

ISRAEL INNOVATION AUTHORITY REPORT 2017

“If there isn’t a dramatic increase in the number of people employed in the hi-tech industry – the Israeli economy will lose momentum. The Israel Innovation Authority’s goal: half-a-million employees in the innovation industry within a decade (doubling the current number).”

Jerusalem, Israel. October 2nd, 2017

The Israel Innovation Authority Report 2017 examines the trends and characteristics of the Israeli hi-tech industry, presents key challenges it faces and offers means of confronting them. The main points of the report are as follows:

- Israeli hi-tech is an unprecedented success story enjoying a period of consistent growth. Nevertheless, our flourishing hi-tech success does not spill over into other areas of the economy, and most do not enjoy its fruits.
- Only 8.3% of salaried employees are in the hi-tech sector. Their salary is more than double the national average.
- Our goal: half-a-million people employed in the innovation industry within a decade (doubling the current number). This would be achieved through:
 - * Expanding the circles of influence of multinational companies – both in terms of employment opportunities and the range of technological fields in which they currently operate.
 - * Encouraging the growth of Israeli companies – from startups at the early stages of developing technology to companies with a complete value chain: design, manufacturing, marketing, sales, etc.
 - * Expanding spheres of employment in hi-tech, including integration of women, members of the Arab sector and Ultra-orthodox Jews in the workforce, along with veteran engineers above the age of 45. In addition, by diversifying the entry points to hi-tech employment by promoting initiatives such as coding boot-camps and others.
 - * Developing other innovative sectors apart from ICT (software, computing and communication) – with an emphasis on the life sciences.

* Promoting innovation in a wide range of industries, especially leveraging global trends in Industry 4.0.

- All this in parallel with the preservation of Israel's leadership position in R&D, and its unique entrepreneurial culture, especially in fields at the forefront of technology.

Israeli Minister of Economy and Industry, MK Eli Cohen: "In a global economy characterized by technological innovation, Israel is a key player. This can be seen mainly in the number of startups in Israel, and the number of leading international companies active in Israel. The 2017 Innovation Report published by the Israel Innovation Authority encompasses a range of achievements and challenges faced by the Israel innovation industry and presents a roadmap for future development. We are providing incentives for more multinational companies to add manufacturing and export activity to their R&D; this will increase the number of people employed in technological branches in general, particularly in the periphery."

Aharon Aharon, Director of the Israel Innovation Authority: "Today, Israel enjoys achievements on a global scale: first in the world in R&D investment and in venture capital investments as a percentage of GDP; 600 new startups per year, more than 300 multinational R&D centers – such as Intel, Google, IBM and Apple; second in the world in the Global Economic Forum's Innovation Index. However, these achievements do not carry over to other branches of the economy: the percentage of employees in hi-tech lies at only 8% for over a decade now; the average monthly salary in the hi-tech sector is NIS 21,000, more than double the average national salary (NIS 9,800). Manufacturing industries in Israel are not innovative enough and have trouble competing with the low costs in the East and the high production standards and innovation level of the West. If we do not act to leapfrog these industries forward – the gap between the hi-tech industry and traditional economy will only increase. In addition, the hi-tech industry itself is facing significant challenges. First, it suffers from a lack of engineers and programmers, which hinders its growth. The shortage of highly trained employees is partly the reason for the high salaries in this sector. Between 2005 and 2015, the average salary in the hi-tech sector increased by 38%, particularly significant given the shekel's 13% hike in value against the U.S. Dollar over the past years. Second, the Israeli model of innovation is largely based on creating technological added value, mainly in startup companies and multinational R&D centers. The Israeli innovation ecosystem, however, is still in the first stages of developing efficient mechanisms for seizing the economic value emanating from the technological value created here. The result is that today, R&D activity in the Israeli economy, especially in multinational R&D centers and startups, is a basis for creating *technological* value in Israel, but the *economic* value is enjoyed outside Israel's borders."

