surgeons to apply patient-specific surgical plans during actual surgeries, synchronizing movements with onscreen guides.[30] COO Alon Zuckerman explains, "The same techniques that allow pilots to rehearse for missions using satellite images can be used to help surgeons rehearse, immersing themselves in a patient's unique anatomy, looking between structures and seeing issues. This helps them pre-plan procedures and helps patients understand the process and their options, such as the choice between surgery and chemotherapy."

Headquartered in Ohio and with offices in Los Angeles and Netanya, Israel, Surgical Theater has three R&D centers (in California, Ohio and Israel) with its Israel facility focusing on AI and production done in Los Angeles. Its technology is now being used in leading academic hospitals including UCLA Medical Center, Stanford Hospital, the Lucile Packard Children's Hospital at Stanford, UCSF Benioff Children's Hospital, Mount Sinai Hospital, the Mayo Clinic, and Tel Aviv Hospital[31] and Rambam Medical Center in Israel, supporting more than 15,000 complex surgeries and 100,000 patient consultations.[32]

Mobility

Israel has become an active player in the field of mobility, with large tech companies like Mobileye and automotive chip maker Valens Semiconductor and service providers such as Waze and Gett, all of which began in Israel. While Israel doesn't have a history of automotive manufacturing, its strength is in smart mobility, based on depth in AI and semiconductors, which are driving the sector's expansion.

The digitalization of mobility particularly focuses on advancements in object recognition and tracking as well as behavior projection, fields where Israel has developed expertise. That capacity is reflected in growing investment by automotive players such as General Motors, Volkswagen, Daimler, Ford, Renault-Nissan, Bosch, Samsung (Harman), and others.[33] Much of this investment is centered on startups. Between 2010 and 2019, more than 40 mobility-dedicated startups received funding from investors, as well as more than 300 startups with possible applications in mobility, totaling $18.4 billion for the period. Excluding Mobileye, yearly investment in the field grew 400% between 2010–2013 and 2014–2018. Total investment in the sector puts Israel in fourth place globally as a destination for mobility investment, after the United States, China, and the United Kingdom, and ahead of traditional automotive powerhouses like Japan and Germany. Most of these investments are directed to companies developing autonomous driving related technologies, as well as cybersecurity and telematics.[34]

Israel's best-known success story is Mobileye, which revolutionized camera-based computer vision for autonomous driving[35] and was acquired by Intel for $15.3 billion in 2017. This was the largest exit ever made by an Israeli company.[36] Other notable examples include Waze, a community-driven GPS navigation app that was acquired by Google in 2013 for $1.1 billion;[37] Argus Cyber Security, a developer of cybersecurity technologies for use in automobiles that was acquired by Continental for an estimated $430 million;[38] Innoviz Technologies, a developer of LiDAR sensors and perception software that enables mass production of autonomous vehicles;[39] Aurora Labs, which produces "self-healing software" that is able to detect and fix problems that a vehicle encounters in real time, much like the human body's self-healing mechanisms; and Upstream Security, the first cloud-based centralized cybersecurity and analytics platform that protects the applications of connected and autonomous vehicles. Upstream has attracted funding from car manufacturers such as Volvo, Renault, and Hyundai.[40]

Waycare

Waycare builds next generation systems for traffic management. Looking at the high level of traffic fatalities in Israel, founder Noam Maital believed that many were avoidable and that spending wasn't correlating with innovation. The company's cloud-based platform synthesizes multiple datasets using AI to generate predictive analyses. After developing the technology in Israel, Waycare entered the US market through a pilot in Nevada and now generates several million dollars in revenue there. Seeing a larger opportunity in California, Maital moved to Los Angeles in 2019. The company's R&D is still in Israel while marketing and management are in Los Angeles, and its systems are deployed in ten states.

