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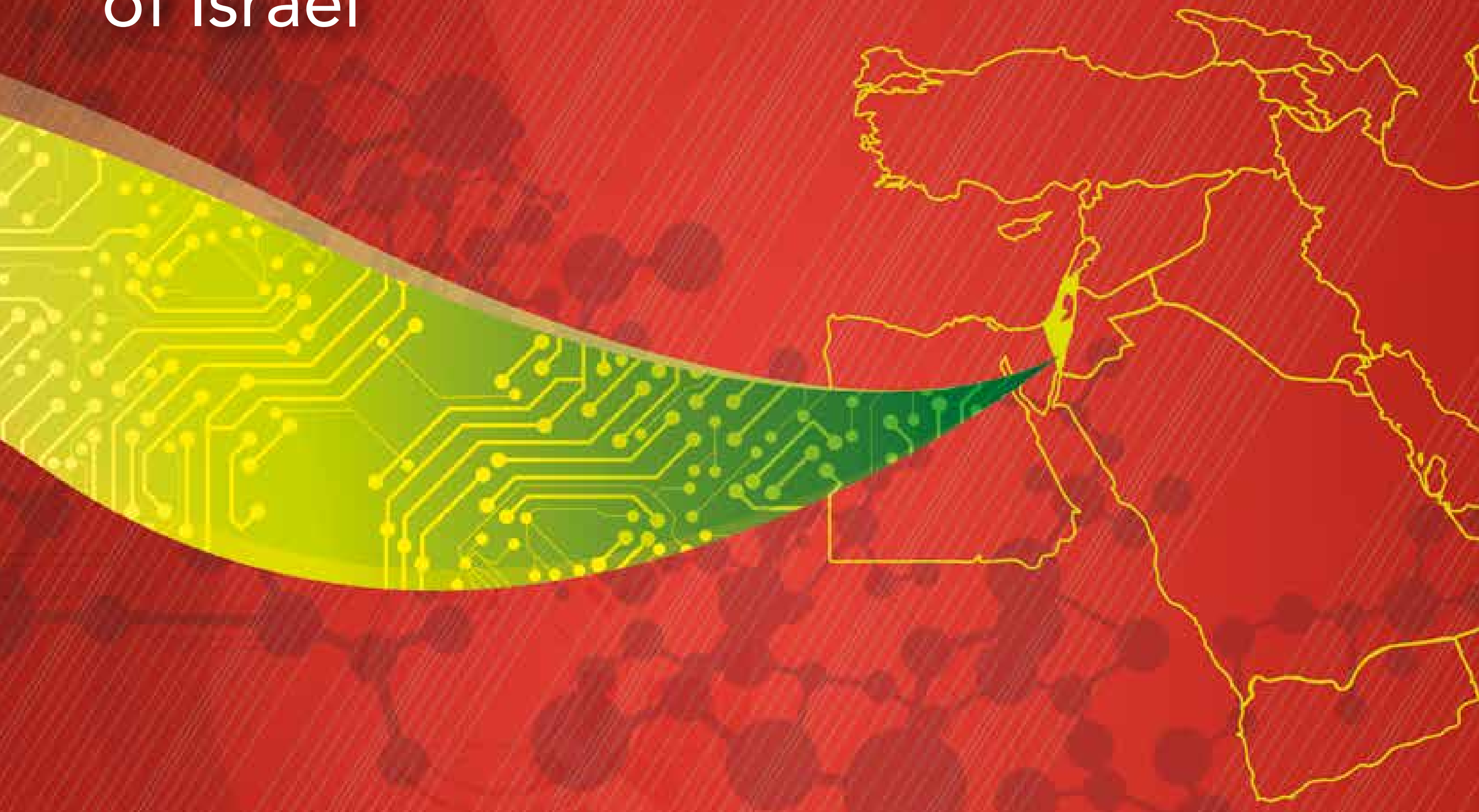
Mapping Research and Innovation in the State of Israel



GO→SPIN Country Profiles in Science, Technology and Innovation Policy
Volume 5

Mapping Research and Innovation in the State of Israel

GO→SPIN Country Profiles in Science, Technology and Innovation Policy

Volume 5

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THE ISRAEL ACADEMY OF SCIENCES AND HUMANITIES

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Samuel Neaman Institute
For Advanced Studies In Science And Technology

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Acronyms and Abbreviations

ARO	The Agricultural Research Organization – Volcani Institute
BARD	United States-Israel Agricultural R&D Fund
BSF	The US-Israel Binational Science Foundation
CBS	Central Bureau of Statistics
CHE	Council for Higher Education
EPO	European Patent Office
ERC	European Research Council
FDI	Foreign Direct Investment
FTE	Full-time equivalent
GDP	Gross Domestic Product
GIF	The German-Israeli Foundation for Scientific R&D
GO→SPIN	Global Observatory of Science, Technology and Innovation Policy Instruments (UNESCO)
HDI	Human Development Index (UNDP)
IAEC	Israel Atomic Energy Commission
ICT	Information and Communication Technology
IASH	Israel Academy of Sciences and Humanities
ILPO	Israel Patent Office
INNI	Israel National Nanotechnology Initiative
IP	Intellectual Property
IPR	Intellectual property rights
ISCED	International Standard Classification of Education
ISERD	Israel-Europe R&D Directorate for the Framework Programme
ISF	Israel Science Foundation
KNESSET	The Israeli Parliament
MAGNET	Generic pre-competitive R&D
MAFAT	Defence R&D Administration
MATIMOP	The Israel Industry Centre for R&D
MDG	Millennium Development Goals
ME	Ministry of Economy
MNC	Multinational Companies
MOST	Ministry of Science, Technology and Space
NCRD	National Council for Research and Development
NIS	New Israel Shekels
OCS	Office of Chief Scientist of the Ministry of Economy
OECD	Organisation for Economic Co-operation and Development
PBC	Planning and Budgeting Committee of the Council for Higher Education
PCT	Patent Cooperation Treaty

PPP	Purchasing Power Parity
SETI	Science, Engineering, Technology and Innovation
S&T	Science and Technology
SME	Small and Medium Enterprises
SNI	Samuel Neaman Institute
STI	Science, Technology and Innovation
TELEM	The Forum for National Research and Development Infrastructure
TFP	Total Factor Productivity
TTO	Technology Transfer Office
TVET	Technical and Vocational Education and Training
R&D	Research and Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UIS	UNESCO Institute for Statistics (Montreal)
USPTO	United States Patents and Trademark Office
VC	Venture Capital
WIPO	World Intellectual Property Organization

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Foreword by Irina Bokova

In September 2015, the world agreed on a new vision for human development and peace for the next 15 years, embodied in the *2030 Agenda for Sustainable Development*. The power of the sciences stands at the heart of this new vision, as an essential driver for progress across all of the new Sustainable Development Goals. This is why UNESCO is deeply committed to strengthen science, technology and innovation (STI) policy systems and governance strategies – to equip Member States with the knowledge and skills to address complex developmental challenges of unprecedented environmental change, resource depletion and social transformation.

In order to strengthen national frameworks, Governments need tools to map the landscape of STI in their countries. This is the importance of UNESCO's *Global Observatory of Science, Technology and Innovation Policy Instruments* (UNESCO GO→SPIN), to map STI policies, create inventories of STI policy instruments, STI legal frameworks and institutions, with the aim to improve policy-making, implementation and evaluation.

This Country Profile reviews different dimensions of STI policy in Israel from the late sixties to the present. The result of a strong collaboration between the *Samuel Neaman Institute for National Policy* and UNESCO, the *Israel Academy of Sciences and Humanities* played a key role in enabling the participation of the most important STI stakeholders in Israel. Their in-kind contribution, together with the support of Sweden, through the Swedish International Development Cooperation Agency, made this volume possible, for which I am deeply grateful. I am confident that this fifth volume in the UNESCO series of country profiles will provide Israel, and the global scientific community, with a vital tool as we strive to build more inclusive knowledge societies towards 2030.

Irina Bokova

Executive Summary

Mapping Research and Innovation in the State of Israel is the fifth of a series of country profiles prepared by UNESCO's Global Observatory of Science, Technology and Innovation Policy Instruments (GO→SPIN). The series is designed to expose – through the rigorous application of an assessment lens—usable insights about science, technology, engineering and innovation (SETI) policies and their context. The GO→SPIN programme is helping Member States to reform and upgrade national science systems and governance. It promotes building capacity to monitor and evaluate the policy performance, through a structural analysis (covering the explicit policy, the SETI national ecosystem, the legal framework and operational policy instruments), because such analysis points to implicit policies and gaps, and situates the performance of Israel's policy. In this way, the scope of standard SETI assessment can be widened, to take into account country-specific contexts, as well as emerging knowledge of technological advances that contribute to sustainable development. While complementing efforts to promote evidence-based SETI policy-making as well as efforts to evaluate policy performance, GO→SPIN offers a good baseline for the promotion of scientific and technological foresight studies.

The present country profile is the result of a very synergistic collaboration between the Samuel Neaman Institute (SNI) for National Policy Research (Technion-Israel Institute of Technology, Haifa) and UNESCO's Division of Science Policy and Capacity Building (Paris) at the invitation of the Israel Academy of Sciences and Humanities (IASH). IASH played a fundamental role enabling the participation of the most important SETI stakeholders in Israel and creating a very fruitful co-operation environment.

This country profile is an attempt to systematize the different dimensions of SETI policy in Israel from the late 1960s to present. It compiles statistical information as well as presenting inventories of the fundamental instruments in order to create a reliable framework for policy analysis.

The volume is organized so as to present the following items: (a) a long-term description of the political, economic, social, cultural and educational contextual factors; (b) a study of R&D and innovation indicators; (c) a long-term scientometric analysis of scientific publications, patents, trademarks and utility models; (d) a historical background to SETI policies in Israel, (e) a description of the SETI policy cycle; (f) a standard content analysis of the explicit SETI policies, (f) a complete analysis of the SETI organizational chart at five different levels (policy-making level; promotion level; research and innovation execution level; scientific and technological services level and evaluation level); (g) an inventory of all the SETI government bodies and organizations related to research and innovation activities and to science and technology services; (h) an inventory of the SETI legal framework, including acts, bills, regulations and international agreements; (i) a standard inventory with 18 different analytic dimensions of all the SETI operational policy instruments which are in operation and (j) an analysis of Strengths, Weaknesses, Opportunities and Threats (SWOT) of the country's research and innovation landscape.

Some key findings arising from this work of describing the Israeli SETI system are summarized below:

In the past two decades, the country succeeded in establishing a knowledge-intensive economy with high- and medium-tech products contributing significantly to the trade balance. Israel achieved top ranks in terms of Gross Expenditures on R&D, Business Expenditure on R&D, and venture capital as a percentage of GDP. It has the second highest concentration of high-tech companies in the world and is a major player in development and application of technology, cyber security, and innovative capacity. Israel is a world leader in research collaboration between the academia and industry. The close ties between academia, industry and government enable scientific innovation to be swiftly translated into marketable products and business initiatives. The MAGNETON programme promotes existing industry-science co-operation for a period of up to 2-years and the NOFAR programme aims to advance applied research in biotechnology and nanotechnology.

Israel is ranked second (after the USA) in terms of venture capital availability, thus ensuring a threshold condition required to foster entrepreneurship and innovation by small companies in all sectors. In this way, Israel's thriving start-up industry is complemented by a flourishing venture capital market, which attracted a total of US$ 2 346 million in 2013. Government insures 25% of the risk of Israeli institutional investors who join high-tech funds as limited partners.

The country has developed a series of strategic programmes to occupy technologically-specialised niches in the global economy. The Cyber-Security Initiative, promised US$ 50 million for 2012–2014 to strengthen human capital in the cyber security field by transferring military expertise to industry. Another area of expertise in knowledge-intensive industries is defence exports. The Government has been promoting the pharmaceutical and biotechnology industry with a relative success via the Office of the Chief Scientist's incentives. New areas have been identified, and specific policy instruments and funding allocations have already been established (i.e. Cleantech, nanotechnology and the Fuel Choices Initiative).

On the one hand, Israel's economy includes a relatively small, excellent high-tech sector, which serves as its engine. On the other hand, a much larger, less efficient traditional industry and services sector exists. The country's technology-driven growth was not sufficiently inclusive; poverty and inequality have risen. The dual economic structure results in a well-paid labour force living at the 'core' of the country, namely the Tel Aviv metropolitan area, and a poorly paid labour force living primarily on the periphery.

The gap between Israel and developed countries in labour productivity has widened substantially in the past decades. In Israel labour productivity – in GDP per hour worked in 2014 – was US$ 37.5, a small value compared with US$ 85.1 in Norway or US$ 67.2 in the USA. Moreover, in Israel, there is a large gap between labour productivity in the high technology versus the medium-high technology sectors, and trends show this is persistent. Traditional industry suffers from low productivity per employee and from a slow rate of improvement in productivity. Due to its considerable share in the national production and in employment, long-term economic growth cannot be attained without improving the productivity of traditional industry. The key to achieving this objective is to provide incentives to employers to implement innovations, including by assimilating advanced technologies, opening up to organizational and business model changes, and increasing exports as a share in output.

Israel is at the bottom of OECD countries (with a world rank of 53) on the *Ease of Doing Business Index*, showing the need for a significant improvement in various aspects of the regulatory framework for doing business. The business community identified 'inefficient government bureaucracy' as the major difficulty for promoting innovation and competitiveness.

Israel is facing challenges from water scarcity and security resource scarcity, climate change threats, the need for energy security and independence, as well as changing demographics. These drivers are becoming more and more important in their influence on everyday life. The Government approved in 2011 the proposal of the Minister of Environmental Protection and the Minister of Economy to prepare a national green growth strategy for the years 2012–2020. The decision defines green growth as 'socio-economic growth and development that does not harm the environment, makes efficient economic and sustainable use of natural resources, and creates jobs while maximizing opportunities for the use of clean growth engines.' In 2012, the shares of the Office of the Chief Scientist's grants to Cleantech were of only 5%. In order to achieve long-term sustainability goals, a plan to expand the public support for developing these green technologies is required.

The high investments made in primary, secondary and tertiary education during the first three decades of statehood were not maintained over the past decades. In particular, there is a trend of substantial decline in higher education investment. Data from recent years show that educational achievements in core curriculum subjects (mathematics and science) are low in comparison to OECD countries, e.g. PISA scores; they also show that public spending on primary education has fallen below the OECD average level. The worrying state of the Israeli education system also stems from the deteriorating quality of teachers (primary and secondary level) and college teachers, as well as from the lack of stringent demands from the students.

Israel has seven research universities. Common to all Israeli universities is their striving for excellence. This is reflected in the high impact of their scientific publications and citations, their high-ranking at global level, and the number of prestigious international awards for Israeli researchers including five Nobel Laurates in the past decade. Israeli academic researchers have a high rate of success in winning research grants, strong inventive performance in term of patents and the intense and rigorous activity of Technology Transfer Offices in the commercialization of IP. The Office of Chief Scientist's MAGNET programme has successfully supported knowledge transfer since 1994 through grants for new pre-competitive consortia. In the past five years, there was a rise of 30% within the budget of the Council for Higher Education. The Six-year Planning and Budgeting Committee Plan is increasing research budgets and retaining more researchers. The system is benefitting from the recent I-CORE programmes for centres of research excellence.

The number of articles by Israeli scientists listed in the Science Citation Index, Social Science Citation Index and Arts & Humanities Citation Index shows a linear-growth over the past five decades (R^2=0.99). At the same time, the number of articles per capita exhibits an asymptotic behaviour, reaching a saturation (R^2=0.97) at around 1570 articles per million inhabitants. Since the late 1960s, Israel long had the highest worldwide productivity in terms of articles per million inhabitants. This position was lost in 1994. In 2014, Israel occupied the 12th rank for countries with a population of over one million inhabitants. The number of articles per capita against the GDP per capita in constant US dollars also showed a saturation behaviour (R^2=0.94) at around 1570 articles per million inhabitants for a GDP per capita over US$ 20 000. Consequently, the yearly shares of Israel's articles relative to all articles worldwide have also been decreasing, by 30% over the past two decades. Moreover, while in the Republic of Korea and China the distribution pattern of scientific articles across major fields of science reveals that 80% of the publications fall in the natural sciences or engineering and technology fields, in Israel this share is only 60%. In the past two decades, the share of articles in the natural sciences fell by 5% while there was an increase of 5% in the social sciences field. This publication pattern is the result of the zero-growth policy in the number of full-time equivalent academic researchers, and the reductions that Higher Education Expenditures on R&D suffered in the past decade, from 0.69% in 2003 to 0.59% in 2013.

In 2012, Israeli inventors ranked 10th in the number of patents applications in the United States Patent and Trademark Office, of which patents most are owned by multinational companies which have research centres in Israel. The rate of transfer of Israeli intellectual property, know-how and technology to the possession of multinational companies has substantially increased in the past decade. In the period 2001-2011, foreign R&D centres in Israel filed at least 9 800 distinct patent applications around the world. In 2011, the inventive activity of foreign R&D centres in Israel constituted 27% of total number of distinct patent applications (as compared to 10% in 1990) and 61% of total foreign-owned distinct inventions attributed to the business sector (as compared to 24% in 1990). In the period 1990–2010, at least 1360 distinct inventions were transferred from the ownership of Israeli companies or start-ups to the possession of foreign R&D centres due to acquisitions or mergers. These inventions constituted approximately 13.5% out of the total patent portfolio of the R&D centres. The Israeli economy benefits from the activity of the multinationals' subsidiaries through job creation and other means. However, these advantages are relatively small compared to the potential economic gains that might have been achieved if this intellectual property been utilized to support and foster expansion of the R&D chain from start-ups and seed companies to mature Israeli-owned companies of a considerable size.

The regulations to address discrimination against women in recruitment or promotion to research positions and to foster equal gender representation in academic and research committees, boards and governing bodies are very weak, in terms of effectiveness. In the past 25 years, there was a drop in women's tertiary enrolment in physical sciences, mathematics & computer sciences and biological sciences disciplines. Moreover, the shares of women in the academic staff reach only 11% of the whole in physical sciences, 10% in mathematics and computer sciences, 14% in engineering and architecture, 27% in biological sciences, 34% in medical sciences, 36% in social sciences and 39% in humanities. The participation of women in scientific research is only 22%, one of the lowest in the world.

In terms of explicit SETI policies, the inventories of the SETI legal framework and operational policy instruments show a great diversity of mechanisms to offer maximum support to companies and research universities for promoting R&D and innovation activities in the country. This diversity is one of the most solid bases – in terms of policy design – that the country has in place for its SETI system. The core of Israel's SETI policy includes a list with 53 different operational policy instruments providing funding and other financial mechanisms for research and innovation activities at different stages.

However, Israel has neither formalized SETI policies by producing medium- and long-term plans, nor formalized any R&D master plan that lays out long-term strategies for the entire research and innovation ecosystem with strategic goals and quantitative targets. This gap dilutes the effectiveness of the present policies in the long-run.

Since the elimination of the Ministerial Committee for Science and Technology (MCST) in the late 1960s, there is no formal governmental structure for the co-ordination of the different SETI policies. There is a lack of any formal platform for all governmental stakeholders to work as a clearing-house of national SETI policies. In order to foster synergies and avoid duplication of efforts, a new holistic R&D framework involving the various actors of the SETI system—including the Office of the Chief Scientist; the Chief Scientists in the various government ministries; the Ministry of Science, Technology and Space; Israel's research universities; research centres of excellence; hospitals and academic medical centres; and corporate R&D laboratories—is required.

In 1991, the major sources of R&D financing were a combination of business enterprise and foreign sectors (50%), and the combination of government and higher education sectors (49%). In 2012, the shares were 84% and 12% respectively, meaning a substantial decrease in the public funding component. The foreign financing component alone has also been increasing over time, reaching 49% in 2012. In order to address the various weaknesses of the research and innovation system and to assert leadership in conducting and implementing new SETI policies, the participation of public funding should be increased to around 30%.

Israel has made international co-operation a policy priority. Competitive grants have been offered to support the internationalization of research and innovation and to encourage high-tech exports. International co-authorship increased from 35% to 47% in the past two decades and the percentage of GERD financed from abroad increased from 19% to 49% in the same period. Israel received almost US$ 800 million from the European Union Seventh Framework Programme of which almost two thirds went to universities, and the country has just arranged its participation in the European Union's Horizon 2020 research financing scheme. Israel's SETI ecosystem relies on foreign multinationals and large corporate R&D investors. The I-CORE programme – which began in 2011 – includes the establishment of 16 centres of excellence in Israeli universities to improve their competitive position globally and to promote networking and brain-gain by attracting back to the country senior researchers. MATIMOP (a governmental non-profit organization) promotes the development of advance technologies in Israel with the purpose of creating fruitful international partnerships through industrial co-operation and joint ventures.

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Mapping Research and Innovation in the State of Israel is the outcome of a collaboration process initiated by UNESCO and joined by the Samuel Neaman Institute for National Policy Research (SNI) at the recommendation of the Israel Academy of Sciences and Humanities (IASH). We would like to express our gratitude to the Israel Academy of Sciences and Humanities for their generous financial support for the draft's preparation and for the organization of the GO→SPIN validation workshop in Jerusalem on January 17, 2016. Our sincere thanks go to the Government of Sweden and the Swedish International Development Cooperation Agency (SIDA) for their financial support during the preparation and publication of this volume.

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Flavia Schlegel
Assistant Director-General for Natural Sciences
United Nations Educational, Scientific and Cultural Organization

The methodological framework for this series

GO→SPIN Country Profiles in Science, Technology and Innovation Policy is a series of reports published by UNESCO within its Global Observatory of Science, Technology and Innovation Policy Instruments (GO→SPIN). The GO→SPIN programme is run by UNESCO's Division of Science Policy and Capacity-Building.

The aim of this new series is to generate reliable, relevant information about the different landscapes of science, engineering, technology and innovation (SETI) policies around the world. The published information is based on replies to the GO→SPIN surveys, combined with government reports and statistical data from the UNESCO Institute for Statistics and other international sources.

Each country profile represents a comprehensive study of all the SETI policies, which include:

1. a long-term description of the political, economic, social, cultural and educational contextual factors;
2. a standard content analysis of the explicit SETI policies, including those research and innovation policies implemented in other sectors, such as the agricultural, energy, health, industrial and mining sectors;
3. a study of R&D and innovation indicators;
4. a long-term scientometric analysis of scientific publications, patents, trademarks and utility models;
5. a description of the SETI policy cycle;
6. a complete analysis of the SETI organizational chart at five different levels (policy-making level; promotion level; research and innovation execution level; scientific and technological services level and evaluation level);
7. an inventory of all the SETI government bodies and organizations related both to research and innovation and to science and technology services;
8. an inventory of the SETI legal framework, including acts, bills, regulations and international agreements on SETI issues;
9. a standard inventory with 18 different analytic dimensions of all the SETI operational policy instruments in place;
10. a SWOT analysis of the country's research and innovation landscape.

THE GO→SPIN APPROACH

The strategy of the GO→SPIN programme is four-fold:

- **Capacity-building:** training high-ranking national officials in the design, implementation and evaluation of a variety of SETI policy instruments at national and regional levels;
- **Standard-setter:** providing a standard practice for surveys on SETI policies and operational policy instruments through the *Paris Manual*[1]
- **Data collection:** worldwide distribution of the GO→SPIN surveys, prioritizing Africa, Arab States, Asia–Pacific and Latin American and the Caribbean.
- **GO→SPIN platform:** creation of an online, open access platform for decision-makers, knowledge-brokers, specialists and general public, with a complete set of various information on SETI policies.

The online platform will provide an innovative cluster of databases equipped with powerful graphic and analytical tools. The platform has been devized for political leaders, planners, directors and administrators of S&T in government, parliament, universities, research institutions, productive enterprises concerned with innovation, international organizations working for development; research personnel and specialists whose field of study embraces S&T policies.

1 The *Paris Manual* is being drafted by an international committee of experts put together by UNESCO in 2011. Once completed, the manual will define the ontological and epistemological bases of a common paradigm for evaluating STI policies and policy instruments worldwide.

The platform will also be a useful tool for the democratization of decision-making and public accountability of SETI policies.

The GO→SPIN survey and the information generated are primarily intended for the use of specialists and governmental bodies responsible for national SETI policies. It is their function to analyse the results of the survey and draw appropriate conclusions when they are required to prepare decisions by political bodies in the field of science, engineering, technology and innovation. The survey is also of interest to national bureaux of statistics and international organizations for promoting scientific and technological co-operation among their member states. Collectively, these users are:

- The national developing planning agencies, more particularly the government bodies responsible for formulating and co-ordinating national SETI policies and other national bodies involved in the application of science and technology (S&T) to sustainable development;
- Parliamentary groups especially concerned with STI policies;
- SETI information brokers, consulting groups and advisory bodies;
- Teaching and research departments engaged in SETI policy studies;
- The governing bodies of R&D institutes and S&T services;
- The boards of management of productive enterprises heavily reliant on R&D or engaged in the transfer of technology and innovation;
- International governmental and non-governmental organizations concerned with SETI and their application to sustainable development;
- Other more peripheral users, such as university departments of political science, economics and social sciences and national and international documentation and information services;
- The mass media.

At individual level, the main groupings are:

- **Decision-makers:** i.e. those responsible for national SETI policies and the management of R&D (ministries of R&D or S&T, directors of bodies responsible for formulating national S&T policies, directors of R&D institutes, heads of productive enterprises heavily reliant on R&D, etc.)
- **Intermediate users:** i.e. those who serve as the link between decision makers referred to above and researchers in S&T policy; their function is to prepare decisions by the former using theories and methods put forward by the latter, this category is made up of experts, consultants, advisers, liaison officers, the staff of ministerial offices and of parliamentary committees, etc., and they usually require rapid access to factual data.
- **Researchers in SETI policies:** i.e. those who develop the theories and methods on which S&T policy is based (researchers in the philosophy, history, sociology and economics of science, engineering and innovation, in the transfer of technology and in the management of R&D.
- **The general public:** by making SETI information more accessible, the GO→SPIN approach introduces a new dimension to the democratization of SETI.

THE METHODOLOGICAL FRAMEWORK

Science, engineering, technology and innovation (SETI) are becoming increasingly important for socio-economic and sustainable development. During the past 60 years, both developed and developing countries have recognized this fact by increasing the number of SETI government bodies, establishing new SETI legal frameworks and implementing a diverse set of new SETI policy instruments. This has driven investment in scientific research, technological development and innovation (STI), led to an increase in the number of scientists and engineers and fostered exponential growth in the number of new scientific articles and patents worldwide (UNESCO, 2010a).

The information economy is one of the key concepts invented to explain structural changes to the modern economy (Godin, 2008). The infrastructure to manage SETI information has been largely considered the core resource of national competitiveness in research and innovation (Neelameghan and Tocatlian, 1985). With the globalization of SETI information infrastructure has come a need to implement comprehensive strategies to connect, share and trade both domestic and foreign information at the national level (Lee and Kim, 2009).

The formulation of adequate SETI policies is critical to tackling contemporary challenges that include mitigating the consequences of global climate change; exploring new energy sources; generating innovation to foster social inclusion; promoting the sustainable management and conservation of freshwater, terrestrial resources and biodiversity; disaster resilience; and fostering the eradication of extreme poverty and hunger. These policies also need to be designed to achieve the UN Millennium Development Goals.

Over the past five decades, operational definitions have been elaborated within the framework of multilateral organizations to measure R&D and the broader concept of S&T. Statistical techniques have been developed to estimate private and public resources invested in these areas. For the former the OECD has laid down a methodological framework in the *Frascati Manual*, the sixth edition of which was published in 2002 (OECD, 2002). For the latter, the Member States of UNESCO have adopted the *Recommendations concerning the International Standardisation of Statistics on Science and Technology* (UNESCO, 1978; 1982; 1984a; 1984b). Methodologies for generating data about R&D investment and human resources have been constantly upgraded and extended.

During the first African Ministerial Conference on Science and Technology[2] (AMCOST I), in 2003, countries committed themselves to developing and adopting a common sets of STI indicators. The New Partnership for African Development (NEPAD) established the African Science, Technology and Innovation Indicators Initiative (ASTII) with the objective of building Africa's capacity to develop and use STI indicators. More specifically, NEPAD aims to: (a) develop and promote the adoption of internationally compatible STI indicators; (b) build human and institutional capacities for STI indicators and related surveys; (c) enable African countries to participate in international programmes on STI indicators; and (d) Inform African countries on the state of STI in Africa. The first *African Innovation Outlook* was published in 2011, while the second volume is being published in 2013. The methodology employed – that suggested by ASTII officials – follows the recommendations of the *Frascati Manual* for R&D indicators and the *Oslo Manual* (OECD, 2005) for innovation indicators.

In 2009, the UNESCO Institute for Statistics organized an Expert Meeting on Measuring R&D in Developing Countries, in Windhoek (Namibia). During the meeting, the experts identified the difficulties and challenges faced by the majority of developing countries, which were not explicitly addressed in the *Frascati Manual* (UNESCO Institute for Statistics, 2010; see Box A). The UNESCO Institute for Statistics is working towards a global standardization of STI statistics, including those items which are not taken into account in the *Frascati Manual*.

The availability of input and output R&D indicators alone does not suffice to evaluate SETI policies. Much more important than the particular value of one specific indicator at a given time is the long-term rate of change that long temporal series of indicators show (Lemarchand, 2010: 27–28). For that reason, long-term temporal series of indicators are necessary to analyse the impact of specific public policies. Improving the reliability of this analysis requires new ways of standardizing information about public policies and the policy instruments designed to implement them. Owing to the complexity of these issues, the 'science of science policy' has emerged in recent years as a new discipline where new analytic paradigms can be tested.

2 The final declaration of the AMCOST meeting in 2012 recommended co-ordination between the African Observatory on STI (AOSTI), ASTII and UNESCO's GO→SPIN. An agreement between UNESCO and AOSTI in February 2013 assigned AOSTI with responsability for following up GO→SPIN surveys with a group of West African countries.

BOX A – MEASURING R&D: CHALLENGES FACED BY DEVELOPING COUNTRIES

The methodology for measuring R&D is detailed in the *Frascati Manual* (OECD, 2002), which has been in use for more than 50 years. A revised edition is due out in 2015. Despite the manual's longevity, developing countries still face problems when trying to apply its standards to measuring the situation in their particular country.

The UNESO Institute for Statistics conducts a biennial data collection of R&D statistics and produces a methodology tailored to the needs of developing countries; it also holds training workshops and builds capacity through other means in developing countries.

In 2014, the UNESCO Institute for Statistics published a *Guide to Conducting an R&D Survey: for Countries starting to Measure R&D*. This guide presents the relevant R&D indicators, discusses the main issues facing each of the major sectors of performance, provides a simple project management template and proposes generic model questionnaires for the government, higher education, business and private non-profit sectors which countries can use and adapt to suit their needs.

In 2010, the UNESCO Institute for Statistics produced a technical paper on *Measuring R&D: Challenges faced by Developing Countries*. The OECD Working Party of National Experts on Science and Technology Indicators subsequently suggested that the paper serve as the basis for an annex to the *Frascati Manual: Proposed Standard Practice for Surveys of Research and Experimental Development (6th edition)*. This annex was adopted as an online adjunct to the *Frascati Manual* in March 2012 (OECD, 2012).

Measuring R&D: Challenges faced by Developing Countries provides guidance on a number of challenges that are relevant to developing countries and which may not be elaborated on clearly enough in the *Frascati Manual*. The following situations are addressed in the document, among others:

- Despite the increasing presence of developing countries in global R&D, there is still a marked lack of demand for science, technology and innovation (STI) indicators from policy-makers in developing countries. Even if the demand does exist, there are often significant problems with compiling the data due to a lack of co-ordination at the national level, a lack of co-operation by research institutions, universities and businesses, and a generally weak statistical system in the country.
- R&D used to be largely funded by the government but new sources of funds are emerging. Foundations, scientific associations, NGOs and particularly foreign organizations already play an important role. In addition, the contribution of private business is becoming more important and gaining more recognition in a wider range of developing countries. Many of these new sources of funding go directly to individuals and groups rather than to institutions and therefore remain unaccounted for, including for statistical purposes.
- Although the *Frascati Manual* recommends the collection of primary data through direct surveys, the use of secondary data from national budgets and budgetary records of public R&D performing units has been a widely adopted practice to obtain a rough estimate of gross expenditure on R&D (GERD). However, there is often a discrepancy between voted and allocated budgets. Furthermore, national research systems have a limited absorption capacity, which may leave funds unused in central accounts instead of being transferred to institutions performing R&D. Moreover, care needs to be taken to ensure that such transfers are not 'double counted' as expenditure of both the funding body and the institution performing R&D.
- The definitions used by finance ministries and other government institutions to establish S&T budgets may be *ad hoc* and fail to distinguish between broad S&T and narrower R&D activities. Furthermore, many institutions (universities in particular) do not compile a separate R&D budget, especially where research is a low institutional priority.
- R&D components in the national budget, especially capital expenditure, can be difficult to identify and may be aggregated under different headings. In addition, when R&D activities

stretch over more than one financial year, it may not be easy to estimate the amount of resources used each year. For example, work done to develop land and buildings used for research in a given year should be clearly earmarked and not recorded in subsequent years.

- A concentration of innovation activities by sector or in a small set of institutes may lead to volatility and inconsistencies in statistics. There is generally lower emphasis on R&D in the business sector, in part due to reduced competitive pressure in local markets.
- In the higher education sector, the increasing number of private universities makes it useful to distinguish between public and private higher education and to further break up private higher education into government-dependent and independent private institutions. Further disaggregation into private-for-profit and private-not-for-profit higher education institutions should also be considered to track where most research is carried out.
- Surveys that cover all R&D performers should in principle all report for the same period. This is difficult to achieve since, in many countries, higher education institutions and businesses do not necessarily report on the same period – the business sector's calendar tends to be the most problematic. Also, not all countries follow the same calendar. As a solution, the recommendation that R&D performers report on the financial year closest to the survey period may have to suffice.
- Information systems in government and higher education are often not set up to enable the extraction of data on R&D personnel and expenditure. Thus, accurate information on financial expenditure only becomes available a long time after completion of an activity. Unfortunately, ad hoc IT solutions to address these issues may also lead to errors and inconsistencies.
- The collection of data in full-time equivalents (FTE) for researchers provides useful information on the true volume of human resources devoted to R&D. This information is also essential for estimating R&D labour costs. Tallying the number of researchers in a given country presents further challenges. In some developing countries, salaried researchers may not have research budgets or unpaid researchers may undertake research. In other scenarios, academic staff may hold part-time contracts at more than one university. Even if academic staff have contracts that specify the amount of time to be spent on conducting research, it is difficult to enforce especially where there is a lack of resources. Estimating the time spent on research and hence the calculation of the FTE for research staff – particularly in the higher education sector – is fraught with difficulties. This directly impacts the calculation of R&D expenditure.

A number of special types of activity warrant attention when measuring R&D, as they are on the border of what is considered R&D. Three examples follow from the technical paper:

- In the case of traditional knowledge, it is important to set boundaries. Activities which establish an interface between traditional knowledge and R&D are considered R&D. However, the storage and communication of traditional knowledge in traditional ways is excluded.
- Clinical trials are an area of growth in some developing countries. Identifying research personnel in the extended clinical trials value chain may be difficult, as their involvement is occasional and harbours a risk of double counting (i.e. as personnel in the trial and as academic staff).
- Reverse engineering is important in many developing countries. However, this generally falls outside the scope of R&D. Only if reverse engineering is carried out within the framework of an R&D project to develop a new (and different) product, should it be considered R&D.

STI statistical systems are often weak in developing countries. To help strengthen these systems, the paper recommends that countries institutionalize R&D statistics, establish registers of R&D performers and document survey procedures and estimations.

Countries interested in embarking on R&D measurement are encouraged to contact the UNESCO Institute for Statistics.

Better ways of measuring evidence-based policies

SETI policy debates are not yet dominated by a thoughtful, evidence-based analysis of the likely merits of different investment options and policy decisions. The latter are strongly influenced by past practice or data trends that may be out of date (Husbands Fealing *et al.,* 2011). The evolution of new policies has been accompanied by more difficult challenges related to planning and evaluating these policies (see Box B); this indicates a need to improve the theoretical frameworks for policy formulation (Steinmueller, 2010).

Unfortunately, a number of factors prevent countries from reaching most of the objectives established by their own development plans: the lack of reliable information on SETI national potentialities; difficulties in coordinating the various SETI stakeholders; an absence of mechanisms for promoting a strong interaction between the *supply* and *demand* sectors in SETI, and; the absence of any explicit industrialization policy promoting endogenous innovation.

These difficulties mostly appear in small economies. For example, Flanagan *et al.* (2011) have explored the ways in which innovation policy studies treat actors, instruments, institutions and interactions, in order to arrive at a more useful conceptualization of the policy mix for innovation. They stress the need for a genuinely dynamic view of policy formulation and policy interaction. They conclude that 'despite the importance attached to "strategic policy intelligence" in recent innovation policy analysis, little empirical attention has been devoted to actual processes of policy learning.' In developing and exploiting technological opportunities, institutional competencies – namely, the governance of SETI decision-making bodies – are just as important as the SETI incentive instruments they promote (Pavitt, 1996). Path dependency emerges, as the cost of institutional changes to SETI is often higher than that of accommodating new instruments and policies in existing structures (Van der Meulen, 1998). For this reason, the design, analysis and monitoring of any national SETI policy will strongly depend on the adequate mapping of: the structure of the SETI governing bodies; the SETI national legal framework and; of the implicit and explicit operational SETI policy instruments which are implemented (Herrera, 1971; 1972; Sagasti and Aráoz, 1976).

BOX B – THE POLICY-MAKING CYCLE

A stylized presentation of the policy-making cycle typically involves five stages:

- *Agenda-setting*: refers to the process by which problems related to SETI and the linkages between SETI and both society and the economy come to the government's attention;
- *Policy formulation:* refers to the process by which SETI policy options are formulated by the government;
- *Decision-making:* refers to the process by which governments adopt a particular course of action or non-action;
- *Policy Implementation:* refers to the process by which governments put SETI policies into effect and;
- *Policy evaluation:* refers to the process by which the results of SETI policies are monitored by both the State and societal actors. The result may be a re-conceptualization of policy problems and solutions, in which the effectiveness, efficiency and continuing appropriateness of policies and policy instruments are assessed and the results fed back into another round of agenda-setting.

Responsible and accountable SETI governance entails developing capabilities at each of these five stages.

WHY TALK ABOUT SETI POLICIES?

The term 'science policy' was coined following publication in 1945 of Vannevar Bush's seminal article 'Science – the Endless Frontier', which laid the foundations for the first social contract for science. By 1950, UNESCO had initiated the first systematic studies on science policies in a dozen developed countries. Originally, this term referred to public policies related to scientific and technological research, experimental development, scientific and technological services and innovation. Science policy as a discipline evolved over the coming decades. Today, it is possible to distinguish specific operational policy instruments according to the different needs established by science policies, engineering policies, technology policies and innovation policies. As these four distinct types of public policy require different skills, major universities around the world have recently introduced specific postgraduate programmes targeting each of the four types of policy:

Science policy: relates to those policies needed to: promote scientific research, determine and select scientific objectives and goals consistent with national plans or strategies, exercise judgment in fixing norms to govern the ways and means by which science is developed, transferred and applied; gather, organize and deploy resources required to pursue the selective objectives and; monitor and evaluate the results obtained from applying the policy. The following are therefore among the most important questions dealt with by policy-makers in the field of science policy: (a) establishing and strengthening government structures and mechanisms for planning, budgeting, co-ordinating, managing and promoting scientific research; (b) gathering, processing and analysing basic data concerning the national scientific potential, including data on ongoing research, monitoring national scientific development and ensuring the smooth growth of the institutional infrastructure for scientific research; (c) maintaining a proper balance between the various types of research (fundamental, applied, experimental development), supporting the development of a creative national scientific community and setting standards for the status of scientific researchers in conformity with their responsibilities and rights; (d) optimizing human, financial, institutional and informational resources to achieve the objectives established by the national SETI policy; (e) assessing and promoting productivity, relevance, quality effectiveness of national research and scientific and technological services in various sectors of performance (higher education, government institutions, business enterprise, private non-profit) and removing organizational and managerial difficulties encountered in the execution of scientific research; (f) initiating appropriate legislative action in relation to the impact on the individual, society as a whole or the natural environment of the application of discoveries and inventions; evaluating the economic profitability and social utility (or harmful effects) of the said discoveries and inventions. Although the aforementioned list is not exhaustive, it indicates the key areas for which government policy-makers are primarily responsible. Each individual issue requires the design of a particular operational policy instrument.

Engineering policy: the role of engineers in public policy can be seen as a two-fold endeavour: (1) to help create public policy related to the utilization of technology to solve public problems as well as monitor and ensure compliance with such policies; and (2) to use engineering knowledge to assist in the construction of policy directives to help solve social problems. In many cases, the development and implementation of such regulations and laws requires both a technical understanding of the functioning of these artefacts and an understanding of how this technology interacts with social and natural systems and would benefit from the involvement of a technical expert. The issues addressed by engineering policies are vast and global in nature and include water conservation, energy, transportation, communication, food production, habitat protection, disaster risk reduction, technology assessment and the deterioration of infrastructure systems. These issues need to be addressed while respecting the rights and meeting the needs and desires of a growing world population [for a detailed list of issues and challenges addressed by engineering policies, see UNESCO (2010c).

Technology policy: the fundamental premise of technological policies is that it is possible for governments to implement public policies to improve social welfare by influencing the rate and direction of technological change. The conventional entry point for economic analysis is to identify the conditions needed for such influence to be superior to the outcome of ordinary market competition. These conditions, in turn, direct further examination of the feasibility and methods for such intervention, including the question of whether government intervention is necessary to improve social welfare. Succinctly stated, government intervention would be necessary if profit-seeking actors underperformed or performed poorly in producing or exchanging technological knowledge from the perspective of social welfare.

Innovation policy: innovation policy can be characterized in various ways, such as by distinguishing between 'supply-side' and 'demand-side' policy, or between 'mission-oriented' and 'diffusion oriented' policy. Policy instruments include financial instruments (e.g. R&D tax credits, export incentives, soft loans, etc.) and regulatory instruments such as laws and binding regulations (e.g. the use of safety equipment for children in cars). Innovation policy encompasses many types of innovation. Innovation may be characterized, *inter alia*, by: the type of innovation – technological (product and process) or non-technological (organizational and marketing); the mode of innovation – novel innovator (strategic and intermittent), technology modifier and technology adopters and; the socio-economic impact – incremental, disruptive or radical. The effectiveness of innovation policies requires a sufficiently stable framework, institutions and policies. Stability and predictability are particularly important for risky activities with a long time horizon such as R&D and innovation. Excessive instability may inhibit innovation by increasing uncertainty for innovators. It may lessen the effectiveness of policy instruments by weakening the incentives they provide. In addition, it reduces opportunities for learning and developing evidence-based policy practices. Whereas there are manifold sources of unwarranted discontinuities, political instability and fiscal problems − often related to policy cycles − are a common cause. In an increasingly complex innovation landscape, developing effective governance requires better co-ordination at, and among, the local, regional, national and international levels.

SETI projects normally occur within a larger temporal framework administered by an organization or a government policy-making body. The early stages of a new SETI policy usually appear as successive expansions of the group of agents and stakeholders whose endorsement is needed to launch the initiative, whereas the latter stages focus on programme management, with feedback as to its success or failure at the policy level (Marburger III, 2011). Consequently, in order to provide an accurate landscape of the SETI policies and policy instruments in a specific national context, it is imperative to understand the long-term evolution of the SETI organizational chart, SETI infrastructure and legal framework (i.e. explicit policies), as well as the type of funding mechanisms implemented. The latter dimensions must be contrasted with detailed analyses of the long-term behaviour of political, educational, economic, productive and social macrovariables (i.e. implicit policies).

It is impossible to describe the current status of SETI without accurate data. Moreover, these data should be presented in such a way as to allow decision-makers and experts to estimate whether the status of SETI meets societal needs or expectations. Policy-makers benefit from additional policy tools to assist them in deciding about budget allocations or in the design of new SETI policy instruments, especially if these are real-time tools or new innovative prospective methodologies. Recent empirical studies show the relevance and long-term impact of appropriate SETI information services on SETI policies designed to improve national competitiveness (Lee and Kim, 2009).

It is also important to note the availability of a large group of public and private databases. These can be most useful tools for evaluating the performance of the SETI policies and providing adequate technology intelligence studies. There are robust, accessible systems designed to make rapid analyses and apply mathematical models to identify critical points or levers triggered by policy changes that can directly affect the performance of innovation activities. For example, Zucker and Darby (2011) present a comprehensive survey of all available databases that may be used to analyse the impact of SETI policies (see Box C).

BOX C – USING MATHEMATICAL THEORY TO PROMOTE STRATEGIC NATIONAL INNOVATION

Recent developments in the mathematical theory of networks can be applied to formulating new SETI policies, in order to promote strategic innovation within national economies.

Hidalgo *et al.* (2007) found that 'economies grow by upgrading the products they produce and export. The technology, capital, institutions and skills needed to make newer products are more easily adapted from some products than from others. The study of this network of relatedness between products, or 'product space,' shows that more-sophisticated products are located in a densely connected core, whereas less sophisticated products occupy a less connected periphery. Empirically, countries move through the product space by developing goods close to those they currently produce. Most countries can reach the core only by traversing empirically infrequent distances, which may help to explain why poor countries have trouble developing more competitive exports and fail to converge to the income levels of rich countries.'

This type of analysis can be applied directly to formulating customized SETI policy instruments to foster the development of specific technologies, where the country has detected a potential new technological niche. The availability of access to new electronic international databases (Zucker and Darby, 2011), combined with the appropriate analytic software, might transform this type of analysis into a standard procedure for selecting national SETI priorities.

Access to appropriate, reliable data is also a prerequisite for responsible and accountable governance, which demands informed decision-making at the planning stage of SETI policy and foresight as to the possible short and long-term impact of policy decisions. Therefore, policy-makers not only need a clear picture of the national, regional and global situation. They also need to be able to estimate the impact of current SETI policies and plan on future policies. The analysis of any national or regional SETI policy strongly depends on the adequate mapping of the structure of SETI governing bodies, SETI national legal frameworks and the implicit and explicit operational SETI policy instruments. Gaps or blind spots in information can cause a specific field to be neglected, which can result in missed opportunities for socio-economic development.

POLICY INSTRUMENTS: LEVERS FOR IMPLEMENTING DECISIONS

A policy may remain a mere rhetorical statement if no means are provided for its implementation or to realize its potential effect. To do this, a number of things may be needed, which we will incorporate under the term of policy instrument. A policy instrument constitutes the set of ways and means used when putting a given policy into practice. It can be considered as the vehicle through which those in charge of formulating and implementing policies actualize their capability to influence decisions taken by others.

The study of public policy instruments in national settings has contributed significantly to the understanding of policy, political systems and relations between State and citizen. Research on policy implementation usually focuses principally on the effects of a specific instrument, within a wider reflection on whether the correct instrument has been chosen for the purpose. As far as new governance models is concerned, the search for suitable instruments is above all governed by pragmatism (Kassim and Le Gales, 2010).

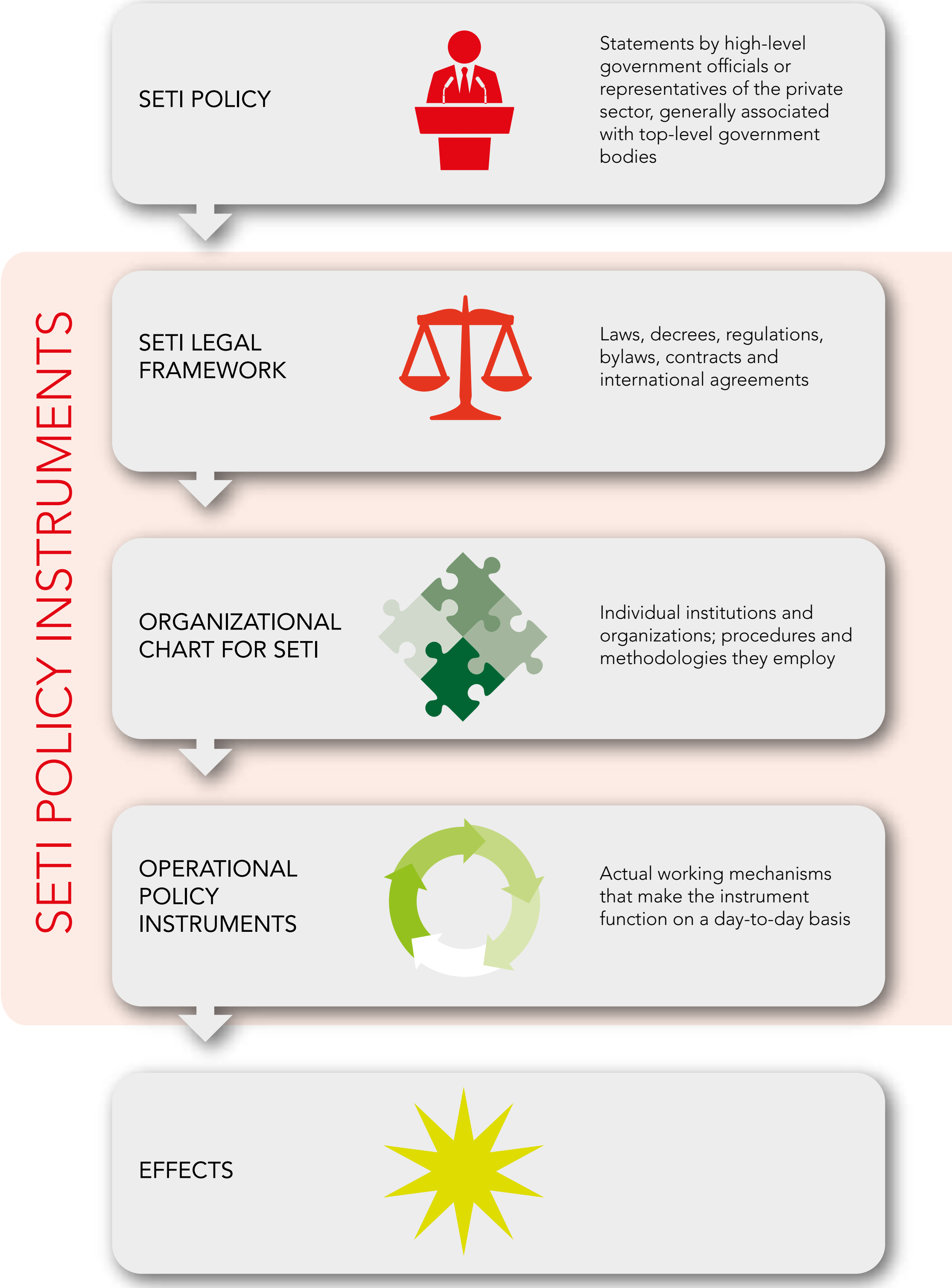


Figure A: Instruments for ensuring a policy obtains the desired effect. Adapted from Sagasti and Aráoz (1976)

SETI operational policy instruments are the levers by which the organizational structure ultimately implements the decisions on a day-to-day basis and attempts to produce the desired effect on the variables the policy has set out to influence. Throughout the analysis of an instrument's effectiveness, it is important to bear in mind the 'actors' or key decision-makers who are directly involved in the design and use of a policy instrument. An instrument does not act on its own accord. Rather, it responds to the will of the policy-makers and decision-makers using it.

A related concept can be found in the problem of *Ordnungspolitik* stressed by the German Freiburg School in the 1930s. Here, the focus was how to devise a framework or set of rules (*Ordnungsrahmen*) for an economy that would define the operating space for individual and private activities. The challenge for SETI policy instruments can be interpreted as a problem of transformation, namely the question of choosing the best policy instrument in order to reach the set target.

A policy instrument attempts to make individuals and institutions take decisions following the rationality dictated by the collective objectives established by those in power. It is the connecting link between the purpose expressed in a policy and the effect that is sought in practice. An SETI policy instrument includes, as a significant component, the manipulation of SETI variables.

One of the first and more relevant studies on SETI policy instruments was conducted in the 1970s by the International Development Research Centre. The principal objective of the study was to devise ways and means of understanding how a country's investment in S&T could be most effectively related to its objectives for industrial development. Sagasti and Aráoz (1976) developed an interesting methodological framework for making a survey and analysing the policy instruments of ten countries in Latin America, the Middle East, Southern Europe and Asia.

UNESCO's Global Observatory of Science, Technology and Innovation Policy Instruments[3] (GO→SPIN) has adapted and expanded the theoretical framework of Sagasti and Aráoz (1976), in order to implement a systematic survey in Africa, Arab States, Asia and the Pacific and in Latin America and the Caribbean. The information in the present country profile has been organized according to this methodological approach. Figure A presents the basic analytical units around which the present report is organized.

All national SETI policies, be they *implicit* or *explicit* (Herrera, 1971; 1972), attempt to harness a country's creative potential to its socio-economic, environmental and cultural objectives. An *explicit* SETI policy is a statement by a high-level government official or institution, such as a ministry or the planning secretariat, that deals with activities related to STI. The policy expresses a purpose (effects according to SETI variables) and may set objectives, define desired outcomes and establish quantitative goals. Policies also contain criteria for choosing from among several alternatives to guide decision-makers as to how SETI works. SETI policies might also be formulated by representatives of the private sector. A number of factors impinge on the efficiency of SETI governance, namely, the extent to which policy processes have the greatest effect with a given use of resources. It must be acknowledged that overall efficiency is not easily defined and measured in a multi-objective, multi-actor world.

3 See URL: http://www.unesco.org/new/en/natural-sciences/science-technology/sti-policy/global-observatory-of-policy-instruments/

THE KEY ROLE OF THE SETI ORGANIZATIONAL STRUCTURE IN POLICY IMPLEMENTATION

The SETI organizational structure or chart usually shows the distribution of responsibility for implementing a given policy. Under the term 'organizational structure,' it is possible to distinguish at least five different levels: (1) policy planning level (policy design); (2) promotional level (i.e. funding and co-ordination of R&D, innovation and scientific and technological services); (3) implementation level (execution of R&D and innovation); (4) scientific and technological services and; (5) assessment or evaluation level.

1. *Policy planning level*: includes policy planning, budgeting, decision-making, interministerial co-ordination. The responsibility for the formulation of SETI policies generally rests with a special government department, ministry or statutory body, in some cases assisted by national councils of research and innovation. SETI policy formulation normally includes the preparation of the national development plan or strategy relating to SETI; it also includes the annual preparation of the functional state budget for SETI activities (mainly research, innovation and scientific and technological services). The decision-making function usually falls to the government, or to a committee of ministers more specifically concerned with SETI; it mainly involves the approval of the national SETI plan (or strategy), as well as the assignment of funding mechanisms. The interministerial co-ordination takes place during the formulation of policies and preparation of plans and budgets then at the various stages of the implementation of these policy documents, once approved by the government.
2. *Promotional level*: the promotion, financing and co-ordination of research, innovation and scientific and technological services in the various sectors of the economy and in society. The functions performed at this level begin with the policy decisions taken by the government and continue with the various government departments or ministries through traditional budgetary procedures along administrative budget lines or through programme budget procedures, as applied to the so-called management by objectives. Several funding mechanisms and SETI operational policy instruments of various kinds have been implemented over the years (i.e. research funds, innovation funds, sectoral funds, tax-incentives; competitive grants, scholarships, etc.). Most countries apply a combination of operational policy instruments to handle the financing of research, innovation and scientific and technological services according to well-defined programmes. The latter can be achieved either by responding to requests for the funding of specific projects submitted by external institutions, laboratories, research units, individual research scientists and high-tech enterprises, or by providing incentives for innovation, or by selectively entrusting the external bodies mentioned above with the execution of specific projects called for by certain development objectives according to the national SETI plan or strategy (normative method). At this particular level, several countries have special institutions (i.e. national research councils) which promote the advancement of scientific research and technological development with a view to improving the quantity and quality of new scientific knowledge to expand the country's potentialities, particularly through support for post-graduate education and research at universities and polytechnics.
3. *Implementation level*: this operational level concerns the actual performance of scientific research, technological development and innovation.
4. *Scientific and technological services (STS) level*: this represents a mixed group, including the institutions in charge of: (a) SETI information and documentation, (b) museums of science and technology, botanical and zoological parks and other SETI collections (anthropological, archaeological, geological, etc.), (c) general purpose data collections: all the activities comprising the routine systematic collection of data in all fields of SETI, such as topographical, geological and hydrological surveys, routine astronomical, meteorological and seismological observations, surveying of soils and plants, fish and wildlife resources, atmosphere and water testing, monitoring of radioactivity, UV and CO_2 levels, prospecting and related activities designed to locate and identify oil and mineral resources, gathering of information on human, social, economic and cultural phenomena, usually for the purpose of compiling routine statistics; testing, standardization, metrology and quality control, activities related to patents and licenses, as well as the production of scientific publications.

5. *Assessment or evaluation level*: this consists in government sectors and institutions monitoring the implementation of policy goals and measuring the societal impact of those policies. Their function also encompasses the conduct of an ongoing survey of a country's SETI potential at the level of research, innovation and scientific and technological service units, including ongoing research results and their practical application.

The GO→SPIN methodological approach introduced a normalized way of encoding the different types of organization and their functions. By representing each national SETI organizational chart and by using the same set of coding tools (Lemarchand, 2010: 310), it will be possible in future to associate these charts and tools with specific topological metrics to identify patterns in performance. The latter will be very useful for defining a new set of SETI policy indicators able to reveal the level of complexity and functionality of each STI organizational chart. Table A shows examples of how different countries structure SETI policy design.

Since its purpose is to guide decisions about the future that must be taken now, a SETI watch cannot seek to identify future developments in S&T independently of past and current developments, or independently of the material and human resources devoted to research and innovation. The prerequisites for any future is: knowledge of the present, knowledge of the current trends observed in a real world composed of different nations and institutions, and knowledge of the strength and weaknesses of the national SETI system in which the decisions informed by the GO→SPIN survey's methodological approach have to be taken.

Table A: Models of governing bodies heading SETI policy design

Argentina	Scientific and Technological Cabinet (GACTEC) Ministry of Science, Technology and Productive Innovation
Australia	Prime Minister's Science Engineering and Innovation Council Commonwealth State and Territory Advisory Council on Innovation Co- ordination Committee on Innovation
Chile	Inter-ministerial Committee for Innovation National Corporation for the Promotion of Production (Ministry of Economy) National Commission for Scientific and Technological Research (Ministry of Education)
Croatia	Ministry of Science, Education and Sports National Council for Science National Council for Higher Education
Czech Republic	Ministry of Industry and Trade Council for Research, Development and Innovation Ministry of Education, Youth and Sports
Finland	Research and Innovation Council Ministry of Employment and the Economy Ministry of Education and Culture
Ireland	Inter-Departmental Committee on STI Department of Jobs, Enterprise and Innovation
Malaysia	Ministry of International Trade and Industry Ministry of Science, Technology and Innovation Economic Planning Unit
Republic of Korea	National Science and Technology Council Ministry of Science and Technology
Singapore	Economic Development Board Research, Innovation and Enterprise Council National Research Foundation
South Africa	Department of Science and Technology Department of Trade and Industry Department of Higher Education and Training

Source: UNESCO

The diversity of institutions at the promotion level (funding) in a given country seems to be one of the most fundamental indicators of good practices. The GO→SPIN global database will provide empirical evidence to confirm or refute this and other hypotheses.

The so-called *legal framework* can also be considered as a set of legal instruments. This embodies the policy, or parts thereof, in the form of a law, decree or regulation. Formal agreements, contracts and international STI co-operation treaties may also be included in this category. A legal instrument goes one step beyond a policy by stipulating obligations, rights, rewards and penalties. The GO→SPIN systemic approach has developed a friendly platform offering direct access to the entire SETI legal framework, description and the full text of laws, acts, decrees and agreements adopted by each country. Table B shows different examples of the most important types of legal instrument.

Table B: Examples of SETI legal instruments

A law for the creation of national research labs, universities, national research councils, ministry of S&T, R&D Funds, etc., or a legal framework to regulate the organization of the national innovation system.
A law to regulate the imports/exports of high-tech products.
A law to regulate tax incentives to promote innovation within the private sector.
A law to regulate foreign direct investments promoting the establishment of new high-tech enterprises.
A law to regulate the protection of the national biodiversity and to establish norms on how foreign companies exploit the active substances available within each national territory (new rules for the protection of indigenous knowledge).
Laws to foster R&D activities within the private sector and the creation of technological funds associated with the most strategic sectors of the economy (energy, mining, agriculture, industry, communication, fishing, tourism, etc.).
National regulations and decrees to establish new national policies, creation of new funding mechanisms, import/export tariffs, etc.
Bilateral, regional and international agreements on SETI activities.
Contracts on technology transfer.

Source: UNESCO

GO→SPIN also includes a complete description of SETI operational policy instruments; these are the levers, or actual means, through which the organizational structure ultimately implements the decisions on a day to day basis and attempts to influence the behaviour of the various stakeholders targeted by the policy. Throughout the analysis of an instrument, it is important to keep in mind the actors or key decision-makers who are directly involved in the design and use of a policy instrument. An instrument does not act on its own accord. Rather, it responds to the will of the policy-makers and decision-makers using it. Table C shows different types of operational policy instrument, whereas Figure B shows various instruments that can be employed to effect at the different stages leading to market penetration of an innovation. Table D presents the taxonomic classification of SETI operational policy instruments employed by GO→SPIN according to its methodological approach, by objective and goal; the type of mechanism/mode of support and target groups/beneficiaries. By analysing the aggregated information for groups of countries employing these classification schemes, it is possible to detect development patterns.

Table C: Examples of operational SETI policy instruments

Programmes and objectives	Policy instrument	Strategic objectives	Beneficiaries	Mechanisms for allocating funding
Scientific research and technological development	Competitive grants	Promote the endogenous production of new scientific knowledge in the exact and natural sciences. Promote regional networking.	Research groups at national universities and national research centres associated with similar research groups from other countries in the region, within formal partnership agreements	Competitive grants selected on a peer review basis; national research groups must be associated with similar groups from countries in the region which provide matching funding
Promotion of science education	Public subsidies for projects establishing science laboratories at public secondary schools	Improve scientific knowledge; methodological approach and critical thinking for secondary school pupils	Public secondary schools in less developed parts of the country	Public subsidies to mount new science cabinets and laboratories and new posts for science professors
Promotion of gender equality in research and innovation	Scholarships	Promote the participation of women in high-tech research and innovation	Young women enrolled in a PhD programme in basic and engineering sciences	Scholarships of up to four years and small grants for participation in international conferences
Protection of indigenous knowledge	Intellectual property rights, public law–national legislation and public subsidies	Protection of traditional knowledge to confer exclusive ownership and rights on local communities when the object of protection is a product or domesticated animal, cultivated plant or any micro-organism, or a design or an object of a functional or aesthetic nature, including any element of handicrafts, the act prohibits third parties from making, using, stocking, offering for sale, selling, commercializing, importing, exporting or identifying the active substances for commercialization, without consent	A local traditional practitioner, a local community or its representative may apply to register traditional knowledge	Public subsidies and tax exemptions to defend the Intellectual property rights of holders of indigenous and traditional knowledge
Attraction and reinvestment of foreign direct investment	Public financing Tax incentives	Strategies vary from country to country, examples being: (a) an Industrial policy based on attracting export-oriented industries; (b) promotion of structural change; (c) capacity-building to improve competitiveness, focusing on sectors or market niches; (d) internationalization of enterprises, and promotion of innovation; (e) prioritizing the generation of higher-tech goods and services (f) attracting selective FDI oriented towards ICTs, biotechnology, nanotechnology and financial services; (g) improving the business climate by refining legislation and simplifying formalities to facilitate corporate operations.	National Infrastructure (buildings, technology corridors, technological cities) and training of labour and professionals for the industry in question SMEs with export capacity	Soft-loans, tax incentives, grants For specific periods: tax discounts, exemptions, preferential rates, rebates on machinery and equipment
	Attracting R&D firms		Endogenous entrepreneurs High-tech emerging sectors: biotechnology, nanotechnology, new materials, ICTs.	The same tax incentives plus special competitive funding
	Other services	Structural change within a large country offers more opportunities for the domestic market, small and medium-sized countries generally focus on schemes conducive to the development of exports	Strengthening exports of industries and services considered to have strong potential in the country	Creation of a "one-stop shop" with representatives from different ministries/ agencies to deal with problems concerning programmes, public regulations and post-investment services

Programmes and objectives	Policy instrument	Strategic objectives	Beneficiaries	Mechanisms for allocating funding
Technological development	Non-repayable contributions	Increased competitiveness through innovation in products, services and processes	Micro-, small and medium-sized enterprises and broader enterprises certified as having attained international standards	By public competition; up to 50% of project cost
	Loans for technological development projects	Finance for middle-income technology production projects	Micro-, small and medium-sized enterprises with R&D departments or teams, collaborating groups and technical linkage units underwritten by the enterprise	Compulsorily repayable loans; up to 80% of the total cost, allocated on an open window basis, with a maximum of $... for three years
Technological modernization (improvement of products and processes, training)	Fiscal credit programme	Assistance in executing R&D	Physical or juridical persons who own enterprises producing goods and services	Subsidies through fiscal credit certificates obtained via public competition; up to 50% of the total cost of the project
	Loans for modernization Projects	Technological adaptation and improvements to products and processes with a low level of technical and economic risk	Enterprises with R&D department or groups; collaboration groups, and technical linkage units underwritten by the enterprise	Special compulsorily repayable loans allocated on an open window basis. Up to 80% of the total cost of the project, with a maximum of $...in three years
	Loans to enterprises	To finance projects for the development of new production processes, products and modifications thereto	Enterprises, without any restriction on size or sector; no finance provided for projects with a rate of return of less than 12%	Compulsorily repayable loans allocated on an open window basis. Up to 80% of the total cost of the project, with a maximum of $...
Promotion of the technological services market (research institutes and business research centres)	Subsidies for projects to develop business plans	Finance for business development projects based on R&D	Micro-, small and medium-sized enterprises whose projects are executed by technical linkage units	Subsidies allocated on an open window basis. Up to 50% of the total project cost, with a maximum of $..., for up to one year
	Loans to institutions	To promote the establishment and strengthening of structures for the provision of technological services to R&D enterprises and institutions	Public or private institutions providing services to the private productive sector; projects may be presented on an individual or associated basis	Obligatorily repayable subsidies allocated on an open window basis, up to a maximum of $...
Training and technical assistance	Subsidies for training and retraining projects	Subsidies to support activities for training and retraining human resources in new technologies	Micro-, small and medium-sized enterprises whose projects are executed by technical linkage units	Subsidies allocated on an open window basis. Up to a maximum of 50% of the total cost of the project, or $... for up to six months
	Subsidies for project Formulation	Support for the formulation of R&D projects, technology transfer or technical assistance	Micro-, small and medium-sized enterprises whose projects are executed by technical linkage units	Subsidies allocated on an open window basis. Up to a maximum of 50% of the total cost of the project, or $... for up to six months
Technological advisory assistance programmes and those strengthening the performance of technical small and medium-sized enterprises	Technological advisory assistance programme	Support for the formulation of R&D projects, technology transfer or technical assistance	Micro-, small and medium-sized enterprises producing goods and services which incorporate technological added value	Subsidies allocated on an open window basis to individuals or groups, with a maximum of 50% of the total cost of the project, or $... and a maximum of $... per participating enterprise
Popularization and social appropriation of science	Competitive grants	Support for the organization of national exhibitions and science fairs	Science museums, educational institutions at primary, secondary and tertiary levels	Subsidies allocated on a competitive basis

Source: UNESCO, UN ECLAC, FONTAR (Argentina)

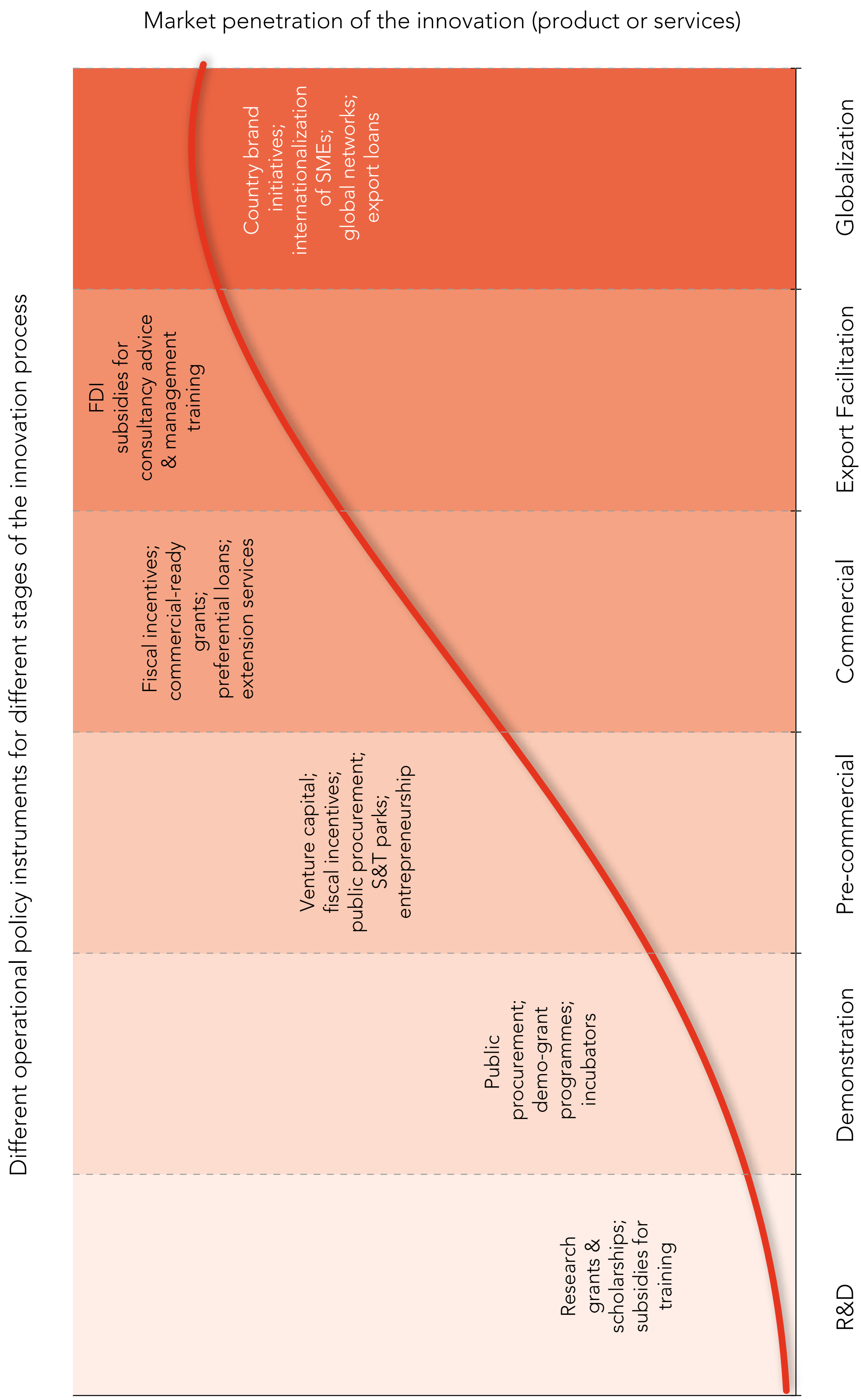


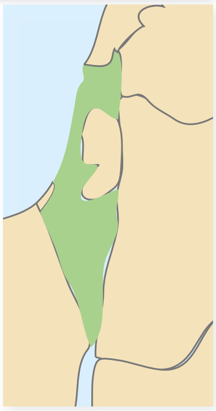
Figure B: Policy instruments for different stages of the innovation process and market penetration.
Source: UNESCO

Table D: Taxonomic classification of SETI operational policy instruments employed by GO→SPIN

Objectives and goals	Type of mechanism/ Mode of support	Target groups/Beneficiaries
Strengthen the production of new endogenous scientific knowledge	Grants (grant funds)	Technical and support staff at SETI
Strengthen the infrastructure of research laboratories in the public and private sectors	Donations (individuals/ companies)	Students
Human resources for research, innovation and strategic planning; capacity building, education and training of specialized human capital for (1) the production of new scientific knowledge, (2) development of new technologies, (3) promotion of innovation within the productive and services systems and (4) management of the knowledge society	Loans	Individual professionals / PhD holders
Strengthen gender equality for research and innovation	Creation of, and support for, technological poles and centres of excellence	Teachers/ Researchers
Strengthen the social appropriation of scientific knowledge and new technologies	Tax incentives	Universities
Development of strategic technological areas and new niche products and services with high added value; promotion and development of innovation in the production of goods and services; promotion of start-ups in areas of high technology	Technical assistance	Research centres
Strengthen science education programmes at all levels (from primary school to postgraduate)	Scholarships	Technical training centres
Promotion of the development of green technologies and social-inclusion technologies	Credit incentives and venture capital	Schools/ Colleges/ Institutes
Promotion of indigenous knowledge systems	Trust funds	Corporations/ Foundations
Research and innovation eco-system: strengthening co-ordination, networking and integration processes which promote synergies among the different actors of the national scientific, technological and productive innovation system (i.e. government, university and productive sectors)	Information services	Professional Institutes
Strengthen the quality of technology foresight studies to: assess the potential of high-value markets; develop business plans for high-tech companies; construct and analyse long-term scenarios and; provide consulting services and strategic intelligence	Others	SETI local groups (e.g. a group of independent researchers)
Strengthen regional and international co-operation, networking and promotion of SETI activities		Private companies
		Science and technology public or private non-profit organizations
		Ad hoc associations
		Individuals
		Small and medium-sized enterprises
		Public institutions
		Co-operatives
		Other

Source: UNESCO

Israel: mapping the landscape of a complex innovation system



OFFICIAL NAME: State of Israel

ABBREVIATION: IL

CAPITAL CITY: Jerusalem

PRIME MINISTER: Benjamin Netanyahu

PRESIDENT: Reuven Rivlin

NATURE OF GOVERNMENT: Parliamentary Republic

POPULATION: 8.24 million (c. 2014)

TOTAL AREA: 20 770 km^2

ETHNIC GROUPS: 75.3% Jewish, 20.7% Arab, 4% other (2013)

OFFICIAL LANGUAGES: Hebrew, Arabic

MAIN RELIGIONS: Judaism, Islam, Christianity, Druze

UNIT OF CURRENCY: New Israeli Shekel (NIS)

DATE OF INDEPENDENCE: 14 May 1948

Date of Constitution[1]

HISTORY OF A PEOPLE AND THE LAND

The narrow geographical region between the Mediterranean Sea in the west, the Jordan Valley in the east, the Gulf of Eilat in the south and the Lebanese Mountains in the north is known as the Levantine Corridor, through which early humans moved from Africa to Asia and Europe, and vice versa. This region is characterized by a variety of landforms (the Dead Sea, the Judean Mountains and the Coastal Plain) and is characterized by a mixture of elements originating from different biogeographical zones. It contains thousands of archaeological sites, both caves and open-air sites that reveal an extremely long chapter of humankind's history. Their study sheds light on human adaptation, survival and cognitive abilities throughout the Pleistocene and the beginning of the Holocene eras. The earliest sites document prolonged occupation of lakesides by hunter-gatherer communities with a material culture similar to that known in African cultures.

Key matters of global importance that have been investigated in the region include: 1) the mechanism and nature of the earliest migrations out of Africa, with the earliest evidence discovered at the site of Ubeidiya in the Jordan Valley (dated at 1.6 million years ago); 2) the earliest cemeteries in the world, at the sites of Qafzeh in Lower Galilee and Skhull on the slopes of Mount Carmel (dated at about 100 000 years ago), where remains of Archaic Modern Humans are buried; and 3) indications of the transitional process from a hunter-gatherer lifestyle to permanent settlements, as evidenced by the Natufian culture (c. 13 100 – 9 600 BCE).

The sites of the second millennium BCE provide evidence of urbanization as well as the appearance of historical records. The first extensive political entities to arise in the region were the kingdoms of Israel and Judah, which evolved in the tenth century BCE and whose history is narrated in the Hebrew Bible. In the eighth century BCE, during the period of these kingdoms, the first demographic peak was reached (Table 1).

The kingdom of Israel succumbed to the Neo-Assyrians in 722 BCE; the kingdom of Judah and the First Jewish Temple in its capital, Jerusalem, were destroyed by the Neo-Babylonians in 586 BCE, after which the Jews were exiled to Mesopotamia. Following the Persian conquest of the Neo-Babylonian Empire in

1 Israel does not have a written constitution, even though according to the Proclamation of Independence a constituent assembly should have prepared a constitution by October 1, 1948. The delay in the preparation of a constitution resulted primarily from problems that emerged against the background of the alleged clash between a secular constitution and the Halacha (the Jewish religious law). URL: http://www.knesset.gov.il/description/eng/eng_mimshal_hoka.htm

539 BCE, King Cyrus allowed the Jews to return to the land of the former kingdom of Judah and erect the Second Jewish Temple, in Jerusalem. It came under the rule of Alexander the Great of Macedon in 332 BCE, and was later ruled by his Ptolemaic and Seleucid successors. In 167 BCE, the Jews revolted against the Seleucids and created the independent Hasmonean kingdom.

This kingdom came under Roman rule in 63 BCE, though Jerusalem and its Temple continued to function as the centre of the Jewish people. During this period the second demographic peak was reached. In addition, the Christian religion branched off from Judaism. An astronomical book written in Aramaic – a Dead Sea Scroll discovered in 1952 – forms part of the Jewish literature of the Second Temple period and attests to an interest in this branch of learning (Drawnel, 2011).

The Second Temple period ended with the revolt against Rome in 66–70 CE and the destruction of Jerusalem and the Temple. Subsequently, the Romans changed the name 'Judea' to 'Palaestina'. In the following centuries it was ruled from Rome and, after 330, from Constantinople. During this period, the Jewish population gradually dwindled, and most inhabitants began following the Greco-Roman and other polytheistic religions. Following the fourth century, many became Christians.

In the fifth century, the third demographic peak, unequalled until our own time, was reached. Several scholars of that period left behind works on scientific subjects. Marinus of Flavia Neapolis (today Nablus), a Samaritan born c. 440 who embraced the Greek way of life, wrote commentaries on Euclid's Data and on astronomical topics. The mathematician Eutocius of Ascalon (today Ashqelon), born c. 480, composed an important commentary on three treatises of Archimedes. Timotheus of Gaza wrote an epic that reveals interest in zoology. Numerous recognized physicians of the period include Rufus of Samaria, a Jew (or Samaritan) who lived around 100 CE and wrote commentaries on Hippocrates in Greek, and Tribunus, the Greek physician from Palestine whose reputation was so great that, in 545, the Persian king Kosrow I, while negotiating a truce with the Byzantine emperor Justinian, stipulated that Tribunus enter his service. Flavius Boethus of Ptolemais (today Akko), governor of Syria-Palaestina in 166, was known for his passion for anatomical theory, and Galen, the greatest physician of the age, produced nine works at his request (Geiger, 2012).

Table 1: Population estimates from the 8th Century BCE to the present

The land between the Jordan River and the Mediterranean Sea				
Period	Total Population	Christians	Jews	Muslims
8th century BCE (1st peak)	1 000 000			
before 66 CE (2nd peak)	2 500 000			
5th century CE (3rd peak)	2 900 000			
1180	400 000			
1340	225 000			
1400	150 000			
1533–39	156 800	5 900	5 400	145 300
1553–54	205 000	9 200	7 200	188 400
1800	275 000	21 800	6 700	246 300
1890	532 060	57 400	42 900	431 600
1914	689 300	70 000	94 000	525 150
1922	752 048	71 464	83 790	589 177
1931	1 033 314	88 907	174 606	759 700
1947	1 970 400	143 300	630 000	1 180 000
The State of Israel				
15 May 1948	805 600	33 200	649 600	108 700
31 December 1951	1 577 800	39 000	1 404 400	118 900
31 December 1975	3 493 200	80 200	2 959 400	411 400
31 December 2000	6 369 300	135 100	4 955 400	970 000
31 December 2013	8 134 500	160 900	6 104 500	1 420 300

Source: Bachi (1977) for all data up to 1975. For the dates up to 1914, the table presents estimates, excepting the evaluations for the years 1533–1554, which are based on Ottoman household lists. From 1922 onward, the data are based on censuses and vital and migratory statistics. Statistical Abstract of Israel, No. 65 (Jerusalem, 2014), p. 91 –for the years 2000, 2013

The Arabs conquered the region in the 630s and a gradual conversion of the population to Islam got under way. The Noble Sanctuary in Jerusalem, established on the site of the destroyed Jewish Temples, eventually became Islam's third holiest shrine.

The land, at that time divided into the two districts of Filastīn and al-Urdunn, did not play a significant role in the scientific flourishing that characterized the Islamic Golden Age. Nevertheless, there is evidence of activity by Muslim, Christian and Jewish physicians in Jerusalem as well as in Ramla, the capital of Filastīn. Al-Tamīmī, who in the tenth century studied medicine in Jerusalem with two masters, a Muslim and a Christian, became a distinguished physician of that age, and his writings on materia medica was widely quoted for generations, inter alia by Maimonides in the twelfth century (Amar and Serri, 2004).

By 1047, there was a hospital in Jerusalem, as in other centres of the Islamic realm in which salaried physicians attended to patients. Following the Crusader conquest of Jerusalem in 1099, the Knights Hospitaller established a hospital there that welcomed not only Christians but also Muslims and Jews. Following Muslim or Byzantine models, the institution was divided into wards and employed salaried physicians. In due time it served as a model for hospitals in Western Europe. In the twelfth century, under Crusader rule, it was possible to study medicine in Jerusalem. In the thirteenth century, the ophthalmologist Benvenutus Grapheus of Jerusalem, who combined Western and Arabic lore, wrote a treatise on ocular diseases and their treatment that became one of the most influential works in its field, in Europe, well into early modern times (Ḳedar, 2006).

During Mamluk rule (1260–1516) and in the early part of the Ottoman period (1516–1800), the land that increasingly came to be known in Europe as Palestine was very sparsely populated and tilled, the number of inhabitants amounting to less than one-tenth of the population that had lived there during the fifth-century peak. While Europe witnessed the Scientific Revolution of the early modern period, with breakthroughs in mathematics, astronomy, physics, chemistry and biology, Palestine was a backward country that played no role whatsoever in these developments, quite unlike the situation in Roman and Byzantine times.

The modernization of the country and the growth of its population began in the nineteenth century under the Ottomans. Zionist Jews, who began to arrive from Eastern Europe in 1882, played an ever-increasing role in these two developments. Tel Aviv, the first Jewish city, and Degania, the first kibbutz, were founded in 1909. The cornerstone of the Hebrew Technion in Haifa, the first institute in Palestine devoted to engineering and the sciences, was laid in 1912. Modernization and population growth were greatly accelerated after the British conquest of the country in 1917–18 and after Great Britain received a mandate to administer it from the League of Nations in 1922. The preamble to the mandate document declared that the Mandatory (Great Britain) should be responsible for putting the Balfour Declaration of 2 November 1917 into effect 'in favour of the establishment in Palestine of a national home for the Jewish people.' Zionism believed that science would play a crucial role in building this national home and in making the country fertile and productive once again. One of the first steps taken by the Zionist Organization was to found The Hebrew University of Jerusalem, the first modern research institution in the country. Its foundation stones were laid in July 1918, when battles between the Ottoman Turks and the British were still raging north of the city, and it was officially opened in April 1925.

Palestine's population grew from 752 000 in 1922 to 1 970 000 in 1947, to a considerable extent because of Jewish immigration that intensified after the Nazi takeover in Germany. This immigration, which made the Jewish national home a reality, triggered opposition and outbreaks of violence by Palestine's Arabs, most notably in 1929 and 1936–39. The murder of six million Jews by the Nazis during the Second World War rendered urgent the establishment of an independent Jewish state, open to survivors of the Shoah and other Jews. On 29 November 1947, the General Assembly of the United Nations adopted Resolution 181 calling for the partition of Palestine into two independent states, one Jewish and the other Arab. The country's Jewish community accepted the Partition Plan, while the Arab community and the surrounding Arab States rejected it and tried to prevent its implementation by force of arms.

On 14 May 1948, the Jewish State of Israel declared its independence, and the declaration was immediately followed by the invasion of the country by five neighbouring Arab States' armies. Israel emerged victorious from its War of Independence and in 1949 signed armistice agreements with the adjoining Arab States.

Israel was admitted into the United Nations as its 59th member. Further rounds of large-scale warfare took place in 1956, 1967, 1973 and 1982. In 1979, Israel signed a peace treaty with Egypt and in 1994 with the Hashemite Kingdom of Jordan. In 1993, a framework was set up in order to settle the Israeli-Palestinian conflict, which, however has not yet been resolved.