An update on the Innovation Authority's activities

The law establishing the Israel Innovation Authority was approved by the Knesset in August 2015, but the Authority began its activity only in early 2017. This year, the Authority's CEO, Aharon Aharon, began his tenure, and recently a new Chief Scientist and Head of the Israel Innovation Authority was appointed, Dr. Ami Appelbaum. The Authority was established based on the model of the Office of the Chief Scientist at the Israeli Ministry of Economy and Industry with the goal of optimally fulfilling the missions mandated by the R&D Law and providing high-quality and effective services for the Israeli innovation ecosystem. For this purpose, the Authority is structured with a series of innovation divisions with budgets of NIS 1.6 billion per year. In 2016, the Authority distributed grants to 1,115 R&D projects at 650 companies, with an average grant of NIS 1.4 million (in addition, 179 entrepreneurs enjoyed support as part of the "Tnufa" program). The Authority's board, the supervising body of the Authority's activities and compliance to policy goals, has approved four new support programs, in addition to the existing support programs moved from the Office of the Chief Scientist to the Innovation Authority: innovation labs and biotech incubators in the Authority's Startup Division, coding boot-camps in the Authority's Societal Challenges Division, and a program of multinational R&D centers in biotechnology and medicine in the Authority's Growth Division.

The report presents the Israel Innovation Authority's strategy for the challenges detailed above:

1) Increasing the number of employees in the innovation industry by half-a-million within a decade (thus doubling the current number, which is approx. 270,000). The percentage of people employed in hi-tech has been 8% for a decade, but the constant rise in demand for skilled employees leads to a consistent rise in salaries. Accordingly, the salary gap between hi-tech employees and the rest of the economy is worsening. The Israel Innovation Authority is working to significantly increase the scope of employment in hi-tech and in the various sectors of the innovation industry, so that a larger segment of the work force will be able to enjoy high-quality, well-paying jobs.

How can this be done?

Source of growth	Details	Potential for additional employees in the innovation industry
Increasing skilled workforce in hi-tech	40% increase in the number of college and university students with technology-oriented majors in	1500

	accordance with the Planning and Budgeting Committee's 5-year plan	
	Coding boot-camps	1000
	Returning Israelis, new immigrants and those with work visas	1500
	Members of the Arab & Ultra-orthodox communities, veteran hi-tech workers and women	1000
	Secondary staff to be added as a result of growth in the number of engineers and programmers	4000
Company Growth	Encouraging growth in Israeli companies	3000
Bolstering multinational R&D activity	Incentives for MNCs to expand their circle of employment – increasing the rate/number of non-engineers in multinational R&D centers	2500
Fostering innovation in the manufacturing industries	An innovation revolution in manufacturing: promoting Industry 4.0 in Israel, leveraging BEPS opportunities and innovation labs	3500
Developing additional innovation ecosystems	Digital health, pharma and medical equipment	4000
	Total	Over 20,000 per year

2) Increasing the economic value of R&D activity of multinational companies in Israel

There are 307 multinational R&D centers in Israel, many of which were established following the acquisition of Israeli hi-tech companies. The R&D centers constitute an important part of the Israeli innovation ecosystem and create significant technological value – they represent about 50% of investments in R&D. In addition, these R&D centers positively affect the economy from the perspective of salaries and productivity. In addition, alumni of the R&D centers often move among different players in the hi-tech industry over the course of their careers, thus distributing the technological and managerial skills they have acquired, a phenomenon known professionally as *spillover*.

Today, about 70% of jobs in multinational R&D centers are actually positions in research and development – mainly engineers and programmers. Thus, the R&D centers' effect on employment is limited, especially considering the shortage of engineers and programmers in Israel. Subsequently, in order to increase their influence on the economy, the multinational R&D centers should be encouraged to increase their activity in Israel beyond R&D to a range of different activities in the value chain of a global corporation: manufacturing, marketing, support, design and more. In this way, these multinationals will hire additional employees in supportive roles beyond existing R&D positions.

Adoption of the OECD's BEPS guidelines also provides a prime opportunity. The guidelines create an incentive for countries such as Israel to produce a competitive tax regime for hi-tech companies, thus encouraging them to register their IP at R&D centers in Israel. Such a process can contribute – as is the case in other countries – to the import of additional elements of the corporation's value chain to Israel. This year, an amendment to the *Law for the Encouragement of Capital Investment* was approved, which provides significant tax benefits for hi-tech companies.

In addition, there is strategic significance in promoting the activity of multinational R&D centers in a wide variety of technological fields. Today, the vast majority of activity of multinational R&D centers in Israel is in information and communications technology (ICT). Accordingly, the Israel Innovation Authority has launched a program to encourage the establishment and expansion of R&D activity in biotechnology and medicine.