An example of the system's applications is automated incident identification. Existing systems rely primarily on call-ins or on cameras for information. Waycare's approach relates current data to historical patterns in order to detect anomalies. Data gathered and analyzed from sources such as cameras, private companies like Waze, in-vehicle data, and information on road surface conditions is layered onto a mapped interface that provides users with a real-time outlook for road conditions, factoring in congestion, risk zones, stalled vehicles, debris, traffic stops, and major events. The system's primary customers are cities and municipal transportation agencies, with analyses used to improve safety, congestion, crash prediction, and crash response. In the Bay Area, Waycare has been working with the Metropolitan Transportation Commission (MTC) and the California Department of Transportation (Caltrans District 4) since January 2021 on the development of a pilot to help improve 511 operations and public notifications of traffic incidents.[41]

Agtech and Water

“Israel has a competitive advantage in foodtech and agtech. There's a history there—they have basically been growing things in the sand. ”

Adam Bergman, Managing Director, EcoTech Capital

Agtech

For many years, Israel has been at the global forefront of innovative solutions that help farmers optimize crop yield and management. Its industry builds on expertise developed over many decades as the country was required to maximize the efficiency of water use and agricultural production in order to sustain food production in an arid and water-limited environment. With desert occupying a large portion of the country, and little possibility for trade with neighboring countries, Israel was forced to invent its own agricultural solutions. That included new seed variety development that has made Israel a leader in plant research, with plants bred to be as water efficient as possible, and the development of plants that can thrive on brackish water. Much of this technology was initially applied on kibbutzim, a legacy that has carried to the present day as 51% of Israel's agtech ventures have a founder that comes from a kibbutz.[42]

As of mid 2021, there are more than 400 AgriFood-tech companies in Israel.[43] The rate at which new companies are being created has been growing steadily, with 184 companies launched between 2015 and 2020, compared to 81 in the 2010–2014 and 64 in the 2000–2009 time periods. Between 2015 and 2019, both the total annual investment and the median investment deal value in the AgriFood-tech sector have quadrupled, with equity investments totaling more that $200 million in 2020.[44]

As with medical devices, the government complements private investment in the sector, with the Israel Innovation Authority (IIA) providing annual investment in new startups totaling $35 million and the Ministry of Agriculture and Rural Development supplying $6 million (with IIA).[45]

Many startups have grown out of academic research, often licensing their technology from Israeli universities and research centers. The **Volcani Center (Agricultural Research Organization)**, the

research arm of Israel's Ministry of Agriculture and Rural Development, plays an important role. With its main campus outside Tel Aviv and smaller campuses in northern and southern Israel, Volcani supports approximately 200 researchers, each with their own labs, and nearly 1,000 personnel including students. While not an academic institution, it enjoys close ties with universities whose students participate in its research projects. Its technology portfolio has a strong focus on arid zone agriculture but also includes wastewater irrigation, aquaculture, and many other fields. Most research is publicly funded and broadly disseminated in the farming community, through shared research with farmers and an active extension program, but also includes R&D with private sector partners that is open to companies from anywhere in the world. In California, Volcani has a particularly strong connection with UC Davis, which many researchers visit for PhDs, postdocs, and sabbaticals.[46]

A second wave of innovation has come from the Information and Communication Technologies (ICT) field, and particularly the fields of Data and Computation and Sensing. Applications focus on issues relating to crop yield and harvest management, as well as pathogen and pest management and alternative food sources. Digitally based, this involves software to tap large data sets, providing tools and input to guide farmers through the cultivation process and connect them to market opportunities. Data and Computation startups address issues relating to yield and harvest management, targeting the identification of genes and substances that boost crop resilience and yield. AgrIOT, for example, helps farmers determine the optimal fertilizers for their crops; BeeHero tracks beehive conditions and pollination patterns in fields;[47] while Beewise houses multiple bee colonies in solar-powered houses that enable remote monitoring and management, including pest control, AI-assisted swarm management, and automated harvesting.[48]

An estimated 20–40% of crops worldwide are lost due to pathogens and pests, and while chemical treatments are generally effective in treating this problem, they are often overused. More than 14 Israeli startups offer environmentally friendly alternatives to conventional pesticides. While solutions have primarily been

biological or chemical, more than 12 Israeli startups employ machinery and robotics to identify and address threats, allocating the precise amount of pesticide needed. Examples include Skyx, Green-eye Technology, and AgroScout, all of which use drones to scout fields and customize spraying.[49] FruitSpec uses hyper-spectral imaging and deep learning algorithms to analyze fruit tree images at the beginning of a season to help farmers estimate harvest yields, including fruit count, size, and weight.[50]