Israel's population in 2015 was more than ten times larger than in 1948. The country's Jewish population grew dramatically with the mass immigration from Europe and the Arab countries in the early years of statehood, as well as in the wake of the breakup of the former Soviet Union. From its inception, Israel has been a parliamentary democracy, characterized by a multi-party system. Because of the proportional electoral system prevailing since the establishment of the state, no political party has ever achieved a majority in the 120–member *Knesset*. Hence, all of its governments have been coalition governments. This occasionally gives rise to weak governments, sometimes creating impediments to reaching and/or implementing difficult decisions. On the other hand, it guarantees political pluralism and a vital and contentious political culture. At the time of this writing, Arabs comprise 20% of the country's population and 14% of its parliamentarians, representing six different political parties. Following Hebrew, Arabic is the second official language of the country.

DEMOGRAPHIC PROFILE

Between 1948 and 2012, about 3.1 million immigrants arrived in Israel. Every Israeli government throughout the years has encouraged immigration of Jews to Israel[2]. The legal instrument that allows Jews and people of Jewish ancestry and their spouses to gain automatic Israeli citizenship is the Law of Return passed in the *Knesset* (Parliament) in July 1950. The new immigrants enjoy tax discounts, special loans and subsidies. In addition, there are programmes specifically for new immigrants in education, vocational training, establishment of new businesses, etc. The Ministry of Absorption is responsible for most government programmes for new immigrants. In 2012, the rate of immigration was relatively low – 2.6 immigrants per 1 000 residents—which amounts to 16 558 immigrants arriving in Israel, a decrease of 2% in the number of immigrants compared to 2011. The largest number of immigrants arrived from the following countries: Russia, Ethiopia, the United States, the Ukraine and France[3]. The same year 15 900 Israeli citizens emigrated from Israel to other countries and lived abroad for one year or more, according to Central Bureau of Statistics data. A recent study conducted by Cohen–Kastro (2013) found that the main emigration destination of Israeli families was the United States (64%), followed by Western and Central Europe (18%). Israeli families who immigrated to the United States were characterized by an especially high level of education and skills.

As of the end of August 2014, Israel's population is estimated at 8.24 million inhabitants (Figure 1). The growth rate of the total population during 2014 was 1.91%, similar to the growth rate in the previous decade (Figure 2). A similar rate of growth was prevalent in Israel during the 1980s, a period characterized by low immigration rates. In the 1990s, a decade characterized by a high immigration rates (from the former Soviet Union), the population growth rates peaked at approximately 6% in 1991. Approximately 75.3% of the Israeli population is Jewish (about 6.1 million inhabitants), 20.7% is Arab (about 1.68 million inhabitants), while the remaining 4.3% (about 348 thousand inhabitants) are mainly Christians of European descent and residents who do not have an ethnic or religious classification[4].

The average number of children per woman (total fertility rate) in 2012 was estimated at approximately 3.05 – the highest level in the OECD. Life expectancy at birth in 2012 was 79.9 years for men and 83.6 years for women. Life expectancy rose from the end of the 1970s (1975–1979) by 8.7 years among men and 8.9 years

2 Central Bureau of Statistics. URL: http://www.cbs.gov.il/www/publications/isr_in_n13e.pdf
3 Central Bureau of Statistics (2013), Statistical Abstract of Israel No. 64.
4 Central Bureau of Statistics (2014). URL: http://www.cbs.gov.il/reader/shnaton/templ_shnaton.html?num_tab=st02_03&CYear=2014

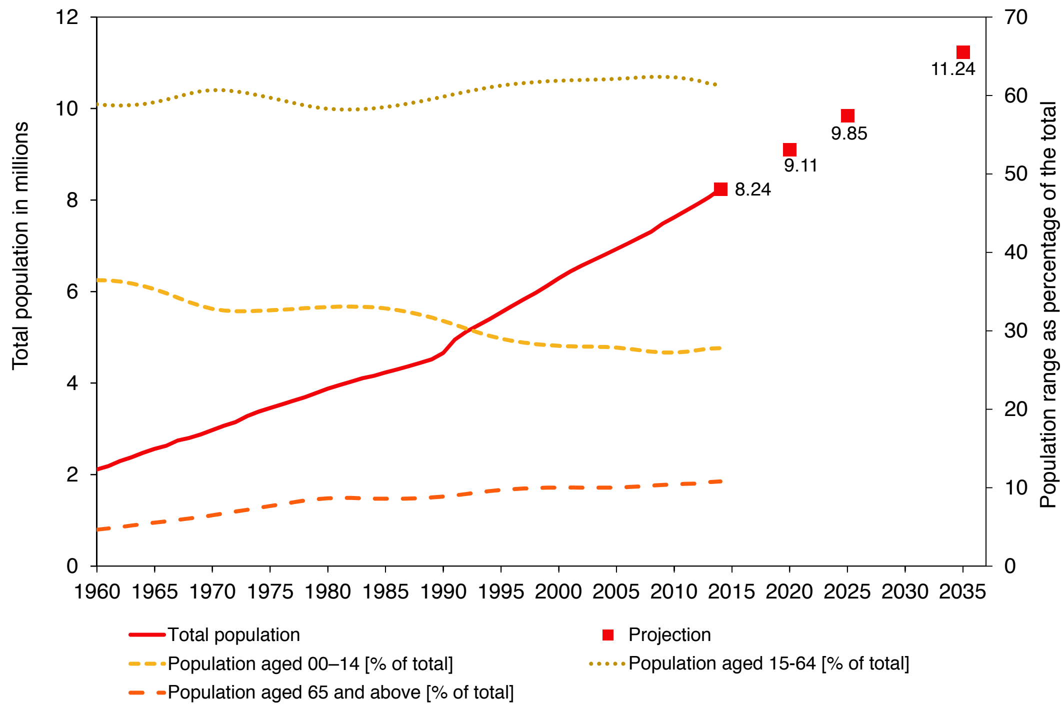


Figure 1: Evolution in the population of Israel, 1960–2014. Source: UNESCO, based on data provided by UN Statistics Division. The Central Bureau of Statistics of Israel estimated the projection

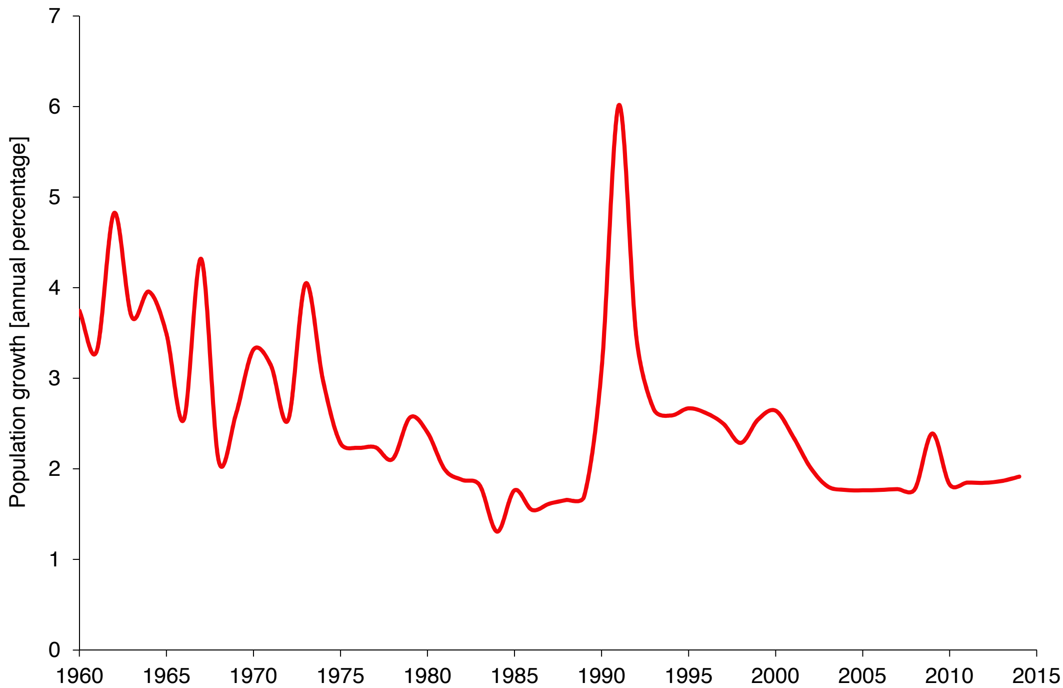


Figure 2: Evolution in the population's growth rate of Israel, 1960–2014. Source: UNESCO, based on data provided by UN Statistics Division

among women. Israel's life expectancy is higher than most OECD countries. In 2011, the life expectancy of men was ranked 4th (after Iceland, Switzerland, Italy, and together with Sweden) and life expectancy for women was ranked 13th among OECD countries.

HUMAN DEVELOPMENT IN ISRAEL

The concept of human development focuses on the result rather than the means of achieving development. This holistic approach puts people at the centre of the development process. Since 1989, the United Nations Development Programme (UNDP) has been measuring the Human Development Index (HDI). It describes in a summary way the achievements of a country in relation to three dimensions of human development: a long and healthy life, access to knowledge, and a decent standard of living. The HDI's country coverage is of course limited by data availability. The data for the three dimensions are normalised with the corresponding lowest and highest values obtained from a sample of 187 countries, then combined into a single index. Each country will have a HDI value situated between 0 and 1. The global rank of countries is obtained by representing each individual HDI value in descending order.

Countries are classified as achieving very high, high, medium or low human development, according to their ranking. In 2013, Israel achieved a HDI of 0.888, which corresponds to very high human development (world rank 19). Between 1980 and 2013, Israel's HDI value increased from 0.749 to 0.888, an increase of 18.5% or an average annual increase of about 0.52%. The HDI is below the average of 0.890 in the very high human development group and above the average of 0.876 for OECD countries. However, the HDI of Israel is below those OECD countries with similar populations (i.e. Denmark and Switzerland).

The logistic growth trend shown in Figure 3 can be best explained by disaggregating the HDI dimensions into their components. For example, one of the components of a long and healthy life is life expectancy at birth. In Israel, this has continuously increased in a quasi-linear way between 1960 and 2014. In 1973, the life expectancy at birth was 71.6 years while in 2013 was 81.7 years.

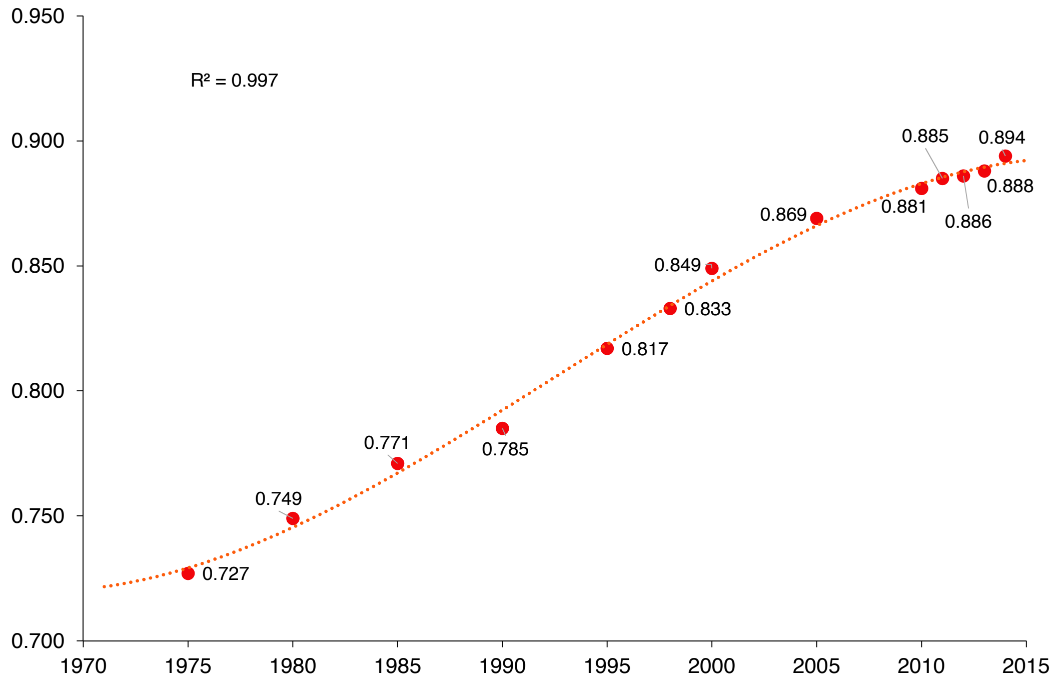


Figure 3: Evolution in Israel's Human Development Index, 1970–2015. Source: UNESCO estimation, adjusted according to the latest HDI methodological approach and data provided by UNDP (2015)

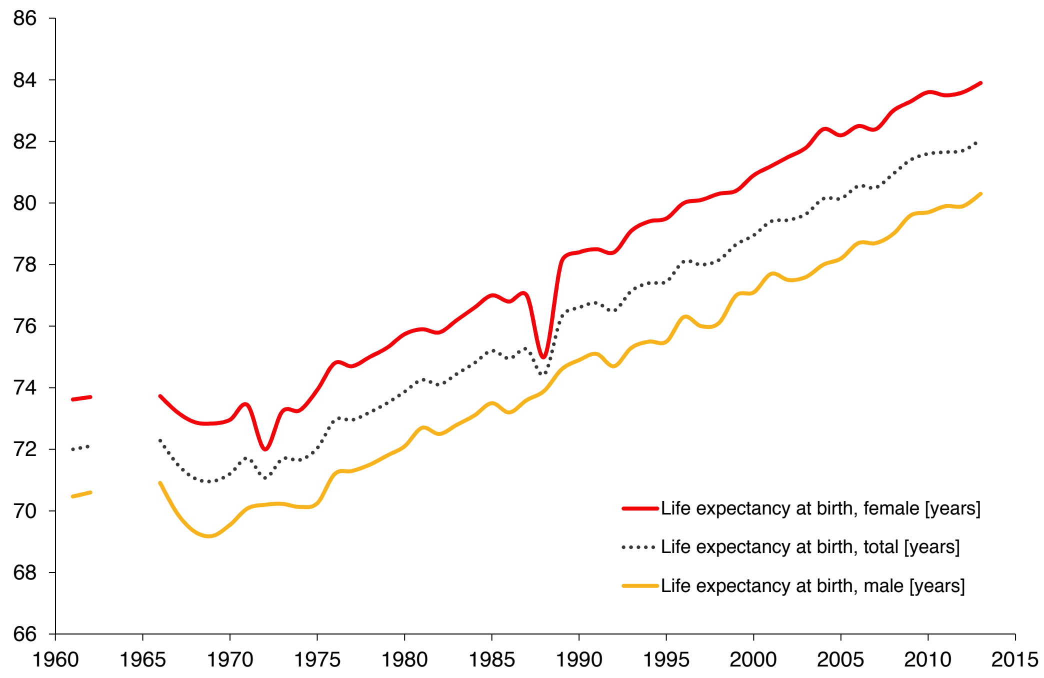


Figure 4: Evolution in life expectancy at birth in Israel, 1960–2014. Source: UNESCO, based on raw data provided by UN Statistics Division

The mean (average) income level, which helps constitute the measure for decent standard of living, measured as GDP in PPP per capita has been increasing linearly over the last four decades, going from 10 600 PPP$ in 1975 to 29 966 PPP$ in 2013.

The mean (average) number of years of schooling for adults has also increased substantially in a quasi-logarithmic way over the past 30 years: from 9.8 years in 1980 to 12.5 years in 2013 (see Table 2).

Recent *Human Development Reports* have launched an Inequality Adjusted Human Development Index (IHDI), which takes into account inequality in all three dimensions of the HDI by 'discounting' each dimension's average value according to its level of inequality. The IHDI is basically the HDI discounted for inequalities. The 'loss' in human development due to inequality is given by the difference between the HDI and the IHDI, and can be expressed as a percentage. As the inequality in a country increases, the loss in human development also increases. Recent *Human Development Reports* present the coefficient of human inequality as a direct measure of inequality, which is an unweighted average of inequalities in three HDI dimensions.

Israel's HDI for 2014 is 0.894. However, when the value is discounted for inequality, the HDI falls to 0.775, an overall loss of 13.3% due to inequality in the distribution of the HDI dimension indices. For example, Denmark and Switzerland show losses due to inequality of 7.3% and 7.4% respectively. The average loss due to inequality for very high HDI countries is 12.1 % and for the OECD it is 13.3%. The IHDI coefficient for Israel is equal to 12.9% (UNDP, 2015). The last coefficient is composed by 3.8% loss due to the inequality in life expectancy at birth, 9.9% loss due to the inequality in education and 25% loss due to the inequality in income.

The GII reflects gender-based disadvantages in reproductive health, empowerment and the labour market. Countries with better gender equality tend to have low maternal mortality, low adolescent fertility and a high proportion of males and females with at least secondary education. The GII can be interpreted as the loss in human development due to inequality between female and male achievements in the three GII dimensions.

Table 2: Quality of life in Israel

Indicator	Value (2014)
Human Development Index (HDI)	
HDI [value]	0.894
HDI [world ranking out of 187 countries]	18
Health	
Public expenditure on health [percent of GDP]	7.7
Under-five mortality [per 1 000 live births]	4.0
Life expectancy at birth [years]	81.8
HIV prevalence [percent ages 15–49 both sexes]	
Education	
Public expenditure on education [percent of GDP]	5.6
Pupil teacher ratio	13
Primary school dropout rates [percent of primary school cohort]	1.1
Expected years of schooling [of children] [years]	16
Adult literacy rate, both sexes [percent aged 15 and above]	97.8
Mean years of schooling [of adults] [years]	12.5
Population with at least some secondary education [percent aged 25 and above]	85.8
Inequality	
Coefficient of human inequality	12.9
Gini coefficient 2005–2013	42.8
Loss due to inequality in education [percent]	9.9
Loss due to inequality in life expectancy [percent]	3.8
Loss due to inequality in income [percent]	25.0
Gender	
Population with at least secondary education [percentage of females to males]	96.7
Adolescent fertility rate [births per 1000 women aged 15−19]	7.8
Labour force participation rate [percentage of females to males of ages 15 and older]	83.6
Gender-related development Index [female to male ratio of HDI]	0.971
Women in parliament [percent held by women]	22.5
Maternal mortality ratio [deaths of women per 100 000 live births]	7.0
Sustainability	
Carbon dioxide emissions per capita [tonnes]	9.3
Natural resource depletion [percent of GNI]	0.3
Population living on degraded land [percent]	12.9
Impact of natural disasters [deaths per year per million people]	1
Fresh water withdrawals [percent of total renewable water resources]	79.7
Forest area [percent of total land area]	7.1
Demography	
Urban population [percent of total]	92.1
Median age [years]	30.1
Dependency ratio of young age [ages 0–14]	45.8
Dependency ratio of old age [65 and older]	17.8

Source: UNDP (2015) Human Development Report

Israel has a GII value of 0.101, ranking it 18 out of 155 countries in the 2014 index. In Israel, during the 19th Knesset 22.5% of parliamentary seats are held by women (highest share of women ever), and 84.4% of adult women have reached at least a secondary level of education compared to 87.3% of their male counterparts. For every 100 000 live births, 2 women die from pregnancy related causes; and the adolescent birth rate is 7.8 births per 1000 live births. Female participation in the labour market is 57.9% compared to 69.1% for men. In comparison, Denmark and Switzerland are ranked at 4 and 2 respectively on this index.

In 2014, UNDP introduced a new measure, the Gender Development Index (GDI) based on the sex-disaggregated HDI. It was defined as a ratio of the female to the male HDI. The GDI measures gender inequalities in achievement in three basic dimensions of human development—health (measured by female and male life expectancy at birth), education (measured by female and male expected years of schooling for children and mean years for adults aged 25 years and older); and command over economic resources (measured by female and male estimated GDP per capita). Country rankings are based on absolute deviation from gender parity in HDI (UNDP, 2014). The 2013 female HDI value for Israel is 0.879 in contrast with 0.893 for males, resulting in a GDI value of 0.984. In comparison, GDI values for Denmark and Switzerland are 0.989 and 0.953 respectively.

HEALTH CARE

Health care services were developed at the beginning of the 20th century (the first being *Kupot-Holim* Clalit, in 1913) by non-profit health organizations and by the British Mandatory government that existed prior to the establishment of the State of Israel in 1948 (Rosen, 2011). These health plans called *Kupot-Holim* were originally based on the German 'sick funds' (Krankenkasse) model.

Universal insurance coverage in Israel is mandated by the 1995 National Health Insurance (NHI) Law. The law sets forth the state's responsibility to provide health services for all residents of the country. All permanent residents are free to choose from among the country's four, competing, non-profit health plans. Public NHI financing comes from two sources: the health tax and general tax revenue. The health tax is an earmarked payroll tax collected by the National Insurance Institute. Individuals pay 3.1% on wages up to half of the average national wage and 4.8% on income beyond that level, to a ceiling of five times the annual wage. There are exemptions and discounts for various groups, such as pensioners and recipients of income maintenance allowances (Rosen, 2011). Health care services covered by the law include medical diagnosis and treatment, preventive medicine and health education, hospitalization, surgery and transplants, preventive dental care for children, medical treatment for drug abuse and alcoholism, medical equipment and appliances, obstetrics and fertility treatment, medications, treatment of chronic diseases and paramedical services.

The Israeli health system has over 2000 community-oriented primary care clinics throughout the country, operated by the *Kupot-Holim,* the Ministry of Health or the municipalities. There are some 26 000 physicians in Israel, most of whom are salaried employees of hospitals and the *Kupot-Holim.* The ratio of physicians to 1 000 persons is 4.6, one of the highest levels in the world. Forty-seven general hospitals presently operate in the country with some 13 000 general beds. The health system also includes some 14 000 beds for chronic-care patients and some 7 000 for psychiatric patients. The ratio of all hospital beds to population is 5.95 per thousand. The Ministry of Health operates a nation-wide public network of 850 mother-and-child-care centres, which offers low-cost, easily accessible services. The services provided include health education programmes, regular check-ups to monitor child development and a comprehensive immunization programme. In Israel, 95% of all babies and children are immunized. The nation's comprehensive immunization programme is a major factor contributing to the low infant mortality rate – approximately 6.3 per 1 000 live births. Source: Israel Ministry of Foreign Affairs URL: http://www.mfa.gov.il

BOX 1 – PROGRAMMES AND POLICIES FOR ENCOURAGING SOCIAL MOBILITY

Social mobility is defined as 'the opportunity for an individual to transcend social strata'. According to the Human Capital Report 2015 prepared by the World Economic Forum, Israel is ranked in a relatively low place in this indicator, 29th place among 124 countries (World Economic Forum, 2015).

In recent years, the Israeli government has initiated a variety of programmes in order to improve social mobility among minorities and disadvantaged populations. The preferred means has been investment in education and in vocational training programmes, especially among the Arab, Ultra-Orthodox and new immigrant (Ethiopian in particular) populations.

The Authority for the Economic Development of Minorities initiates most programmes to improve the economic status of the Arab population in Israel. This Authority operates from within the Prime Minister's Office. While Arabs, Druze and Circassians constitute approximately 20% of the population, their contribution to the GDP is estimated at 8%. Reasons for this disparity include lack of equal opportunities and proper infrastructures; inaccessibility of capital; as well as impediments related to Arab society such as low participation in the labour force and inadequate education levels, especially in the S&T fields. The Authority has developed tools to encourage entrepreneurship and investment benefiting minorities. These include creating private investment funds in the business sector, encouraging initiatives of local authorities, vocational training for Arab women, and creating programmes to integrate Arab university graduates in the private sector.

An additional organization that is actively involved in setting policy and specific goals aimed at mitigating disparities between the general population and the minority population is the Planning and Budgeting Committee (PBC). The PBC views formal education as 'a primary means of social mobility and a key element in the development of each population group in Israel'. In the framework of the multi-year programme for 2010-2016, for the first time the PBC set a goal of making higher education accessible to minorities and to the Ultra-Orthodox population (Shaviv *et al.*, 2013). The main points of the multi-year programme are:

- Establishment of information, consultation and guidance centres for the Arab population.
- Effective absorption of students during the first year of studies – reducing dropout and change of major, reaching timely graduation, raising achievement levels, increasing the numbers of Arab and Jewish Ultra-Orthodox students in fields in which they are under-represented.
- Programme for outstanding Arab graduate students: expanding support for outstanding doctoral students.
- Continuing operation of the Ma'of Fund that supports outstanding young Arab lecturers in higher education institutions.
- Integration of Arabs in governing institutions and committees. Adopting principles of affirmative action when appointing members of committees, governing bodies and senior staff.
- Establishment of scholarship and loan fund for Arab students from low socio-economic backgrounds, studying in preferred fields such as engineering (Shaviv *et al.*, 2013).

NATIONAL INSURANCE

The National Insurance Institute (*Hamosad LeBituach Leumi* in Hebrew) is Israel's national social security agency. The Institute pays disability pensions to individuals who have lost the ability to earn a living due to medical disability, to individuals whose earning capacity has dropped by at least 50% and to homemakers whose ability to perform household duties has decreased by at least 50%. The monthly pension rate is determined by the degree of disability. All citizens, permanent residents and those among new immigrants who are no more than 60 years of age upon arrival to the country are eligible for old-age pensions, paid by the National Insurance Institute[5]. This is financed by a tax levied on all Israeli residents over the age of 18 with the exception of soldiers in the Israeli Armed Forces, National Service volunteers and students enrolled in vocational training courses. A tax is also levied on employers. The current rates of national insurance tax for employers and employees are specified in Table 3[6].

Table 3: Share of national insurance tax by income level (including health insurance), 2014

	Up to NIS 5 453 monthly salary	NIS 5 453–43 240 monthly salary
Employee's share	3.50%	12.00%
Employer's share	3.45%	5.90%

Source: National Insurance Institute of Israel

LONG-TERM ECONOMIC GROWTH

Over the past three decades, the Israeli economy has gone through major structural changes. During this period, a semi-socialistic economy, exporting goods in the primary sector (agriculture and mineral mining) and secondary sector (e.g. diamond polishing, textile, chemical, plastic) was transformed to become a market-based knowledge economy, driven by the private sector and characterized by strong orientation towards international markets (Leck, 2008; Getz *et al.*, 2014). According to Trajtenberg (2001, 2005), this transformation was facilitated by efforts of the Israeli government, which actively supported export-oriented industrial R&D, and by the harnessing of spillovers from the advanced defence sector to civilian industries. Large investments in the defence and aerospace industries created new technologies that became the basis for Israel's high-technology industries (e.g. medical devices, electronics, telecommunications, computer software and hardware).

Since the end of the 1970s, many initiatives have been taken by the Israeli government to attract foreign investment. These include tax incentives, policies to stimulate capital investments and incentives for the development of foreign venture capital (Trajtenberg, 2000, 2005). Today, Israel is a technologically advanced market economy. Its major imports include crude oil, grains, raw materials and military equipment. Cut diamonds, high-technology equipment and pharmaceuticals are among its leading exports.

Figure 5 shows the long-term evolution of the GDP per capita (1960–2014) expressed in 2015 constant US dollars and in 2011 constant PPP international $. Both curves can be fitted by parabolic growth curves with determination coefficients $R^2>0.95$. For more than five decades the GDP per capita of Israel had almost the same value as the average OECD high-income countries. Particularly over the last five years, Israeli income per capita is a little bit above OECD average.

5 National Insurance Institute. URL: http://www.btl.gov.il/English%20homepage/Pages/default.aspx

6 The National Insurance Institute (2014). Rates and amounts of insurance contributions. The amount of NIS 43240 is the maximum level of income for which national and health insurance contributions must be paid. URL: http://www.btl.gov.il/English%20Homepage/Insurance/Ratesandamount/Pages/default.aspx

The monetary policy of Israel is primarily directed towards maintaining stability in the general level of prices. As in the case of many other western countries, the monetary policy of Israel is set by the central bank. The Bank of Israel, established in 1954, is the central bank of the State of Israel. The Bank is independent, with objectives and operating methods specified in the Bank of Israel Law, 5770–2010. The Bank's main objectives are to support the Government's objectives (economic growth, employment, reduction of social gaps), to support the stability of the financial system, and to maintain price stability.

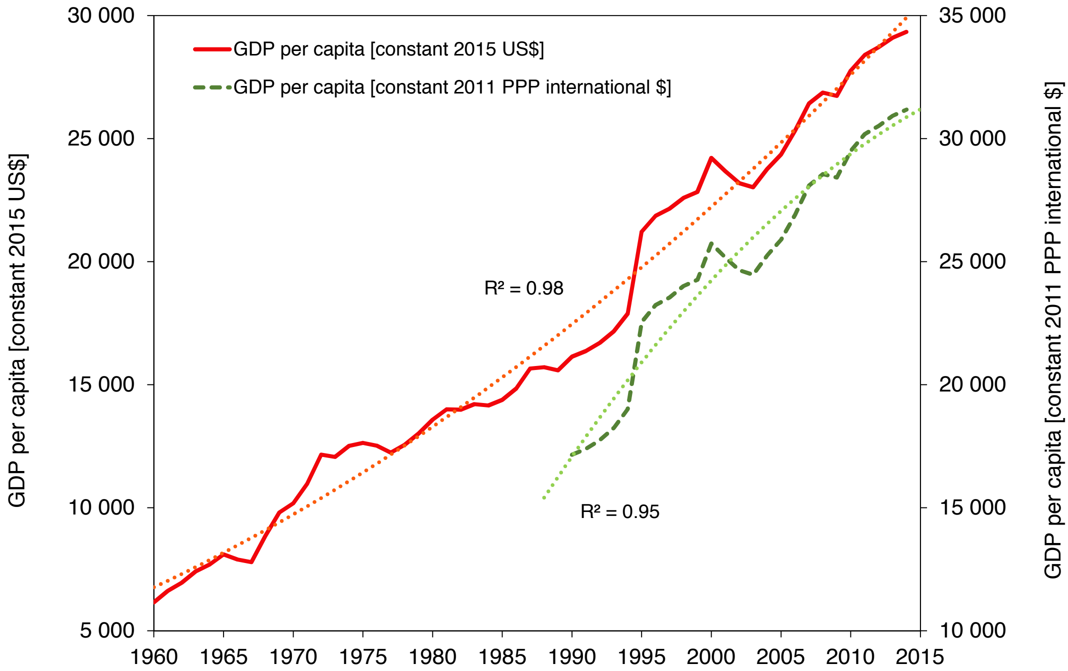


Figure 5: Evolution of GDP per capita, expressed in constant 2012 US dollars, in Israel, 1960–2014. The dotted lines show the best fitted curves, which follow a quadratic growth. Source: UNESCO, based on data provided by the UN Statistics Division, World Bank Databank (August 2015)

LABOUR MARKET

As of July 2014, Israel's civilian labour force numbered more than 3.8 million individuals. Of these, 3.55 million were employed and approximately 250 000 were unemployed. Among the employed persons, 1.87 million were men and 1.68 million were women. The Israeli labour force is highly educated, with 55% of individuals between the ages of 15 and 65 having more than 13 years of schooling and 30% of them having 16 or more years of schooling. The general labour force participation rate grew in the last decade, from 59.8% in 2003 to 63.7% in 2013 (Fatal, 2013). According to a report prepared by the Bank of Israel, this growth can be explained by the increase in the general education level of the population[7].

Two population groups in Israel are characterized by low levels of labour force participation: Arabs and Ultra-Orthodox Jews (Table 4). The low participation rate of Arab women (27%) is mainly due to cultural reasons, related to the structure and characteristics of traditional Arab society. In recent years, the Israeli government, via the Authority for Economic Development of Minorities (AEDM) in the Prime Minister's Office, has introduced several programmes aimed at strengthening the minority sector's integration into the national economy. Two examples of these programmes are vocational training for Arab women and integration of Arab university graduates into the private business sector.

7 URL: http://www.boi.org.il/en/NewsAndPublications/PressReleases/Pages/27022013-a.aspx

The Ultra-Orthodox population in Israel numbers, according to various estimates, between 700 000 and 820 000 individuals, comprising 8.5% to 10% of the total Israeli population. The annual growth rate of the Ultra-Orthodox population stands on 7%, due to very high fertility rates. The extremely low labour force participation rates among Ultra-Orthodox men (41% in 2013) are explained by the fact that the Ultra-Orthodox community is a Scholar-Society, in which the large majority of adult males engage in religious studies for their entire lives, within Yeshivas and Kolels. In recent years, both the Israeli Government and the Council for Higher Education have initiated vocational training (particularly for men) and special academic support programmes providing a comprehensive response to the barriers faced by Ultra-Orthodox students, including enhancement of learning skills and overcoming cultural and educational differences. The Ultra-Orthodox and the Israeli Arab populations are viewed as the main growth engines labour-force in future years. Their integration into the labour-force and the enhancement of their educational level is vital for safeguarding Israel's growth potential in the coming years (Eckstein, 2010).

Table 4: Labour force participation rate as a share of the population, 2013

	Men	Women	Total
Ultra-Orthodox Jews	41.0	59.0	50.0
Arab	66.1	27.1	46.6

Source: Central Bureau of Statistics, 2014b

Wages

The average annual wage in Israel in 2012 was US$ 31 934 (20th in the OECD[8]). Table 5 presents trends in the gross monthly wage in Israel by comparing the national mean wage to the mean wage in the high-technology sector.

Table 5: Average monthly gross wage in the high-technology manufacturing and services sectors versus the national gross wage, 1995–2014

Year	National Mean (NIS)	High-tech Manuf. Mean (NIS)	Knowledge Intensive Services Mean (NIS)	High-tech Manufacture	High-tech Services
				Relative to mean wage	
1995	4 355	7 482	7 386	1.7	1.7
1996	4 915	8 843	8 569	1.8	1.7
1997	5 493	10 175	9 934	1.9	1.8
1998	5 914	11 377	11 150	1.9	1.9
1999	6 377	12 861	12 973	2.0	2.0
2000	6 835	13 401	14 714	2.0	2.2
2001	7 207	13 774	14 879	1.9	2.1
2002	7 147	13 991	13 995	2.0	2.0
2003	6 972	13 909	13 540	2.0	1.9
2004	7 145	13 962	13 928	2.0	1.9
2005	7 324	14 535	14 579	2.0	2.0
2006	7 576	14 991	15 161	2.0	2.0
2007	7 749	15 431	15 462	2.0	2.0
2008	8 075	15 478	15 937	1.9	2.0
2009	8 131	15 569	16 009	1.9	2.0
2010	8 414	16 304	16 326	1.9	1.9
2011	8 768	17 816	16 885	1.9	2.0
2012	8 971	18 251	17 367	1.9	2.0
2013	9 212	18 601	18 805	2.0	2.0
2014	9 373	19 171	19 544	2.0	2.0

NOTE: The data for the years 2004–2010 are based on a new sample. Data from 2011 onwards are based on a new classification of economic branches. Comparison to earlier years can be only done by using a chain-linked index

Source: Central Bureau of Statistics

8 In PPP $ 2012 constant prices. See OECD Stat data (August 2015).

As can be observed from the data, high-technology sector wages and the national mean wage usually fluctuate in the same direction and at similar rates. Since 1999, wages in the high-technology manufacturing sector and in the high-technology service sector have been 1.9–2.2 times higher than the national average. Analysis of the data shows that the gap between high-technology service sector wages and national average wages narrowed slightly in 2010 but widened again in 2011 and in 2013.

DISTRIBUTION OF INCOME

Table 6 presents the distribution of the gross monthly income by deciles of households. As can be observed from the table, in 2013, nearly 42% of the gross monthly income in Israel was concentrated in the top two deciles of households. The Israeli Middle Class (deciles 4–7) accounts for only 34% of the gross income. Table 7 presents trends for the last decades in the Gini index[9], further demonstrates the inequality in the distribution of income. The table shows that since the mid-1980s, there is a steady and constant rise in the value of this indicator, pointing to widening social-economic gaps in the country. This trend can be attributed to the country's transition from a semi-socialistic economy towards an open competitive market economy. It is important to note that between 2000 and 2010, the ratio between the Gini index calculated before taxes and transfer payments and the Gini index calculated after taxes and transfer payments has sharply decreased. This points to the fact that in recent years welfare benefits have been significantly reduced by government. However, the opposite behaviour took place between 2010 and 2013 (see Table 7).

Table 6: Total monthly income in deciles of households in NIS thousands, 2013

Decile	Gross monthly income ('000)	Percentage of total	Net monthly income ('000)	Percentage of total
1	1 064 869	2.6	996 602	2.9
2	1 709 573	4.2	1 599 600	4.7
3	2 053 621	5.0	1 891 151	5.6
4	2 602 457	6.3	2 367 369	7.0
5	3 125 548	7.6	2 811 556	8.3
6	3 742 845	9.1	3 277 252	9.7
7	4 416 181	10.7	3 781 840	11.1
8	5 267 655	12.8	4 392 378	12.9
9	6 527 165	15.9	5 200 965	15.3
10	10 615 392	25.8	7 633 264	22.5
Total	41 125 305	…	33 951 977	…

Source: Central Bureau of Statistics, 2014b

Table 7: Gini index in Israel, 1985–2013

	1985	1990	1995	2000	2005	2010	2013
Gini index, after taxes and transfer payments	0.326	0.329	0.338	0.347	0.378	0.376	0.360
Gini index, before taxes and transfer payments	0.472	0.476	0.494	0.504	0.513	0.501	0.535
Ratio before/post	1.450	1.450	1.460	1.450	1.360	1.330	1.490

Source: OECD.Stats

9 The Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of zero represents perfect equality and 1 (or 100%), perfect inequality. For further information on Gini Index see URL: http://data.worldbank.org/indicator/SI.POV.GINI

GOVERNMENT EXPENDITURES

Due to several factors, Israel's government-expenditures were relatively high – compared to OECD countries – from the early 1950's until the late 1980s. These included the need to absorb massive immigration (especially in the 1950's), increasing defence expenses (especially after 1967) and more. In the last two decades, Israel has gradually lowered public expenditures. Figure 6 presents the structure of central government expenditures in 2013.

Israel underwent a major economic crisis in the early 1980s, characterized by a high budget deficit, growing public debt and skyrocketing inflation. In order to deal with the grave economic situation, the Israeli government introduced the *Economic Stabilization Plan* in 1985. The objectives of the Plan were to decrease inflation, equalize the balance of payments and stabilize the economy. The Plan included a sharp devaluation of the Shekel, long-term fixing of the foreign exchange rate, price control on basic products and services, wage controls and a substantial cut in government expenditures and deficit. Following implementation of the Plan, Israel's budget deficit was maintained at a relatively stable level. The government budget deficit in November 2013 to October 2014 was NIS 12.6 billion or 2.5% of GDP, well below the government deficit target, mainly due to higher than expected revenues and lower spending than planned.

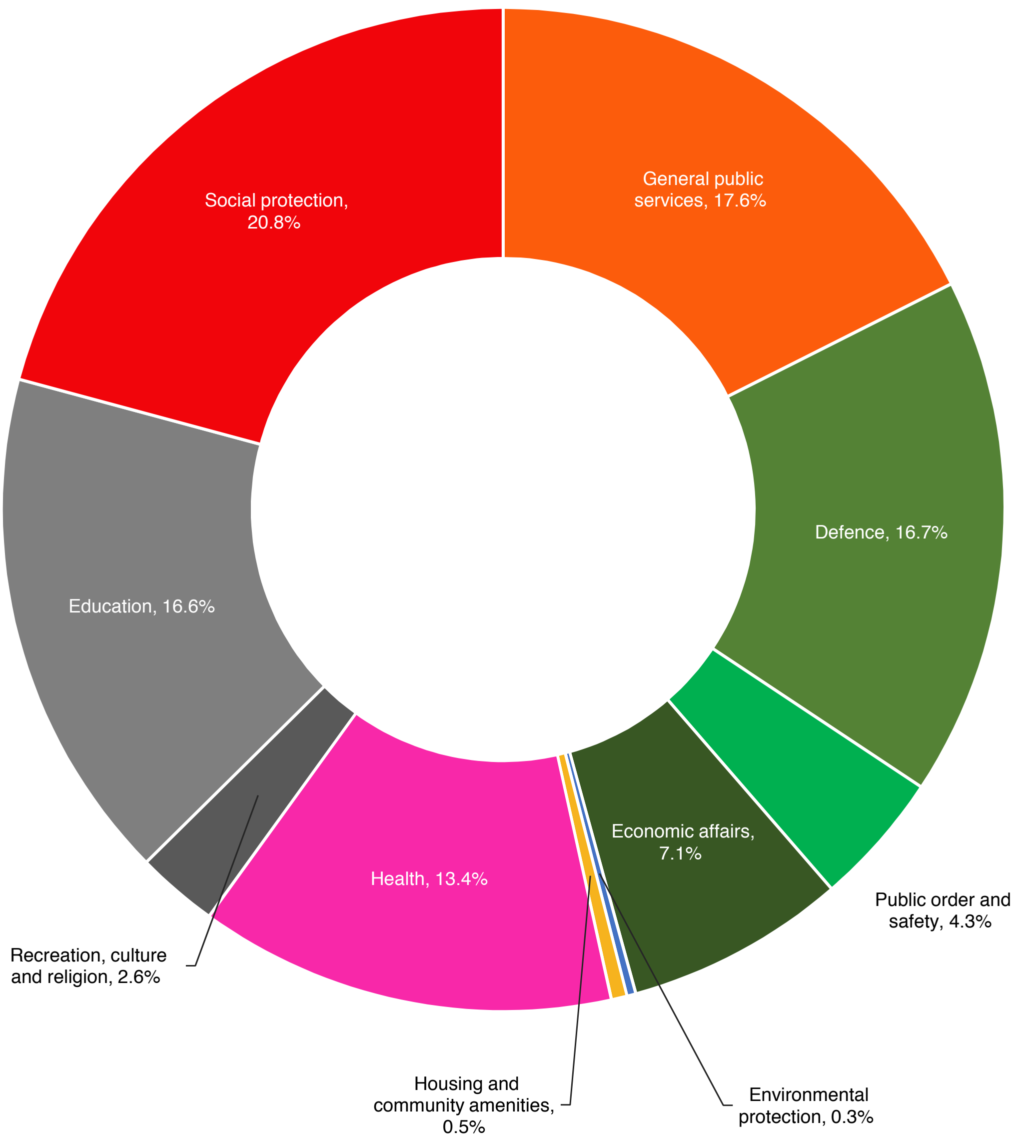


Figure 6: Structure of central government expenditures, 2013. Source OECD.Stats

ATTRACTING FOREIGN DIRECT INVESTMENT

Foreign direct investment[10] (FDI) is also usually considered a major source of growth. FDI is an important source of finance for transition economies, as it helps to cover the current account deficit and fiscal deficit (in case of privatization-related FDI) and supplements inadequate domestic resources to finance both ownership change and capital formation.

Secondly, compared with other financing options, FDI may facilitate international transfer of technology, expertise and skills, including more advanced technologies and managerial skills, and may help local enterprises expand into foreign markets. It may not only increase the activity of FDI-beneficiary firms but also have a knock-on effect on other firms and sectors through technological spillover and through increased competition, thus raising productivity for the whole industry.

Although FDI is commonly considered an important vehicle of international knowledge transfer, the effectiveness of this process depends crucially on the absorption capacity of the host economy, which is determined by a complex set of political, structural and institutional variables (competition policies, IPR, quality of education, availability of scientists and engineers, R&D infrastructure, etc.).

Countries can increase the inflow of FDI by creating a business climate that makes foreign investors feel that their capital is safe, for example by improving rule of law, stabilizing the regulatory framework, establishing and protecting private property rights, and reducing corruption. Among the incentives that governments can offer, one could cite low tax rates or other tax incentives, access to loans and co-funding, zoning in proximity to where workers live, and improved infrastructure that allows products and services to reach markets.

According to the latest *World Investment Report* (UNCTAD, 2015), developing countries accounted for a record 55% of global FDI inflows in 2014, exceeding flows to developed economies by US$182 billion.

Economies obtain useful new technologies through various channels, such as FDI, international trade and the international diffusion of knowledge and innovation. Technology transfer may be a major reason for the growth in total factor productivity (TFP) in many economies. Wang and Wong (2012) demonstrated that, over the period 1986–2007, foreign R&D, the products of which were transferred through inward FDI and imports, improved the technical efficiency of countries by an estimated 9.97% on average. In other words, a country with an average technical efficiency score of 0.85 would have dropped to about 0.72 had it not benefited from foreign R&D through FDI and imports.

This research indicates that FDI is an effective conduit for technology transfer through technology spillovers to domestically owned firms in the host country. This is consistent with a vertical technology spillover hypothesis: foreign firms have an incentive to facilitate knowledge transfer to local firms to enable them to produce intermediate inputs more efficiently, thereby making them available to foreign firms upstream at a lower cost.

The potential of FDI for improving technical efficiency

In their study, Wang and Wong (2012) define technical efficiency as a country's ability to obtain maximum output from a given vector of inputs, so technical efficiency improvement refers to the movements toward greater productivity. Based on showing that inflow of foreign R&D via FDI improves technical efficiency in a regular manner across countries, they were able to estimate technical efficiency scores for individual countries (as a multiple of inflow of foreign R&D transferred via FDI).

10 The International Monetary Fund defines (foreign) direct investment in its *Balance of Payments Manual* as the category of international investment that reflects the objective of obtaining a lasting interest by a resident entity in one economy (direct investor) in an enterprise resident in another economy (direct investment enterprise). A direct investor is defined by its ownership of 10% or more of the ordinary shares or voting power in a direct investment enterprise.

Whereas least developed countries typically do not have adequate domestic resources to promote the accumulation of R&D stock, this work points to the conclusion that adopting preferential policies to promote trade and capital inflows, so as to access results of foreign R&D, can be extremely important to improve technical efficiency and, consequently, industrial competitiveness.

However, technical efficiency, innovation and competitiveness also depend on other variables, such as infrastructure and political stability. Arnold (2004) identified still other factors, such as: managerial deficits; a lack of technological understanding, learning ability or absorptive capacity to make use of externally generated technology; failure to (re)configure public institutions, such as universities or research institutes, to work effectively within an innovation system; deficiencies in regulatory frameworks (e.g. health and safety rules); as well as other indirect factors, related to the sophistication of demand or cultural and social values, which can have a negative effect on innovation and economic performance. Improvements in infrastructure and political stability, combined with adequate human capital policies, can help to improve a country's technical efficiency and its attractiveness for FDI.

Table 8: FDI inflow and outflow for Israel, 1990–2014

Year	FDI inflow [million current US$]	FDI outflow [million current US$]	FDI inflow/ GFCF*
1990	137.1	261.0	0.02
1991	49.6	355.0	0.02
1992	303.9	256.2	0.04
1993	471.9	744.7	0.04
1994	475.2	673.9	0.03
1995	1 576.6	574.2	0.06
1996	1 616.8	436.8	0.05
1997	1 990.4	750.0	0.06
1998	1 966.7	1 162.8	0.07
1999	4 187.2	829.6	0.17
2000	6 957.4	3 335.4	0.30
2001	1 771.7	687.6	0.07
2002	1 582.8	981.0	0.07
2003	3 322.4	2 109.5	0.15
2004	2 947.4	4 540.7	0.12
2005	4 818.3	2 945.8	0.19
2006	15 295.9	15 438.0	0.54
2007	8 798.3	8 604.6	0.25
2008	10 874.7	7 210.0	0.27
2009	4 607.0	1 751.4	0.12
2010	5 509.6	8 656.1	0.13
2011	10 765.6	5 329.1	0.18
2012	9 481.3	2 352.2	0.15
2013	11 803.8	4 932.2	0.21
2014	6 432.0	3 975.0	0.11

*Gross fixed capital formation

Source: UNCTAD World Investment Report(s) [several years]

FDI trends in Israel since 1990

Market failures imply a potential for policies to increase welfare by encouraging technology transfer (Sagasti and Aráoz, 1976; Berg and Fuchs, 2013). To be effective, policy must alter the incentives of agents that possess innovative technologies in order to ensure that they transfer these technologies. In practice, this means encouraging the means for technology transfer: for example, licensing and inflows of FDI.

Table 8 shows the long-term evolution of Israel's FDI inflow and outflow as well as the ratio of its net FDI inflow to gross fixed capital formation[11] (GFCF) between 1990 and 2014. Figure 7 presents the long-term evolution of FDI flows as a percentage of the GDP. Figure 8 shows the long-term evolution of GFCF between 1960 and 2014.

From Table 8 and Figure 7 it is possible to reconstruct the long-term evolution of FDI behaviour in Israel between the years 1970 and 2014. Particularly, Figure 7 shows that since 1995 FDI has been increasing substantially relative to prior levels, marked by three well-determined peaks (2000, 2006 and 2013). The FDI in 2006 was US$15.3 billion, while the following years produced much lower investment. This outcome can be explained by the 2008 world economic crisis. FDI inflow reached US$4.4 billion and US$5.1 billion in 2009 and 2010 respectively. By 2013, it had already reached a high of US$11.8 billion.

It is very important to note that the FDI inflows/GFCF ratio is very low indicating that the investment was oriented to medium and high technology projects.

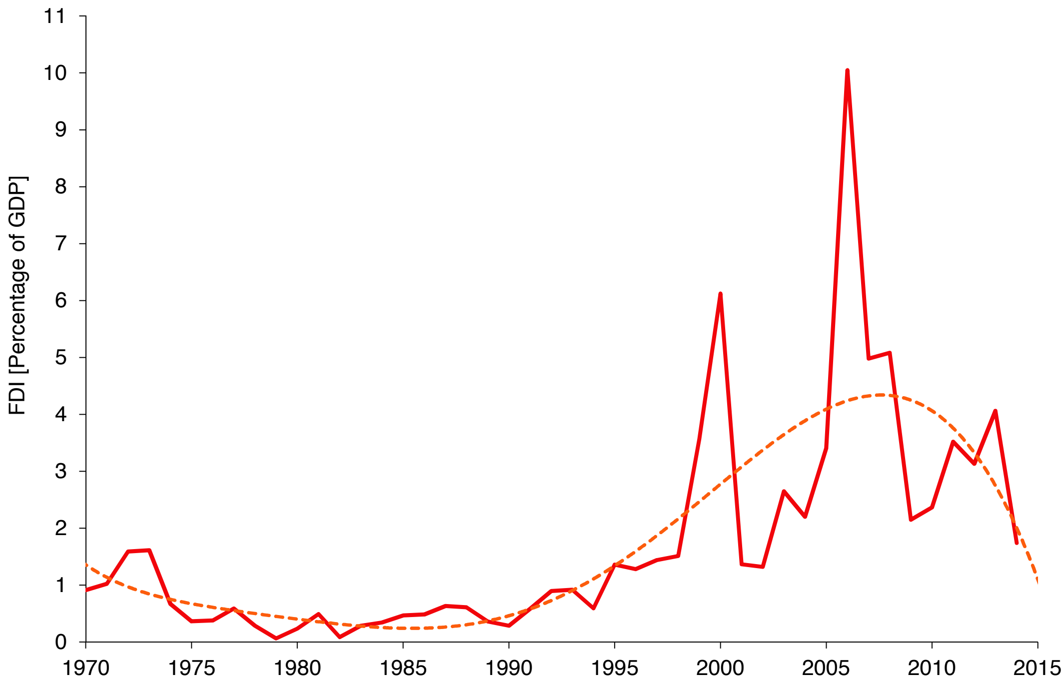


Figure 7: Evolution of net inflow of Foreign Direct Investment (FDI) in Israel expressed as a percentage of GDP, 1970–2014. The dotted line indicates the best-fitting curve. Source: UNESCO based on raw data provided by the World Bank

11 GFCF consists of investment in land improvements (fences, ditches, drains and so on); plant, machinery and equipment purchases; and the construction of roads, railways and the like, including commercial and industrial buildings, offices, schools, hospitals and private residences.

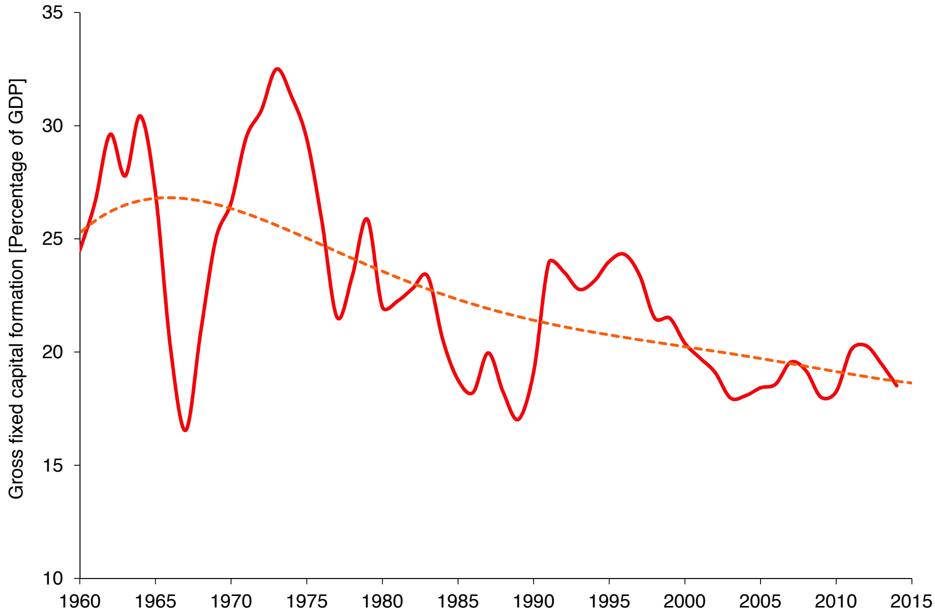


Figure 8: Evolution of gross fixed capital formation in Israel expressed as a percentage of GDP, 1960–2014. The dotted line indicates the best-fitting curve. Source: UNESCO based on raw data provided by the World Bank databank (August 2015)

THE CORRELATION BETWEEN GOOD GOVERNANCE AND SCIENTIFIC PRODUCTIVITY

In an increasingly complex innovation landscape, developing effective governance requires better co-ordination at and among the local, regional, national and international levels. With the broadening of innovative processes players and locations, the systems of governance that nourish their relationships and proper functioning become even more important. As no single actor has the knowledge and resources to tackle the innovation challenge unilaterally, every country – in one way or another – faces the task of better co-ordinating the various actors involved in formulating and implementing policy.

A country's social capital, anchored on good governance and an effective and capable state, is considered a minimal condition to stimulate harmonious development. It is understood that institutions, politics and economics are central features of any system of governance. Where controversy has sometimes arisen, it has concerned what constitutes good and bad governance, and how to link governance to democracy.

Since 1996, the World Bank has published a set of standardized governance indicators each year for every country in the world. The World Bank's team defines governance as the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected monitored and replaced; the government's capacity to formulate and implement sound policies and; the level of respect on the part of both citizens and the state for the institutions that govern economic and social interactions (Kaufman *et al.* 1999).

Within UNESCO's GO→SPIN programme some correlation among these governance indicators and SETI productivity was found (Lemarchand, 2013). For example in Figure 9, countries are represented in a Cartesian graph (four quadrants) according to their positive or negative values for government effectiveness and political stability/absence of violence. The size of the bubble reflects the number of scientific publications – listed in the *Science Citation Index Extended* – per million inhabitants. Few nations fall in the first quadrant. Those countries with the largest GDP per capita and number of scientific publications per million population are located in this first quadrant (Lemarchand 2013).

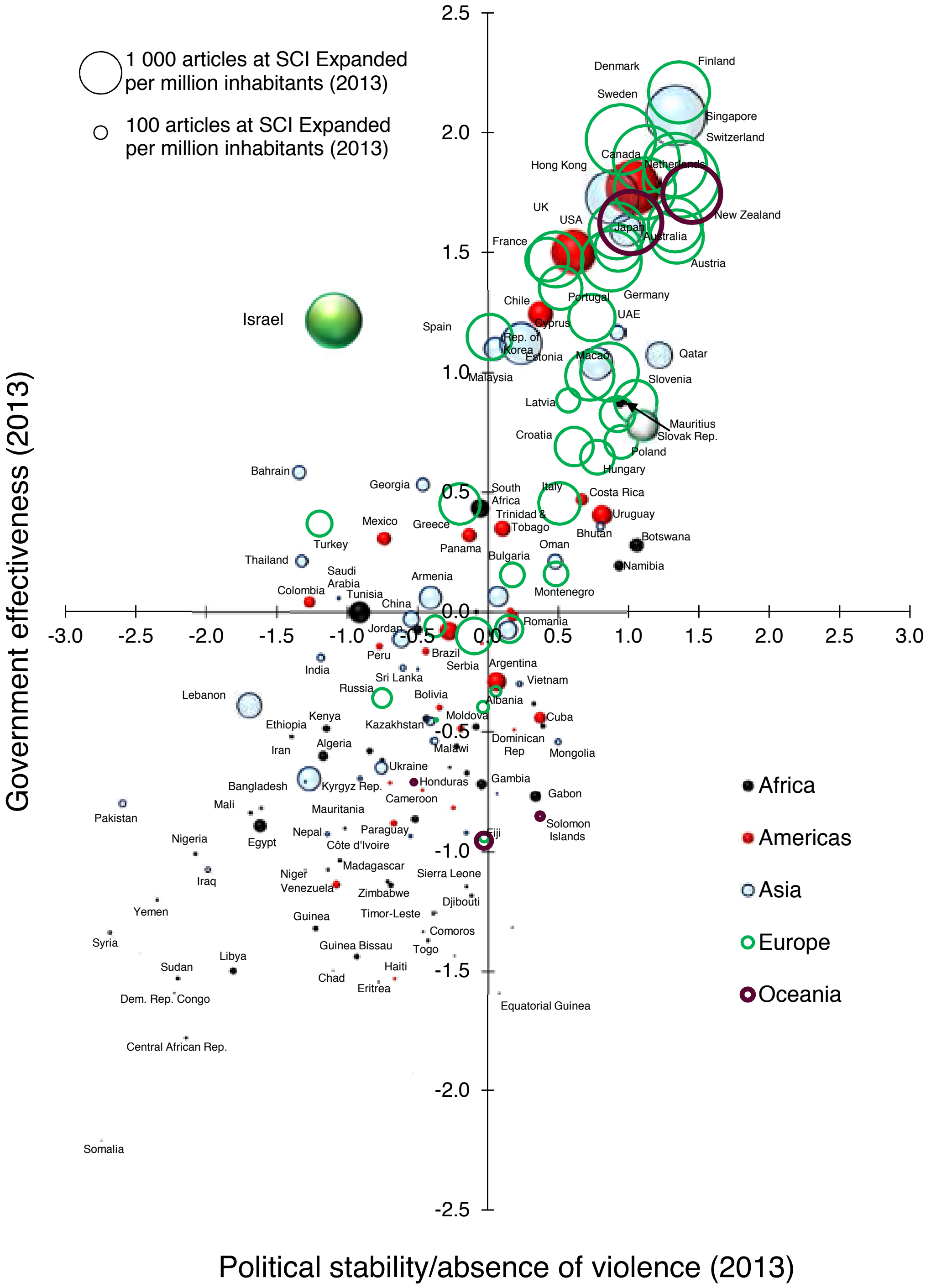


Figure 9: Evolution in government effectiveness worldwide, as measured against political stability/ absence of violence, 2013. The size of the bubbles reflects the number of scientific articles at SCI Extended per million inhabitants in 2013 for countries with more than 500 000 inhabitants. Source: UNESCO based on raw data provided by World Bank databank (August 2015), UN Statistics Division and the SCI Extended

Within the second quadrant, we find those countries, which have negative values for political stability/ absence of violence, but positive values for government effectiveness. In general, these are countries with some level of violence in their society (i.e. terrorism, war, drugs trafficking, etc.) or which are facing some economic or political crises (i.e. Greece). Israel has been evolving within the second quadrant since the indicators were published for the first time (Figure 10).

The third quadrant (negative values for both indicators) concentrates the great majority of African countries. Lastly, in the fourth quadrant (positive values for political stability/absence of violence but negative values for government effectiveness), we have a series of countries which have certain political stability but there are not so efficient in the implementation of their policies. Figure 9 also informs about differences of scientific productivity using as its measure: the number of scientific publications resident scientists annually published in journals recognized by international indexes per million inhabitants of the country's population. The smallest bubble size represents the least productive countries; larger bubbles represent countries that are more productive. The first quadrant features very high productivity.

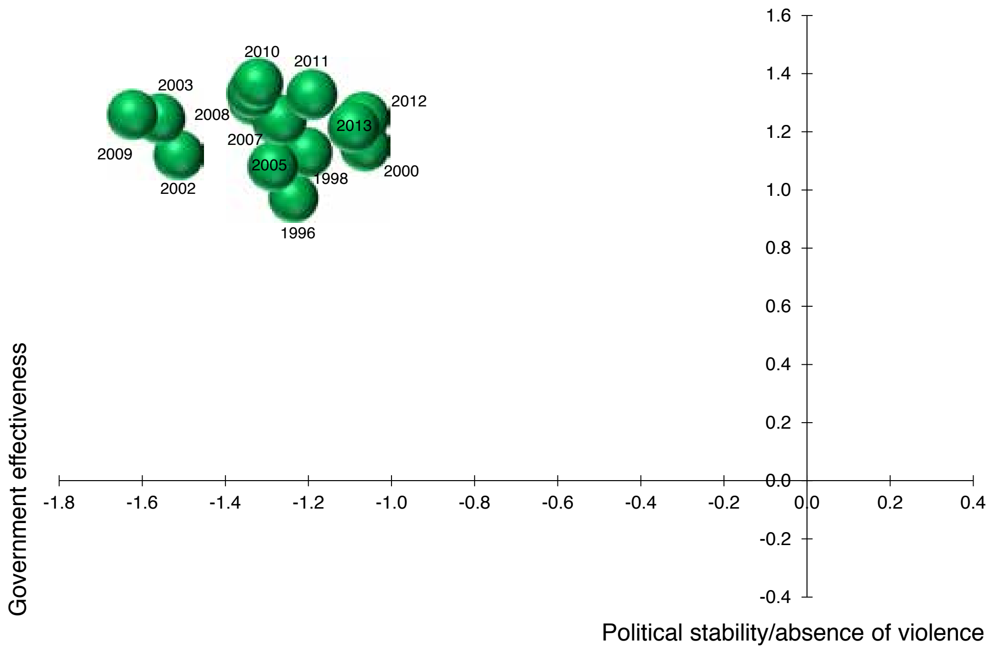


Figure 10: Evolution of the governance indicators and scientific productivity in Israel, 1996–2013

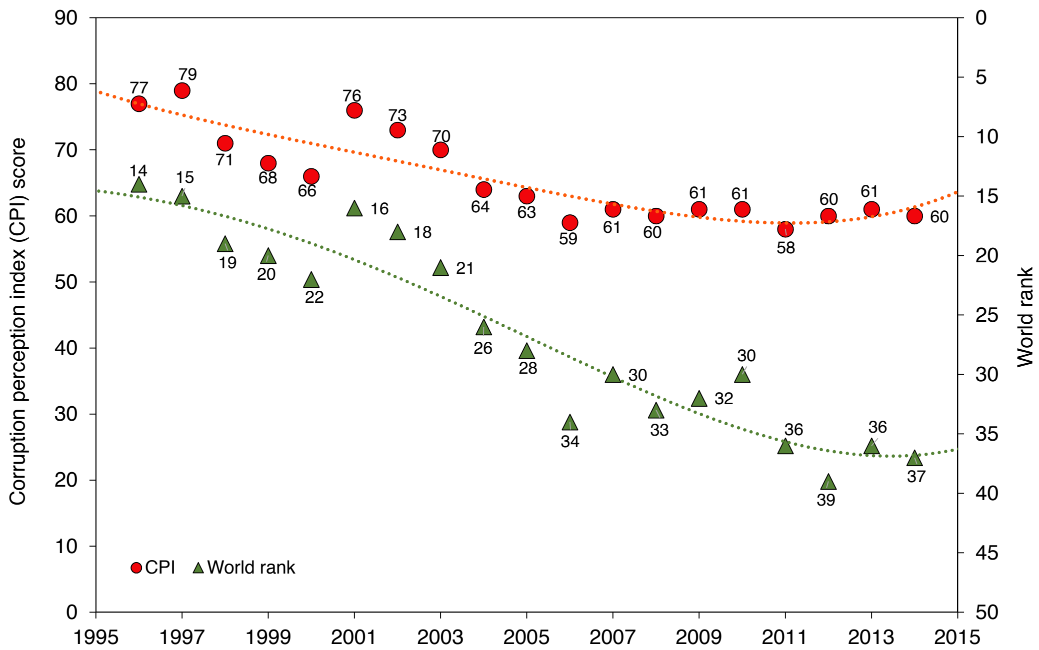


Figure 11: Evolution of the Corruption Perceptions Index (CPI) in Israel (circles associated with the left-axis) and world rank (triangles associated with the right-axis), 1996–2014. The dotted lines represent the best-fitting curves. Source: UNESCO based on raw data generated by Transparency International

Figure 10 shows on a magnified scale the evolution in the same two governance indicators (and scientific productivity) for Israel over time for the period between 1996 and 2013. The political stability/absence of violence dimension had negative values during the whole period (1996–2013), while the dimension government effectiveness had positive values. The scientific productivity of Israel in terms of scientific articles listed at the SCI Extended per million inhabitants remained the same over the whole period.

Since 1995, Transparency International has published the *Corruption Perceptions Index* (CPI). The CPI ranks countries and territories based on how corrupt their public sector is perceived to be on a scale from 0 (highly corrupt) to 100 (very clean). A country's rank indicates its position relative to the other countries and territories listed in the index. The total number of countries included in the survey varies each year ranging from 85 (1998) to 183 (2011). The last survey performed in 2014 included 175 countries. The CPI is calculated using data from 10 independent institutions. All 13 sources measure the overall extent of corruption (frequency and/or size of bribes) in the public and political spheres and all sources provide a ranking of countries.[12]

Figure 11 shows the CPI scores of Israel and its corresponding world ranking between 1996 and 2014. The shape of these curves show a smooth increase in the corruption level of the country during the past two decades. In 2005 Israel ranked 28th (out of 159 countries) in 2011 it ranked 36th (out of 183 countries) and in 2014, 37th (out of 175 countries).

Political stability and good governance sustained over decades are prerequisites for developing sound public policies. Stability and predictability are particularly important for research and innovation since both endeavours involve risk-taking with long time horizons. They thus require a stable framework of institutions and policies. Political instability may inhibit innovation by increasing uncertainty for innovators and venture capitalists; it may lessen the effectiveness of SETI policy instruments by weakening the incentives they provide.

Moreover, research and innovation are crosscutting activities that involve the ministries of science and technology, higher education, health, agriculture, energy, mining, environment, water and planning among others. To be effective, research and innovation measures require co-ordination and coherence among government departments programmes and policies. Empirical studies over the past two decades show that governments find this difficult since their traditionally departmentalised structures are generally ill-suited to deal with cross-cutting policy issues such as research and innovation. Adopting a coherent approach entails not only co-ordinating a multitude of policy moves dictated by the core set of research and innovation policies such as those for higher education and entrepreneurship but also evaluating their possible interaction with policies pursuing other primary objectives such as the fiscal policy competition laws and regulations which provide the framework for innovation (OECD 2010).

12 To determine the mean value for a country, the data are standardized using the technique of matching percentiles. This method uses the country ranking reported by each individual source. It is useful for combining sources that have a different distribution. Whereas there is some information loss with this technique, it allows all reported scores to remain within the bounds of the CPI, i.e. between 0 and 100. A beta-transformation is then performed on scores. This increases the standard deviation among all countries included in the CPI and avoids a smaller standard deviation from year to year, one of the drawbacks of the matching percentiles technique. All of the standardized values for a country are then averaged, to determine a country's score. The CPI score and the ranking position are accompanied by the number of sources, high-low range, standard deviation and confidence range for each country. The confidence range is determined by a bootstrap (non-parametric) methodology, which allows inferences to be drawn from the underlying precision of the results. A 90% confidence range is then established, whereby there is a 5% probability that the value is either below or above this confidence range. Source: Transparency International.

CONSTRUCTING AN INNOVATION PROFILE: INDUSTRIAL POLICIES AND DEMAND FOR SETI

The national innovation systems paradigm usually characterizes the relationship among institutions that support and foster knowledge creation and firms that exploit this knowledge. This stream of work suggests that to maximize innovation, institutions within a country need to complement each other and work in tandem. Moreover, it suggests that technology policy aiming to create efficient institutional mechanisms for integrating the functions of knowledge production and knowledge commercialization is likely to enhance a country's ability to sustain an innovative technology system over time (Stern *et al.*, 2002).

Innovation policy is usually defined as a set of policy instruments and appropriate institutions that assist in the local adoption of technologies and the introduction new products and services to the market. This may include adapting imported technologies to local conditions. Appropriate technology and innovation policies can be derived only from an understanding of how technical change takes place in local enterprises. Whereas companies everywhere have to make an effort to master or adapt existing technologies, a high level of basic knowledge and capabilities exists in most firms in mature industrial countries or can be easily acquired from other firms, labour markets, supporting institutions, or consultants. This makes it relatively easy and routine to master existing technologies. In developing countries by contrast not only is the internal knowledge base for mastering technologies relatively weak; the support network provided by other enterprises institutions and human capital also tends to be underdeveloped (Lall and Teubal, 1998).

Promoting innovation at firm level involves both public and private sectors (e.g. entrepreneurs, researchers, public servants, financiers etc.) and may include civil society organizations. Successfully launching and running initiatives involving innovation requires aligning interests of numerous stakeholders. This implies a difficult co-ordination process. The state is often best placed for the role of initiating, guiding, or facilitating co-ordination, owing to its stronger convening and co-ordinating power, and it has an important tool available only to it: incentives can be designed in public policies to influence behaviours and the relations of actors involved in the innovation process. For example, by aligning incentives with stakeholders, establishing risk-sharing mechanisms for multi-stakeholder ventures, and promoting knowledge sharing and dissemination, the state significantly promotes the co-ordination process. In developing countries, inadequate public sector involvement to co-ordinate stakeholders may stymie innovation.

The productive sector and its markets represent demand for SETI. The characteristics and behaviour of this SETI demand over time determine whether or not it is possible in the economy of a country to absorb the results of research obtained by universities and research centres (SETI supply) so as to generate new goods and services. To handle new knowledge and incorporate it in production, a firm has to make a number of technological decisions. Some are clearly concerned with the choice of alternatives regarding the source of new knowledge, the source of equipment and the use of such inputs. Others have to do with the building-up of the firm's capacity (technical and design groups, administrative/organisational information) to make such choices to adapt foreign technology and to incorporate new knowledge effectively into production. The adaptation of foreign technology is particularly important since it contributes to the optimal use of foreign technology and can link foreign technology to domestic S&T.

Supply and demand analysis should guide the public sector's involvement. A lack of adequate understanding of the characteristics and potentialities of the SETI supply and demand in a given country will trigger failure for any research and innovation policies policy instruments and incentives put in place.

In recent years, a growing number of surveys have studied the behaviour of entrepreneurship and innovation in different countries. Some of these provide valuable information on Israel (World Economic Forum, 2014; INSEAD *et al.*, 2015). See Table 9 for a series of subjective and objective indicators showing the perception of research and innovation in Israel.

Table 9: Selected subjective and objective measurements for Israel

Subjective index: World Economic Forum Executive Opinion Survey 2014 (Max. value = 7)			Objective Measurements		
Indicator	Value 1–7	Rank out of 144	Indicator	Value	Rank out of 144
Quality of the education system	3.7	69	Secondary enrolment gross percentage (2014)	101.7	26
Quality of Math and Science Education	4.0	79	Tertiary education enrolment gross percentage (2014)	65.8	30
Quality of management schools	4.9	32	School life expectancy in years (2012)	15.7	28
Internet access in schools	5.5	32	Individuals using internet percent (2014)	70.8	37
Availability of research and training services	4.6	38	Broadband internet subscriptions/100 inhabitants (2013)	25.7	24
Extent of staff training	4.0	76	Int'l internet bandwidth kb/s per user (2013)	100.5	29
Availability of latest technology	6.3	10	Mobile broadband subscriptions/100 inhabitants (2014)	53	37
Firm level technology absorption	6.0	5	Mobile telephone subscriptions/100 inhabitants (2013)	122.8	53
FDI and technology transfer	5.4	11	Fixed telephone lines/100 pop (2012)	44.8	15
Capacity for innovation	5.8	3	Patent families filed in 3+ offices/bn PPP$ GDP (2013)	2.9	6
Quality of scientific research institutions	6.3	3	Scientific articles/bn PPP$ GDP (2014)*	46.4	11
Company spending on R&D	5.3	7	Citable scientific articles-H index (2014)	496	15
University-industry collaboration in R&D	5.5	7	Life expectancy at birth in years (2014)	81.7	10
Government procurement of advanced tech products	4.3	9	Women in labour force ratio to men (2013)	0.88	36
Availability of scientists and engineers	5.2	10	Imports as a percentage of GDP (2014)	32.5	108

Note: The subjective indicators (from a low of 1 to a high of 7) are based on a series of executive opinion surveys prepared by the World Economic Forum whereas the objective indicators (related to research and innovation) were originally produced by other agencies and have been compiled by the World Economic Forum. Both columns show Israel's ranking out of 148 nations for each individual indicator. INSEAD *et al.* (2015) have also produced similar surveys and data. *Taken from INSEAD et al (2015)

Source: World Economic Forum (2014) *Global Competitiveness Report* 2014–2015

Characteristics of the manufacturing sector

In recent years, several executive polls have been conducted by different international organizations to measure the dynamism of innovation and the competitiveness of different countries (i.e. World Economic Forum, 2014; INSEAD *et al.*, 2015).

Figure 12 shows the results of an executive poll designed to determine the major difficulties faced by the productive sector in promoting innovation and improving competitiveness. The poll reveals that foreign currency regulations lack of access to financing an inadequately educated workforce insufficient capacity to innovate and inadequate supply of infrastructure are deemed the major hurdles.

INSEAD *et al.* (2015) made a systematic analysis of the major components of innovation in 143 countries. Their study analyses seven pillars: business sophistication; creative output; human capital and research; infrastructure; institutions; knowledge and technology output and; market sophistication. Figure 13 shows the cartographic results obtained by Israel for each individual pillar. In 2014, Israel came out 15th out of 144 countries with an integrated value of 55.5 out of 100 maximum points. Institutions and market sophistication are the pillars that have the highest scores.

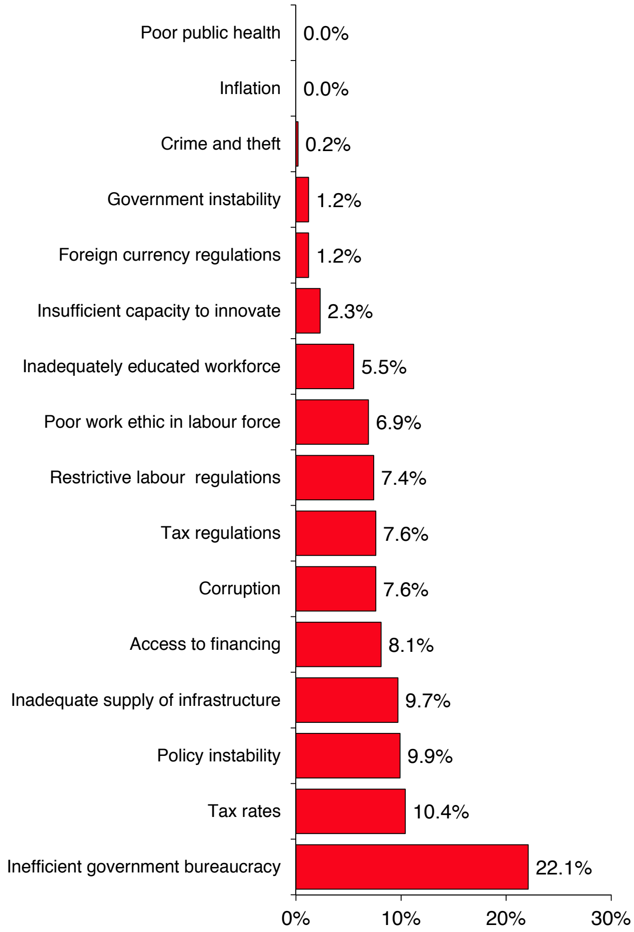


Figure 12: Major difficulties in promoting innovation and competitiveness in Israel, 2014. Source: World Economic Forum (2014)

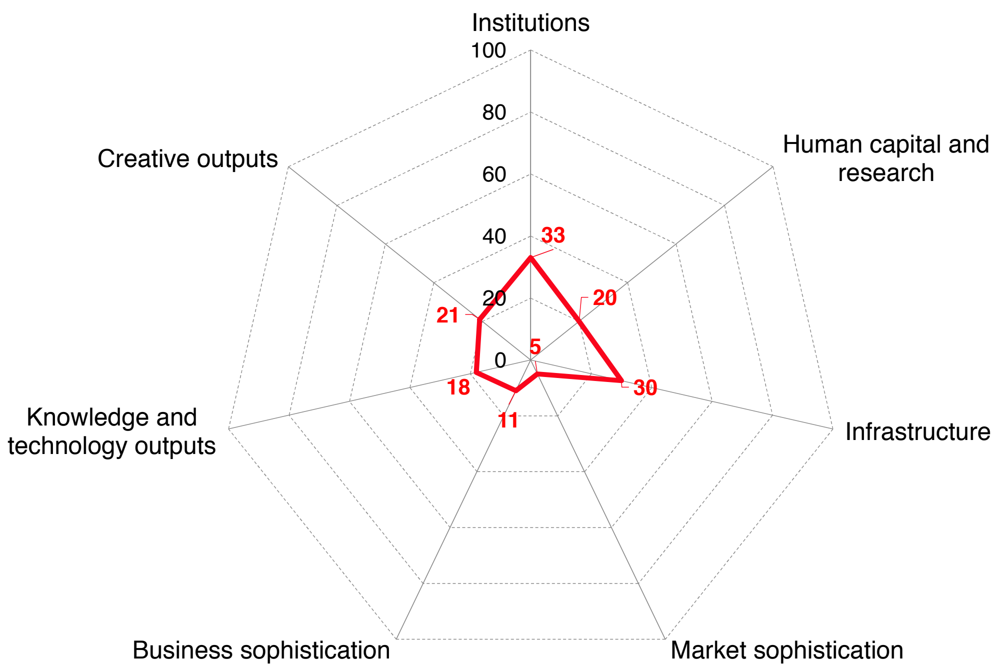


Figure 13: Israel's scores (0–100) for each individual pillar of innovation taking into account the estimation of the Global Innovation Index. Source: INSEAD *et al.* (2015)

Trends and Drivers of Macro-Economic Performance

In the past decade, the GDP in Israel has risen significantly. Data shows that between the years 2003 and 2013, the GDP grew by 36%, while the GDP per capita rose by 23% (Figure 5). Israel's high economic performance in the past two decades can be explained by the dominance of the high-technology sector (high technology and medium-technology manufacturing and in particular the ICT manufacturing and services sectors) which constitutes the economy main growth engine.

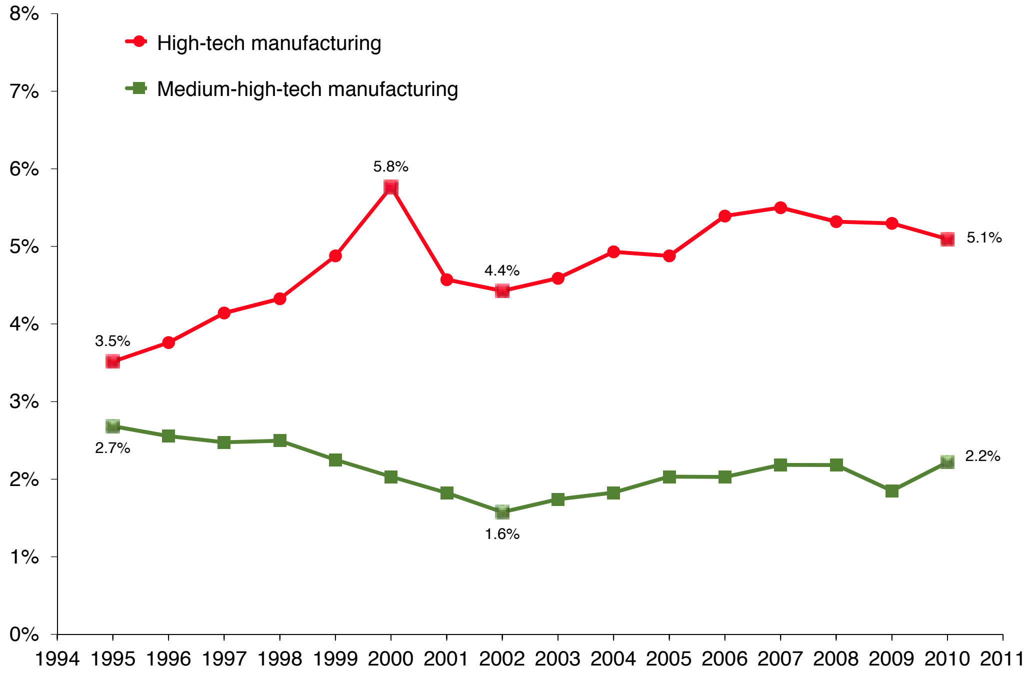


Figure 14: Share of high-technology and medium-high-technology manufacturing in GDP. Source: Central Bureau of Statistics. Data processing by SNI

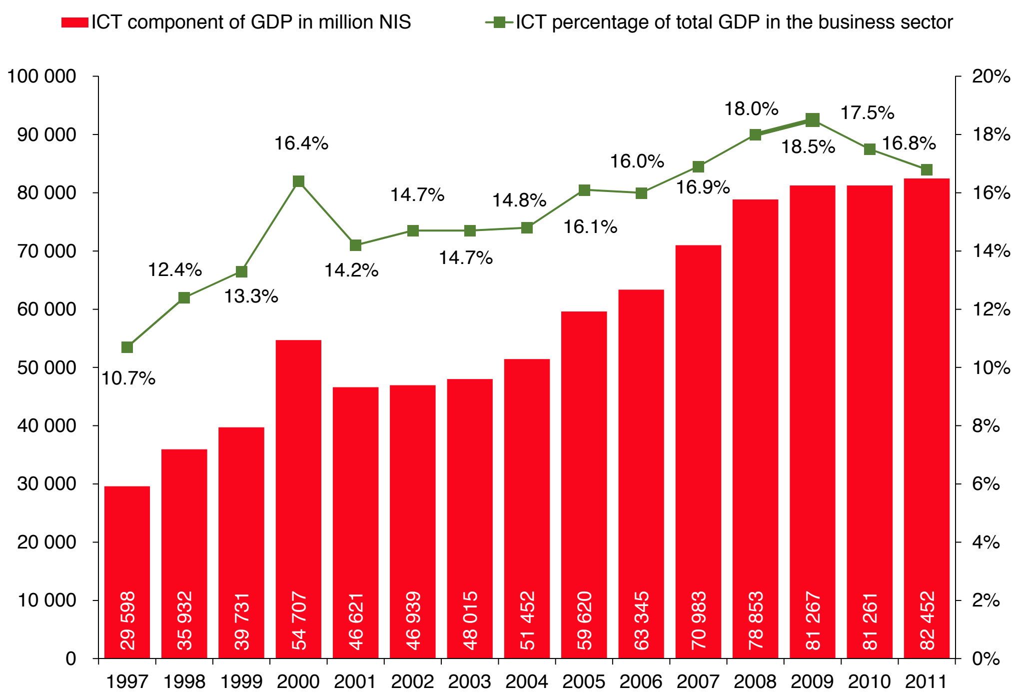


Figure 15: Share of ICT of total business sector GDP. Source: OECD Stat and Central Bureau of Statistics

Figure 14 presents the share of high technology and medium-high-technology manufacturing in Israel's GDP. Data shows that in recent years the share of these two manufacturing sectors constituted approximately 7.3% out of the GDP. The main driver for growth is the ICT manufacturing[13] and ICT service[14] sectors which, in 2011, constituted approximately 17% of the business sector GDP. Overall, 65% of ICT gross product can be traced to the service industries and 35% originates from manufacturing industries (Getz *et al.*, 2013).

Total factor productivity (TFP)

Total Factor Productivity (TFP) is a variable that accounts for effects in total output not caused by traditionally measured inputs of labour and capital. TFP can be taken as a measure of an economy's long-term technological change or technological dynamism, if all other inputs are fully taken into account. TFP cannot be measured directly. Instead, it is a residual, often called the *Solow residual*, which accounts for effects in total output not caused by inputs. The main components explaining TFP growth are technological innovations, technological improvements and the scope of R&D in the country (Getz *et al.*, 2013). Since this indicator is also affected by non-recurrent factors, it is best to use an average over several years, as exhibited in Figure 16. As can be seen from the data, the average TFP growth in Israel during the years 2005 to 2010 was 1.3%, topped only by the Republic of Korea, another country that exhibits strong technological innovative capabilities.