3) Helping innovative companies grow in Israel as “mature companies”

A mature company – unlike a startup which focuses on the technology development – carries out additional activities, including manufacturing of advanced components along with R&D, global tech support, product engineering and manufacturing, global operations, accounting, budgeting, logistics and more. The significant financial influence of these companies is mainly

expressed in their ability to employ people with a variety of specializations at a high salary, which makes nurturing them a key strategic goal of the Innovation Authority. Specifically, we are encouraging this activity via a framework of bank guarantees intended to increase the credit available for hi-tech companies' growth.

4) Nurturing human capital for hi-tech through “coding boot-camps”

The Israel Innovation Authority is an active partner in the national program to expand the skilled workforce for the hi-tech industry, launched by the government in early 2017 – in light of the significant implications that a lack of skilled employees has on the future development of the hi-tech sector. In this program, the Israel Innovation Authority has begun working in several channels to increase the number of people employed in the industry and to maximize the potential of the existing workforce. Within this context, the Authority is leveraging the global trend of non-academic training in computer programming – coding boot-camps. This trend is based, on the one hand, on the increased demand for career reorientation without the need to return to academia, and, on the other, on the shortage of engineers and programmers in Israel, which makes employers willing to recruit skilled employees even if they lack academic training in hi-tech. The training programs work closely with industry and are structured according to its needs, so that top level programs can enroll successful college graduates who are interested in a career shift with the potential for higher salaries.

In Israel, this phenomenon is still in its beginning stages, but in the U.S., coding boot-camp graduates made up about a quarter of the computer science graduates who completed their studies in 2016, and who are being onboarded into the American hi-tech industry. In other words, the growth of such high-quality training programs can create a new and significant path for integration into the Israeli hi-tech industry, and can serve as an additional solution for the shortage in skilled employees.

Therefore, Israel Innovation Authority seeks to encourage the growth of top level, non-academic, computer programming training in Israel. As part of this initiative, the Innovation Authority this year launched its coding boot-camp program. The Innovation Authority's efforts can be divided into two parts: bolstering the reputation of these boot camps among both potential employers and employees by attracting top notch players to train, and to supervise and monitor these programs, and increasing the programs' visibility and benefits. Second, upgrading the boot-camps and increasing the number of students through grants to the programs themselves based on their level of job placements in the industry. The program will initially be operated as a pilot.

In addition, the Authority is preparing to absorb skilled employees from abroad in the hi-tech industry, with an emphasis on returning Israelis and new immigrants. As part of this initiative, the Authority is formulating a new training program for returning academics, which will focus on the needs of the hi-tech industry.

5) Integrating and keeping employees aged 45+ in the hi-tech industry

Conventional wisdom has it that hi-tech is a profession exclusively for the young, and that there is no room for industry veterans over a certain age. These claims are not unique to hi-tech, but given the shortage in skilled labor in this industry, one wouldn't expect that such biases would exist in the sector. In order to create an empirical basis for examining this phenomenon, the Innovation Authority has undertaken a survey regarding the employment of industry veterans in hi-tech in cooperation with The Association of Engineers, Architects and Graduates in Technological Sciences in Israel. The first and most pronounced finding of the survey is the negative relationship between level of employment and rise in age, meaning: age *does* have a negative influence on the odds of employment in hi-tech. The results of the survey show that this reduction in levels of employment is even more prominent amongst executives.

Another finding refers to the change in types of professions as age rises: the rate of salaried employees in hi-tech declines as age increases, while the number of freelancers rises, meaning that over the course of one's career, many employed in hi-tech and adjacent sectors exit the job market.

The Ministry of Welfare, Labor and Social Services, in cooperation with the Joint Distribution Committee and the Technion's School of Engineering, have recently launched a course for "technological refreshment" for veteran software engineers. Building on this experience, the Innovation Authority will examine the development of programs that would provide a solution for this market failure and encourage the integration and preservation of veteran employees in hi-tech.

6) Encouraging the development of innovative systems in additional technological branches

In the life sciences, agriculture and food industries, Israel maintains several advantages and success stories, but these industries have yet to develop integral systems of innovation. Specifically, they lack sufficiently developed ingredients contributing to the success of ICT in Israel – like a broad financial infrastructure and involvement of multinational companies. It may be that by developing these missing elements it will be possible to leverage existing advantages in these fields to build a sustainable ecosystem. Specifically, Israel's capability to create a competitive-edge based on the strength of its ICT should be examined in fields where the potential for growth has already been demonstrated, such as medical equipment, digital health, personalized medicine and precision farming.