Innovation is also occurring around alternative food sources, aiming to disrupt the livestock industry and reduce its impact on climate change. Between 2013 and 2018, 17 companies focusing on alternative food sources were launched. Israeli startups are pursuing diverse approaches. Some offer vegetarian substitutions for meat dishes, such as InnovoPro, a startup that creates dairy and meat alternatives made from chickpeas.[51] Two other notable companies, Aleph Farms and Biofood Systems, are among the few in the world to offer beef grown without the animal.[52] Redefine Meat has produced the world's first 3D-printed plant-based steak.[53]

Investment in the foodtech/agtech sector is growing. In addition to government resources, a consortium of investors launched in 2019 to focus on foodtech and agtech innovation. The partnership includes Palo Alto-based Finistere Ventures, Israeli venture firm OurCrowd, Israel's largest food manufacturer Tnuva, and Tempo, a long-established Israeli beverage company.[54] Focused on the food and beverage value chain, from alternative proteins to supply chain efficiency, the consortium plans to invest up to $100 million in the sector. The partnership's launch was connected to the Israeli government's establishment of a foodtech innovation incubator in Northern Israel in Kiryat Shemona, which the consortium now operates.[55]

Several environmental factors distinctively link California agriculture with Israel: similar crops (e.g., tomatoes, tree crops, and vegetables versus the corn or soybeans more prominent in the Midwest), semi-arid climates, and similar challenges (such as minimizing evaporation in scarce conditions and improving efficiency through water recycling). This makes California an important market and partner for shared solutions. Innovative

Israeli agtech companies with a presence in the state include

■ Taranis, a digital platform that enables users to identify, analyze and treat early signs of crop threats such as weeds, insects, and disease, by enabling data-based field monitoring and management;[56]

■ SeeTree, a digital platform that enables tree management and monitoring, providing metrics that identify underperforming and non-producing trees through drones, manned and unmanned vehicles, IoT, AI and machine learning algorithms, aerial data, and agronomists on the ground;[57]

■ Seedwiz, a GIS/AI database platform for seed varieties that helps farmers select the optimal plant variety seeds based on genetic potential, farm location, environmental conditions, growing season, means of production, market segment, and disease resistance;[58]

■ CropX, a cloud-based farm management and automation platform that integrates above- and below-ground data to determine the optimal use of water and nutrients, with potential enhancements to crop yield of 10% and water savings of 30%;[59]

■ Saturas, a sensor-based precision system for monitoring and optimizing the irrigation of trees and wine grapes;[60]

■ Fieldin, a smart farming platform that helps specialty crop growers manage and optimize pesticide applications, harvest activities, and other critical field operations;[61]

■ RootsTalk, an advanced drip irrigation system, that is the first to offer "irrigation as a service" through an autonomous irrigation controller that monitors roots to ensure efficiency of water use and maximize plant growth;[62] and

■ Prospera, a digital platform to help growers maximize production, using AI and machine learning to support agricultural production planning, monitoring $5 billion in production across 4,700 fields.[63] In May 2021, Prospera was acquired by Valmont Industries, creating the world's largest vertically integrated AI company in agriculture.[64]

RootsTalk, Taranis, Prospera, and Fieldin all operate from the Western Growers Center for Innovation & Technology in Salinas, which supports the rapid commercialization of technology—water, precision agriculture, and big data—in California and connects the Western Growers association's members with solutions providers who can help them be more predictive and efficient in a market facing rising costs. Center Director Dennis Donohue says contributions can come from anywhere and particularly Israel: "The maturity of Israeli management teams and their leaders is high. Most aren't true startups but are looking to scale, and if you want to scale, you come to California. Because of its strong ecosystem, there's a widespread perception that Israeli companies are solid and have something to add, so when they come, most will get a look. Israel made the desert bloom, and when Israeli companies come to America, people pay attention to what they're doing."[65]

SPOTLIGHT
BeeHero

BeeHero's CEO and co-founder Omer Davidi, a graduate of IDC Herzliya and a serial entrepreneur, was fascinated by the connection between bees, pollination, and their impacts on the world's food supply. His co-founder had come from a family of professional beekeepers.