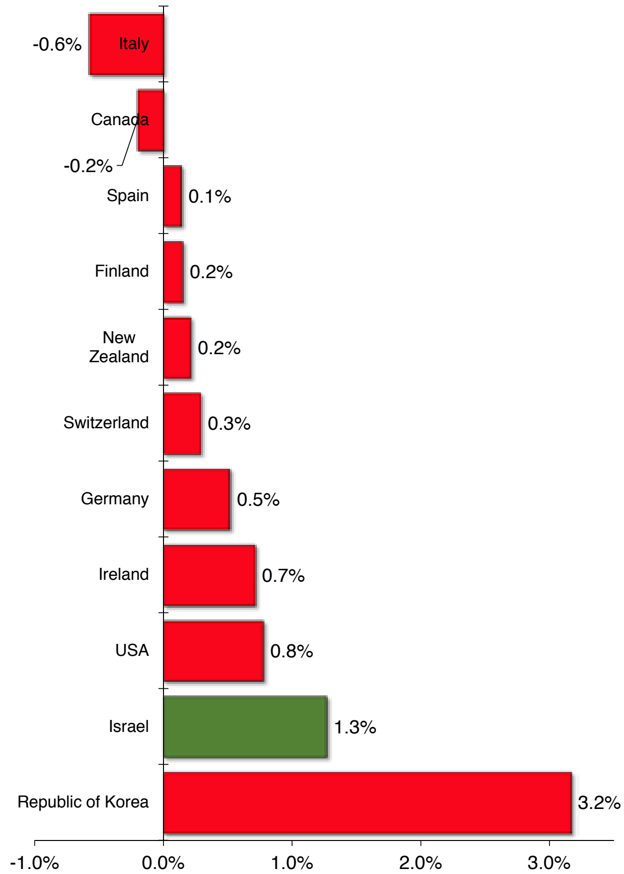


Figure 16: Average growth-rate in Total Factor Productivity (TFP) for a selection of developed countries, percent, 2005–2010. Source: OECD Stat and Central Bureau of Statistics

13 ICT manufacturing industries are industries that produce ICT equipment such as office machinery, accounting machinery, and computers, electronic components, electronic communication equipment and industrial control and supervision equipment (excluding medical equipment).

14 ICT service industries are communication services, computerization and software services, research and development services, and start-ups.

Employment by sectors and firms

The Israeli economy can be divided into five main sectors: manufacturing sector, service sector (public services such as education, health and welfare; services in the business sector), electricity and water, construction and agriculture (Figure 17). The service sector is the main employer in the economy. In 2012, 80.3% of the workforce was employed in this sector and their share in the Net Domestic Product (in 2010 prices) was 79.4%. The manufacturing sector constituted 12.9% of total employment. Chemical products and computers, electronic and optical products are this sector's two main industries.

Table 10 exhibits the distribution of firms by size and the distribution of employees in the manufacturing sector by firm size. As can be seen, almost 90% of Israeli manufacturing firms are small-medium business establishments employing less than 50 employees. The share of these firms (employing less than 50 workers) out of total employment, however, is only 26%. Medium-large firms (50 employees or more) employ approximately 74% of the employees in the manufacturing sector.

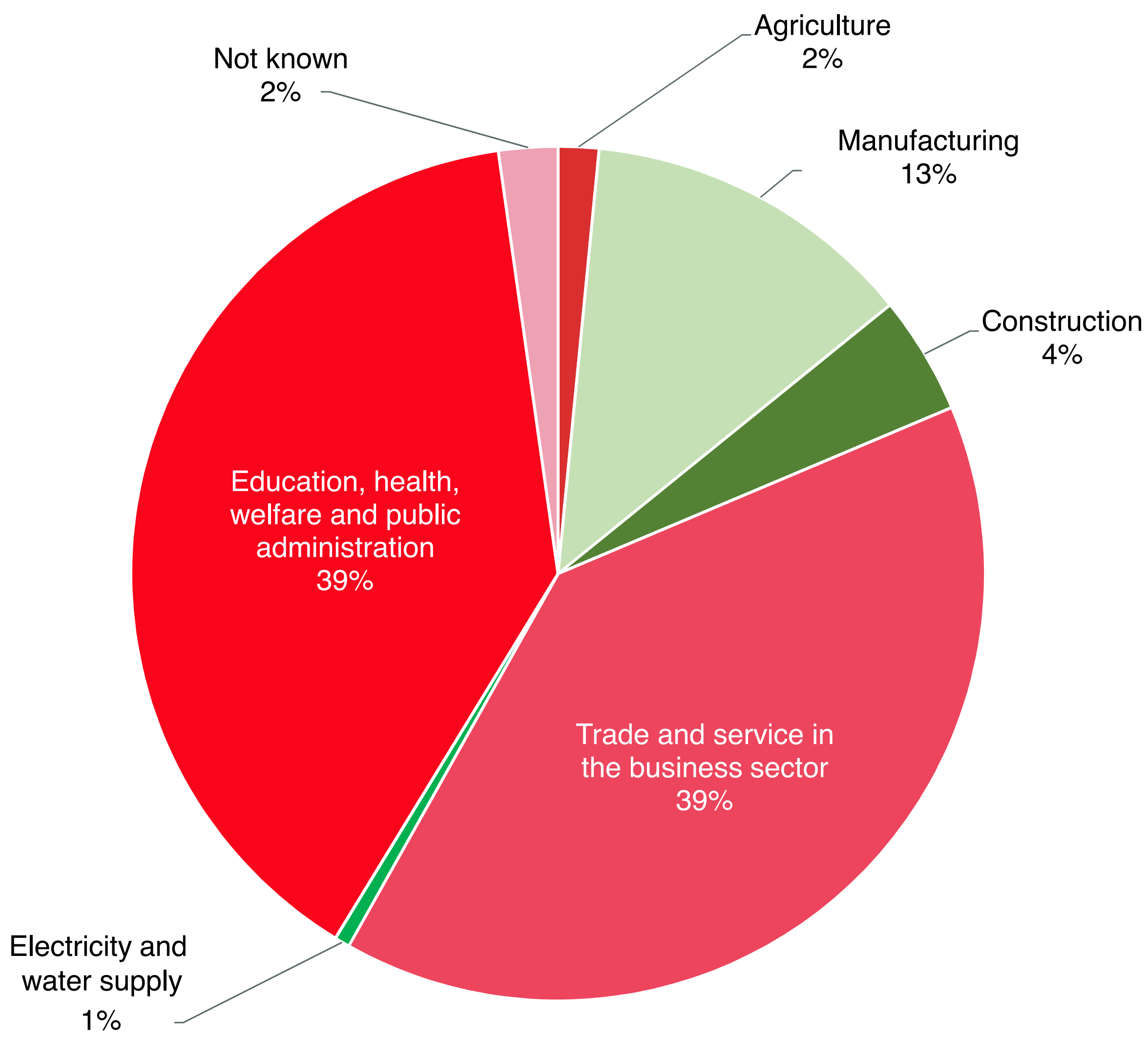


Figure 17: Share of employees by industrial sector, 2012. Source: Central Bureau of Statistics, 2013

Table 10: Firms and jobs in manufacturing, mining and quarrying, by size, monthly averages, 2012

Size Group [number of jobs in firm]	Firms		Employees	
	N	Percent	N [000']	Percent
1–4	5 580	46.6	12.5	3.5
5–9	2 065	17.3	13.7	3.8
10–19	1 666	13.9	23.4	6.4
20–29	662	5.5	16.0	4.4
30–49	720	6.0	28.4	7.8
50–99	622	5.2	45.5	12.5
100–299	477	4.0	84.5	23.3
300+	170	1.4	138.4	38.2
Total	11 962	100.0	362.3	100.0

Source: Central Bureau of Statistics, 2013

Labour productivity and the dual economy

Despite Israel's proven innovative abilities, the country's labour productivity is among the lowest in the OECD (Ben David, 2013). In 2014, the productivity level in Israel, measured as GDP per work hour, occupied the 25th place among OECD member states (see Figure 18).

During recent years, Israel's productivity level has risen only by 0.74%, as compared to 4.4% in the Republic of Korea, 3.7% in Ireland, 1.9% in Sweden and 1.9% in the United States (OECD, 2013). It is important to note that labour productivity in Israel differs by technological intensity. Labour productivity in the high-technology and the medium-high technology industries is significantly higher than in other manufacturing industries. In the service sector, the highest levels of production per employer are in the technology-intensive industries (for example, computers, R&D services and communications) and in the knowledge-intensive industries (Getz *et al.*, 2013).

Since 2007, policy makers in Israel[15] raised the problem of dual economy that emerges between the high-tech and low-tech industrial sectors. Israel's dual economy consists of a relatively small, yet world-class high-tech sector which serves as the engine of the economy, on the one hand, and the much larger but less efficient traditional industry and services sectors, on the other hand. The economic contribution of the flourishing high-tech sector does not necessarily always spill over into other sectors of the economy.

Over time, this 'dual economic structure' has led to a well-paid labour force living at the 'core' of the country, namely the Tel Aviv metropolitan area, and a poorly paid labour force living primarily on the periphery. The growing socio-economic gap that has resulted from the structure of the economy and the concentration of wealth among the upper 1% is having a destabilizing effect on society (Trajtenberg, 2006; Brodet, 2008; Fisher and Eilan, 2011).

As mentioned, in the medium- and high-tech industries, labour productivity is significantly higher than in other manufacturing industries. The medium- and high-tech manufacturing sectors account for about 13% of GDP and 7% of total employment, although their output contributes 46% of industrial exports, as mentioned earlier. The main industries in the manufacturing sector are: chemical and pharmaceutical products, and computers, electronic and optical products (Getz *et al.*, 2013).

15 National Economic Council, Socio-Economic agenda for Israel: 2008–2010.

It is to be considered whether public policy recommendations and related specific policy instruments could be designed to promote the generation of R&D spin-offs and diffusion of innovation skills from these high and mid-high tech sectors to the mid and low tech industrial sectors.

García-Torres (2014) considered that any diversion of a major part of the government resources intended to support industrial R&D to other new fields would cause extensive economic damage. Taking into account that high-tech exports, predominantly based on ICT, are responsible for close to half of Israeli exports, a diversion of resources from ICT would deprive Israeli industry of an important element of its competitive capacity.

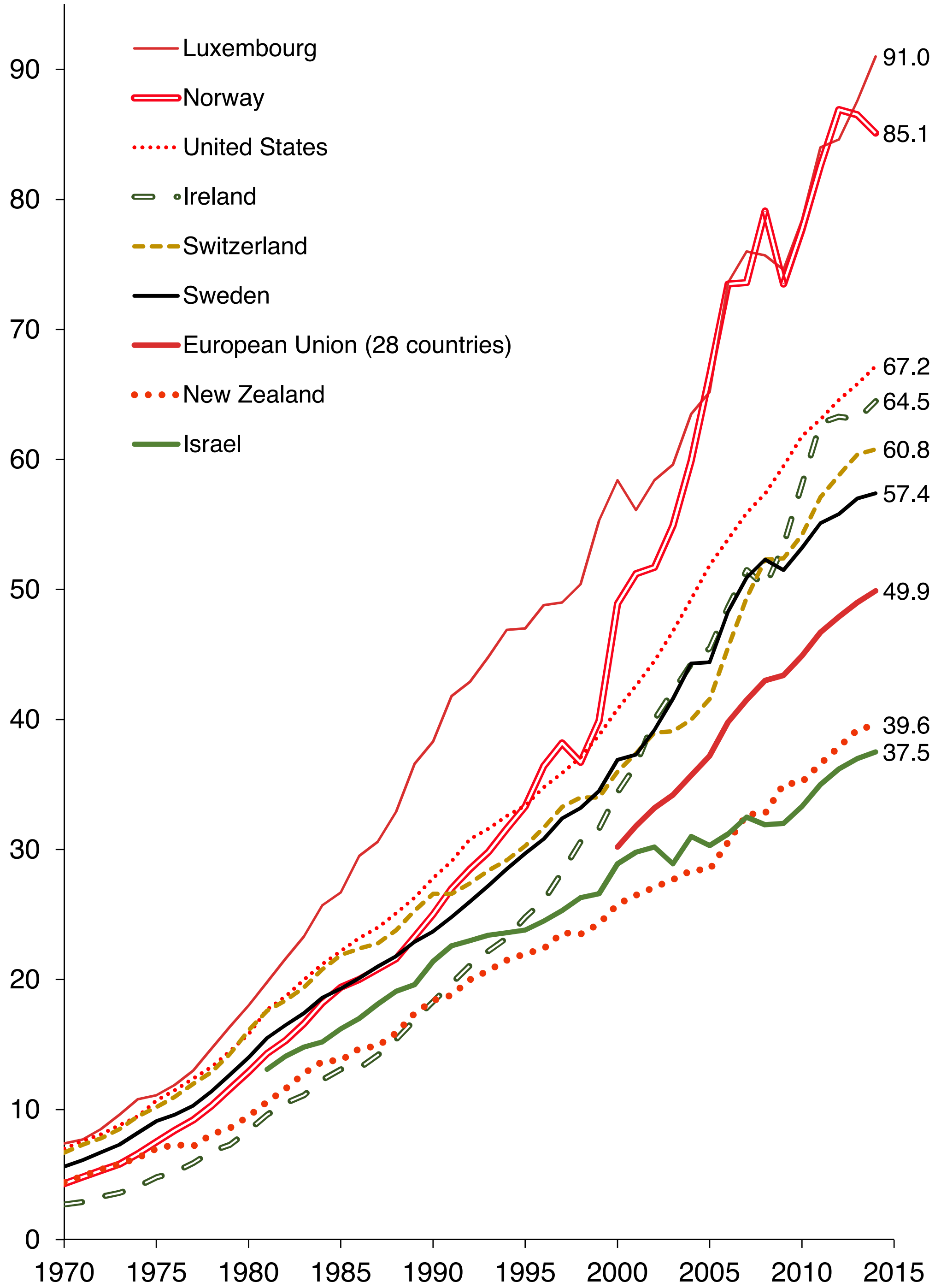


Figure 18: GDP per worked hour in US dollars. Source: OECD.Stats

BOX 2 – FOSTERING INNOVATION IN TRADITIONAL INDUSTRIES IN ISRAEL

Traditional industry includes the low-tech manufacturing sector (e.g. food, tobacco, textiles, paper, printing, furniture, etc.) and the medium-low-tech manufacturing sector (mining and quarrying, rubber and plastic, basic metals, metal products, ferrous and nonferrous minerals, and jewellery). Traditional industry in Israel suffers from low productivity per employee and from slow rate of improvement in productivity. Due to its considerable share in production and in employment, long-term economic growth cannot be attained without focusing on improving the productivity of this industry. The key to achieving this objective is to provide incentives to employers so as to implement innovation (including assimilation of advanced technologies, openness to organizational changes/business model modifications), and so as to increase export's share in output (Brodet, 2008).

The Israel *2028 Strategic Plan* recommends taking the following measures in order to encourage innovation in traditional industries and to foster productivity improvements:

- Adapt specially tailored versions of Office of Chief Scientist (OCS) programmes that were originally created for high-technology sectors, such as Magnet and Tnufa, to suit traditional industries.
- Initiate specific programmes for encouraging collaboration between university laboratories and traditional industries.
- Encourage the creation of cooperative consortia of technology users.
- Grant tax credits for employers in traditional industries in the periphery, to expand employment in their businesses.
- Facilitate mergers and acquisitions that enable the penetration of innovation and R&D activity, in order to support organizations that have a critical mass.
- Increase awareness among manufacturers about the importance of innovation, and about support available for this purpose.
- Initiate professional industrialist forums for specific industries involved in innovation.

A recent report prepared by Fortuna (2012) on leveraging Israel's traditional (classical) industry has identified small classical companies as a neglected segment that has potential. According to his report, the major barriers that postpone a breakthrough in small enterprises are:

- Managers' unwillingness to change long-established patterns of thinking.
- Lack of systematic support suited to their needs (business, organizational, operational, financial, and technological).
- Scale and language gaps, which complicate communication between small enterprises and government support mechanisms.
- Lack of knowledge regarding export potential and lack of courage to dream about exporting (Fortuna, 2012).

The report recommends taking the following steps:

- Designate an official entity to initiate a process of integrating and coordinating all government programmes, so as to ensure they are compatible with the characteristics of small enterprises, and which will effectively guide small enterprises so as to facilitate use of these programmes.

- Support the concept of ‘anchor industries’ leading to upgrading their subcontractors, in terms of efficiency and quality.
- Support the establishment of ‘clusters’ on the basis of branch, sector, or geographic proximity, leading to economies of scale.
- Eliminate the term ‘low-tech’ from the professional and public jargon as part of a communications effort to improve image and to set higher expectations for traditional industries (Fortuna, 2012).

Policy Tools for Supporting and Encouraging Innovation in Traditional Industries

The Office of the Chief Scientist (OCS) of the Ministry of Economy, as part of its R&D Fund, operates a special programme designed to encourage the implementation of innovation in traditional industry. This special programme runs parallel to the main track, which supports industrial R&D. The special programme funds up to 50% of an approved R&D plan. Companies conducting R&D activities in peripheral regions are eligible for a grant of 60%. There is no limit to the sum of the grant, however industrial firms need to provide justification for the requested amount based on the technological innovation and marketing potential. Since the launch of the programme in 2005, 500 traditional industry enterprises have approached the OCS; they submitted 1 320 requests for funding projects, totalling about NIS 3.1 billion. Of these requests, 1050 projects from 392 companies were approved, with a total budget of NIS 1.4 billion. The total amount of R&D grants was NIS 786 million. Among those supported were companies from the following industries: plastics, rubber, metal machining using CNC machine tools, glass, ceramics, building materials, textiles, wood, leather, paper, jewellery and food (OCS, 2014).

Doing business in Israel

An economy with an efficient bureaucracy and rules of governance that facilitates entrepreneurship and creativity among individuals, and that provides an enabling environment for people to realize their full potential, can enhance living standards and promote growth and shared prosperity. Table 11 shows a selection of countries with population sizes comparable to that of Israel (+/- 30%), in which national policies facilitate doing business. The data presented was collected by the World Bank Group’s Doing Business initiative, which tries to track and measure (with a series of normalized indicators) how easy it is to do business, trade and exchange in a given country (World Bank, 2015). The numbers presented in Table 11 are organized by the global rankings of over 189 countries, and by the main components that characterize doing business. The data is consistent with other opinion polls done by different organizations (INSEAD *et al.*, 2015; World Economic Forum, 2014). Israel occupied the 53th world rank in ease of doing business, far below what might be expected from its scientific productivity or human development index ranks. On the one hand, the negative value of political stability/absence of violence (see pages 20–23) prevents foreign companies to make long-term investments. On the other hand, Israel recently made paying taxes more costly for companies by increasing the corporate income tax rate, the rate for social security contributions paid by employers for the upper wage bracket employees, and by adjusting municipal taxes.

Table 11: Ease of doing business in selective group of countries with population sizes similar to Israel, 2015

Country	Population [million inhabitants]	Ease of doing business world rank 2016	Starting a business	Dealing with construction permits	Getting electricity	Registering property	Getting credit	Protecting minority investors	Paying taxes	Trading across borders	Enforcing contracts	Resolving insolvency
Singapore	5.4	1	10	1	6	17	19	1	5	41	1	27
Hong Kong	7.2	5	4	7	9	59	19	1	4	47	22	26
Switzerland	8.1	20	69	45	5	16	52	78	18	22	22	41
Austria	8.5	21	106	47	17	26	59	36	74	1	6	18
Portugal	10.5	23	13	36	25	27	97	66	65	1	20	8
Slovak Rep.	5.4	29	68	84	48	5	42	88	73	1	63	33
Bulgaria	7.3	38	52	51	100	63	28	14	88	20	52	48
Hungary	9.9	42	55	88	117	29	19	81	95	1	23	65
Israel	8.1	53	56	96	91	127	42	8	103	58	77	29
Serbia	7.2	59	65	139	63	73	59	81	143	23	73	50

Source: Doing Business 2016: Measuring Regulatory Quality and Efficiency, International Bank for Reconstruction and Development and World Bank (2015)

Characteristics of merchandise exports

The effect of exports on economic growth depends on the content of value-added and the generation of linkages in the production structure. In turn, an increase in the proportion of value added is sensitive to the technological content of the goods and services in question. Countries that export goods associated with higher productivity levels usually grow more rapidly. Compared to products of low-technological content or those based on natural resources, the production and export of medium- or high-technology goods requires a higher level of physical and human capital and involves more innovation-intensive activities. Governments are interested in setting up support programmes to enable firms to increase their export sales given the positive impact that a surge in exports has on the economic growth and competitiveness of a country.

To visualize research and innovation as components of merchandise exports over time Figure 19 shows the evolution between 1988 and 2013 of manufactured exports as a percentage of merchandise exports against high-tech exports expressed as a percentage of all manufactured exports. Over the past three decades between 82% and 94% of all Israel's exports were manufactured products and within them 10–20% were high-tech products. It is very interesting to note that between 1988 and 1998 the manufactured and high-tech components of all exports were continually increasing, followed by a drop between 1999 and 2007 and a recovery afterwards (Figure 20). The last measurements (2012–2014) show that 93% of total exports were manufactured products, and of these exports, 16% were high-tech products (2012–2013)[16].

16 When this publication was prepared, no measurement of the high-tech component was published for the year 2014.

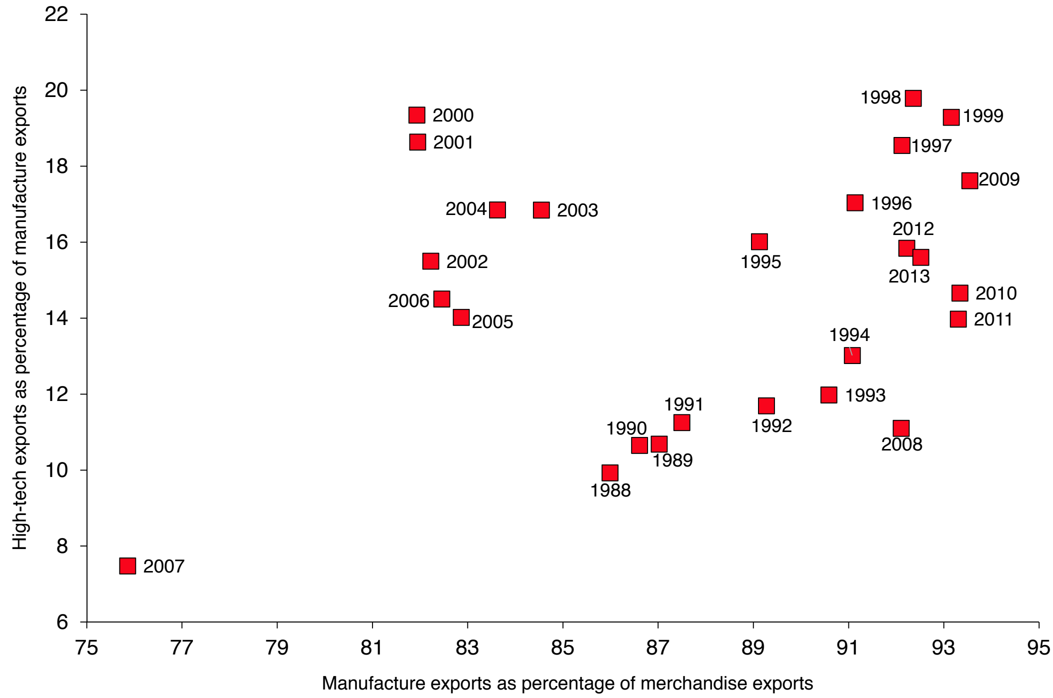


Figure 19: High-tech exports as a percentage of manufactured exports versus manufactured exports as a percentage of merchandise exports from Israel, 1988–2013. Source: UNESCO based on raw data provided by World Bank databank (August 2015)

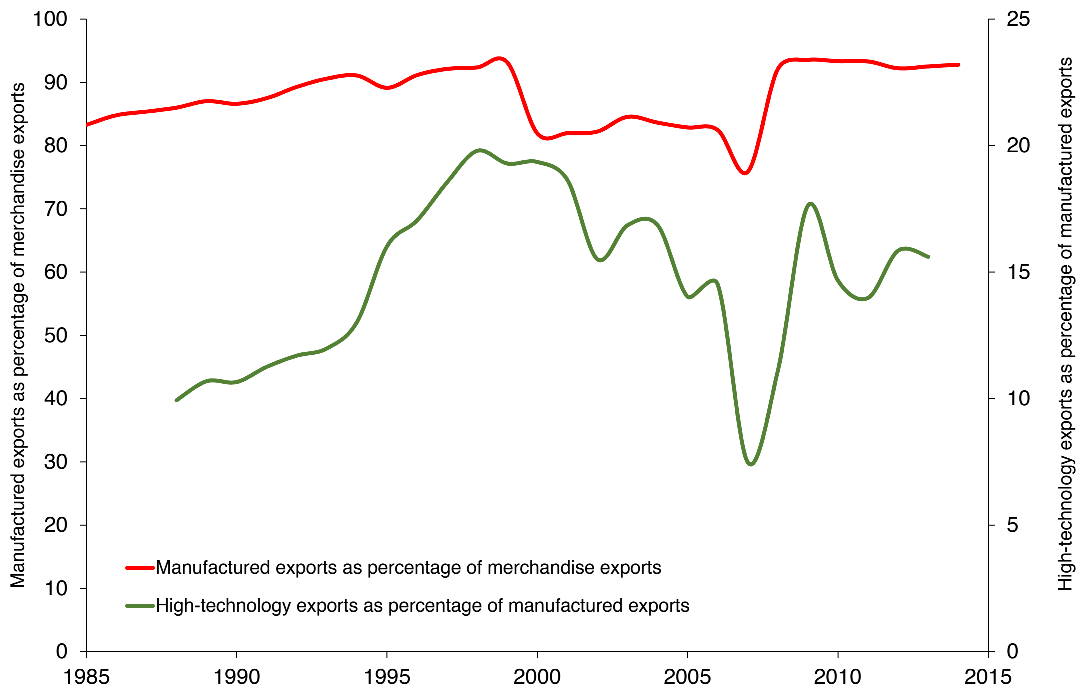


Figure 20: Evolution of high-tech exports as a percentage of manufactured exports and manufactured exports as a percentage of merchandise exports from Israel, 1988–2013. Source: UNESCO based on raw data provided by World Bank databank (August 2015)

HIGH-TECH INDUSTRY AND VENTURE CAPITAL FUNDS

The first global technology firms established in Israel were Motorola (1948) and IBM (1949). The first Israeli-owned technological firms were Tadiran and Elron Electronics, founded in 1962. Many other Israeli firms developed and expanded their activities in the country due to their strong ties with the Israeli military (Braznitz, 2007). Israeli defence industries have traditionally focused on components, electronics, avionics and other systems. The development of these auxiliary systems has given the Israeli high-technology industry an edge for civilian spin-offs in the software, communications, and internet sectors. Civilian applications of skills derived from military industries have become increasingly important. For example, the need for better night-vision equipment led to the development of image processing (Globes, 2000).

The venture capital (VC) industry has played a fundamental role in the dramatic development of the high-technology sector in Israel over the past years (Avnimelech and Teubal, 2005). VC funds are enterprises that raise capital for investment in start-up companies. Since such enterprises invest in the cutting edge of scientific research, the extent of VC raised is considered a good proxy for the country's R&D activity. The Israeli VC industry has significantly grown in the past two decades. Several factors have contributed to the growth of this industry. These include tax exemptions on Israeli VC investments, funds established in collaboration with large international banks and financial companies and the involvement of major organizations desiring to capitalize on Israeli high-technology companies (BDO Israel, 2014). Among the latter are the world's largest multinational companies such as IBM, Intel, Apple, Microsoft, Cisco, Google, Facebook, Siemens, Samsung, Oracle and others.

By providing and allocating funding, VC has served as a link between start-up companies and investors, and is regarded as an essential infrastructure for any technological environment. It is also an effective tool for financing, supporting and guiding companies toward a successful course. Today, Israel is considered to be one of the largest venues for venture capital investment in the world, outside the US (Breznitz and Zehavi, 2007; IVC Research Centre, 2012).

The 2008 economic crisis has significantly contracted Israel's VC market (Figure 21). Between the years 2008 and 2009, VC raised by Israeli firms plummeted by 46% from US$ 2 076 million to US$ 1 122 million. This was followed by a relatively mild upturn in 2010 (a 12.5% increase), bringing the total to US$ 1 262 million. An additional steep increase (69.5%) was recorded in 2011. In 2014, Israeli firms raised US$ 3 407 million in VC (a 43.3% increase compared to 2013).

The composition of investments made by VC funds has also varied in recent years. Table 12 shows that in 2008–2009, the share of investments that benefit final stage product development (late revenue growth) declined, wheras investments in mid-stage product development rose. The picture was different in 2011, by which time there was a steep increase in late revenue-growth stage investment, a decline in early stage, and a slight contraction in mid-stage as well. In 2013, investments at the mid-stage R&D grew at the expense of investments at the seed stage.

When looking at the distribution of VC investment by technological field (Table 13), the main trends observed in the last decade reveal a contraction of investment in ICT in contrast to its expansion for firms developing life-science products. The share of VC capital investment in ICT dropped from 69% in 2000 to 37% in 2013, while the share of investment in life sciences grew from 8% to 23%.

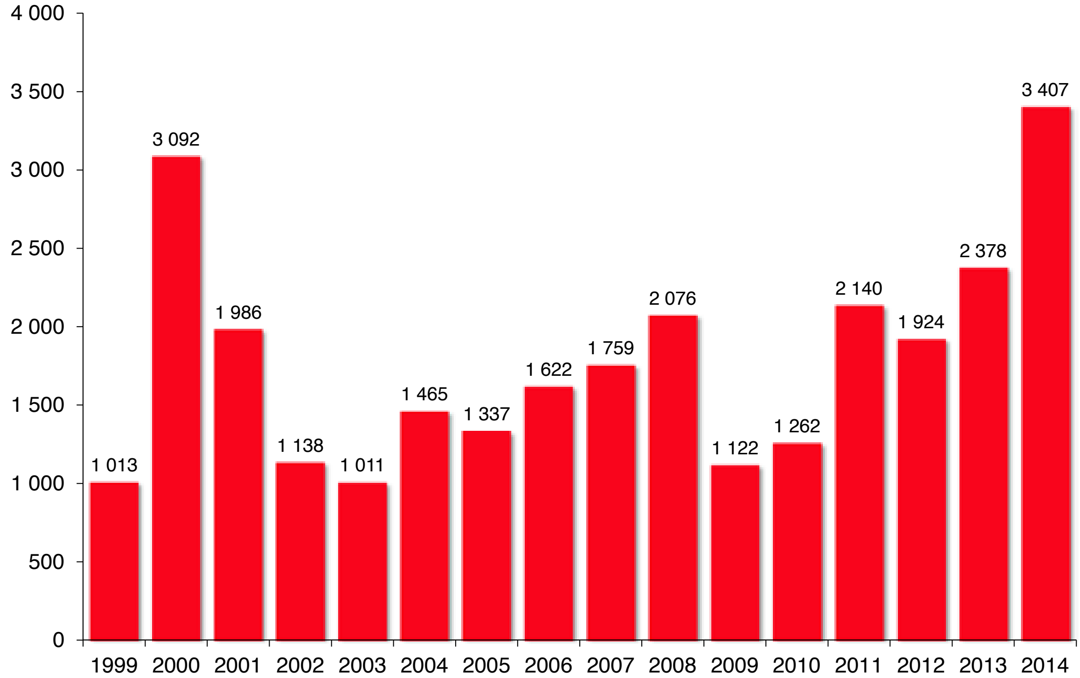


Figure 21: Venture capital raised by Israeli firms, in million US dollars. Source: IVC Research Centre

Table 12: Venture capital fund investments, by stage

Year	Growth Stage			
	Seed	Early R&D	Mid	Late revenue growth
2000	10%	38%	30%	22%
2001	5%	41%	32%	22%
2002	2%	35%	54%	9%
2003	6%	32%	49%	13%
2004	8%	24%	56%	12%
2005	8%	28%	53%	11%
2006	9%	31%	42%	19%
2007	8%	32%	38%	22%
2008	5%	36%	38%	21%
2009	6%	30%	49%	16%
2010	3%	35%	46%	16%
2011	4%	27%	42%	27%
2012	8%	32%	41%	19%
2013	5%	30%	47%	18%

Source: IVC Research Centre

Table 13: Israeli venture capital fund investments, by technological field of activity

Year	Field of Activity				
	Communications	Internet	Software	Life Sciences	Other
2000	39%	30%	16%	8%	6%
2001	42%	9%	20%	16%	13%
2002	37%	4%	18%	15%	26%
2003	35%	4%	18%	19%	24%
2004	29%	4%	22%	22%	23%
2005	35%	3%	17%	21%	24%
2006	24%	5%	22%	23%	26%
2007	21%	15%	13%	20%	31%
2008	25%	14%	20%	15%	27%
2009	20%	13%	23%	24%	20%
2010	19%	18%	11%	27%	23%
2011	20%	23%	19%	19%	19%
2012	16%	21%	17%	27%	19%
2013	17%	20%	21%	23%	19%

Source: IVC Research Centre

The role of multinational companies in driving innovation and economic growth in Israel

Multinational companies (MNCs) are central actors in the global innovation process. As a result, domestic innovation activities in host countries are affected by the location decisions taken by these global firms. There is a growing interest among countries in formulating policies aimed at attracting MNCs, especially those specializing in high technology and R&D activities (Getz *et al.*, 2014).

A considerable volume of evidence exists in the economic literature demonstrating the importance of supply-side factors to attract MNCs and FDI investments. Among these, Faeth (2009) classifies the government incentives that may be offered into three main categories: fiscal incentives (e.g. tax exemptions and credits, etc.), financial incentives (grants, subsidies, etc.) and other incentives (e.g. subsidized services and infrastructure, preferential treatment).

Additional location and investment considerations that were identified in the economic literature as important to global firms include: access to highly skilled human resources (Von Zedtwitz and Gassmann, 2002; Chung and Alcacer, 2002), stock of private R&D capital in host countries (Erken and Kleijn, 2010), access to high quality scientific infrastructure (Abramowsky *et al.*, 2007; Karlsson and Anderson, 2005), existence of agglomeration economies and economies of scales (Head *et al.*, 1999; Head and Mayer, 2004), tapping informal networks of knowledge (Von Zedtwitz and Gassmann, 2002), market size, e.g. China and India (Shimizutani and Todo, 2008; Friedman 2011), the cost of R&D resources (UNCTAD, 2005; Ernst, 2006) and the degree of IP protection in the country (Athukorala and Kohpaiboon, 2005).

Due to government incentives and the availability of high-level human capital, Israel has become an attractive location for R&D centres of leading multinationals. R&D centres are Israeli subsidiaries of foreign multinational firms of which a key objective is carrying out technological research and development activities. These tasks are conducted in facilities based on local infrastructure and a local staff of scientists and engineers. Motorola was the first American firm to set up a branch in the country, in 1964. Microsoft and Cisco Systems built their first R&D centre outside the US in Israel and Motorola maintains its largest R&D centre in the world, outside the US, in Israel. Intel, which began its operations in Israel in 1974, has two manufacturing facilities and four R&D centres in the country.

According to the Israel Venture Capital Database (IVC), 264 foreign R&D centres are currently active in Israel. Most of these R&D centres are part of large international firms (mostly in the technological sector) that acquired Israeli companies in the past decade and transformed them into local research facilities.

The activity of a few R&D centres (e.g. Intel, Applied Materials, Motorola, and IBM) spans more than three decades. The activity of most R&D centres is concentrated in central Israel (Tel Aviv metropolitan area). This owes to the fact that the Israeli economy is characterized by a clear spatial dichotomy of its industry. Most of Israel's tertiary and quaternary sectors are located in the core region, whereas most of its primary and secondary industries are situated in the periphery (Frenkel and Leck, 2014). Shefer and Frenkel (1998) attribute the concentration of R&D activity in a region to the existence of a local innovation milieu. This distinct physical and human environment, which constitutes the main catalyst for innovation, is prevalent in the core region. It relies heavily on the existence of agglomeration economies, regional spillovers and collaboration among firms.

A recent study conducted by the Samuel Neaman Institute on the innovation of foreign R&D centres in Israel found that most R&D centres are small. Approximately 73% of them employ fewer than 100 workers. Only 6% of the R&D centres employ more than 500 workers (e.g. Intel, Applied Materials, HP, Motorola, IBM, and Marvell). The research found that almost two thirds of the R&D centres in Israel belong to American multinational firms and 20% to European firms. Nearly 27% of foreign R&D centres belong to the IT and Enterprise Software sectors. The Communication, Semiconductors and Life Science sectors constitute approximately 50% of these firms' activity in Israel (Getz *et al.*, 2014). According to Avnimelech and Teubal (2005) and Avidan–Shpalter (2012), the emphasis placed by multinational firms on these four sectors in Israel stems from the country's relative advantage in scientific infrastructure, skilled labour force and entrepreneurial culture. These important factors strongly foster R&D activity.

In 2011, foreign multinational companies were responsible for the employment of 33 000 workers through local subsidiaries (23 170 in R&D jobs)[17]. The share of foreign-controlled corporations out of total output and total jobs in the manufacturing sector in this year stood on 16.7% and 14%, respectively (Figure 22).

In 2011, the R&D centres spent a total of NIS 14.7 billion on R&D activity, an increase of 16% compared to 2010. Most of the R&D activity in the R&D centres is concentrated in the Scientific R&D division, in which the expenditure on R&D constituted 48% of all expenditure in R&D centres[18]. Table 14 presents key innovations developed by selected foreign R&D Centres in Israel.

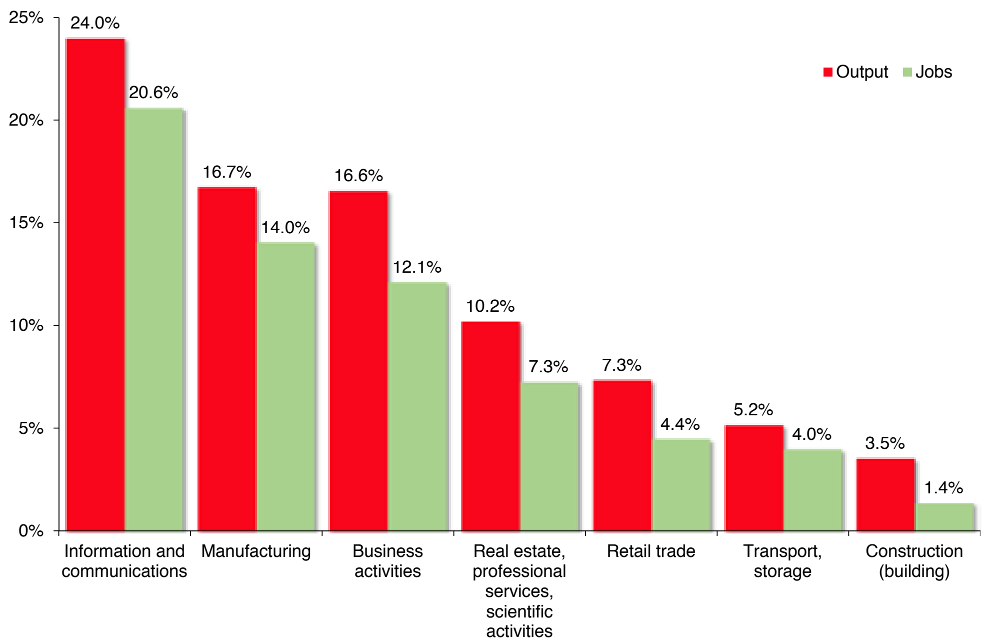


Figure 22: Share of foreign controlled corporations of total output and of total jobs, 2011. Source: Central Bureau of Statistics, 2014b

17 Central Bureau of Statistics (2014). URL: http://www1.cbs.gov.il/webpub/pub/text_page_eng.html?publ=56&CYear=2011&CMonth=1

18 Total expenditure on business R&D includes all expenditure on R&D in companies. The expenditure items included are labour cost, purchase of raw materials, payments to external factors, other expenditures and overhead and capital formation for the purpose of R&D. Central Bureau of Statistics (2014). URL: http://www1.cbs.gov.il/webpub/pub/text_page_eng.html?publ=56&CYear=2011&CMonth=1

Table 14: Key innovation of foreign R&D centres in Israel

R&D Centre	R&D Centre's Sector (IVC classification)	Number of R&D Centres in Israel	Establishment Year in Israel	Number of employees in Israel	Key innovations/ technologies/products
Apple	Semiconductors	3	2011	500	Development of hardware and chips for I-phone and I-pad
Samsung	Semiconductors and Communications	2	1999	250	Galaxy camera, eye tracking system for Galaxy S4 smartphone
Yahoo!	Internet	2	2008	50	Time traveller application, smart advertising (market segmentation)
Google	Internet	2	2007	250	Google autocomplete, Live results, Google related, Google instant, Google analytics
Intel	Semiconductors	5	1974	8 500	Pentium M microprocessor, Sandy Bridge and Ivy bridge family of processors
Microsoft	IT and Enterprise Software	2	1989	800	Business Intelligence in the Cloud and in Office, XBOX Analytics: building a novel real-time recommendations platform for the Microsoft entertainment business
General Motors	Miscellaneous Technologies	1	2011	60	Autonomous Vehicles; Human Machine Interface (HMI); Connected Vehicle
Qualcomm	Semiconductors and Communications	3	1993	260	Wi-Fi technology and the next generation of wireless LAN connectivity; Mobile enterprise security technologies; Qualcomm Snapdragon Mobile Development Platforms; Digital pen and gestures based on ultrasound technology
HP	Miscellaneous Technologies	4	1994	5 700	Enterprise Swarm; Automatic Print Quality Inspection; Semantic Automation from Screen Capture; HP Indigo Photo Enhancement Server
SanDisk	Semiconductors	3	2006	700	Trusted Flash technology; digital cameras (with Zoran); SSD drivers
IBM	IT and Enterprise Software; Semiconductors	3	1949	1 000+	ECO-2000 Optimized Crew Scheduling System; Websphere Content Discovery Server; mobile shopping app

Sources: Cohen, 2013, and Ministry of Economy. URL: http://www.investinisrael.gov.il/

Support of industrial R&D by the Office of the Chief Scientist (OCS)

Although R&D is widely perceived as a main catalyst for the growth and development of firms, it is considered as a risky investment. As a result, R&D investment by the private sector can be scarce – a serious obstacle to the goal of maintaining Israel's lasting competitive edge in applied innovation. The government's willingness to share in this risk greatly aids in both reducing uncertainty and in ensuring successful fruition of the investment (OCS, 2013).

The high-technology sector in Israel has made a giant leap in the course of the past thirty years both by domestic and international standards. There is no doubt that government policy was a key factor in the early success of this sector. The beginning of government support for industrial R&D in Israel dates back to 1968. At that time a government commission recommended the creation of the Office of the Chief Scientist (OCS) at the Ministry of Industry and Commerce (currently the Ministry of Economy), with the mandate to subsidize commercial R&D projects undertaken by private firms. Support was restricted until then to the National R&D Labs, and to academic R&D, in addition to the weighty resources that were devoted to defence-related R&D and to agricultural research (Trajtenberg, 2000). The OCS administers all government-sponsored support of R&D within Israeli industry. It operates through the R&D Fund, as well as a wide spectrum of domestic and international programmes, agreements and collaborations. The OCS supports hundreds of projects annually, ranging from unripe concepts within a pre-seed framework, to incubator and start-up companies, to autonomous industrial R&D enterprises (Trajtenberg, 2000; OCS, 2013).

All OCS programmes and instruments are empowered by the Law for the Encouragement of Industrial R&D, which is commonly known as the R&D Law, enacted in 1985. This important piece of legislation defines the parameters of government policy towards industrial R&D. The stated goal of the legislation is to develop science-based, export-oriented industries, which will promote employment and improve the balance of payments. The legislation provides the means to expand and exploit the country's technological and scientific infrastructure, and leverage its high-skilled human resources (OCS, 2013). At the heart of the law is a programme of financial incentives. Companies – whether big corporations or small start-ups – which meet certain eligibility criteria, are entitled to receive matching funds for the development of innovative, export-targeted products. The OCS funds up to 50% of R&D expenses in established companies, and up to 66% in start-ups.

The OCS supports and administers a wide range of programmes, the main ones being: (i) MAGNET; (ii) the technological incubators programme; (iii) various programmes involving bilateral and multilateral international R&D collaboration.

The MAGNET (acronym in Hebrew for Generic Pre-Competitive R&D) programmes encourage collaboration among industrial companies, and between companies and researchers from academic institutions, through several instruments that deal with innovative technologies. Those instruments aim to develop Israel's industrial infrastructure by supporting R&D activities and sharing technological knowledge between the participants. The main MAGNET instruments are MAGNET Consortia, MAGNETON, NOFAR and KAMIN.

MAGNET Consortia: supports the formation of consortia made up of industrial companies and academic institutions, in order to jointly develop generic, pre-competitive technologies.

MAGNETON: promotes technology transfer from academia to industry via co-operation between an individual firm and a specific academic research group, in order to reduce the firm's uncertainty before using the technology in new developments.

NOFAR: supports applied academic research in specific technological areas (biotechnology, nanotechnology, medical devices, water and energy storage, multidisciplinary research). The aim of the programme is to form a bridge between basic and applied research, for research areas yet to be recognized by the industry as having commercial potential.

KAMIN: designed to be an additional bridge between basic and applied research that is not yet ready for commercial investment. KAMIN offers an opportunity for academic research groups whose research programme has reached an applied phase and is no longer eligible for basic research funds to continue in the applied direction, for up to two years, at a level of support of 85–90%. The remainder of the R&D costs is to be borne by the research institute (OCS, 2013).

The Office of the Chief Scientist initiated the Public Technological Incubator Programme (PTIP) in the early 1990s in the wake of the large influx of immigrants from the former USSR, many of whom were scientists and engineers. Technological incubators are support organizations that give inexperienced entrepreneurs an opportunity to develop their innovative technological ideas, and to set up new businesses in order to commercialize the ideas. The goal of the incubators is to support novice entrepreneurs at the earliest stage of technological entrepreneurship, and help them implement their ideas and form new business ventures. Each incubator is structured to handle 10–15 projects simultaneously, and provides assistance in the following areas: determining the technological and marketing applicability of the idea, drawing up an R&D plan and organizing the R&D team, raising capital and preparing for marketing, providing secretarial and administrative service, maintenance, procurements, accounting and legal advice (Frenkel and Maital, 2014). The 1991-1998 incubators programme developed some 500 companies with a 50% success rate (Trajtenberg, 2000).

The Office of the Chief Scientist collaborates with international counterparts to support Israeli and foreign companies through bilateral R&D partnerships. The Office of the Chief Scientist also offers several direct incentives to foreign investors and technological corporations for collaboration with Israeli companies. Such collaborations may be executed through joint operation of technological incubators, government backing of venture capital, co-development of technology through generic pre-competitive R&D instruments, and more (OCS, 2013). A comprehensive description of the Office of the Chief Scientist's R&D support programmes, as well as other government SETI instruments and tools, is provided in the following chapters of this report.

In the past decade, OCS grants have been reduced both in scale (Figure 23) and in their share of the state budget. Reports published by the OCS show that OCS grants constituted 0.4% of the total state budget in 2011, as compared to 0.8% of the total state budget in 2000. The communications field received the highest OCS support (Figure 24). However, the share of support for research in this field has been trending down in the past decade – from 40% of grant value in 2002, to 28% in 2012. Grants for electronics and electro-optics R&D have remained unchanged (20%). Conversely, the share of support for life-science research has been rising, from 18% in 2002 to 25% in 2012. Several R&D incentive programmes for the promotion of research in these fields (e.g., NOFAR) have been launched during this period (Figure 24).

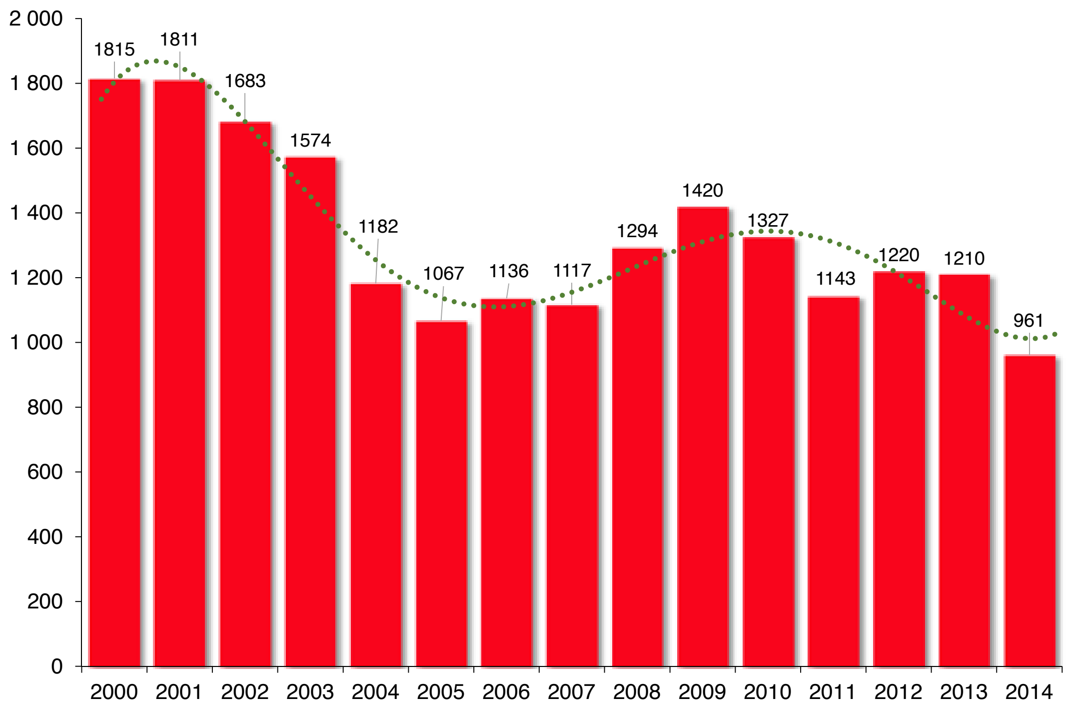


Figure 23: R&D budgets for all OCS support programmes, million NIS 2011 prices. Source: Office of the Chief Scientist (2015)

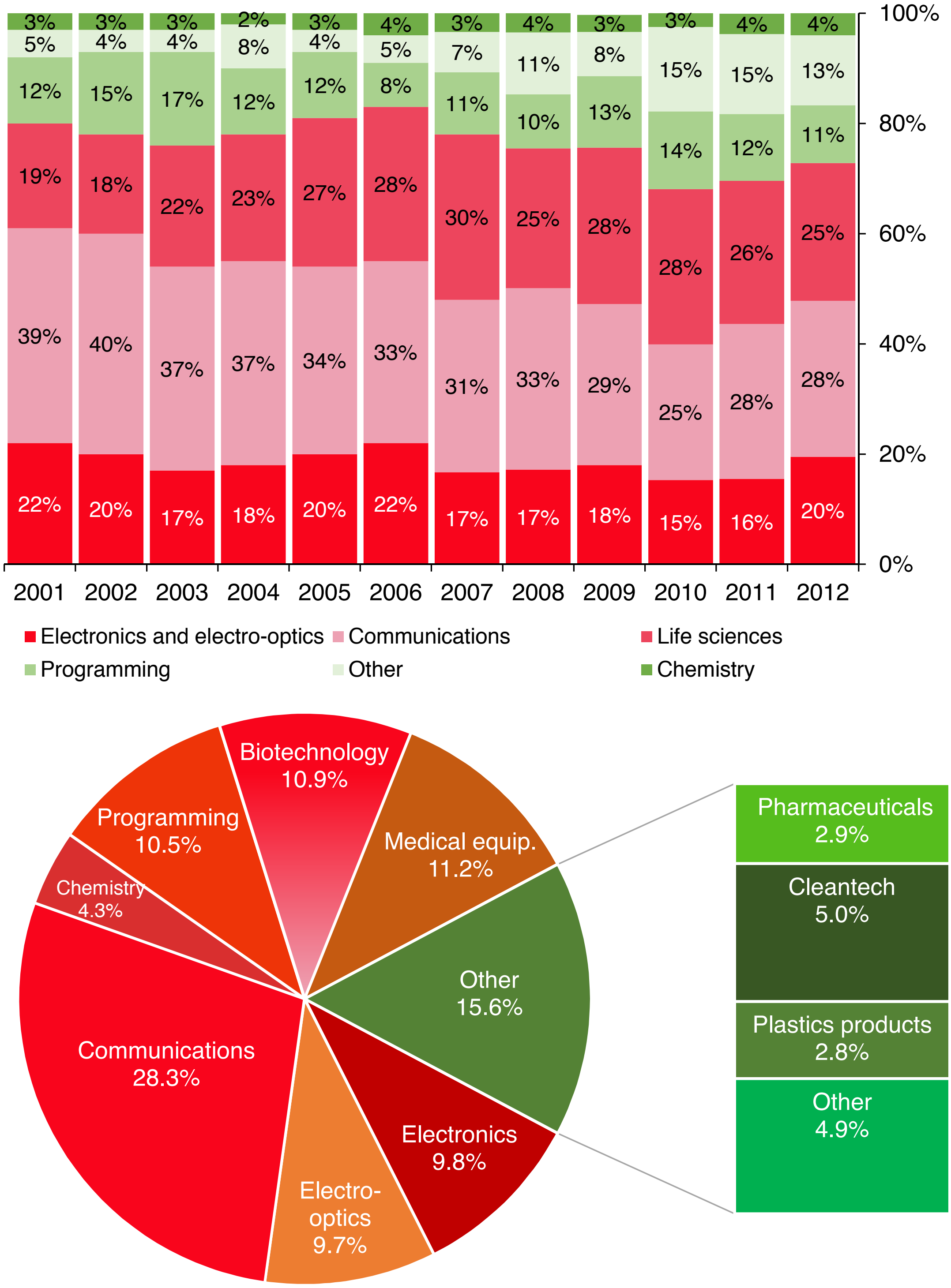


Figure 24: Distribution of OCS grants by technological classification. Source: Office of the Chief Scientist (2012)

BOX 3 – DEFENCE R&D AND ECONOMIC GROWTH IN ISRAEL

Four major wars with much larger neighbouring countries in its first three decades, on top of the need to accommodate large volume of immigrants in a barren land with little or no natural resources and a relatively well educated population – clearly pointed to a science- and technology- based course for the development of Israel's economy and military defence. Major forces and policies that enabled this development are briefly described in this box.

Growth in the economy and the technology sector

The economy faced enormous challenges since after 1948. It managed to overcome these and to exhibit rapid growth, in part by developing a high-tech powerhouse. Here are some broad metrics of economic growth and the role-played in it by the high-tech industries.

Total GDP exhibited intensive growth until 1973, with an average of 8.9% per year, and an average of 3.8% per year since then. Even after taking into account high population growth (with a compound annual growth rate or CAGR of 2.5% since 1960), the GDP per capita exhibited an impressive average annual growth of 4.9% until 1973, and slightly below that of Europe at a respectable average rate of 1.6% thereafter. Today, high-tech output comprises 12-14% of the country's output, and high-tech sectors employ about 9% of the Israeli workforce. More than 50% of exports are from high-tech and life sciences industries. High-tech industries exhibited very strong growth for a long period. Their share of the industrial product was 37% in 1965, grew to 58% in 1985, and levelled off at around 70% in 2006. Today, more than 50% of Israel's exports are from high-tech and life sciences industries, and roughly 80% of the output of these industries is exported.

Civilian R&D expenditures are a consistently high share of GDP (4.2% in 2013), accompanying the impressive science and technology achievements. Israel is among the countries with the highest per-capita expenditure on R&D at $1 370 (current prices PPP). In 2013, the country occupied the fourth rank among OECD countries, and around 50% above OECD average. Since the early 1990's the Government offers a wide array of R&D programmes—mostly through R&D grants by the Office of the Chief Scientist at the Ministry of the Economy and via the Law for Encouraging Capital Investment— that effectively encourage R&D projects by firms and their joint R&D ventures. These programmes have significantly contributed to the growth of high-tech industries in Israel, mostly in the ICT and pharmaceutical sectors. The Government also played a major role in jumpstarting the venture capital sector in the early 1990s, which today funds a major fraction of high-tech investment in Israel.

Science and technology are well developed in Israel, and three of the seven research universities are among the world's top 100. The country's percentage of scientific articles published worldwide is almost 10 times higher than its percentage of the world's population. Despite a small population relative to other industrialized nations around the world, Israel has the highest per capita concentration of scientists, technicians, and engineers in the world, with 140 scientists, technicians, and engineers per 10,000 employees, compared to 85 in the USA and 83 in Japan.

Israeli scientists have contributed to the advancement of the natural sciences, agricultural sciences, computer sciences, electronics, genetics, medicine, optics, solar energy and various fields of engineering. Israel has one of the world's most technologically literate populations, and for years the country has attracted branches of many key global high-technology firms. Since 1998, Tel Aviv has been recognized among the 10 technologically most influential cities in the world. In 2013, the Boston Globe's ranking named it the second best city for start-ups after Silicon Valley. In 2015, the Global Start-up Ecosystem Report places Tel Aviv's metropolitan area as the 5th best place in the world for technology start-ups, following four major U.S. urban centres, and ahead of London, Chicago, Seattle, Berlin, Singapore, Paris, etc. Israel is the second source country (following Canada) for foreign firms traded in US stock exchanges, and it is home to the highest number of such firms traded in NASDAQ.

Necessity is the mother of invention: the symbiotic relationship between defence needs and high-tech

Even before 1948, it was evident that Israel would have to rely on superior military technology to defend itself. This was and remains true today: Israel is small in population and territorial depth, bounded on all sides by sea or hostile states, and lacking natural resources. As the saying goes, necessity is the mother of invention. Advanced military technologies were needed to achieve a quick victory in armed conflicts, with minimal casualties, preferably on the enemy's soil, and—better still – to deter enemies from launching attacks in the first place.

Although civilian high-tech companies, mostly in electronics, were established in Israel from the 1960s, the rapid development of the high-tech sector occurred two decades later. In the early 1990s massive immigration from the collapsing Soviet Union made available a new skilled and educated workforce, and increased the Israeli population by 20% within one decade. Meanwhile, starting in the late 1980s, hundreds of scientists and engineers were laid off from defence industries because lower public procurement budgets the world over (following the end of the Cold War) lowered demand, and the ambitious programme to develop an advanced fighter plane was cancelled (the Lavi, a joint project with the USA). Many dual-use technologies (e.g. advanced materials, sensors, micro-electronics, electro-optics, computing and software, communication technology, medical engineering aeronautics and space etc.) developed in defence industries found their way, via the movement of highly qualified scientists and engineers, to products for civilian markets. This became one of the key drivers for spectacular growth of the high-technology sector in the 1990s (Eshel, 1998).

Graduates of elite military technology units established many start-ups in Israel, in particular from the intelligence and the air force arms. The hierarchy in the Israeli Defence Forces (IDF) is relatively flat, with fewer high ranking officers commanding army units and services than found in other armed forces. Consequently, many low-ranking young officers in advanced technology units assume enormous responsibilities, both financial and technological, when they are put in charge of developing or deploying new weapon systems. They gain invaluable experience making them well prepared if they later become high-tech entrepreneurs or take positions in contexts placing high value on quick problem solving and improvisation skills.

General impact of defence R&D on scientific and technological development

Economists have in the past paid little attention to the economic impacts of the relative composition of government spending. Recent studies tend to show that a shift in the composition of government demand towards high-tech goods in the 1970s and 1980s in the USA, functioned there as an effective de-facto innovation policy tool, as a lever significantly boosting the high-tech sector[19]. Defence R&D in the USA is also well known to have created many technological breakthroughs with non-military uses, such as Internet, GPS, lasers, etc. In a recent Brookings Institution forum, Ben Bernanke, former Chairman of the Federal Reserve Bank, claimed that USA defence spending on R&D had a positive impact on that country's economic growth, citing "spill over" effects from defence R&D to other high-tech sectors. Researchers found that each currency unit spent on defence R&D generates 20-30% in additional private R&D. With defence R&D amounting to 17% of the USA's defence budget (of some US$600 billion) this means US$19

19 Cozzi, G. and Impullitti, G. (2010) Government Spending Composition, Technical Change, and Wage Inequality. *The Journal of the European Economic Association,* 8(6): 1325–1358.

billion is additional private R&D spurred by defence R&D. Other research (on effectiveness of R&D subsidies) suggests that each additional dollar of R&D can result in more than two dollars of increased economic output[20].

Israel's defence industries are the backbone of the manufacturing side of its high-tech sector, consisting of hundreds of companies. Three of the largest four (IAI, Rafael and IMI) are government-owned, and the three largest are among the largest 100 defence contractors in the world, each with revenues exceeding US$1.5 billion. However, even these companies are small compared to defence giants like Lockheed Martin, Boeing, Northrop or Raytheon. In addition, although Israel is among the top 10 arms exporting countries in the world, its share of the global arms market is no larger than 2%. Table 15 shows the development of different military technologies in Israel (1940–2000).

Table 15: Timeline of Israel's weapon and military technologies

Decade	Product
1940s	Hand grenades submachine guns mortars armoured cars
1950s	Uzi submachine gun small arms ammunition
1960s	Jericho intermediate-range ballistic missiles first-generation non-conventional capabilities Fouga Magister jet trainer (licensed production) Gabriel anti-ship missile
1970s	Unmanned aerial vehicles laser range-finders and designators Galil assault rifle Reshef missile boat family Kfir fighter Merkava tank Barak surface-to-air missile Popeye air-to-ground missile
1980s	Electronic-warfare suites ELINT and COMINT systems thermal imaging and electro-optical systems Ofek reconnaissance satellite Jericho ballistic missile Mark 2 Harpy attack UAV Lavi fighter (cancelled); secured communication systems deciphers and encoders Python–4 all-aspect air-to-air missile directed-energy weapons advanced armour techniques and anti-armour weapons energy weapons
1990s	Attack multipurpose UAVs complex composite structures cyber-warfare Arrow anti–ballistic missile; simulators electronic warfare systems communication systems; remote sensing anti-tank guided missiles; cruise missiles upgrade programmes Merkava tank Mark 4
2000s	Iron Dome and other anti-missile systems

Source: Priscilla Offenhauer, Israel's Technology Sector, Federal Research Division. Library of Congress, November 2008, p. 71

20 Gudgin, G. and Gibson, N. (2011) *Modelling the Economic Impact of R&D Tax Credits*. A Report for Economic Advisory Group, HMRC 107, Oxford Economics: Oxford.

Will defence R&D continue to drive growth in the Israeli economy?

Reviewing the unique confluence of forces and events that produced such unprecedented synergy between defence and high-tech development in the last 50 years, it is difficult to expect more of the same in the future. In fact, there are many reasons to doubt that defence R&D will continue to be such a driving force in future economic development:

1. Future scientific fields likely to lead technology development in the future, such as molecular biology and nanotechnology, have more civilian usages than military ones. Thus, the main driving force for development in these fields will not come from the defence sector.
2. Defence budgets continue to shrink all over the world, and with them the needs and procurement budgets for advanced weapon systems. Israel's own defence expenditures has declined from 16% of GDP just a couple of decades ago to 6% in recent years.
3. As Israel's security no longer entails an immediate and existential threat as it did half a century ago, bright young scientists and engineers no longer feel the 'national mission' obligation to develop their careers within the defence sector. Moreover, the aforementioned decline in defence budgets all but eliminated the 'research lab' atmosphere in defence organizations, which allowed the previous generation of scientists to flourish within those industries.
4. The defence industry's trend of continued consolidation, and its inherently non-competitive nature with a high degree of political attention to procurement decisions, will make it hard for relatively small Israeli companies to successfully compete for the dwindling military procurement budgets world wide, whereas the need to rely on exporting much of its output is expected to increase.
5. Israel is facing a major decline in the average educational attainment rates in the population, and consequently a decline in tertiary attainment, while Ultra-Orthodox and Arab populations continue to grow at a faster rate than the general population.
6. However, new security threats, in areas like homeland security and cyber, and increased need for intelligence and surveillance, may place Israel in a good position to establish a niche in these growing markets, exploiting existing knowledge and new scientific discoveries.

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SUSTAINABILITY AND ENVIRONMENTAL POLICY IN ISRAEL

In recent years, sustainability and environmental considerations are becoming increasingly important factors in the formulation of the general SETI policy in Israel. In order to promote sustainability and environmental policies, the Israeli government is using various legislative tools (e.g. Green Growth and Greenhouse Gases Emission Reduction acts), as well as economic and R&D incentives targeting the private sector aimed at mitigating environmental hazards and maximizing efficiency (e.g. renewable energy, water treatment) through the development of novel technologies.

Both internal and external forces are responsible for the promotion of sustainable environmental policy. The growing recognition in Israel of the scarcity of its natural and water resources, the shortage of available land for development and meeting the challenge of providing solutions for various problems in light of the significant population growth in the 21st century (e.g. housing) are among the key internal drivers. Among the external drivers are international and regional environmental agreements signed by Israel in recent years (e.g. Kyoto and Barcelona Protocols) which set new environmental standards and benchmarks (Golovaty, 2006). Israel's admission to the OECD in 2010, as well as the need to comply with EU environmental directives and guidelines for export are also among the external catalysts in the promotion and formulation of environmental policy in Israel in the past decade.

Ministry of Environmental Protection

The Ministry of Environmental Protection is responsible for the formulation of an integrated nationwide policy for the protection of the environment. In addition to the Ministry of Environmental Protection, the Ministry of Economy also plays a vital role, through its various R&D instruments and programmes, in directing SETI policy in the environmental domain.

Prior to the 1972 United Nations Conference on Human Environment held in Stockholm, environmental responsibility in Israel was divided among several ministries. Within a year of the conference, the Israeli government established the Environmental Protection Service, as a first step in the creation of a comprehensive and modern environmental administration in Israel.

In December 1988, the Ministry of the Environment (renamed the Ministry of Environmental Protection in 2006) was established under Government Resolution Number 5. The establishment of this ministry proved to be a landmark in Israel's environmental development and in the government's determination to tackle environmental issues.

At the national level, the Ministry is responsible for developing an integrated and comprehensive policy, as well as strategies, standards, and priorities for environmental protection. To this end, the Ministry has professional divisions and departments that deal with a myriad of environmental issues. At the local level, the Ministry supports 50 environmental units (municipal organizations) that were established in municipalities throughout the country and are responsible for executing national environmental policy at the local level. The environmental units provide services to 85% of the country's population and serve as an advisory body for local authorities on environmental issues. The environmental units handle a myriad of complex environmental issues such as air monitoring, supervision and control over industries relating to issues of emissions, industrial wastewater, industrial and hazardous waste, environmental education and agro-ecology[21].

The Chief Scientist in the Ministry of Environmental Protection

The Chief Scientist in the Ministry of Environmental Protection works to strengthen the scientific basis for the Ministry's activities. The objectives and goals of the office are determined by the Minister, the Director General, and Ministry management. The Chief Scientist funds research relating to environmental issues via its Requests for Proposals (RFPs) or tenders. The research contributes to a better understanding of the processes that affect the environment in Israel, constituting an essential factor in the Ministry's policy formulation. The main priorities of the Chief Scientist in the Ministry of Environmental Protection are:

- Advancement of scientific knowledge that will constitute the professional basis for the Ministry's work.
- Eco-innovation: Establishment and advancement of technological innovation and environmental business models.
- Establishment of a national programme on health and the environment that includes aims to increase general knowledge about the impact of environmental factors on public health.
- Preparation of national plans for climate change mitigation and adaptation.
- Dissemination of environmental data to decision makers and to the public, both in Israel and abroad, with the ultimate goal of creating a national environmental database.
- Promotion of collaborations with academia and research institutions.
- Encouragement of environmental science research studies at the high school level.

Israel today is a world leader in solar energy, water desalination, irrigation technology and water treatment and purification (see Box 4).

21 Ministry of Environmental Protection (2013). URL: http://www.sviva.gov.il/English/AboutUs/Pages/AboutUs.aspx

BOX 4 – STRATEGIES FOR SUPPORTING CLEANTECH, ENVIRONMENTAL CONTROL AND GREEN GROWTH POLICY IN ISRAEL

Cleantech refers to technologies that make the consumption of energy, water and other critical resources more efficient or, alternatively, to the technologies that replace the need for finite resources with renewable alternatives. There are a few drivers for Cleantech: resource scarcity, climate change threats, need for energy security and independence, as well as changing demographics. These drivers are becoming more and more important in their influence on everyday life (Axelrod, 2010).

In 1955, David Ben Gurion, the Prime Minister of Israel, stated that 'Israel requires the study of desalination, massive utilization of solar energy, preventing waste of useful rainwater and maximization of power from wind turbines'. David Ben Gurion's vision has been realized by Israeli technology, which led Israel to become a world leader in water resource management and water-related technologies. Israel is considered one of the earliest developers of Cleantech. This is especially evident in the fields of 'producing water' and efficient use of water in agriculture (Gunther, 2013).

The following describes some of the leading industrial companies that developed Cleantech solutions, using public assistance through R&D funds and other policy measures:

- Netafim – Company was founded in 1965 and pioneered the idea of drip irrigation, a process that virtually eliminates water waste in agricultural irrigation. This technology is currently used worldwide.
- Chromagen – Established in the mid-1960s. The company pioneered solar thermal water heaters for domestic and international markets.
- IDE-Technologies – World leader in water treatment solutions. IDE specializes in the development, engineering, construction and operation of enhanced desalination facilities and industrial water treatment plants.

Additionally, other global leaders include Ormat (geothermal recovered energy) and Solel (solar thermal power generation) (Gunther, 2013).

At the beginning of the 21st century, entrepreneurs and industrialists emerging from the country's high-tech sector began to take a lead in developing the next generation of Cleantech technologies. Significant investment in R&D in Cleantech technologies and renewable energy was made possible largely by the R&D support instruments of the OCS in the Ministry of Economy, which recognized the Cleantech industry as an important growth engine. As part of its policy to promote water technologies and renewable energy, the OCS actively supports two technological centres whose main goal is to promote establishment of start-ups in the water technology and renewable energy sectors. The two centres are:

- Technological Centre for Water Technologies on Kibbutz Sde-Boker
- Technological Centre for Renewable Energy in the Negev and Arava Regions.

Greenhouse Reduction Program and Green Growth Strategies

In 2010, the Government set up a national programme for reduction of greenhouse gases by 20% by the year 2020 relative to a 'business as usual' scenario. In order to achieve this task, the Ministry of Economy established an investment support mechanism to encourage the development and installation of energy efficient, cleaner and less polluting systems.

Green Growth for Israel

In a landmark decision taken by Israel's cabinet on 23th October 2011, the government approved the proposal of the Minister of Environmental Protection and the Minister of Economy to prepare a national green growth strategy for the years 2012-2020. The decision defines green growth as 'socio-economic growth and development that does not harm the environment, makes efficient economic and sustainable use of natural resources, and creates jobs while maximizing opportunities for the use of clean growth engines.'

Educational achievements in core subjects

According to Ben David (2015), the study of mathematics at the highest levels has a major influence in determining future wages. His study shows that students taking the mathematics matriculation exams (*bagrut* in Hebrew) at 3 units subsequently earned 19% more than those who studied at lower levels. The gap expands to 36% for those taking 4 units and to 60% for those taken 5 units. However, the share of Israeli 12th graders taking the mathematics matriculation exams at the highest levels has been continuously declining from 14.1% in 2006 to 9.2% in 2012.

The improvement of the performance of university students requires enlarging the funnel at the primary and secondary school levels. The Programme for International Student Assessment (PISA) tests provide a way to compare the quality of secondary school education at international level.

PISA tests, which are administered to over 70 countries every three years since 2000, aim to assess education systems around the world by measuring 15- and 16-year-old students' skills in literacy, math and science, in order to examine their readiness to enter adulthood.

The last tests took place in March 2012 in Israel among a representative sample of 5 055 pupils from 172 schools across the country.

According to the figures, Israel's achievement in reading is close to the average of OECD countries, while in other areas the gap is larger. For the printed test, Israel ranks 40th in math, 33rd in reading and 40th in science. For the computerized test, the country ranks 27th in math (see Figure 25) and 26th in reading. Overall, from 2006 to 2012, Israel's scores have increased by 24 points in math and 16 points in science. From 2002 to 2012, the reading scores have increased by 34 points.

In addition, the PISA study of Israel showed that in 2012 the rate of 'excellent' students was similar to the OECD's average. In reading, 10% of Israeli pupils were found to be excellent, compared to 8% on average in the rest of the OECD countries; in math the Israeli rate stands at 9%, compared to the OECD's 12%; and in science, it stands at 6% in Israel vs. 8% in the OECD.

The rate of weaker students, on the other hand, was higher in Israel than in the rest of the OECD countries. Some 24% of Israeli students who took the exam were considered weak in reading, compared to only 17% in the rest of the OECD. In mathematics the Israeli rate stood at 34%, compared to 23% in the OECD. In science, the rate was 29% in Israel and 18% in the rest of the participating countries. Significant gaps in achievements were recorded between students from different socioeconomic backgrounds, more specifically between Arabic-speaking students and their Hebrew-speaking counterparts.

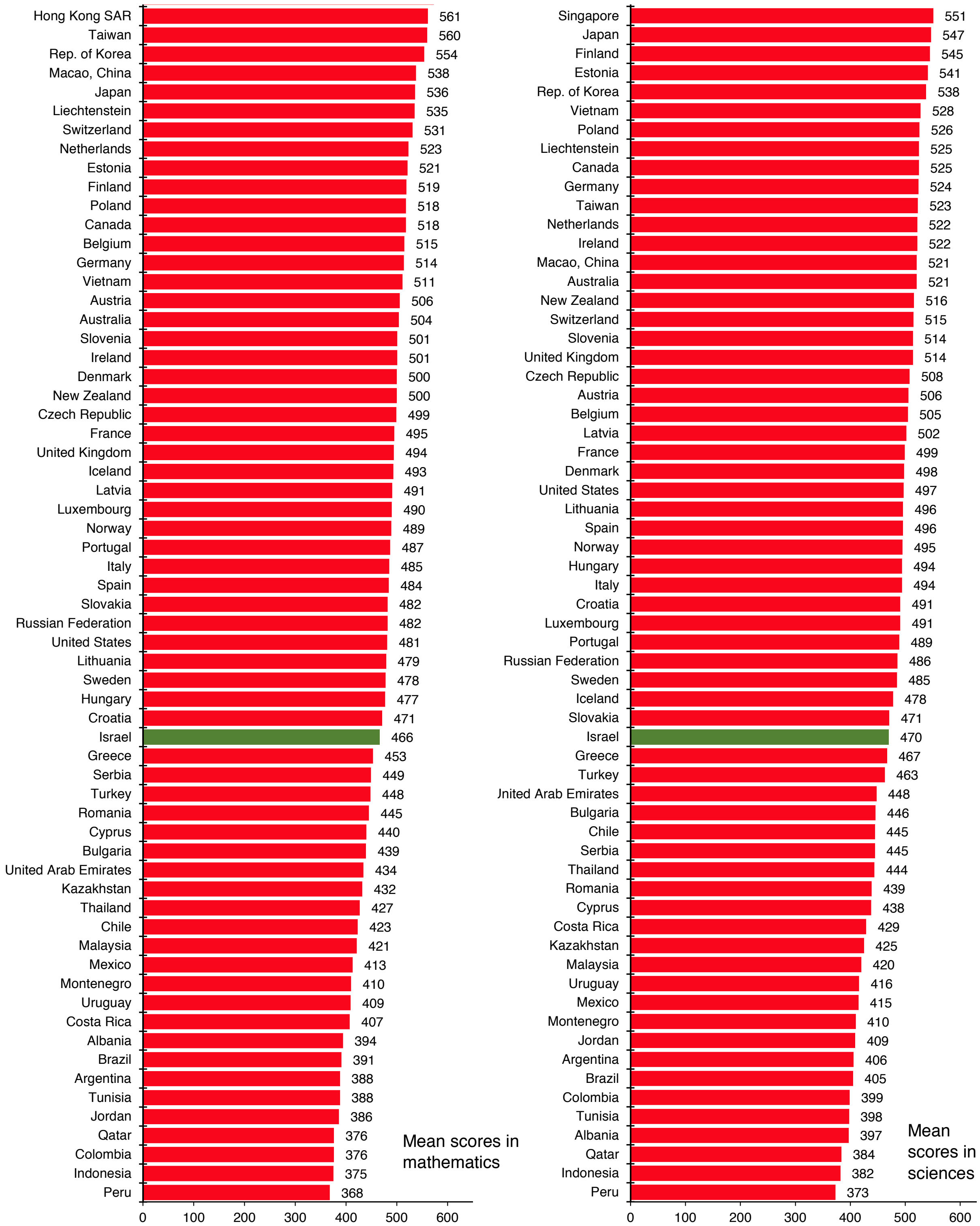

Figure 25: Mean scores of the Programme for International Student Assessment (PISA) test for mathematics and science, 2012. Source: OECD.Stats

The research universities

The backbone of Israel's higher education system is built from seven research universities. The Hebrew University of Jerusalem, the country's first research university, was established in 1925 with the specific aim of conducting teaching and basic research activities. The Technion-Israel Institute of Technology was established a year earlier as a technological institute for training engineers, and much later became a scientific-technological research-university. The Sieff Institute (later renamed the Weizmann Institute of Science) was established in 1934 as a basic and applied research institute (Tadmor, 2011). Tel Aviv University was founded in 1953, with the opening of the Academic Institute of Natural Sciences, but received its accreditation from the Council for Higher Education in 1969. Bar-Ilan University was established in 1955 with the specific aim of forging closer links between Jewish studies and general studies. It was fully accredited by the Council for Higher Education in 1969. The University of Haifa, the second research university on Mount Carmel, was established in 1963 (receiving accreditation from the Council for Higher Education in 1972). Unlike the Technion, The University of Haifa is more oriented towards the social sciences and the humanities. Ben-Gurion University of the Negev, established in 1969, is Israel's youngest research university.

The higher education model in Israel

The Hebrew University of Jerusalem was founded during the early years of the British Mandate of Palestine, as an important symbol of Zionism, reflecting the aspiration for political independence among Jews (Bar-Gal, 2000). During that period, the academic and personal atmosphere at the Hebrew University was strongly influenced by the German higher education system. During the 1920's and 1930's, the scientific language in various universal disciplines, such as natural sciences and mathematics, was oriented towards the German world (Katz and Heyd, 1997). At the Technikum (later named the Technion), a fierce ideological conflict over the planned language of instruction took place between the Technikum's founding group led by German Jewish intellectuals, and the Zionist movement. The Zionists, who strongly supported Hebrew as the official language of instruction, won.

Other Israeli universities were inspired by the model that was set at The Hebrew University, placing strong emphasis on basic research. According to Tadmor (2011) 'all research universities were established at different times and as a result of different initiatives, but all together, they determined one important element of Israel's scientific policy: almost all basic scientific research is conducted in research universities and not, as is customary in several other countries, in national research institutes.' Another key decision made by the research universities in later years was to move from the European (German) university model to the American research university model, in which all faculty members are on tenure track. The granting of tenure and promotion of faculty members are based on merit judged by international peer review. Israeli research universities have also adopted two additional practices: mandatory sabbatical leaves for faculty members and the receiving of adequate funding for travel to international conferences. These two practices have enabled Israeli scientists to keep abreast of scientific developments and have played an important role in preventing the provincialization of Israeli science (Tadmor, 2011).

Figure 26 shows the continuous decrease of government expenditure on tertiary education as a percentage of GDP (1998–2011). However, in 2011, the six-year Higher education Plan was introduced with US$ 1.9 billion allocation. This included a 30% increase for the Council for Higher Education.

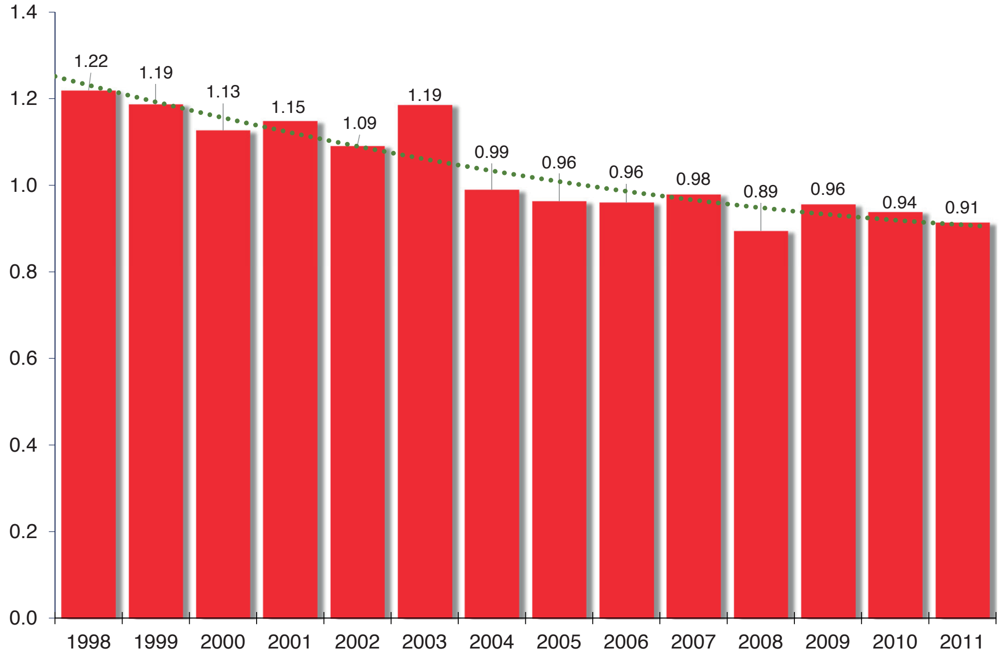

Figure 26: Government expenditure on tertiary education as percentage of GDP. Source: UNESCO Institute for Statistics

BOX 5 – PROFILE OF ISRAEL'S RESEARCH UNIVERSITIES

The following section presents a short profile of Israel's seven research universities and The Open University. The profiles are based on the official information presented in the Council for Higher Education (CHE) website[22].

The Hebrew University of Jerusalem

The Hebrew University of Jerusalem is the mother of the research universities in Israel. It was founded in 1918 and officially opened on Mt. Scopus in 1925. The Hebrew University is a multi-disciplinary academic institution with an international reputation for instruction and research. It maintains extensive connections with the academic community in Israel and abroad. The University stresses research and studies for advanced degrees. It works for the welfare of the community by disseminating knowledge and promoting youth. The University aims to educate public, scientific, educational and professional leadership, to preserve the Jewish cultural, spiritual and intellectual heritage while expanding the borders of knowledge for the whole of humanity.

Technion – Israel Institute of Technology

The Technion – Israel Institute of Technology focuses on engineering and exact sciences. Its main campus is located in Neve Sha'anan, Haifa, and has 18 faculties and academic units. The Technion's main faculties are Biology, Chemistry, Physics, Mathematics, Computer Science, Electrical Engineering, Architecture, Medicine, Agricultural Engineering, Aeronautical Engineering, Food Engineering, Materials Engineering, Industrial Engineering and Management, and Technological Education. The Technion was the first institution of higher education in Israel

22 The Council for Higher Education. URL: http://che.org.il/en/?page_id=15417#Universities

and is the most veteran and leading institution in Israel in the field of technological research. It works to advance the State of Israel in the development of human capital, leadership and the creation of knowledge.

Weizmann Institute of Science

A research institute conducting research in all fields of the natural sciences and mathematics, located in Rehovot, Israel. The Institute is a university institute and the Feinberg Graduate School admits students to studies for advanced – master's and doctoral – degrees. The Weizmann Institute was the third institution of higher education established in Israel (after the Technion in Haifa and The Hebrew University of Jerusalem). At the time of its founding in 1934, the Institute was called the Sieff Institute and was adjacent to the agricultural research station, Institute for Wheat Research. The Institute has five faculties (biology, biochemistry, chemistry, physics and mathematics and computer sciences) where approximately 2,500 researchers, engineers, and doctoral and master's degree students study and work. The Institute of Science Education prepares innovative curricula for schools. The Weizmann Institute maintains widespread international relations and about 100 visiting researchers visit the institute each year. The Weizmann Institute was the first higher education institute in Israel to engage in nuclear and cancer research. Israel's first electronic computer and particle accelerator were set up at the Institute.

Tel-Aviv University

Tel-Aviv University (TAU) is Israel's largest university (30 000 students, 2200 faculty members). It is located in Ramat-Aviv, Tel-Aviv. The University was established in stages over a period of ten years, through the merging of different institutions. The core of the University was founded on December 1, 1953 in Abu Kabir, near Jaffa. TAU was accredited by the CHE in 1969. TAU is comprised of nine faculties (Exact Sciences, Life Sciences, Medicine, Engineering, Social Sciences, Management, Humanities, Arts and Law), 27 schools, 98 departments and some 130 research institutes and centres. The University promotes a multidisciplinary approach to research in neuroscience, environmental studies, cardiac research, cancer research, energy studies, nanoscience and technology, bioinformatics, aging, communications and cultural studies. The University operates Israel's largest supercomputer and the only astronomical observatory in the Middle East. The University enjoys extensive research contacts with leading academic and scientific institutions abroad, including over 150 co-operation agreements with universities in North and South America, Europe and Asia.