There is extensive activity of 570 Israeli companies in the field of medical equipment with significant success, especially in the subsector of medical aesthetics, where Israeli companies

are leaders in the global market. Another burgeoning field over the past several years is digital health, in which Israel has many valuable assets that can be leveraged: first, Israel's leadership in the field of data science, and second, the unique data infrastructure that exists in Israel's medical records. Government initiatives such as the national program for digital health aspire to enable Israeli industry and academia to extract the maximum from these assets.

In the pharma industry, there is great potential for Israeli scientific excellence to yield successful results. There are a number of world-renowned research facilities in Israel, led by the Weizmann Institute, rated sixth in the world in life sciences research by the prestigious *Nature* magazine. But this excellence in research has yet to gel into an overarching industry, and commercial successes have been few and far between. Nevertheless, over the past several years, there have been signs that the Israeli pharma industry has matured, and we are witnessing a significant number of companies that have reached the clinical trial stage, a trend that is only expected to grow.

The vast majority of R&D centers in Israel focus on the field of ICT. There is great importance in attracting activity by multinational companies to other technological fields – especially the life sciences. The life sciences industry in Israel can greatly benefit from the knowledge, experience and access to markets engendered by multinational corporations. This year, the Israel Innovation Authority began a program to encourage the establishment and expansion of R&D centers in the fields of medicine and biotechnology, emphasizing the economic value these fields can bring to the Israeli economy.

7) Promoting innovation and productivity in the manufacturing industries

The manufacturing industries have a difficult time competing with the low cost of production in developing economies (especially in East Asia), and they do not reach the high level of manufacturing in North-American and European companies. As detailed in the Israel Innovation Authority Report 2016, a central reason for this is insufficient technological capacity and lack of innovation, especially problematic in an industry that does not enjoy advantages of scale or proximity to markets.

Harnessing technology and entrepreneurship for manufacturing can put a halt to the erosion in this industry and help develop a long-lasting competitive edge. In addition to the R&D grants given to industrial facilities as part of the activity of our Advanced Manufacturing Division, the Authority launched its "Innovation Labs" program in the Startup Division in order to encourage industrial corporations – especially those dealing with advanced manufacturing – to cooperate with entrepreneurs and startups.

Special significance is attributed to the Israeli industry's implementation of current technological trends, especially the "smart factory" (Industry 4.0) revolution, leveraging developments in robotics, the Internet of Things, Machine Learning and Big Data for

streamlining manufacturing processes and increasing productivity. Israeli leadership in these technologies, together with its unique entrepreneurial culture, creates ripe conditions for a significant leap forward in the level of innovation and productivity of Israel's manufacturing industries.

In addition, as noted above, adopting the BEPS guidelines and adapting Israel's tax system accordingly may encourage multinational companies to expand their activities in Israel, including manufacturing harnessing advanced technologies, a development that would bolster Israel's manufacturing industries.

Aharon Aharon, Director of the Israel Innovation Authority: "The Israel Innovation Authority has taken on an ambitious and challenging mission: taking the Israeli innovation system to the next level. We are acting to strengthen Israel's position as a global hub of innovation; to ensure that our hi-tech growth engine – including technological innovation and entrepreneurship – reaches additional sectors and branches of the economy, and to increase the economic value that technological activity in ICT brings. The Authority's strategy is based on three tiers – developing infrastructure for innovation, strengthening technological value and harnessing economic value – while distinguishing between innovation ecosystems (ICT, manufacturing, life sciences and so on). It should be noted that this strategy constitutes a change in Israel's innovation policy, which until today focused mainly on the second tier, i.e. encouraging R&D processes and creating technological value."