While agtech had seen enormous improvements, there was a problem. The common ground for all food is that flowers are pollinated and for 75% of crops, this is done by animal pollinators, mostly insects.[66] The scale of farming has increased to where farmers can no longer rely on wild bees and instead rent bees from commercial beekeepers. Recently many of those bees have been dying, and 40–50% of colonies have been collapsing each year.[67]

For Davidi, this led to two questions regarding the process of pollination: (1) how to improve the health of colonies and (2) how to deploy hives to enable the most efficient pollination. The solution was to develop tiny sensors that attach to and collect data from both outside and inside hives. With those sensors, it's possible to predict

failure (for example, if a queen dies, if there's an invasion of mites that can destroy a colony, or if there's a food shortage or possibly a viral disease). This analysis happens by identifying patterns that measure sound, temperature, humidity, and vibration from the hive's interior, while external sensors measure environmental factors. Pollen traps and computer vision also check the amount of pollen brought to the colony. Beekeepers can inspect their hives every 3–4 weeks at best, and often learn too late that a hive is collapsing. But using sensors with 3–5 days warning, if a queen has died, a new one can be brought in to keep the colony going. Management of this kind can effectively increase crop yield.

The first investment in BeeHero was from Technion DRIVE Accelerator,[68] followed later by venture investment from UpWest Labs, which brought the company to the Bay Area and provided the infrastructure for a soft landing. Other investors followed, with a seed round in 2020 that included Rabobank, iAngels, Plug and Play, J-Ventures,[69] and Good Company, among others. In that time, the company grew from an initial ten hives in its co-founders' back yard to 1,400 across Israel, and 48,000 under management today in the US.[70]

Since 2019, BeeHero has engaged with both large commercial beekeepers and farmers in a two-track model. Beekeepers contract with it to help improve the quality of their hives, with BeeHero providing sensors and access to its platform at no cost. From there, Bee Hero provides pollination services directly to the farmer. Currently, California's biggest focus is on almonds, a key crop. Eighty percent of the world's almonds are produced in California (1.26 million acres[71]), accounting for 100% of the US commercial supply.[72] Almonds are entirely dependent on insects for pollination but face a shortage of hives. In 2021, 15 commercial beekeeping companies and 45 farms in California were enrolled as clients, with 20,000 acres of almonds in the state supported by BeeHero's pollination services (more than the total acreage in Israel).

BeeHero is currently raising Series A investment, with the goal of having 200,000 acres covered by its pollination services within five years. In parallel, it is working with Bayer, UC Davis, Oxford University, the USDA, and others to research how insecticides affect bees, and with sustainability coalitions to help establish bee-friendly products.[73]

Water

Closely related to agtech, Israel is a global leader in the field of water technology and water management, a development documented in the 2015 book by Seth Siegel, *Let There be Water*.[74] The revolution began in the Negev area of southern Israel, a semi-arid region that receives only 1.2 inches of rainfall annually.[75] Agricultural necessity led to high-impact innovations in water management, starting in the late 1950s with the discovery that irrigating a plant drop-by-drop limits evaporation and delivers the water that a plant needs directly to its roots, offering an alternative to conventional flood and sprinkler irrigation. The new irrigation method also proved to significantly enhance crop yield.[76] Other breakthroughs followed in the use of brackish (salty) water (which is found in abundance under the Negev Desert's sands) for agricultural production.[77]

Today, by growing a significant amount of the country's production of fruits and vegetables with otherwise undrinkable water, Israel has developed a multi-billion dollar agricultural export industry. Approximately 80% of wastewater is recycled, accounting for roughly 25% of the total water supply; most recycled water is used for agricultural irrigation.[78] With this experience, Israeli water and agtech companies are active globally, with drip irrigation and desalination a key focus. A good example is Netafim, a leading producer of drip irrigation systems,[79] that now holds more than a 30% share of the global market in the field.[80]

Sᴘᴏᴛʟɪɢʜᴛ
IDE

IDE grew out of a technical paper on how to convert sea water to fresh water that was submitted in 1965 to Prime Minister David Ben-Gurion to

support his vision of bringing life to the desert through desalination. Ben-Gurion sent the paper to the University of California, which validated the idea, leading to the creation of a small research group of 13 engineers (Israel Desalinization Engineering) that later became a government-owned company and was subsequently privatized as IDE. Since then, IDE has played a central role in the development of Israel's water supply, including the construction and management of several of its largest desalination plants.

