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State Actions to Increase the Number of Employees in the High-Tech Industry

Abstract

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Background

Israel's advanced high-tech industry has earned it the status of "Start-Up Nation", and made it stand out in international comparison. This industry is a principal growth engine of the Israeli economy, contributing 12% to the State's gross domestic product (GDP).

Various international entities predict far-reaching changes in the labor market as a consequence of the rapid technological revolution the world is witnessing. The present trends are expected to create a demand of 20–50 million new positions worldwide in various technological professions, including —computer science and engineering. A chronic shortage of skilled employees in Israel's high-tech industry is a strategic threat to this sector, in particular, and to the Israeli economy, in general: in July 2019, there were an estimated 18,500 vacancies in the high-tech industry. The shortage is primarily of excelling university graduates from the fields of computer hardware and software engineering with professional experience.

In January 2017, the Israeli Government adopted a resolution to formulate the "National Program to Increase the Skilled Workforce for the High-Tech Industry", which intended to advance a solution for the shortage of skilled personnel in the high-tech industry. The Government resolution details the objectives to be achieved and the steps required in higher education, in non-academic training, and in the Ministry of Defense, including in the Israel Defense Forces (IDF), in integrating underrepresented populations and more.

Key facts

9.2%

The percentage of employees in the high-tech industry in Israel in 2019, out of the Israeli workforce (approx. 321,000 employees)

18,500

Estimated number of technological vacancies in the Israeli high-tech industry as of 2019

900 million NIS

The budget of the "National program to increase the skilled workforce for the high-tech industry"

17%

Of the students taking the 5-unit (highest level) mathematics matriculation exam do not have a computer science program in their school

40%

The rate of increase in the number of undergraduate university students majoring in academic high-tech subjects, in line with the target set in the Government resolution

22%

of students who began their University undergraduate studies majoring in computer science, did not complete their degree within 6 years.

Another 20% switched majors during their undergraduate studies.

4.9%

The percentage of ultra-Orthodox and Arab employees (women and men) in the high-tech industry in 2019, compared to 20% in the general workforce.

31%

The percentage of Jewish non-ultra-Orthodox women working in the high-tech sector in 2019, compared to 40% in the general workforce

Audit actions

From January 2019 to March 2020, the Office of the State Comptroller examined the actions taken by the Government to increase the number of employees in the high-tech industry, in accordance with Government resolutions and in view of the need to prepare the industry for future demand for employees. The audit examined the actions of the education system; the actions of the Council for Higher Education (CHE) to increase the number of students majoring in high-tech subjects; actions to integrate underrepresented populations in the high-tech sector; and IDF actions to leverage military service for the benefit of the high-tech industry. The audit was conducted in the Labor Branch of the Ministry of Labor, Social Affairs and Social Services (Ministry of Labor), the Ministry of Education, the National Economic Council, the IDF and the Ministry of Defense, the Ministry of Finance, the CHE and the Israel Innovation Authority. Supplementary audits were conducted in some universities and colleges.

Key findings

- **The education system as the infrastructure for increasing the number of high-tech employees:** The majority of students taking the five-unit matriculation exams in scientific–technological subjects—areas that are highly relevant for academic studies in high-tech subjects and for employment in the high-tech industry—studied in schools which are 'strong' in socioeconomic terms. For example, more than half of the students taking the five-unit mathematics and computer science exams (53% and 55%, respectively) studied in stronger schools, whereas, only 8% of them (in each subject) studied in weaker schools. The education system is not fulfilling the potential of those students who are capable of studying scientific–technological subjects—especially among girls, and students from the Arab and the Jewish ultra-Orthodox populations.

- **Schools teaching mathematics and computer science:** Only about 40% of the weakest schools (those lowest on the Ministry of Education's school nurture index[1]) offer their students the opportunity to study at the five-unit level both in mathematics and in computer science. In contrast, among the "strong" schools (in socioeconomic terms), the percentage of schools offering both these subjects at the five-unit level is the highest. For example, 88% of the strongest schools (those ranked highest on the school nurture index) that teach five-unit level of mathematics also teach five-unit level of computer science. This situation paves the way to academic studies in high-tech subjects mostly for students from "strong" schools. In general, approximately 3,000 students taking five-unit mathematics in school have no opportunity to study computer science in school, mainly due to a shortage of teachers.