Additional issues touched upon in the report:

1) The Artificial Intelligence (AI) revolution represents a tremendous opportunity for Israeli hi-tech, especially in the field of smart transportation and autonomous vehicles

The technological leap in the field of AI is enabling autonomous vehicles as the cars of the future. The automobile is becoming a smart and sensor-rich system, as well as a computing and communications device. The model of car ownership is being replaced with a model of transportation as a personal service, rich in information and communications technologies. This revolution is accompanied by many technological challenges in the fields of sensors, AI, navigation, communications and cybersecurity. All of these create a tremendous opportunity for Israel to achieve leadership positions in completely new markets. Currently, there are approximately 450 companies in Israel focusing on smart transportation, in fields such as ride sharing, communication, sensors and monitoring. The acquisition of Mobileye by Intel in 2017 for \$15.3 billion, one of the largest exits in the auto industry this year, focused attention amongst global companies and investors on the great potential that lies in harnessing Israel's technological leadership in the autonomous vehicle revolution.

In order to accelerate the development of Israel's industry in the field of autonomous vehicles and smart transportation, it is crucial to develop infrastructure that will serve Israeli

companies in developing and commercializing technologies, and which will enable them to adopt innovative business models. For this, a physical and regulatory infrastructure should be established that answer the needs of this field, namely opening local transportation systems to innovation, so that Israel can serve as an initial market for local initiatives on their path to global growth.

The government this year launched a national program to promote smart transportation, intended to encourage the integration of advanced technologies in Israeli transportation systems, while accelerating the development of Israeli technology in this field, including establishing a dedicated test center and creating a supportive regulatory environment. The Israel Innovation Authority is playing an active role in this program.

In addition, in order to enable mass marketing of autonomous vehicles, an adapted regulatory environment must be developed. There are several locations today that have created supportive regulation for experimental stages of this industry, most notably California. But there is still no legal framework for the commercial activity of autonomous vehicles. Lawmakers (including Israel's Knesset) will need to draft guidelines regarding safety, manufacturing standards, licensing, insurance, traffic laws and more.

2) The innovation systems in Israel and South Korea complement one another, and therefore the potential for cooperation is very high. At the same time, South Korea is becoming a groundbreaking powerhouse of innovation, like Israel, and competition for global leadership is increasing.

South Korea has undergone, since its establishment as an independent country in 1948, a process of accelerated economic development, based on widespread investment in technological innovation. In this process, called "The Miracle on the Han River," South Korea transformed from a poor agricultural economy to one of the world's most developed and wealthiest economies. The country's per capita GDP increased from \$605 in 1970 to \$35,970 in 2016. The South Korean government has, over the years, acknowledged the importance of technological innovation to the country's development, and therefore continues to invest immense funds in research and development, especially in ICT. The percentage of South Korea's national expenditure on R&D with respect to GDP has doubled between 2000 and 2015, and the country is today second in the world after Israel in this index. The government's share in expenditures for R&D is especially high compared to other developed nations, standing at about 1% of GDP. Korea surpassed Israel to take first place in the Bloomberg Innovation Index for 2016.

South Korea's innovation is substantially different from Israel's innovation. The former focuses on the gradual growth of small-and medium-sized companies into large corporations, and in establishing a comprehensive, technologically advanced manufacturing chain. Israel, conversely, specializes in creating small startups based on a groundbreaking idea. The mega-

corporations of South Korea (such as Samsung and LG) have traditionally leaned toward generating technological projects with medium to low risk. Accordingly, they specialize mainly in establishing large production lines based on innovation for complex products, and less in developing innovative components or groundbreaking technologies.

Thanks to these relatively complementary advantages, Israeli-South-Korean cooperation in recent years has contributed to the growth of both economies. These reciprocal relations have developed with the support and encouragement of the governments of both countries, especially through the Koril-RDF – the Korea Israel Research and Development Fund – founded in 2001 after the two countries tightened relations. Until 2016, the fund helped more than 140 technologically innovative initiatives. These joint-initiatives, developed by Israeli and Korean companies, were granted a total of \$54 million. In addition, both Samsung and LG are very active in Israel through local R&D activity and investment in Israeli technology.

Over the past few years, South Korea aspires to transition from moderate innovation to groundbreaking innovation. A young generation of entrepreneurs is growing there, which aims at launching innovative startups, generating a growing demand for funding for independent innovation. In addition, the mega-corporations have been creating groundbreaking developments in a variety of fields. Thus, for example, Samsung is a technological pioneer in the field of 3D NAND flash memory, and Samsung and LG both are at the forefront of innovation in the field of OLED screens. Therefore, aside from the fruitful R&D cooperation between Israel and South-Korea and the synergy between their innovation systems – the latter is becoming a significant competitor in the global innovation arena.

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