Ben-Gurion University of the Negev

Ben-Gurion University of the Negev was established by the Government of Israel in order to advance the development of the Negev (Israel's southern periphery). The University is an important centre for instruction and research. It includes the Faculties of Engineering Sciences, Health Sciences, Natural Sciences, Humanities and Social Sciences, Business and Management and a School of Advanced Graduate Studies. It also has several research institutes: the National Institute for Biotechnology, the Institutes for Desert Research, the International School for Desert Studies and the Ben-Gurion Research Institute for the Study of Israel and Zionism. The University has campuses in Beer Sheva, Sde-Boker and Eilat. It is committed to academic excellence, social involvement and promotion of higher education. Since its establishment in 1969, the University has gained an international reputation for research and development of desert agriculture and for innovative approaches to multi-cultural community medicine and it makes an important scientific contribution to developing countries in the world.

Bar-Ilan University

Almost 34 000 students study at Bar-Ilan University, 25,930 of them studying for a degree at the main University campus in Ramat-Gan and at regional colleges in programmes under the academic auspices of the University. A further 8 000 study in various study programmes at Bar-Ilan University. The uniqueness of Bar-Ilan University is in the imparting of the foundations of Jewish heritage through basic courses in Jewish Studies, the Institute for Advanced Torah Studies and the nurturing of Jewish identity together with high-level academic study and the promotion of advanced research in its faculties, departments and research centres. It has also established the fifth Israeli school of medicine.

The University of Haifa

The University of Haifa was established in 1963 under the joint auspices of The Hebrew University of Jerusalem and the Municipality of Haifa. In 1972, the University was accredited as an academic institution by the Council for Higher Education. The University has six faculties: the Faculty of Humanities, the Faculty of Social Sciences, the Faculty of Natural Sciences, the Faculty of Law, the Faculty of Social Welfare and Health Sciences, and the Faculty of Education. The University also has five schools: business administration, social work, history, public health and political science.

The Open University of Israel

In addition to the seven research institutions, another higher education institution eligible to award undergraduate and postgraduate degrees in Israel is The Open University. The Open University admits to undergraduate study any individual without entrance examinations or certificates of previous education and offers studies using The Open University method (distance education). At the master's degree level, entrance requirements are similar to those that are in use in other universities. Graduates of The Open University can be admitted to Master's or Doctoral degree programmes in the other universities.

Legislation covering the field of higher education

The higher education system in Israel is regulated by two entities: the Council for Higher Education (CHE) and the Planning and Budgeting Committee (PBC). The former body was created by a law and the latter by a Government resolution (Box 6). The framework of the system of higher education in Israel is defined in the Council for Higher Education Law, 1958. This law mandates the procedures for the accreditation of institutions of higher education. Academic freedom in Israel (both individual freedom and the freedom of the institutions) is also protected by this law. Its Article 15 guarantees that institutions of higher education have autonomy in the conduct of their academic and administrative affairs, within the framework of their budgets and their terms of accreditation. The PBC was established in 1977 via a formal Government Resolution (666). The PBC, modelled after the British Grants Committee, is an independent subcommittee of the Council for Higher Education and is chaired by senior faculty members (Tadmor, 2004). The PBC's main mission is to be an independent buffer entity between the Government and the higher education institutions, in all matters of budgeting and allocation of funds.

Council for higher education law (1958)

The purpose of the Council for Higher Education law is to establish a public, apolitical, independent and professional body to stand between the Government and the institutions of higher education and to deal with all issues related to higher education in Israel. The law empowers the Council for Higher Education to grant a permit to open and operate an institution of higher education; accredit an institution as an institution of higher education; authorize an accredited institution to award academic degrees; approve studies under the academic auspices of an accredited institution and make recommendations to the Government regarding the establishment of additional institutions of higher education. The law states that the Council for Higher Education will consist of not less than 19 and not more than 25 members and they will be appointed by the President of the State of Israel at the recommendation of the Minister of Education, after consultation with the institutions of higher education; the Minister of Education ex-officio will act as chair; two thirds of the members should be individuals of stature in the field of higher education. The institutions of higher education will be free to manage their academic and administrative affairs as they see fit, within the allocated budget. The law emphasizes the need to safe-guard academic freedom for the purpose of advancing research and education.

Government resolution 666 (1977)

The Government hereby establishes the Planning and Budgeting Committee as a sub-committee of the Council for Higher Education to fulfil the following missions:

- To be an independent buffer entity between the Government and the Higher Education institutes in all matters of budgeting.
- To recommend operational and development budgets based on national and social needs, while protecting academic freedom and promoting research and education.
- To perform budget disbursement between higher education institutes.
- To recommend to the government and to the Council for Higher Education plans for the development of higher education.
- To promote collaboration between the institutes in order to efficiently utilize public resources and funding.
- To monitor spending.
- To advise the Council for Higher Education on new institutes and programs (Tadmor, 2004).

Research excellence in Israel

The success of Israeli academic policies over the last decades is demonstrated by its impressive output of scientific publications, high ranking of universities, prestigious international awards for Israeli science, and the universities as a major innovation pillar (i.e. patents and the commercialization of knowledge).

The high ranking of Israeli universities is particularly evident in computer science, mathematics, economics, and chemistry. According to the 2015 Shanghai Ranking of Universities, the Technion is ranked 18th *worldwide in computer science and* 44th in engineering, the Hebrew University of Jerusalem ranked 17th in mathematics in 2013 and 33th in 2015. Tel Aviv University has the 20th place in computer science. The Weizmann Institute of Science is ranked in 41st place in chemistry. The evolution (2003–2015) of the general ranking of Israel's research universities according to Shanghai University top 500 ranking is presented in Figure 27. In 2015, the Hebrew University of Jerusalem and the Technion occupied the 67th and 77th world's ranks respectively.

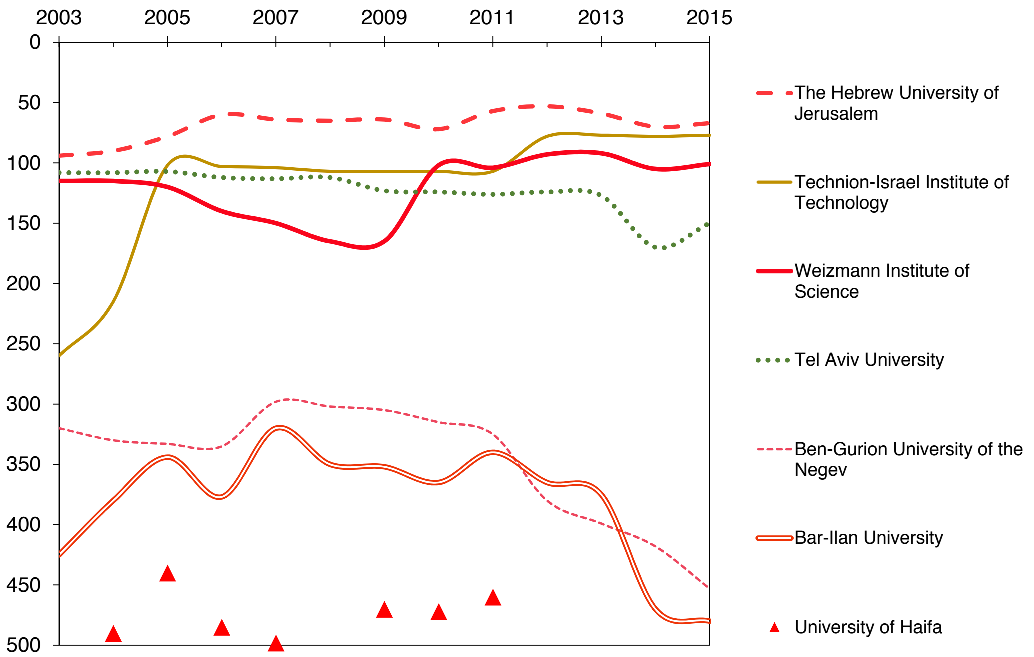

Figure 27: Evolution of Israeli research universities within the global rank of the 500 most important universities in the world, 2003–2015. Source: UNESCO based on raw data taken from URL: http://www.shanghairanking.com/

The excellence of Israeli science and Israeli academia is demonstrated in the large number of funded European Research Council Starting Grants[23]and Advanced Grants[24] as well as the European Union's Seventh Framework Programme for Research (FP7). The European Research Council (ERC) is a pan-European funding body for frontier research. The ERC's mission is to encourage the highest quality research in Europe through competitive funding and to support investigator-driven frontier research across all fields, based on scientific excellence. The ERC is now part of the first pillar – 'Excellent Science' – of Horizon 2020, the new European Union Programme for Research and Innovation. The total budget allocated to the ERC for the period 2014–2020 is 13.1 billion euros[25]. As can be seen from Figure 28, Israel is ranked in second place in Europe, after Switzerland, in the success rate (funded projects/evaluated projects) of ERC Starting Grants (success rate of 17.6%. 142 funded projects) for the 2007–2014 period. The country is also ranked in ninth place on the continent in successful ERC Advanced Grants (success rate of 13.6%, 85 funded projects) for the 2008–2013 period (Figure 29). The Hebrew University (33), the Technion (41), Tel Aviv University (47) and the Weizmann Institute of Science (48) were ranked among the top 50 higher education organizations in FP7 with signed grant agreements for the 2007–2012 period.

All Israeli research universities have a technology transfer office (TTO). Weizmann Institute's commercialization arm, YEDA Research and Development Company Ltd. was founded in 1959, much earlier than other noted TTOs elsewhere in the world. The university TTO's are collaborating on a regular basis with leading Israeli companies. Moreover, the research universities and in particular the Technion, The Hebrew University and the Weizmann Institute of Science, began educating students and conducting advanced world-class research in information, communication and computer sciences, which are the foundation of ICT related high tech industries.

23 European Research Council Starting Grants aim to support young researchers who are about to establish a research team. The scheme targets promising researchers who have the proven potential to become independent research leaders. Researchers of any nationality with 2–7 years of experience since the completion of their PhD may apply for the grant. Grants amount to up to 2 million euros per grant for five years.
24 European Research Council Advanced Grants allow exceptional established research leaders of any nationality and any age to pursue ground-breaking, high-risk projects that open new directions in their respective research fields or other domains. Grants amount to up to 3.5 million euros per grant for five years.
25 URL: http://erc.europa.eu/

A notable example (one of many successful partnerships) for this type of co-operation is the collaboration between the Weizmann Institute of Science and Teva Pharmaceutical Industries in the discovery and development of the Copaxone drug for the treatment of multiple sclerosis. Copaxone is Teva's largest selling drug, with US$1.68 billion in sales in the first half of 2011 (Habib-Valdhorn, 2011).

BOX 6 – ISRAELI CENTRES OF RESEARCH EXCELLENCE

The Israeli Centres of Research Excellence (I-CORE) program was launched in October 2011. The program is jointly run by the Planning and Budgeting Committee of the Council for Higher Education (PBC) and the Israel Science Foundation (ISF). By 2015, 16 centres had been established on a wide array of topics. Six centres specialize in life sciences and medicine, five in the exact sciences and engineering, three in social sciences and law and the last two in humanities.

The I-CORE project areas are preselected by the management committee through a call for proposals. In each such area, Centres of Research Excellence are then selected via a peer review process conducted by the Israel Science Foundation.

So far, 16 I-COREs have been established in a wide array of topics: the first wave of 4 I-COREs started operating on October 2011, and the second wave 12 I-COREs started operating in May 2013. Of the 12 new Centres that were established as part of the second wave, 5 engage in research in the social sciences and humanities and 7 in exact sciences, engineering, life sciences and medicine. The second wave represents another major step in the Centres of Research Excellence programme and is a main pillar in the *Multi-Year Reform Plan in Higher Education*– a programme aimed at fundamentally strengthening the long term positioning of Israel's academic research and its stature among leading researchers in Israel and abroad.

The research topics are selected through a broad bottom-up process comprising consultations with the academic community, to ensure that the topics selected reflect the genuine priorities and scientific interests of researchers in Israel.

By May 2014, around 60 young researchers had been absorbed into Centres of Research Excellence, many of whom had previously worked abroad.

I-CORE is funded by the Council for Higher Education, the host institutions and strategic business partners, with a total budget of NIS 1.35 billion (US$ 365 million).

The original target was to set up 30 Centres of Research Excellence by 2016. The establishment of the last 14 Centres has provisionally been shelved, however, for lack of sufficient external capital. In 2013–2014, The PBC budget for the entire I-CORE programme amounted to NIS 87.9 million (about 1% of the total PBC budget to higher education the same year).

Source: Council for Higher Education (2014)

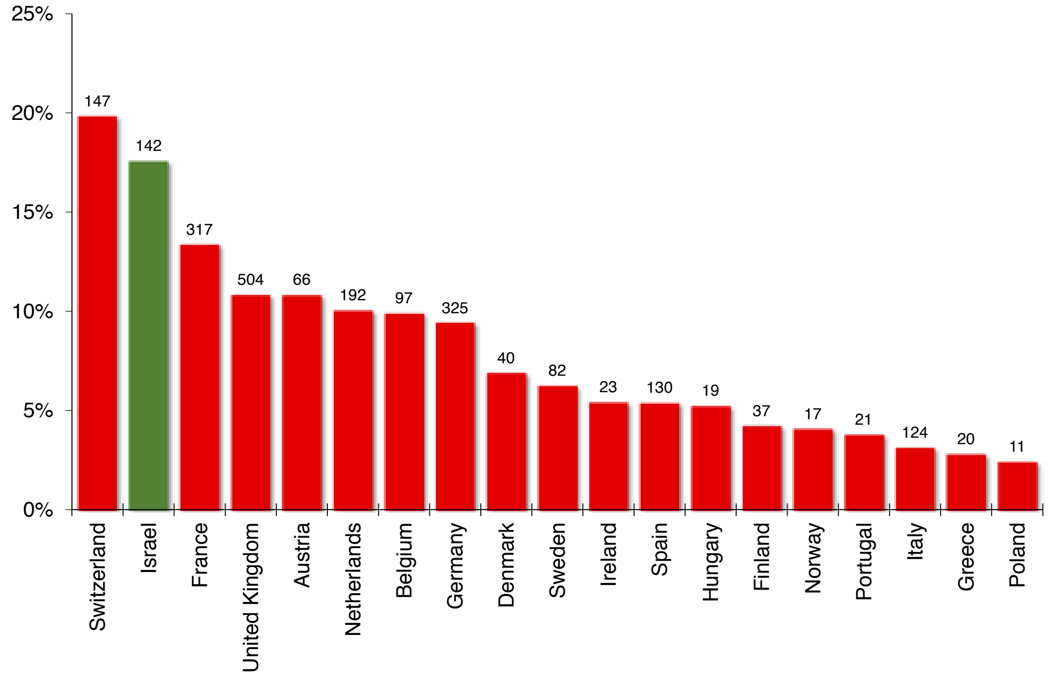

Figure 28: European Research Council Starting Grants, absolute number of funded projects and percentage of success rates per country of host institution, 2007–2014. Source: European Research Council

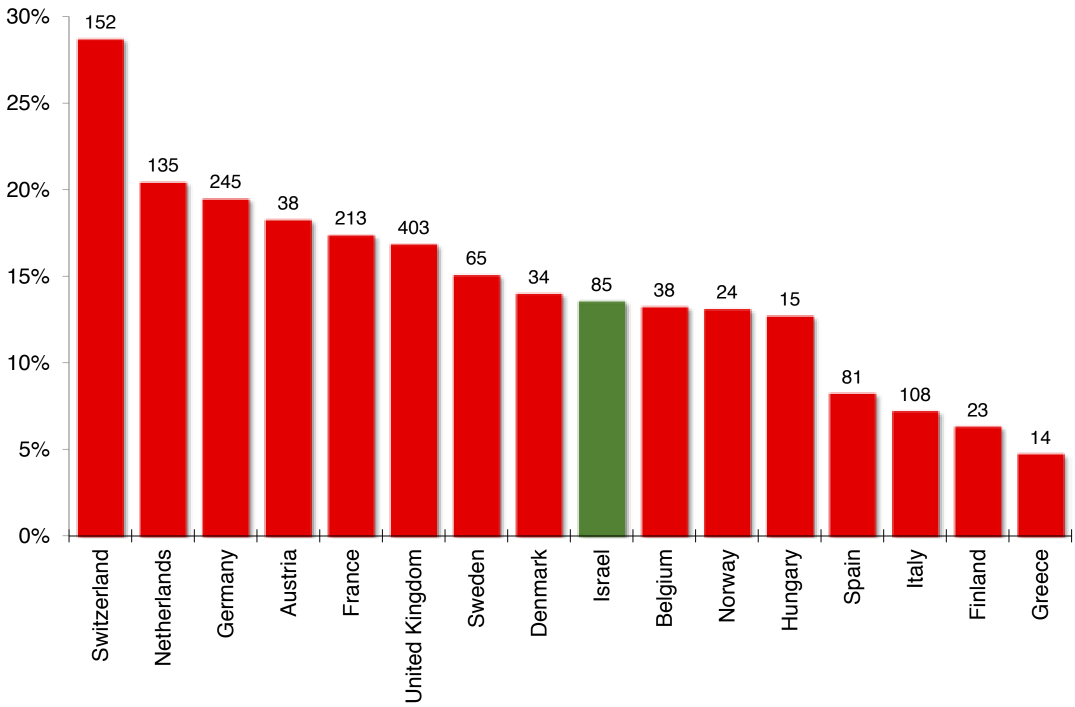

Figure 29: European Research Council Advanced Grants, absolute number of funded projects and success rates per country of host institution, 2008–2013. Source: European Research Council

The Yissum Research Development Company of the Hebrew University is responsible for marketing the technology and scientific expertise generated by the Hebrew University researchers and students. To date it has registered over 7 000 patents for 2 023 inventions; more than 600 of these patents have been commercialized. Products manufactured based on the patents are sold at over US$2 billion a year. Yissum's portfolio boasts 72 companies established based on inventions developed by the Hebrew University researchers[26].

Research conducted recently by the Samuel Neaman Institute revealed that, in the past decade, university patent applications constituted 10%-12% out of the total inventive activity of Israeli applicants (Getz *et al.*, 2013). This share is one of the highest in the world and is largely due to the intensive activity of the Technology Transfer Offices in the universities. A report prepared by Eurostat shows that four Israeli higher education institutions were ranked among the top 100 higher education institutions active within the EPO in the past decade: Weizmann Institute of Science (10); Yissum Research Development Company of the Hebrew University of Jerusalem (11); Technion Research and Development Foundation Ltd (69) and Ramot at Tel Aviv University Ltd (77) (Van Looy *et al.*, 2011).

BOX 7 – THE ROLE OF TELEM IN PROMOTING R&D AND NATIONAL TECHNOLOGICAL AND SCIENTIFIC INITIATIVES

The Forum for National Research and Development Infrastructure (TELEM) was established at the initiative of the Israel Academy of Sciences and Humanities in 1997. TELEM is a high-level, ad hoc organization comprised of heads of Israel's major national research-funding organizations: Israel Academy of Sciences and Humanities, Chief Scientist of the OCS, Chair of the PBC of the Council for Higher Education, Director-General of the Ministry for Science, Technology and Space (MOST), the Head of the Research and Development Division of the Ministry of Defence and the Assistant Head of the Budget Department of the Ministry of Finance. The President of the Israel Academy of Sciences and Humanities serves as the chairperson of TELEM.

TELEM pools together the budgetary resources of its member organizations in order to catalyse and implement major joint science and technology initiatives of national interest. The major initiatives supported by the TELEM in recent years are:

- Establishment of nanotechnology and nanoscience R&D centres in five research universities (US$142.5 million).
- Establishment of RBNI – Nanotechnology Research at the Technion (US$78 million).
- The Internet2 initiative – second-generation broadband communications (US$38 million).
- Soreq Applied Research Accelerator Facility – SARAF (US$25 million).
- Participation in the European Synchrotron Radiation Facility – ESRF (US$10 million).
- Establishment of equipment centres intended for R&D in biotechnology (US$10 million).
- Purchase of heavy equipment for research in nanotechnology (US$ 11 million).
- Purchase of equipment for stem cells R&D (US$10 million).
- Establishment of a national Bio-bank and Bio-bank database (US$8.9 million).
- In addition to these initiatives, the feasibility of establishing R&D centres in the fields of brain research and photonics is being examined.

A Zoom on TELEM's Nanotechnology Initiative (INNI)

In 2007, the Israel National Nanotechnology Initiative (INNI) was launched with the aim of establishing research and structural infrastructures at six research universities, with the government, academia and the private sector equally sharing the costs. The mission of INNI is to make nanotechnology the next wave of successful industry in Israel by creating an engine for global leadership. To achieve this task, INNI activities include:

26 The Hebrew University of Jerusalem (2013). URL: http://new.huji.ac.il/en/cpage/449

- Establishing a national policy of resources for nanotechnology, with the aim of faster commercialization.
- Establishing long-range nanotechnology programmes for scientific research and technology development in academia and industry, and promoting the development of a world-class infrastructure in Israel to support them.
- Leading in the creation of projects that promote agreed national priorities, allocating their budgets and reviewing development progress.
- Actively seeking funding resources from public and private sources in order to implement the selected projects.
- Promoting development of innovative local nanotechnology industries, which will strongly affect Israeli economic growth and benefit investors.
- Managing TELEM Instruments for the Promotion of the Life Sciences, including:

TZATAM (Life-Sciences R&D Supporting-Equipment Purchase Grants) – an instrument designed to assist experienced companies specializing in providing research services in the field of Life Sciences by enabling them to purchase expensive equipment, thus strengthening the in-country Life Sciences R&D capabilities.

Bio-Bank – an organized collection of human biological material and associated information stored for one or more research purposes. Bio-banks allow researchers to analyse data representing a larger number of individuals than they previously had access to, thus profoundly improving the efficient use of biological information and hastening new medical discoveries. Samples are collected and distributed by selected medical institutions around the country. The biological material is available for academic researchers at a subsidized cost. Local for-profit entities are able to obtain the materials at cost.

Source: OCS (2013)

Academic staff

University staff is an important if not a definitive factor in the advancement of university research. It is also responsible for the quality of curricula and teaching and, in this sense, for the quality of graduates of higher-education institutions—who constitute the national reserve of human capital. The university teaching and research staff in Israel is divided into the following ranks:

- *Senior academic staff* – professors, associate professors, senior lecturers, and lecturers
- *Junior academic staff* – instructors (doctoral students), assistants, and teaching and research aides
- *Other academic staff* – mainly external teachers

Figure 30 presents total university academic staff funded via the universities' regular budget in 1995–2013 in terms of full-time-post equivalent (monthly average). In 2012/13, there were 4 600 senior academic staff posts. This figure is basically unchanged since 1996/97. Concurrently, the number of senior staff posts in academic colleges has more than doubled during the last decade from 960 posts in 2002 to 1965 posts in 2013 (Council for Higher Education Report, 2014). The student-teacher ratio in research universities has remained constant in the past decade, standing on 25 students per one faculty member, as compared to 11 students per one faculty member in the OECD.

Figure 31 presents the distribution of staff members in 2010/11 by fields of knowledge (UNESCO, 1978, OECD, 2002). The distribution is the following: agricultural sciences (1%), engineering and technology (13%), humanities (20%), medical and health sciences (9%), natural sciences (28%), and social sciences (25%).

According to 2010/11 data, 28% of the senior academic staff were women, 5% higher compared to 2000/2001. Women's representation increased in most disciplines but remained very low in engineering (14%), physical sciences (11%), and mathematics/computer science (10%) relative to education (52%) and paramedical occupations (63%).

The average age of university senior academic staff in 2001 was 52.9 years. Nearly 46% of the senior academic staff in universities and colleges was over the age of 55 (Getz *et al.*, 2013).

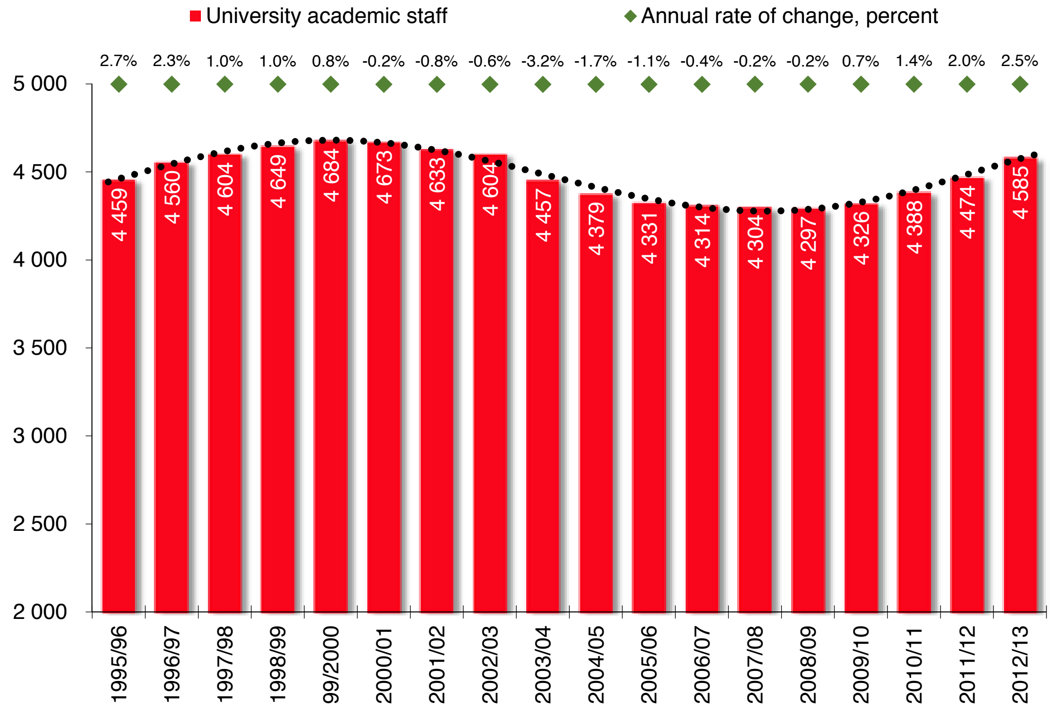

Figure 30: FTE university teaching and research staff, 1995–2013. Source: UNESCO based on data by Central Bureau of Statistics

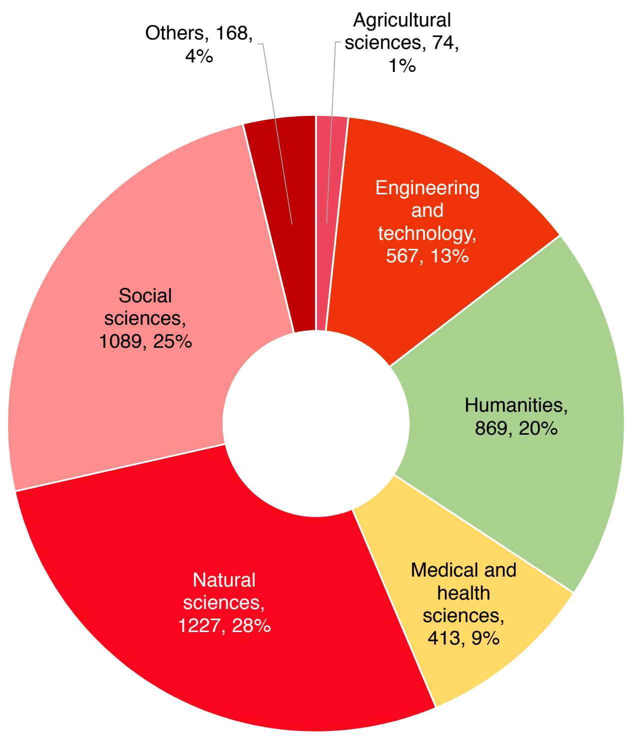

Figure 31: Number and percentage of FTE university senior academic staff by field of knowledge, 2010/11. Source: UNESCO based on data by Central Bureau of Statistics

Time devoted to R&D by type of research

In 2009, the Central Bureau of Statistics performed a survey on teaching and research activities of university senior academic staff (Central Bureau of Statistics, 2011). The data presented in Figure 32, based on this survey, presents the time devoted by academic staff to R&D activity and the distribution of time by type of research.[27] The data shows that in engineering and architecture, 41% of senior academic staff time was devoted to R&D, as compared 49% in mathematics and the natural sciences. The share of time invested in basic research is lower in engineering and architecture than in other fields, whereas that invested in applied research in these fields is higher.

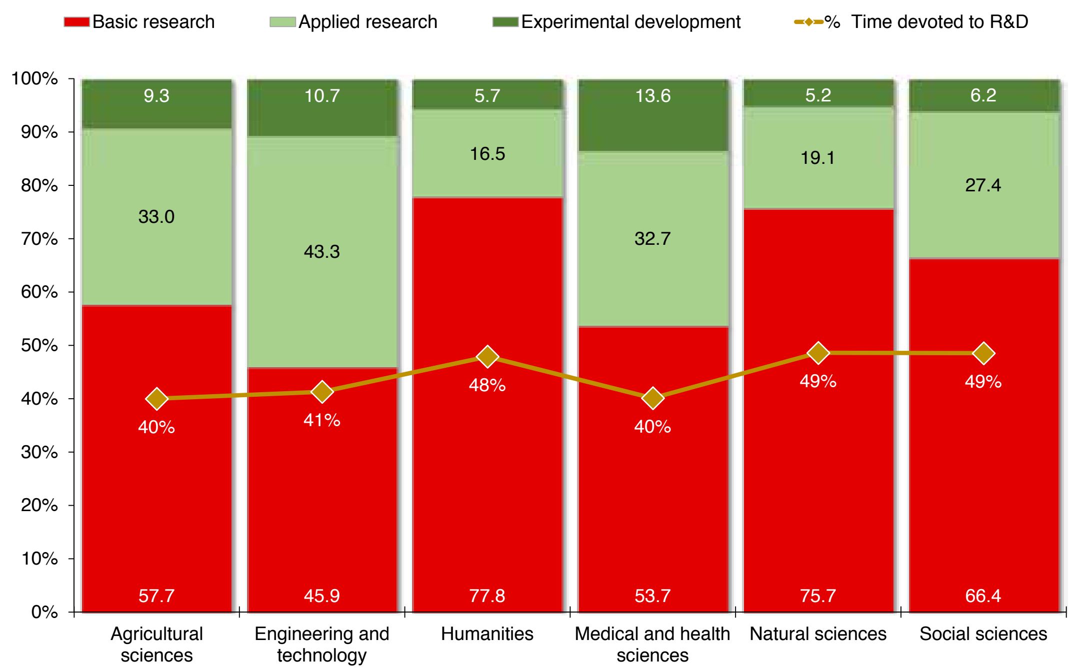

Figure 32: Time devoted to research and type of research, 2009/10. Source: UNESCO based on data by Central Bureau of Statistics

Capacity building for science and engineering

Israel's pool of scientific and technological human capital is crucial for its R&D activity and definitive in cementing its standing in scientific research, a major engine of economic growth. The human-capital pool is composed of current human capital and a reserve in which the state invests, by providing education and higher schooling, to assure quality human capital in the future. Most basic research takes place in the higher-education system and is crucial for the development of the economy and tomorrow's research labour force. Since it takes many years to observe changes in human capital, it is immensely important to track indicators of human-capital reserves so that Israel may remain at the cutting edge of knowledge and progress (Getz *et al.*, 2013).

Figure 33 illustrates growth trends in the number of students in institutions of higher and tertiary education in Israel (1945–2014). The data reflects the total number of enrolled students (both sexes) according to the International Standard Classification of Education (ICSED) level 5 (short cycle tertiary education), level

27 According to UNESCO (1978) research is parsed into three distinct types: (1) *Basic research* – experimental or academic research performed without application or pre-planned use meant to yield basic knowledge about a phenomenon or an existing work, (2) *Applied research* – original research geared to a specific objective or a specific useful purpose, and for acquiring new knowledge and (3) *Experimental Development* – systematic work based on existing knowledge and aided by practical studies and experiments for producing new materials, products, or instruments (e.g., new processes, services, and systems, or to improve existing ones perceptibly).

6 (Bachelor's degree of equivalent level), level 7 (Master's degree or equivalent level) and level 8 (PhD or equivalent level). For a detailed description of UNESCO's ISCED classification, see pages 318–320. Figure 33 shows four different periods according to their respective growth rates (1945–1963, 1964–1972, 1973–1988 and 1989–present). These patterns are reflected at both higher and tertiary education.

Until the late 1980s, Israel's higher-education system was based almost exclusively on universities. This changed during the early 1990s with the establishment of a large number of colleges that allowed new population groups to access higher education. According to Council for Higher Education (2013), in the course of two decades (1993–2013), the number of students studying for a first-degree in the academic colleges increased by more than 1000%, whereas the number of students for a first-degree in the research universities has grown by only 16%.

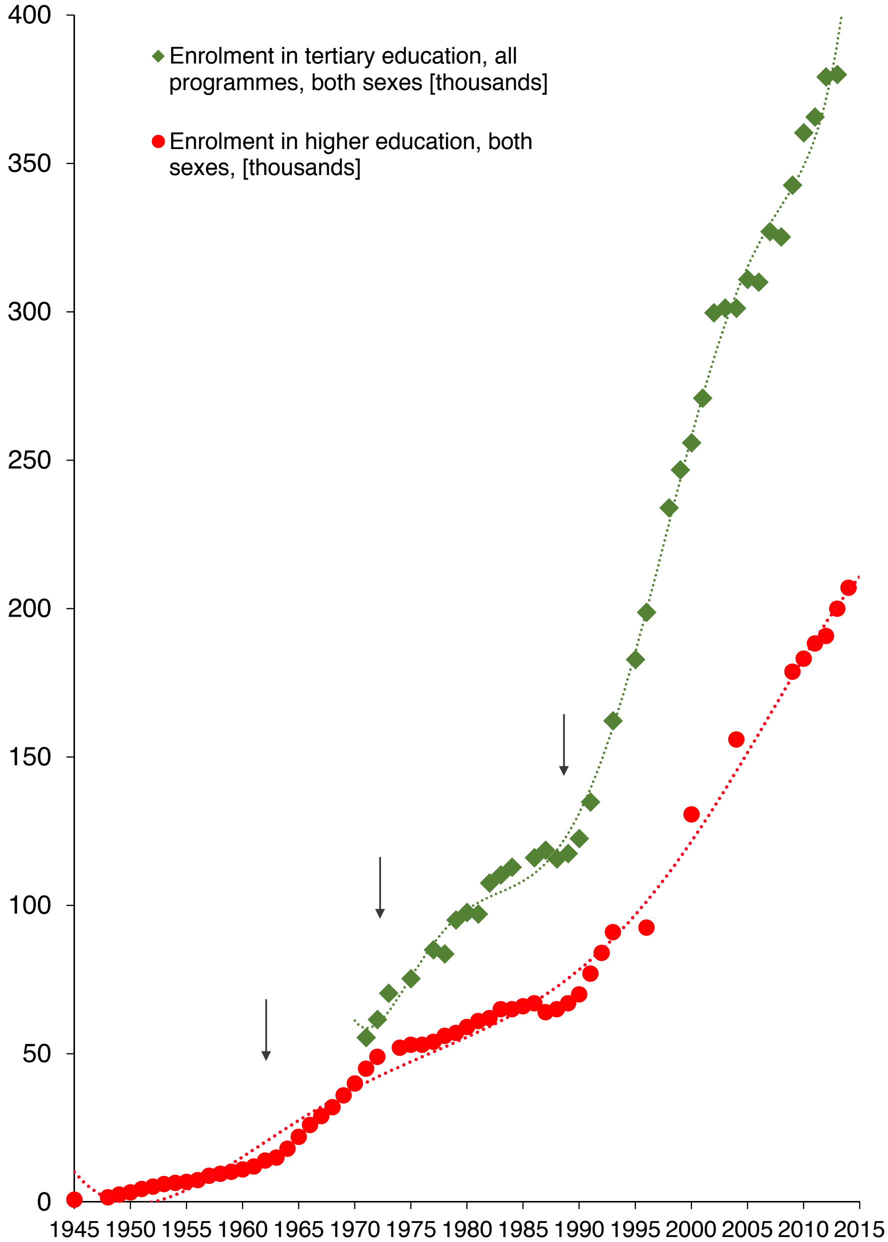

Figure 33: Total tertiary education (ISCED 5, 6, 7 and 8) enrolment in all programmes and in higher education (ISCED 6, 7 and 8) for both sexes in Israel 1945–2014. The dotted lines are the best-fitting curves. Source: UNESCO based on raw data available at UNESCO archives and UNESCO Institute for Statistics

Figure 34 presents the enrolment in tertiary education in thousands students by ISCED level and sex. This graph is represented in semi-logarithm scale. For example, in this type of graphs exponential growths are represented by straight lines.

The total number of students in research universities (all degrees) by year and academic institution is shown in Table 16. According to the data, since 1990, Ben-Gurion University has exhibited the largest growth in the number of students (nearly 200%), followed by The University of Haifa (155%). The Hebrew University of Jerusalem had the lowest growth rate (15%) in this period (Council for Higher Education, 2013).

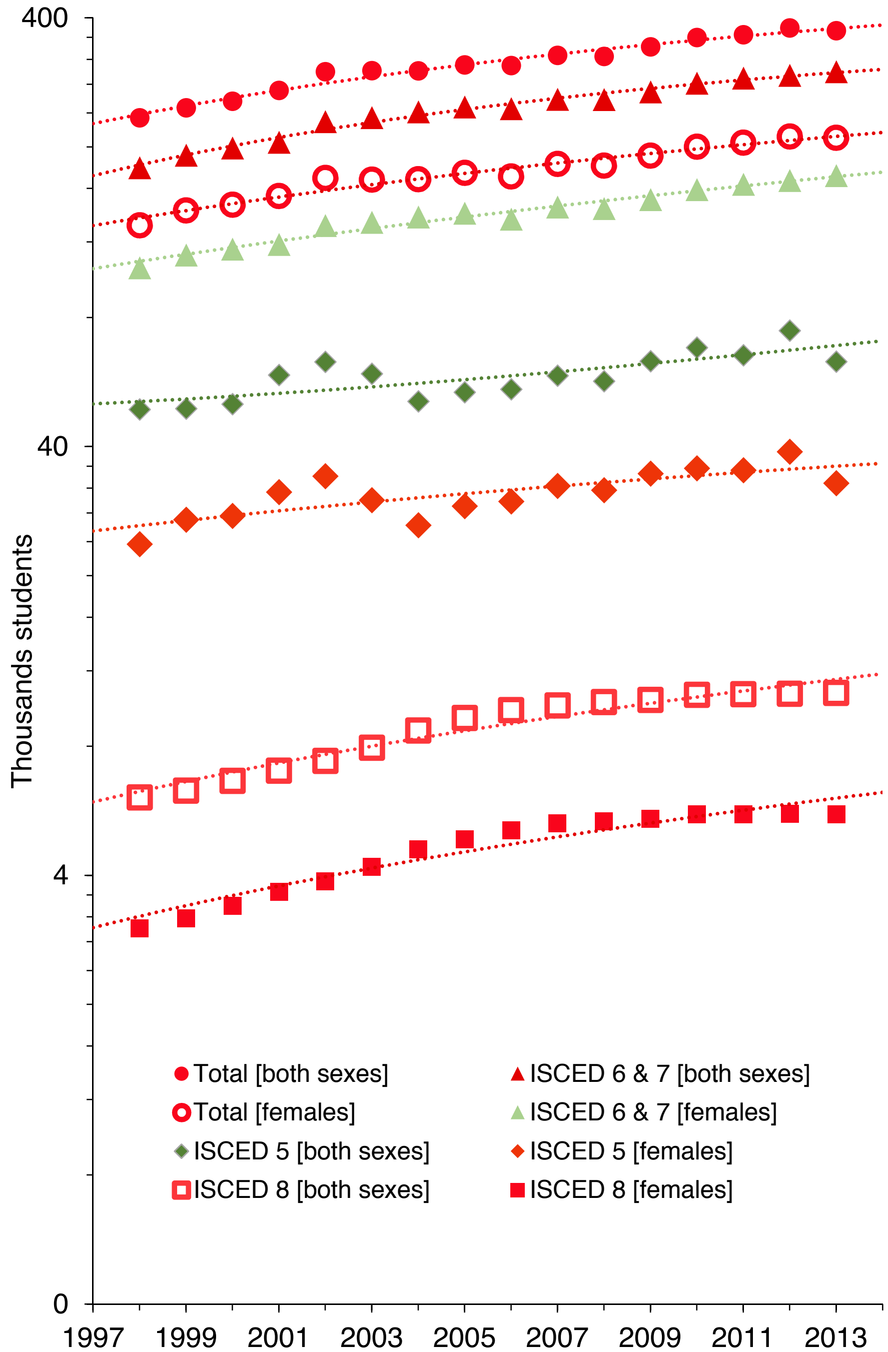

Figure 34: Enrolment in tertiary education in thousands students by ISCED level and by sex in Israel, 1998–2013. Source: UNESCO Institute for Statistics.

Table 16: Students in universities by institution (all degrees)

Academic Year	Weizmann Institute	Ben-Gurion University	University of Haifa	Bar-Ilan University	Tel-Aviv University	Technion	Hebrew University	Total
1990/91	640	6 410	7 030	10 200	19 440	9 770	17 700	71 190
1991/92	680	7 490	8 120	11 930	21 530	10 280	18 610	78 640
1992/93	740	8 220	9 670	13 320	23 440	10 470	19 130	84 990
1993/94	750	9 080	11 450	14 830	25 190	10 500	19 680	91 480
1994/95	770	10 340	12 440	16 890	26 030	10 480	20 300	97 250
1995/96	760	12 250	12 820	19 110	26 100	10 370	20 290	101 700
1996/97	750	13 830	13 000	19 810	25 660	10 780	21 070	104 900
1997/98	740	14 870	13 390	20 700	25 860	11 840	21 730	109 130
1998/99	760	16 020	13 510	21 030	26 120	12 380	21 510	111 330
1999/00	790	16 310	13 550	21 770	26 480	12 720	21 390	113 010
2000/01	800	16 910	13 850	21 810	26 300	13 040	21 040	113 750
2001/02	850	17 920	14 590	22 800	26 790	13 520	21 040	117 510
2002/03	920	19 050	15 260	23 480	27 310	13 225	21 625	120 870
2003/04	930	19 340	16 170	24 590	28 480	13 320	21 975	124 805
2004/05	960	18 640	16 270	25 025	28 740	12 810	21 985	124 430
2005/06	960	18 080	16 655	24 785	28 200	12 520	21 810	123 010
2006/07	980	17 910	16 780	25 290	26 490	12 490	21 640	121 580
2007/08	975	18 347	17 460	25 890	25 130	12 420	21 175	121 397
2008/09	996	19 350	16 549	25 930	25 145	12 424	20 635	121 029
2009/10	1 044	19 854	16 830	26 468	26 346	12 750	20 673	123 965
2010/11	1 082	19 902	17 329	26 367	27 173	12 832	20 374	125 059
2011/12	1 075	19 297	17 590	26 209	27 979	12 840	20 584	125 574
2012/13	1 086	18 884	17 910	25 404	28 129	13 231	20 313	124 957

Source: Council for Higher Education – Statistical Data.

UNESCO and OECD classification by field of sciences includes six major topics: (a) natural sciences (including biological sciences, chemistry, physics, mathematics and computer science), (b) engineering and technology, (c) health and medical sciences, (d) agriculture sciences, (e) social sciences and (f) the humanities. Of these, (a) through (e) lie at the core for defining science and technology human capital.

Table 17 shows distribution of students in institutions of higher education in Israel by field of study and degree level. Student enrolment in S&T fields provides an indirect indication of the future labour force. In the 2012/2013 academic year, 34% of all Bachelors students, 27% of all Masters students and 56% of all PhD students were enrolled in natural sciences, engineering and technology, agricultural sciences, or health/medical sciences. By comparison, in the 1995/1996 academic year, students enrolled in these fields at these levels accounted for 28%, 30%, and 59%, respectively.

Table 17: Students in institutions of higher education by level of degree and field of study, 1995–2014

Field of knowledge	1995/96	2000/01	2004/05	2009/10	2010/11	2011/12	2012/13	2013/14
	Bachelor's degree							
Agricultural sciences	0.8%	0.6%	0.6%	0.5%	0.5%	0.6%	0.6%	0.6%
Engineering and technology	11.2%	16.6%	17.6%	18.8%	18.3%	18.0%	17.9%	17.6%
Humanities	36.7%	31.5%	28.7%	23.4%	23.3%	23.3%	24.1%	24.9%
Natural and exact sciences	11.1%	13.7%	10.1%	9.1%	9.2%	9.4%	9.5%	9.9%
Medical and health sciences	5.0%	5.0%	5.3%	5.4%	5.6%	5.7%	6.1%	6.4%
Social sciences	35.2%	32.6%	37.7%	42.7%	43.1%	43.0%	41.8%	40.6%
Total number of students	92 530	130 685	155 895	178 739	183 157	188 226	190 810	192 708
	Master's degree							
Agricultural sciences	1.7%	1.4%	1.4%	1.2%	1.1%	1.1%	1.1%	1.0%
Engineering and technology	7.9%	8.7%	7.7%	6.5%	6.8%	6.6%	6.7%	7.3%
Humanities	26.8%	26.8%	24.7%	25.9%	28.2%	29.1%	30.1%	30.5%
Natural and exact sciences	10.9%	10.3%	12.2%	9.3%	8.7%	8.2%	8.2%	8.1%
Medical and health sciences	9.2%	8.9%	9.1%	10.8%	10.2%	10.6%	11.1%	11.5%
Social sciences	43.5%	43.8%	44.8%	46.3%	45.0%	44.4%	42.8%	41.6%
Total number of students	25 720	31 500	38 980	47 237	50 765	52 668	54 466	54 738
	Doctorate							
Agricultural sciences	3.7%	3.1%	2.6%	2.8%	2.7%	2.6%	2.6%	2.5%
Engineering and technology	9.3%	7.3%	7.6%	8.4%	8.3%	8.6%	9.0%	9.3%
Humanities	26.1%	30.2%	28.6%	25.5%	25.7%	24.8%	25.0%	24.8%
Natural and exact sciences	43.6%	37.4%	36.0%	37.9%	37.9%	38.4%	39.1%	38.3%
Medical and health sciences	5.2%	4.8%	6.0%	6.7%	6.9%	7.1%	5.2%	5.5%
Social sciences	12.1%	17.1%	19.2%	18.7%	18.5%	18.5%	19.1%	19.6%
Total number of students	5 470	7 020	9 340	10 567	10 590	10 615	10 655	10 719

Source: Council for Higher Education – Statistical Data

Women in the higher education sector

Huyers (2015) showed that women's participation in research overall at global level can be seen as a leaky pipeline. Women are actively pursuing Bachelor's and Master's degrees and even outnumber men at these levels, since they represent 53% of graduates. However, these numbers drop off abruptly at PhD level to 43% (UNESCO Science Report, 2015: 84–103). The discrepancy widens at the researcher level, with women representing 28% of the global pool. For these reasons, the growing proportion of women in higher education is, thus, not necessarily translating into a greater presence in research.

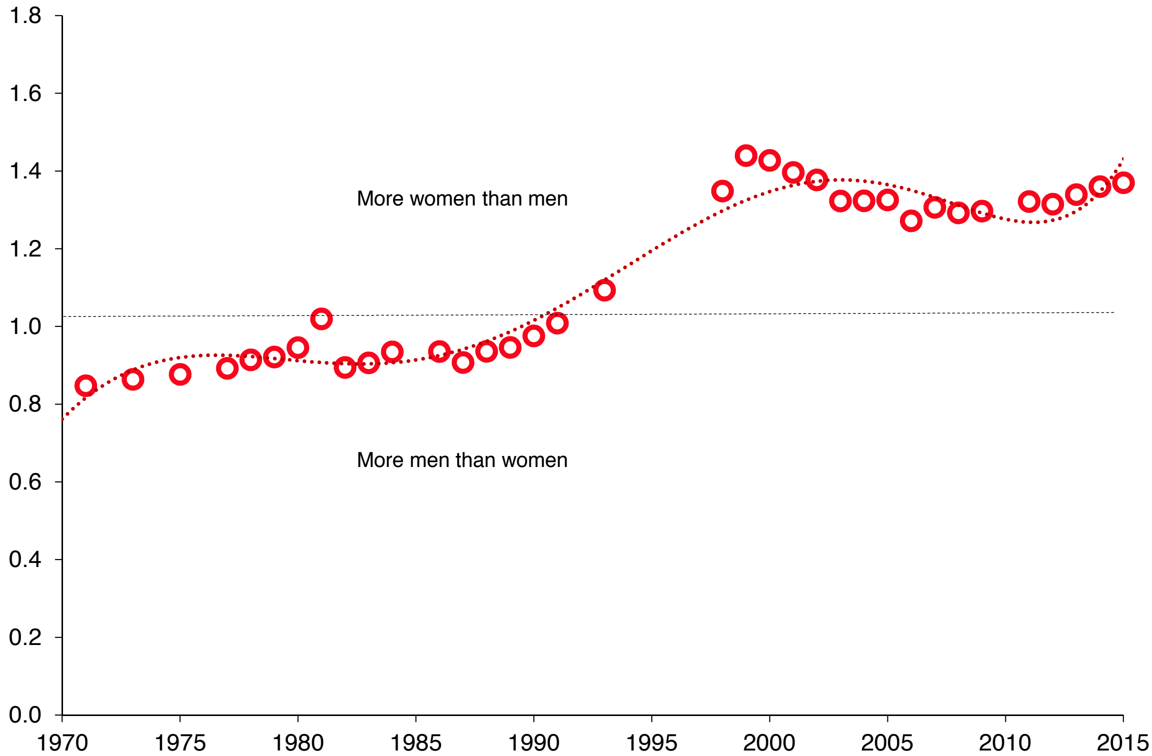

Figure 35: Gender parity index (GPI): ratio of female to male gross tertiary enrolment in Israel, 1970–2013. Source: UNESCO Institute for Statistics

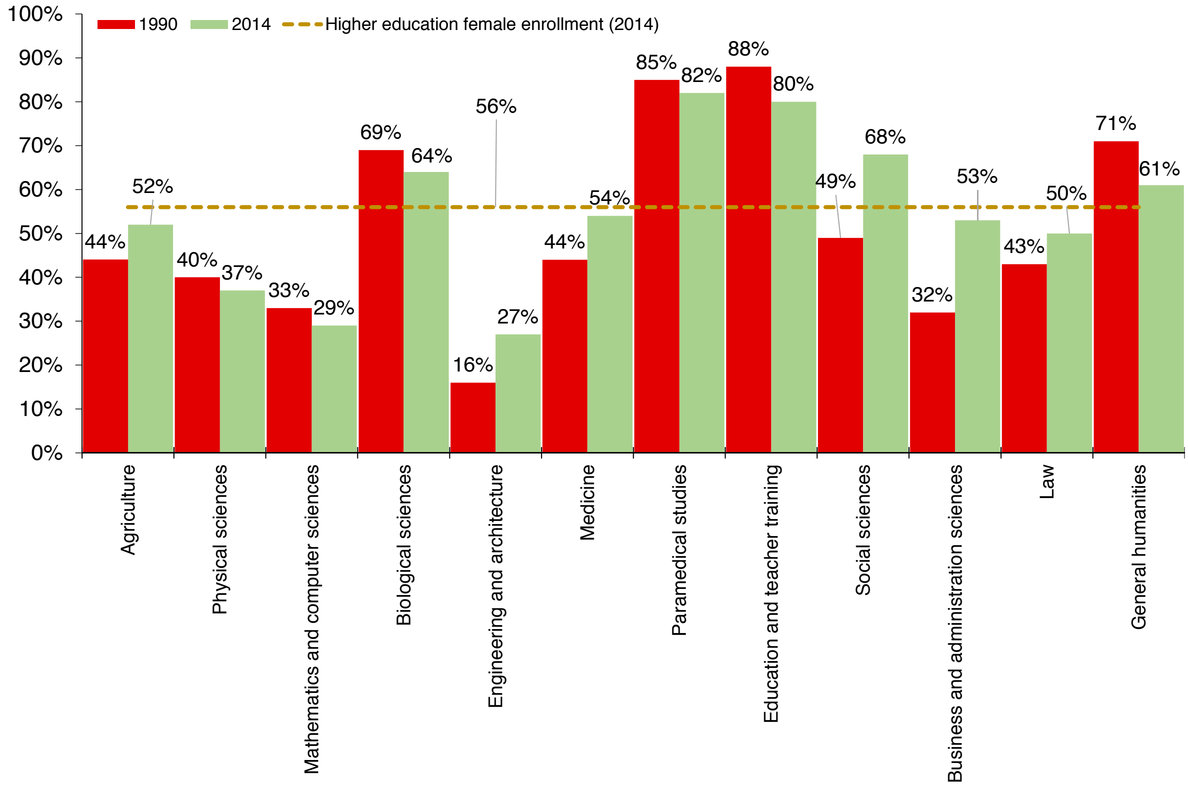

Figure 36: Higher education female enrolment by field of science, 1990 and 2014. Source: Planning and Budgeting Committee, Israel

Figure 35 shows the gender parity index or the ratio between female and male gross tertiary enrolment for Israel (1970–2013). On average, more women than men are pursuing university degrees in Israel for each year since 1990. However, Figure 36 presents a different picture by showing the disaggregated shares by major field of science for 1990 and 2014. In the past 25 years, there was a drop in women's tertiary enrolment in physical sciences, mathematics & computer sciences and biological sciences. There was a modest increase in agriculture sciences, engineering & architecture and medicine. The global enrolment average (56%) is a little bit over the global average (53%). Figure 37 presents the distribution of shares of women out of academic staff by field of study (2000, 2005 and 2011). It is very clear that with the exception of paramedical studies and education & teacher training, women are highly underrepresented. These facts and continuous trends constitute a major gap in the higher education system of Israel.

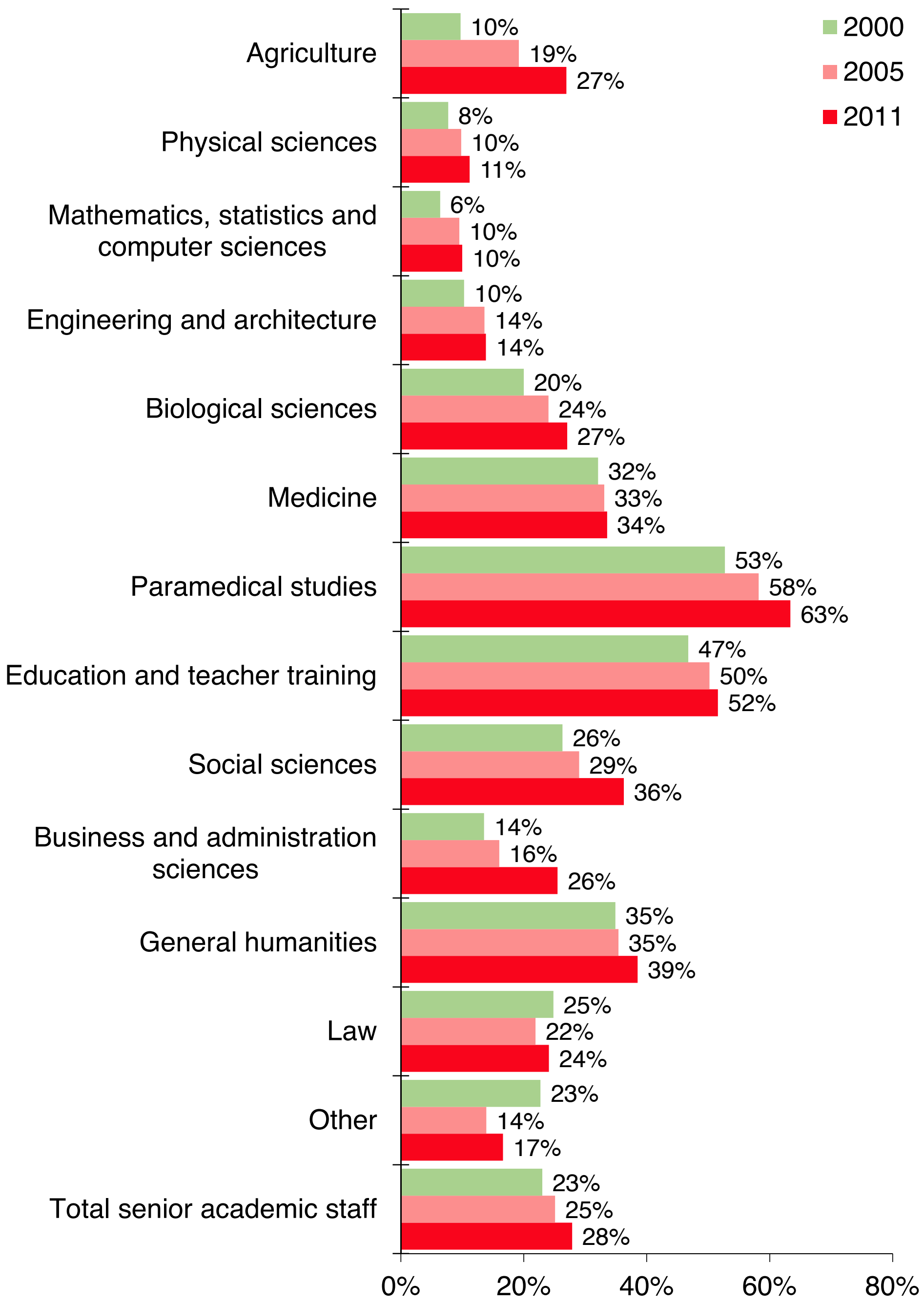

Figure 37: Women as a percentage of Academic Staff in Israel, 2000, 2005 and 2011. Source: Planning and Budgeting Committee, Israel

BOX 8 – THE CONTRIBUTION OF ACADEMIA TO THE LIFE SCIENCE INDUSTRY

Israel's thriving life sciences industry is world-renowned for its ground-breaking innovations, ingenuity and creativity. It is home to around 1 000 Life Science companies, with 40 new companies being formed each year. Multinational companies including Johnson and Johnson, Perrigo, GE Healthcare and Phillips Medical, together with local companies such as Teva, Insightec, Medinol, Compugen, Kamada and others have been at the forefront in the development of life-changing medical devices, treatments and medications.

Israel's life science sector is supported by a strong foundation of academic excellence. Basic research in the life sciences is strongly supported by the Israel Science Foundation (ISF), the TELEM Forum and by Israel's leading research universities. Seven university-associated and five hospital-affiliated technology transfer offices (TTO) provide a valuable bridge to connect researchers and early-stage projects with both investors and partnerships with multinational corporations. Each year, Israeli TTO generate a total of approximately US$360 million in royalties, while Israeli universities and research institutions license some 150 new technologies. An average of 15 new companies are established annually based on academic inventions and breakthroughs.

The Life Science Industry in Israel

Teva Pharmaceuticals is Israel's leading and most successful multinational company. Headquartered in Israel, Teva operates in 60 countries and has 45 000 employees worldwide. Teva is ranked among the top 15 pharmaceutical companies in the world and is the world's largest generic pharmaceutical company with US$ 20.3 billion in net revenues in 2013.

Key Innovations in Medical Devices and Biopharmaceuticals by Israeli Firms

- Pillcam, the first miniature ingested camera which diagnoses and photographs abnormalities in the gastrointestinal tract was introduced by Given Imaging, acquired in 2014 by Ireland's Covidien.
- Galil Medical's minimally invasive cryotherapy solutions freeze and ablate benign cancerous tissue, thereby hastening a patient's recovery.
- Teva's Copaxone (the drug, Glatiramer acetate was discovered by Michael Sela, Ruth Arnon and Dvora Teitelbaum at the Weizmann Institute of Science) and Azilect (the drug, Rasagiline was developed by Moussa Youdim at the Technion-Israel Institute of Technology) are revolutionary drugs developed in Israel for the treatment of Multiple Sclerosis and the Parkinson's disease.
- Medinol's closed cell stent is used worldwide for heart catheterization.
- Rebif, a treatment for central nervous system disorders was developed by the Weizmann Institute of Science and Serono.
- Insightec developed a non-invasive surgery technique – ExAblate 2000, which uses MR-guided focused ultrasound to treat uterine fibroids.
- Exelon, a drug for the treatment of Alzheimer's originated at The Hebrew University and was developed and marketed by Novartis.
- Doxil – A chemotherapy drug for the treatment of ovarian cancer was developed at the Hadassah Medical Centre and sold to Johnson and Johnson.
- Microneedle based systems for the painless intradermal delivery of drugs was implemented by NanoPass, which collaborated with GlaxoSmithKline on optimization of its platform for vaccine delivery.
- Mazor Robotics Renaissance Guidance System, developed by Mazor Robotics Ltd, allows surgeons to perform complex spine surgeries and minimally invasive surgery techniques.

Student mobility

Since the 1970s, there has been a great expansion in higher education enrolment across the world. Governments are currently going through a period of policy transition with policy makers seeking to reorient the objectives and instruments of policy to reflect the increasingly sharp awareness of knowledge creation and learning as drivers of innovation growth employment and wealth.

Human resources are recognised as being key for conducting scientific research developing new technologies commercialising and diffusing innovation. Among them doctorate holders are not only the most qualified in terms of educational attainment but also those who are specifically trained to conduct research. Governments and institutions increasingly build internet-based social networks that are expressly designed to allow post-graduate students, doctorates and researchers abroad to keep in contact with institutions in the home country e.g. diaspora networks.

The international mobility of tertiary students has been a phenomenon of growing interest for scholars and policy makers since the 1960s and can have a significant impact on shaping the structure of national innovation systems. The mobility of students worldwide is perhaps the most visible form of cross-border higher education and one that has been monitored over years.

According to UNESCO Institute for Statistics (2012) in 1980, the population of internationally mobile students was about 1.1 million. The number increased slightly to 1.3 million in 1990 but by 2009 had tripled to 3.4 million. The number of mobile students has been expected to grow to 8 million by 2020 (Altbach, 2006).

Students from Israel are dispersed across a wide range of host countries. A wider dispersion may imply that students are returning to their home country with a richer mix of new ideas. On the one hand, Table 18 shows the number of tertiary students from Israel studying abroad in the top-39 countries over the past 15 years. In order of importance, Jordan, USA, Italy, Germany, Moldova, Canada and United Kingdom were the preferred destinations. On the other hand, Table 19 shows the distribution of tertiary students who are studying in Israel, broken down according to their regions of origin. The majority of foreign students come from North America, Europe and Asia.

Table 18: Number of tertiary students from Israel studying abroad, 1999–2013

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Australia	117	105	..	267	327	292	268	224	202	202	191	168	156	128	314
Austria	49	52	54	30	34	37	..	44	57	93	120	118	124	88	108
Belarus	35	..	30	30	15	35	31	31	40	47	54	50	45	52	50
Belgium	49	45	51	45	49	..	11	8	13	..	20	18	15	27	29
Brazil	..	..	..	..	..	2	..	..	..	..	23	18	22	18	..
Bulgaria	76	62	57	54	61	69	61	77	82	72	64	61	53	52	65
Canada	153	153	174	201	273	291	270	288	287	315	264	258	189	951	..
Chile	4	2	..	11	11	..	4	..	5	7	2	7	..	..	..
Czech Republic	39	33	40	61	85	111	150	153	186	168	144	137	133	125	117
Denmark	36	37	39	39	49	54	39	44	39	6	12	19	16	13	46
Finland	19	20	22	21	22	24	27	..	24	23	28	20	19	22	24
France	258	260	267	251	342	343	305	299	275	284	309	256	290	267	186
Germany	995	944	876	878	960	1 116	1 225	1 223	1 275	1 295	1 348	1 500	1 466	1 533	1 555
Greece	..	..	..	29	26	37	36	64	83	..	..	66	68	71	..
Hungary	334	..	578	637	664	706	741	761	754	791	795	806	794	739	739
India	..	2	10	..	6	7	8	17	..	..	..	..	45	..	..
Ireland	10	3	1	3	6	6	6	9	12	11	12	13	10	9	..
Italy	681	626	670	682	910	923	1 002	1 060	1 121	1 209	1 461	1 525	1 626	1 619	..
Japan	31	32	27	32	32	37	37	43	38	47	46	36	33	33	..
Jordan	..	372	..	..	1 060	716	1 695	1 863	2 316	3 086	2 836	2 913	2 911	2 876	..
Latvia	977	4 922	6 819	1 940	1 092	19	17	..	19	15	14	14	14	9	8
Lithuania	18	30	46	62	61	62	79	99	109	107	110	93	94	93	99
Netherlands	63	67	77	96	124	87	98	84	74	70	55	61	76	114	..
New Zealand	2	4	7	12	17	20	11	..	7	12	12	15	18	16	10
Norway	11	12	15	13	21	21	24	18	21	25	24	22	15	22	13
Poland	16	16	15	52	47	22	32	29	25	27	27	38	45	50	68
Republic of Korea	2	..	..	1	1	1	3	4	3	2	5	5	5	..	5
Republic of Moldova	..	..	45	105	61	71	8	130	175	208	300	525	766	1 086	1 433
Romania	590	454	453	460	471	504	592	586	527	651	612	768	939	..	..
Russian Federation	..	..	..	..	..	..	..	..	..	407	368	..	364	..	..
Slovakia	..	8	100	101	111	116	148	153	146	137	114	94	77	57	108
South Africa	..	..	..	..	..	..	..	..	..	..	..	..	36	20	..
Spain	78	106	75	77	82	30	36	30	25	44	48	40	48	50	107
Sweden	15	19	26	26	36	4	1	1	1	15	18	29	30	26	20
Switzerland	32	35	43	40	56	57	74	73	75	86	86	98	92	93	32
Thailand	2	..	3	3	..	..	6	7	8	13	9	13	12	15	..
Turkey	102	85	65	44	25	21	22	23	24	21	15	17	22	20	34
United Kingdom	2 047	1 770	1 409	1 609	1 289	1 300	1 122	937	889	616	613	562	593	508	497
USA	2 852	2 989	2 951	3 458	3 521	3 474	3 471	3 540	3 341	3 007	3 010	2 753	2 649	2 412	2 326

Note: empty cells indicate that no information on the number of tertiary students from Israel was submitted to the UNESCO Institute for Statistics by the host country. Source: UNESCO Institute for Statistics

Table 19: Tertiary students from different regions studying in Israel, 2010–2012

Tertiary students from different regions studying in Israel	2010	2011	2012
Africa [both sexes]	50	53	74
Asia [both sexes]	134	172	350
Europe [both sexes]	531	649	943
North America [both sexes]	890	1 016	1 642
Oceania [both sexes]	14	19	33
South America [both sexes]	68	83	107
The Caribbean and Central America [both sexes]	24	27	46
Unknown continents [both sexes]	1 181	1 927	1 311
Total [both sexes]	2 892	3 946	4 506
Total [females]	1 334	2 133	2 386

Source: UNESCO Institute for Statistics

BOX 9 – INTERNATIONAL CO-OPERATION – SCIENCE FOR PEACE AND PEACE FOR SCIENCE

Though Science was not included in the original title of the Organization, the British delegation will put forward a proposal that it be included, so that the title would run "Educational, Scientific and Cultural Organization." In these days, when we are all wondering, perhaps apprehensively, what the scientists will do to us next, it is important that they should be linked closely with the humanities and should feel that they have a responsibility to humankind for the result of their labours. I do not believe any scientists will have survived the world catastrophe, who will still say that they are utterly uninterested in the social implications of their discoveries.

Ellen Wilkinson, President of the first General Conference of UNESCO, 6 November 1945

Scientists have always formed a world brotherhood. Their problems and the solutions they sometimes find are truly human and therefore international. What wonderful scope for the development of collaboration and brotherhood between the different countries of the world! The only spadework needed for mutual understanding between scientists is the mere understanding of the same language: if they have this, two botanists or two physicists from the most distant continents are immediately drawn together by strong common interests.

Pierre Auger, UNESCO Courier, vol. 1 (7): 3, 1948

While actions at the level of community and state are urgently needed, legitimate local interests must not take precedence over the common interest of all human beings in justice, happiness, and peace. Responsible control of technology by social systems and institutions is an urgent *global* concern, overriding all conflict of interest and all divergences in religion, race or political allegiance. Ultimately all must benefit from the promise of technology…

The Mount Carmel Declaration on Technology and Moral Responsibility.
Jerusalem, 25 December 1974

Science for peace through international co-operation

At the end of the Second World War, Edoardo Amaldi, Pierre Auger, Neils Bohr, Raoul Dautry and Lew Kowarski imagined the creation of a European atomic physics laboratory, not only to unite European scientists, but also to allow them to share the increasing costs of nuclear research.

Nobel laurate, Louis de Broglie put the first official proposal at the European Cultural Conference in 1949. Few months later, during the fifth UNESCO General Conference held in Florence in 1950, Isidor Rabi another Nobel laurate, tabled a resolution authorizing UNESCO to 'assist and encourage the formation of regional research laboratories in order to increase international scientific collaboration…' In 1951, at an intergovernmental meeting of UNESCO in Paris, the first resolution concerning the establishment of a European Council for Nuclear Research (CERN) was adopted. The CERN Convention was established in 1953 and was ratified by the original twelve Member States (Belgium, Denmark, France, the Federal Republic of Germany, Greece, Italy, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom and Yugoslavia). On 29 September 1954, the European Organization for Nuclear Research officially came into being. The provisional CERN was dissolved, but the acronym remained.

SESAME as a tool to strengthen scientific co-operation in the Middle East

Fifty years later, a new cooperative venture by scientists and governments of the Middle East region was modelled institutionally on CERN and set up under the auspices of UNESCO following the formal approval given by the Organization's Executive Board (164th session, May 2002). The project known as SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) was consolidated in an intergovernmental facility built in Jordan. It operates as a truly international research centre by fostering a regional community of scientific users, thus building scientific and cultural bridges in the Middle East. SESAME's Member States are Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestine and Turkey. The Observers countries are Brazil, China, France, Germany, Greece, Italy, Japan, Kuwait, Portugal, the Russian Federation, Spain, Sweden, Switzerland, the United Kingdom and the United States of America.

UNESCO serves on the Council of SESAME, which is the governing body of the Centre, and helps to promote partnerships within the Centre's programmes and among its Members as an instrument to empower them to enhance their basic and applied scientific knowledge and technology, harness science and technology innovations for sustainable development, and construct the defences of peace in the minds of people through co-operation in the sciences, education and intercultural dialogue in a region that calls for international solidarity and action.

SESAME is providing a vast scientific potential for scientists from the Middle East and neighbouring countries, enabling them to determine the structure of complex biologically active molecules and viruses to improve medical remedies, to get insight into the interior and the three-dimensional micro-structure of objects such as materials of primary importance for high technologies, cultural heritage and archaeology, or to investigate magnetisation processes which are highly relevant for magnetic data storage, to cite just a few examples.

UNESCO's support to SESAME was preceded by other important activities. In 2004, in the presence of several Nobel Prize laureates and other leading personalities of the scientific community, UNESCO hosted the international launch of the Scientific Committee of the Israeli- Palestinian Science Organization (IPSO).This event was also an inspiring occasion and served as a concrete illustration of the constructive spirit needed for building peace in the Middle East. That spirit was based on goodwill, intellectual courage and solidarity, and on a willingness to move beyond controversy and to seek together practical and innovative solutions to the many challenges in the fields of education, culture, science and communication facing the Middle East region.

Digging for the roots of peace – a window for an International Peace Research Centre in the Middle East

Despite ancient origins, it was in years after the Second World War that peace research, as a formal field of study with its own academic institutions and professional journals was established (Rogers and Ramsbotham, 1999). By the early 1960s, several international peace research centres were founded (i.e. Peace Research Institute Oslo, Japanese Peace Research Group, US Conference on Peace Research and History, Stockholm International Peace Research Institute; etc.). In 1964, the International Peace Research Association was founded at a meeting in London with important support from UNESCO (Galtung, 1985).

The basic concern of peace research is the reduction of violence of all kinds; this is done by progressively removing barriers in space (transnational, global studies), in the organization of knowledge (transdisciplinary, holistic studies), in time (integrating empirical studies of the past, critical studies of the present and constructive studies for the future). Peace research is a subject of study, which requires the combination of natural, social and human sciences in order to adequately address their different levels of complexity.

At the dawn of 21st Century, there are enormous gaps in our understanding of the roots of peace and in developing appropriate strategies to construct peaceful and sustainable societies.

Sixty years ago, Bertrand Russell and Albert Einstein published a Manifesto where they stated: 'We have to learn to think in a new way. We have to learn to ask ourselves, not what steps can be taken to give military victory to whatever group we prefer, for there no longer are such steps; the question we have to ask ourselves is: what steps can be taken to prevent a military contest of which the issue must be disastrous to all parties?' (Roblat, 1972).

The Middle East has been one of the most conflictual regions of the world, favouring negative effects on governance (see Figure 9, page 21), on the quality of life, and preventing sustainable development. However, negligible human and financial resources were devoted to perform serious scientific research on peace studies. Figure 38 shows the number of scientific publications by Israel's authors on peace research/conflict resolution appearing in the Science Citation Index (SCI) and Social Science Citation Index (SSCI) and the corresponding shares with the total number of articles on the same topics published in the world and the total number of scientific articles by Israeli authors (1980–2015). During the past 35 years, Israel produced on average 3.10% of the world production of articles on peace research and conflict resolution. However, this production only represents 0.11% of the total number of articles by Israel's authors included in the SCI and SSCI.

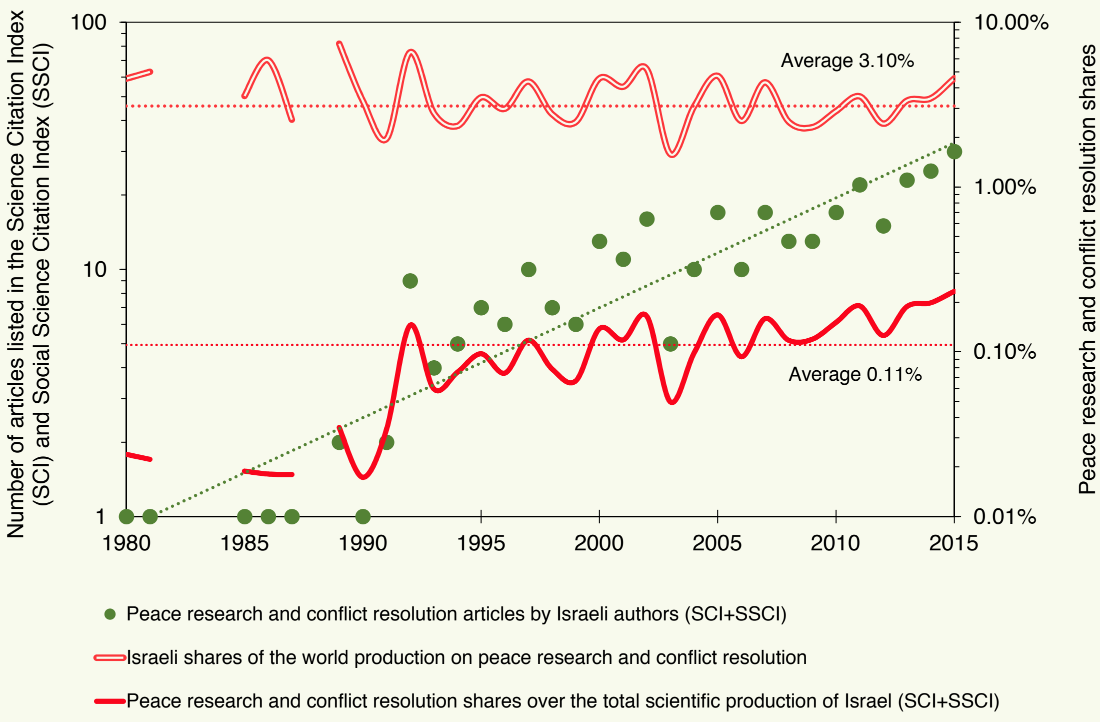

Figure 38: Number of articles by Israel's authors listed in the Science Citation Index and Social Science Citation Index on peace research/conflict resolution and the corresponding shares. Source: Web of Science, processed by UNESCO

For almost six decades, the Israel Academy of Sciences and Humanities as well as the research universities have been promoting excellence in scholarly research at natural and social sciences, as well as within the humanities. Internationally recognized scholars are working in Israel in all these areas. Peace research is a thematic field, which requires interdisciplinary and transdisciplinary approaches. There is room to create an International Centre of Excellence in Peace Research Studies with the aim of developing new knowledge, better understanding and eventually disembodied technologies for the promotion of peace among the different communities of the Middle East Region and all over the world. At global level, there are only few hundred scientists working on peace research issues—a community a thousand times smaller than the number of researchers working on defence R&D. Peace among Israelis, Palestinians and the Arab States could greatly contribute to the achievement of political and economic stability in the region that will benefit all the communities. Science is an extraordinary tool to achieve those goals. This aim will improve the mutual relationship between Israel and its neighbours by opening new development opportunities.

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R&D indicators for Israel

UNESCO has been conducting global surveys on R&D indicators since the early 1960s (UNESCO, 1960). For decades, this work was performed by the organization's former divisions of Science Policy and of Statistics on Science and Technology. Between 1970 and 1995, information from UNESCO's global R&D surveys was published in the annual UNESCO Statistical Yearbooks and in special reports prepared by the aforementioned divisions. Between 1960 and 1990, several R&D surveys were conducted in Africa, Asia and the Pacific, the Arab States, Europe and Latin American and the Caribbean.

In the late 1990s, the Division of Statistics left UNESCO headquarters in Paris to become the UNESCO Institute for Statistics (UIS) in Montreal. Since then, the UIS has become the international repository of statistics on R&D input for the United Nations system. In 2014, it published the findings of its first global innovation survey generating valuable information to analyse the economic impact of research and innovation activities worldwide. The first UNESCO R&D surveys in Israel were conducted in the early 1960s (UNESCO, 1970). The following is a description of the long-term evolution of the main R&D indicators of Israel.

TRENDS IN RESEARCHERS IN RESEARCHERS

Policymakers have increasingly emphasized the importance of skilled people—what social scientists refer to as human capital—to both knowledge creation and productive innovation. As technical content spreads throughout a knowledge-based societies, skills associated with research and innovation are increasingly demanded. The planning and formulation of SETI policies require the knowledge of the total numerical strength of the most qualified human resources namely the total stock and the number of economically active persons who possess the necessary qualifications to be scientists, engineers and technicians.

The analysis and evaluation of SETI data assists in identifying the most efficient agents involved in creating basic and applied knowledge and knowhow, thus providing decision makers with valuable information, enabling them to channel public resources to where they generate the highest social return (Getz *et al.* 2013).

In this section, the assumed definitions on the different categories of R&D personnel follow the ones presented in the Glossary (see pages 318–320). Certain categories of measures are better adapted for addressing some questions than others and not all general population and workforce surveys include questions in each category. Fortunately the available data on Israel that is presented in this study not only has historical value, but also affords the possibility to track long-term trends, and thus to consider if policy change causes impacts.

For example, Table 20 shows the breakdown of total civilian R&D personnel, to expose full-time equivalent (FTE) units spend on R&D activities by sector for the years 2000–2012.

Data for two sectors (government and private non-profit) were neither available for the years 2000–2010 nor for 2012. As can be seen from Table 20, during the 2000–2011 period, the number of R&D employee posts in the business-enterprise sector increased by nearly 40%. The business-enterprise sector includes jobs in the manufacturing industries, computer and related services and in R&D. During the same period, the number of R&D employee posts in the higher-education sector decreased by 2%. Figure 39 shows the shares in the number of FTE researchers against sectors of employment. As of 2012, the business-enterprise sector comprised more than 84% of the total civilian R&D posts and the higher-education sector constituted approximately 15% of the total posts. The government and the private non-profit sectors made up on less than 1% of the total R&D researcher posts.

In 2012, Israel had 7.9 FTE researchers per thousand inhabitants and 17.5 FTE researchers per thousand members of the labour force. These numbers represent the highest density of FTE researchers of a given society in the world. However, only 21.2% of the FTE researchers are women, placing Israel among the countries with higher gender inequality in science and engineering.

Unfortunately, there are no records on the FTE and head count (HC) distribution of researchers and technicians by the qualification ISCED level (see Glossary pages 318–320), by sector of performance or by field of science. Israel needs to systematize and improve the information on indicators of R&D personnel for planning purposes.

Table 20: Total FTE R&D personnel (civilian), by sector of employment, 2000–2012

Year	Sector of employment			
	Business enterprise	Government	Higher education	Private non-profit
2000	41 144	n/a	9 405	n/a
2001	40 612	n/a	9 451	n/a
2002	39 743	n/a	9 684	n/a
2003	38 434	n/a	9 568	n/a
2004	38 829	n/a	9 130	n/a
2005	42 524	n/a	9 011	n/a
2006	46 530	n/a	8 956	n/a
2007	53 085	n/a	8 988	n/a
2008	51 620	n/a	9 181	n/a
2009	51 229	n/a	8 987	n/a
2010	53 511	n/a	9 120	n/a
2011	59 790	837	9 220	554
2012	64 734	n/a	n/a	n/a

Source: Central Bureau of Statistics and UNESCO Institute for Statistics

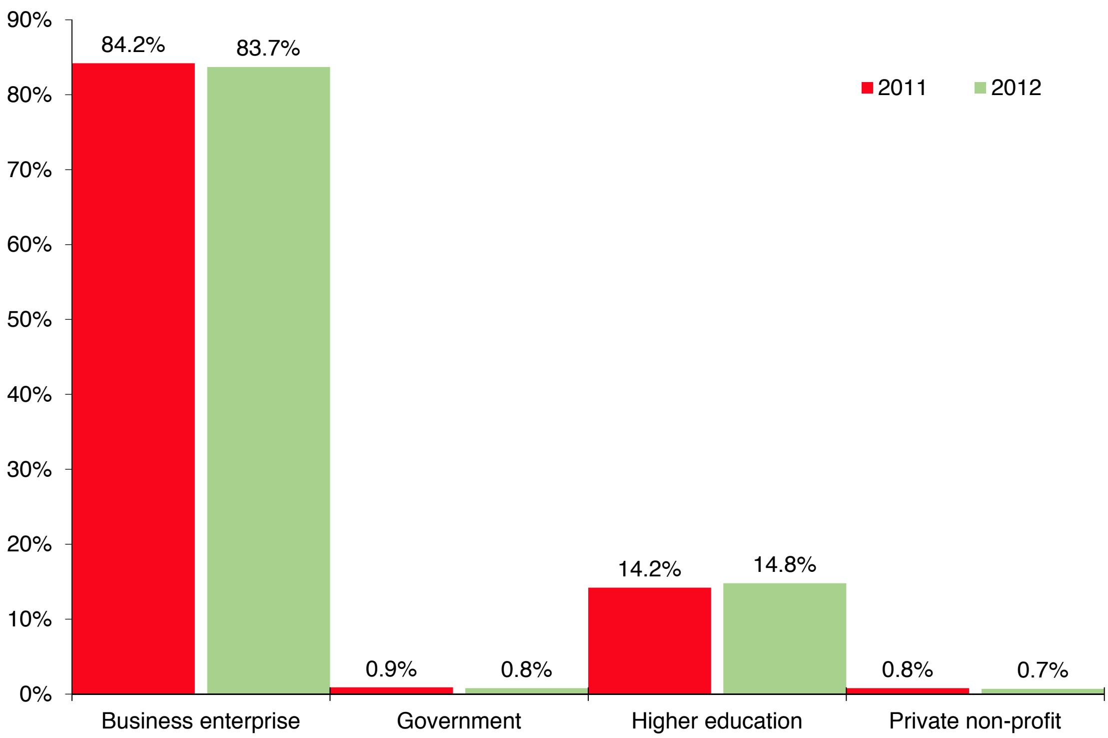

Figure 39: Percentage of FTE researchers by sector of employment. Source: UNESCO Institute for Statistics

BOX 10 – WOMEN IN SCIENCE AND ENGINEERING

Israel is an interesting case for the examination of gender equity in science and technology since a meaningful gap exists between:

a. The extremely high level science and technology research and development conducted both in academia and second sector organizations, e.g. "the Startup Nation" (Senor and Singer, 2011), on the one hand, and
b. The relatively low representation of women, on the other hand.

A gender gap persists despite substantial efforts that have been invested in improving the status of women in Israel, and the laws and regulations designed to prevent discrimination and to mitigate obstacles to allow fuller participation (see pages 214–215).