Headquartered in Israel, IDE has an office in Carlsbad and approximately 600 US employees who focus on sales, development, project management, operations, and maintenance. IDE's approach to desalination, industrial water treatment, and advanced water reuse includes an emphasis on sustainability, energy efficiency, and cost reduction as targets. It operates the Carlsbad desalination plant in Southern California, which is owned by Poseidon Water and produces 50 million gallons of drinking water daily, meeting 10% of water demand in San Diego County.[81] The technology used is the same as that used at IDE's Ashkelon plant, Israel's first large-scale desalination facility. IDE's plant at Sorek is the world's largest desalination facility, while Carlsbad is the largest desalination plant in the Western Hemisphere.

IDE also operates a smaller desalination plant in Santa Barbara that produces 3 million gallons per day, meeting 30% of demand in the city.[82] Another project in the City of Pismo Beach is demonstrating a new technology for advanced water reuse that increases the rate of recovery, cuts waste by half, produces reverse osmosis without the need for chlorination, and reduces energy use by 35–40%. The pilot ran for more than a year, producing data that is being used now to design a full-scale project.[83]

Younger companies are also making a mark. San Francisco-headquartered **Epic Cleantec**—co-founded by two Israelis and Tel Aviv University master's degree holder Aaron Tartakovsky and his father, Igor—deploys onsite water reuse systems for residential, commercial,

and industrial buildings, producing treated water for reuse in non-potable applications like toilet flushing, irrigation, cooling towers, and laundry. Its technology enables property owners and real estate developers to reuse up to 95% of their water onsite, reducing utility costs while improving resilience and sustainability. Its approach also includes a resource recovery component that converts wastewater organics into fertilizer, recovering wastewater heat that can be repurposed for the building's internal hot water supply.

The company was developed based on initial work supported by the Bill and Melinda Gates Foundation's "Reinvent the Toilet Challenge," which aimed to provide novel water and wastewater solutions for the roughly 3.5 billion people in the world who lack access to clean water and basic sanitation.[84] That led to the realization that decentralized wastewater solutions that are independent from centralized systems and large wastewater treatment plants have applications in developed economies as well. The technology is particularly applicable to new, large residential and commercial buildings and is finding a key market in the real estate development sector. In 2015, the City of San Francisco mandated onsite water reuse systems in all new construction of buildings of more than 250,000 square feet, and Los Angeles similarly requires that cooling towers in all new buildings over 25 stories use at least 50% recycled water.[85] By 2023, the State of California plans to produce a uniform water recycling framework to help cities across the state develop similar programs.[86]

Buildings in San Francisco where Epic Cleantec is currently operating include the 45-story NEMA tower south of Market Street and the newly-constructed Fifteen Fifty apartment tower on South Van Ness Avenue.[87] More high-profile projects are in development throughout California and across the United States, including Park Habitat, a 20-story green office tower planned for downtown San Jose.[88]

Enabling Technologies: AI

Israel has developed impressive strength in the underlying technologies that support these sectoral

advances, particularly AI. Recognizing that, in 2018 Google opened its first startup accelerator focusing on artificial intelligence and machine learning outside the US in Tel Aviv.[89] The CB Insights 2021 list of the world's 100 most promising AI startups, representing twelve countries across 18 industries, includes 10 that are from Israel or have R&D centers in Israel:[90]

- Beewise, which has developed the world's first autonomous beehive, Beehome, housing up to 40 bee colonies, monitored through a mobile app;

- Deci AI, which makes an algorithmic platform offering solutions for real-time deep learning inference, maximizing data center hardware utilization and reducing deep learning cloud costs;

- Percepto, which uses robotics to perform autonomous inspections of vital infrastructure and assets;

- Prospera Technologies, which makes smart digital systems for greenhouse farming and autonomous row-crop management;

- Run:AI, which offers a deep learning (DL) orchestration platform to manage graphics processing unit (GPU) resource allocation and increase cluster utilization;

- Syte, which focuses on next-generation search and discovery experiences for e-commerce sites;

- Theator, which enhances the capabilities of surgeons and surgeons-in-training through its surgical intelligence platform, based on analysis of over 30,000 hours of videos of a variety of procedures;

- Snyk, which specializes in applications security— finding and fixing vulnerabilities in code;

- SentinelOne, which uses AI to prevent, detect, and undo known and unknown cybersecurity threats; and

- Aurora Labs, which has pioneered "self-healing software" for connected cars that detects and looks to fix any problems a vehicle encounters in real time.