- **Increasing the number of university graduates in high-tech subjects:** The main barriers hindering an increase in the number of university graduates in high-tech subjects are a shortage of academic staff and high dropout rates of students from these subjects. Nonetheless, the Planning and Budgeting Committee (PBC) in the CHE has not set objectives for increasing the number of academic staff and reducing the dropout rates. The PBC has also not requested the universities to examine the reasons for student dropout.

- **Leveraging military service to increase the number of trained personnel for the high-tech industry:** The Ministry of Defense has not formulated an operative program for leveraging the military service in the IDF to increase the number

1 The Ministry of Education ranks every school according to a performance index, based on the demographic and socioeconomic background of its students. The index includes the following parameters: level of education of the most educated parent in the family (40%); per capita income level in the family (20%); periphery-level of the school (20%); status as immigrant, specifically from developing countries (20%). The performance index determined for each school is used to establish the differential allocation of resources for the school, with the objective of improving the economic support to those schools that require more nurturing compared to other schools.

of trained personnel for the high-tech industry, as required by the Government resolution in this matter.

- **Integrating women into the high-tech industry:** In 2019, the share of women in the high-tech industry working in technological positions was about 22%, and in technological management positions—18%. The government programs for integration of women into the high-tech industry lacks comprehensive planning.

- **Integrating the Jewish ultra-Orthodox into the high-tech industry:** The head of the Labor Branch has not formulated a methodological program for increasing the number of employees from the ultra-Orthodox population in the high-tech industry. The majority of Government activity in this regard does not focus on the core professions in the industry, but rather trains for junior technological positions. No suitable program has been developed for the approx. 1,900 ultra-Orthodox women studying practical software engineering in seminaries, even though some of them clearly have the potential to study high-tech subjects at a higher level and later work as software developers in the high-tech industry.

- **Non-academic training:** There is no mechanism in place to coordinate the operation of the two main Governmental entities responsible for non-academic training for the high-tech industry—the Israel Innovation Authority and the Labor Branch. The two operate without defining the scope of responsibility and authority of each of them.

- **Monitoring the implementation of the Government resolution regarding the high-tech industry:** The ministerial committee for skilled personnel in the high-tech industry, established according to the Government resolution in this matter, has not convened. The professional team responsible for this matter has met twice. Consequently, tasks included in the resolution were not advanced.

The Initiative of the Ministry of Education to increase the number of students taking the five-unit exams in technological and scientific subjects ("Double the 5's"): The initiative succeeded in doubling the number of students matriculating in five-unit mathematics—from 9,000 in 2013 to 18,000 in 2018. An increase was noted also in the number of students taking the five-unit exams in technological and scientific subjects such as physics, chemistry, biology, computer science and system design and programming.

The number of undergraduate students majoring in high-tech subjects: The higher education system has met the target established by the Government, and as early as the academic year 2018/2019, the number of university students majoring in high-tech subjects, increased by 40%, compared to academic year 2015/2016.

Key recommendations

- **The education system as the infrastructure for increasing the number of high-tech employees:** It is recommended that the Ministry of Education formulate a program for removing the barriers hindering the increase of the number of students studying scientific–technological subjects in upper secondary schools and act to fulfill the potential of all students, and specifically those taking the five-unit mathematics exams. It is recommended that a special emphasis be placed on increasing the number of girls studying scientific–technological subjects as well as students from the Jewish ultra-Orthodox and Arab populations.

- **Addressing the shortage of teachers for computer science:** It is recommended that the Ministry of Education examine additional ways to increase the number of teachers for computer science, including the option of formulating training programs and programs for encouraging teachers to teach computer science in communities belonging to low socioeconomic clusters; consider adding computer science as one of the subjects in the "Virtual high schools[2]"; consider establishing centers for computer science studies accessible to students from geographic areas characterized with small settlements; and try to integrate in the school teaching staff appropriate instructors from programs operating outside of the schools. These actions may place the foundations for more of the future generation to study computer science, with an emphasis on schools with students from weaker populations.

- **Increasing the number of university graduates in high-tech subjects:** It is recommended that the CHE and PBC in cooperation with the Ministry of Finance and the heads of academic institutions prepare a systematic program to advance a long-term solution—which will enable optimal handling of the shortage of academic staff in high-tech subjects and will include objectives to increase the number of staff. It is also recommended that they systematically analyze the dropout reasons and the characteristics of students who drop out, establish yearly goals for reducing the numbers of dropouts, and provide tools and solutions for achieving these goals.