While lower participation of women in science and technology is a well-known phenomenon in many western countries, Israel's demographic profile may suggest unique ways to design interventions aiming to raise women's participation. In particular, a finding that gender gaps vary by social group invites deeper examination. This analysis is briefly conducted below by taking a closer look at the four groups comprising Israeli society: Secular Jews, National Religious Jews, Ultra-Orthodox Jews and Arabs. Each group has a separate educational system at the primary and secondary school levels.

Since diversity promotes new ideas, increases networking, and opens new markets for new ventures, high attention should be paid to strengthening diversity especially in science and engineering in Israel, since:

- Science and technology are considered to be Israel's economic engine;
- Israel can further exhaust its human resources and at the same time, increase the diversity in this area and further develop it;
- Both academia and the private sector suffer from lack of qualified labour supply in science, technology, engineering and mathematics (STEM), especially in software, electronics and R&D (State of Israel, 2012).

A close examination reveals that:

- A lack of diversity in the entrepreneurs' demographic profiles; most of them are male Secular Jews. Ultra-Orthodox Jews, Arabs, and women are together a majority of Israel's population, but individuals from these groups are rarely involved in high-tech entrepreneurship and innovative start-ups (Kon *et al.*, 2014).
- On average, only 10%-25% of women enrol in STEM fields at the first-degree level. Female student enrolment and the share of women in senior academic staff in the engineering fields are especially low (Erez, 2012a; 2012b).
- In Arab high schools, female students study advanced-level mathematics, physics, computer science and electronics, making up 60%, 57%, 53%, and 56% respectively of students in these disciplines. In contrast, in Jewish high schools, female students make up only 42%; 29%; 30% and 18%, respectively. Chemistry and biology attract women at similar rates in both settings; and, in these disciplines, more women than men participate in advanced level courses (data compiled and processed by the Szold Institute using Ministry of Education data; also see Dvir *et al.*, 2014).

A closer examination of girls' and women's representation in S&T reveals that:

- In absolute terms, women who are identified as being members of two social groups by Secular Jews and National Religious Jews comprise the majority of the female university students in S&T, female tenured track positions in S&T, and females occupying posts in S&T in industry. At the same time, however, inside each of these social groups, girls' and women's participation rates in S&T compared to that of boys and men, at the high school, university and industry levels, are particularly low.

- In contrast, girls' and women's participation rates in S&T at the high-school level are high among Arabs and the Ultra-Orthodox, and remain high at the university and in industry, among the Ultra-Orthodox.
- Both the Arab and the Ultra-Orthodox populations are considered to be Israel's next growth engine. Therefore:
  - In order to better utilize the potential of these two groups, it is imperative to expand and further develop social policy instruments suited for the special needs of these two distinct groups, as the existing policy instruments designed generically for the advancement of women in S&T may not be sufficient.
  - At the same time, it is important to increase girls' participation in STEM subjects at the high school level among Secular Jews, to better tap their skills and potential.

In addition, the literature suggests a number of obstacles for recruiting and retaining women in the STEM sector, just as they are in many western countries:

1. Work-family conflict: Long working hours, frequent travelling and relocations (Ahuja, 2002; Ceci and Williams 2011; Lemons and Parzinger, 2008).
2. Organizational masculine identity: STEM industries, which represent cutting-edge technologies, have a masculine image, and men predominate (Lemon and Parzinger, 2008; the State of Israel, 2012).
3. Inferior informal networks: Differences between men and women's networks in STEM (Honig *et al.*, 2006).
4. Scarce role models: The low numbers of women in the high-tech industry in general and in high management and professional levels in particular, discourage women from entering this industry (Ahuja, 2002; Fouad and Singh, 2011).

As already mentioned, the data suggests that special examination should be given so as to take into account the Israeli context and see below the surface of the most general trends. From this point, to improve diversity, it appears that the top-down policies (including special scholarships and other programs for the enhancement of diversity in science and technology) will not bring about much change in the currently low representation of women in the high-tech industry and in high-level managerial positions. Closer examination of social factors may be recommended, specifically to design other approaches and policy instruments. A few lines of inquiry are examined hereunder.

Social perceptions and gender gaps in secondary STEM education

In a recent research work, Even Zahav (2016), applied strategic analysis to examine STEM education, including the implementation of a Risk Management Process. This research identified social perceptions as strategic risks (strategic risks block the system to achieve its goal). Among the strategic risks that the research identified were:

- Common perceptions regarding diminished image of technological/vocational education;
- High school students' self-perceptions with respect to scientific subjects; and
- Specific communities' deeply rooted perceptions (as well as historic processes which generated them), resulting for example, in lower participation in STEM subjects of Ultra-Orthodox males at all levels.

In relation to the low participation of girls, the research identified risks that may aggravate it. Conceptions that directly emphasize gender disparities could be, e.g. 'if a female student has difficulty learning advanced level science course, there is a tendency forward her to a lower level of learning'.

These risks reflect three types of barriers in coping with the gender gap in STEM education (Havelock and Huberman, 1977). The three types of barriers relate to both genders and to all social groups and therefore, interventions may need to address the whole of the Israeli population. The three types of barriers are:

Socio-cultural barriers: The multi-cultural characteristics of Israeli society and the existence of social differences between communities (related to identity, religion and language) have led to the establishment of different educational settings, including for example the independent educational system for the ultra-orthodox. Institutional separation itself has resulted in variation in the academic content that is learned in these schools. One result is that ultra-orthodox schools today offer low-level STEM courses. This alone might explain the low representation of the ultra-orthodox sector in STEM subjects.

Psychological-personal barriers: Advanced level science (physics, chemistry, mathematics and computer science) are considered 'hard courses'. Few students choose them. Low self-esteem or other personal barriers conditioning success at hard subjects constitutes another set of barriers preventing students from choosing these subjects (Hannover and Kessels, 2004).

Procedural barriers: Because school officials have incentives to see that their schools achieve high scores on matriculation exams, they may channel students toward lower level courses. Diverting students whose scores are low in an advanced level course to a lower level course will raise the grade point average in both groups.

The study presented a Risk Response Plan that may reveal opportunities to mitigate strategic risks, and includes some suggested actions to address their underlying causes. For example, the following actions may lead to a change in social perceptions:

- Increasing awareness to the development of negative perceptions to science subjects, and preventing the conditions that encourage these perceptions.
- Fostering a high social status for those who study STEM (Hannover and Kessels, 2004).
- Cultivating competence and self-confidence among female students (Deci and Ryan, 2008), and avoiding directing them to lower level courses, even if low performance is expected.
- Collaborations between the education system, academia, and industry to encourage students to choose to study STEM. Examples are TWIST, 'Future Scientists' and 'Leading to the Technion, in Science, Industry, Technology and Engineering'.
- Opportunities in the army: As part of dealing with the workforce shortages in STEM professions, Israel Defence Forces (IDF) offers female students and Ultra-Orthodox female students, among others, attractive STEM courses and interesting career development options during service. For example, IDF offers entrepreneurship education in co-operation with the education system, encouraging female students to study computer science, software engineering and cyber subjects, and it commits to their practicing professionally in these fields during military service. These actions could increase representation of women in STEM education and careers.

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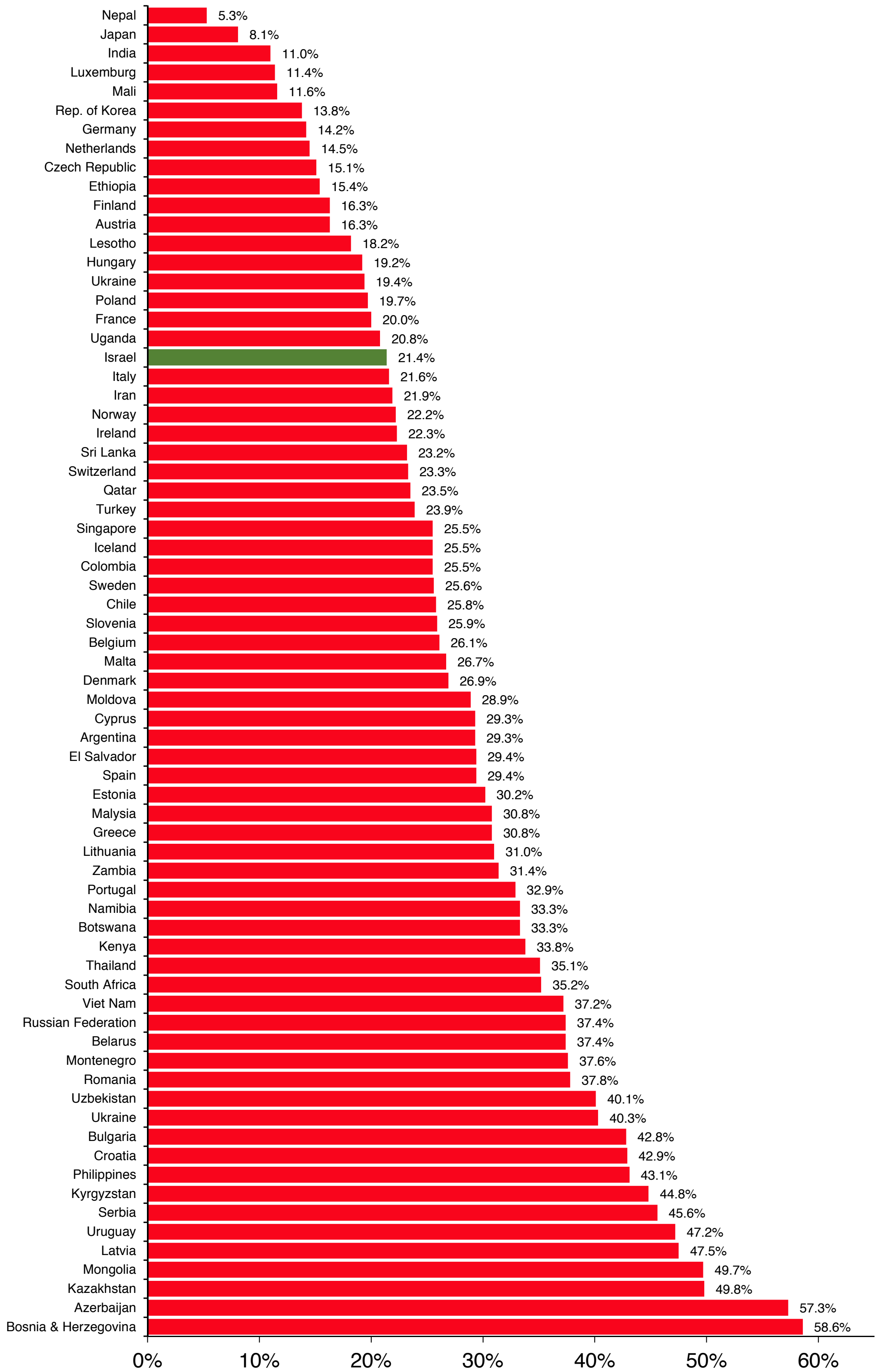


Note: Data refer to head counts. The oldest data are for the Philippines and Israel (2007), Iran, Lesotho and Zambia (2008) and Thailand (2009).

Figure 40: Share of women among researchers employed in the business enterprise sector, 2013 or closest year. Source: Adapted from UNESCO Science Report (2015).

NATIONAL GROSS EXPENDITURE ON R&D (GERD)

The civilian gross expenditure on research and development (GERD) stood at NIS 44.2 billion in 2013 (current prices), constituting 4.21% of the GDP in that year. Figure 41 presents the long-term evolution of Israel's GERD in constant NIS 2010 prices, between 1990 and 2013 and its annual rate of change.

R&D intensity is a comparative metric denoting the share of GERD in the gross domestic product (GDP). Figure 42 shows the long-term evolution of GERD (1961–2013) expressed as a percentage of GDP. The first explicit SETI policies were formulated in the early 1960s (see pages 126–135). In those days, the shares of the investment in R&D activities in the country where were relatively high (around 1% GDP). Since the early 1980s, the investment in R&D continuously increased to reach a peak of 4.48 % GDP in 2006. These metrics do not include the national expenditures on defence R&D.

Over the past decades, Israel had the highest R&D intensity in the world. Figure 43 shows the recent evolution in R&D intensity for a selection of countries (2000–2013). Israel ranks first in international standings, reflecting its strength by global standards and the importance of R&D and innovation in its economy. As can be seen from Figure 43, since 2007, the R&D intensity in Israel is weakening as compared to countries such as the Republic of Korea, and Taiwan, which exhibit consecutive growth in this parameter. The R&D intensity in the Republic of Korea climbed from 2.2% in 2000 to nearly 4.2% in 2013.

Figure 44 shows the breakdown of GERD by sector of finance (1991–2012). In 2007, there was a change in the methodology used to distinguish between the financing provided by local and foreign business enterprises. For that reason, the addition of business enterprise financing and foreign funding had been also included. On the one hand, by 2012 the government contribution to GERD decreased to a third of the shares in 1991. On the other hand, the contribution made by the combination of business enterprise and foreign funding increased by 70% between 1991 and 2012.

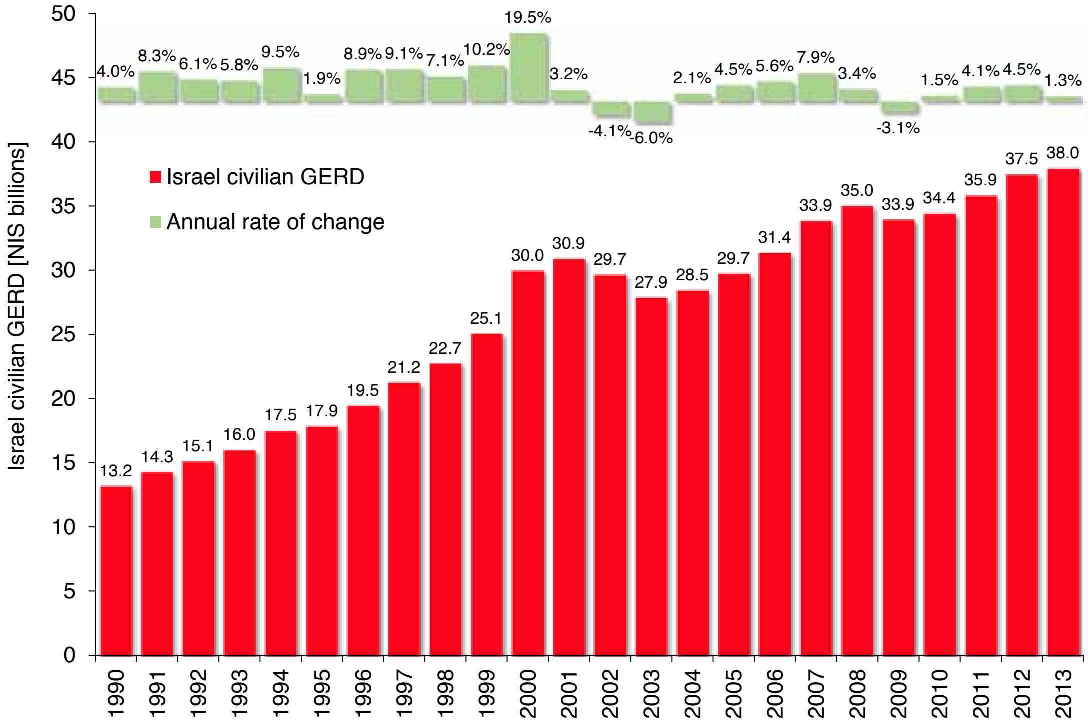


Figure 41: Israel civilian GERD in billion NIS 2010 prices and the annual rate of change, 1990–2013.
Source: Central Bureau of Statistics. Data processing by SNI and UNESCO

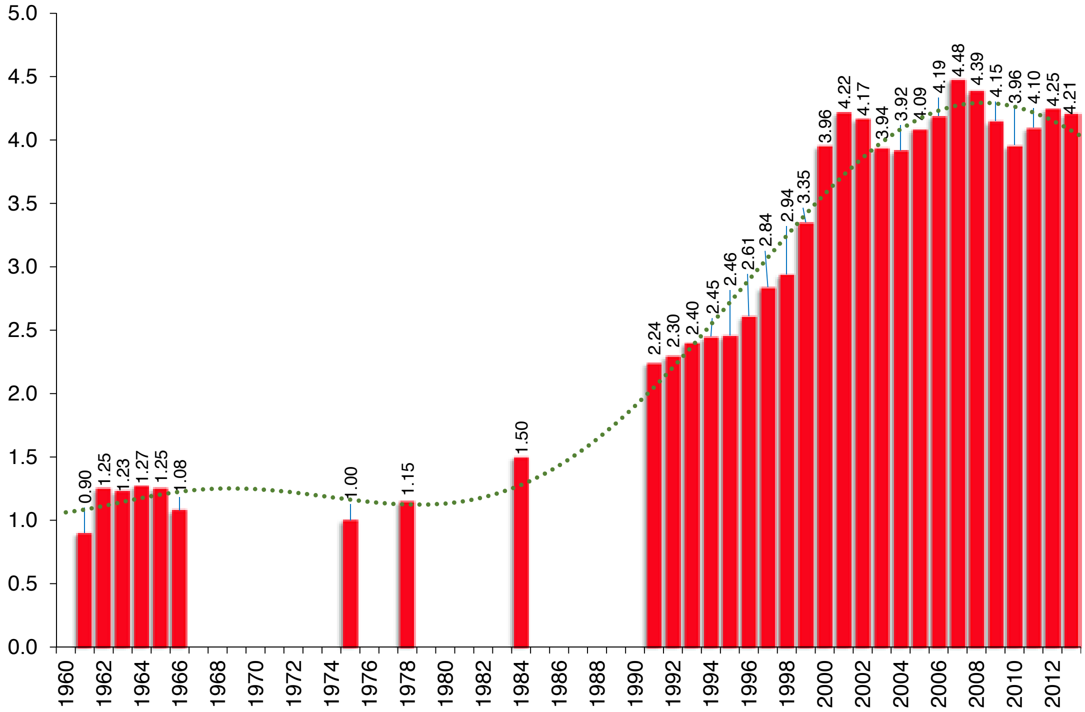
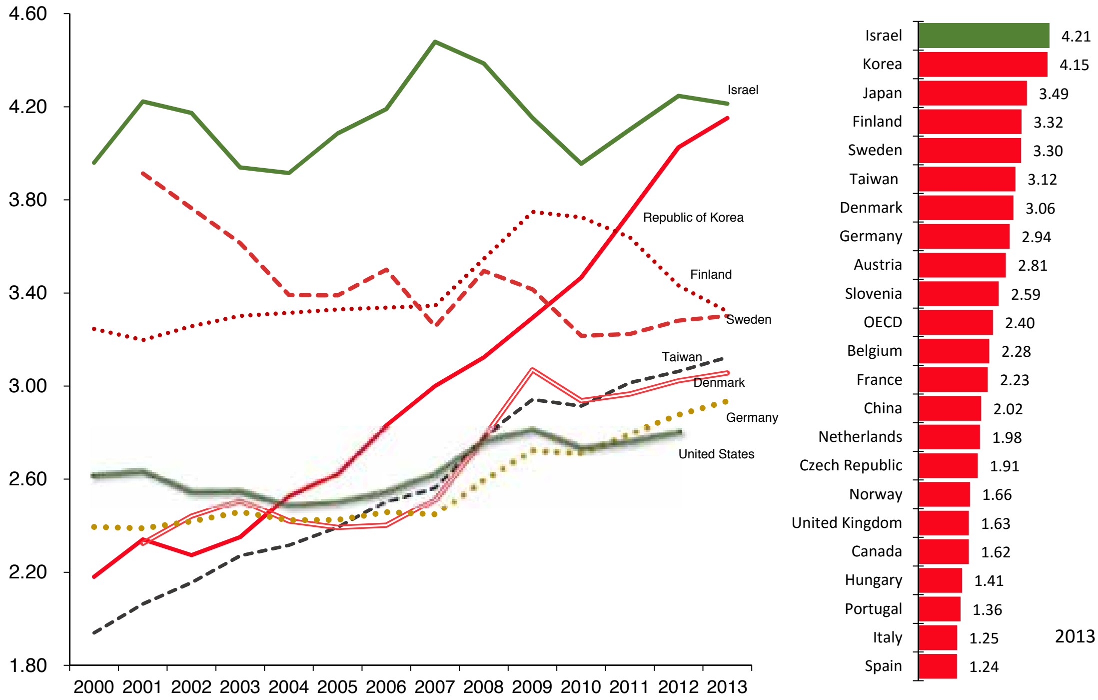


Figure 42: Israel civilian GERD as percentage of GDP, 1961-2013. Source: UNESCO



Note: Data for Israel does not include national expenditure on defence R&D

Figure 43: GERD as a percentage of GDP, for a selection of countries, 2000–2013. Source: OECD and UNESCO Institute of Statistics

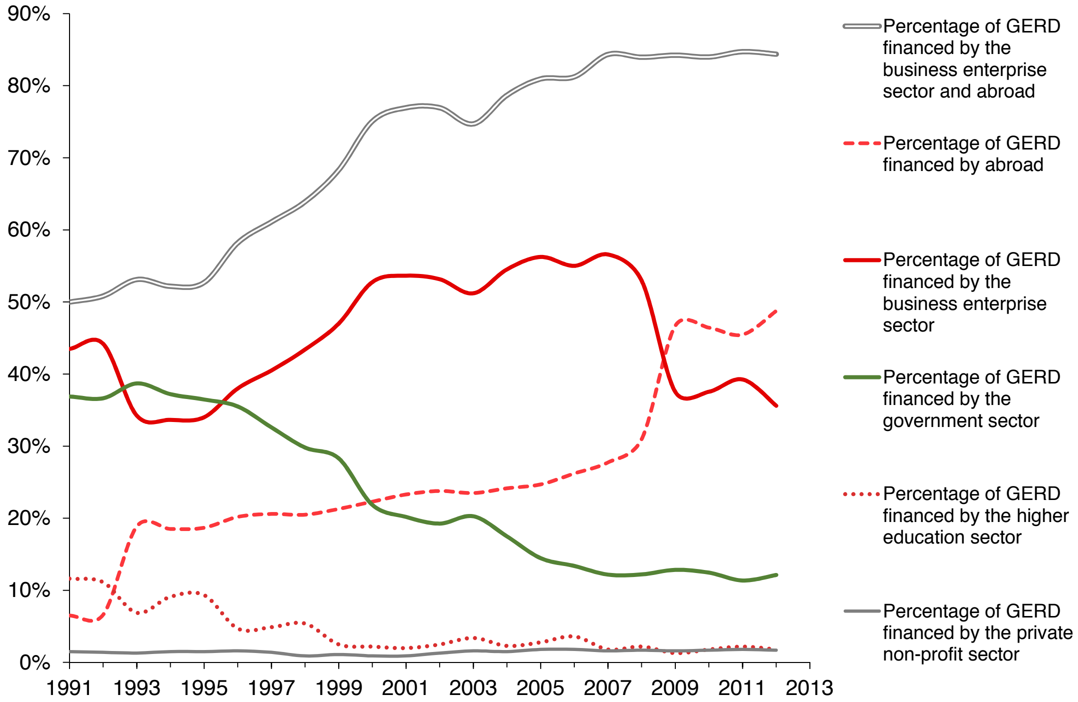


Figure 44: GERD by sector of finance, 1991–2012. Source: UNESCO Institute for Statistics

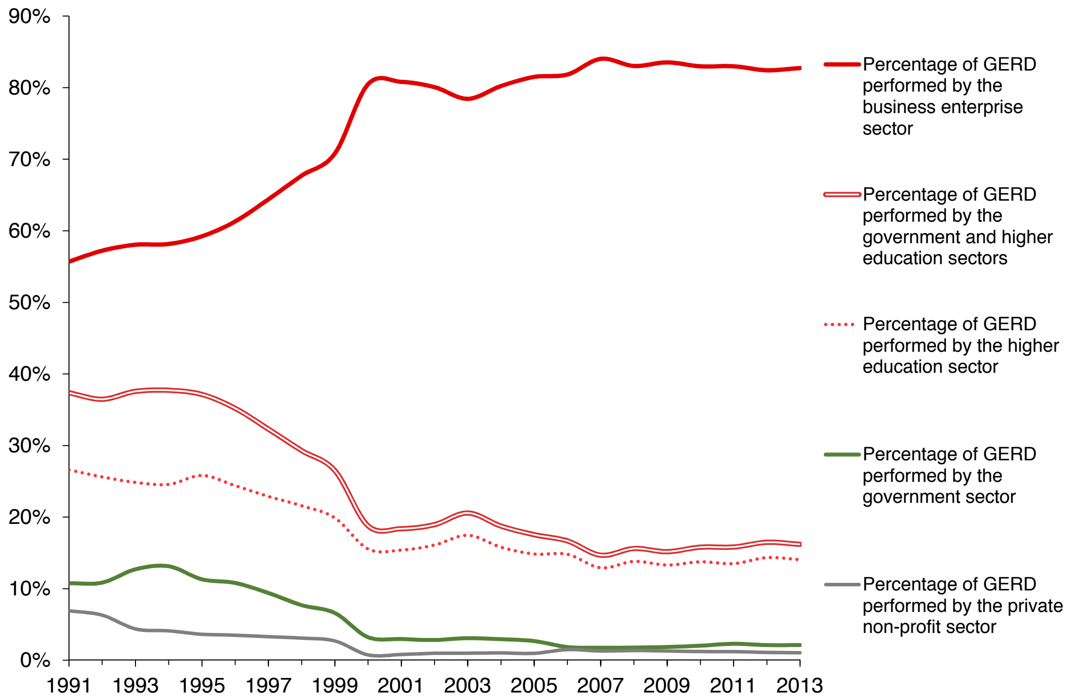


Figure 45: GERD by sector of performance, 1991–2013. Source: UNESCO Institute for Statistics

In Israel, local companies finance approximately 46% of the Business Enterprise Expenditures on Research and Development (BERD). This is a relatively low share by international standards. In contrast, 50% of BERD is financed by foreign entities. The government finances some 3% of BERD. This is a relative small share compared to countries such as the USA (10.6%), the UK (9.3%), Norway (9.7%) and France (7.6%).

Figure 45 shows the distribution of GERD by sector of performance (1991–2013). This figure is consistent with Figure 44 showing a constant increase in the participation of the business enterprise sector and a decrease in the participation of the combination of government and higher education sectors. During the past five years, the shares remained constant. In particular, performance by the higher education sector remained constant during the past decade, as did the size of its S&T personnel (see Table 20, page 79)

BOX 11 – UNESCO'S FIRST R&D SURVEYS IN ISRAEL, 1961–1966

On 14 November 1958, the General Assembly of the United Nations (13th session, 780th plenary meeting) adopted Resolution 1260 requesting the Secretary-General:

> … in co-operation with the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the other Specialized Agencies concerned with the peaceful application of science, as well as the International Atomic Energy Agency, to arrange for a survey to be made on the main trends of inquiry in the field of the natural sciences and the dissemination and application for peaceful ends of such scientific knowledge, and on the steps which might be taken by the United Nations, the Specialized Agencies and the International Atomic Energy Agency towards encouraging the concentration of such efforts upon the most urgent problems, having regard to the needs of the various countries…

In the same resolution, the General Assembly requested that the Secretary-General 'submit this survey to the Economic and Social Council at its thirtieth session' in July 1960.

Ultimately, this report was co-ordinated and edited by Pierre Auger, a prominent physicist and former Assistant Director-General for Science at UNESCO. The study included a description of the most influential trends in scientific research and a series of analyses of their potential long-term impact on humanity (Auger, 1961). The report introduced the need for states to establish national scientific and technological policies, as well as new schemes fostering international scientific co-operation, one example being UNESCO's proposal in the early 1950s for the creation of the European Centre for Nuclear Research (CERN).

Auger's report broke new ground. For the first time, the UN system proposed a standard classification for scientific research and experimental development and defined scientific researchers, technicians and engineers. This preceded the OECD's Frascati Manual (c. 1963) and even the OECD itself, founded in 1961.

Using the standard classification proposed by Auger, UNESCO conducted a series R&D surveys in Israel in the 1960s, which were later published as part of a national science policy report (UNESCO, 1970). Unfortunately, no additional R&D surveys were performed until the early 1990s.

The following tables were constructed based on the measurements conducted in the 1960s. Table 21 represents the percentage of GERD breakdown according to the sectoral origin and allocation of funds (1961–1966). Table 22 shows the expenditures on R&D breakdown according to the performance sectors and major fields of science (1961–1966).

Table 21: GERD breakdown according to the sectoral origin and allocation of funds, 1961–1966[27]

by sector of finance	1961	1962	1963	1964	1965	1966
Government sector[1]	45.8%	54.0%	52.2%	55.5%	58.1%	47.0%
Business enterprise sector	11.7%	7.4%	6.4%	5.6%	5.3%	10.6%
Higher education sector[2]	23.8%	21.0%	18.6%	11.8%	9.0%	9.8%
Other[3]	18.7%	17.6%	22.5%	27.1%	27.7%	32.6%
by sector of performance	**1961**	**1962**	**1963**	**1964**	**1965**	**1966**
Government sector	23.8%	18.9%	20.9%	24.0%	27.5%	24.7%
Business enterprise sector[4]	11.6%	7.3%	6.3%	5.3%	5.1%	12.0%
Higher education sector	61.2%	70.9%	69.2%	67.5%	63.0%	61.6%
Other[5]	3.4%	2.9%	3.6%	3.2%	4.4%	1.7%

Source: Adapted from UNESCO (1970)

Table 22: GERD breakdown according to the performance sector and major field of science, 1961–1965

by sector of performance	1961			1962			1963		
	Physical Sciences	Engine-ering sciences	Life sciences	Physical Sciences	Engine-ering sciences	Life sciences	Physical Sciences	Engine-ering sciences	Life sciences
Government sector	17.7%	12.8%	69.5%	16.8%	19.4%	63.8%	14.8%	24.4%	6.8%
Business enterprise sector	56.8%	43.2%	..	67.1%	42.9%	..	56.9%	43.1%	..
Higher education sector	55.1%	13.9%	31.%	59.2%	8.6%	32.2%	51.4%	8.7%	39.9%
Other	..	.5%	8.6%	..	.4%	7.5%	..	2.3%	97.7%

by sector of performance	1964			1965		
	Physical Sciences	Engine-ering sciences	Life sciences	Physical Sciences	Engine-ering sciences	Life sciences
Government sector	22.8%	17.7%	59.9%	19.0%	18.2%	62.8%
Business enterprise sector	56.9%	43.1%	..	56.9%	43.1%	..
Higher education sector	52.3%	12.2%	35.5%	55.3%	13.8%	3.9%
Other	..	0.7%	7.5%	..	0.7%	10.1%

Source: Adapted from UNESCO (1970)

28 Includes government funds used for research in the higher education sector.
29 Excludes that part of higher education funds originating from government.
30 Research grants, lotteries, Histadruth, Hadassah Medical Organization.
31 Includes research in the industries of the Ministry of Development.
32 Hospitals.

THE GOVERNMENT SECTOR

The implementation of support programmes for R&D, technological development, and scientific research is part of the government's policy for the advancement of industry and scientific research in particular fields. In recent years, 42% of government financing of R&D is spent on the higher-education sector, 24% on the business-enterprise sector, 24% on the government sector, and 9% on not-for profit organizations (Getz *et al.*, 2013).

An important indicator showing the extent of government financing of R&D is GOVERD (Government Expenditures on R&D). In Israel, GOVERD includes the budgets of the Planning and Budgeting Committee (PBC) of the Israel Council for Higher Education, which represents government expenditure on research at institutes of higher education. Using the standard classification of the Frascati Manual (OECD, 2002), the GOVERD was divided into thirteen fields. Figure 46 presents the distribution of GOVERD in 2000–2013, excluding defence GERD. Most government expenditure over the years has been allocated to the advancement of industrial technologies (29.9% in 2013) and general university funds (51.8% in 2013). The share of environmental-quality expenditure has doubled in the past decade but remains less than 1% of total GOVERD.

The intensity of the higher education expenditures on R&D (HERD) is a common indicator used for cross-country comparisons. Figure 47 shows the recent evolution of HERD for a selection of developed countries. In 2012, HERD intensity in Israel was 0.49% or 29% smaller than in 2002. Comparison of Israel with other countries shows that R&D intensity in Israel's higher-education system was relatively high until 2003 (0.69% GDP), but has been falling ever since. Concurrently, the rates in other nations such as Denmark, Finland, Sweden and Estonia have been rising vigorously in recent years. A broad cross-country comparison for 2013 found Israel to be located in 11th place among the most developed countries in HERD. In absolute terms, Israel also spends considerably less on HERD in comparison to countries that are comparable in population size (e.g. Denmark, Sweden, Switzerland, Finland and Norway).

By cross-country comparison, Israel is unique among OECD countries in its segmentation of government support. Figure 48 compares Israel with several developed countries in government support of R&D. The Israeli government is the strongest supporter of industrial R&D. Israel also has one of the largest shares of transfers to university research among OECD members (41.3%) – lower than Switzerland (60.3% in 2012), Austria (56.3%), Sweden (54.1%), and the Netherlands (50.2%) but higher than Finland (29.8%), Ireland (20.6%), Belgium (16.8%) and even G-7 countries such as Japan (37.8%) and the UK (29.4%). Israel ranks at the bottom in government support of research in healthcare, environmental quality, and infrastructure development. In 2012, 0.5% of the total R&D promotion budget in Israel was allocated to the production and utilization of energy, as compared to 11.8% in Japan, 11.4% in Finland, 10.5% in Canada, and 7.5% in France. The distribution of government support for R&D in Israel is characterized by acute concentration. In 2012, the two main areas of activity in Israel (advancement of industrial technology and general university funds) together accounted for 79.4% of total support, the highest in the OECD.

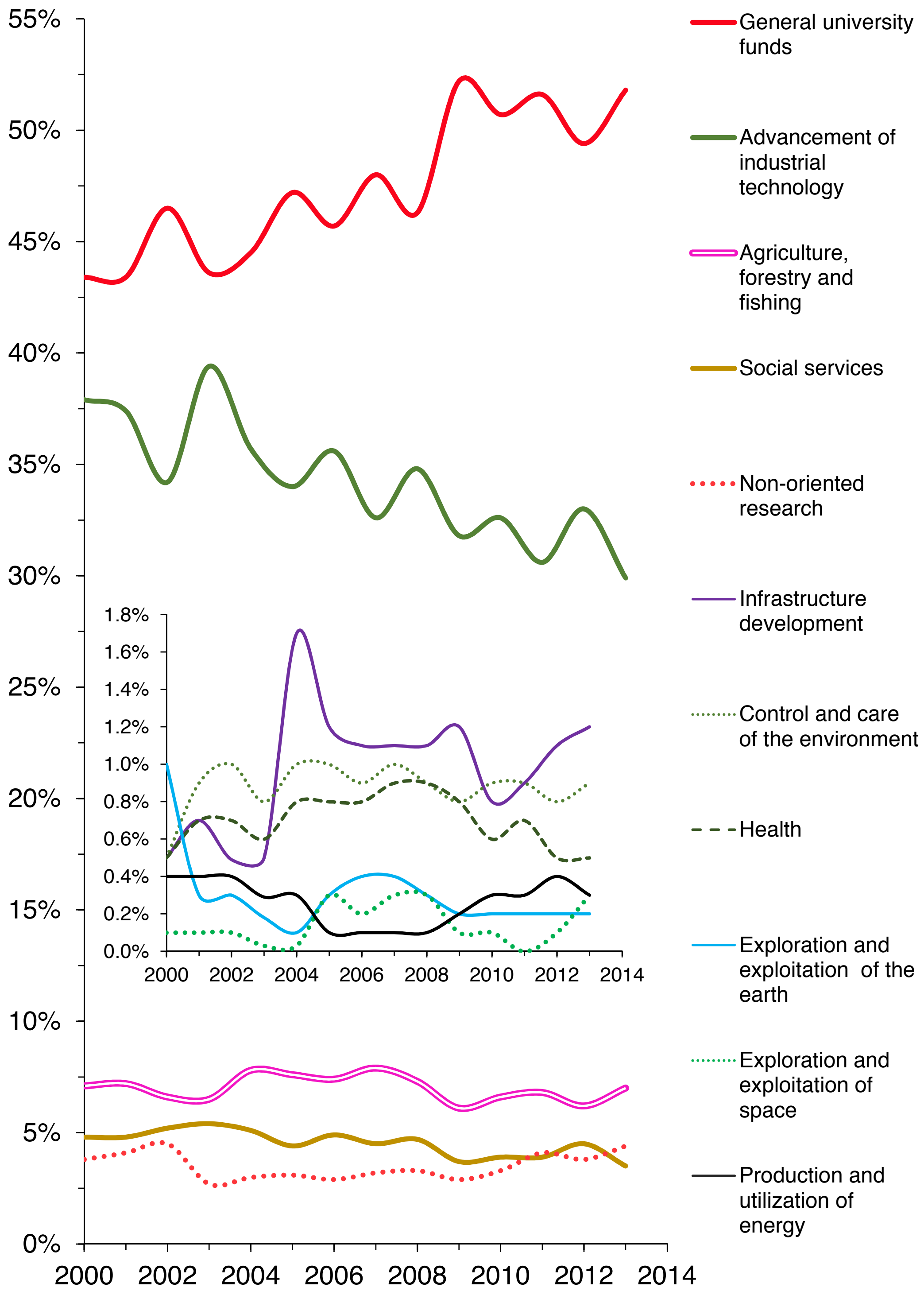


Figure 46: Government expenditures on R&D by fields, as percent of total GOVERD, 2000–2013.
Source: UNESCO based on raw data by Central Bureau of Statistics

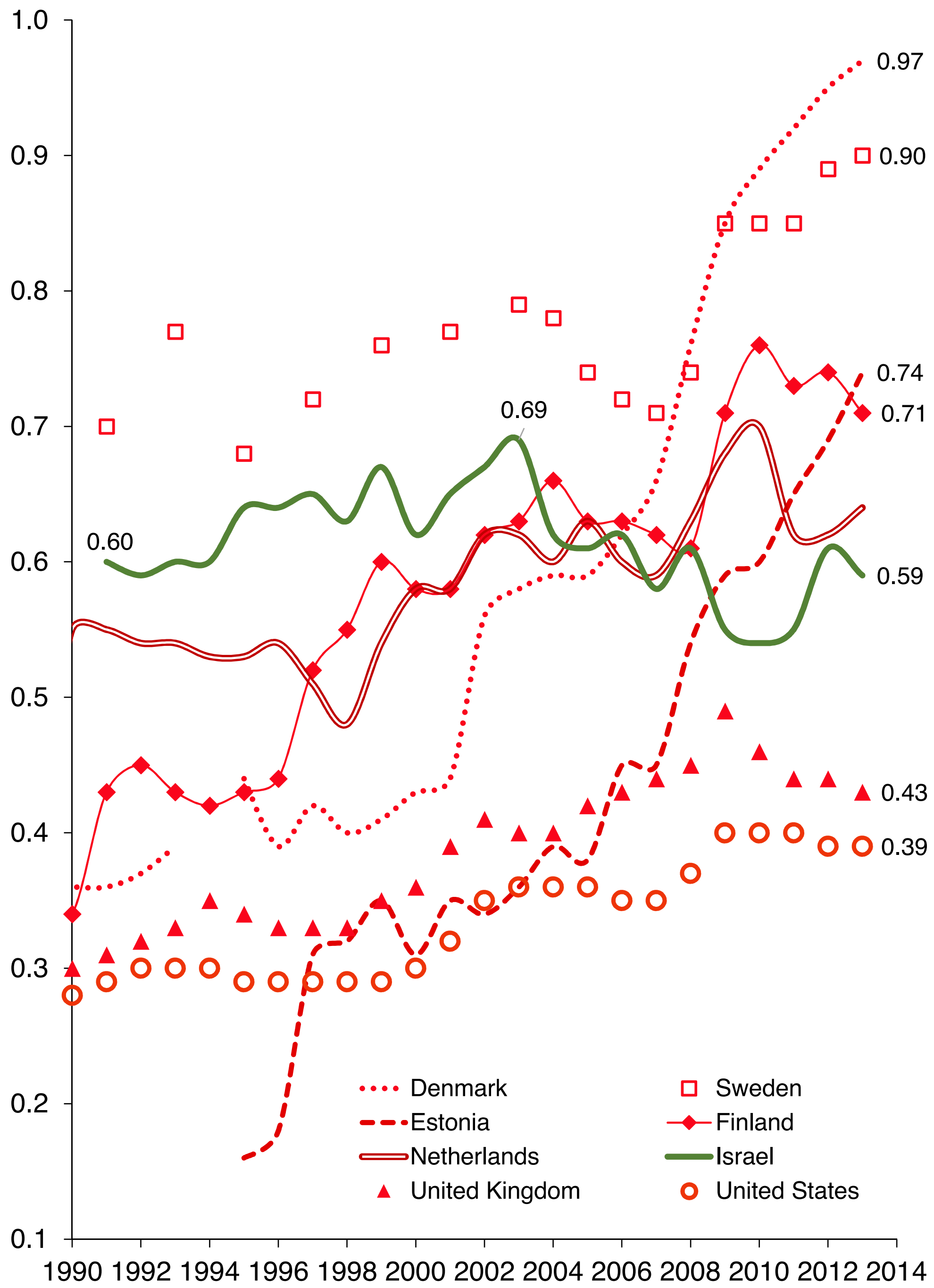


Figure 47: HERD as percentage of GDP for a series of selected countries, 1990–2013. Source: UNESCO

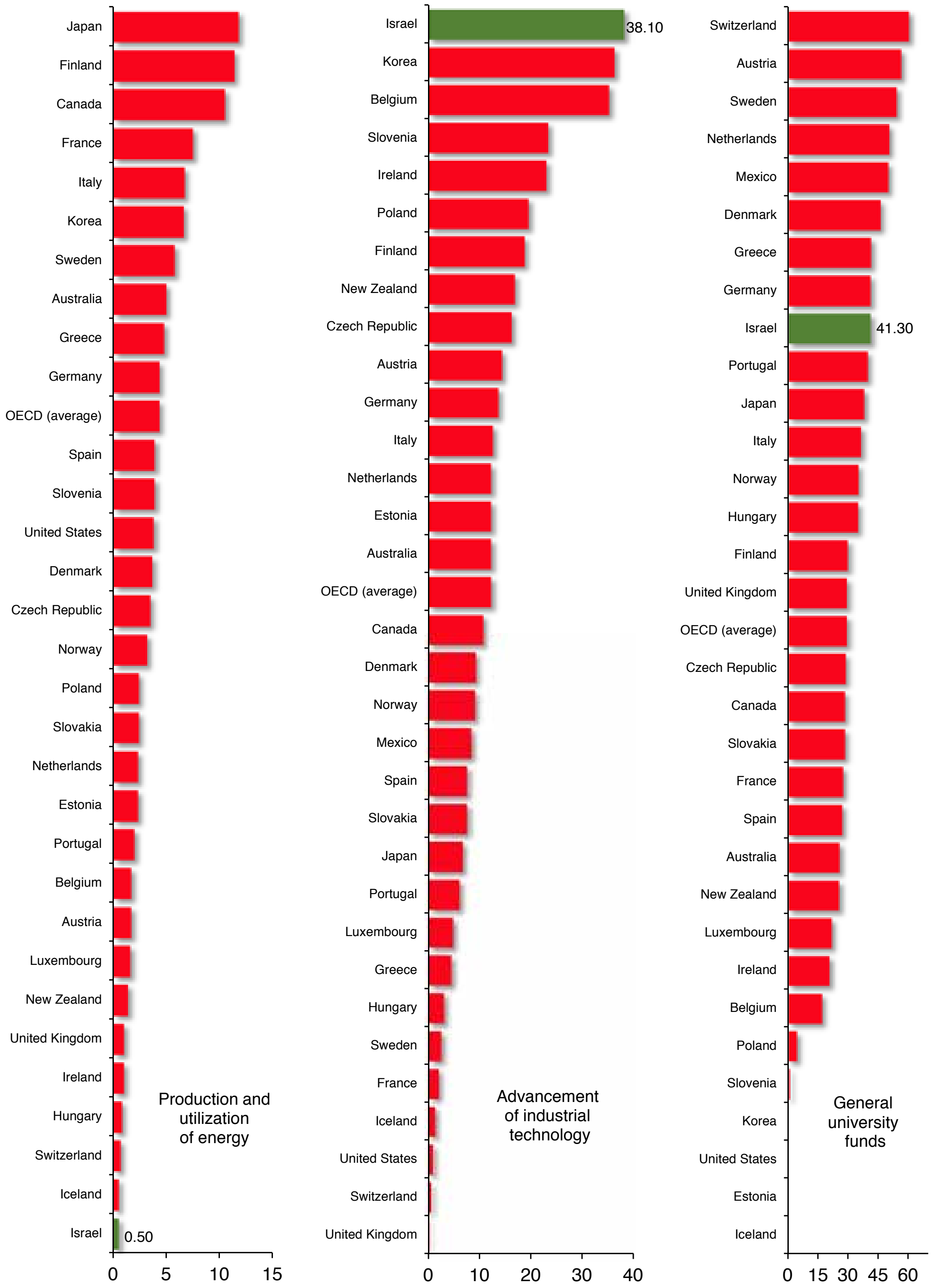


Figure 48: Government support of R&D in OECD countries, by selected objectives, 2012. Source: OECD and Central Bureau of Statistics. Data processing by SNI

BOX 12 – INNOVATION SURVEYS IN ISRAEL

Innovation has long been known to play a key role in generating economic development and growth. Nevertheless, the systematic production of innovation indicators – particularly in order to support policy design – is a much more recent affair. While guidelines to support the collection of research and development (R&D) statistics exist since 1963, formal methodological recommendations for the production and analysis of innovation statistics were only set in 1992 when the first edition of the Oslo Manual[33] was published.

Innovation data typically give a profile of innovative firms in a country, broken down by economic activity, size, class and region. Innovation data also describe the portion of firms' revenue that comes from new products launched in the market; the activities firms perform in order to innovate; the sources of funding for innovation; the importance of the linkages with other agents; the obstacles to innovation faced by firms; the intellectual property methods used by firms.

To date, Israel has carried out two national innovation surveys. The first one covers the three-year observation period 2006–2008 and the second covers the years 2010–2012. The innovation rates of Israeli manufacturing firms – in other words, the percentage of manufacturing firms that implemented innovations – for both observation periods are presented in Figure 49.

The results show a decrease in the innovation rates of Israeli manufacturing firms, for all types of innovation. Marketing innovation prevailed as the type of innovation that was implemented by most of the manufacturing firms in the country in both observation periods. Nevertheless, this was also the type of innovation where the greatest reduction (in percentage points) in the share of innovators is observed, dropping from 57.9% to 36.2%.

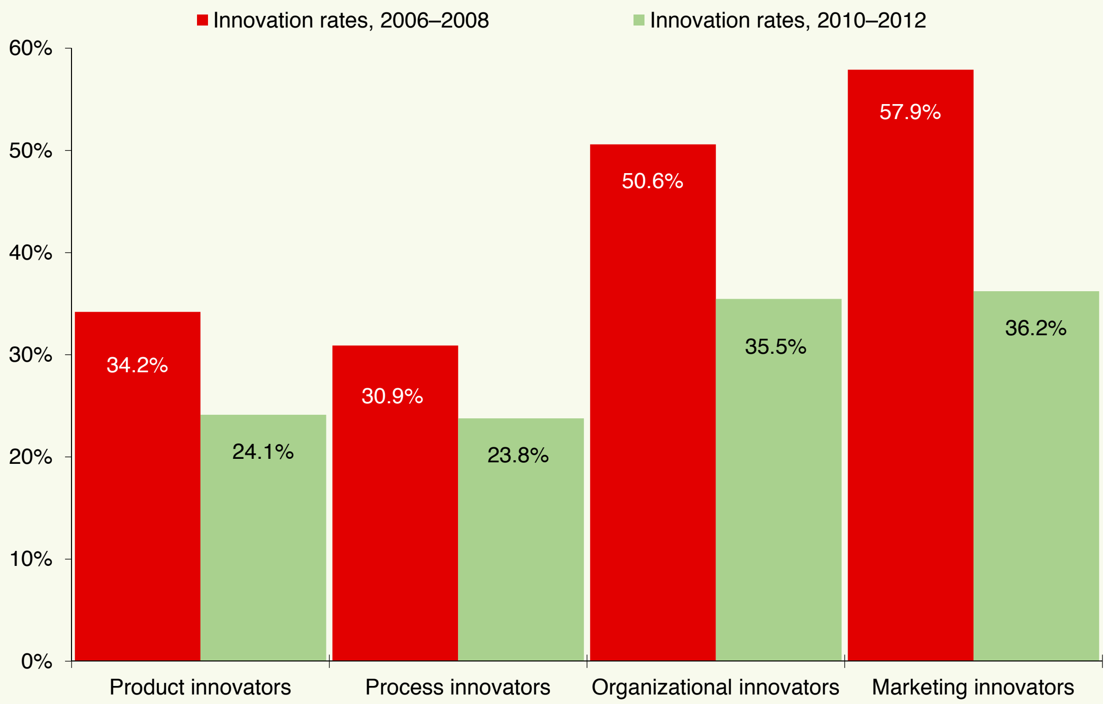


Figure 49: Innovation rates, as a percentage of manufacturing firms. Source: UNESCO Institute for Statistics

33 The revision of the current – third – edition of the Oslo Manual (OECD, 2005) has just begun and its fourth version is expected to be published in 2017.

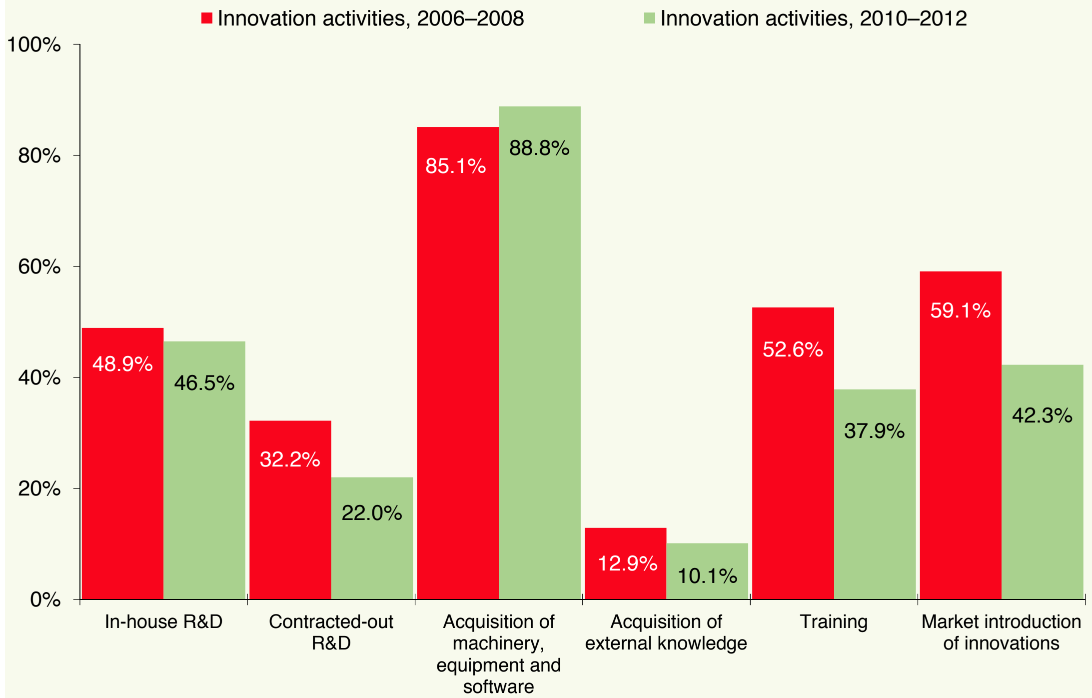


Figure 50: Firms that engaged in innovation activities, as a percentage of all innovation-active manufacturing firms. Source: UNESCO Institute for Statistics

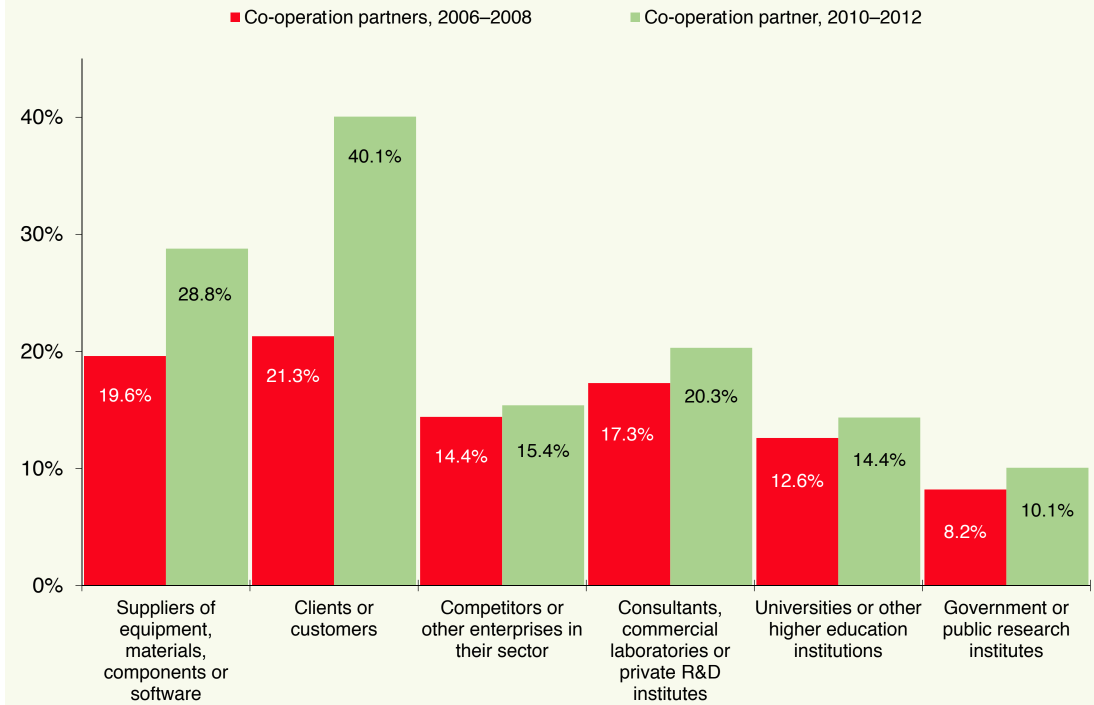


Figure 51: Firms that cooperated with external partners for innovation, as a percentage of all innovation-active manufacturing firms. Source: UNESCO Institute for Statistics

Another observation is that the gap between the highest and the lowest innovation rates in the years 2010 –2012 – marketing innovators (36.2%) and process innovators (23.8%) – is smaller than in the previous period – marketing innovators (57.9%) and process innovators (30.9%). In addition, the rates of organizational and marketing innovators are very similar – the same is true for product and process innovators.

Concerning their engagement in activities that support the development and implementation of innovations, innovation-active[34] firms appear to be most engaged over time in the acquisition of machinery, equipment and software, as shown in Figure 50. This is in fact the only innovation activity where an increase in the share of manufacturing firms reporting engagement is observed.

Lastly, regarding co-operation for innovation, an increase in the share of firms cooperating with all types of external partners is observed over the years, as illustrated in Figure 51. Clients or customers are the leading external co-operation partners of Israeli manufacturing firms in the two observation periods, presenting an increase of almost 20% in the share of firms that actively participated in joint innovation projects or activities with them. On the other hand, the share of firms that cooperated with universities or other higher education institutions, or with the government or public research institutes is in each case below 15%.

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Assistant Programme Specialist,
UNESCO Institute for Statistics, Montreal

34 Innovation-active firms are those that implemented product or process innovations or had abandoned or ongoing innovation activities to develop product or process innovations.

A scientometric analysis of Israel

Basic research is usually carried out in universities or other academic institutions. The traditional method used to measure or assess the results of academic research uses bibliometric indicators. Bibliometrics is a general term for the inventory and statistical analysis of articles publications and citations and other more complex indicators of scientific outputs derived from such statistics. Bibliometric indicators are important tools for assessing R&D performance and the specialization of countries' institutions, laboratories, universities, thematic areas and individual scientists. As with any indicator, they are not faultless and should therefore be interpreted with caution.

The procedure for assessing the impact of industrial R&D is essentially based on an analysis of patent statistics and when it comes to the impact of industrial R&D on trade, based on an analysis of high-tech products as well as through studies of the trade balance of high-tech items for each country.

Both bibliometric analyses and patent statistics are included in a discipline known as scientometrics. At present thanks to exponential growth in our data-processing capacity, it is possible to prepare sophisticated multidimensional indicators on the production of scientific articles in all disciplines from exact sciences to humanities. Moreover very precise analyses can be made of the impact of publications, the state-of-the-art of knowledge in various subject areas in each country, the level of co-operation in terms of co-authorship of publications, co-citations, the creation and evolution of scientist networks (i.e. 'invisible colleges') etc. By analysing cross-references used in patent applications or by cross-referencing information published in scientific literature we can use bibliometrics to examine the links between STI and patents (Lemarchand, 2010).

One of the most relevant sources of information about the productivity of scientific knowledge is accessible through international databases (Lemarchand, 2013). This type of information is not usually open access. In particular, a very well established class of indicators about scientific production can be estimated by counting the number of articles and citations published in mainstream journals. One of the most complete databases is the Web of Science, which includes the Science Citation Index (SCI) Social Science Citation Index (SSCI) and Arts and Humanities Citation Index (A&HCI). The latter is now maintained by Thomson-Reuters, a private company and covers 12 000 peer-reviewed journals. The other major database is SCOPUS which is maintained by Elsevier Science and covers 18 000 peer-reviewed journals.

An analysis of the aggregated temporal evolution in the data available in the Web of Science shows a homogeneous trend that is independent of any academic discipline and avoids any substantial change in national trends owing to the continual incorporation of new journals in the databases. In this way, it is also possible to study the evolution in co-operation patterns among countries and institutions search for the most developed disciplines and analyse the impact of scientific research based on how other scientists have made use of this material.

Not all Israeli scientists submit their research results to mainstream journals listed by the Web of Science. Therefore, the existence of local and regional journals in several countries may reflect some peculiar domestic circumstances or a specific national scientific agenda that are not considered by the mainstream journals. For this reason, publication in mainstream journals represents only a fraction of the total scientific production of any particular country. The main advantage of using these databases is that they have been systematically collected and organized over several decades using similar methodologies allowing us to perform a long-term analysis with a relatively high level of confidence (Lemarchand, 2012).

In spite of the drawback of underrepresented local and regional journals, it can be argued that there is a good correspondence among Web of Science database (SCI Extended SSCI A&HCI) and other international databases on scientific knowledge production. De Moya-Anegón and Herrero-Solana (1999) and Lemarchand (2012) have shown a strong correlation in the distribution of citable articles between the Science Citation Index Extended and other databases like PASCAL INSPEC COMPENDEX CHEMICAL

ABSTRACTS BIOSIS MEDLINE and CAB. They have obtained the following values for the correlation coefficient (R) among the different databases: $0.957 \leq R \leq 0.997$. This finding supports the hypothesis that the combination of SCI Extended SSCI and A&HCI listed by the Web of Science database is a good indicator for any study of mainstream scientific knowledge production and trends in co-authorship networks among different countries.

At this point, it is important to take into account that during the period analysed here (1966−2013) the number of journals has expanded substantially and consequently so has the total number of published articles included in the Web of Science database. Mabe (2003) showed that journal growth rates have been remarkably consistent over time with average rates of 0.034 since 1800 to the present day. This study presents evidence that during the entire 20th century these growth phenomena appear to show a system that is self-organizing and in equilibrium with a 0.032 growth constant. Considering that the Web of Science database includes only a fraction of all the new journals that are published, the growth rate for databases should be even smaller than was estimated by Mabe (2003).

Lemarchand (2012, 2016) has developed a mathematical model showing the proportionality between the size of the national scientific network (e.g. number of FTE researchers in a country) and the corresponding scientific productivity (in terms of the aggregate number of publications per year and the number of co-authored scientific articles between pairs of countries). In this way, the productivity of scientific articles over time is a good proxy for estimating the extent of growth in the number of full-time-equivalent researchers.

Table 23 shows the distribution of publications, which at least have one Israeli author listed in the Science Citation Index Extended (SCI), Social Science Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI) by type (1967–2014). From this set of publications, 71.6% are articles, which constitute the hard core of the generation of new knowledge through scientific research. Here on the bibliometric study performed in this chapter will include the subset of scientific articles, excluding all the other categories of publications.

Figure 52 shows the evolution in the number of scientific articles produced by Israeli authors listed in SCI, SSCI and A&HCI (1967–2014) and the number of articles per million inhabitants. It is interesting to observe that the trends follow a linear growth for the number of articles (R^2=0.99) and an asymptotic growth for the number of articles per million inhabitants against time (R^2=0.97). This behaviour is consistent with the fact that the number of FTE S&T personnel in the higher education sector – where most of the articles are produced – remained constant over the past decades (see Table 20, page 79).

Figure 53 presents the evolution (1970–2014) of the number of scientific articles listed in SCI, SSCI and A&HCI per million inhabitants for a selection of countries. For decades (1965–1994), Israel was the most productive country in the world. However, since the mid-1990s the scientific productivity in terms of articles per million inhabitants in Israel remained constant while in other countries were in continuous expansion. In 2014, Israel was occupying the 12th position at global level for countries with populations over a million inhabitants[35].

Figure 54 presents the behaviour of the number of scientific articles per million inhabitants against the GDP per capita in constant 2015 US dollars. The graph shows an asymptotic correlation, meaning that an increase in the income (GDP per capita) over US$ 20 000 is no longer correlated with an increase in the number of publications per capita.

35 For statistical reasons, this ranking does not include those countries and regions with very small populations (i.e. Iceland, Monaco, Greenland and Liechtenstein) which are also over Israel in the global rank of scientific productivity.

Table 23: Distributions of publications of Israel by type, of those listed in the Science Citation Index Extended, Social Science Citation Index and Arts and Humanities Citation Index, 1967–2014

Type of document	Number of items	Percentage
Articles	366 308	71.56
Meeting abstracts	57 962	11.32
Proceedings papers	19 997	3.91
Reviews	17 112	3.34
Letters	14 973	2.93
Editorial material	12 459	2.43
Notes	12 254	2.39
Book reviews	7 579	1.48
Corrections	906	0.18
Book chapters	546	0.11
Discussion	529	0.10
Biographical items	377	0.07
Items about an individual	210	0.04
News items	166	0.03
Poetry	155	0.03
Correction addition	101	0.02
Reprints	101	0.02
Bibliography	48	0.01
Software review	39	0.01
Abstract of published items	11	0.00
Excerpts	11	0.00
Art exhibit reviews	8	0.00
Fiction creative prose	8	0.00
Theatre reviews	7	0.00
Records reviews	5	0.00
Film reviews	4	0.00
Music scores reviews	4	0.00
Chronology	1	0.00
Dance performance review	1	0.00
Database review	1	0.00
Hardware review	1	0.00
Music performance review	1	0.00

Source: Web of Science (August, 2015)

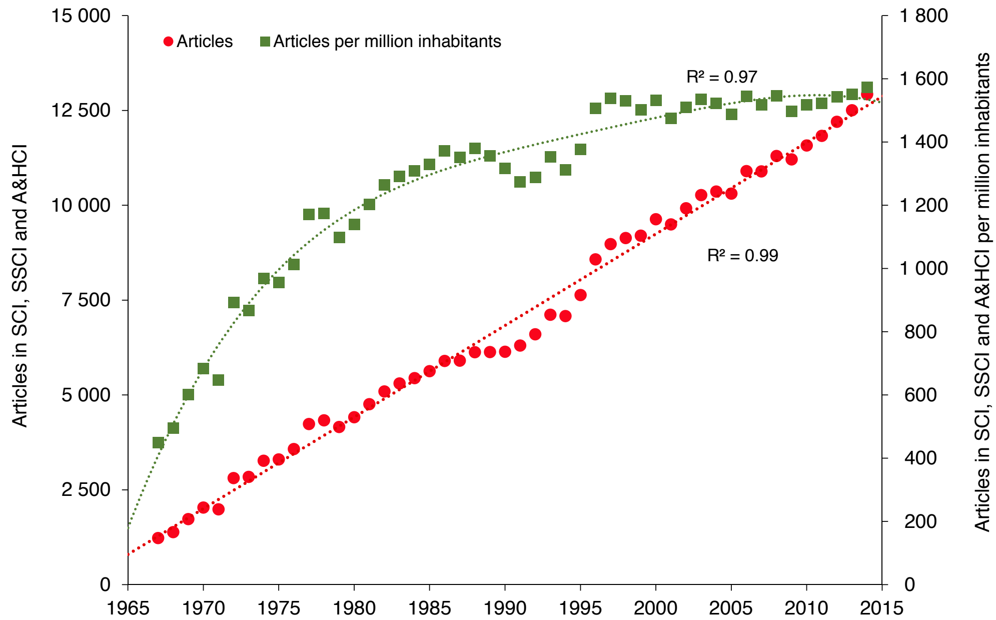


Figure 52: Number of articles by Israel's authors that are listed in SCI, SSCI and A&HCTI, and number of articles per million inhabitants, 1967–2014. Source: UNESCO based on raw data by Web of Science and UN Statistics Division

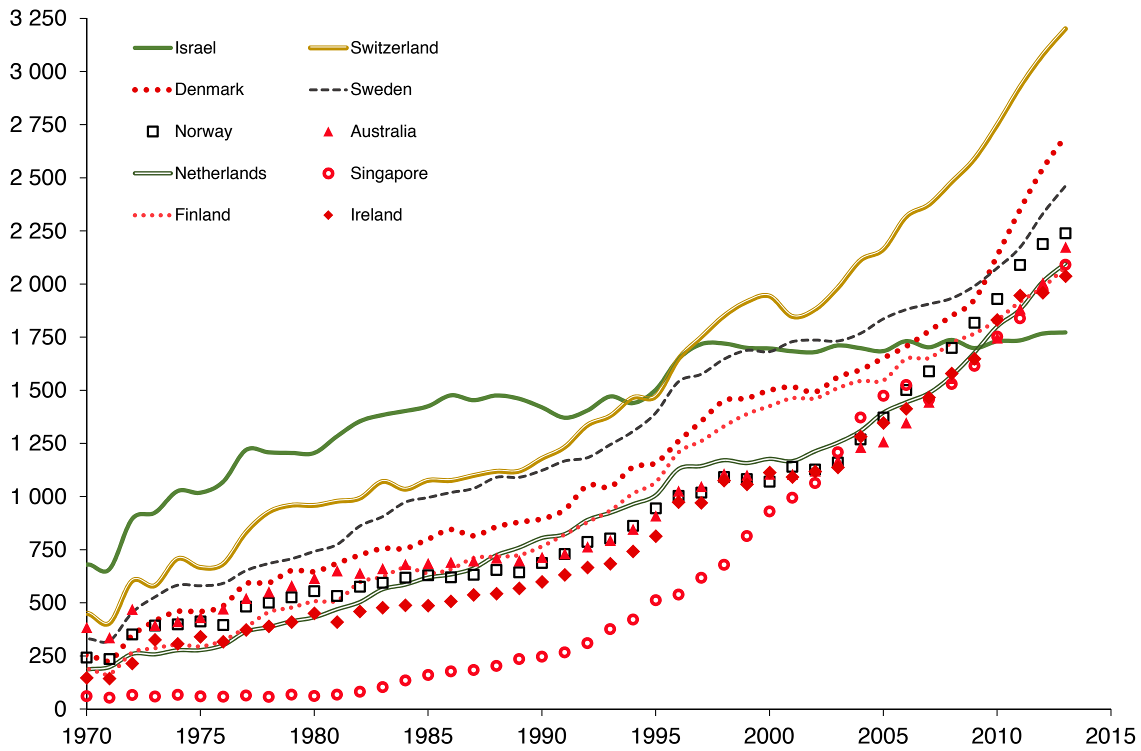


Figure 53: Most productive countries in the world in terms of scientific articles per million inhabitants, 1970–2014. Source: UNESCO based on raw data by Web of Science and UN Statistics Division

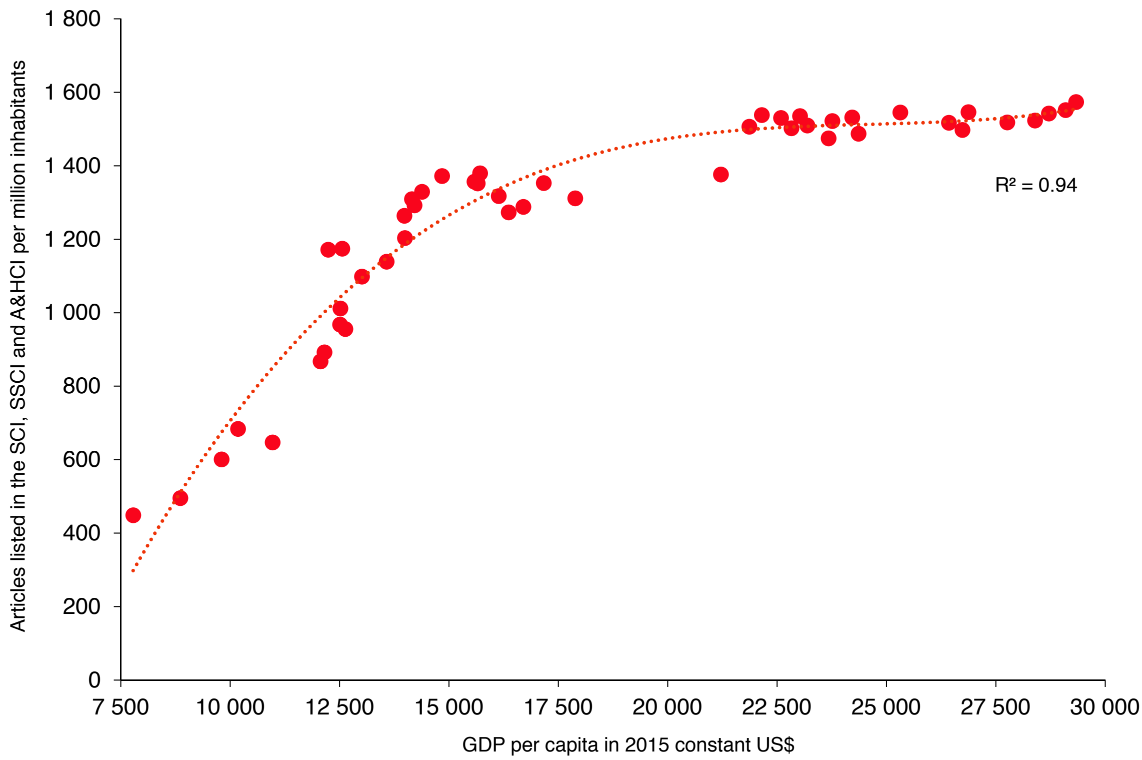


Figure 54: Number of articles by Israel's authors that are listed in SCI, SSCI and A&HCTI per million inhabitants against GDP per capita in 2015 constant US dollars. Source: UNESCO based on raw data by Web of Science, World Bank and UN Statistics Division

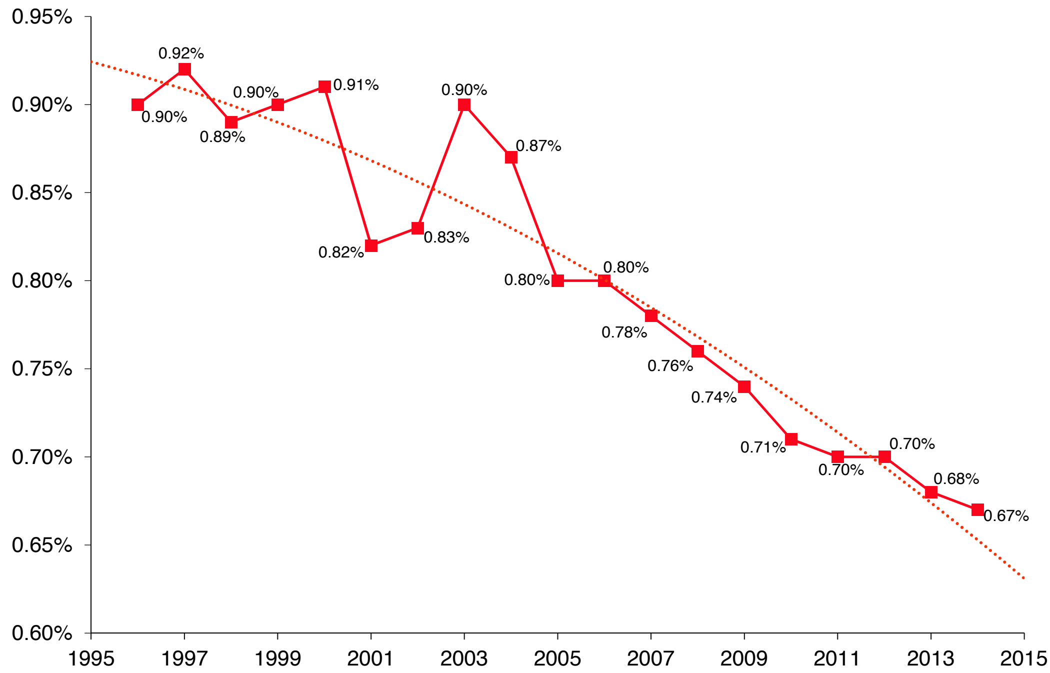


Figure 55: Israel's shares of the world's production of scientific articles, 1996–2014. Source: UNESCO based on raw data by Web of Science

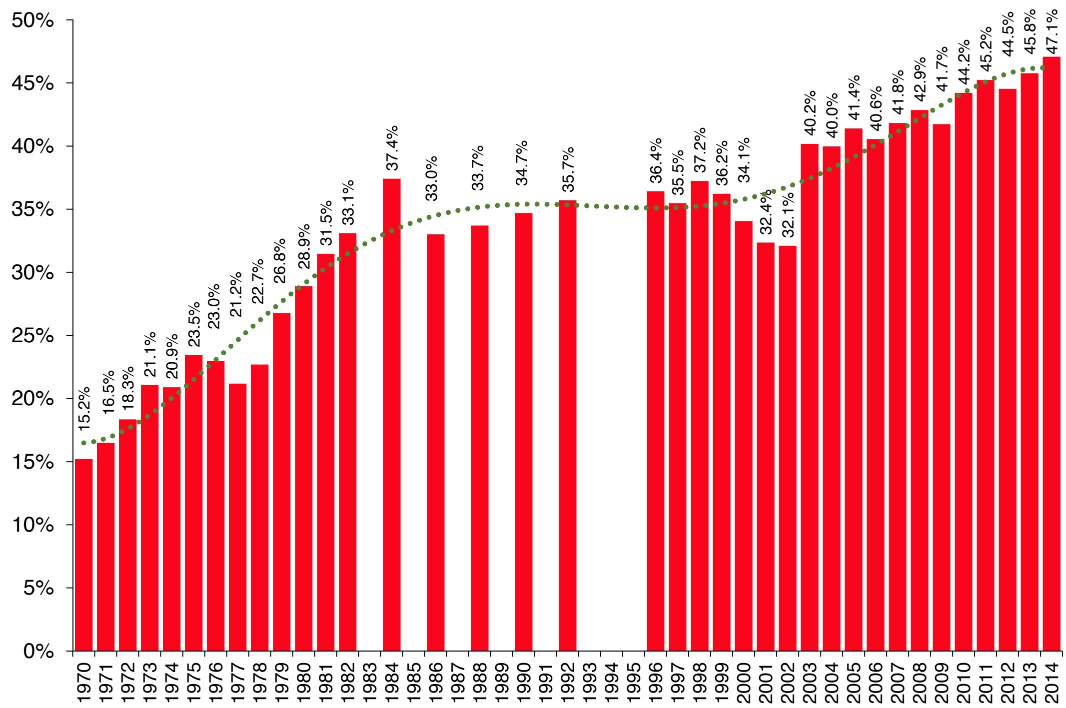


Figure 56: Evolution in international collaboration in scientific publications as a share of total annual publications in Israel, 1970–2014. Source: UNESCO based on raw data by Web of Science

Figure 55 presents the recent evolution of the shares in the world's production of scientific articles (listed in SCI, SSCI and A&HCI). The global participation of Israel has been decreasing in a quadratic manner over the past decades. Compared to 20 years before, its global share is 27% smaller in 2014.

Figure 56 shows the evolution of international collaboration in terms of percentage of articles co-authored by scientists from other countries over the total number of articles produced by Israel each year. The graph shows two periods at which there was a continuous growth in the internationalization of publications (1970–1985 and 2002–2014). In 2014, 47% of the total number of scientific articles were co-published with scientists from other nations.

Table 24 lists the 30 countries within which Israeli authors most frequently co-authored publications internationally, during four different periods (1970–1984, 1985–1999, 2000–2014 and 2014). In the past decades, USA, Germany, United Kingdom, France, Italy and Canada were the countries most relevant for international scientific co-authorship.

Table 25 shows the productivity of scientific articles in Israel produced by the top 25 national institutions and laboratories, within four different periods (1970–1984, 1985–1999, 2000–2014 and 2014). Until 1999, the most productive institution was the Hebrew University of Jerusalem, followed by Tel Aviv University. After 2000, these ranks were inverted. The Technion-Israel Institute of Technology, Ben Gurion University, Weizmann Institute of Science and Bar-Ilan University follow them in the list of the most productive institutions.

Table 26 presents the ten most important foreign and international research organizations responsible for co-authoring scientific articles with Israel's researchers, according to articles listed in the SCI Extended SSCI and A&HCI. The most important foreign partners are the University of California System (USA), Harvard University (USA) and the Centre National de la Recherche Scientifique (France).

Figure 57 shows the distribution of Israel's publications (as listed in the SCI Extended SSCI and A&HCI for 1996−2014) broken down by six main research fields (UNESCO 1978; OECD 2002): agricultural sciences; arts and humanities; engineering and technology; exact and natural sciences; medicine & health sciences and social sciences. This figure was organized in this way in order to allow comparisons with R&D input indicators such as the number of graduates (i.e. Table 17 page 67) and number of researchers by field of science and R&D expenditure, all of which were disaggregated by field of science.

Figure 57 shows that over the past two decades most research articles have related to natural and exact sciences. However, its annual share has been decreasing from 40% to 35% over that period. On the contrary, articles in social sciences have been expanding from 7% to 12%. The shares for the rest of the major fields of science remained relative constant over the same period. It is important to note that within emerging economies such as China or the Republic of Korea, 80% of the scientific articles are concentrated in only two fields: natural & exact sciences, and engineering & technology.

Figure 58 shows the distribution of graduates (Bachelors, Masters and PhDs) in Israel between 1996 and 2014 by main field of science (see Table 17, page 67). Clearly, there is no correlation between the share of scientific publications and the number graduates, in any given field of science. The combination of the three levels of graduates shows that around 40% of the graduates are in social sciences, 25% in humanities, 15% in engineering and technology, 10% in natural and exact sciences, 8% in medical & health sciences and 1% in agriculture sciences.

Table 27 analyses in detail the production of articles, by breaking it down into 30 sub-fields of science and four different periods between 1970 and 2014. The data show clearly that the most productive sub-fields are physics, chemistry, mathematics, engineering, computer sciences, biochemistry & molecular biology, psychology, neurosciences and neurology.