This follows six Israeli companies included on the CB Insights 2020 AI 100 List:[91]

- Razor Labs, a predictive maintenance platform for the mining industry;

- Zebra, a medical imaging platform for radiologists;

- Healthy.io, a mobile health company that turns smart phones into medical devices for applications such as home urinalysis;

- Snyk, the applications security company that also appears on the 2021 list; and

- Viz.ai, which uses AI to synchronize stroke care and improve access to lifesaving therapies.

AI applications extend to energy. Based in Israel and San Mateo, automation platform developer Zira uses AI to enable the holistic management of machines and industrial processes at manufacturing facilities, improving productivity as well as energy efficiency. Its technology grew out of an industrial research project between UC Berkeley, MIT, and the University of Chicago,[92] and has attracted grants by the BIRD Foundation ($1 million) and the California Energy Commission ($9.2 million).

Another company attracting attention is San Francisco-headquartered Gong.io, the developer of technology that automatically inputs customers' and their clients' communications into an AI platform that analyzes interactions for data trends that can help them retain, sell, and market to their clients. With $583 million in funding[93] and a valuation of $2.2 billion, its workforce of several hundred is concentrated in the Bay Area, in addition to an R&D center in Israel.[94] In 2021, Gong.io was named to the Forbes Cloud 100 (which ranks the world's top private cloud companies) for the second year[95] and was ranked by LinkedIn as number two in its annual ranking of young venture-backed startups in the country.[96]

A 2020 Cardumen Capital analysis shows Israel as home to more than 1,000 active AI startup companies which, from 2012 through the first quarter of 2020, have cumulatively raised $10 billion in funding, including $3.7 billion in 2019 alone. Deal count has also grown sharply, reaching 199 in 2019. Key sectors include healthcare, enterprise software (particularly B2B), computer vision, and mobility.[97]

Conclusion:
Aligning Interests and Capabilities

" If you look at the effects of climate change and its effects on hydrology, it's a global conversation. You have to ask how you can manage the resources and infrastructure you have now better. With hotter days and quicker snowmelt, reservoirs aren't filling as they were modeled to. We're learning from places like Israel that have already faced many of these challenges. **"**

Joaquin Esquivel, Chairman,
California State Water Resources Control Board

Israel sits on a short list of countries that are first-tier global hubs for technology and innovation. The scale of its global impact is remarkable, given its small size and population.

California and Israel share core interests that have enabled the two economies to align. As that has occurred, California has become a key source of investment and a launching pad for Israeli startups into US and global markets. Israel, for its part, has become an important base for R&D and a source of innovation and technology that contributes to the bottom lines of California companies, to their competitive capacities, and to employment.

Israel is also emerging as an important strategic partner, as global supply chains for critical technologies realign in search of reliability and security. For the United States,

this puts a premium on geostrategic alignment based on core values such as democracy and a commitment to open markets—values shared with Israel. This is particularly the case in fields such as semiconductors, which are essential to national and economic security. Cybersecurity is another critical field where the alignment of values and capabilities will assume new importance.

There are strong opportunities to grow this partnership across a range of current and emerging technologies— AI, cybersecurity, healthtech, fintech, mobility, water, and agtech, among others. This parallels opportunities for closer collaboration at the national level to build strategic partnerships around digital challenges such as health and cybersecurity, cooperate internationally on digital trade to protect the cross-border movement of data, and address critical issues such as climate change through collaborative research.

Recommendations

Closer cooperation at the state level can support California's priorities in fields ranging from agriculture and water to climate change and energy and enable the deeper engagement of Israeli and California businesses and universities.