- **Leveraging military service to increase the number of trained personnel for the high-tech industry:** It is recommended that the Ministry of Defense, in cooperation with relevant entities, formulate a program for this objective, which will include details of all the entities responsible for every task, will examine ways to remove the barriers to its implementation, will present a timeline for implementation and will detail its budget requirements as well as the funding sources.

- **Integrating women into the high-tech industry:** It is recommended to advance a comprehensive program that will propose a range of solutions for removing the barriers to integration of women in the high-tech industry, according to their life stages and professional development. The program should start with solutions

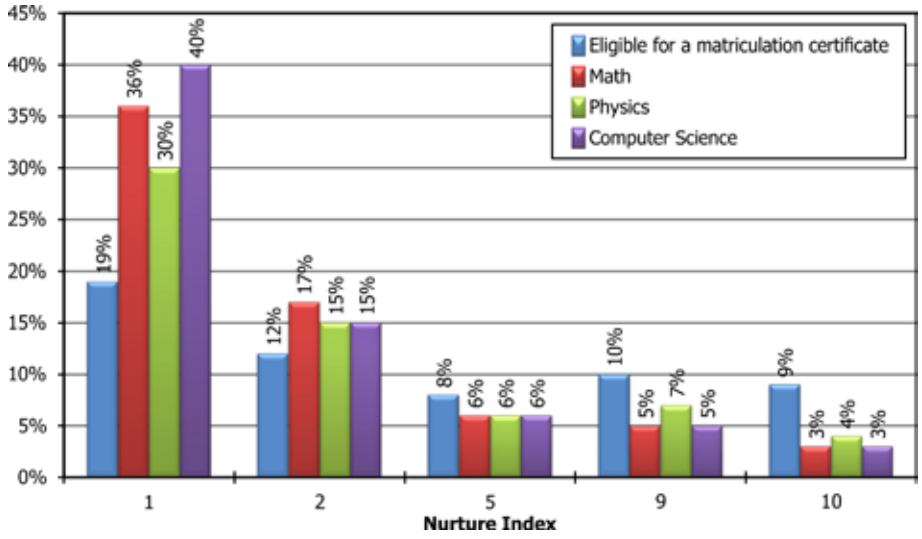
2 The "Virtual High-School" allows students from high-schools across Israel to study online such subjects as mathematics and physics at the five-unit level.

for the education system, through to the military service, academia, and finally - employment in the high-tech industry.

- **Integrating the Jewish ultra-Orthodox into the high-tech industry:** It is recommended that the head of the Labor Branch open additional channels, aside from academic high-tech education, to integrate the ultra-Orthodox into the high-tech industry. For example, retraining ultra-Orthodox university graduates from other study fields, could be considered. It is suggested that the formulation of plans will be done in consultation with relevant representatives from the ultra-Orthodox population, as well as other relevant entities including the Ministry of Education, the IDF and the National Civil Service, the CHE, the Israel Innovation Authority and actors from the high-tech industry. It is further recommended that the Government Institute for Technology and Science Training and the Ministry of Education examine ways to fulfill the potential of ultra-Orthodox female students and, including ways to broaden and upgrade the curricula in relevant high-tech subjects.

- **Non-academic training:** It is recommended that Israel Innovation Authority and the head of the Labor Branch establish a mechanism for coordination between them and define their respective areas of responsibility in order to efficiently utilize the resources available and achieve maximum outputs. It is further recommended to consider establishing a joint internet website, containing comprehensive information regarding all the non-academic training options for various populations.

The distribution of the share of students taking five-unit exams in mathematics, physics and computer science out of all the students taking those exams, and of the share eligible for a matriculation certificate, by their school's performance on the nurture index (1 – the strongest population; 10 – the weakest population), 2018.



Summary

In order to ensure the continued status of Israel as a "Start-Up Nation", the relevant Government entities (CHE, Ministry of Finance, Ministry of Education, Ministry of Labor, Welfare and Social Services, Israel Innovation Authority, Ministry of Defense) should undertake to remove the barriers blocking this objective: address the existing shortage of skilled personnel in the high-tech industry and ensure a long-term solution for suitable personnel; a special and crucial emphasis must be placed on involving the Ministry of Education fully in this task; an additional source for broadening the potential high-tech workforce lies in integrating populations that are at present only slightly represented in the industry, and practically excluded from it—first and foremost, women, but also the Arab and Jewish ultra-Orthodox populations. A further challenge that emerged from the audit is addressing the shortage of academic staff and reducing the dropout rate of university students from high-tech subjects - this is essential in guaranteeing the next high-tech generation.