Table 24: Countries with which Israelis' scientists co-authored mainstream scientific publications, 1970–2014

Rank	1970–1984			1985–1999			2000–2014			2014		
	Country	Art	Share of total [%]	Country	Art	Share of total [%]	Country	Art	Share of total [%]	Country	Art	Share of total [%]
	Israel	51 680	100%	Israel	106 481	100%	Israel	165 370	100%	Israel	12 290	100%
1	USA	6 395	12.37	USA	21 463	20.16	USA	38 704	23.40	USA	3 386	26.19
2	Germany	954	1.85	Germany	4 664	4.38	Germany	12 439	7.52	Germany	1 231	9.52
3	United Kingdom	793	1.53	United Kingdom	3 007	2.82	United Kingdom	9 564	5.78	United Kingdom	1 174	9.08
4	France	519	1.00	France	2 784	2.61	France	7 430	4.49	France	783	6.06
5	Canada	423	0.82	Canada	2 300	2.16	Italy	6 072	3.67	Italy	781	6.04
6	Switzerland	265	0.51	Italy	1 557	1.46	Canada	5 649	3.42	Canada	601	4.65
7	Netherlands	241	0.47	Switzerland	1 259	1.18	Netherlands	4 000	2.42	Spain	517	4.00
8	Sweden	198	0.38	Japan	1 089	1.02	Spain	3 920	2.37	Netherlands	462	3.57
9	Australia	144	0.28	Netherlands	1 016	0.95	Switzerland	3 429	2.07	Switzerland	440	3.40
10	Italy	133	0.26	Russia	956	0.90	Russia	3 408	2.06	China	424	3.28
11	Denmark	131	0.25	Australia	727	0.68	Japan	3 015	1.82	Australia	382	2.95
12	Belgium	110	0.21	Spain	608	0.57	Australia	2 933	1.77	Russia	337	2.61
13	South Africa	105	0.20	Sweden	578	0.54	China	2 795	1.69	Sweden	326	2.52
14	Japan	79	0.15	Belgium	479	0.45	Sweden	2 223	1.34	Japan	309	2.39
15	Brazil	57	0.11	South Africa	421	0.40	Belgium	2 132	1.29	Denmark	268	2.07
16	Norway	32	0.06	Denmark	404	0.38	Poland	2 017	1.22	India	266	2.06
17	Austria	30	0.06	Poland	387	0.36	Denmark	1 801	1.09	Poland	258	2.00
18	Finland	29	0.06	Hungary	386	0.36	Austria	1 767	1.07	Austria	254	1.96
19	India	29	0.06	Brazil	273	0.26	India	1 569	0.95	Belgium	224	1.73
20	Greece	20	0.04	Austria	267	0.25	Turkey	1 450	0.88	Portugal	220	1.70
21	Mexico	20	0.04	Finland	232	0.22	Greece	1 449	0.88	Turkey	215	1.66
22	Poland	16	0.03	Norway	220	0.21	Brazil	1 439	0.87	Brazil	210	1.62
23	Yugoslavia	15	0.03	India	162	0.15	Hungary	1 412	0.85	Greece	209	1.62
24	Argentina	14	0.03	China	159	0.15	Czech Republic	1 374	0.83	Czech Republic	198	1.53
25	Hungary	13	0.03	Rep. of Korea	154	0.14	Norway	1 358	0.82	Norway	193	1.49
26	Venezuela	13	0.03	Mexico	153	0.14	Portugal	1 155	0.70	Hungary	179	1.38
27	Taiwan	12	0.02	Greece	146	0.14	Rep. of Korea	1 084	0.66	South Africa	160	1.24
28	Kenya	11	0.02	Czech Republic	129	0.12	South Africa	987	0.60	Chile	154	1.19
29	New Zealand	11	0.02	New Zealand	128	0.12	Finland	965	0.58	Taiwan	153	1.18
30	Czechoslovakia	10	0.02	Turkey	121	0.11	Taiwan	938	0.57	Argentina	149	1.15

Source: UNESCO based on articles listed at the *Science Citation Index Extended, Social Science Citation Index and Arts and Humanities Citation Index*

Table 25: Production of mainstream scientific articles in Israel by national institutions and laboratories, 1970–2014

Rank	1970–1984			1985–1999			2000–2014			2014		
	Institution	Art	Share of total [%]	Institution	Art	Share of total [%]	Institution	Art	Share of total [%]	Institution	Art	Share of total [%]
	Israel	51 680	100%	Israel	106 481	100%	Israel	165 370	100%	Israel	12 930	100%
1	Hebrew University of Jerusalem	15 691	30.36	Hebrew University of Jerusalem	27 710	26.02	Tel Aviv University	44 731	27.05	Tel Aviv University	3 609	27.91
2	Tel Aviv University	11 710	22.66	Tel Aviv University	27 197	25.54	Hebrew Univ. of Jerusalem	35 428	21.42	Hebrew University of Jerusalem	2 508	19.40
3	Weizmann Institute of Science	6 971	13.49	Technion Israel Institute of Technology	15 983	15.01	Technion Israel Institute of Technology	26 424	15.98	Technion Israel Institute of Technology	1 894	14.65
4	Technion Israel Inst. of Technology	6 268	12.13	Weizmann Institute of Science	11 742	11.03	Ben Gurion University	20 717	12.53	Ben Gurion University	1 626	12.58
5	Ben Gurion University	3 605	6.98	Ben Gurion University	10 066	9.45	Weizmann Institute of Science	16 263	9.83	Weizmann Institute of Science	1 181	9.13
6	Bar Ilan University	1 875	3.63	Bar Ilan University	5 200	4.88	Bar Ilan University	11 517	6.96	Bar Ilan University	1 065	8.24
7	Agriculture Research Organisation	1 848	3.58	Chaim Sheba Medical Centre	3 960	3.72	University of Haifa	8 762	5.30	University of Haifa	893	6.91
8	Chaim Sheba Medical Centre	1 719	3.33	Agriculture Research Organisation	3 579	3.36	Chaim Sheba Medical Centre	7 957	4.81	Chaim Sheba Medical Centre	694	5.37
9	University of Haifa	1 123	2.17	University of Haifa	3 301	3.10	Tel Aviv Sourasky Medical Centre	4 386	2.65	Tel Aviv Sourasky Medical Centre	337	2.61
10	Beilinson Medical Centre	992	1.92	Beilinson Medical Centre	1 880	1.77	Agriculture Research Organisation	3 769	2.28	Agriculture Research Organisation	229	1.77
11	Soreq Nuclear Research Centre	684	1.32	Nuclear Research Centre Negev	900	0.85	Rabin Medical Centre	2 919	1.77	Rabin Medical Centre	218	1.69
12	Nuclear Research Centre Negev	543	1.05	Tel Aviv Sourasky Medical Centre	835	0.78	Shaare Zedek Medical Centre	1 335	0.81	Soroka Medical Centre	151	1.17
13	Hasharon Hospital	375	0.73	Soreq Nuclear Research Centre	786	0.74	Israel Ministry of Health	834	0.50	Shaare Zedek Medical Centre	136	1.05
14	Israel Inst of Biological Research	270	0.52	Shaare Zedek Medical Centre	628	0.59	Israel Open University	803	0.49	Rambam Health Care Campus	132	1.02
15	Kimron Veterinary Inst.	265	0.51	Carmel Medical Centre	554	0.52	Geological Survey Israel	717	0.43	Israel Ministry of Health	87	0.67
16	Israel Ministry of Health	251	0.49	Rabin Medical Centre	525	0.49	Nuclear Research Centre Negev	714	0.43	Israel Open University	82	0.63
17	Shaare Zedek Medical Centre	233	0.45	Hasharon Hospital	504	0.47	Carmel Medical Centre	675	0.41	Geological Survey Israel	71	0.55
18	Rambam University Hospital	232	0.45	Israel Institute of Biological Research	456	0.43	Soreq Nuclear Research Centre	651	0.39	Beilinson Medical Centre	70	0.54
19	Geological Survey Israel	228	0.44	Kimron Veterinary Inst.	419	0.39	Edith Wolfson Medical Centre	649	0.39	Clalit Health Services	67	0.52
20	Assaf Harofeh Medical Centre	178	0.34	Geological Survey Israel	396	0.37	Bnai Zion Medical Centre	602	0.36	Tel-Hai Academic College	66	0.51
21	Israel Ministry of Agriculture	164	0.32	Israel Oceanographic and Limnological Research	327	0.31	HaEmek Medical Centre	574	0.35	Carmel Medical Centre	54	0.42
22	Israel Atomic Energy Commission	131	0.25	Assaf Harofeh Medical Centre	326	0.31	Rambam Health Care Campus	548	0.33	Bnai Zion Medical Centre	45	0.35
23	Ichilov Hospital	126	0.24	Israel Ministry of Health	315	0.30	Kimron Veterinary Inst.	527	0.32	Nuclear Research Centre Negev	44	0.34
24	Israel Ministry of Defence	79	0.15	Bnai Zion Medical Centre	275	0.26	Soroka Medical Centre	516	0.31	The Academic College of Tel-Aviv	36	0.28
25	Haifa Rambam Government Hospital	74	0.14	Israel Defence Forces	275	0.26	Tel-Hai Academic College	455	0.28	Holon Institute of Technology	33	0.26

Source: UNESCO based on Web of Science articles

Table 26: Top ten foreign research institutions and centres co-authoring articles with Israel scientists 1970–2014

Rank	1970–1984			1985–1999			2000–2014			2014		
	Institution	Art	Share of total [%]	Institution	Art	Share of total [%]	Institution	Art	Share of total [%]	Institution	Art	Share of total [%]
	Israel	51 680	100%	Israel	106 481	100%	Israel	165 370	100%	Israel	12 930	100%
1	University of California	1299	2.51	University of California	5 414	5.08	University of California	7 776	4.70	University of California	910	7.04
2	State University of New York	404	0.78	National Institutes of Health USA	2 065	1.94	Harvard University	3 504	2.12	Harvard University	461	3.57
3	University of Illinois	333	0.64	Centre National de la Recherche Scientifique	1 309	1.23	Centre National de la Recherche Scientifique	3 446	2.08	Centre National de la Recherche Scientifique	433	3.35
4	National Institutes of Health USA	315	0.61	US Department of Energy	1 303	1.22	National Institutes of Health USA	2 825	1.71	State University of New York	379	2.93
5	Centre National de la Recherche Scientifique	303	0.59	Harvard University	886	0.83	Max Planck Society	2 546	1.54	Russian Academy of Sciences	304	2.35
6	US Department of Energy	271	0.52	Max Planck Society	814	0.76	University of London	2 442	1.48	University of London	269	2.08
7	Harvard University	247	0.48	University of Chicago	810	0.76	Russian Academy of Sciences	2 311	1.40	Max Planck Society	268	2.07
8	Stanford University	229	0.44	University of London	772	0.73	US Department of Energy	2 283	1.38	Columbia University	254	1.96
9	University of Pennsylvania	229	0.44	State University of New York	717	0.67	University of Toronto	2 031	1.23	University of Toronto	246	1.90
10	University of Chicago	188	0.36	University of Illinois	673	0.63	Columbia University	1 857	1.12	US Department of Energy	232	1.79

Source: UNESCO based on articles listed at the Science Citation Index Extended Social Science Citation Index and Arts and Humanities Citation Index

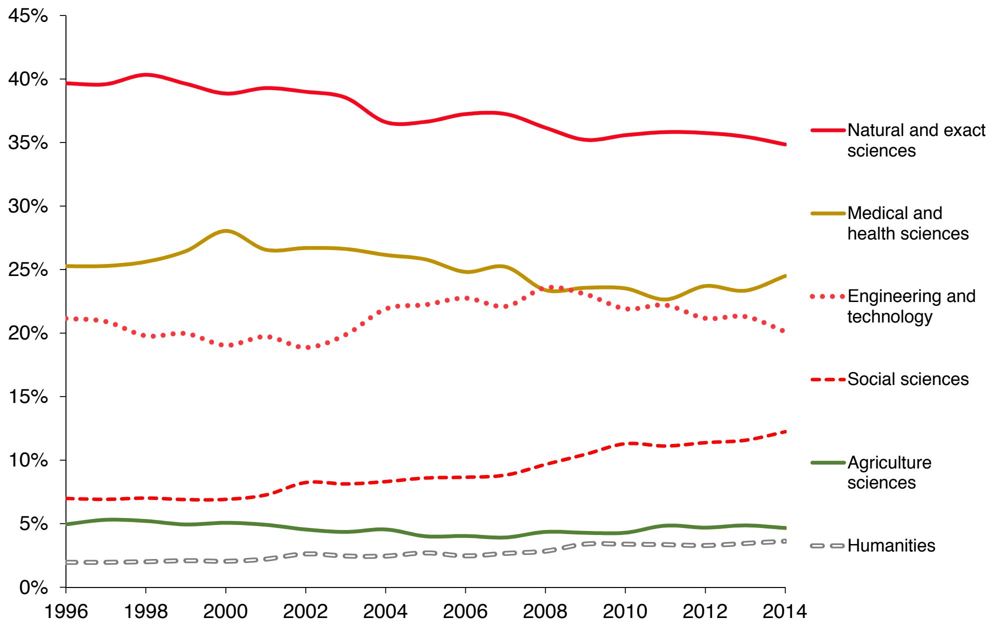


Figure 57: Distribution of publications by field of science 1996–2014. Source: UNESCO estimation based on SCOPUS data

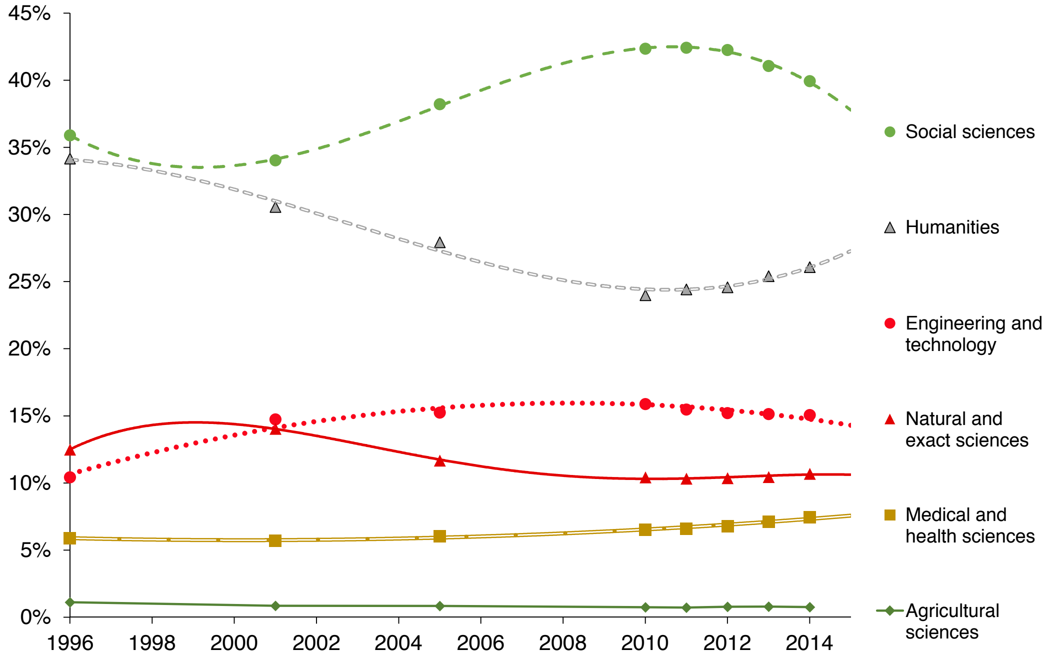


Figure 58: Distribution of Israel graduates (Bachelors, Masters and PhD) by field of science, 1996–2014. Source: UNESCO estimation based on Table 17 (see page 67)

Table 28 shows that in Israel and in the developed countries that are its peers, physics holds highest priority (with the exception of Australia, where engineering ranks first). In all countries in the table, chemistry and engineering rank in second and third place. Different countries assign different priority levels to the other scientific disciplines.

The quality of Israeli publications in various S&T fields is shown in Table 29. The table presents the mean citations of Israeli publications in main S&T fields, normalized to average citations in the field worldwide during the period 2007–2011. The analysis of the data reveals that there is greater cross-country variance in research quality (reflected in citations) than in the priority given by the various countries to the different research disciplines. Materials science, earth science, computer science, and physics usually surpass the global average level of quality for all disciplines. Even in these disciplines, however, this expectation of higher quality does not hold true for all countries. Citations are most frequently made to Israel's scientific production in materials science, followed by space science, life and plant sciences, and physics (this is surprising given the priority that Israel assigns to clinical medicine, physics, and chemistry).

In recent years, a more coherent way to estimate the impact of scientific publications was proposed by Hirsch (2005). The so-called h-index is an indicator of the impact of an individual's scientific output, which can be generalized to institutions and countries. At an aggregated level indicates the number of articles *(h)* of a given country that have received at least h citations. Table 30 presents the top 40 countries in terms scientific productivity, considering the total number of citations, self-citations, citations per article and the h-index, during the period 1996–2014. It is interesting to note that Israel ranked 23th for the total number of articles published between 1996–2014, but ranked 18th in citations, 25th in citations per article, and 15th in terms of *h*-index.

Table 27: Distribution of mainstream scientific articles by sub-field 1970–2014

Rank	1970–1984			1985–1999			2000–2014			2014		
	Sub-fields	Art	Share of total [%]	Sub-fields	Art	Share of total [%]	Sub-fields	Art	Share of total [%]	Sub-fields	Art	Share of total [%]
	Israel	51 680	100%	Israel	106 481	100%	Israel	165 370	100%	Israel	12 930	100%
1	Physics	5 948	11.51	Physics	14 502	13.62	Physics	21 775	13.17	Physics	1 435	11.10
2	Chemistry	4 290	8.30	Mathematics	7 032	6.60	Chemistry	11 470	6.94	Engineering	863	6.67
3	Biochemistry molecular biology	3 912	7.57	Chemistry	6 991	6.57	Mathematics	11 469	6.94	Science and technology, other topics	860	6.65
4	General internal medicine	2 902	5.62	Biochemistry molecular biology	6 827	6.41	Engineering	10 980	6.64	Chemistry	857	6.63
5	Engineering	2 696	5.22	Engineering	6 508	6.11	Biochemistry molecular biology	9 770	5.91	Mathematics	842	6.51
6	Mathematics	2 628	5.09	Computer science	4 153	3.90	Computer science	8 919	5.39	Psychology	695	5.38
7	Psychology	1 824	3.53	Neurosciences, neurology	3 903	3.67	Neurosciences, neurology	8 117	4.91	Neurosciences, neurology	658	5.09
8	Business economics	1 792	3.47	Psychology	3 675	3.45	Psychology	6 628	4.01	Biochemistry molecular biology	618	4.78
9	Plant sciences	1 784	3.45	Materials science	3 232	3.04	Materials science	6 484	3.92	Computer science	571	4.42
10	Biophysics	1 772	3.43	General internal medicine	3 073	2.89	Science and technology, other topics	6 397	3.87	Materials science	559	4.32
11	Agriculture	1 416	2.74	Plant sciences	3 030	2.85	General internal medicine	4 507	2.73	Astronomy and astrophysics	379	2.93
12	Cell biology	1 361	2.63	Agriculture	2 834	2.66	Environmental sciences ecology	4 250	2.57	Environmental sciences ecology	347	2.68
13	Science and technology, other topics	1 341	2.59	Business economics	2 768	2.60	Optics	4 166	2.52	Business economics	326	2.52
14	Surgery	1 327	2.57	Cell biology	2 762	2.59	Cell biology	4 038	2.44	Psychiatry	320	2.47
15	Immunology	1 209	2.34	Obstetrics gynaecology	2 687	2.52	Astronomy and astrophysics	4 003	2.42	Cell biology	300	2.32
16	Neurosciences, neurology	1 193	2.31	Surgery	2 613	2.45	Oncology	3 734	2.26	Cardiovascular system cardiology	288	2.23
17	Astronomy and astrophysics	903	1.75	Immunology	2 608	2.45	Business economics	3 679	2.22	General internal medicine	288	2.23
18	Pharmacology and pharmacy	889	1.72	Astronomy and astrophysics	2 279	2.14	Cardiovascular system cardiology	3 487	2.11	Optics	286	2.21
19	Materials science	881	1.70	Oncology	2 279	2.14	Genetics heredity	3 392	2.05	Oncology	282	2.18
20	Environmental sciences ecology	871	1.69	Environmental sciences ecology	2 199	2.07	Psychiatry	3 344	2.02	Pharmacology and pharmacy	268	2.07
21	Psychiatry	804	1.56	Optics	2 181	2.05	Immunology	3 315	2.00	Genetics heredity	255	1.97
22	Computer science	797	1.54	Science and technology, other topics	2 100	1.97	Surgery	3 301	2.00	Obstetrics gynaecology	237	1.83
23	Obstetrics gynaecology	781	1.51	Cardiovascular system cardiology	2 065	1.94	Pharmacology and pharmacy	3 259	1.97	Surgery	217	1.68
24	Oncology	774	1.50	Pharmacology and pharmacy	2 061	1.94	Paediatrics	3 225	1.95	Paediatrics	212	1.64
25	Paediatrics	720	1.39	Biophysics	1 994	1.87	Obstetrics gynaecology	3 203	1.94	Endocrinology metabolism	209	1.62
26	Endocrinology metabolism	705	1.36	Genetics heredity	1 898	1.78	Agriculture	2 780	1.68	Immunology	202	1.56
27	Physiology	645	1.25	Paediatrics	1 851	1.74	Plant sciences	2 776	1.68	Public environmental occupational health	178	1.38
28	Optics	640	1.24	Endocrinology metabolism	1 720	1.62	Endocrinology metabolism	2 445	1.48	Agriculture	177	1.37
29	Zoology	632	1.22	Psychiatry	1 629	1.53	Haematology	2 258	1.37	Geology	172	1.33
30	Genetics heredity	624	1.21	Mechanics	1 514	1.42	Microbiology	2 233	1.35	Microbiology	166	1.28

Source: UNESCO based on articles listed at the Science Citation Index Extended Social Science Citation Index and Arts and Humanities Citation Index

Table 28: Distribution of scientific articles by sub-fields of science as percentage of domestic publications, cross-country comparison, 2000–2014

Country/ (Articles 2000–2014) Sub-field of science	Israel (165 370)	Australia (495 498)	Denmark (160 824)	Finland (137 313)	Sweden (254 643)	Switzerland (284 076)	USA (4 567 205)
Physics	13.17%	5.74%	8.14%	9.96%	10.24%	14.28%	8.30%
Chemistry	6.94%	6.07%	7.18%	7.38%	7.87%	9.77%	6.96%
Mathematics	6.94%	2.86%	2.37%	2.95%	2.59%	2.67%	3.48%
Engineering	6.64%	8.05%	6.40%	8.50%	7.55%	7.05%	7.87%
Biochemistry molecular biology	5.91%	4.15%	6.23%	4.99%	6.50%	6.03%	6.29%
Computer science	5.39%	3.30%	2.69%	3.95%	2.39%	3.16%	3.17%
Neurosciences, neurology	4.91%	4.16%	4.65%	4.54%	4.72%	5.09%	5.09%
Psychology	4.01%	3.71%	1.52%	2.37%	1.96%	2.16%	4.30%
Materials science	3.92%	4.09%	2.91%	4.77%	5.16%	4.46%	3.95%
Science and technology, other topics	3.87%	3.13%	3.41%	2.81%	3.63%	4.15%	3.94%
General internal medicine	2.73%	2.74%	2.01%	1.41%	1.64%	1.98%	1.84%
Environmental sciences ecology	2.57%	5.92%	5.57%	6.67%	5.67%	4.51%	3.82%
Optics	2.52%	1.39%	1.76%	1.75%	1.39%	1.31%	1.31%
Cell biology	2.44%	1.61%	1.89%	1.73%	2.15%	2.53%	2.65%
Astronomy and astrophysics	2.42%	2.08%	2.35%	2.75%	1.98%	3.19%	2.25%
Oncology	2.26%	1.81%	2.82%	2.68%	3.33%	2.35%	2.85%
Business economics	2.22%	3.40%	2.62%	2.57%	2.31%	2.03%	2.92%
Cardiovascular system cardiology	2.11%	1.61%	2.74%	2.26%	2.71%	2.33%	2.36%
Genetics heredity	2.05%	1.96%	2.33%	2.63%	2.24%	1.91%	1.97%
Psychiatry	2.02%	2.20%	1.81%	1.74%	1.60%	1.52%	1.62%

Source: UNESCO based on raw data from Web of Science

Table 29: Ratio of mean citations in S&T fields in Israel to mean citations per field, cross-country comparison – normalized to discipline (Global), 2007–2011

Sub-field of science	Israel	Denmark	Finland	Switzerland	USA	EU-27
Materials Science	1.59	2.03	1.01	1.77	1.74	1.11
Space Science	1.53	1.61	1.04	1.77	1.38	1.17
Plant & Animal Science	1.46	1.55	1.22	1.65	1.33	1.22
Physics	1.42	1.49	1.52	1.89	1.56	1.20
Geosciences	1.32	1.64	1.66	1.77	1.48	1.16
Molecular Biology & Genetics	1.30	1.55	1.64	1.57	1.36	1.10
Agricultural Sciences	1.30	1.53	1.63	1.35	1.36	1.23
Chemistry	1.29	1.41	1.06	1.55	1.59	1.16
Microbiology	1.25	1.34	0.94	1.41	1.49	1.13
Biology & Biochemistry	1.24	1.37	1.16	1.60	1.42	1.08
Pharmacology & Toxicology	1.15	1.22	1.33	1.38	1.35	1.17
Clinical Medicine	1.13	1.67	1.51	1.57	1.42	1.10
Economics & Business	1.11	0.93	0.89	1.25	1.37	0.92
Neuroscience & Behavior	1.06	1.14	1.14	1.26	1.31	1.06
Immunology	1.06	0.97	1.01	1.40	1.30	1.00
Engineering	1.01	1.49	1.13	1.39	1.17	1.04
Psychiatry/Psychology	1.00	1.15	1.14	1.31	1.19	1.01
Environment/Ecology	0.98	1.52	1.43	1.73	1.30	1.12
Computer Science	0.96	1.30	1.11	2.45	1.25	1.06
Mathematics	0.96	1.13	1.32	1.38	1.30	1.06
Social Sciences, general	0.94	1.19	1.00	1.31	1.21	1.00

Source: Web of Science. Data processing by SNI

Table 30: Top 40 list of impact indicators for the period 1996–2014

Rank	Country	Citations	Self-citations	Citations per article	h- index
1	United States	177 434 935	83 777 658	23.36	1 648
2	China	19 110 353	10 462 121	7.44	495
3	United Kingdom	44 011 201	10 321 539	21.03	1 015
4	Germany	35 721 869	9 141 181	18.50	887
5	Japan	27 040 067	7 619 559	13.79	745
6	France	24 700 140	5 516 943	17.95	811
7	Canada	22 152 666	4 136 384	21.40	794
8	Italy	18 019 464	4 186 908	17.52	713
9	India	6 989 150	2 409 025	9.61	383
10	Spain	12 628 097	3 068 362	16.14	591
11	Australia	13 772 961	2 947 945	19.49	644
12	Republic of Korea	7 063 429	1 528 443	12.38	424
13	Russian Federation	4 289 618	1 273 073	6.50	390
14	Netherlands	14 278 721	2 321 446	24.56	694
15	Brazil	5 036 027	1 699 530	11.73	379
16	Switzerland	10 872 269	1 458 098	26.10	686
17	Taiwan	4 790 230	1 075 153	12.17	331
18	Sweden	9 417 604	1 448 940	23.21	614
19	Poland	3 491 958	901 545	9.57	371
20	Turkey	2 938 841	737 423	9.79	266
21	Belgium	6 691 791	948 874	21.01	547
22	Iran	1 504 541	573 856	9.83	180
23	Israel	5 079 652	694 959	20.56	496
24	Austria	4 334 382	583 299	19.24	449
25	Denmark	5 494 671	779 833	24.94	518
26	Finland	4 295 721	666 893	21.20	443
27	Greece	2 702 414	444 424	14.36	326
28	Czech Republic	1 867 611	440 161	10.74	294
29	Mexico	1 962 572	408 914	11.69	289
30	Norway	3 354 827	530 420	20.17	402
31	Hong Kong	2 951 215	393 784	16.87	359
32	Singapore	2 561 645	331 822	15.78	349
33	Portugal	2 096 242	407 892	15.17	297
34	South Africa	1 774 278	386 014	13.41	292
35	New Zealand	2 495 935	380 280	18.52	351
36	Malaysia	670 387	183 198	9.41	165
37	Argentina	1 681 700	354 132	13.49	273
38	Hungary	1 660 840	264 809	13.60	301
39	Ireland	1 999 703	233 733	19.01	332
40	Ukraine	635 570	176 428	5.03	174

Source: Scimago 2015

WHAT PATENTS TELL US ABOUT RESEARCH AND INNOVATION

A patent is a document issued by an authorized government agency granting the right to exclude—using the legal system—anyone else from the production or use of a specific new device apparatus or process for a stated number of years (see Glossary pages 319–321). The grant is issued to the inventor of this device or process after an examination that focuses on both the novelty of the claimed item and its potential utility.

Measuring the link between publications and patents has been a subject of academic research in recent decades. It helps us to understand the intensity and orientation of research as well as the relation between science and technology. A measurable relation allows us to investigate knowledge transfers and potential spillovers; to describe the knowledge base of particular technologies; to disclose the technological neighbourhood of scientific themes or research fronts; to reveal an ongoing innovation process (from research to technology then on to commercialisation).

A patent constitutes a milestone in the progress of a given technology. However, it is only one piece in a larger puzzle of technological innovation, which entails combining new knowledge with a suitable business strategy and other factors to achieve commercial success. Patent data have been widely used in many innovation studies (Griliches, 1990). Next to patent count data, it is obvious that patent documents because of legal reporting requirements provide the STI policy expert with a wealth of information, which can be used for various types of foresight and strategic analysis. For instance, typical patent documents contain the names and the addresses of the inventors and their applicants as well as references to other scientific and technological documents. This information can easily be used to map progress and collaboration in technological fields as well as to assess the vitality of various organisations (firms as well as universities) in a particular field of technological development or in a particular system of innovation.

The kind of economic studies in which patent statistics have been used include those that examine: the long-term changes in the amount and direction of inventive output in particular industries; the relationship between these changes and other long-term economic indicators; the relative efficiency of company-financed and government-financed industrial R&D; the contribution of individual firms to particular areas of innovative activity; the relative significance of foreign and home-generated technology; and individual inventive output.

Patent analysis takes many forms with important distinctions between micro- and macro- analyses (Trippe, 2003). In the private sector, for instance intellectual asset management groups probe deeply to understand the development of individual technologies through a systematic mapping of the content of patents. From the perspective of SETI policy studies, the methodological approach has recourse to macro-analysis. This analysis focuses on studying the patenting patterns at national level combining this with bibliometric research.

Even though patent grants can be thought of as a moving average of past applications statistical studies reveal that, the figures for granted patents tend to fluctuate as much or more than the number of patent applications. It is also clear that economic conditions impinge on the rate of patent applications (Griliches, 1990). Any analysis of long-term temporal series of patents will reflect the innovation behaviour of a particular country and the stage of national development at different epochs as well as any economic political and societal crises along the way.

Patents comprise a unique source for technological knowledge. They are considered a good proxy for invention skills, R&D activities and for the scope of technological innovation of countries, regions, sectors and firms. The use of patent statistics makes it possible to track technological changes and to examine knowledge transfer and R&D co-operation between various sectors and countries. Since patent indicators are calculated in different ways, one has to be careful when using them for international comparisons of S&T outputs (Getz *et al.*, 2014).

Applications Filed in the Israel Patent Office

Figure 59 presents the number of patent applications filed in the Israel Patent Office by origin of the applicant (residents and non-residents) between 1960 and 2013. As can be determined from the data, 2007 was the record year in patent applications, both for resident and non-resident applicants. The steep decrease in patent applications in 1998 was evidently technical, attributable to the assimilation of a new automatic counting system for patent applications (replacing the previous manual counting method). Since 2000, the number of patent applications from abroad has risen significantly due to the implementation of the Patent cooperation Treaty (PCT) in Israel. Nearly 80% of patent applications filed in the past decade (2002–2012) in the Israel Patent Office (ILPO) are attributed to non-residents applicants (60 860), whereas only 20% of the applications were filed by Israeli applicants (15 566). In 1990–2000, by comparison, foreign patent applications made up 71% of the total applications filed in the ILPO.

Figure 60 shows the distribution of patents (1998–2013) by top field of technology. Medical and computer technologies, pharmaceuticals, biotechnology, digital communication, organic fine chemistry and measurements are the main technological fields.

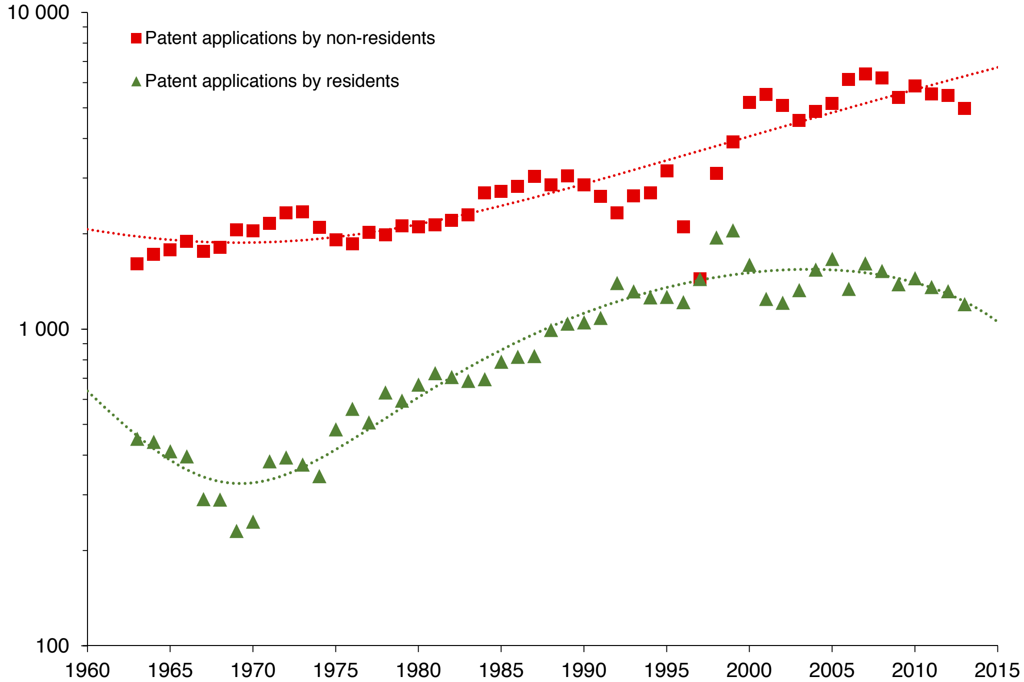


Figure 59: Number of patent applications by residents and non-residents at the Israel Patent Office in a log-normal scale, 1960–2013. Source: Israel Patent Office

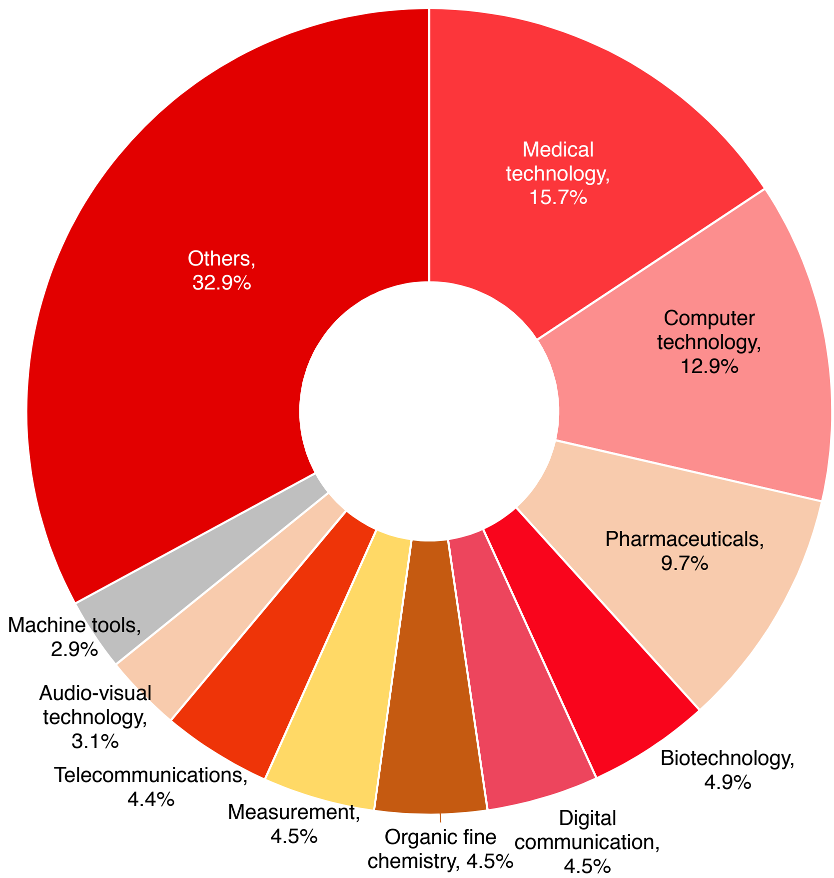


Figure 60: Patent applications in Israel by top field of technology, 1999–2013. Source: WIPO

BOX 13 – ISRAEL'S INTELLECTUAL PROPERTY POLICY

In recent years, there is increased awareness of the rising value of intellectual property. Israel has undertaken a broad and active effort to strengthen the economy's ability to benefit from an enhanced system for intellectual property rights (IPRs). This includes increasing the resources of the Israel Patent Office, upgrading enforcement activities as well as implementing programmes to bring ideas funded by government research to the market (OECD, 2011).

Israel Patent Office

The Israel Patent Office (ILPO) is the legal body responsible in Israel for registering IP–patents, designs and trademarks. The ILPO is also responsible for providing information to the public regarding registered rights, serving as a repository and providing access to registered IP, and providing the interface for international organizations dealing with protection of industrial intellectual property, such as the World Intellectual Property Organization (WIPO). Israel joined WIPO in April 26, 1970.

The ILPO acts under the Patents Law, 5727-1967, the Patents and Designs Ordinance, the Trademarks Ordinance 5732-1972 and the Appellations of Origin and Geographical Indications Law, 5725-1965. Since 1996, ILPO acts as a receiving office for the Patent Cooperation Treaty (PCT) applications and, since 2010, also acts as an office of origin for international trademark applications in accordance with the Madrid Protocol. Since June 2012, the ILPO acts as an International Searching and Preliminary Examination Authority under the PCT solely for applications by Israeli applicants (The Israel Patent Office, 2013).

The Commissioner of Patents, Designs and Trademarks is responsible for conducting certain legal proceedings, including appeals to examiners' decisions, objections to registrations and requests to cancel rights. In addition, the ILPO provides information and guidance to the public relating to its functions and responsibilities and in matters concerning patents, designs and trademarks.

Intellectual Property Rights Policy

Intellectual property rights in Israel provide protection for copyrights and performers' rights, trademarks, geographical indicators, patents, industrial designs, topographies of integrated circuits, plant breeds and undisclosed business secrets. Many of the intellectual property statutes in Israel find their roots in British Mandatory law. That legislation has been updated and amended throughout the years to meet new needs and developments. Israeli case law provides for a continuing source of modernization and sophistication in this regard. Laws and practices from modern countries, particularly Anglo-American law, the emerging body of European Union law, and proposals of international organizations, affect both Israeli legislation and Israeli case law today. The intellectual property legislation and case law, apart from dealing with the subject matter itself, also contain a well-developed and progressive range of civil remedies for infringement, including important preliminary relief such as the Anton Pillar Order, the Mareva Injunction and the appointment of special receivers for infringing goods (WIPO, 2004).

Israeli Patent Applications in the PCT System and in the United States Patent and Trademark Office

The Patent Cooperation Treaty (PCT) is an international treaty, administered by the World Intellectual Property Organization (WIPO). The PCT makes it possible to seek patent protection for an invention simultaneously in each of the 140 member states by filing a single international patent application, instead of filing several separate national or regional patent applications. Thus, a PCT filing can be seen as a worldwide patent application and is much less biased than national applications. A further advantage of the PCT is that it is used increasingly by applicants from many comparable countries (OECD, 2009).

Table 31 and Table 32 report the numbers of PCT applications, by resident inventors and by resident applicants respectively, for each OECD country. As demonstrated by the data, in 2012, Israel was ranked in 12th place among OECD countries in the total number of inventor filings and was ranked in 15th place in applicant filings in 2011.

A better comparative indicator reflecting the intensity of inventive activity in a country is the number of applications expressed relative to the size of the population. Figure 61 shows that in 2012, Israel was ranked fifth among OECD countries in the number PCT applications of inventors per population (23.9 applications per 100 000 inhabitants). Figure 62 shows that Israel occupied the ninth place among OECD countries in the number its nationals' PCT patent applications relative to its population (17.4 applications by Israelis per 100 000 inhabitants). The data reflects a drop of one point in the position of inventor applications, and a drop of four points in the position of assignee applications in comparison to 2007.

Figure 63 shows that Israel enjoys a relative (revealed) advantage[36] in the fields of Medical Technology (ranked second among OECD countries after Ireland) and ICT (ranked fourth among OECD countries after Finland, Republic of Korea and Sweden). Denmark has a significant relative advantage over other OECD countries in the field of energy generation from renewable sources (especially wind energy).

Table 33 presents the number of patent applications filed in the United States Patent and Trademark Office (USPTO), by country of origin. The country of origin of an application is based on the residence of the first-named inventor. As demonstrated by the data, the number of Israeli inventor application filings in the USPTO was significantly higher than the number of filings in the ILPO and the European Patent Office (EPO). The USPTO constitutes the main venue for patent application filings by Israeli inventors mainly due to the intensive activity of foreign R&D centers (MNCs) in Israel, which are owned primarily by American firms (e.g. IBM, Intel, Sandisk, Microsoft, Applied Materials, Qualcomm, Samsung, Motorola, Google, Hewlett-Packard, etc.). These inventions' patents are attributed to Israelis as their inventors but not as their owners (applicant or assignee). As Table 33 shows, in the year 2012, Israeli inventors filed 6 455 patent applications in the USPTO, positioning Israel in 10th place among world nations.

Table 34 and Table 35 include both large and small countries. When analyzing the results, one needs to take country-size differences into account. Table 3 presents the number of patent applications in the USPTO per 100 000 inhabitants. As the table shows, in 2012 Israel was ranked first in the world, relative to the size of its population, in USPTO inventor patent applications (almost 91 patent applications per 100 000 inhabitants), surpassing even the United States.

The next indicator presented is the number of patent applications normalized to R&D investment (Table 37). It shows the number of patent applications filed in the USPTO per US$ 1 million (in 2005 prices, PPP) of GERD in 2002–2012. This indicator, an expression of the ratio of inputs to outputs, may give evidence to the efficiency of a country's R&D system. In 2012, the number of patent applications in the USPTO relative to R&D investment was 0.7 Israeli patent applications (inventors) per US$ 1 million GERD expenditure. For that year, Israel was second only to Taiwan in this metric.

36 An index that represents the share of patents of a country in a particular technological domain divided by the share of patents of a reference group (OECD countries) in the same technological domain

Figure 64 shows a parabolic correlation between inventive activity (represented by PCT applications by residents) and the civilian GERD (R^2=0.93). This correlation means that an increase of one unit of GERD produces a quadratic increase in the number of patents. However, this correlation also shows that there is a maximum peak (vertex of the parabola), which has already been reached.

Figure 65 shows the parabolic correlation between the inventive activity (represented by PCT applications by residents) and societal output measured by GDP (R^2=0.94). This means that an increase in one unit of GDP produces a quadratic increase in the number of patents. However, again, this correlation shows that there is a maximum peak which has also been reached. Figures 64 and 65 are consistent with the relation that has already been shown between the number of scientific articles per million inhabitants and the GDP per capita (see Figure 54, page 101).

However, in both cases, a cautious approach must be taken when interpreting the data, and one should not infer that a causal relationship exists between the two sets of data.

Table 31: PCT applications at international phase, by inventor's country, 2001–2012

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
United States	40 107	39 993	42 292	45 634	49 778	52 068	50 044	44 654	42 887	45 232	48 213	50 151
Japan	12 288	14 761	19 175	24 122	26 112	26 709	29 001	28 082	31 002	37 126	41 721	42 780
Germany	13 580	14 154	15 011	15 964	16 731	17 589	18 744	17 053	17 301	18 492	17 959	17 105
Republic of Korea	2 182	2 600	3 397	4 253	5 221	6 427	7 257	7 188	8 728	9 548	10 515	11 256
France	4 991	5 085	5 308	5 922	6 362	6 482	6 819	6 903	7 012	7 224	7 680	7 272
United Kingdom	5 868	5 946	5 923	5 963	5 989	6 540	6 417	6 029	5 686	5 760	5 523	5 281
Netherlands	3 649	3 100	3 056	3 213	3 391	3 567	3 578	3 570	3 247	2 944	3 487	3 499
Canada	2 330	2 371	2 330	2 497	2 807	2 995	3 037	2 619	2 693	2 935	2 886	3 054
Italy	2 053	2 216	2 422	2 618	2 968	3 330	3 360	3 215	3 134	3 147	3 245	3 050
Sweden	2 506	2 222	2 105	2 224	2 494	2 827	3 165	3 004	2 849	2 849	2 856	2 800
Switzerland	1 675	1 681	1 747	1 975	2 070	2 147	2 456	2 257	2 226	2 360	2 599	2 672
Israel	1 440	1 345	1 461	1 659	1 908	2 035	2 119	1 793	1 690	1 701	1 767	1 893
Australia	1 757	1 770	1 904	2 043	2 092	2 057	2 020	1 841	1 849	1 757	1 772	1 641
Finland	1 386	1 314	1 295	1 522	1 465	1 644	1 600	1 503	1 502	1 567	1 530	1 598
Spain	787	845	867	1 164	1 294	1 395	1 539	1 629	1 775	1 905	1 795	1 559
Austria	716	866	943	1 080	1 168	1 308	1 326	1 190	1 281	1 414	1 387	1 346
Belgium	779	801	839	974	1 020	1 098	1 161	1 089	1 144	1 254	1 239	1 221
Denmark	987	985	1 060	1 087	1 171	1 174	1 353	1 253	1 128	1 145	1 243	1 090
Norway	564	575	499	598	641	660	660	667	749	734	645	671
Turkey	78	110	119	189	258	324	380	388	462	560	450	657
Ireland	254	257	260	304	319	357	438	426	379	340	415	384
Poland	111	161	123	118	108	140	165	196	257	279	271	344
New Zealand	307	313	363	386	369	399	390	338	323	343	309	307
Hungary	171	176	175	190	196	203	248	222	234	244	255	213
Mexico	126	127	136	157	189	203	216	226	208	235	188	193
Czech Republic	92	94	117	125	134	154	219	213	179	155	177	169
Portugal	36	35	48	45	93	106	114	134	139	135	143	152
Slovenia	49	83	77	86	107	103	120	141	131	135	124	118
Chile	9	13	13	24	27	25	40	52	89	118	113	108
Greece	75	83	85	62	104	93	118	109	110	91	79	95
Luxembourg	33	35	29	50	38	52	38	55	52	54	69	77
Slovak Republic	24	40	38	33	40	44	48	33	36	48	52	30
Iceland	33	49	41	37	40	37	28	26	35	27	31	29
Estonia	13	11	18	17	11	32	46	46	48	50	38	13

Note: The number are organized by priority year and partial count of inventor country

Source: OECD.Stat

Table 32: PCT applications at international phase, by applicant's country, 2000–2011

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
United States	41 449	40 506	39 790	42 145	45 733	50 122	52 565	50 408	44 942	43 071	45 488	49 320
Japan	10 647	12 180	14 774	19 298	24 230	26 226	26 759	28 927	28 065	31 094	37 331	42 056
Germany	13 486	13 674	13 907	14 598	15 479	16356	17 344	18 218	16 689	17 089	18 462	17 907
Rep. of Korea	1 962	2 192	2 590	3 368	4 227	5 242	6 478	7 349	7 246	8 859	9 646	10 605
France	4 462	4 850	4 858	4 970	5 569	6 174	6 533	6 923	7 085	7 392	7 623	7 899
United Kingdom	5 219	5 143	4 940	4 863	4 815	4 900	5 287	5 240	4 749	4 547	4 508	4 408
Switzerland	2 334	2636	2 715	2 925	3 249	3 484	3 725	3 944	3 827	3 923	4 169	4 217
Netherlands	3 301	3 776	4 361	4 354	4 528	4 562	4 422	4 448	4 486	3 857	3 399	3 817
Sweden	3 277	2 914	2 503	2 598	2 654	2 952	3 294	3 860	3 777	3 325	3 329	3 360
Italy	1 535	1 752	1 961	2 125	2 276	2 611	2 886	2 857	2 735	2 682	2 683	2 807
Canada	2 056	2 121	2 136	2 006	2 092	2 354	2 513	2 592	2 245	2 241	2 508	2 482
Finland	1 516	1 622	1 615	1 612	1 846	1 741	1 922	2 031	1 922	1 898	2 032	2 000
Australia	1 633	1 633	1 598	1 760	1 897	1 953	1 927	1 897	1 661	1 681	1 668	1 676
Spain	524	659	739	767	1 028	1 122	1 211	1 350	1 467	1 629	1 725	1 627
Israel	1 228	1 161	1 120	1 190	1 382	1 567	1 667	1 836	1 520	1 413	1 433	1 354
Denmark	895	938	964	1 016	1 050	1 109	1 070	1 312	1 284	1 121	1 224	1 311
Austria	642	588	699	812	896	933	993	963	1 015	1 145	1 302	1 285
Belgium	632	641	696	770	924	960	1 055	1 076	979	1 032	1 129	1 138
Norway	534	535	530	452	544	589	570	574	595	716	667	594
Ireland	258	355	333	344	360	460	437	514	503	476	462	430
Turkey	78	75	106	110	171	240	315	365	368	441	541	429
Luxembourg	149	141	172	161	199	227	272	286	242	318	334	333
New Zealand	279	286	287	322	351	341	359	352	301	293	326	282
Poland	96	93	138	104	99	81	110	123	158	195	203	208
Mexico	77	104	110	111	157	172	195	196	224	179	224	156
Czech Republic	71	77	73	95	118	104	122	163	166	146	125	149
Hungary	128	137	144	128	156	144	150	169	143	157	132	143
Portugal	32	41	33	44	48	74	82	101	119	128	119	124
Slovenia	42	36	57	67	73	87	79	104	125	114	121	112
Chile	2	5	7	7	10	14	16	28	41	82	105	95
Greece	46	64	61	69	50	87	78	96	94	90	73	63
Slovak Republic	32	17	26	28	26	30	34	38	25	34	45	41
Estonia	12	13	9	11	17	11	26	36	32	39	38	35
Iceland	31	38	58	50	51	53	50	63	56	53	44	33

Note: The number are organized by priority year and partial count of inventor country

Source: OECD.Stat

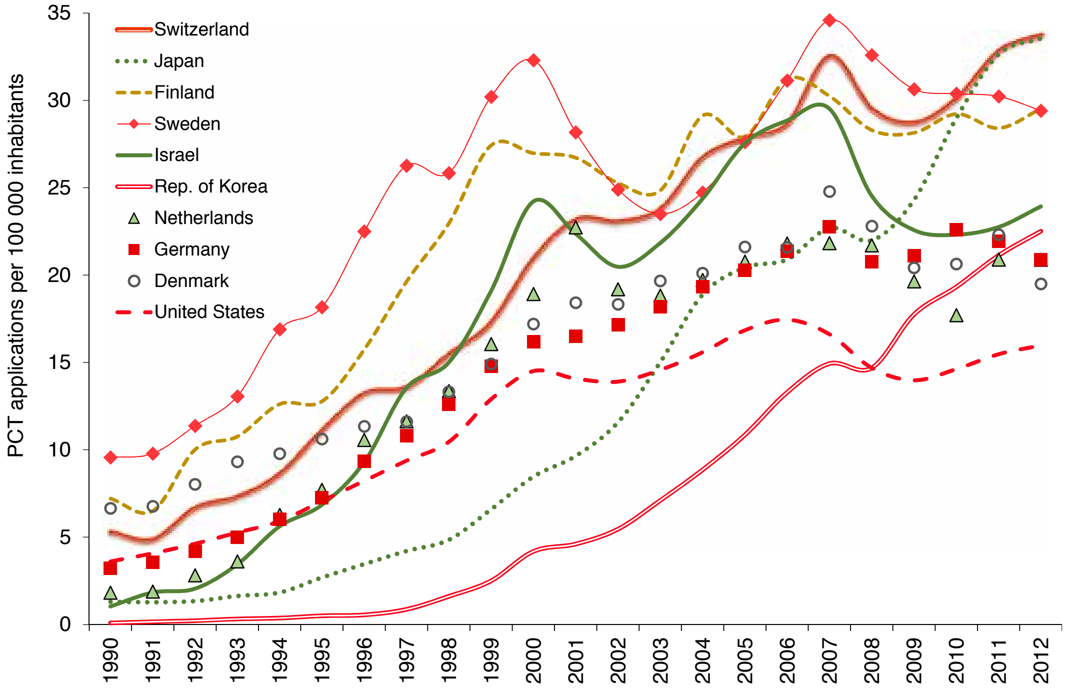


Figure 61: PCT applications per 100 000 inhabitants by inventor's country of residence, 1990–2012. Source: OECD.Stats

Figure 62: PCT patent applications per 100 000 inhabitants by applicant's country of residence, 2000–2011. Source: OECD.Stats

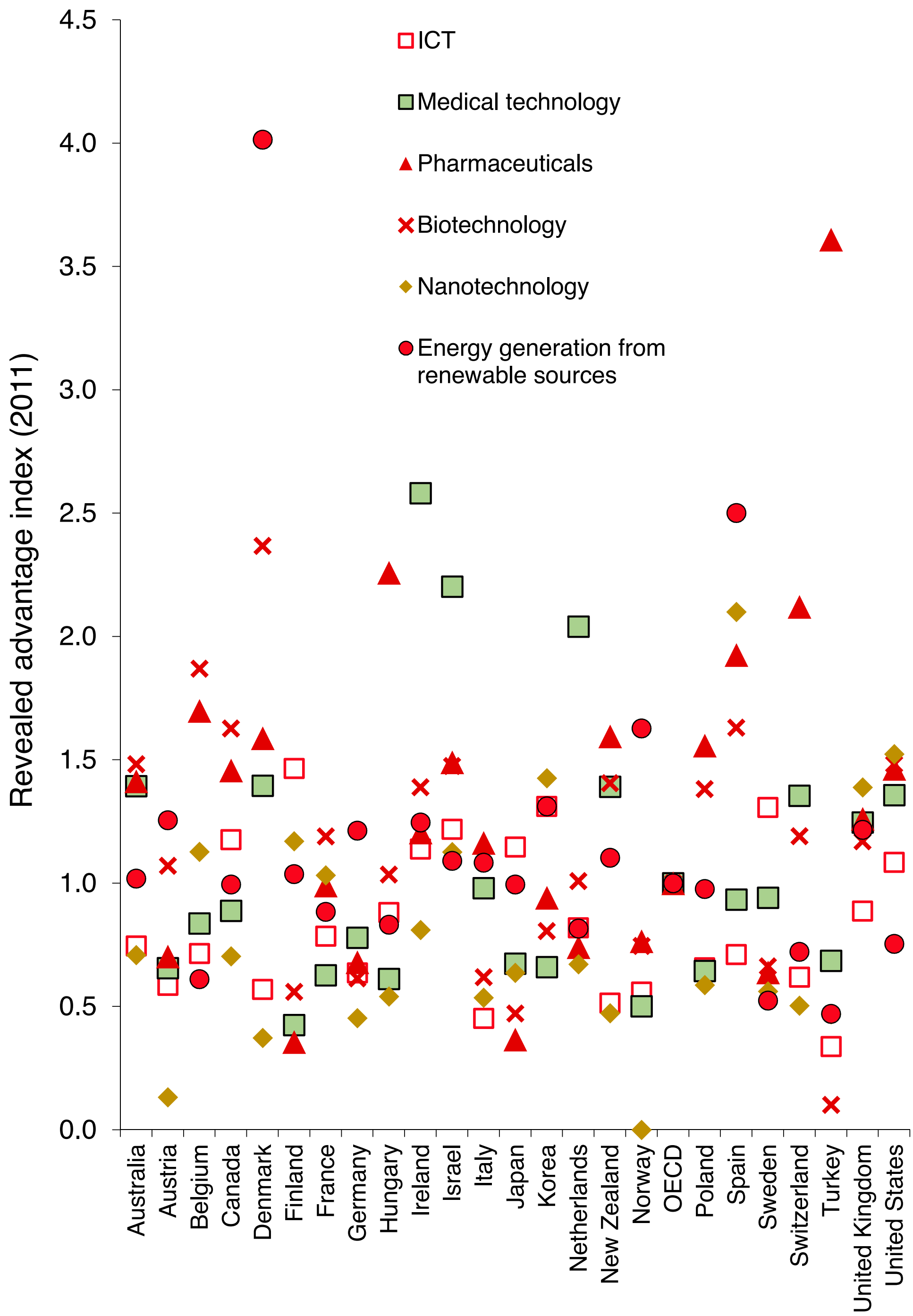


Figure 63: Revealed advantage in patenting activity by technological domains, PCT applications, 2011. Source: OECD.Stats

Table 33: Patent applications filed in the USPTO, by country of origin, 2002–2012

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
United States	184 245	188 941	189 536	207 867	221 784	241 347	231 588	224 912	241 977	247 750	268 782
Japan	58 739	60 350	64 812	71 994	76 839	78 794	82 396	81 982	84 017	85 184	88 686
Rep. of Korea	7 937	10 411	13 646	17 217	21 685	22 976	23 584	23 950	26 040	27 289	29 481
Germany	20 418	18 890	19 824	20 664	22 369	23 608	25 202	25 163	27 702	27 935	29 195
Taiwan	12 488	13 786	15 057	16 617	19 301	18 486	18 001	18 661	20 151	19 633	20 270
Canada	7 375	7 750	8 202	8 638	9 652	10 421	10 307	10 309	11 685	11 975	13 560
Chinese Taipei	888	1 034	1 655	2 127	3 768	3 903	4 455	6 879	8 162	10 545	13 273
United Kingdom	8 391	7 700	7 792	7 962	8 342	9 164	9 771	10 568	11 038	11 279	12 457
France	6 825	6 603	6 813	6 972	7 176	8 046	8 561	9 331	10 357	10 563	11 047
Israel	2 645	2 539	2 693	3 157	3 657	4 410	4 550	4 727	5 149	5 436	6 455
India	919	1 164	1 303	1 463	1 923	2 387	2 879	3 110	3 789	4 548	5 663
Italy	2 980	3 011	2 997	2 993	3 274	3 376	3 805	3 940	4 156	4 282	4 516
Switzerland	2 338	2 275	2 316	2 447	2 773	3 079	3 353	3 508	4 017	4 086	4 394
Sweden	2 410	2 314	2 270	2 243	2 680	3 164	3 265	3 515	3 840	4 140	4 390
Netherlands	2 602	2 257	3 052	3 188	3 823	3 946	3 883	4 203	4 463	4 418	4 303
Australia	2 160	2 310	3 000	2 919	2 928	3 412	3 976	3 699	3 739	3 767	3 603
Finland	1 811	1 935	2 096	2 032	2 383	2 444	2 621	2 610	2 772	2 551	2 760
Belgium	1 293	1 395	1 309	1 460	1 546	1 766	1 609	1 846	2 084	2 115	2 211
Denmark	1 065	1 002	923	997	1 165	1 284	1 439	1 703	1 773	1 974	2 059
Austria	1 115	933	1 022	1 044	1 214	1 438	1 418	1 564	1 661	1 849	2 008

Source: United States Patent and Trademark Office

Table 34: Patent applications filed in the EPO, by country of origin, 2002–2011

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
United States	31 586	33 584	34 143	35 823	37 212	34 771	32 030	29 885	29 668	28 412
Germany	22 284	22 220	22 668	23 465	24 237	24 715	24 489	22 667	23 370	22 605
Japan	20 524	21 196	22 677	23 191	22 089	21 494	21 470	19 497	19 945	19 614
France	7 430	7 655	7 999	8 413	8 490	8 481	8 782	8 635	8 608	8 340
United Kingdom	5 674	5 607	5 691	5 749	5 782	5 988	5 727	5 405	5 345	5 052
Rep. of Korea	1 721	2 406	3 359	4 574	5 300	5 183	4 481	4 060	4 778	4 931
Italy	4 169	4 417	4 584	4 790	4 968	5 095	4 853	4 188	4 275	4 201
China	426	666	867	1 068	1 780	2 022	2 507	3 109	4 320	3 173
Switzerland	2 720	2 768	2 977	3 147	3 291	3 238	3 288	3 127	3 200	3 095
Netherlands	3 970	3 595	3 562	3 723	3 600	4 064	3 450	3 421	3 326	2 872
Sweden	2 222	2 154	2 288	2 433	2 610	2 796	2 886	2 599	2 591	2 229
Canada	1 738	1 906	2 221	2 374	2 465	2 420	2 252	2 194	2 426	2 045
Austria	1 247	1 298	1 417	1 472	1 581	1 789	1 666	1 663	1 683	1 736
Belgium	1 249	1 341	1 379	1 570	1 576	1 583	1 574	1 372	1 435	1 430
Chinese Taipei	451	539	545	674	781	847	1 101	1 110	1 253	1 315
Spain	939	928	1 006	1 294	1 400	1 411	1 376	1 427	1 632	1 290
Denmark	956	1 007	1 093	1 180	1 198	1 227	1 385	1 280	1 218	1 285
Finland	1 422	1 249	1 308	1 415	1 360	1 375	1 354	1 269	1 383	1 167
Israel	953	921	1 107	1 259	1 400	1 318	1 234	1 216	1 163	1 063

Source: OECD.Stats

Table 35: USPTO patent applications per 100 000 inhabitants, 2002–2012

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Israel	45.9	43.1	44.8	51.5	58.6	69.5	70.3	71.6	76.2	78.4	90.8
United States	66.3	67.1	66.6	72.3	76.4	82.4	78.4	75.4	80.4	81.6	87.6
Japan	46.9	48.1	51.6	57.1	60.9	62.3	65.0	64.6	66.1	66.9	69.7
Rep. of Korea	17.4	22.8	29.7	37.3	46.7	49.3	50.4	50.9	55.1	57.4	61.6
Switzerland	32.9	31.9	32.3	34.0	38.3	42.2	45.7	47.4	53.7	54.0	57.4
Finland	35.1	37.5	40.5	39.2	45.8	46.9	50.1	49.7	52.6	48.2	51.9
Sweden	27.2	26.1	25.6	25.2	30.1	35.4	36.4	38.9	42.2	45.2	47.5
Canada	24.5	25.5	26.7	27.9	30.9	33.0	32.3	32.0	35.8	36.3	40.6
Denmark	20.1	18.8	17.3	18.6	21.7	23.9	26.7	31.4	32.6	36.1	37.5
Germany	24.5	22.6	23.7	24.7	26.7	28.2	30.1	30.0	33.1	33.4	35.0
Netherlands	16.6	14.3	19.2	20.0	23.8	24.5	23.9	25.8	27.3	26.9	26.1
Austria	13.9	11.7	12.7	13.0	15.0	17.7	17.3	19.0	20.1	22.2	24.1
Belgium	12.6	13.6	12.7	14.2	15.0	17.0	15.4	17.6	19.7	19.8	20.5
United Kingdom	14.3	13.1	13.2	13.5	14.0	15.4	16.3	17.5	18.2	18.5	20.3
France	11.6	11.2	11.5	11.7	12.0	13.3	14.0	15.2	16.7	17.0	17.7
Australia	11.5	12.1	15.6	15.0	14.9	17.1	19.7	18.0	17.9	17.7	16.6
Italy	5.2	5.3	5.3	5.2	5.7	5.8	6.5	6.7	7.0	7.2	7.5
China	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.5	0.6	0.8	1.0
India	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.5

Source: United States Patent and Trademark Office and OECD.Stats

Table 36: USPTO patent applications relative to GERD in 2005 constant PPP milllion, 2002–2012

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Taiwan	1.1	1.1	1.1	1.1	1.2	1.1	0.9	0.9	0.9	0.8	0.8
Israel	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7
United States	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.7
Japan	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.7
Canada	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6
Rep. of Korea	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5
Finland	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Sweden	..	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4
Denmark	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4
United Kingdom	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Germany	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3
Netherlands	0.3	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3
Belgium	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.3
France	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Austria	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Italy	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

Source: United States Patent and Trademark Office and OECD.Stats

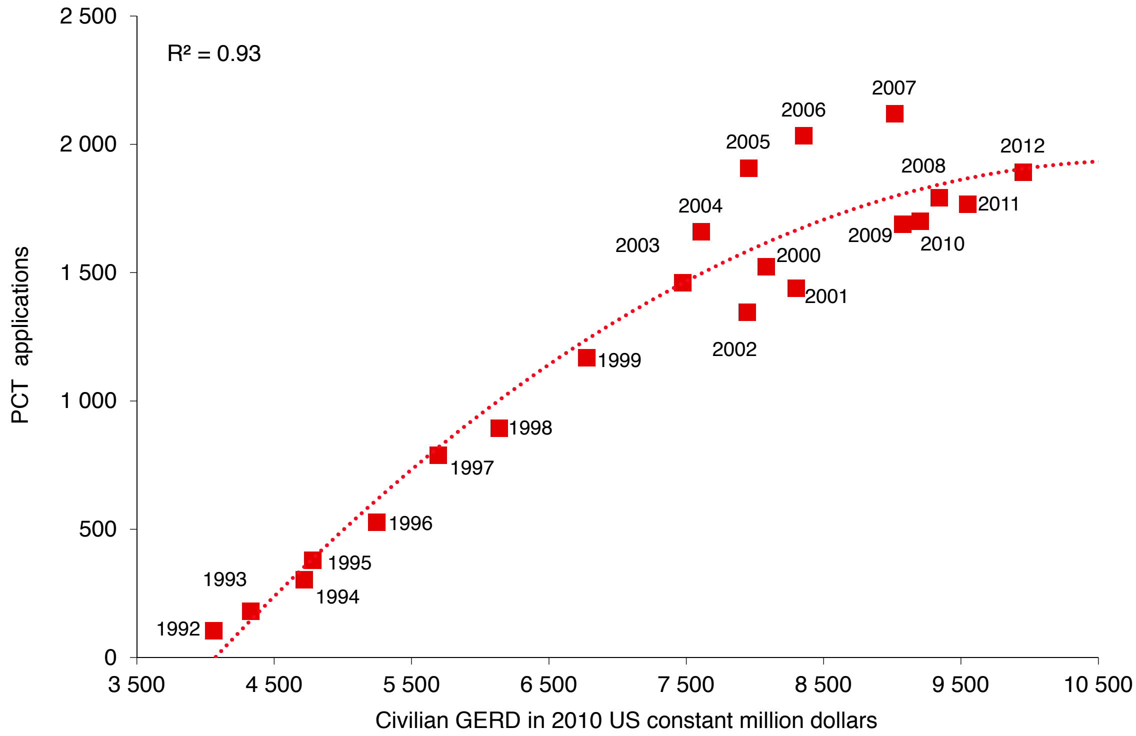


Figure 64: Correlation between PCT patents applications and civilian GERD, 1992–2012

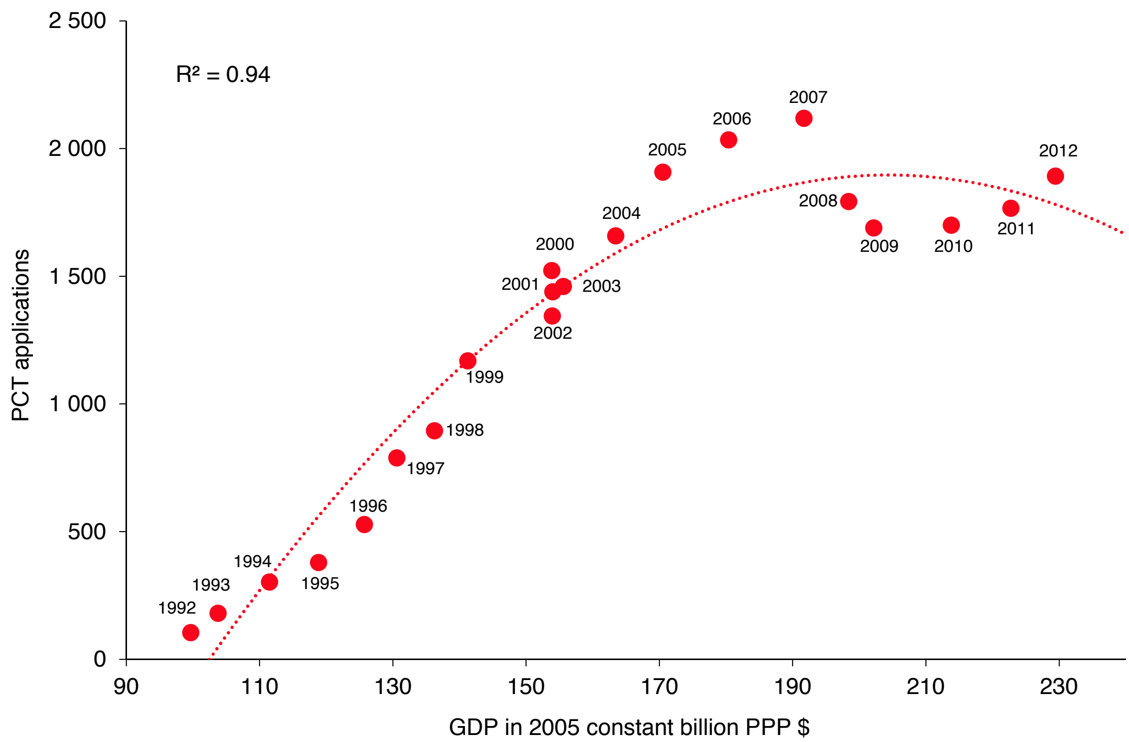


Figure 65: Correlation between PCT patents applications and GDP, 1992–2012

WHAT TRADEMARK AND INDUSTRIAL DESIGN DATA REVEAL ABOUT INNOVATION

Recently trademark data have also been used to convey information on two key aspects of innovation, which are not usually covered by traditional indicators: marketing innovation and innovation in the services sector (Millot 2009). Different empirical studies have shown a link between trademark counts and other indicators of innovation performance, when available. For instance, trademark numbers at the firm level have been found to correlate positively with several innovation indicators (as reflected in responses to innovation surveys), with R&D (for certain industries) with patents and with the number of new product launches. These correlations are particularly strong in knowledge-intensive service industries, and in high-tech industries such as pharmaceuticals. An advantage of using trademarks as an indicator is their broad availability and relatively easy accessibility.

A trademark is a sign capable of distinguishing the goods or services of one enterprise from those of other enterprises. Trademarks are protected by intellectual property rights. In principle, a trademark registration will confer an exclusive right on the use of the registered trademark. This implies that the trademark can be used exclusively by its owner or licensed to another party for use in return for payment. Registration provides legal certainty and reinforces the position of the right holder for example in case of litigation. The term of registration can vary but is usually ten years. It can be renewed indefinitely on payment of additional fees. Trademark rights are private rights and protection is enforced through court orders.

The link between trademark deposits and product innovation is relatively straightforward: the commercialisation of new products is sometimes associated with the creation of a new trademark in order to communicate about the innovation and later possibly become the reference on the market for the product, which in turn enables firms to appropriate the benefits of their innovation. When it comes to marketing innovation, the link with trademark deposits is more complex.

Data on trademarks are available for Israel from 1960 onwards. Figure 66 shows the evolution in trademark applications by residents and non-residents between 1960 and 2013. The vertical axis has a logarithmic scale. The non-resident applications' trend follows a cubic growth with a great drop between 1982–1993. However, the resident applications' trend shows an exponential growth with a coefficient of determination of R^2=0.94.

According to WIPO (2014) an estimated 956 600 industrial design applications were filed worldwide in 2013 with modest growth of 1.7% over 2012, the lowest in the past two decades after three consecutive years of double-digit growth.

Industrial designs are applied to a wide variety of industrial products and handicrafts. They refer to the ornamental or aesthetic aspects of a useful article including compositions of lines or colours or any three-dimensional forms that give a special appearance to a product or handicraft. The holder of a registered industrial design has exclusive rights against unauthorized copying or imitation of the design by third parties. Industrial design registrations are valid for a limited period. The term of protection is usually 15 years for most jurisdictions. In an industrial design application or registration, some offices allow applications to contain more than one design for the same good or in the same class—others allow only one design per application. To capture the differences in application filing systems across offices one needs to compare their respective application and registration design counts (WIPO, 2014).

Table 37 shows number of industrial designs applications and registrations by residents and non-residents in Israel (1998–2012).

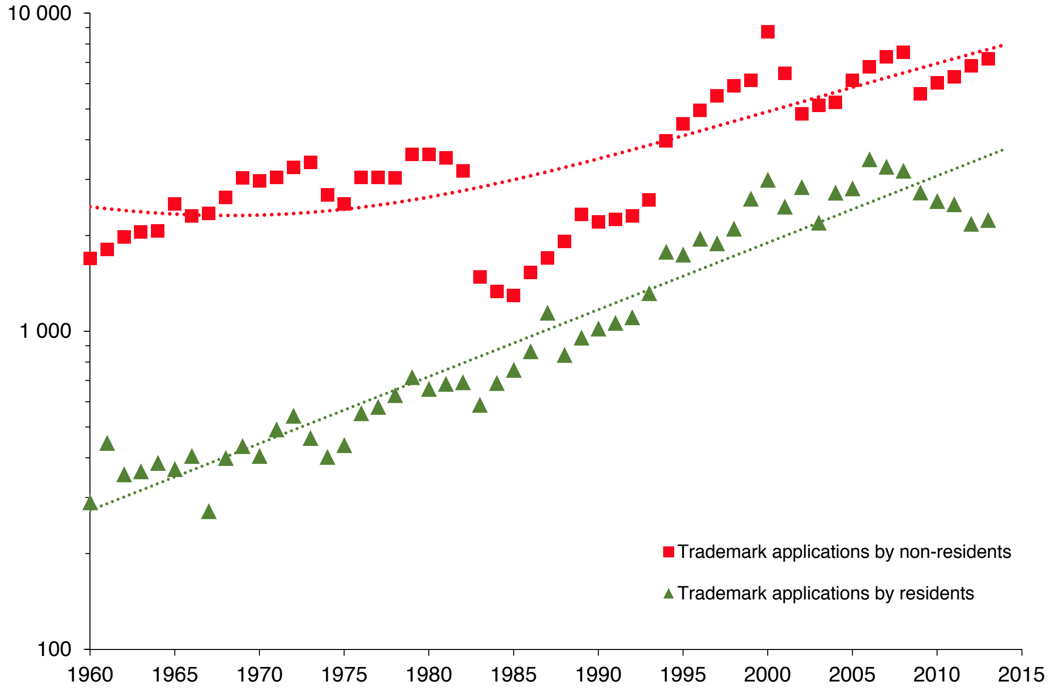


Figure 66: Trademarks applications by residents and non-residents, 1960–2013. The dotted lines are the best-fitting curves. The vertical axis is expressed on a logarithmic scale. Source: UNESCO based on data provided by WIPO

Table 37: Industrial design applications and registrations 1999–2013

Year	Industrial design applications						Industrial design registrations					
	Resident	World rank	Non-resident	World rank	Abroad	World rank	Resident	World rank	Non-resident	World rank	Abroad	World rank
1999	1 532	15	306	50	83	27	844	14	179	48	136	21
2000	1 487	17	376	52	178	24	508	22	207	54	117	23
2001	1 157	20	253	59	260	22	518	22	121	60	161	24
2002	1 003	22	237	58	75	30	592	21	244	54	72	29
2003	..	..	..	..	1 020	20	..	..	..	..	550	20
2004	1 063	20	318	48	1 500	23	573	24	298	46	1 713	22
2005	..	..	..	..	1 364	26	..	..	..	..	1 348	26
2006	1 192	20	432	37	1 388	26	758	22	488	34	1 285	26
2007	..		..	..	2 375	25	..	..	..	..	2 188	24
2008	1 312	20	482	26	2 375	24	724	25	353	34	2 012	25
2009	..	..	..	..	2 070	25	..	..	..	..	2 099	24
2010	1 200	22	417	25	2 611	24	..	..	..	..	2 215	24
2011	1 030	25	481	27	3 843	24	552	33	309	31	3 463	24
2012	1 011	26	538	25	4 235	23	390	38	246	38	4 082	23
2013	860	29	489	28	4 020	24	441	40	217	51	2 385	24

Source: WIPO

Historical background to SETI policies in Israel

PRE-INDEPENDENCE HISTORY

Since its independence, Israel has developed remarkable abilities in science and technology. The distinctness of the Israeli innovation system stems in large part from the environmental surroundings and forces shaping Jewish immigration to Mandatory Palestine during the 1920's and 1930's. The tradition of Jewish scholarship and learning, the strong determination to establish a modern state, and the ideology of the Jewish national movement (Zionism) were the driving forces that shaped the base for modern scientific research, technological development and the training of new generations of scientists.

The Zionist movement realized that a poor country without natural resources would only have a chance of succeeding if it invested massively in its human capital via education, and invested in science and technology (Shimshoni, 1965; Kon *et al.*, 2014). In the Fifth Zionist Congress held in Basel in 1901, a decision was made to establish the Jewish National Fund (JNF). In addition to its initial goals of acquiring land for the establishment of new agricultural collective communities (kibbutz) and villages, the JNF was also instrumental in founding secondary schools and pioneering higher education. Following the decision of the Zionist Congress to establish high schools, JNF contributed land in 1909 for the construction of the Herzliya Hebrew Gymnasium (Gymnasia Herzliya) and the Hebrew Reali School of Haifa, which opened its gates to new students in 1913. Two other schools that are worthy of mention are agricultural schools: Mikveh Israel and Kadoorie. The Mikveh Israel School was founded in 1870 by Charles Netter and supported by the philanthropy of Baron Edmond James de Rothschild. Netter pioneered progressive methods for teaching agriculture and educating future farmers. Another agricultural school, Kadoorie, was established 60 years later during the period of the British Mandate of Palestine thanks to the donation of the Jewish philanthropist Sir Ellis Kadoorie. In fact, two related institutions holding this name were established during this period: one for the Arab community– (the Khodori Institute in Tulkarem founded in 1930) and one for the Jewish community –(the Kadoorie agricultural school, founded in 1933 near Kfar Tavor) (Domka, 1985). Through the next decades, the alumni of these four exceptional schools occupied key political and academic posts.

The first Jewish hospital (Rothschild Hospital) was set up in 1854 in the old city of Jerusalem, followed by two others (Bikur Holim and Misgav Ladach). The first General Sick Funds (Kupat Holim Clalit), known today as the Clalit Health Care Services, was established in 1913 and further expanded during the time of the British Mandate of Palestine. The Hadassah Medical Mission established in 1922 the Hadassah Hospital, also in Jerusalem. Additional hospitals were established by the Hadassah organization in Tel Aviv, Haifa, Safed and Tiberias. At that time, the hospitals engaged in a broad range of activities such as sanitary and anti-malaria work, programmes against tuberculosis and trachoma[37]. Both the Hadassah hospitals and the hospitals of Kupat Holim Clalit established the necessary infrastructure for medical research in Israel, in conjunction with the medical schools of the research universities.

During the 1920's the first institutions of higher education were established in the country. The Hebrew University of Jerusalem, the country's first research university was created in 1925 with the specific aim of conducting teaching and basic research activities; it became a research institute with full teaching faculty in 1934. The Technion-Israel Institute of Technology was created a year earlier (in 1924) as a technological institute for training engineers, and much later became a scientific-technological research-university (Tadmor, 2011). In 1934, a fully-fledged agricultural research centre – the Daniel Sieff Institute was established in Rehovot by Chaim Weizmann, a research scientist who later became the first President of Israel. The Sieff Institute became the part of a larger research university, known today as the Weizmann Institute of Science, which officially opened in 1949 (UNESCO, 1970).

When dealing with the early history of Israel's science it is sometimes rather difficult to trace the persons who developed the specific solutions to commonly recognized problems in agriculture. Much empirical and pragmatic experimentation, mostly not well documented, led to solutions which have been used since those days (Keyman, 1972). Most of these activities were focused around agricultural stations. The first such station was established in Atlit in 1910.

37 The Development of Health Care in Israel. The Jewish Virtual Library. URL: https://www.jewishvirtuallibrary.org/jsource/med/one.html

In 1921, the Zionist Congress decided to set up a group of agricultural stations, which culminated in the setting up of a Central Agricultural Institute in Rehovot in 1931 (UNESCO, 1970). One of these, the Agricultural Experiment Station, established in 1921, later evolved into the Agricultural Research Organization (ARO), commonly known as the Volcani Institute.

In 1923, Pinhas Rutenberg who received a permit to produce electricity from the British Mandatory Government established the first electric power plant in Tel Aviv. Two other small power stations were established in Haifa and Tiberius, by Rutenberg's Palestine Electric Company in 1925, and a large hydroelectric power plant was built in Naharayim in 1932. Electrical power has substantially transformed the economy of the country, and advanced the development of science, industry, agriculture and commerce.

Moshe Novomeysky (1873–1961), an engineer and entrepreneur, saw the potential of the Dead Sea as the basis upon which to build a large chemical industry, and as a result, in 1930, established the Palestine Potash Company. The company conducted and financed – in co-operation with the Department of Physical Chemistry of the Hebrew University – a pioneering research programme. After Independence, the Palestine Potash Co. became the Dead Sea Works Ltd., a government-owned company under the Ministry of Development.

The Mandatory Government prior to independence had also established research- oriented institutes such as a meteorological service (known today as the Israel Meteorological Service), a forestry station, a veterinary institute (known today as the Kimron Veterinary Institute), and a hydrological Institute. They also encouraged the creation of a Building Testing Station, which later became the Standards Institution of Israel, covering a wide range of activities and subsequently engaging to some extent in applied industrial research (UNESCO, 1970).

In 1942, the Mandatory Government established the Board of Scientific and Industrial Research (BSIR) to deal, at first, with problems related to the war effort. In 1945, the Government expanded the terms to include matters such as citrus, quarrying and building materials. BSIR's main task was to examine and approve research proposals relating to agriculture, industry, and trade and the improvement of the health and living conditions of the country's inhabitants (UNESCO, 1970).

POST-INDEPENDENCE ERA

The UN General Assembly Resolution 181 of 29 November 1947 called for the partition of the British-ruled Palestine Mandate into a Jewish State and an Arab State. The Jewish Leadership accepted the partition, whereas the local Arab Leadership as well as the Arab States rejected it (see pages 1–4). On 14 May 1948, the independent State of Israel was declared by the Jewish People's Council headed by David Ben-Gurion (1886–1973). This was promptly followed by an attack and invasion by six neighbouring Arab States armies.

On August 20, 1948, at the height of the ensuing war, Professor Shmuel Simbirsk, the secretary of the British BSIR, asked Ben-Gurion, the head of the Provisional Government, to renew the activity of the BSIR with the specific aim of establishing a governmental mechanism to deal with institutions of higher education and pure and applied research. Simbirsk called for the centralized management of national applied science, fearing that various government ministries would set up independent research institutions.

At the end of February 1949, the council was officially named the Scientific Council of Israel and operated under the auspices of the Prime Minister's Office. The Council comprised of twelve leading scientists. It was later expanded to include senior executives of the three major institutions of higher education at that time. A small staff of professionals, under the scientific executive secretary was responsible for the execution of policy laid down by the Council, which used advisory committees to consider different branches of science and economy (UNESCO, 1970; Barell, 2014). The Council fostered scientific research for the development of the economy of Israel, mainly by creating several research institutions:

- The Geological Institute that was established in 1949.

- A Dead Sea Research Laboratory to conduct research on the valuable chemical resources of the Dead Sea.
- The National Physical Laboratory was established in 1950. Its function was to standardize instruments, provide metrology services and conduct research in applied science.
- The Institute of Fibres and Forest Products was established in 1953. It conducted research related to textiles and the utilization of natural fibres.
- The Negev Institute for Arid Zone Research was established in 1956 in co-operation with UNESCO (UNESCO, 1970).

According to Barell (2014), the Scientific Council of Israel, which operated from 1948 to 1959, made a relatively marginal contribution to the advancement of applied research in the country and to the formation of an overall national science policy. Professor Daniel Shimshoni, an Israeli science policy expert, who later on became the first Director of the National Council of Research and Development in 1959, described Israel's situation in those years as 'the growth of science without the benefit of policy' (Shimshoni, 1965; Keynan, 1972). This development occurred because the country at large was convinced of the usefulness of science and much of its development did not depend on the government. In those days, several universities, which were private institutions, obtained strong support from their organizations of 'friends' abroad and thus developed during that period without much domestic help. As a matter of fact, most of the higher education research institutes were founded and developed without any government initiative and little local support (Keynan, 1972).

BOX 14 – FIRST GOVERNMENT'S VIEWS ON SCIENCE AND TECHNOLOGY

The first Prime Minister of Israel, David Ben-Gurion (1886–1973) understood the crucial role that S&T plays in nation building. In his presentation of the Government's policy (known as 'basic guidelines') during the Seventh Meeting of the Knesset on March 8, 1949, he mentioned three catalysts that were to enable the young state to overcome its social and economic hardships. These were: (1) the assistance of the Jewish People of the diaspora, (2) the 'creative pioneering force that beats in the hearts of the youth' and (3) the utilization of science and technology in achieving national development objectives and economic development. In his own words he proclaimed:

> In our generation, perhaps the greatest revolution ever known to humankind is taking place: the revolution of the human control on the mighty forces of nature, the force of the atom, the conquest of air and space and (unfolding) the mysteries of the universe. We cannot match to other nations in strength, wealth, size or material but we are also not inferior to any other nation in our intellectual and moral abilities.
>
> As the most advanced nations in the world, we must take scientific research, be it basic or applied, to its highest peak, not as the privilege kept to the geniuses or single individuals, but rather as the right of the masses, kept to the creators and the builders of the land. Science shall be in the use of the economy and the culture that we shall create in this land and it will be utilized for advancing agriculture, industry, construction, education and health.
>
> This is the single largest legacy left to us by the Jewish history marked by suffering, grief and courage. Every deed that shall be done in body and in spirit to the fortification of our security, the expansion of our economy, the education of our sons and daughters and for absorbing immigrants, will be based on the conclusions, principles and the supremacy of basic and applied science and on the most advanced and sophisticated technology. This shall be done by us in order not to fall from the most developed and industrious nations in the world in the quality of our labour, output and productivity. This is how we see our mission and we shall try to fulfil it in good faith and to the best of our ability.

Source: The Prime Minister's announcement on the composition of the Government and its policy. The Knesset Protocols, 8 March 1949, Volume 1 (in Hebrew). Translation by Eran Leck.

New institutions to foster higher education and scientific research

The development of the Israeli science and technology system continued during the first decade following the establishment of the state. Relative to the modest resources of the country at that time, the early years of statehood were characterized by high relative investment in primary and secondary education, fortification of the higher education system and large investment in the developing of the defence industries (Ben-David, 1962; UNESCO, 1970; Peled, 2001).

The Council for Higher Education (CHE) was established by the *Knesset* (Parliament) in 1958, as the national regulatory body in charge of higher education in Israel. It laid down the rules and regulation for the establishment of higher education institutions and the granting of academic degrees. The CHE also granted autonomy to the institutions, thus securing academic freedom for the faculty. The Planning and Budgeting Committee (PBC) was established by a Government resolution in 1977 as a sub-committee of the CHE. The PBC serves as a buffer between the higher education institutions and the Government. It not only provides a legal framework for the funding of these institutions but also protects them from political intervention, thus securing the independence of the whole system. This powerful body holds the exclusive right to propose higher education budgets and allocate the regular and development budgets for higher education between the institutions of higher education.[38] Figure 36 (page 68) shows how the slopes in the tertiary education enrolment changed in relation to – with a certain lag – the introduction of all these reforms and new institutions.

Tel Aviv University was founded in 1953, with the opening of the Academic Institute of Natural Sciences, and received its accreditation from the CHE in 1969. Bar-Ilan University was established in 1955 as a private institution with the specific aim of forging closer links between Jewish studies and general studies. It was fully accredited by the CHE in 1969.

In 1959, the Scientific Council of Israel was replaced by the National Council for Research and Development (NCRD), still within the Prime Minister's Office. The NCRD comprised 25 members, and included senior civil servants from the Treasury and other Ministries concerned with scientific and research activities.[39]

By 1968, the NCRD comprised 36 members appointed by the Prime Minister for terms of 3 years (UNESCO, 1968). The NCRD gave advice to the Government on national science policy, through professional committees in various fields. As a basis for its advice, the NCRD conducted surveys of the resources available for the implementation of policy, giving regard to organizational structures, and the availability of funds, trained personnel and ancillary services.

The NCRD executive arm included economists, and its terms of reference were wider than those of the Scientific Council of Israel. Institutes set up by the NCRD included the Pharmacological Institute, the Fermentation Unit, the new Industrial Research Centre in co-operation with the United Nations, a Bureau of Scientific Liaison, the Centre for Scientific and Technological Information, and the Oceanographic and

38 URL: http://che.org.il/en/

39 The relevant Cabinet decision of 15 November 1959, amended on 21 February 1960 and 30 May 1962, reads: (1) There shall be stablished a National Council for Research and Development, which shall carry out the following tasks, (a) advise the Government on action relating to scientific research and planning, and technological development of national significance; (b) make recommendations to the government as to an overall policy for directed scientific research; (c) make recommendations to the Government as to the total amount to be allocated in the State budget for directed research and for development; (d) make decisions as to the appointment and utilisation of the funds for research and development at the disposal of the Government and its agencies; (e) keep under review and supervise the implementation of research projects, as above; (f) initiate programmes for scientific research and technological development projects; (g) go-ordinate, within the framework of an overall policy of research and development, between agencies carrying out directed research and those who avail themselves of their services; (h) conduct a survey of the resources available for the implementation of the overall policy, from the point of view of (i) organization, (ii) funds, (iii) scientific and technological personnel, (iv) ancillary services. (2) The National Council for Research and Development shall consist of 16 to 25 members (including the Chair and Vice-Chair) appointed personally by the Prime Minister for a period of 3 years One third of the appointments shall expire in every year. The composition of the Council shall be as follows: Chair, Vice-Chair, 9–15 scientists, technologists and industrialists, the Director-General of the Prime Minister Office, the Director General of the Ministry of Agriculture, the Director General of the Ministry of Commerce and Industry, the Director General of the Ministry of Development, and one representative from the Ministry of Finance, Ministry of Defence and Ministry of Labour.

the Agency of Limnology (UNESCO, 1970). From its inception until today, the NCRD has set guidelines for short-term and long-term national R&D policy and has advised the Government regarding investment in fields of national priority and on the development of necessary scientific infrastructure.

