

SCIENCE & TECHNOLOGY

When Israel declared independence in 1948, its small population was immediately forced to deal with very real existential threats from the neighboring Arab nations as well as figure out ways to absorb hundreds of thousands of refugees fleeing persecution in other areas of the world. Given the country's struggle for survival and the urgency of providing for the most basic needs of a population which tripled itself in a decade, it was hard to imagine that Israel would make significant progress in economics or technology.

And yet, now more than 60 years after its establishment, Israel has become an economic and technological powerhouse.

Much of the progress is due to innovative abilities in the applied sciences and technology. As a country almost bereft of natural resources, special emphasis was placed on the need for advanced education and scientific research. In fact, the combination of the educational and scientific infrastructure with the country's most pressing problems unexpectedly made for a creative synthesis which set development into motion.

Education and Technology

[Israel](#) today boasts seven top-level institutions of higher education including one of the world's most highly respected institutes of technology.

An emphasis on education was already a core principal for the Jewish community in [Pre-state Israel](#) and two of Israel's leading universities were founded before the establishment of the state: The [Technion-Israel Institute of Technology](#) was established in Haifa in 1924 and the [Hebrew University of Jerusalem](#) was founded the following year in 1925.

Israel ranks as having one of the world's highest percentages of citizens engaged in scientific and technological research and development in relation to its Gross Domestic Product (GDP). In 2010, approximately 200,000 first-degree students were enrolled in Israel's universities and colleges and nearly 32% of all these students specialized in engineering, medicine or the sciences. In addition, out of the nearly 14,000 students who graduated in 2010 with masters or other advanced degrees, 32% received diplomas in engineering, applied mathematics, sciences or medicine.

This education has created a large boost in employment in this fields as well. While education and business remain the most populated sectors of the Israeli workforce, the percentage of engineers, doctors and other such advanced fields has grown. In 2010, out of every 100 Israeli employees just over 15 people worked in these specialized fields, a percentage nearly double that of the [United States](#).

Research and Development in Industry

Israel has a chief scientist in the [Ministries of Agriculture](#), Communications, [Defense](#), National Infrastructure, [Health](#) and [Industry](#) to promote and encourage science-based high-tech industries. Each chief scientist acts as

an advisor to the minister on matters of industrial research and development, promotes cooperation with foreign countries, and provides financial aid to worthy research and development projects.

The Law for the Encouragement of Industrial Research and Development is aimed at developing science-based export-oriented industries, capable of creating employment and improving the country's balance of payments. The chief scientist of the Ministry of Industry and Trade is responsible for implementing this law, and provides [R&D](#) grants to industries seeking to export their products. If a project fails, the government's money is lost; if it succeeds, the entrepreneur pays back three percent of the grant yearly until the sum is repaid.

Israel has also signed [bilateral R&D cooperation agreements](#) with the [United States](#), [Canada](#), members of the European Union, [India](#) and [Singapore](#). The aim of the agreements is to encourage contacts between Israel and overseas companies to facilitate joint ventures in R&D, manufacturing and marketing. The establishment of joint ventures with foreign industrial firms has often utilized the strength of the Israeli firm in innovation and those of the foreign firm in large-scale production and market penetration. Joint ventures have been undertaken in areas such as electronics, software, medical equipment, printing and computerized graphics, with many actively assisted by these bi-national frameworks.

Another way Israel has excelled in R&D is through bilateral foundations set up between itself and the United States such as the [Binational Science Foundation](#) (BSF) and the [Binational Industrial Research and Development Fund](#) (BIRD). The foundations are able to bring together scientists, researchers and industrialists in both countries who use government grants and private seed money to develop new technologies and innovate new practices.

BIRD, for example, has funded more than 830 projects in total and more than 235 different projects since 2001 alone. The cumulative sales of products developed through BIRD projects have exceed \$8 billion and BIRD has received nearly \$100 million in royalty repayments from projects. BSF, meanwhile, has awarded some \$480 million to more than 4,140 research projects involving more than 2,000 scientists from more than 400 institutions located in 46 states. BSF has also documented no less than 75 new discoveries made possible by its research grants and counts 37 Nobel Prize and 19 Lasker Medical Award laureates among its joint partners.

Technological incubators were introduced in 1991 to encourage the development of innovative ideas by individual entrepreneurs, whose companies were too small or whose ideas were too risky to fit into the Ministry of Industry & Trade's regular research and development program. The establishment of the incubators coincided with mass immigration from the [Former Soviet Union](#), which brought an estimated 65,000 engineers to Israel, many of them experts in their field but lacking capital and experience with a free enterprise economy. Incubators assist entrepreneurs to complete their projects and turn them into commercially viable ventures. They provide assistance in recruiting R&D staff, perform marketing and feasibility studies, and provide physical facilities, professional and managerial guidance and assistance in recruiting investment capital.

Medicine & Biotechnology

Israel has made significant theoretical and practical contributions to the [biotechnology](#) revolution and has developed an advanced infrastructure of medical and paramedical research as well as bioengineering

capabilities. Clinical medicine and biomedical research account for over half of all scientific publications. The country's industrial sector has increased its activities in the medical field to capitalize on its extensive knowledge base.

Local scientists have developed methods for producing a human growth hormone and interferon, a group of proteins effective against viral infections. Genetic engineering, including cloning, has resulted in a wide spectrum of diagnostic kits based on monoclonal antibodies, along with other microbiological products.

Sophisticated medical equipment for both diagnostic and treatment purposes has been developed and marketed worldwide, such as computer tomography (CT) scanners, magnetic resonance imaging (MRI) systems, ultrasound scanners, nuclear medical cameras and surgical lasers.

Other innovations include a controlled-release liquid polymer to prevent accumulation of tooth plaque; a device to reduce both benign and malignant swellings of the prostate gland; the use of botulin to correct eye squint; and a miniature camera encased in a swallowable capsule used to diagnose gastrointestinal disease.

Energy & Optics

Extensive development of alternative [energy sources](#) such as [solar](#), thermal and wind energy has been a response to the country's lack of conventional energy sources. As a result, Israel is a leader in the solar energy field at every level and the world's largest per capita user of residential solar water heaters. Recently a new, high-efficiency receiver to collect concentrated sunlight has been developed that will enhance the use of solar energy in industry as well.

An advance in harnessing wind energy has been the production of a wind turbine with a flexible, inflatable rotor. Technology utilizing pond water with a certain degree of salinity and mineral composition to absorb and store solar energy has been developed. Geothermal power stations, capable of extracting heat from the ground and converting it to steam for powering turbines, are now being tested. A newly approved project, developed by a team of scientists at the Technion, uses dry air and water (even sea or brackish water) to produce energy through 1,000-meter high chimneys.

Optics, electro-optics and lasers have been growing rapidly as industrial fields. Israel is a world leader in fiber-optics, electro-optic inspection systems for printed circuit boards, thermal imaging night-vision systems and electro-optics-based robotic manufacturing systems.