In March 2014, then Governor Jerry Brown and former Israeli Prime Minister Benjamin Netanyahu signed

an agreement to develop joint projects and conduct mutually beneficial research in California and Israel. In it, the two sides agreed to (1) convene bilateral interagency and interministerial working groups to coordinate initiatives; (2) facilitate collaborations between Israeli and California entrepreneurs; (3) support exchanges and cooperation in key sectors including water conservation and management, alternative energy and clean energy technologies, health and biotechnology, cybersecurity, arts and culture, education, and agricultural technologies; and (4) encourage collaboration between California and Israeli universities and public and private research institutions.[1]

The steering committee established to oversee the MOU's implementation should be reconvened and revitalized, with a focus on technological advances in the years since the MOU was signed and evolving policy priorities on both sides. One option to consider is the convening of a California-Israel technology conference which, if successful, could be repeated annually.

In particular, California and Israel confront deep issues relating to climate change, water, and agriculture and share a strong interest in agricultural sustainability. As drought and water scarcity grow, California would benefit from a deeper dialogue with Israel on issues including water recycling, water conservation, the use of brackish water for agricultural applications, desalination, and precision agriculture—fields where Israel's experience could be applied. Deeper technology connections around the challenge of climate change should also be a priority.

The California Department of Food and Agriculture (CDFA) has actively implemented the 2014 MOU through a series of exchanges:

- a water conference in San Diego in 2016 to strengthen business partnerships in water technology;

- a water conservation delegation to Israel in 2016 led by CDFA Secretary Karen Ross;

- a 2016 webinar on the use of recycled water for specialty crops;

- the 2017 signing by Secretary Ross and former Israeli Agriculture Minister Uri Ariel of a letter of intent to cooperate on climate-smart agriculture;

- a 2017 forum in Sacramento on shared water and agriculture co-hosted by CDFA and Israel's Ministry of Agriculture and Rural Development;

- a future of water for irrigation workshop collaboration between Israel's Agricultural Research Organization and the University of California's Division of Agriculture and Natural Resources, held at UC Davis in 2018;

- a binational financial innovations lab organized by the Milken Innovation Center under the California-Israel Global Innovation Partnership; and

- a 2021 webinar on agricultural adaptation to climate change.

CDFA has also conducted virtual buyers meetings, in partnership with the Western United States Agricultural Trade Association, connecting California and Israeli companies: a 2020 exchange focused on dried fruit and nuts, and an October 2021 virtual buyers meetings program will connect companies in the consumer-oriented food sector.[2] Other parts of state government have not been as active as CDFA, which points to an opportunity for broader exchanges.

University research can play a central role. Promising fields include biotech, data science, and security, particularly advanced cryptographic systems such as post-quantum cryptography. Embedding intelligence at the edges of computing—through intelligent vehicles and highway systems, for example—is creating new security vulnerabilities. With more intelligence in the grid, there is a growing question of how to secure it, and with the world at an inflection point between data-enabled connectivity and systemic vulnerability, a rich opportunity exists for collaboration with Israel in fields such as AI and cybersecurity.

Beyond research, universities can contribute to deeper entrepreneurial connections. UC Berkeley's SkyDeck accelerator, for example, has begun discussions with

Tel Aviv University, The Hebrew University, and other universities in Israel that also have incubation programs. These exchanges should be pursued. As SkyDeck extends its program globally through initiatives such as model curricula and boot camps, SkyDeck programs can be brought to Israel and entrepreneurs from Israeli incubators can spend time at SkyDeck.

Finally, both the California-Israel Global Innovation Partnership launched in 2015 to implement the 2014 Brown-Netanyahu MOU and the 2017 MOU on research cooperation between the University of California and the Israel Innovation Authority (discussed in Chapter 4 of this report) lack designated public funding. Strengthening these exchanges will require a deeper

level of investment. A proposal by the Jewish Caucus in California's legislature would fund the implementation of the cooperative MOUs that California has signed with three overseas partners—Israel, Mexico, and China's Jiangsu Province—to support competitively chosen applied research partnerships in clean energy. This kind of support, if matched by Israel, could advance the shared US-Israel research and technology agenda. While the current proposal would fund energy research through the California Energy Commission, consideration should also be given to broad-based funding for the wider range of cooperative initiatives called for in the MOUs, an investment that can advance the California-Israel research and technology agenda and potentially produce deeper benefits for both sides.

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