Looking back on the relationship between government and science, it would be correct to state that the establishment of NCRD in 1959 created the first official meeting-place and framework for a formal dialogue between the machinery of government on a high level and the scientific community (Shimshoni, 1965; Keynan, 1972).

In the late 1960s, the Government created – at Cabinet level – the Ministerial Committee for Science and Technology (MCST). This Committee brings together the Ministers of Health, Education and Culture, Development, Commerce and Industry, Interior, Justice, the Minister without Portfolio and the Prime Minister (as the Chairperson). The Chairperson of the NCRD acts as Secretary to the MCST[40].

Figure 67 presents the SETI organization chart in the public sector of Israel, circa 1968. In those days, the Ministry of Finance played a considerable role in planning, in addition to allocating funds and supervising their use. The chart shows that scientific research was conducted in three sectors: the institutions of higher education, the research institutions of the different governmental departments and the industrial research organizations, which received public funding.

The research activities conducted by the Ministries of Agriculture, Commerce and Industry, with research on a broad scale, were co-ordinated by the NCRD. However, this was not the case for other ministries, e.g. Development, Health and Housing, of which research functions tended to be narrowly-focused.

In agriculture, for example, science and research was considered vitally important. During both pre- and post-Independence, there were about a dozen committees that examined problems related to agricultural commodities, and made recommendations for short-term research to address such problems. Meanwhile, long-term research was co-ordinated by the NCRD.

In those days, the integration of science policy planning and overall national planning was carried out by two ministerial committees and their executive arms: the MCST, with the NCRD as its executive arm and the Ministerial Committee for Economic Planning, with the Economic Planning Authority as its executive arm (UNESCO, 1970).

Shortly after the establishment of the NCRD, the Israel Academy of Sciences and Humanities (IASH) was created by the *Knesset* in 1959 (see Box 15, pages 132-133). Over the years, the Academy was expanded to approximately 110 of Israel's most distinguished scientists and scholars, and has been responsible for monitoring and promoting Israeli intellectual excellence, advising the government on scientific planning, funding and publishing research of lasting merit, and maintaining active contact with the broader international scientific and scholarly community.

The University of Haifa, the second research university on Mount Carmel, was established in 1963 (receiving accreditation from the CHE in 1972). Unlike the Technion, the University of Haifa is more oriented towards the social sciences and the humanities. Ben-Gurion University of the Negev, established in 1969, is Israel's youngest research university. All research universities were established at different times and as a result of different initiatives, and together, they define one important element of Israel's scientific policy, namely that almost all basic scientific research is conducted in research universities and not, as may be customary in some comparable countries, in national research institutes (Tadmor, 2011).

During the 1960s and 1970s, the State of Israel's academic system underwent a process of rapid growth. The number of academic degree holders tripled between 1961 and 1974, while the population increased by 150%. The proportion of Israeli scientists and engineers engaged in R&D in natural sciences, agriculture, medicine and engineering during those years was one of the highest in the world (UNESCO, 1970; Tal *et al*., 1977).

40 This is probably the first institution – within a developing country – with this type of interministerial mandate for SETI issues. The cross cutting nature of SETI activities demand this type of organizations for the co-ordination of inter- and transdisciplinary research and technological development to address societal problems. This type of interministerial institution appeared in Latin America at the end of the 1990s (Lemarchand, 2010).

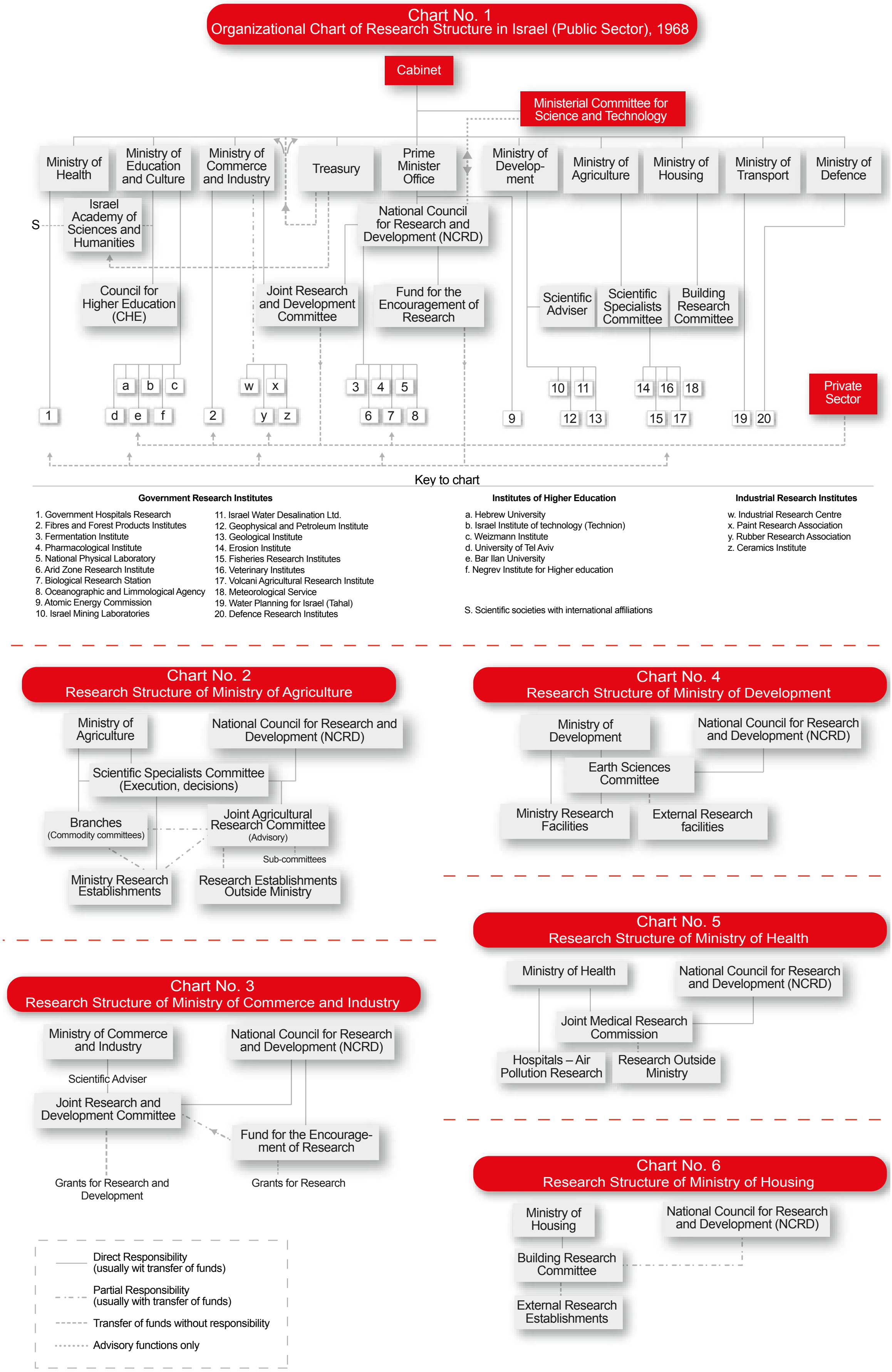


Figure 67: SETI organization chart in the public sector of Israel, circa, 1968. Source: UNESCO (1970)

BOX 15 – THE ISRAEL ACADEMY OF SCIENCES AND HUMANITIES[41]

The Israel Academy of Sciences and Humanities (IASH) was established in 1959. The Academy operates under the 1961 law of the same name. Its seat is in Jerusalem, and its aims (as specified in legislation and its by-laws) are as follows:

- to have a membership of leading scholars in the sciences and humanities who are residents of Israel
- to foster and promote scientific activities in the sciences and humanities;
- to advise the Government on activities related to research and scientific planning of national importance;
- to maintain contact with comparable bodies abroad;
- to represent the Israeli sciences and humanities on international bodies and at international conferences, in co-ordination with government bodies;
- to publish significant scholarly works advancing the sciences and humanities;

The Academy endeavours to give expression to the special qualities of Israeli scholarly creativity and thought and to guarantee their excellence, as well as to provide firm foundations for the tools needed to promote scholarly research in the State of Israel. The Academy initiates and directly funds research studies with regional implications in the natural sciences, focusing on the flora, fauna, and geology of the Land of Israel.

In the humanities, the research programme involves study of the Bible and Talmud, Jewish historical sources, Jewish thought, Hebrew poetry and prose, Jewish languages, and Jewish art. Some of these studies are undertaken in collaboration with institutions in Israel and abroad. All the programmes are conducted by ranking experts and are intended to help build the research infrastructure in their fields.

The Union of Natural Science Collections in Israel operates within the Academy. Efforts are being made to establish a national museum of local natural history adjacent to the Israel Museum in Jerusalem. The Academy also works to maintain close ties with national science associations around the world and helps obtain invitations for Israeli scholars to visit countries with which Israel has no diplomatic ties.

The Academy runs the Israel Academic Centre in Cairo, whose purpose is to assist Israeli scholars with research dealing with Egypt and Egyptian culture, and to encourage co-operation with Egyptian academics in all fields of scholarship and research. Dozens of Israeli scholars and writers in the humanities, especially Mideast studies, as well as artists, social scientists, and medical researchers, visit the Centre. Egyptian students and teachers visit the Centre to use its library, and to attend its lectures and screenings of Israeli films.

The Academy has Observer status at the European Science Foundation. It participates in all Foundation activities, including the sessions of the standing committees of the Humanities Fund, the Social Sciences Fund, the European Councils for Medical Research, the European Councils for Scientific Research, and the meetings of the four scientific networks maintained by the Foundation.

The Academy's publications summarize research projects initiated by it. They include scientific editions of manuscripts by outstanding scholars. The Proceedings of the Israel Academy of Sciences and Humanities series contains research studies or lectures presented to the Academy.

The Academy convenes a wide variety of specialized committees to provide expert advice and guidance on contemporary issues involving science and technology. The Academy consists of 70 members below of age 75, half of them in exact sciences and half in social sciences and

41 The Israel Academy of Sciences and Humanities. URL: http://www.academy.ac.il

humanities. The actual number of members including those above the age of 75 is approximately 110 comprising Israel's most distinguished scientists and scholars, who, with the aid of the Academy's staff and committees, monitor and promote Israeli intellectual excellence, advise the government on scientific planning, select for funding and publication research of lasting merit, and maintain active contact with the broader international scientific and scholarly community.

The Academy is divided into two sections: the natural sciences and the humanities and social sciences. Both share equal responsibility in conducting the Academy's affairs. It is administered by a Council consisting of the President of the Academy, the outgoing president (honorary member), the Vice President, the Chairpersons of the Sciences and Humanities Sections, and the Executive Director. The President of the Academy is appointed by the President of the State of Israel, upon the recommendation of the Academy's membership. The by-laws that govern the Academy's internal operations are self-determined, in consultation with the Ministry of Education and Culture.

The Academy manages a number of research funds based on contributions and grants from private individuals or agencies, among them the Fulks Fund for Medical Research, the Adler Fund for Space Research, and the research grants of the Wolf Foundation. The Academy also manages the Einstein Fellowships Fund, which is intended to bring senior scientists from throughout the world closer to the Israeli academic community and make a research and teaching contribution to the higher-education system in Israel.

The Academy founded The Israel Science Foundation[42] (ISF), Israel's predominant source of competitive grants for basic research, accounting for about two thirds of such awards annually. The Academy served as a catalyst in establishing institutions such as the inter-agency Forum for National Research and Development Infrastructure (TELEM), the Focal Initiatives in Research in Science and Technology (FIRST) programme. Many Academy initiatives such as those related to synchrotron radiation, the CERN Large Hadron Collider, nanotechnology, clinical research and the Contact Centre for Israeli Researchers have been ad hoc responses to perceived national research needs.

The international activity of the Academy involves strong contacts and agreements with over thirty academies worldwide. These agreements include Frontiers of Science programmes and joint workshops with several foreign academies.

Office of the Chief Scientist

Until the 1960s, civilian industry in Israel was very much based on foreign expertise and on small factories oriented towards a protected domestic market. The members of the NCRD realized that it was absolutely necessary to create an export-oriented industry based on the results of endogenous R&D. The NCRD adopted a policy intended to convince the government to allocate funds for industrial research and organise additional industrial research institutes; to convince scientists in academic institutions to accept more responsibility in carrying out research for the industry, or research which might create new industries; to convince industry to invest and sponsor research for innovation and to find ways to make venture capital available to entrepreneurs who intended to go into science-based industries (Keyman, 1972).

In 1966, Professor Ephraim Katzir headed a committee that prepared a report with recommendations dealing with the efficient operation of government research institutes and their staffing, and the link of such institutes with government ministries.

42 In the early 1970s, the Israel Academy of Sciences and Humanities together with the National Council for Research and Development has proposed to the government the establishment of the Israel National Science Foundation, to be administered jointly by both organisations (Keyman, 1972).

The main recommendation was the creation of a post of Chief Scientist in each of the various government ministries. This was intended to help bring scientific considerations and scientific knowledge into governmental programmes, and decision-making.

In 1969, the Government adopted the recommendations of the Katzir Committee, and established the Office of the Chief Scientist (OCS) within the Ministry of Industry and Commerce (currently the Ministry of Economy). Its mandate was to subsidize commercial R&D projects undertaken by private firms. Until then, support had been restricted to the national R&D labs and to academic R&D, in addition to the weighty resources that were devoted to defence-related R&D and to agricultural research. Additional chief scientist posts were established in other Ministries as well (UNESCO, 1970; Tal *et al.*, 1977; Trajtenberg, 2000).

The Ministry of Commerce and Industry was the first ministry to appoint a chief scientist, a large and increasing fund for industrial research was established in this ministry, matching industry's own investments in research, and special fiscal incentives were rapidly developed for science-based industry (Keyman, 1972). It was a fact that during the International Economic Conference of 1968, organized by the government in Jerusalem, the creation of science-based industry was a central theme.

Today, the OCS of the Ministry of Economy administers all government-sponsored support of R&D within Israeli industry, and supports hundreds of projects annually, ranging from early concepts within a pre-seed framework, to incubator and start-up companies, to autonomous industrial R&D enterprises (Trajtenberg, 2000; OCS, 2013).

Defence R&D

Government policy towards defence R&D could be traced back to the establishment of the Science Corps within the pre-statehood paramilitary Haganah organization, which later became the Israel Defence Forces (IDF) in 1946.

In 1958, the Armament Development Authority (RAFAEL) was founded as Israel's national R&D defence laboratory for the development of military technology. In 1972, the Ministry of Defence established an R&D Department by merging several units of the IDF with its Office of the Chief Scientist. In the early 1970s, this Ministry constituted the largest and most successful applied research organisation in the country with a gross expenditure on R&D of 1.5% GDP[43] (Keyman, 1972). A decade later, the R&D Department was re-organized and renamed as the Administration for the Development of Weapons and Technological Infrastructure (MAFAT). The main objectives of MAFAT are to promote the technological and scientific infrastructure needed for military R&D, make decisions on the direction of R&D, analyse and coordinate work related to R&D with various security agencies, and to operate various excellence programmes intended for the education and utilization of human capital in engineering, technological and R&D domains.

Many dual-use technologies (e.g. advanced materials, sensors, micro-electronics, electro-optics, computing and software, communication technology, medical engineering for aeronautics and space etc.) were developed by defence industries from the 1980s onward (see Box 3, pages 44-47 and Table 15, page 46). Innovations found their way, via staff movements of highly qualified scientists and engineers, to other industries and this shift became one of the key drivers for spectacular growth in the high-technology sector in Israel in the 1990s (Steinberg, 1985; Vekstein and Mehrez, 1997; Eshel, 1998; Vekstein, 1999).

43 Recently, Tabansky and Ben Israel (2015: 20) estimated that Israel's defence expenditures on R&D activities still are 1.5% GDP.

Between 1966 and 1973, the national expenditure on R&D doubled, although though decreasing significantly at the end of this period, following the Yom Kippur War in October 1973 (see Figure 45, page 86). During this period, the Government constituted the main source for R&D financing in Israel. The Government funded all defence R&D, and its share in civilian R&D grew from 51% in 1966–1967 to 62% in 1975–1976, at which time it spent nearly half a billion Israeli Pounds (about 1.2% of the government budget) on civilian R&D counting its direct but also its indirect contributions, such as through its support to academic institutions (Tal, Arnon, and Dudai, 1977).

The decade following the 1973 Yom Kippur War (1974–1984) was characterized by a period of economic stagnation in the form of low growth, high public budget deficits, hyperinflation, rising national debt, and declining foreign exchange reserves resulting in the virtual collapse of the banking system, which was bailed out by the Government. This period, known as the 'lost decade' of the Israeli economy, ended with the *Economic Stabilization Plan* of 1985 (Bruno, 1986).

R&D Law

In 1984, the *Law for the Encouragement of Industrial Research and Development* (commonly known as the R&D Law) was enacted. This important piece of legislation defined the parameters of government policy towards industrial R&D. The stated goal of the legislation is to develop science-based, export-oriented industries, which will become a driver for the whole economy and promote employment. The legislation provides the means to expand and exploit the country's technological and scientific infrastructure, and leverage its high-skilled human resources. At the heart of the law is a programme of financial incentives operated by the OCS. Companies, which meet certain eligibility criteria, are entitled to receive matching funds for the development of innovative, export-targeted products. This law was instrumental in improving the balance of payments of the State of Israel through export of high technology (primarily ICT) science-intensive products (OCS, 2013).

The end of the 1980s marks a turning point for the Israeli economy. It can be viewed as a time of transition to a neo-liberal market economy shaped by knowledge-based and innovation-driven agents. According to Trajtenberg (2000) and Tadmor (2011) several key drivers enabled this transition: the maturing of military technologies followed by the successful transfer of dual-use technologies to the evolving high-technology sector and the migration of engineers and scientists to the private sector. The collapse of the 'Iron Curtain' in 1989 also prompted a large wave of immigration from the former states of the Soviet Union, doubling the number of engineers and scientists in five years (see Figures 1 and 2, page 6). Other contextual factors were also very important such as the existence of excellent electrical engineering and computer science departments in the universities that trained thousands of high quality engineers and scientists.

A key factor was the establishment of a venture capital industry during the 1990s, which started with a government initiative and was later joined by the private sector (see Figure 21 page 37and Table 12 and 13, pages 37 and 38). Finally, the ignition of the peace process with the signing of the Oslo Accords between Israel and the Palestine Liberation Organization in the early 1990s opened Israel to new international markets; and the bold entrepreneurial spirit of Israelis helped it gain ground in the high-tech industries.

Much of this transformation was enabled by the proactive approach taken by the Government in harvesting and utilizing the fruits of academic, industrial and defence-oriented R&D. Highly technologically skilled military and defence-industry personnel were assimilated into the labour market. These individuals had entrepreneurial character, and they met a civilian and business market that was dynamic and rewarding. Both of these processes occurred at a time when there was a sharp increase in global demand for innovation especially in ICT (Trajtenberg, 2000).

Promoting innovation through a new series of policy instruments

The early 1990s mark the formation of a technology cluster along Israel's coastal plain. This region saw the concentration of laboratories, research institutes and universities, multinational companies, start-ups, financial institutions and government agencies. The high level of development produced by this innovation cluster was recognized as comparable in strength to that of Boston, Helsinki, London, and Kista in Sweden, second only to California's Silicon Valley (Hillner, 2000; Trajtenberg, 2000).

The large immigration waves from the states of the former Soviet Union raised the question of how to better integrate this important and skilled human capital into Israeli society and economy. When the OCS initiated the Technological Incubators Programme in 1991, the programme was presented as a solution to the inexperience and inability of many technically oriented or scientific entrepreneurs to become successful at commercial stage by finding financing for their ideas. It also addressed the issue of assisting the technologically skilled immigrants in finding jobs and integrating into a capitalist society.

Another revolution occurred in the higher-education system. Until the late 1980s, Israel's higher-education system was based almost exclusively on universities. This changed during the early 1990s with the establishment of a large number of colleges that allowed new population groups access to higher education. As it was shown in Figure 36, in the course of two decades (1993-2013), the number of students studying for a first-degree in the academic colleges increased by more than 1000% (see Figure 33, page 64), whereas the number of students for a first-degree in the research universities has grown by only 16% (Council for Higher Education, 2013).

In 1992, IASH founded the Israel Science Foundation (ISF), Israel's predominant source of competitive grants for basic research, accounting for about two thirds of such awards annually. In 1997, the Forum for National Research and Development Infrastructure (TELEM) was established at the initiative of IASH. TELEM is a high-level, ad-hoc organization comprised of heads of Israel's major national research-funding organizations: IASH, Chief Scientist of the OCS, Chair of the PBC of the CHE, Director-General of MOST, the Head of the Research and Development Division of the Ministry of Defence and the Assistant Head of the Budget Department of the Ministry of Finance. TELEM pools together the budgetary resources of its member organizations in order to catalyse and implement major joint science and technology initiatives of national interest (see Box 7). It is noteworthy to point out that TELEM is a non-governmental voluntary committee deriving its strength an influence from the quality of its members and operating with virtually no bureaucracy.

The Ministry of Science, Technology and Space (MOST), established in 1982 under another name, is an additional body that affects Israel's S&T policy (see Table 38). MOST is responsible for identifying scientific and technological research areas that are of national priority. It acts to develop human capital and maintain equal opportunity in all areas of science and technology. Another central goal of MOST is to strengthen as well as initiate international scientific collaborations with other countries and international organization. Its main implementation-level instrument for supporting research is the National Infrastructure Program established in 1995.

The Israel-Europe R&D Directorate (ISERD) was established in 1997 as an inter-ministerial directorate by the Israeli Ministry of Economy, MOST, the PBC of the CHE, the Ministry of Finance and the Ministry of Foreign Affairs, and it operates through the OCS. ISERD's purpose is to promote Israeli entities' participation in R&D ventures of the European Research Area (e.g. Horizons 2020 programme). In 2004, the Israel Industry Centre for R&D (MATIMOP) became the executive agency within the OCS (it previously operated as a private NGO). This agency is responsible for promoting industrial R&D co-operation between Israeli and foreign companies through partner matching and access to funding.

Table 38: Titles, names and political party of each Minister in charge of S&T, 1982–2015

Minister	Party	Term start	Term end
Ministry of Science and Development			
Yuval Ne'eman	Likud	26-Jul-82	10-Oct-83
Ministry of Science and Technology			
Yuval Ne'eman	Likud	10-Oct-83	13-Sep-84
Ministry of Science and Development			
Gideon Patt	Likud	13-Sep-84	22-Dec-88
Ministry of Science and Technology			
Ezer Weizman	Alignment	22-Dec-88	15-Mar-90
Yuval Ne'eman	Likud	11-Jun-90	21-Jan-92
Amnon Rubinstein	Meretz	13-Jul-92	31-Dec-92
Shimon Sheetrit	Labour Party	13-Jul-92	7-Jun-93
Ministry of Science and the Arts			
Shulamit Aloni	Meretz	7-Jun-93	18-Jun-96
Ministry of Science			
Benny Begin	Likud	18-Jun-96	16-Jan-97
Benjamin Netanyahu	Likud	18-Jun-96	9-Jul-97
Ministry of Science and Technology			
Michael Eitan	Likud	9-Jul-97	13-Jul-98
Silvan Shalom	Likud	13-Jul-98	6-Jul-99
Ministry of Science			
Ehud Barak	One Israel	6-Jul-99	5-Aug-99
Ministry of Science, Culture and Sport			
Matan Vilnai	One Israel	5-Aug-99	2-Nov-02
	Labour Party		
Ministry of Science and Technology			
Eliezer Sandberg	Shinui	28-Feb-03	19-Jul-04
Ilan Shalgi	Shinui	24-Jul-04	29-Nov-04
Victor Brailovsky	Shinui	29-Nov-04	4-Dec-04
Matan Vilnai	Labour Party	28-Aug-05	23-Nov-05
Roni Bar-On	Kadima	18-Jan-06	4-May-06
Ministry of Science, Culture and Sport			
Ophir Pines-Paz	Labour Party	4-May-06	1-Nov-06
Yuli Tamir	Labour Party	5-Nov-06	21-Mar-07
Raleb Majadele	Labour Party	21-Mar-07	31-Mar-09
Ministry of Science and Technology			
Daniel Hershkowitz	The Jewish Home	31-Mar-09	18-Mar-13
Ministry of Science, Technology and Space			
Yaakov Peri	Yesh Atid	18-Mar-13	4-Dec-14
Danny Danon	Likud	14-May-15	27-Aug-15
Ofir Akunis	Likud	27-Aug-15	

Recent policy developments

In a series of decisions between 2000 and 2002, the Government bolstered the National Council for Civilian R&D Law of 2002. This tool offered a means toward a comprehensive R&D policy, encompassing all non-military R&D (Fisher and Elian, 2011). The establishment of the National Council Civilian R&D (NCCRD) and the National Economic Council marked the start of an attempt to use R&D in a broader policy context. Yet SETI policy still follows a mix between bottom-up and top-down approaches, notably with specific policies in various areas and no overall national strategy to guide research and innovation policies. Consequently, in the last decade, the co-ordination of government R&D policies emerged as a major challenge. There is debate about the need of a more top-down strategy.

Constraints on the overall resources mean that there is a need for chief scientists to co-ordinate their respective agendas to maximise the effectiveness of R&D investments. The Forum of Chief Scientists had indicated some basic goals related to welfare where there is a demand for R&D, such as health care (particularly preventive medicine), ecology (particularly air and water quality) and aging-related problems. Inclusive innovation appears to be one of the major challenges for Israel's SETI policy. The country faces challenges relating to water scarcity and security, consequently several policy initiatives promote oil independence and water technologies (OECD, 2014).

During the last decade, budget cuts and a decrease in resources caused young top-tier Israeli academics and professionals to be drawn to positions abroad, lured by higher salaries and better working conditions. More than 25% of lecturers who have taught in Israel have taken jobs in the USA. This figure makes Israel's rate of academic brain drain one of the highest in the world (Fisher and Elian, 2011).

As a consequence of this situation, a six-year Higher Education Plan was introduced in 2011 with US$ 1.9 billion to promote academic excellence and upgrade research and teaching infrastructures. Universities' budgets have been increased, with a 30% rise in the budget of the Council for Higher Education (OECD, 2014). Another important initiative was the creation of 16 centres of research excellence (I-Core) financed with US$ 114 million, to advance cutting-edge academic research and offer a more attractive research environment.

In 2011, Israel established the National Cyber Bureau (INCB). This organization functions as an advisory body to the Prime Minister, the government and its committees on national policy related to the cyber field. The Bureau works to promote the national capability in cyberspace and to improve Israel's preparedness in dealing with the current and future challenges in cyberspace.

The Cyber Security Initiative is also a recent policy initiative to advance the development of secure technologies. A national cyber security incubator based on public-private partnership has been established and a National Cyber Security Centre of Excellence has also recently been created.

According to the INCB, Israeli exports of the cybersecurity software and services sector follows the United States in global volume. In recent years, over 200 cybersecurity start-ups operate in Israel (Cheung *et al*. 2014). According to Tabansky and Ben Israel (2015), in the past 4 years alone, over 100 new cybersecurity companies have sprouted up in Israel, with nearly US$ 400 million invested in 78 companies, mostly by venture capitalists. In 2014, over 220 local companies alongside 20 foreign R&D centres developed security solutions, applied globally, recruiting hundreds of local employees in the process.

In June 2015, the Government drafted a resolution for the establishment of a National Authority for Technology and Innovation, which will function as the executive arm of the OCS.

> The authority will reinforce the government's long-term goals for the high-technology industry, namely, maintaining Israel's global leadership in the face of growing competition while at the same time connecting wider parts of the economy to this engine of growth. The authority will have the professional capabilities and maximum flexibility to allow it to take initiatives and efficiently promote technological innovation in industry at a pace that befits the market. The additional goals of the authority are encouraging growth, increasing productivity and promoting technological innovation in various fields of industry in Israel[44].

By January 2016, the Israeli Government replaced the Office of the Chief Scientist of the Ministry of Economy by the National Authority for Technological Innovation (NATI). The new Authority was established pursuant to a major amendment to the 1984 Law for Encouragement of Research and Development in Industry (the R&D Law) enacted on July 29, 2015. NATI will have more flexibility and freedom than the previous OCS in launching creative funding tracks and instituting new guidelines that will govern the transferability and licensing of the resulting technology. NATI has the mandate to publish new grant tracks and guidelines, but it will take some time to become fully operational. In the interim, the existing OCS regulations continue to apply. Licensing regulations similar to those previously proposed by the OCS are expected to be adopted by NATI and go into force in the course of 2016[45].

44 Israel Ministry of Foreign Affairs URL: http://mfa.gov.il/ and Government Resolution 104, 21 June 2015.
45 Note: This institutional replacement took place while we were correcting the proofs. At the moment, very scarce information about the new role of NATI is available. The information was based on the following URL: https://law.co.il/en/m/#/news/9025/

ACHIEVEMENTS BY ISRAELI SCIENTISTS

Since 2004, five scientists from Israeli universities have won the Nobel Prize in Chemistry and the Economic Sciences. Professor Avram Hershko and Professor Aaron Ciechanover received the Nobel Prize in Chemistry in 2004 for characterizing the method that cells use to degrade and recycle proteins using ubiquitin. Professor Robert John (Yisrael) Aumann received the Nobel Prize in Economic Sciences in 2005 for his work on conflict and co-operation through game-theory analysis. Professor Ada E. Yonath won the Nobel Prize in Chemistry in 2009 for her studies on the structure and function of the ribosome. Professor Dan Shechtman received the Nobel Prize in 2011 for the discovery of quasicrystals. In this section provides a detailed description of Israeli Nobel Prize Laureates, as well as winners of other prestigious awards obtained by Israeli nationals, and a list of other major contributions to international science.

NOBEL PRIZE LAUREATES

Professor Aaron Ciechanover and Professor Avram Hershko
Nobel Prize in Chemistry 2004

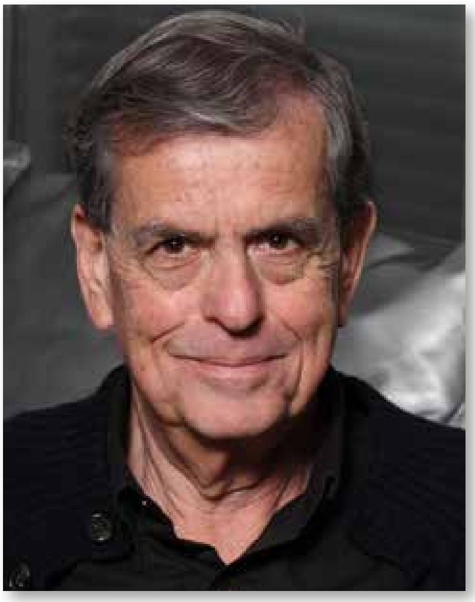


Photo: courtesy of Dan Porges

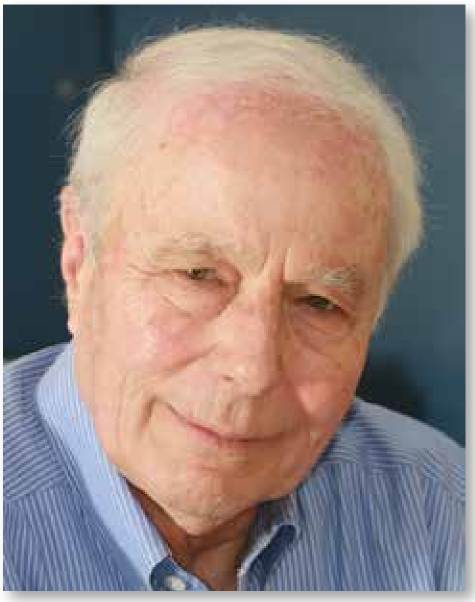


Photo: courtesy of Yossi Shrem

Affiliation: Technion – Israel Institute of Technology, Haifa, Israel

Prize motivation: for the discovery of ubiquitin-mediated protein degradation

Contribution: Professor Aaron Ciechanover and Professor Avram Hershko have led us to understand that the cell functions as a highly-efficient checking station where proteins are built and broken down at a furious rate. The degradation is not indiscriminate but takes place through a process that is controlled in detail so that the proteins to be broken down at any given moment are given a molecular label, a 'kiss of death', after which the labelled proteins are fed into the cells' waste disposers, proteasomes, where the labelled proteins are chopped into small pieces and destroyed. The molecular label is a molecule called ubiquitin. This fastens to the protein to be destroyed, accompanies it to the proteasome where it is recognized as the key in a lock, and signals that a protein is on the way for disassembly. Shortly before the protein is squeezed into the proteasome, its ubiquitin label is disconnected for re-use. Thanks to the work of the laureates, it is now possible to understand at the molecular level, how the cell controls a number of central processes, to break down certain proteins and not others. Aaron Ciechanover and Avram Hershko were awarded the Nobel Prize in Chemistry for their discovery with Professor Irwin Rose. *Source:* URL: http://www.nobel.prize.org/

Professor Robert J. (Yisrael) Aumann
Sveriges Riksbank Prize in Economic Sciences
in Memory of Alfred Nobel 2005

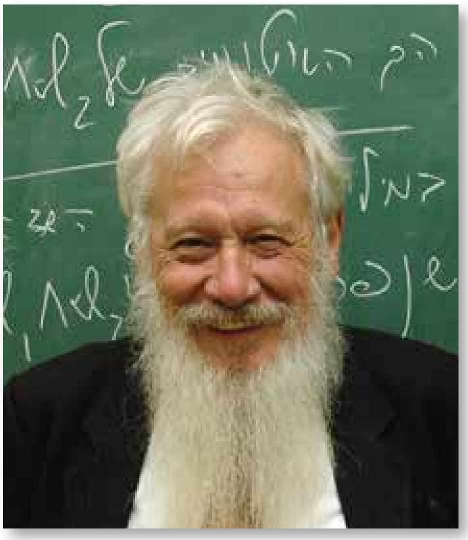


Photo: courtesy of Smadar Bergman

Affiliation: The Hebrew University of Jerusalem, Centre for Rationality, Jerusalem, Israel

Prize motivation: for having enhanced our understanding of conflict and co-operation through game-theory analysis

Contribution: In many real-world situations, co-operation may be easier to sustain in a long-term relationship than in a single encounter. Analyses of short-run games are, therefore, often too restrictive. Professor Robert Aumann was the first to conduct a full-fledged formal analysis of so-called infinitely repeated games. His research identified exactly what outcomes can be maintained over time in long-run relations. The theory of repeated games enhances our understanding of the prerequisites for co-operation: why it is more difficult when there are many participants, when they interact infrequently, when interaction is likely to be broken off, when the time horizon is short or when others' actions cannot be clearly observed. Insights into these issues help explain economic conflicts such as price wars and trade wars, as well as why some communities are more successful than others in managing common resources. The repeated-games approach clarifies the raison d'être of many institutions, ranging from merchant guilds and organized crime, to wage negotiations and international trade agreements. Robert J. Aumann shared the prize with Thomas Schelling. *Source:* URL: http://www.nobel.prize.org/

Professor Ada E. Yonath
Nobel Prize in Chemistry 2009

Photo: courtesy of Micheline Pelletier

Affiliation: Weizmann Institute of Science, Rehovot, Israel

Prize motivation: for studies of the structure and function of the ribosome

Contribution: DNA molecules are inside every cell of all organisms. These molecules contain the blueprints for how a human being, a plant or a bacterium, looks and functions. However, the DNA molecule is passive. If there were nothing else, there would be no life. The blueprints in these DNA molecules become transformed into living matter through the work of ribosomes. Based upon the information in DNA, ribosomes produce proteins: oxygen-transporting haemoglobin, antibodies of the immune system, hormones such as insulin, the collagen of the skin, or enzymes that break down sugar. There are tens of thousands of proteins in the body and they all have different forms and functions. They build and control life at the chemical level. An understanding of the ribosome's innermost workings is important for a scientific understanding of life. This knowledge can be put to practical and immediate use; many of today's antibiotics cure various diseases by blocking the function of bacterial ribosomes. Professor Yonath has developed a revolutionary method of measuring for collecting crystallographic data at very low temperatures. This method has allowed determination of the crystallographic structure of the ribosome. She has generated 3D models that show how different antibiotics bind to the ribosome. Professor Yonath shared the prize with Venkatraman Ramakrishnan and Thomas A. Steitz. *Source:* URL: http://www.nobel.prize.org/

Professor Dan Shechtman
Nobel Prize in Chemistry 2011

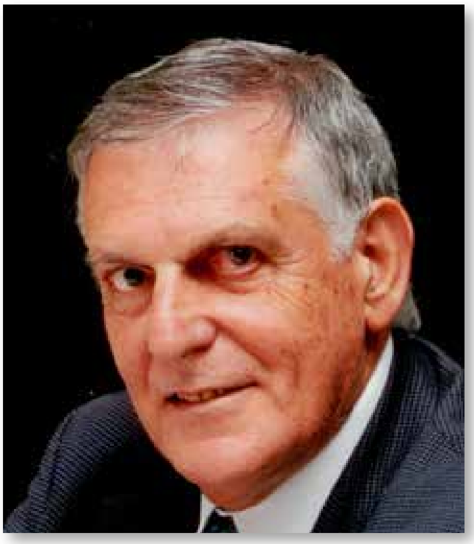


Photo: Shechtman personal collection

Affiliation: Technion – Israel Institute of Technology, Haifa, Israel

Prize motivation: for the discovery of quasicrystals

Contribution: In all solid matter, atoms were believed to be packed inside crystals in symmetrical patterns that were repeated periodically. For scientists, this repetition was required in order to obtain a crystal. Professor Shechtman discovered that atoms were packed in a pattern that could not be repeated. Such a pattern was considered just as impossible as creating a soccer ball using only six-cornered polygons, when a sphere needs both five and six-cornered polygons. When scientists describe Shechtman's quasicrystals, they use a concept drawn from mathematics and art: the golden ratio. This number had already caught the interest of mathematicians in Ancient Greece, as it often appeared in geometry. In quasicrystals, for instance, the ratio of various distances between atoms is related to the golden mean. Following Shechtman's discovery, scientists have produced other kinds of quasicrystals in the lab and discovered naturally occurring quasicrystals in mineral samples from a Russian river. Scientists are currently experimenting with using quasicrystals in different products such as frying pans and diesel engines. *Source:* URL: http://www.nobel.prize.org/

BOX 16 – STATE-OF-THE-ART COMPUTER SCIENCE IN ISRAEL: A SHORT STORY FOR A STRATEGIC SOURCE OF INNOVATION

The world acclaimed achievements in computer science, engineering and information theory in Israel, stem historically from the fact that about a century ago the Technion in Haifa and the Hebrew University in Jerusalem were founded. Many leading faculty were recruited from among the immigrants or refugees from Europe. Over the years, the Hebrew University turned out to be a centre of excellence in computer science and the Technion, the Israel Institute of Technology, turned out to be a centre of excellence in engineering. Other leading institutions include the Weizmann Institute and Tel-Aviv University.

After the State of Israel's establishment in 1948, there was an urgent need to quickly develop technical leadership at the National Defence R&D authority, which later became RAFAEL. The late Professor E.D. Bergman, a world-renowned chemist, was the Chief Scientist at that time and he adopted an innovative policy of encouraging and financially supporting young promising engineers to get a PhD from first league universities abroad. This is how Jacob Ziv, who later co-devised the LZ data compression algorithm with Abraham Lempel, got his doctorate from MIT and was exposed and enchanted by Information Theory, which back then was a newly born branch of science. Much later, from 1995 to 2004, Ziv was to serve as President of the Israel Academy of Sciences and Humanities.

During the 1960s, a group of leading scientists, including Israel Bar-David, Moshe Zakai and Jacob Ziv, moved from the Defence R&D authority to the Technion's Electrical Engineering department, led at the time by Professor Israel Cederbaum, an expert on graph theory and networks. This move turned out to be of historic significance, because it transformed the department from a classical electrical engineering one into an advanced and modern electronics and communication sciences department, thus helping to lay the academic foundations for the Israeli high tech industry. Soon the department became an internationally renowned research centre with the highest standards, competing with the best electrical engineering departments worldwide. Abraham Lempel, whose PhD advisor was Cederbaum, became a faculty member and later joined the newly established Computer Science department at the Technion. In 2004, the Institute of Electrical and Electronics Engineers (IEEE) recognized the LZ data compression algorithm as a historic milestone. The students who graduated from this department over the past half a century were crucial to the core of the Israeli High Tech Industry.

Independently, Chaim L. Pekeris, who worked at Princeton's Institute for Advanced Studies at the time von Neumann's seminal computer architecture was there being designed, moved to the Applied Mathematics Department at the Weizmann Institute of Science. He and Engineer Gerald Estrin brought von Neumann's technology to Israel, resulting in WEIZAC, one of the world's earliest electronic computers, which was put together at the Weizmann Institute in 1954. This computer was also recognized as an IEEE Historic Milestone. Following WEIZAC, two Golem computers were built at Weizmann in the 1960s.

Fully-fledged Computer Science study programmes were offered already in 1970 at the Technion, the Hebrew University and the Weizmann Institute (the latter has no undergraduates, so these were graduate studies), and the other universities followed shortly thereafter. The key figure in this development was Professor Michael Rabin, a mathematician from the Hebrew University, who started to work on the fundamentals of computing in the late 1950s and who has made pioneering contributions to computer science ever since, including his work with Scott on finite automata and laying the foundations for randomized algorithms. In addition to the aforementioned developments in electrical engineering and in building hardware, it was Rabin's push to initiate the computer science department at the Hebrew University, and the cadre of students he taught and supervised over the years, which gave a tremendous push to the central role Israel has played ever since in Theoretical Computer Science.

Over the years, computer science research in Israel has grown and flourished in an unparalleled way. Israel is commonly considered to be second only to the USA in the overall impact worldwide of its research in computer science. It exhibits special strength in complexity theory and cryptography, in software engineering and verification, and in computerized vision. This leading world-class research in computer science and computer engineering also gave rise to an advanced high-tech industry at an unprecedented rate.

Some evidence of Israel's impact in computer science and related engineering and mathematical fields can be gleaned by the number of major awards won by Israelis. One example is the A.M. Turing Award, which has been awarded by the Association for Computing Machinery every year since 1966, and is considered the Nobel Prize of computing. Michael Rabin co-won it in 1976 for his work on automata and nondeterminism, the late Amir Pnueli won it in 1996 for his work on temporal logic and verification, and in 2002, Adi Shamir co-won it for his work on cryptography and the RSA system. The 2012 Turing Award was co-won by Shafi Goldwasser, who is both from the Weizmann Institute and from MIT. The prestigious Nevanlinna Prize for excellence in the mathematical aspects of computing was won in 1992 by Avi Widgerson of the Hebrew University. The Nobel equivalent for Information Theory is the Claude E. Shannon Award, which was won in 1997 by Jacob Ziv and in 2011 by Shlomo Shamai.

In addition, the Israel Prize, the highest honour that the state bestows on its citizens for achievements in science and humanities, has been won by several information and computer scientists (including mathematicians whose work is directly related to computing). These include Chaim Pekeris in 1982, Jacob Ziv in 1993, Michael Rabin in 1995, Amir Pnueli in 2000, David Harel (currently Vice President of the Israel Academy of Sciences and Humanities) in 2004, Noga Alon and Adi Shamir in 2008 and Shimon Ullman in 2014. The RESPONSA project, a full-text retrieval database of Jewish scholarship, based in Bar-Ilan University was awarded the Israel Prize as a project in 2007. It was founded and scientifically directed by Aviezri Fraenkel and Jacob Choueka.

Professor David Harel
The William Sussman Professorial Chair
Department of Computer Science and Applied Mathematics
The Weizmann Institute of Science

Professor Jacob Ziv
Herman Gross Professor of Electrical Engineering and
Technion Distinguished Professor

A.M. TURING AWARD WINNERS

Professor Michael O. Rabin
A.M. Turing Award 1976

Affiliation: The Hebrew University in Jerusalem

Contribution: Professor Rabin won the Turing Award together with Dana S. Scott, for their joint paper 'Finite Automata and their Decision Problem' which introduced the idea of nondeterministic machines. Rabin used a computational model known as a finite state machine. These theoretical machines, like the Turing machine, move from one state to another depending on the input and the defined transition rules. Finite state machines had been investigated before, but Rabin considered different kinds. One was a nondeterministic machine that did not just have one possible transition out of each state, rather several. Essentially the machine could, upon accepting an input symbol, replicate itself. Then each machine would proceed with the computation along one of the possible transitions. As noted in the citation for the Turing Award, this concept of a nondeterministic machine has proven to be extremely valuable in the theoretical investigation of many problems, and continues to be an inspiration for new work. *Source:* URL: http://amturing.acm.org/

Professor Adi Shamir
A.M. Turing Award 2002

Affiliation: Weizmann Institute of Science

Contribution: Professor Shamir won the Turing Award together with Leonard M. Adleman and Ronald Rivest, for 'their ingenious contribution to making public-key cryptography useful in practice'. Professor Shamir is one of the individuals who made the greatest contribution in the field of cryptography and his work touched every aspect of the field. Professor Shamir also contributed to the development of the RSA algorithm, which is an Internet encryption and authentication system that uses an algorithm developed in 1977 by Ron Rivest, Adi Shamir, and Leonard Adleman. The RSA algorithm is the most commonly used encryption and authentication algorithm and is included as part of Web browsers from Microsoft and other companies. *Source:* URL: http://amturing.acm.org/

Professor Shafi Goldwasser
A.M. Turing Award 2012

Affiliation: Weizmann Institute of Science, Massachusetts Institute of Technology

Contribution: Professor Goldwasser received the Turing Award with Silvio Micali for her 'transformative work that laid the complexity-theoretic foundations for the science of cryptography, and in the process pioneered new methods for efficient verification of mathematical proofs in complexity theory'. Professor Goldwasser has made fundamental contributions to cryptography, computational complexity, computational number theory and probabilistic algorithms. Her career includes many landmark articles, which have initiated entire subfields of computer science. These include creating the theoretical foundations of modern cryptography, the introduction of zero-knowledge interactive proofs, the introduction of multi-prover proofs (later known as probabilistically checkable proofs), discovering the connection between probabilistically checkable proofs and the intractability of approximation problems, showing how to use the theory of elliptic curves to distinguish primes from composites, and launching combinatorial property testing. *Source:* URL: http://amturing.acm.org/

FIELDS MEDAL

Professor Elon Lindenstrauss
Fields Medal 2010

Affiliation: The Hebrew University in Jerusalem

Prize motivation: 'for his results on measure rigidity in ergodic theory, and their applications to number theory'

Contribution: Professor Lindenstrauss has made far-reaching advances in ergodic theory, the study of measure preserving transformations. His work on a conjecture of Furstenberg and Margulis concerning the measure rigidity of higher rank diagonal actions in homogeneous spaces has led to striking applications. Specifically, jointly with Einsiedler and Katok, he established the conjecture under a further hypothesis of positive entropy. This conjecture has impressive applications to the classical Littlewood Conjecture in the theory of Diophantine approximation. Developing these as well other powerful ergodic theoretic and arithmetical ideas, Lindenstrauss resolved the arithmetic quantum unique ergodicity conjecture of Rudnick and Sarnak in the theory of modular forms. He and his collaborators have found many other unexpected applications of these ergodic theoretic techniques in problems in classical number theory. His work is exceptionally deep and its impact goes far beyond ergodic theory.

OTHER OUTSTANDING ACHIEVEMENTS BY ISRAELI SCIENTISTS

I. The Lempel–Ziv Algorithm: International Standard for Transferring Information
Professor Jakob Ziv and Professor Abraham Lempel

Affiliation: Technion, Israel Institute of Technology

Contribution: LZ77 and LZ78 are the two lossless data compression algorithms published in papers by Abraham Lempel and Jacob Ziv in 1977 and 1978. They are also known as LZ1 and LZ2 respectively. These two algorithms form the basis for many variations including Lempel–Ziv–Welch (LZW), Lempel–Ziv–Storer–Szymanski (LZSS), Lempel–Ziv–Markov Chain Algorithm (LZMA), and others. Besides their academic influence, these algorithms formed the basis of several ubiquitous compression schemes, including GIF and the DEFLATE algorithm used in PNG. Professor Jakob Ziv has received many awards, among them the Marconi Prize, the Shannon Prize, the Israel Defence Prize, the Rothschild Prize and the Israel Prize.

II. Symmetry in Particle Physics
Professor Yuval Ne'eman and Fellow Israeli Physicists

Affiliation: Tel-Aviv University

Contribution: Professor Ne'eman's greatest achievement in physics was his 1961 discovery of the classification of hadrons (a composite particle made of quarks held together by the strong force) through the SU (3) flavour symmetry, now named the Eightfold Way, which was also proposed independently by Murray Gell-Mann. The SU (3) symmetry laid the foundation of the quark model, proposed by Gell-Mann and George Zweig in 1964 (independently of each other). Several other Israeli Physicists, including Professor Zvi Lipkin and Professor Haim Harrari from the Weizmann Institute of Science, made pioneering contributions to the understanding of the structure of matter. They all received many awards among them the Israel Prize, Weizmann Prize, Rothschild Prize and the Albert Einstein Award for their unique contribution in the field of theoretical physics.

III. The Aharonov – Bohm Effect
Professor Yakir Aharonov

Affiliation: Tel – Aviv University

Contribution: As part of his doctoral thesis at the Technion, Professor Aharonov, under the supervision of Professor David Bohm, in 1959, discovered a phenomenon in quantum mechanics, that a charged particle is affected by electromagnetic fields, despite being confined to a region in which both the magnetic field and the electric field are zero. Professor Yakir Aharonov received the US National Medal of Science in 2010, the Wolf Prize in 1998 and the Elliott Cresson Medal in 1991.

IV. Foundation of Black Hole Thermodynamics
Professor Jacob Bekenstein

Affiliation: The Hebrew University of Jerusalem

Contribution: Black holes are massive astronomical objects with gravity so great that not even light can escape, hence the name 'black hole'. Einstein explains possibility of their existence and their basic properties within the framework of general relativity. Professor Jacob Bekenstein shed new light on black holes when he demonstrated in his ground breaking work, that they have a statistical thermodynamic feature known as entropy. Bekenstein also formulated the generalized second law of thermodynamics, black hole thermodynamics, for systems including black holes. Professor Jacob Bekenstein was named the 2012 recipient of the prestigious Wolf Prize for his work on black holes. He also received the Israel Prize in 2005 and the Rothschild Prize in Physics in 1988.

V. Theoretical Chemistry: Intramolecular Radiationless Transitions and Energy Acquisition
Professor Joshua Jortner

Affiliation: Tel-Aviv University

The innovative research of Professor Joshua Jortner in physical and theoretical chemistry explored the phenomena of energy acquisition, storage and disposal in isolated molecules, clusters, condensed phase and biomolecules driven by light absorption. His contributions became seminal to the development of chemical dynamics, photo selective laser chemistry, ultrafast chemistry, molecular electronics and nanoscience. His school pioneered the concept and theory of coherent vibrational wave packet dynamics and quantum beats in femtosecond chemistry, whose experimental discovery 14 years later led to the award of the 1999 Nobel Prize to Professor Ahmed Zewail of the California Institute of Technology.

The work of Professor Jortner has been recognized by the award of the Wolf Prize, the Israel Prize, the Rothschild Prize and the EMET Prize.

VI. Chemical Transformations and Selectivity
Professor Raphael D. Levine

Affiliation: The Hebrew University of Jerusalem

Professor Raphael Levine has played a central role in initiating, developing and applying the theoretical framework for our current understanding of chemical transformations in time and space. He has paid special attention to the selectivity of energy requirements and specificity of energy disposal in chemical reactions. To do so he introduced surprisal analysis showing that thermodynamics can be applied to very small, even few-atom, systems. This has spread into diverse branches of science most recently in quantifying biological individuality in disease.

Professor Levine won many awards including the EMET Prize, the Israel Prize and the Wolf Prize.

VII. Development of the Copaxone Drug for the Treatment of Multiple Sclerosis
Professor Michael Sela and Professor Ruth Arnon

Affiliation: Weizmann Institute of Science

Contribution: Drug development is the main occupation of pharmaceutical companies. The main mission of universities and research institutes is to conduct basic research with the specific aim of enhancing the scope of knowledge in the world. It happens sometimes that basic research yields a finding that can be put into practical use and be transformed into a commercial product. This is the story of the drug Copaxon (Glatiramer acetate), for the treatment of Multiple Sclerosis. It was originally discovered by Professor Michael Sela, Professor Ruth Arnon and Dr Dvora Teitelbaum at the Weizmann Institute of Science and developed by the Israel Teva Pharmaceutical Industries Ltd. and marketed worldwide. Professors Michael Sela and Ruth Arnon won many awards, including the Israel Prize, the Rothschild Prize and the Wolf Prize. Professor Sela won UNESCO's Albert Einstein Golden Medal in 1995.

VIII. Epigenetics
Professor Haim Cedar and Professor Aharon Razin

Affiliation: The Hebrew University of Jerusalem

Contribution: Ground breaking research by Professor Cedar and Professor Razin, more than three decades ago, laid the foundation for Epigenetics, a new scientific field in biology, which is the study of heritable changes in gene activity that are not caused by changes in the DNA sequence. Professor Haim Cedar and Professor Aharon Razin have won many awards. In 2008, they were awarded the Wolf Prize in Medicine, 'for their fundamental contributions to our understanding of the role of DNA methylation in the control of gene expression'. In 2011, they won Canada's Gairdner Award for their 'pioneering discoveries on DNA methylation and its role in gene expression'. In 2004, Professor Razin was awarded the Israel Prize in Biochemistry. In 1999, Professor Cedar was awarded the Israel Prize in Biology.

IX. Bio recognition and Targeted Therapy
Professor Meir Wilcheck

Affiliation: Weizmann Institute of Science

Contribution: Meir Wilchek is known for his research in the field of biorecognition or affinity phenomenon, and its various applications, e.g. affinity chromatography, affinity labelling, affinity therapy, and the avidin-biotin system. The avidin-biotin complex is the highest affinity interaction in nature, and its utilization in biochemistry integrates all of the above approaches. Thus, affinity chromatography allows the separation of molecules according to their biological properties; affinity labelling enables the elucidation of the active site of molecules; and affinity therapy is a biorecognition approach to selectively deliver a cytotoxic drug or toxin to a specific target cell, thus allowing more efficient treatment of cancer. For this contribution, Professor Wilcheck has won many awards including the Israel Prize, the Wolf Prize and the Rothschild Prize.

X. Cherry Tomatoes
Professor Nachum Kedar and Haim Rabinowitz

Affiliation: The Hebrew University of Jerusalem

Contribution: The State of Israel, despite its small size and location in a semi-desert environment, is known for its state-of-the-art agriculture. Israel gained worldwide acclaim in the agricultural domain thanks to high quality research conducted in the universities. Just two notable examples are the development of high-protein wheat varieties and maize varieties resistant to insects. One of the best-known plant varieties developed in Israel is the cherry tomato. These little tomatoes, used for food and decoration, are very tasty and occupy an increasingly growing market share. Cherry tomato seed varieties also constitute an important export of the Israeli agricultural industry.

The SETI policy cycle of Israel

The term 'policy cycle' refers to the recurrent pattern of processes that lead to the creation of a public policy and its renewal. The greatest advantage of the analytical model of a SETI policy cycle is that it facilitates an understanding of public policy-making by breaking down the complexity of the process into a limited number of stages and sub-stages each of which can be investigated alone or in terms of its relationship to any or all of the other stages of the cycle. This also allows for an examination of the role played by all actors and institutions dealing with SETI policies rather than solely those governmental agencies formally charged with the task.

The GO→SPIN methodological approach divides the SETI policy cycle into five stages. Here are the working definitions provided for the survey:

- *Agenda setting:* refers to the process by which problems involving SETI in relation to society and the economy come to the attention of the government. Agenda setting is also a socially- constructed process in which actors and institutions influenced by their respective ideologies play a fundamental role in determining which problems or issues require government action (Howlett and Ramesh, 2003).
- *Policy formulation:* refers to the process by which SETI policy options are formulated by the government. Policy formulation involves identifying and assessing possible solutions to policy problems weighing the pros and cons and deciding which should be accepted and which rejected. The relationship between the government and social actors thus exerts a significant influence on the formulation of public policies.
- *Decision-making:* refers to the process by which governments adopt a particular course of action or non-action.
- *Policy implementation*: refers to the process by which governments put SETI policies into effect. This is when a decision is carried out through the application of government directives and is confronted with reality.
- *Policy evaluation:* refers to the process by which the impact of SETI policies are monitored by both state and societal actors the result of which may be a re-conceptualisation of policy problems and solutions.

SETI POLICY CYCLE IN ISRAEL

Agenda Setting

The Science and Technology Committee

The *Knesset* determines the laws that govern R&D activities and approves their budgets. The *Knesset*'s Science and Technology Committee was established during the 14th *Knesset* in December 1996 (and was at first called the Special Committee for Research and Development). The Committee deliberates on legislation, oversees the work of the Government and raises issues which are on the public agenda in science and technology. The Committee invites various experts and stakeholders from the academy industry and the government to its hearings on a regular basis. Their point of view and opinion are taken into consideration when setting an agenda (Knesset, 2013).

The Office of the Chief Scientist in the Ministry of Economy

The Office of the Chief Scientist in the Ministry of Economy (OCS) is the support arm of the Government responsible for fostering the development of industrial R&D in Israel. Its mission is to assist the advancement of Israel's knowledge-based science and technology industries in order to encourage innovation and entrepreneurship while stimulating economic growth. The OCS has a major influence on agenda setting by advising the Government and the Science and Technology Committee. The post of the Chief Scientist in the Ministry of Economy, when compared to the posts of chief scientists in other ministries, has the largest financial resources and highest impact on SETI policy at all phases of the policy cycle (OCS, 2013); despite that other ministries have chief scientists, only this office is customarily referred to as the Office of the Chief Scientist, or the OCS, without its ministerial setting being mentioned.

Policy Formulation

The main players in Israel's national research and innovation system responsible for policy formulation and governance are the Planning and Budgeting Committee of the Council for Higher Education (PBC) (responsible for academic R&D and the allocation of funds to the Israel Science Foundation (ISF), the OCS (responsible for industrial R&D), the Ministry of Defence, the Ministry of Finance, the IASH and MOST.

In academia, R&D policy formulation is a bottom-up process whereby the universities pursue scientific research according to the priorities of the scientists. Since 2011, the Ministry of Finance has become much more involved in policy formulation. This has helped to increase co-operation and co-ordination between all entities involved in innovation policy, including the OCS and the PBC. MOST funds numerous thematic research centres (regional R&D centres), and is responsible for international scientific co-operation. The National Council for Research and Development (NCRD) works under the auspices of MOST. It is responsible for devising policy and advising the government.

Decision Making

Decision making with regard to SETI policy in Israel is taken by the following organizations:

- Ministry of Finance
- Office of Chief Scientist of the Ministry of Economy (OCS)
- Council for Higher Education (CHE)
- Planning and Budgeting Committee (PBC) of the Council for Higher Education
- Ministry of Science Technology and Space (MOST)
- Chief Scientist of the Ministry of Agriculture and Rural Development
- Israel National Research Council, and the Forum for National Research and Development Infrastructure (TELEM)
- Ministry of Defence through its R&D arm (MAFAT)
- Forum of Chief Scientists from all government ministries
- The research universities

The OCS focuses on promotion of economic growth in Israel. The Ministry of Economy is engaged in encouraging and supporting export and international commerce in order to assist Israeli businesses in enhancing their exports and entering new markets abroad. Hence, the OCS makes a principal contribution to SETI decision-making. It is important to note that, although MOST also plays a role in policy formulation and decision-making processes, its relative weight in Israel's policy cycle is not as significant as the OCS due to lack of resources and budget.

Policy Implementation

The Office of the Chief Scientist of the Ministry of Economy – OCS

The OCS supports hundreds of projects annually from incipient concepts within a pre-seed framework followed by support of incubator and start-up companies through autonomous industrial R&D enterprises. The support is directed towards development of novel products based on new and innovative technologies in both the high technology and traditional sectors. This support also extends to a broad range of cooperative ventures with foreign commercial entities. In the international arena, the OCS has vigorously pursued a number of avenues of involvement in cooperative industrial R&D with foreign entities both at the governmental and corporate levels (OCS, 2013).

Israel Science Foundation – ISF

The Israel Science Foundation (ISF) founded by the Israel Academy of Sciences and Humanities is now Israel's predominant source of competitive grants for basic research accounting for about two thirds of all such awards annually. The core activity of the ISF is its highly successful competitive grants programme for individual researchers, which constitutes about 80% of its total budget. The ISF funds research in three areas of operation: exact sciences and technology life sciences and medicine and humanities and social sciences. It also supports workshops equipment grants and major ISF Centres of Excellence grants.[46]

Planning and Budgeting Committee (PBC) of the Council for Higher Education

The flagship programme of the PBC is the I-Core Programme. This initiative is part of the *Higher Education Multi-Year Reform Plan*, which gradually establishes leading research centres specializing in a range of disciplines. The centres of research excellence and the programme's vision are aimed at fundamentally strengthening the long-term position of Israel's academic research and its stature among leading researchers in Israel and abroad. The Government endorsed I-CORE and it was adopted by the Council for Higher Education in March 2010. The PBC and the ISF jointly run the programme.

Ministry of Science Technology and Space – MOST

The National Infrastructure Program of MOST seeks to utilize the country's professional work force and to realize the economic potential of those science and technology fields where Israel has a comparative advantage. MOST's investment in the programme is manifested in three main ways:

Research grants: the programme is intended to serve as a bridge between basic and applied research and to reduce the amount of time needed for technological ideas to be translated into practical use.

Scholarships: every year MOST awards scholarships in science and technology from undergraduate to post-doctoral levels.

Infrastructural knowledge centres: each year MOST establishes infrastructural knowledge centres at existing research institutions and endows these centres with special equipment that is beyond the individual institutions' financial reach.

Regional R&D Centres: MOST established seven centres across the geographic and demographic peripheries of the country with the specific aim of drawing young leading scientists into these areas raising the level of local education and promoting economic development. The R&D centres focus on the periphery's local challenges, conditions and resources to enable tailored solutions.

46 Israel Science Foundation. URL: http://www.isf.org.il/english/

Policy Evaluation

Policy evaluation refers to the process in which the impact of SETI policies is monitored by the state or by other actors. This process can lead to a re-conceptualization of priorities and solutions. The following bodies carry out policy evaluation in Israel:

- Planning and Budgeting Committee (PBC) of the Israel Council for Higher Education
- The Council for Higher Education (CHE), restricted to the evaluation of higher education teaching programmes
- Ministry of Science Technology and Space via the National Council for Research and Development (NCRD)
- Ministry of Finance
- Ministry of Economy – Office of Chief Scientist (OCS)
- Israel Academy of Science and Humanities (IASH)

Evaluation of various R&D instruments, programmes and outputs is carried out by the CHE, the NCCRD, the OCS and the Ministry of Finance. The following list presents a short description of these evaluation plans and reports:

- Evaluation of R&D instruments supported by the OCS: as described above, the OCS funds many R&D programmes and instruments aimed at supporting start-ups and technology transfer projects between academia and industry. In recent years, the MAGNET administration in the OCS has initiated several evaluation studies aimed at analysing and evaluating the performance of its policy instruments. These studies are carried out by independent research institutions. The Samuel Neaman Institute conducted studies on Magneton and Nofar programmes (Getz *et al.*, 2009; Getz *et al.*, 2010). In 2014 a committee headed by Israel Makov examined OCS support for R&D in large companies and found that there is economic justification for the incentives (Makov, 2014). Applied Economics evaluated the contribution of the high-technology sector to productivity of the Israeli economy (Applied Economics 2014)[47].
- The CHE evaluates research programmes within the research universities. The main objectives of these evaluations are to improve the quality of higher education in Israel and to develop an internal mechanism that will enable testing of academic excellence and quality of research.
- Evaluations of Israeli research output (studies aimed at analysing the quality of Israeli science and the position of Israel in various scientific fields in comparison to other countries): these evaluations are carried out by independent research institutions (e.g. The Samuel Neaman Institute) upon invitation from a body (e.g. NCRD, MOST, etc.). Bibliometric tools (e.g. scientific publications and patents) and STI indicators are often used in the analysis process. Decision-makers usually rely on these types of studies to draw policy conclusions.
- Evaluations of Israeli R&D indicators: these are conducted by the Research Department in the Ministry of Finance and the NCRD. The Research Department in the Ministry of Finance collects and analyses data on economic development in Israel and abroad and evaluates future developments in the Israeli market. The department's data is used in economic policy formulation. The NCRD is an additional body that commissions evaluation of R&D indicators (Israel in international perspective). In recent years, the Samuel Neaman Institute worked with the NCRD on the evaluation and analysis of scientific and R&D indicator data. The policy cycle in Israel is described graphically in Figure 68.

47 The full list of Evaluation studies is published at URL:http://www.moital.gov.il/NR/exeres/42F82A58-377D-43EF-9F55-5DCB95C1A463.htm

Figure 68: SETI policy cycle in Israel, circa, 2015. Source: SNI

Analytical Content of Israel’s SETI Policy

This section analyses the formal content of the National Science Technology and Innovation Policy of Israel in accordance with the methodological approach of the GO→SPIN survey, which has been designed to allow for international comparisons of the SETI policies adopted by different countries.

All the statements in the pages that follow have been reproduced from the official policy document but are organized hereafter according to the 14 standard fields proposed in the GO→SPIN survey. Some of these fields may be left vacant owing to the fact that the explicit policy does not take these particular items into account.

Advanced national STI ecosystems are highly complex structures that rely on interaction, co-ordination and bi-directional flow of information between the various components or 'actors' of the system. These include the research universities, technological colleges, basic and applied research institutions, national laboratories, hospitals and medical centres, the industry and corporate R&D centres, start-ups, NGO's, the regulation authorities and the government. The main role of the last component of the system is to formulate and mandate the overall policy of the country in regards to STI activities. This is usually done by formulating a national masterplan for R&D.

Modern-day national masterplans for R&D try to avoid rigid and centralized control and monitoring of R&D, but at the same time aim at utilizing and harvesting the benefits of long-term planning. The involvement of the government in the process is perceived as especially crucial for success as it is viewed as the only entity that can deal with market failures related to R&D activity and supply the necessary conditions for the development of a viable ecosystem for promoting optimal use of national resources. Government intervention in this framework requires that the system be designed to include both top-down and bottom-up processes (stemming from other parts of the system of science and innovation, such as industry, the academy and the market) (Slonim, 2011).

Israel differs from many countries in this regard as it fosters a very sophisticated R&D system on the one hand and on the other hand lacks an overarching comprehensive STI policy (a masterplan that lays out long-term strategies with coordinated goals and objectives for all components of the system of science and innovation). The main reason for the absence of an overall masterplan for R&D is historic. Israeli R&D was developed organically on the basis of defence R&D with strong emphasis on a single scientific-industrial component (ICT), and it drew heavily (but not solely) on bottom-up processes (Slonim, 2011). At the same time, other components of the ecosystem did not grow at the same pace (e.g. investment in research infrastructure, focus on science and technology education in primary and secondary schools, financing continuous and long-term research, new posts for teaching and research in the research universities, investing in emerging technological domains etc.), an element that may gradually fracture the 'R&D chain' and impede prospective economic growth.

Numerous SETI bodies in Israel are responsible for planning, promoting and implementing R&D policy (see pages 162–170). The most important bodies in this regard are the National Council for Civilian R&D (NCCRD), TELEM and the Office of Chief Scientist (OCS) in the Ministry of Economy. The OCS' policy is the closest to resembling a general vision for R&D because it includes a clear strategy for uses of R&D. The OCS also closely interacts with all other components of the ecosystem (e.g. the industry and multi-national R&D centres, start-ups, technological incubators, research universities, hospitals, other government offices). The OCS advocates 'soft' monitoring and guiding of R&D, mainly by defining certain domains for research attention, but does not set specific and detailed research directions for the various entities, which it supports.

The OCS' policy towards R&D should not be confused with a national strategy for STI, as its activity centres only on industrial R&D and does not address from a holistic point of view the needs of the entire ecosystem (e.g. the status of the K-12 education system in regards to science and technology, policy towards investment in the higher-education system, basic research in the universities and hospitals etc.).

The template that follows analyses the formal content of the policy of the OCS towards civilian R&D, in accordance with the methodological approach of the GO→SPIN survey, which has been designed to allow for international comparisons of the SETI policies adopted by different countries. All the statements in the pages that follow have been reproduced from the official Ministry of Economy website, the Director General Code of By-Law and the Encouragement of Industrial Research and Development Law, which mandates the activity of the OCS.

ANALYTICAL CONTENT OF THE OCS, INDUSTRIAL TECHNOLOGY AND INNOVATION POLICY

I. **Policy vision:** to ensure and advocate economic growth through technological innovation.

II. **Policy mission:** to execute government policy related to industrial R&D support and to provide a broad spectrum of programmes to encourage technological entrepreneurship and innovation.

III. **Policy goals:** (i) to assist in developing technology in Israel as a means to foster economic growth, encouraging technological innovation and entrepreneurship; (ii) leveraging Israel's scientific potential; (iii) enhancing the knowledge base of the industry in Israel; (iv) stimulating high value-added R&D; (v) encouraging R&D collaboration both nationally and internationally[48].

IV. **Policy objectives:** (i) to create a surplus yield for Israel – increased economic benefit to the economy resulting from R&D or the fruits of S&T activity; (ii) to develop science-intensive industry while utilizing and expanding technological and scientific infrastructure and the existing human resources in the state; (iii) to improve the state's balance of payments through manufacture and export of science-intensive products.

V. **Priorities at the strategic level of the SETI policy:** directing and prioritizing investments toward emerging fields[49],[50] (i) Cleantech (especially water technologies) (ii) biotechnology and life sciences, (iii) nanotechnology (iv) improving the performance of the low-technology industries.

VI. **Normative planning strategies of the policy:** Normative goals were set towards the renewable energy domain: (i) attaining 13% of energy from renewable sources by 2025 and 17% from these sources by 2030.

VII. **Policies related to the supply of SETI:** (i) strengthening export; (ii) enhancing productivity; (iii) increasing revenue.

VIII. **Policies related to demand for SETI:** Demand-side incentives implemented by the OCS for supporting and fostering R&D (via the OCS STI instruments and programmes) include: (i) investment grants; (ii) tax benefits; (iii) employment grants. The OCS funds up to 50% of R&D expenses in established companies, and up to 85% for start-ups (e.g. TNUFA pre-seed fund). Approved projects in the Nanotechnology and Biotechnology sectors may receive the maximal 50% of grant support.

IX. **Policies to foster networking between the SETI supply and demand sides:** (i) initiating various *conferences, conventions and meetings* involving all actors of the ecosystem focusing on various themes, e.g. (1) innovation in the traditional industries (2) nanotechnology; (3) Cleantech and water technologies; (4) innovation in the minority sector; (5) enhancing academy-industry partnerships for R&D, (ii) joint professional committees with other government ministries and other actors of the ecosystem focusing on various domains.

X. **Regional and international dimensions of SETI policies:** (i) many of the OCS instruments (e.g. MAGNET and others) offer incentives to R&D companies to operate in peripheral areas (Negev and Galilee). These incentives include grants of 60% of the total approved R&D budget; (ii) at the international level, the Government of Israel, through the Ministry of Economy, has entered into more than 40 bilateral industrial R&D support agreements all over the world and participates actively in five multinational European programmes.

48 MATIMOP: The Israel Industry Centre for Research. URL: http://www.matimop.org.il/about_matimop.html

49 Office of the Chief Scientist (2004) Press release *(In Hebrew)*. URL: http://www.moital.gov.il/NR/exeres/06F599A2-B4EB-445B-843B-6E02A77C3BEE.htm

50 Office of the Chief Scientist (2004) Research Committee decision on priority in grants approvals for Biotechnology and Nanotechnology *(In Hebrew)*. URL: http://www.moital.gov.il/NR/rdonlyres/E23BA7BF-E1DC-48A0-8CD7-E8E8108DABF2/0/bio_nano1.pdf

XI. **Monitoring, assessment, technological forecasting and prospective scenarios:** (i) Monitoring, technological forecasting and the analysis of prospective scenarios are conducted by the Strategy and Economic Research Unit at the OCS. The activity of the unit includes assistance in guiding the OCS' goals and objectives, planning of overall strategy, monitoring of the Israeli high-technology industry and the Israeli knowledge economy by using comparative STI indicators, (ii) Evaluation of OCS programmes and STI instruments is conducted by the Strategy and Economic Research Unit as well as by independent research institutions.

XII. **SETI policy start date:** the OCS was established in 1971. Most of the current day policies date to 1984 (enactment of the *Encouragement of Industrial Research and Development Law* which mandates the activity of the OCS).

XIII. **Timespan for SETI policy planning:** from 1971 to present day.

XIV. **Link:** http://www.economy.gov.il/English/Pages/default.aspx

BOX 17 – A SHORT HISTORY OF UNESCO'S CO-OPERATION WITH ISRAEL ON SETI POLICIES

UNESCO's co-operation with Israel on strengthening R&D policies started in the late 1950s. Various initiatives were implemented in Israel through UNESCO's Technical Assistance Programme. Between October 1955 and November 1959, a UNESCO expert worked at the Technion in Haifa to start a mineral engineering and mineral education programme (Dessau, 1959). The assistance was also extended to applied physics at the Hebrew University (Tabor, 1961), and, at the Technion, to aeronautical engineering (Young, 1958), to engineering sciences laboratories (Lieber, 1962), to applied mathematics (Unz, 1964) and to metallurgy (Kramien, 1966). UNESCO's Technical Assistance Programme was so successful in Israel that a Round Table on Research in the Field of International Exchanges in Education, Science and Culture was co-organized by UNESCO in Herzliah (Israel) on 8–10 April 1964. This event opened up possibilities for sharing Israel's best practices among a group of international experts.

In 1970, UNESCO published the National Science Policy and Organization of Research in Israel. Professor Zvi Tabor, Director of the National Physical Laboratory of Israel was entrusted with the task of coordinating the various parts of the study (UNESCO, 1970). The report described the historical background and development of the organization of science in the country, the R&D institutional structure and the results of the first surveys on R&D indicators. It listed the main objectives of Israel's science policy, linking them to the national development plan. It analysed SETI activities' financing, academic scientific personnel's training, and other basic socio-economic data.

The science curriculum reform movement, which was strong in Israel during the late 1950s and 1960s, gave momentum to expanding and improving science teaching throughout the 1970s, and into the 1980s. UNESCO became involved through its international programme on Primary-School Science Education, launched – coincidentally enough-- on the initiative of the late Moshe Avidor, Israel's Ambassador to UNESCO (Mayor, 1993), after the fifth Rehovot Conference in 1969.

In 1972, Alex Keynan, a former Chairman of the Israel National Council for Research and Development, was invited to contribute to a special issue of UNESCO's journal Impact of Science on Society, exploring the relationship of the science and government in Israel (Keynan, 1972). This seminal article describes in detail the emergence and early evolution of S&T policies in the country.

In the 1980s, Moshe Sicron – a former Scientific Director of the Central Bureau of Statistics – was invited to contribute to UNESCO's International Social Science Journal by providing a description of the national system of statistics and best practices for the generation of social indicators in Israel (Sicron, 1981).

In 1998, Shlomo Herskovic, Director of Planning and Information on the Planning and Budgeting Committee of the Council for Higher Education, and Ammon Pazy, Professor of Mathematics at the Hebrew University, wrote a chapter on Israel's advances in science policy for UNESCO's World Science Report. This chapter provided valuable information on the development of SETI activities in Israel during the 1990s (Herskovic and Pazy, 1998).

In 2015, Daphne Getz, Senior Research Fellow at the Samuel Neaman Institute for National Policy Research (SNI) at Technion-Israel Institute of Technology (Haifa), and Zahev Tadmor, Professor Emeritus and former President of Technion, wrote an highly compelling survey of recent developments on research and innovation activities in Israel in the UNESCO Science Report (Getz and Tadmor, 2015).

In 2012, at the initiative of Ruth Arnon, then President of Israel Academy of Sciences and Humanities (IASH), UNESCO and IASH explored the possibility of preparing a GO→SPIN Country Profile in Science, Technology and Innovation Policy on Israel. After more than two years of hard work this objective was reached.

The present volume is the result of a very synergistic collaboration between the SNI and UNESCO's Division of Science Policy and Capacity Building (Paris), at the invitation of IASH. IASH played a fundamental role, enabling the participation of the most important SETI stakeholders in Israel and creating a very fruitful context for co-operation. In January 2016, IASH convened a GO→SPIN validation workshop in Jerusalem with the participation of international and national experts in research and innovation policies. IASH, the Government of Sweden and UNESCO provided financial support for the preparation and publication of this country profile.

Photo: Dana Bar Siman Tov, Israel Academy of Sciences and Humanities

Group of participants during the GO→SPIN validation workshop, held at the Israel Academy of Sciences and Humanities in Jerusalem on January 17, 2016

BOX 18 – THE REGIONAL R&D CENTRES – A POLICY INSTRUMENT FOR PROMOTION OF SOCIAL AND ECONOMIC DEVELOPMENT IN ISRAEL'S PERIPHERAL AREAS

MIGAL – MIGAL is internationally recognized as a hub of agro-innovation. Research in MIGAL is highly interdisciplinary combining expertise in plant sciences, agro-technology, chemistry, computational chemistry, biochemistry, biotechnology and microbiology.[51]

Dead Sea-Arava Science Centre (DSASC) – This centre operates along the entire Dead Sea and Arava Valley. The main areas of research and activity are climate change, botanical and zoological species diversity, biotechnology, and sustainable agriculture in an extreme arid climate.[52]

Galilee Society – This institute's mission is to enhance the economic opportunities of the Arab community and provide additional scientific and educational tools for Arab students. Research in the institution focuses on various themes such as health, water conservation, environmental biotechnology, applied biotechnology, agriculture and renewable energy.[53]

Triangle Research and Development Centre (TRDC) – The centre aims to address topics related to the Arab community living in Israel. Research at TRDC focuses on epidemiology, preventive medicine, pharmaceutical chemistry, agriculture, and aromatic plants.[54]

Samaria and Jordan Rift R&D Centre – The centre's main research domains are: water pollution, characterization/development of water resources, remote sensing of natural disasters, climate, hydrogeological modelling, and development of biomass-based renewable energy and more.[55]

The Judea Research and Development Centre – The centre focuses on the ecology of local desert plants, desert agriculture, plant biochemistry, and pharmaceutical and cosmetic applications of local plants.[56]

Golan Research Institute – This institute conducts applied research projects aimed at contributing to the educational industrial economic and social development of the Golan region. Its main research domains are agriculture environment, society & education, and agricultural economics.[57]

51 MIGAL: Galilee Research Institute. URL: http://www.migal.org.il/
52 Dead Sea-Arava Science Centre. URL: http://www.adssc.org/en
53 The Galilee Society: The Arab National Society for Health, Research and Services. URL: http://www.gal-soc.org/
54 Triangle Research and Development Centre. URL: http://www.idealist.org/view/nonprofit/tT2TMgbg778d/
55 Samaria and Jordan Rift R&D Centre. URL: http://www.ariel.ac.il/research/samaria-jordan-rift
56 Judea Research and Development Centre. URL: http://mopyehuda.org.il/
57 The Golan Research Institute. URL: http://golanres.haifa.ac.il/main_en_all.htm

Analysis of the SETI organizational chart and flows in Israel

The SETI organizational chart shows the distribution of responsibility for implementing a given policy. In the organisational chart, there are five distinct levels: (1) the policy-planning level (policy design); (2) the promotional level (funding); (3) the performance level (scientific research, technological development and productive innovation); (4) all science and technology services' level; and (5) the assessment/evaluation level.

The Figures shown in this chapter, taken together, present a schema of the organizational chart of Israel's research and innovation system. Due to the complexity of the Israeli system, the organizational chart was subdivided into four different segments (Figures 69–72). It is important to note that the four charts were segmented primarily for purposes of convenience. Strong interlinks exist between the various bodies within each segment as well as between the segments.

Prior to describing each Figure, it is important to emphasize the role of the Ministry of Economy. As the main ministry responsible for planning and implementing general economic policy, it has the authority to allocate and approve the budgets of the OCS, the CHE, and all other government ministries.

Figure 69 describes four main policy-planning and advising-level institutions: two committees of the *Knesset:* the Science and Technology Committee and the Ministers' Committee of Science and Technology, the National Council for Civilian R&D, and the Forum of Chief Scientists. The policy planning level is completed by the Ministry of Defence, Ministry of Science, Technology and Space, Ministry of Agriculture and Rural Development, Ministry of Health, Ministry on National Infrastructures, Energy and Water Reseources, Ministry of Environment Protection, Ministry of Transport, Ministry of Education and Ministry of Social Affairs.

The mission of the National Council for Civilian R&D (NCCRD) is to advise the Israeli government with regard to the organization and regulation of civilian R&D and the allocation of its budgets. The Council also sets guidelines for short-term and long-term national R&D policy. It recommends and advises the government regarding investment in fields of national priority and on the development of necessary scientific infrastructure.

The Ministry of Science, Technology and Space (MOST) aims to advance, encourage and foster science to the highest levels of achievement in order to 'place Israel as a leading scientific and technological power'[58].

The Ministry also supports R&D programmes through the Forum of Chief Scientists. This Forum serves as a coordinating body among the various government ministries and bodies responsible for the promotion of civilian R&D. This is demonstrated by the Forum's links to both the various government ministries (Economy, Science, Technology and Space, Education, Health, Transport, Environmental Protection, Energy and Water, Agriculture and Rural Development) and to other organizations (e.g. Central Bureau of Statistics, Agricultural Research Organization). The Forum of Chief Scientists also advises the NCCRD on policy formulation issues and on setting priorities in the civilian and government R&D sectors. The Forum is chaired by the Minister of Science, Technology and Space. A key implementation-level instrument of MOST is the National Infrastructure Program. A detailed description of this implementation-level instrument can be found in the chapters 'SETI Policy Cycle' and 'Inventory of SETI Operational Policy Instruments in Israel'.

One of the important implementation-level organizations of the Ministry of Agriculture and Rural Development (a promotional-funding level organization) is the Agricultural Research Organization (ARO). The ARO is the central governmental research institute for agriculture, responsible for planning, organizing and implementing the greater part of Israel's agricultural research effort. ARO is concerned with solving current problems in agricultural production by the introduction of new products, processes and equipment. ARO's infrastructure supports both basic and applied research in agricultural and environmental sciences. The organization consists of six research institutes: plant sciences, animal science, plant protection, soil, water and environmental sciences, postharvest and food sciences and agricultural engineering. ARO is mandated to develop knowledge, technologies and products for food security and environmental protection, and to promote their adoption.

58 The Ministry of Science, Technology and Space. URL: http://most.gov.il/english/Pages/default.aspx

Other important promotional-level bodies are the Administration for the Development of Weapons and Technological Infrastructure (MAFAT), the Prime Minister's Office, the Ministry of Health, and the Israel Atomic Energy Commission.

MAFAT is an administrative body of the Ministry of Defence. The main objectives of MAFAT are to promote the technological and scientific infrastructure needed for military R&D; to make decisions on the direction of R&D, analyse and co-ordinate work related to R&D with various security agencies, including the Israeli Defence Forces (IDF), the Ministry of Defence and various defence industries and organizations; to maintain relations with foreign bodies and organizations in security-related R&D matters; and to operate the Talpiot Program for IDF recruits interested in R&D, as well as other excellence programmes intended to educate and manage human capital in engineering, technological and R&D domains.

The Ministry of Health bears national responsibility for ensuring the health of Israel's population. The Ministry determines policy on matters of health and medical services, and is in charge of planning, supervision, control, licensing and co-ordination of the health system's services. Medical centres (implementation level organizations) in Israel carry out research activities. They usually work closely with the universities, specifically with their medical schools. Research may cover a wide spectrum of subjects such as biomedicine, diagnostics, medical devices, pharmaceuticals, advanced clinical research in targeted fields of high medical relevance, and human clinical trials.

The Prime Minister's Office assists the Prime Minister in his work and co-ordinates inter-ministerial activities in different fields, in accordance with government resolutions and priorities determined by the Prime Minister. The Prime Minister's Office is responsible for setting government policy, determining the agenda for cabinet meetings and co-ordinating government ministry activities. A number of organizations operate within the framework of the Prime Minister's Office, some are integrated in its day-to-day work and others constitute separate, independent units supervised by the office. Relevant SETI organizations working under the auspices of the Prime Minister's Office are the Israel Atomic Energy Commission (IAEC), a policy-promotional-level body, the National Cyber Bureau, at policy-implementation level, and the National Economic Council, which is only punctually involved in the SETI policy cycle, so is not shown on Figure 69.

The Israel Atomic Energy Commission (IAEC) advises the Israeli government in areas of nuclear policy and in setting priorities in nuclear research and development. The IAEC implements governmental policies and represents the State of Israel in international organizations in the nuclear field, such as the International Atomic Energy Agency.

The National Cyber Bureau functions as an advising body for the Prime Minister in the cyber field and promotes the implementation of policy in this field in accordance with the law and government resolutions. The bureau supports basic and applied research in the cyber fields in order to improve Israel's preparedness in dealing with current and future cyber security challenges.

The National Economic Council serves as a co-ordinating body for the Prime Minister on topics which require comprehensive and methodological economic thinking, assists in decision-making processes and is involved in projects on the Prime Minister's agenda and that of the government in general.

Figure 70 describes one of the most important organizations at the policy planning level – OCS in the Ministry of Economy. This body oversees all government-sponsored support for industrial R&D. In 2016, the OCS at the Ministry of Economy was replaced by the National Authority for Technological Innovation (NATI)[59].

The OCS has several promotional level units responsible for operating its domestic R&D programmes and instruments: the R&D fund, pre-seed and seed programmes, encouragement of investment and innovation adoption, and pre-competitive and long-term programmes. The specific domestic implementation-level instruments and programmes of the OCS are presented at the bottom of Figure 70. Some of these

59 As mentioned in page 138 this institutional change took place when we were preparing the proofs of this GO→SPIN country profile.

programmes are designed to encourage collaborations between the business sector, academia and medical centres (e.g. MAGNET instruments). A detailed description of each instrument can be found in the chapter 'Inventory of SETI Operational Policy Instruments in Israel'.

Three additional promotional-level organizations that are affiliated the OCS, as well as with other public organizations, are Israel NewTech, MATIMOP and ISERD.

Israel NewTech is a national programme aimed at promoting Israel's water and sustainable energy sectors. The programme is led by the Ministry of Economy, and is supported by a number of additional government agencies. It helps to advance the water and sustainable energy sectors by supporting academia and research, encouraging implementation in the local market, and by helping Israeli companies to succeed in the international arena[60].

MATIMOP and ISERD are responsible for promoting international partnerships through scientific and industrial co-operation and the creation of joint ventures. MATIMOP is a governmental, non-profit organization acting on behalf of the OCS as the national agency responsible for encouraging and assisting participation of Israeli enterprises in international bilateral or multilateral co-operation programmes for industrial R&D. MATIMOP implements most bilateral R&D co-operation agreements on behalf of the OCS and thus serves as a contact point for various agreements. The OCS through MATIMOP supports international co-operation between companies. This support is conducted on a competitive basis by bi-national funds such as BIRD-F, Canada-Israel R&D Fund, Singapore-Israel R&D Fund and many more (see implementation level instruments in Figure 70.

ISERD (Israel-Europe R&D Directorate for the Framework Programme) aims to promote joint Israeli-EU R&D ventures within the EU's Framework Programmes. ISERD co-ordinates Israel's operation of its bilateral R&D agreements in Europe under the MATIMOP umbrella, Israel's participation in EUREKA, several ERA-NET programmes, as well as other programmes for co-operation in industrial R&D in Europe on behalf of the OCS.

Figure 71 presents the SETI organizations and bodies related to academic research in Israel. Four policy-planning-level organizations are described: the Council for Higher Education (CHE) and its Planning and Budgeting Committee (PBC), IASH, TELEM and the Ministry of Education.

As for these policy-planning-level organizations, the PBC is responsible for allocating budgets among universities and other institutions of higher education. It also supports the Israeli Centres for Research Excellence (I-CORE) Programme. This promotion-level instrument was designed to establish research centres specializing in diverse disciplines. The centres' mission is to strengthen Israel's academic research by encouraging joint research activity between various organizations: universities, colleges, research institutes and individual researchers.

IASH consists of some 100 of Israel's most distinguished scientists and scholars. Its mission is to monitor and promote Israeli intellectual excellence, advise the government on scientific planning, publish research of lasting merit, and maintain active contact with the broader international scientific and scholarly community.

The Minister of Education serves as the Chair of the CHE, thus having influence on policy design. The Minister also nominates the members of the PBC. The important role of TELEM is presented in more detail in Figure 72.

Figure 71 also shows promotion-level institutions, consisting of national and international funds, general funds and private donations to academic institutes.

60 Israel New Tech (2014). URL: http://israelnewtech.gov.il/English/AboutUs/Pages/default.aspx

Among these, the Israel Science Foundation (ISF), supported by the CHE and the Israel Academy of Sciences and Humanities, is a competitive grant for basic research. Its roughly US$ 60 million annual budget funds more than 1 300 grants per year. The ISF awards grants in all fields of exact sciences and technology, life sciences and medicine and humanities and social sciences to Israeli researchers from Israeli universities, other institutions of higher education, research institutes and medical centres.

The United States-Israel Agricultural R&D Fund (BARD) supports competitive applied research and technological development jointly conducted by American and Israeli scientists. During its 30 years of operation, BARD has funded over 1 200 projects with a total investment of more than US$ 300 million.

The US-Israel Binational Science Foundation (BSF) promotes scientific relations between the U.S. and Israel by funding collaborative research projects in a wide area of basic and applied scientific fields, for peaceful and non-profit purposes. Funding for research derives from the annual interest on an endowment contributed in equal parts by the two countries.

The German-Israeli Foundation for Scientific Research and Development (GIF) was established in 1986 in an agreement between the Ministers of Science of the Federal Republic of Germany and the State of Israel, as an additional instrument complementing the continuously fruitful ties in scientific and technological co-operation between the two countries.

Israeli universities and research institutions also have a broad range of cooperative ventures with the EU. Israel was very active in the previous EU's Framework Programme (FP5, FP6, FP7) and recently joined the 77 billion euro Horizon 2020 programme. In 2013, Israel became a full member in the CERN Research Centre, after many years during which Israeli scientists participated in research under Israel's status as an Observer State.

The research universities are implementation-level organizations, and as such their primary role is to produce and provide knowledge through education (teaching) and research (mostly in basic sciences). Universities in Israel have rich and elaborate ties with industry, the government, research organizations, hospitals and medical centres. All seven-research universities have Technology Transfer Offices (TTOs), whose main role is to market, protect and commercialize intellectual property created in the universities.

Figure 72 provides a more detailed presentation of one among the SETI policy-promotion-level institutions that were presented in the Figure 69: The Forum for National Research and Development Infrastructure – TELEM. TELEM is a high-level ad hoc organization, comprised of heads of Israel's major national research-funding organizations: President of the Israel Academy of Sciences and Humanities, Chief Scientist in the OCS, Chair of the PBC of the CHE, Director-General of MOST, the Head of the Research and Development Division of the Ministry of Defence and the Assistant Head of the Budget Department of the Ministry of Finance. Member organizations of TELEM pool their own budgetary resources – and catalyse participation by others – to undertake major joint science and technology initiatives in the national interest. TELEM has played a major role in establishing the Israel National Nanotechnology Initiative (INNI), which provides the needed infrastructure for establishing advanced nanoscience research centres in universities and industry (Israel Academy of Sciences and Humanities, 2013). Other important implementation-level tools, projects and programmes associated with TELEM are the National Bio-Bank, Isragrid, Stem Cells and Brain Research. Due to its advisory role, as well as its funding function, it would be more accurate to locate TELEM at the intermediate stage between the policy planning level and the promotional level.

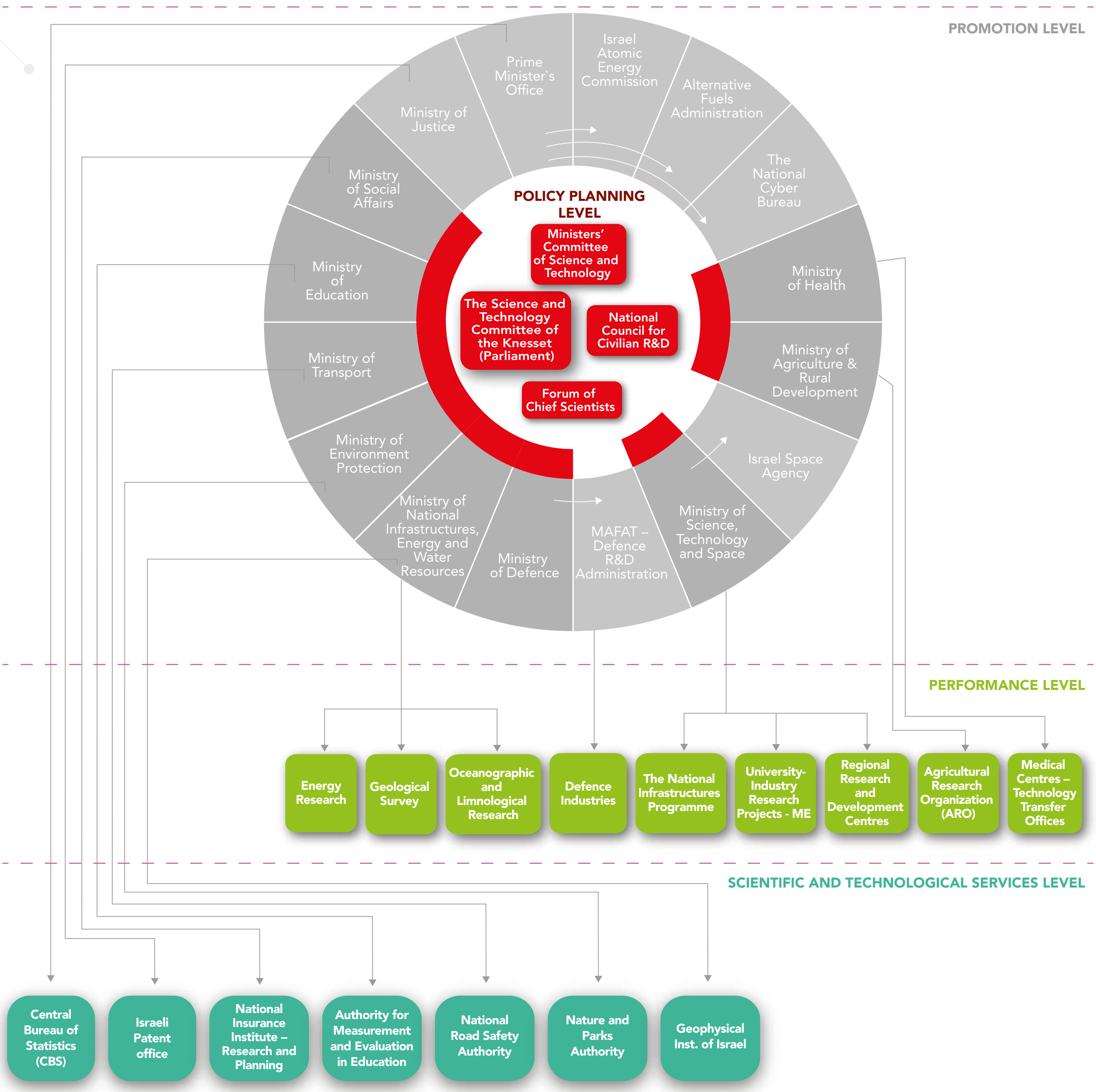


Figure 69: Government R&D organization chart in Israel

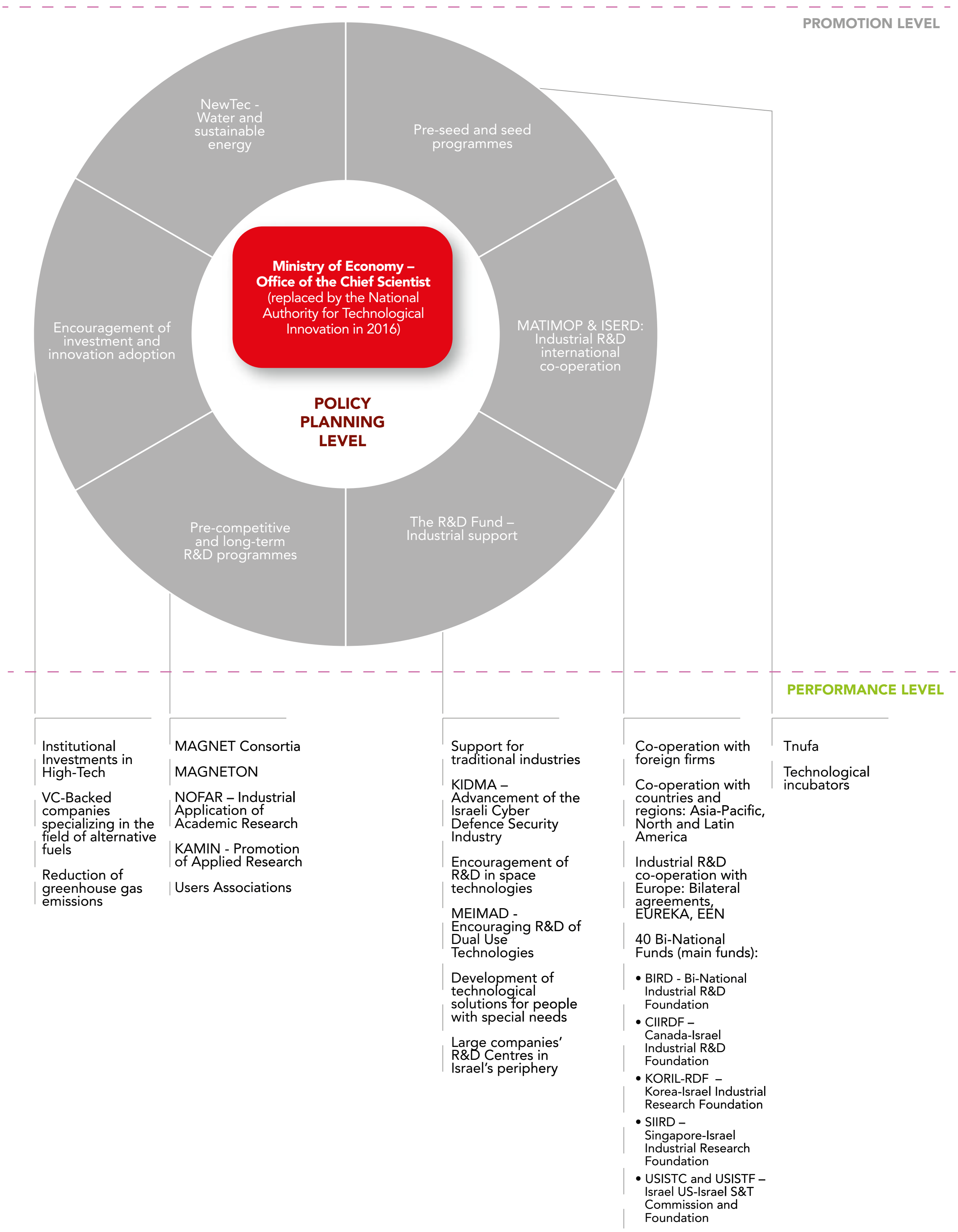
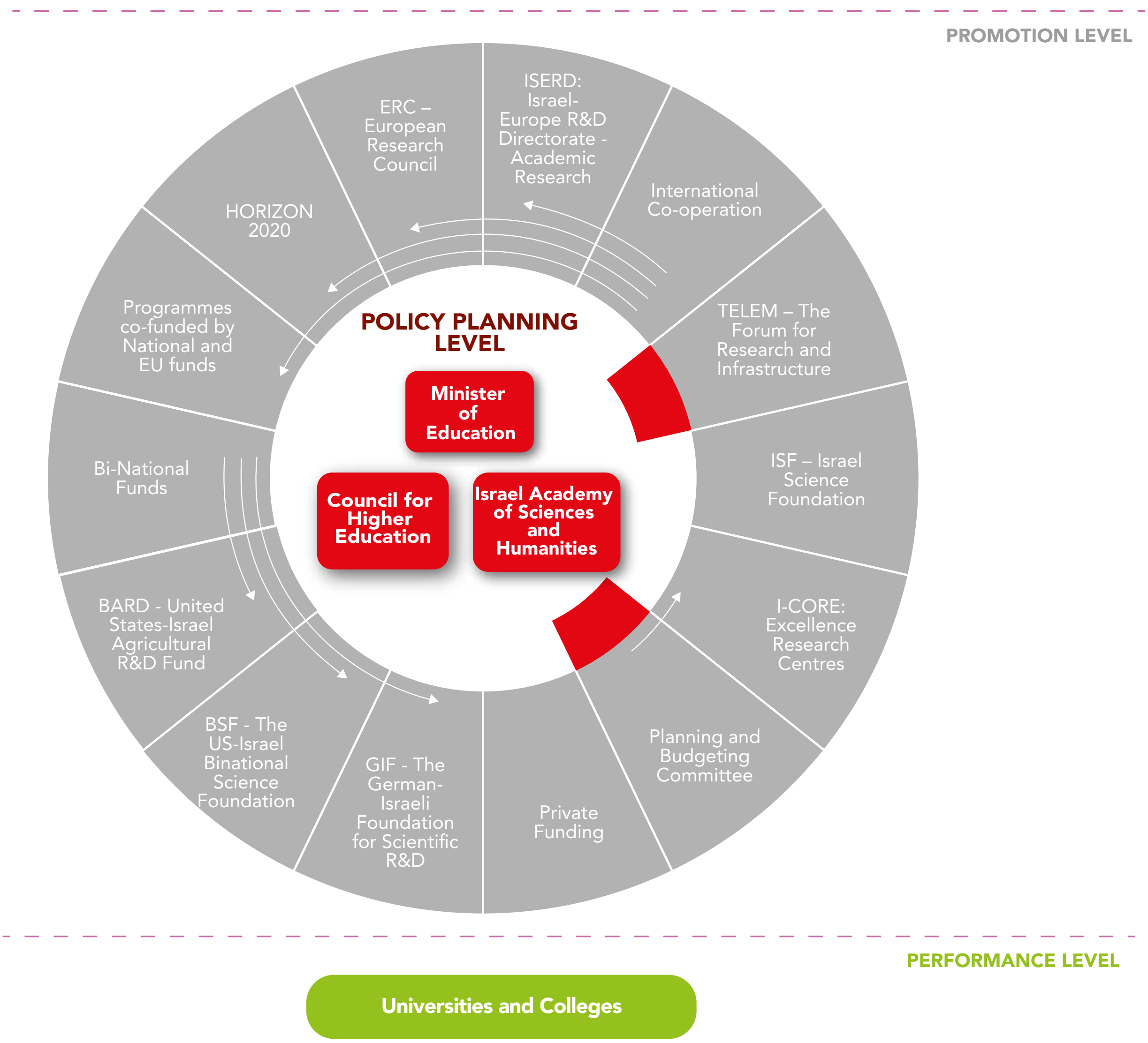


Figure 70: Government organization chart to support business-enterprise R&D in Israel



- Technion – Israel Institute of Technology
- The Hebrew University of Jerusalem
- The Weizmann Institute of Science
- Tel-Aviv University
- Bar-Ilan University
- Ben-Gurion University of the Negev
- The University of Haifa
- The Open University of Israel
- Colleges

Figure 71: Higher education R&D organization chart in Israel

Figure 72: Organization chart to support R&D infrastructure in Israel

BOX 19 – RESEARCH INFRASTRUCTURES IN ISRAEL

In recent years, Western governments place a growing attention to developing state-of-the-art research infrastructures at national, regional and international levels. These infrastructures are seen as catalyzers for economic growth, and as an important foundation for intensifying and fostering scientific and technological development.

In the last decade countries and international organizations have established strategies for identifying and mapping national and international research infrastructures. The term 'research infrastructure' refers to facilities, resources and related services used by the scientific communities to conduct top-level research in the various scientific fields, ranging from social sciences to astronomy, genomics to nanotechnology. For example, at the international level, the European Strategy Forum on Research Infrastructures (ESFRI) provides—for those countries it concerns— a roadmap to enable a coherent and strategy-led approach to policy-making that pertains to research infrastructure, and to encourage the best use and development of these facilities.

In 2009, the NCCRD in MOST launched an initial study for mapping Israeli research infrastructures. The study was conducted by the Samuel Neaman Institute for National Policy Research (SNI). The initial goal of the study was to establish a Research Infrastructure Database that will serve the research community in Israel.

The SNI study (Getz *et al.*, 2013a) presented detailed information on 120 research infrastructures in Israel's academy and industry. In addition, it inventoried international research infrastructures in which Israel participates, including: CERN – European Organization for Nuclear Research in Geneva; ESRF – European Synchrotron Radiation Facility in Grenoble; SESAME – Synchrotron-light for Experimental Science and Applications in the Middle East, currently being established in Jordan; GÉANT – Gigabit European Academic Network; EMBL – European Molecular Biology Laboratory; INSTRUCT – network of structural biology labs; ELIXIR – European life-sciences Infrastructure for biological Information; SHARE – Survey of Health, Ageing and Retirement in Europe; and ESSurvey – European Sociological Survey (the last four infrastructures also appear in the ESFRI roadmap). The SNI study identified national research infrastructures in three scientific domains: nanotechnology, brain research and genomics/proteomics. The importance of this extensive mapping exercise was that it provided a basis upon which a strategic roadmap and national policy on national research infrastructure in Israel could be formulated.

In 2013, the Planning and Budgeting Committee of the Council for Higher Education (PBC) decided to formulate a strategic roadmap for national research infrastructures that includes medium and long-term policy goals. This work aimed at selecting and prioritizing existing research infrastructures in need of upgrading, as well as identifying what new infrastructures are needed. To achieve these ends and to promote new partnerships in international research infrastructures, the PBC appointed an advisory committee for major research infrastructures in the academy.

As a result, the PBC published a roadmap for large research infrastructures in the Israeli higher education institutes. Table 39 shows a classification of these research infrastructures, shown according to relevant field of research.

Table 39: Classification of research infrastructures against scientific fields

Field	Infrastructure description
Physical sciences and engineering	Israel membership in ESO – European Southern Observatory
Life sciences and medicine	Center for Genetically Modified Mice Plant Genomics Center
Energy	Central carbon-based alternative hydrogen fuels Research facility utilizing solar radiation
Humanities and social sciences	Membership in the European Social Survey Historical dictionary of the Hebrew language: interim period The Israeli database of social sciences Membership in the Survey of Health, Ageing and Retirement in Europe (SHARE) CBS rooms: remote access system to the research room of the Central Bureau of Statistics.
Computing and communication	Cloud computing service unit

Source: Getz *et al.*, 2013a

The PBC also decided on the principles for implementing the roadmap and for developing the proposed infrastructures. For each infrastructure, a team will ensure the roadmap's implementation, keeping within the budget allocated by the PBC; this same team will explore possible partnerships, and manage needs that arise during implementation.

Daphne Getz
Senior Research Fellow,
Head of the Center for Science, Technology & Innovation Policy
Samuel Neaman Institute, Haifa

Inventory of the SETI institutions in Israel

LIST OF SETI INSTITUTIONS IN ISRAEL

The Israel Academy of Sciences and Humanities (IASH)

Israel Science Foundation (ISF)

The Council for Higher Education (CHE) and the Planning and Budgeting Committee (PBC)

The Hebrew University of Jerusalem

Technion – Israel Institute of Technology

Weizmann Institute of Science

Bar Ilan University

Ben-Gurion University of the Negev

Tel Aviv University

University of Haifa

The Open University of Israel

National Council for Civilian R&D (NCCRD)

Office of the Chief Scientist (OCS), Ministry of Economy

The Israel National Nanotechnology Initiative (INNI)

The MAGNET Administration

MATIMOP

Israel-Europe R&D Directorate (ISERD)

Chief Scientist Unit – Ministry of Science, Technology and Space

Chief Scientist of the Ministry of National Infrastructures, Energy and Water Resources

Chief Scientist of the Ministry of Environmental Protection

Chief Scientist of the Ministry of Education

Chief Scientist of the Ministry of Agriculture and Rural Development

Chief Scientist of Ministry of Transport and Road Safety

Higher Education and R&D Sector, Budget Division in Ministry of Finance

National Cyber Bureau

The National Economic Council

National Authority for Measurement and Evaluation in Education (RAMA)

The Central Bureau of Statistics (CBS)

Bank of Israel

Israel Patent Office

The Agricultural Research Organization (ARO)

Israel Oceanographic and Limnological Research (IOLR)

The Geophysical Institute of Israel (GII)

The Israel Geological Survey (GSI)

Israel Nature and Parks Authority (INPA)

The Israel Academy of Sciences and Humanities		
Organization details		
Address:	43 Jabotinsky St., Albert Einstein Square, P. O. Box 4040, Jerusalem, 91040, Israel	
Telephone number:	972-2-5676222	
Website:	URL: http://www.academy.ac.il/	
Contact person:	Meir Zadok	
Surname and first name of the executive head:	Nili Cohen	
Official administrative title of the executive head:	President of the Israel Academy of Sciences and Humanities	
E-mail address:	nilico@post.tau.ac.il	
Year of establishment of the organization:	1961	
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Bob Lapidot	
Number of professional staff:	Men n/a Women n/a	
Last annual budget:	NIS 30 230 000 Budget year: 2014	
SETI activities of the organization		
References of main legislative texts governing the organization in the context of SETI activities: • Israel Academy of Sciences and Humanities Law: URL: URL: http://www.academy.ac.il/english/asp/about/about_law_body.html		
Objectives and responsibilities in the context of SETI activities: As stated in the Israel Academy of Sciences and Humanities Law, the goals of the Israel Academy of Sciences and Humanities are: (1) to enlist as its members distinguished scholars and scientists resident in Israel; (2) to cultivate and promote scholarly and scientific endeavour; (3) to advise the government on activities relating to research and scientific planning of national significance; (4) to maintain contact with parallel bodies abroad; (5) to ensure the representation of Israeli scholarship and science in international institutes and conferences; 6) to publish literature intended to promote academic research and science and (7) to engage in any other activity intended to promote the previously mentioned objectives. For more details, see Box 15 (pages 132–133).		
Priority level of the following functions:		
Planning/programming/budgeting of SETI activities:	Highest priority	
Promotion/financing/co-ordination of SETI activities	Highest priority	
Application and transfer of SETI activities	Low priority	
Assessment of SETI activities	Highest priority	
Advocacy of SETI activities	Highest priority	
General policy advice	Highest priority	
Network of relationships in the country (SETI activities):		
Upstream linkage	n/a	
Downstream linkage	Forum for National R&D Infrastructure (TELEM)	
Collateral linkage	Ministry of Education	
Frequency of professional contacts with the following organizations:		
Organizations of the UN system	Occasional	
Other intergovernmental organizations	Occasional	
International non-governmental organizations	Regular	
National SETI policy bodies in foreign countries	Highly frequent	
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Highly frequent	
The future challenges of the organization with regards to SETI policy:		
Challenge	Proposed policy tool / instrument	Explanation
Building a network of international scientific collaborations as a means of addressing the call for academic boycott of Israel	Fostering and nurturing professional ties between Israeli and foreign researchers, with an emphasis on strengthening ties between young scholars.	Academic boycott of Israeli universities constitutes a cardinal threat to Israeli science and R&D, as contemporary, high-quality research is largely based on work conducted within international multidisciplinary teams. In the past decades, Israeli Academia has succeeded in opening to the world and this was one of the secrets of its success. Political boycotts may jeopardize future international scientific collaborations of Israeli scholars with their peers around the world.
Identifying the technological infrastructure needed for the advancement of the Israeli academia in the near future and initiating investments in new scientific fields.	Existing TELEM instruments	The initiation of investments in new scientific infrastructure was one of the key contributions of the Israeli Academy of Sciences and Humanities in recent years. The TELEM forum was active in funding basic and applied Nanotechnology research in the six nanotechnology centres in the research universities, funding Life-Sciences R&D supporting-equipment purchase grants, and in supporting the national bio-bank. This important support will continue during the coming years.
SETI policy publications of the organization: Science policy: URL: URL: http://www.academy.ac.il/english/asp/projects/projects_body.asp?project_id=35		
Additional comments: n/a		

Israel Science Foundation (ISF)		
Organization details		
Address:	43 Jabotinsky Street Jerusalem, 91040, Israel	
Telephone number:	972-2-5885404	
Website:	www.isf.org.il	
Contact person:	Lilach Baruch	
Surname and first name of the executive head:	Tamar Jaffe-Mittwoch	
Official administrative title of the executive head:	Director General	
E-mail address:	lilach@isf.org.il	
Year of establishment of the organization:	1995	
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Lilach Baruch	
Number of professional staff:	Men 01 Women 23	
Last annual budget:	NIS 500 000 000 Budget year: 2014	
SETI activities of the organization		
References of main legislative texts governing the organization in the context of SETI activities: • URL: http://www.isf.org.il/downloads/takanon.pdf		
Objectives and responsibilities in the context of SETI activities: URL: http://www.isf.org.il/downloads/takanon.pdf		
Priority level of the following functions:		
Planning/programming/budgeting of SETI activities	High priority	
Promotion/financing/co-ordination of SETI activities	Highest priority	
Application and transfer of SETI activities	High priority	
Assessment of SETI activities	Highest priority	
Advocacy of SETI activities	Low priority	
General policy advice	High priority	
Network of relationships in the country (SETI activities):		
Upstream linkage	Planning and Budgeting Committee of the Council for Higher Education	
Downstream linkage	Mainly universities, academic hospitals, research institutions and colleges	
Collateral linkage	n/a	
Frequency of professional contacts with the following organizations:		
Organizations of the UN system	n/a	
Other intergovernmental organizations	Occasional	
International non-governmental organizations	Regular	
National SETI policy bodies in foreign countries	Highly frequent	
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Highly frequent	
The future challenges of the organization with regards to SETI policy:		
Challenge	Proposed policy tool / instrument	Explanation
Increase budget	Increase grant size	n/a
Infrastructure	Get allocation earmarked for infrastructure	n/a
SETI policy publications of the organization: URL: http://www.isf.org.il/downloads/keren2013.pdf		
Additional comments: n/a		

The Council for Higher Education (CHE) and The Planning and Budgeting Committee (PBC)	
Organization details	
Address:	43 Jabotinsky St., P. O. Box 4037, Jerusalem, 91040, Israel
Telephone number:	972-2-5094500/02
Website:	URL: http://che.org.il/en/
Contact person:	Liat Maoz
Surname and first name of the executive head:	Rivka Wadmany Shauman and Yaffa Zilbershats
Official administrative title of the executive head:	Rivka Wadmany Shauman: Vice chair of CHE; Yaffa Zilbershats: Chairman, PBC
E-mail address:	Rivka_wad@smkb.ac.il; LishcaSec@che.org.il
Year of establishment of the organization:	CHE-1958 PBC-1977
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Liat Maoz
Number of professional staff:	Men 26 Women 72
Last annual budget (PBC):	NIS 9 000 000 000 Budget year: 2014

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- The Council for Higher Education was established by the Council for Higher Education Law 1958
- The establishment of the PBC was approved by the Government on June 6, 1976, in Decision no. 666

Objectives and responsibilities in the context of SETI activities:
(1) setting policy in fundamental issues while ensuring the independence of the higher education system, the development and preservation of its quality, and at the same time recognizing the diverse characteristics of the institutions of higher education and of the student population in Israel, and (2) Proposing higher education budgets, taking into consideration the needs of society and the State and while safeguarding academic freedom and with due diligence for research and instruction.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	High priority

Network of relationships in the country (SETI activities):

Upstream linkage	Ministry of Finance; Ministry of Education
Downstream linkage	Universities and colleges; ISERD
Collateral linkage	Israel Science Foundation (ISF); Israel Academy of Sciences and Humanities (ASH); Ministry of Science, Technology and Space (MOST)

Frequency of professional contacts with the following organizations:

Organizations of the UN system	n/a
Other intergovernmental organizations	Regular
International non-governmental organizations	Highly frequent
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Regular

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
New Research Infrastructures	Roadmap – examining and prioritizing needs for new infrastructure	n/a
Initiating strategic collaboration in Israel and abroad	Research cooperation programmes	n/a
Recruiting New Staff	I-core , ISF	n/a
Expanding access to higher education	Special programmes for diverse populations: Arabs, Jewish Orthodox, Women etc.	n/a

SETI policy publications of the organization:
Legislation, in Hebrew: URL: http://che.org.il/?page_id=730 Pluralism and Equal Opportunity in Higher Education: URL: http://che.org.il/wp-content/uploads/2013/03/Pluralism-and-equal-opportunities-in-higher-education-FINAL.pdf

Additional comments: n/a

The Hebrew University of Jerusalem	
Organization details	
Address:	Mt. Scopus, Jerusalem 9190501, Israel
Telephone number:	972-2-5882903
Website:	URL: http://new.huji.ac.il/en
Contact person:	Isaiah Arkin
Surname and first name of the executive head:	Menahem Ben-Sasson
Official administrative title of the executive head:	President, The Hebrew University of Jerusalem
E-mail address:	hupres@savion.huji.ac.il
Year of establishment of the organization:	1918
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Vice President for Research and Development
Number of professional staff:	Men 658 Women 247
Last annual budget:	NIS 18 38 641 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:

- URL: http://new.huji.ac.il/en/page/472

Objectives and responsibilities in the context of SETI activities:
The University's research policy aims to increase the scope of the research activities, to improve scientific output and efficiency, in accordance with the interests and resources of the institution. This policy aims: to increase the number of faculty members conducting research to increase the range of areas under investigation, to increase the scope of specialization of each individual researcher, to increase the number and quality of publications and patents, to improve the ratio between investment and output in scientific activity, and to commercially exploit maximally the products of the research. These goals are sought within the framework of available Israeli and international research funding and by utilizing the University's scientific infrastructure, facilities and equipment, subject to the relevant laws and regulations governing research in Israel and the University. For a description of the university's undergraduate and post-graduate programmes, see Annex 1.

Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):	
Upstream linkage	Council for Higher Education/Planning and Budgeting Committee
Downstream linkage	n/a
Collateral linkage	Other Israeli universities

Frequency of professional contacts with the following organizations:	
Organizations of the UN system	n/a
Other intergovernmental organizations	n/a
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	n/a
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
The Authority for Research and Development: https://ard.huji.ac.il/

Additional comments: n/a

Technion – Israel Institute of Technology	
Organization details	
Address:	Technion City, Haifa, 3200003, Israel
Telephone number:	972-4-8295555
Website:	URL: http://www.technion.ac.il/en/
Contact person:	Oded Shmueli
Surname and first name of the executive head:	Peretz Lavie
Official administrative title of the executive head:	President
E-mail address:	president@technion.ac.il
Year of establishment of the organization:	1912
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Executive Vice President for Research
Number of professional staff:	Men 436 Women 123
Last annual budget:	NIS 1 338 464 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- https://law.net.technion.ac.il/files/2012/11/Constitution-and-Bylaws-English-Final-5.9.12.pdf

Objectives and responsibilities in the context of SETI activities:
(1) to disseminate knowledge through teaching and the advancement of research in pure and applied science, engineering, architecture, technology, medicine and related activities including the humanities, social sciences and education; (2) to impart to its students a broad general education; (3) to serve the State of Israel and its economy, industry and government, with counsel, research and other appropriate means, and to serve the people of Israel by the provision of sets of courses and lectures, the publication of books and by similar activities in the areas specified above. For a description of the university's undergraduate and post-graduate programmes, see Annex 1.

Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):	
Upstream linkage	Council for Higher Education/Planning and Budgeting Committee
Downstream linkage	n/a
Collateral linkage	Other Israeli universities

Frequency of professional contacts with the following organizations:	
Organizations of the UN system	Occasional
Other intergovernmental organizations	Occasional
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

- SETI policy publications of the organization:
- Office of the Executive Vice President for Research: URL: http://www.admin.technion.ac.il/manlam/defaultEng.htm
- Faculty Research: URL: http://www.technion.ac.il/en/faculty-research/
- Technion Research & Development Foundation Ltd. URL: http://www.trdf.co.il/eng/
- Code for Responsible Conduct of Research at URL: http://www.admin.technion.ac.il/Manlam/Nehalim/Code%20for%20Responsible%20Conduct%20of%20Research%20-%20RCR.pdf
- Regulations for Conflict of Interests in Research at URL: http://www.admin.technion.ac.il/Manlam/Nehalim/Regulations%20for%20Conflict%20of%20Interest%20in%20Research.pdf

Additional comments: n/a

Weizmann Institute of Science		
Organization details		
Address:	234 Herzl Street, Rehovot, 7610001, Israel	
Telephone number:	972-8-9343111	
Website:	URL: http://www.weizmann.ac.il/	
Contact person:	Haim Garty	
Surname and first name of the executive head:	Daniel Zajfman	
Official administrative title of the executive head:	President of the Weizmann Institute of Science	
E-mail address:	daniel.zajfman@weizmann.ac.il	
Year of establishment of the organization:	1949	
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Vice President's office	
Number of professional staff:	Men 230 Women 43	
Last annual budget:	NIS 1 326 760 000 Budget year: 2014	
SETI activities of the organization		
References of main legislative texts governing the organization in the context of SETI activities: n/a		
Objectives and responsibilities in the context of SETI activities: The Weizmann Institute does not have SETI policy. Its only policy is to recruit the best people it can identify and allow them full freedom in choosing their research topics. The management does not direct research. It responds to scientific needs submitted by faculty members. Evaluation of research activity is done through international panel of experts. For a description of the university's undergraduate and post-graduate programmes, see Annex 1.		
Priority level of the following functions:		
Planning/programming/budgeting of SETI activities	Low priority	
Promotion/financing/co-ordination of SETI activities	Low priority	
Application and transfer of SETI activities	n/a	
Assessment of SETI activities	Highest priority	
Advocacy of SETI activities	Low priority	
General policy advice	Low priority	
Network of relationships in the country (SETI activities):		
Upstream linkage	Council for Higher Education/Planning and Budgeting Committee	
Downstream linkage	n/a	
Collateral linkage	Other Israeli universities	
Frequency of professional contacts with the following organizations:		
Organizations of the UN system	Occasional	
Other intergovernmental organizations	Occasional	
International non-governmental organizations	Occasional	
National SETI policy bodies in foreign countries	Occasional	
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional	
The future challenges of the organization with regards to SETI policy:		
Challenge	Proposed policy tool / instrument	Explanation
The only challenge of the Weizmann Institute is to recruit excellent faculty and provide them with the financial means and infrastructure to carry out their research plans	Searching for promising candidates and actively fund-raising	n/a
SETI policy publications of the organization: Technology Transfer Company of the Weizmann Institute of Science: URL: http://www.yedarnd.com/		
Additional comments: n/a		

Bar Ilan University	
Organization details	
Address:	Bar-Ilan University, Ramat-Gan 5290002, Israel
Telephone number:	972-3-5318111
Website:	URL: http://www1.biu.ac.il/indexE.php
Contact person:	Benjamin Ehrenberg, Vice President for Research
Surname and first name of the executive head:	Rabbi Daniel Hershkowitz
Official administrative title of the executive head:	President of the university
E-mail address:	President.office@mail.biu.ac.il
Year of establishment of the organization:	1955
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Vice President for Research
Number of professional staff:	Men 690 Women 498
Last annual budget:	NIS 1 007 856 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
n/a

Objectives and responsibilities in the context of SETI activities:
Bar-Ilan University, Israel's largest academic community of students, scientists and staff (32 000 in total), seeks to produce students of moral and intellectual aptitude; students who adopt the highest standards of excellence in scientific and academic research; and students who bear a deep commitment to Jewish community. The unique Bar-Ilan formula: blend tradition with modern technologies and scholarship, and teach the compelling ethics of Jewish heritage to all. The university's leading resources of Jewish knowledge create a special responsibility: to place the expertise of its researchers at the disposal of the global Jewish and academic communities. For a description of the university's undergraduate and post-graduate programmes, see Annex 1.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):

Upstream linkage	Council for Higher Education/Planning and Budgeting Committee
Downstream linkage	n/a
Collateral linkage	Other Israeli universities

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Occasional
Other intergovernmental organizations	Regular
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Regular

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
- Bar Ilan University Research Authority: URL: http://research.biu.ac.il/
- Science and technology Series: URL: http://www1.biu.ac.il/indexE.php?id=7702&pt=29&pid=41&level=3&cPath=7702
- Bar-Ilan Research & Development Company Ltd.(BIRAD): URL: http://www.biu.ac.il/birnd/

Additional comments: n/a

Ben-Gurion University of the Negev	
Organization details	
Address:	P. O. Box 653 Beer-Sheva, 8410501, Israel
Telephone number:	972-8-6461111
Website:	URL: http://in.bgu.ac.il/en/Pages/default.aspx
Contact person:	Dan Blumberg
Surname and first name of the executive head:	Rivka Carmi
Official administrative title of the executive head:	President of Ben-Gurion University of the Negev
E-mail address:	president@bgu.ac.il
Year of establishment of the organization:	1969
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	The Office of International Academic Affairs
Number of professional staff:	Men 544 Women 195
Last annual budget:	NIS 1 213 593 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:

- URL: http://in.bgu.ac.il/executive-committee/DocLib/rules.pdf (Hebrew)

Objectives and responsibilities in the context of SETI activities:
Ben-Gurion University of the Negev aspires to be among the best inter-disciplinary research universities in the world, a leader in scientific innovation, inter-disciplinary research and applied sciences – all of which affect daily life. It is committed to social and environmental responsibility and is working to develop the Negev, Israel and the world. The University attracts excellent students and researchers from Israel and abroad, original thinkers with a developed social conscience, who integrate into the country's leadership in a variety of ways. For a description of the university's undergraduate and post-graduate programmes, see Annex 1.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	High priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):

Upstream linkage	Council for Higher Education/Planning and Budgeting Committee
Downstream linkage	BGN Technologies Ltd. – Technology Transfer Company of Ben-Gurion University
Collateral linkage	Other Israeli universities

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Occasional
Other intergovernmental organizations	Highly frequent
International non-governmental organizations	Regular
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Regular

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
Research and Development at Ben-Gurion University of the Negev:

- URL: http://in.bgu.ac.il/en/Pages/research.aspx
- URL: http://cmsprod.bgu.ac.il/eng/BGN1
- URL: http://in.bgu.ac.il/President%20Report/PR_2014.pdf
- URL: http://in.bgu.ac.il/en/Pages/publications.aspx
- URL: http://issuu.com/image2u/docs/r_d2013_high

Additional comments: n/a

Tel Aviv University

Organization details

Address:	P.O. Box 39040, Tel Aviv 6997801, Israel
Telephone number:	972-3-6408111
Website:	URL: http://english.tau.ac.il/
Contact person:	Yoav Henis
Surname and first name of the executive head:	Joseph Klafter
Official administrative title of the executive head:	President of Tel Aviv University
E-mail address:	office.president@tauex.tau.ac.il
Year of establishment of the organization:	1953
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Vice President for Research and Development
Number of professional staff:	Men 722 Women 309
Last annual budget:	NIS 2 112 618 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:

- URL: http://www20.tau.ac.il/yoets/constitution-eng.pdf

Objectives and responsibilities in the context of SETI activities:

The University shall be empowered to engage in research, instruction, and any activity for the advancement and dissemination of science and culture, and in particular: (1) to establish, maintain and administer educational and research units, institutes, laboratories, hospitals, publishing houses, libraries, collections and museums, botanical and zoological gardens and sporting facilities, and to engage in all scientific, educational, administrative or managerial activities requisite therefor; (2) to establish programmes for research and instruction, methods of instruction and study, and rules for the admission of students; (3) to employ a staff of academic and administrative personnel, both permanent and temporary; to appoint teachers, researchers and administrators, and to determine their ranks; (4) to make academic appointments and award academic degrees, diplomas and certificates; (5) to confer honorary degrees and other honours in special circumstances; (6) to award scholarships, grants and prizes; (7) to co-operate with other institutions of research and instruction, to associate with them or to incorporate them; (8) to publish and use the results of research in any manner; (9) to encourage and organize educational activities for the general public; (10) to prescribe rules and procedures for all its units and institutions, and to supervise discipline among its personnel and students; (11) to encourage sport and recreational activities and any other activities for the advancement of the health, well-being and comfort of its personnel and students; (12) to establish and participate in associations, corporations, trusts and funds; (13) to receive allocations, grants, gifts, donations, bequests and loans; (14) to collect tuition fees and other charges for research, instruction or any other service rendered. For a description of the university's undergraduate and post-graduate programmes, see Annex 1.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):

Upstream linkage	Council for Higher Education/Planning and Budgeting Committee
Downstream linkage	n/a
Collateral linkage	Other Israeli universities

Frequency of professional contacts with the following organizations:

Organizations of the UN system	n/a
Other intergovernmental organizations	n/a
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	n/a
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Recruiting young faculty	Increasing the visibility of TAU and providing required infrastructure (mainly labs and seed support)	n/a
Competitive IP policy	Amending current IP policy the meet the needs of both faculty and TAU at the same time	n/a
Expanding the scope of international research collaboration	More institutional support, joint workshops,	n/a
Extracting commercialization potential	Reorganization of RAMOT (TAU's technology transfer company), expanding the scope of industry services	n/a
Expanding interdisciplinary research	Establishing a new school of brain science, increasing the scope and reach of other interdisciplinary unit (e.g.: Nano Centre, School of Environment)	n/a

SETI policy publications of the organization:

- Research Authority (general information in English), URL: http://english.tau.ac.il/research_authority
- Research Authority (Hebrew Website), URL: http://www5.tau.ac.il/Research-Authority/ Technology Transfer Arm, URL: http://english.tau.ac.il/ramot_en

Additional comments: n/a

University of Haifa	
Organization details	
Address:	199 Aba Khoushy Ave., Mount Carmel, Haifa, Israel
Telephone number:	972-4-8240111
Website:	URL: http://www.haifa.ac.il/index.php/en/
Contact person:	Michal Yerushalmy
Surname and first name of the executive head:	Amos Shapira
Official administrative title of the executive head:	President of the University of Haifa
E-mail address:	a.shapira@univ.haifa.ac.il
Year of establishment of the organization:	1963
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Vice President and Dean of Research
Number of professional staff:	Men 303 Women 202
Last annual budget:	NIS 766 133 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:

- URL: http://www.haifa.ac.il/images/pdf/constitution_heb1.pdf (Hebrew)
- URL: http://ra2.haifa.ac.il/index.php/en/policy-a-compliance-4/institutional-constitution.html

Objectives and responsibilities in the context of SETI activities:
(1) to serve as a leading centre of learning, teaching, and acquisition of knowledge through research and promulgation of this knowledge utilizing various means, including teaching, publications, conferences and the training of an academic reserve to benefit the public in the future, and to serve as a centre for education and culture, while aspiring to excellence in all areas; (2) To assist in shaping the spiritual and social image of the State of Israel by encouraging academic studies, including Jewish Studies; and by fostering and establishing national cultural and general human values; (3) To increase co-operation with research and academic institutions in Israel and throughout the world, particularly other leading institutions of higher education and research and (4) To establish and consolidate an academic community based on co-operation and mutual respect among its academic faculty, students and administrative staff. For a description of the university's undergraduate and post-graduate programmes, see Annex 1.

Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):	
Upstream linkage	Council for Higher Education/Planning and Budgeting Committee
Downstream linkage	n/a
Collateral linkage	Other Israeli universities

Frequency of professional contacts with the following organizations:	
Organizations of the UN system	n/a
Other intergovernmental organizations	n/a
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	n/a
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:

- Haifa University Research Authority Portal: URL: http://ra2.haifa.ac.il/index.php/en/

Additional comments: n/a

The Open University of Israel	
Organization details	
Address:	1 University Road, P. O. Box 808 Raanana, 4353701, Israel
Telephone number:	972-9-7782222
Website:	URL: http://www-e.openu.ac.il/
Contact person:	Anat Barnea
Surname and first name of the executive head:	Kobi Metzer
Official administrative title of the executive head:	President of the Open University
E-mail address:	president_office@openu.ac.il
Year of establishment of the organization:	1974
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Miriam C. Souroujon
Number of professional staff:	Men n/a Women n/a
Last annual budget:	NIS 593 479 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- URL: http://www.openu.ac.il/Download/hukatakanon2010.pdf (in Hebrew)

Objectives and responsibilities in the context of SETI activities:
Research activity is at the heart of the academic endeavour at the Open University of Israel and plays a pivotal role in maintaining high levels of course development and teaching. Faculty members' continual involvement in their fields of research ensures that the courses and study programmes they develop – whether for undergraduate or higher degrees – provide an accurate and updated view of the area of study. The university strives to recruit and support faculty members with the strongest possible research capacities. Faculty members at the Open University deal in a broad range of research areas representing various fields of knowledge in the social sciences, humanities, natural sciences, engineering and the exact sciences. They work independently or in cooperation with faculty members from other universities in Israel and abroad, and exercise complete freedom in their professional decisions. Many of them have won international recognition and are considered leaders in their research area. Open University researchers apply for and win research grants from competitive local and international funds. Their research outputs are disseminated to the scientific community through conference presentations, scientific publications and, where applicable, patents, with the aim of transmitting scientific knowledge that benefits the academic community and enhancing Israel's development. For a description of the university's undergraduate and post-graduate programmes, see Annex 1.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	Highest priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	Low priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):

Upstream linkage	Council for Higher Education/Planning and Budgeting Committee
Downstream linkage	n/a
Collateral linkage	Other Israeli universities

Frequency of professional contacts with the following organizations:

Organizations of the UN system	n/a
Other intergovernmental organizations	n/a
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	n/a
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
- Research at the open university, URL: http://www-e.openu.ac.il/research/index.html
- Research authority, URL: http://www-e.openu.ac.il/research/p3.html
- Technology Transfer, URL: http://www-e.openu.ac.il/research/p11.html
- Research code of ethics, URL: http://www-e.openu.ac.il/research/p9.html

Additional comments: n/a

National Council for Civilian R&D (NCCRD)	
Organization details	
Address:	3 Clermont-Ganneau street, Jerusalem, 91490, Israel
Telephone number:	972-2- 5411101
Website:	URL: http://most.gov.il/Molmop/Pages/default.aspx
Contact person:	Yael Goren-Hezkiya
Surname and first name of the executive head:	Isaac Ben Israel
Official administrative title of the executive head:	Chairman
E-mail address:	ncyaelgorenhezkiya@gmail.com
Year of establishment of the organization:	2004
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Isaac Ben Israel
Number of professional staff:	Men 08 Women 04
Last annual budget:	NIS 9 075 000 Budget year: 2011

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- URL: http://www.moital.gov.il/NR/exeres/9F263279-B1F7-4E42-828A-4B84160F7684.htm
- URL: http://most.gov.il/Molmop/Documents/law.pdf

Objectives and responsibilities in the context of SETI activities:
(1) to advise the government of Israel with regard to the organization and regulation of civilian research and development, and with regard to the allocation of budgets for its enhancement; (2) to recommend to the government guidelines for a comprehensive national policy, annual as well as long-term, in the area of civilian research and development; (3) to recommend to the government fields of national priority in the area of civilian research and development; (4) to recommend to the government the establishment of needed scientific infrastructure, and the implementation of scientific and technological projects of national priority; (5) to recommend to the government and other relevant authorities in the area of governmental research and development, including the establishment of government research institutes, and to make recommendations for the appointment of chief scientists in government ministries, and the appointment of heads of governmental research institutes.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Low priority
Promotion/financing/co-ordination of SETI activities	Low priority
Application and transfer of SETI activities	Low priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	Highest priority
General policy advice	Highest priority

Network of relationships in the country (SETI activities):

Upstream linkage	The Ministry of Science, Technology and Space
Downstream linkage	n/a
Collateral linkage	n/a

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Occasional
Other intergovernmental organizations	Occasional
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Promoting research and development in Israel	Reports, Articles, Publications	n/a

SETI policy publications of the organization:
- URL: http://most.gov.il/Molmop/Reports/Pages/default.aspx

Additional comments: n/a

Office of the Chief Scientist (OCS), Ministry of Economy	
Organization details	
Address:	5 BANK ISRAEL ST., P.O. Box 3166, JERUSALEM. 91036, ISRAEL
Telephone number:	972-2-6662485/6
Website:	URL: http://moital.gov.il/CmsTamat/Rsrc/MadaanEnglish/MadaanEnglish.html
Contact person:	Avi Hasson
Surname and first name of the executive head:	Avi Hasson
Official administrative title of the executive head:	Chief Scientist
E-mail address:	Hasson@ocs.economy.gov.il
Year of establishment of the organization:	1971
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	MATIMOP
Number of professional staff:	Men 35 Women 40
Last annual budget:	NIS 3 061 901 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- URL: http://www.moital.gov.il/NR/exeres/9F263279-B1F7-4E42-828A-4B84160F7684.htm

Objectives and responsibilities in the context of SETI activities:
The Office of the Chief Scientist (OCS) in the Ministry of Economy, empowered by the Law for the Encouragement of Industrial Research & Development – 1984 (R&D Law), oversees all Government sponsored support of R&D in Israeli industry. This broad-spectrum support stimulates the development of innovative state-of-the-art technologies, enhances the competitive power of industry in the high-tech global market, creates employment opportunities and assists in redressing Israel's balance of payments. In addition to its domestic activities, the OCS is involved in a myriad of bi- and multinational industrial R&D agreements. The OCS annually supports hundreds of projects, from incipient concepts within a pre-seed framework followed by support of incubator and start-up companies to autonomous industrial R&D enterprises. The support is directed toward the development of novel products based on new and innovative technologies throughout industry: in well-established as well as new companies, and in both high-tech and traditional sectors. This support also extends to a broad range of cooperative ventures with foreign commercial entities. In January 2016, the OCS was replaced by the National Authority for Technological Innovation (NATI).

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	Highest priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	Low priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):

Upstream linkage	Ministry of Economy
Downstream linkage	MATIMOP, MAGNET, R&D Fund-Research Committee, pre-seed and seed programmes
Collateral linkage	Forum of Chief Scientists, SERD, University-Industry research, INNI, Israel Binational Industrial R&D, TELEM

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Occasional
Other intergovernmental organizations	Highly frequent
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Highly frequent
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
- URL: http://www.moital.gov.il/NR/exeres/751980DE-7B81-45EB-88C0-88C56920C27C.htm

Additional comments: n/a

The Israel National Nanotechnology Initiative (INNI)	
Organization details	
Address:	29 Ha-Mered Street, Industry House, 11th Floor, P.O. 50364 ,Tel Aviv 61500, Israel
Telephone number:	972-54-470-9956
Website:	URL: http://www.nanoisrael.org/
Contact person:	Meir Weinstein
Surname and first name of the executive head:	Meir Weinstein
Official administrative title of the executive head:	Operations Manager
E-mail address:	meir.weinstein@nanoisrael.org
Year of establishment of the organization:	2002
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Barry N. Breen
Number of professional staff:	Men 04 Women 00
Last annual budget:	n/a

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- The INNI was established as a shared initiative of Israel's Forum for National Research & Development Infrastructure (TELEM) and Israel's Ministry of Economy. The INNI Board of Directors is appointed by The Chief Scientist in the Ministry of Economy.
- The INNI Board operates out of The MAGNET Program at the Office of the Chief Scientist.

Objectives and responsibilities in the context of SETI activities:
(1) establishing a national policy of resources for nanotechnology, with the aim of faster commercialization; (2) long-range nanotechnology programmes for scientific research and technology development in academia and industry, and promoting development of excellent infrastructure in Israel; (3) leading in the creation of projects that promote agreed national priorities; allocate their budgets and review development progress; (4) actively seeking funding resources from public and private sources in order to implement the selected projects; (5) promoting development of innovative local nanotechnology industries, which will strongly affect Israeli economic growth and benefit investors, and (6) encouraging academia and industry cooperation with public access to a national database of Israel's nanotechnology researchers and industry.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	High priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	Highest priority
Advocacy of SETI activities	Highest priority
General policy advice	Highest priority

Network of relationships in the country (SETI activities):

Upstream linkage	OCS- Ministry of economy
Downstream linkage	n/a
Collateral linkage	n/a

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Occasional
Other intergovernmental organizations	Occasional
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Encouraging nanotechnology commercialization	In 2007, it was decided to establish the area of nanoscience as a national priority project with the goal of creating research infrastructure at six universities that will be the basis for nanotech industries in Israel. A funding mechanism was established	When a national programme is managed with high standards, the result is cooperation between government agencies, academia and industry and making efficient use of public funds. The programme has yielded a remarkable return on investment.

SETI policy publications of the organization:
- INNI Homepage, URL: http://www.nanoisrael.org/

Additional comments: n/a

The MAGNET Administration	
Organization details	
Address:	29 Hamered St., Tel Aviv, 61500, Israel
Telephone number:	972-3-5118110
Website:	www.moital.gov.il/madan.htm
Contact person:	Ilan Peled
Surname and first name of the executive head:	Ilan Peled
Official administrative title of the executive head:	Director of the MAGNET Program
E-mail address:	info@magnet.org.il
Year of establishment of the organization:	1992
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	n/a
Number of professional staff:	Men 9 Women 6
Last annual budget:	NIS 123 000 000 Budget year: 2014
SETI activities of the organization	
References of main legislative texts governing the organization in the context of SETI activities: • URL: http://www.moital.gov.il/NR/exeres/9F263279-B1F7-4E42-828A-4B84160F7684.htm	
Objectives and responsibilities in the context of SETI activities: The MAGNET Administration is responsible for all MAGNET R&D instruments and programmes. MAGNET (acronym in Hebrew for Generic Pre-Competitive R&D) programmes encourage collaboration among industrial companies, and between the companies and researchers from academic institutions, through several instruments that deal with innovative technologies. Those instruments seek to develop Israel's industrial infrastructure by supporting the R&D activities and sharing technological knowledge between the participants.	
Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	High priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	Highest priority
Assessment of SETI activities	Low priority
Advocacy of SETI activities	Low priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):	
Upstream linkage	OCS of the Ministry of Economy
Downstream linkage	MAGNET Program directors
Collateral linkage	Other OCS programmes

Frequency of professional contacts with the following organizations:	
Organizations of the UN system	Occasional
Other intergovernmental organizations	Occasional
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:		
Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
- URL: http://www.economy.gov.il/NR/exeres/111E3D45-56E4-4752-BD27-F544B171B19A.htm
- URL: http://www.economy.gov.il/NR/rdonlyres/5EFF78F4-94FE-43FE-9A5F-C8584FA1DE80/0/nofar2011.pdf
- URL: http://www.economy.gov.il/NR/rdonlyres/F232D421-8788-4B9C-BDB5-468FE804B296/0/magneton.pdf
- URL: http://www.economy.gov.il/NR/rdonlyres/C99700E2-4A31-43C0-9452-079EE1F56E7E/0/magnet2002.pdf

Additional comments: n/a

MATIMOP		
Organization details		
Address:	29 Ha-Mered St., Tel-Aviv, Israel	
Telephone number:	972-3-5118107	
Website:	matimop.org.il	
Contact person:	Michel Hibert	
Surname and first name of the executive head:	Michel Hibert	
Official administrative title of the executive head:	General Manager	
E-mail address:	michel@matimop.org.il	
Year of establishment of the organization:	1978	
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	n/a	
Number of professional staff:	Men Women	15 41
Last annual budget:	n/a	

SETI activities of the organization		
References of main legislative texts governing the organization in the context of SETI activities: • URL: http://www.moital.gov.il/NR/exeres/9F263279-B1F7-4E42-828A-4B84160F7684.htm		
Objectives and responsibilities in the context of SETI activities: To promote international cooperation in industrial R&D programmes between Israeli and foreign enterprises.		
Priority level of the following functions:		
Planning/programming/budgeting of SETI activities		Highest priority
Promotion/financing/co-ordination of SETI activities		Highest priority
Application and transfer of SETI activities		Highest priority
Assessment of SETI activities		High priority
Advocacy of SETI activities		Highest priority
General policy advice		Highest priority
Network of relationships in the country (SETI activities):		
Upstream linkage	The Office of the Chief Scientist [OCS] in the Ministry of Economy	
Downstream linkage	n/a	
Collateral linkage	Technology Transfer Offices (TTO's) in the Universities, other research authorities	
Frequency of professional contacts with the following organizations:		
Organizations of the UN system		Occasional
Other intergovernmental organizations		Highly frequent
International non-governmental organizations		Regular
National SETI policy bodies in foreign countries		Highly frequent
Other institutions in foreign countries dealing with science, technology and innovation policy studies		Highly frequent
The future challenges of the organization with regards to SETI policy:		
Challenge	Proposed policy tool / instrument	Explanation
The updating of the competitiveness of Israeli companies	International agreements for industrial R&D cooperation	The maximal implementation of international cooperative industrial R&D programmes
SETI policy publications of the organization: • Interactive database that includes data on 5,000 R&D companies		
Additional comments: URL: http://www.matimop.org.il/database.aspx		

Israel – Europe R&D Directorate (ISERD)	
Organization details	
Address:	29 Hamered St., Tel Aviv, 61500, Israel
Telephone number:	972-3-5118122
Website:	URL: http://www.iserd.org.il/
Contact person:	Marcel Shaton
Surname and first name of the executive head:	Marcel Shaton
Official administrative title of the executive head:	General Manager
E-mail address:	marcel@iserd.org.il
Year of establishment of the organization:	n/a
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	International Cooperation (INCO)
Number of professional staff:	Men 5 Women 11
Last annual budget:	n/a

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
n/a

Objectives and responsibilities in the context of SETI activities:
ISERD Promotes the participation of Israeli entities in R&D ventures within the European Research Area.
ISERD:
Promotes cooperation between Israel and Europe in thematic and/or bi-national programmes
ISERD's representatives participate in the EU Framework Programme for R&D's (FP's) management committees
Acts in the institutions of the various R&D programmes in Europe
Has an extensive network of contacts with similar agencies in Europe
Assists in Partner Searches
Assists throughout proposals submissions process
ISERD operates through various programmes:
The EU Framework Programme for R&D (HORIZON 2020)
Programs co-funded by national and EU funds
EUREKA for industrial R&D Cooperation
Bi-national programmes for industrial R&D Cooperation
Enterprise Europe Network (EEN) for SMEs

Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	Low priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	Low priority
Assessment of SETI activities	Low priority
Advocacy of SETI activities	Highest priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):	
Upstream linkage	Office of Chief Scientist (OCS) – Ministry of Economy
Downstream linkage	
Collateral linkage	

Frequency of professional contacts with the following organizations:	
Organizations of the UN system	Occasional
Other intergovernmental organizations	Highly frequent
International non-governmental organizations	Highly frequent
National SETI policy bodies in foreign countries	Highly frequent
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
n/a

Additional comments:
ISERD – The Israel–Europe R&D Directorate is an inter-Ministerial directorate, established by the Israeli Ministry of Economy; the Ministry of Science, Technology and Space; the Planning and Budgeting Committee of the Council for Higher Education; the Ministry of Finance; and the Ministry of Foreign Affairs. ISERD operates through the Office of the Chief Scientist of the Ministry of Economy, and is Israel's official contact point (National Contact Point or NCP) with the EU, for all the activities of the FP. ISERD promotes the participation of Israeli entities in R&D ventures within the European Research Area.

Chief Scientist Unit – Ministry of Science, Technology and Space	
Organization details	
Address:	3 Clermont-Ganneau street, Jerusalem, 91490, Israel
Telephone number:	972-2-5411129
Website:	URL: http://most.gov.il/About/ChiefScientist/Pages/chief.aspx
Contact person:	Libi Oz (Spokesperson)
Surname and first name of the executive head:	Nurit Yirmiya
Official administrative title of the executive head:	Chief Scientist
E-mail address:	NuritYirmiya@most.gov.il
Year of establishment of the organization:	2000
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Scientific International Relations
Number of professional staff:	Men 5 Women 10
Last annual budget:	NIS 165 000 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:

- Government decision of July 26, 1982, regarding the establishment of the Ministry of Science and Development.
- Government decision 2895 of the year 2000.
- Government decisions relating to fostering and supporting government R&D and setting up the post of the Chief Scientist in the various government offices: Government Decision 882 (3.8.1969); Government Decision 293 (17.1.1985), Government Decision 659.

Objectives and responsibilities in the context of SETI activities:
The Chief Scientist is the highest scientific authority in the Ministry of Science, Technology and Space. She is responsible for planning and designing the scientific activities of the Ministry, as well as setting the main SETI policy of the office. She serves as the Vice Chairman of the Scientific Steering Committee of ISERD (The Israel-Europe R&D Directorate). She is also responsible for the scientific supervision of the regional R&D centres and the science-community activities of the Ministry. The main responsibilities of the Chief Scientist in the Ministry of Science, Technology and Space are: (1) to co-ordinate the activity of the Chief Scientists Forum (chaired by the Minister of Science, Technology and Space) and the scientific policy of the various government ministries; (2) to represent the Ministry of Science, Technology and Space in forums and meetings with foreign countries with regards to the international scientific relations of Israel; (3) to advise the government in various scientific projects, and (4) to set up national priorities for supporting targeted scientific themes and activities, in co-ordination with the professional staff in the Ministry of Science, Technology and Space and other ministries.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	Highest priority
Advocacy of SETI activities	Highest priority

Network of relationships in the country (SETI activities):

Upstream linkage	The Minister of Science, Technology and Space
Downstream linkage	The Scientific Administration
Collateral linkage	Forum of the Chief Scientists (of government ministries); National Civilian Council for R&D

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Occasional
Other intergovernmental organizations	Regular
International non-governmental organizations	Regular
National SETI policy bodies in foreign countries	Regular
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Regular

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Extension of scientific foreign relations	Benchmarking studies	Evaluation of scientific status and needs
National fund for engineering and applied sciences	Targeted policy and financing proposals	Closing gaps in scientific-technological research fields
Promotion of women and minorities in science and technology	Focused calls for proposals; programme for mentoring young women for scientific careers	Closing the gaps in human resources

SETI policy publications of the organization:

- URL: http://most.gov.il/English/international/Pages/default.aspx
- URL: http://most.gov.il/KCHM/Countries/Pages/default.aspx
- URL: http://most.gov.il/KCHM/InternationalOrganization/Pages/default.aspx
- URL: http://most.gov.il/KCHM/CooperationAgreements/Pages/default.aspx

Additional comments:

Chief Scientist of the Ministry of National Infrastructures, Energy and Water Resources		
Organization details		
Address:	14 Hartom St., Hotzvim Mountain, PO 36148 Jerusalem 9136002, Israel	
Telephone number:	972-2-5316127	
Website:	URL: http://energy.gov.il	
Contact person:	Einat Magal	
Surname and first name of the executive head:	Bracha Halaf	
Official administrative title of the executive head:	Chief Scientist	
E-mail address:	n/a	
Year of establishment of the organization:	1977	
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	n/a	
Number of professional staff:	Men Women	n/a n/a
Last annual budget:	NIS 8 000 000 Budget year: 2013	

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- URL: http://energy.gov.il/InformationForPublic/Pages/GxmsMniLegislationAll.aspx

Objectives and responsibilities in the context of SETI activities:
The Office of the Chief Scientist in the Ministry of National Infrastructures, Energy and Water Resources is the Ministry's technological branch that provides professional support for constructing long-term and technologically informed policies in the fields of energy, earth, and marine sciences. It develops the physical, human, and technological infrastructures required for implementing all ministerial policies, by investing in R&D in academia and industry, by training the professional labour force, and by supporting advanced industries. This office also encourages international cooperation in research and development, and promotes local knowledge and original technologies adapted to Israel's needs, which may contribute to its welfare. The Chief Scientist assists Israeli start-up companies in the energy industry, by supporting their initiatives through a number of programmes.

Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	High priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	Highest priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	High priority

Network of relationships in the country (SETI activities):	
Upstream linkage	Director General, Minister of Energy and Water Resources
Downstream linkage	n/a
Collateral linkage	Fuel and LPG Authority, Electricity Authority, Natural Gas Authority

Frequency of professional contacts with the following organizations:	
Organizations of the UN system	n/a
Other intergovernmental organizations	n/a
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	n/a
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Goal of making Israel a centre of excellence in the fields of renewable energy	The STARTERGY Fund	the STARTERGY fund supports selected entrepreneurs to achieve proof-of concept

SETI policy publications of the organization:
- Start – up and Demonstration projects
- URL: http://energy.gov.il/English/PublicationsLibraryE/projects2012corrected.pdf 2. R&D 2011-2012 URL: http://energy.gov.il/English/PublicationsLibraryE/Research20112012.pdf

Additional comments:
There are 13 scientists in the OCS of the Ministry.

Chief Scientist of the Ministry of Environmental Protection	
Organization details	
Address:	5 Kanfie Nesharim St., PO 34033, Jerusalem, 95464, Israel
Telephone number:	972-2-6553755
Website:	URL: http://www.sviva.gov.il/English/AboutUs/Pages/ChiefScientist.aspx
Contact person:	Sinaia Netanyahu
Surname and first name of the executive head:	Sinaia Netanyahu
Official administrative title of the executive head:	Chief Scientist
E-mail address:	netanyahu-s@sviva.gov.il
Year of establishment of the organization:	1989
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Sinaia Netanyahu
Number of professional staff:	Men 2 Women 3
Last annual budget:	n/a

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- URL: http://www.sviva.gov.il/InfoServices/ReservoirInfo/Legislation/Pages/default.aspx

Objectives and responsibilities in the context of SETI activities:
(1) advancement of scientific knowledge; (2) Eco-innovation, establishment and advancement of technological innovation and environmental business models; (3) formulation of a national programme on health and the environment that will include increased general knowledge about the impact of environmental factors on public health; (4) preparation of a national plan for climate change adaptation; (5) dissemination of environmental facts, figures and data to decision makers and to the public, both in Israel and abroad, with the ultimate goal of creating a national environmental database; (6) promotion of collaborations with the academia and with research institutes and organizations, and (7) encouragement of environmental science studies at the high school level.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	High priority
Promotion/financing/co-ordination of SETI activities	High priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	Highest priority
Advocacy of SETI activities	Low priority
General policy advice	High priority

Network of relationships in the country (SETI activities):

Upstream linkage	Minister of Environmental Protection, General Director
Downstream linkage	n/a
Collateral linkage	Legal Department, Internal Auditing, Accounting, Economy and Technology

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Regular
Other intergovernmental organizations	Regular
International non-governmental organizations	Highly frequent
National SETI policy bodies in foreign countries	Regular
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Regular

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
The impact of environmental changes on human health	Research grants	Leishmaniasis disease vaccines for example
The impact of climate and environmental change on agriculture	Research grants	The impact of environmental changes and climate change (deforestation, dam buildings, new irrigation schemes and urbanization) on agricultural crops
Future energy sector	Research grants	The environmental impacts of gas-based transportation

SETI policy publications of the organization:
- The nexus between the economy and the environment in Israel
- URL: http://www.sviva.gov.il/InfoServices/ReservoirInfo/DocLib2/Publications/P0701-P0800/P0744.pdf
- Adaptations to Climate Change in Israel: Recommendations and Knowledge Gaps URL: http://www.sviva.gov.il/InfoServices/ReservoirInfo/DocLib2/Publications/P0701-P0800/P0739.pdf 3.
- Energy efficiency and greenhouse gas reduction In Israel
- URL: http://www.sviva.gov.il/InfoServices/ReservoirInfo/ResearchAndPublications/Pages/Publications/P0701-P0800/P0721.aspx

Additional comments:
The data source for this document is based on an interview conducted with Sinaia Netanyahu, the Chief Scientist of the Ministry of Environmental Protection.

Chief Scientist of the Ministry of Education	
Organization details	
Address:	29 Shivtey Israel St., Jerusalem, 9100201, Israel
Telephone number:	972-2- 5602957
Website:	URL: http://cms.education.gov.il/EducationCMS/UNITS/Scientist
Contact person:	Ami Valensky
Surname and first name of the executive head:	Ami Valensky
Official administrative title of the executive head:	Chief Scientist of the Ministry of Education
E-mail address:	madanra@education.gov.il
Year of establishment of the organization:	1969
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	n/a
Number of professional staff:	Men 04 Women 02
Last annual budget:	NIS 7 030 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:

- Government Decision No. 882, August 3, 1969.

Objectives and responsibilities in the context of SETI activities:
(1) representing the budgetary interests of the Ministry in the science and research domains; (2) setting criteria for the allocation of resources for research; (3) prioritizing the different themes of research in the education domain; (4) creating frameworks and procedures for conducting research in the education domain and disseminating the research findings; (5) assisting the Ministry of Education and the Government in setting policies and decision-making based on scientific knowledge, and (6) setting policy with regard to the evaluation of the Ministry's activities.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	High priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	Highest priority
General policy advice	Highest priority

Network of relationships in the country (SETI activities):

Upstream linkage	Ministry of Education
Downstream linkage	n/a
Collateral linkage	Chief Scientist Units in other ministries

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Occasional
Other intergovernmental organizations	Regular
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:

- URL: http://cms.education.gov.il/educationcms/units/scientist/mehkar/hazmana/siua_lemechkarim.htm

Additional comments: n/a

Chief Scientist of the Ministry of Agriculture and Rural Development	
Organization details	
Address:	P. O. Box 30, Beit Dagan, 50250, Israel
Telephone number:	972-3-9485553/4
Website:	URL: http://www.science.moag.gov.il/Framelski.html
Contact person:	Avi Perl
Surname and first name of the executive head:	Avi Perl
Official administrative title of the executive head:	Chief Scientist
E-mail address:	vhpert@agri.gov.il
Year of establishment of the organization:	1948
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Avi Perl
Number of professional staff:	Men n/a Women n/a
Last annual budget:	NIS 44 000 000 Budget year: 2011

SETI activities of the organization	
References of main legislative texts governing the organization in the context of SETI activities: • URL: http://www.moag.gov.il/agri/LawsRegulation/default.htm	
Objectives and responsibilities in the context of SETI activities: The main objectives of the Chief Scientist in the Ministry of Agriculture and Rural Development are (1) to identify knowledge gaps in the agricultural research domains; (2) to set goals aimed at bridging these gaps, and (3) to fund research activity in these research domains and to monitor research performance.	
Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	High priority
Promotion/financing/co-ordination of SETI activities	High priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	High priority
Network of relationships in the country (SETI activities):	
Upstream linkage	General Director
Downstream linkage	The Agricultural Research Organization – ARO (Volcani Institute)
Collateral linkage	n/a
Frequency of professional contacts with the following organizations:	
Organizations of the UN system	n/a
Other intergovernmental organizations	n/a
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	n/a
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a
The future challenges of the organization with regards to SETI policy:	

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a
n/a	n/a	n/a

SETI policy publications of the organization: • URL: http://www.science.moag.gov.il/forms/MOARD_May_2009.pdf	
Additional comments: n/a	

Chief Scientist of Ministry of Transport and Road Safety			
Organization details			
Address:	5 Bank Israel St. Government Complex Jerusalem, Israel		
Telephone number:	972-3-9751380		
Website:	URL: http://he.mot.gov.il/index.php?lang_ovrrde=ENG&option=com_content&view=article&id=2080:2008-05-25-08-11-30&iotype=w&catid=79:hanala-c&Itemid=97		
Contact person:	Shay Sofer		
Surname and first name of the executive head:	Shay Sofer		
Official administrative title of the executive head:	Chief Scientist		
E-mail address:	soffers@mot.gov.il		
Year of establishment of the organization:	1975		
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Shay Sofer		
Number of professional staff:	Men	n/a	
	Women	n/a	
Last annual budget:	NIS n/a Budget year: n/a		
SETI activities of the organization			
References of main legislative texts governing the organization in the context of SETI activities:			
Objectives and responsibilities in the context of SETI activities: Preparing background documents and position papers on issues in science and technology; promoting scientific and technological innovation in transportation; managing research and development programmes of the Ministry; developing transportation and implementing intelligent transportation systems (ITS); coordinating between research and development various units (for instance between the Public Transport Authority, Safety Authority, and Lanes Israel); representing the Ministry on scientific and technological issues in relation to institutions and organizations.			
Priority level of the following functions:			
Planning/programming/budgeting of SETI activities	Highest priority		
Promotion/financing/co-ordination of SETI activities	Highest priority		
Application and transfer of SETI activities	Highest priority		
Assessment of SETI activities	Highest priority		
Advocacy of SETI activities	Highest priority		
General policy advice	Low priority		
Network of relationships in the country (SETI activities):			
Upstream linkage	The Minister of the Transport and Road Safety		
Downstream linkage	Government Transport Infrastructure Companies, Government Transport Agencies		
Collateral linkage	Legal Adviser, Economics & Planning (incorporates the Freedom of Information Act); Accountant; Transport Security; Auditor-General and Ombudsman; Spokesperson, Media & International Relations; Administration & Human Resources; Systems Management		
Frequency of professional contacts with the following organizations:			
Organizations of the UN system	n/a		
Other intergovernmental organizations	n/a		
International non-governmental organizations	n/a		
National SETI policy bodies in foreign countries	n/a		
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a		
The future challenges of the organization with regards to SETI policy:			
Challenge	Proposed policy tool / instrument	Explanation	
Research grants mechanism	New government R&D law	n/a	
Small R&D community in transport	Guaranty constant level of R&D grants	Attract PhD students to engage in transport R&D, attract post PhD to return to Israel	
Dissemination of R&D	To involve transport agencies in R&D processes	n/a	
SETI policy publications of the organization: • Survey of ITS Standards for traffic control Israel • URL: http://media.mot.gov.il/PDF/HE_MADAN/seker_tkinut.pdf Vision for Intelligent • Transport Systems for 2020 • URL: http://he.mot.gov.il/index.php?option=com_content&view=article&id=1166:madan-hazon2020&catid=153:its-c&Itemid=266			
Additional comments: The survey answered by research assistant from Samuel Neaman Institute, Relies on written sources from the official website of the Ministry.			

Higher Education and R&D Sector, Budget Division in Ministry of Finance	
Organization details	
Address:	1 Kaplan St. Jerusalem 9103002, P.O. Box 3100, Israel
Telephone number:	972-2- 5317215
Website:	URL: http://www.financeisrael.mof.gov.il/FinanceIsrael/Pages/En/Home.aspx
Contact person:	Micha Perlman
Surname and first name of the executive head:	Micha Perlman
Official administrative title of the executive head:	Manager of Higher Education and R&D Sector
E-mail address:	mica@mof.gov.il
Year of establishment of the organization:	n/a
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	n/a
Number of professional staff:	Men 10 Women 02
Last annual budget:	n/a NIS Budget year: 2013

SETI activities of the organization
References of main legislative texts governing the organization in the context of SETI activities: • URL: http://takam.mof.gov.il/doc/hashkal/horaot.nsf
Objectives and responsibilities in the context of SETI activities: (1) Planning the budgets for the organizations involved in SETI activities, and (2) building the financial instruments for SETI activity promotion.

Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Low priority
Application and transfer of SETI activities	Low priority
Assessment of SETI activities	Low priority
Advocacy of SETI activities	Low priority
General policy advice	High priority

Network of relationships in the country (SETI activities):	
Upstream linkage	Ministry of Finance, Ministry of Economics, |Ministry of Science & Technology
Downstream linkage	n/a
Collateral linkage	Chief Scientists Offices, PBC

Frequency of professional contacts with the following organizations:	
Organizations of the UN system	Occasional
Other intergovernmental organizations	Occasional
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:		
Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
n/a

Additional comments:
n/a

National Cyber Bureau	
Organization details	
Address:	Prime Minister's Office 3 Kaplan St. Hakirya Jerusalem 91950, Israel
Telephone number:	972-3-7450811
Website:	URL: http://www.pmo.gov.il/English
Contact person:	n/a
Surname and first name of the executive head:	Eviatar Matania
Official administrative title of the executive head:	Head of the Bureau
E-mail address:	cyber@pmo.gov.il
Year of establishment of the organization:	2012
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	International Relations Unit, National Cyber Bureau
Number of professional staff:	Men n/a Women n/a
Last annual budget:	n/a

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:

- Government Resolution No. 3611, August 7, 2011
- URL: http://www.pmo.gov.il/English/PrimeMinistersOffice/DivisionsAndAuthorities/cyber/Documents
- The Encouragement of Industrial Research and Development Law, No. 5744 (1984)

Objectives and responsibilities in the context of SETI activities:

(1) To advise the Prime Minister, the Government and its committees regarding cyberspace. In matters of foreign affairs and security, the advice provided to the government, to its committees and to the Ministers, will be provided on behalf of the Bureau by means of the National Security Council; (2) to consolidate the Government's administrative work and that of its committees in the cyber field; to prepare them for their discussions and follow-up on implementation of their decisions. In matters of foreign affairs and security, the consolidation of administrative work, preparation for discussions and follow-up on implementation of decisions will be carried out by the National Security Council; (3) to make recommendations to the Prime Minister and Government regarding national cyber policy; to guide the relevant bodies regarding the policies decided upon by the Government and/or the Prime Minister; to implement the policies and follow-up on their implementation; (4) to inform all the relevant bodies, as needed, about the complementary cyber-related policy guidelines resulting from Government Resolutions and committee decisions; (5) to advance co-ordination and co-operation between governmental bodies, defence community, academia, industrial bodies, businesses and other bodies relevant to the cyber field; (6) to advance legislation and regulation in the cyber field. Regarding the enhancement of cyber security; (7) to serve as a regulating body regulating body in fields related to cyber security; (8) to determine and reaffirm, once a year, the national threat reference in defending cyberspace; (9) to formulate a national concept on dealing with emergencies in cyberspace; (10) to conduct national and international exercises to improve the State of Israel's preparedness in the cyberspace; (11) to assemble intelligence picture from all parties in the intelligence community regarding cyber security; (12) to assemble the national situation status regarding cyber security from all relevant parties; (13) to advance and increase public awareness to threats in cyberspace and mechanisms to cope with them; (14) to formulate and publish warnings and information for the public regarding cyberspace threats, as well as practices for preventative behaviour. Regarding the strengthening of Israel's lead in the cyber field; (15) to promote research and development in the cyber field and supercomputing in the professional bodies; (16) to advance the formulation of national education plans and wise use of cyberspace; (17) to work to encourage cyber industry in Israel and (18) to promote co-operation with relevant bodies abroad.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Highest priority
Promotion/financing/co-ordination of SETI activities	Highest priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	Highest priority
Advocacy of SETI activities	High priority
General policy advice	Highest priority

Network of relationships in the country (SETI activities):

Upstream linkage	The Prime Minister
Downstream linkage	n/a
Collateral linkage	Planning and Budgeting Committee (PBC), MAFAT R&D Administration, The Office of Chief Scientist (Ministry of Economy), The Ministry of Science, Technology and Space

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Occasional
Other intergovernmental organizations	Occasional
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Regular
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Regular

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Fostering and strengthening ties between the academy and industry	Chief Scientist R&D instruments, Research Centres	n/a
Fostering and strengthening human capital	n/a	n/a
Building an ecosystem involving the Industry, the Academia and defence related bodies	n/a	n/a
Advancing international collaboration in Cyber activities with certain of Israel's partners (United States, Europe and in Asia, specifically the Rep. of Korea, Japan, Singapore, Taiwan, and India).	n/a	n/a

SETI policy publications of the organization:

- URL: http://www.pmo.gov.il/BranchesAndUnits/Cyber/Pages/hodaot.aspx

Additional comments:n/a

The National Economic Council		
Organization details		
Address:		3 Kaplan St. Hakirya, Jerusalem, 91950, Israel
Telephone number:		972-2-6705636
Website:		URL: http://www.pm.gov.il/PMOEng/PM+Office/Departments/economy.htm
Contact person:		Mor Alon
Surname and first name of the executive head:		Avi Simhon
Official administrative title of the executive head:		Head of the National Economic Council
E-mail address:		nec@it.pmo.gov.il.
Year of establishment of the organization:		2006
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:		n/a
Number of professional staff:		Men 11 Women 02
Last annual budget:		n/a
SETI activities of the organization		

References of main legislative texts governing the organization in the context of SETI activities:

- The Council was established by Government Resolution No. 430 in September 2006, with the goal of answering the demand for a professional economic body with a macroeconomic perspective and a high analytical ability that would operate in the Prime Minister's Office.
- URL: http://www.pmo.gov.il/Secretary/GovDecisions/2006/Pages/des430.aspx

Objectives and responsibilities in the context of SETI activities:
The National Economic Council serves as a coordinating body for the Prime Minister on topics, which require comprehensive and methodological economic thinking (including SETI themes), assists in decision-making processes and is involved in projects on the Prime Minister's agenda and that of the Government in general. The Council has dealt with many major issues since its inception, including: Israel's socio-economic agenda; a comprehensive taxation policy (and specific taxation issues); financial education; developing agricultural R&D; dealing with the scarcity of trained labour force in high technology; and formulating the national plan for fuel alternatives. The Council's economists deal with issues relating to housing, health, establishing a social capital fund, encouraging capital investments, developing financial tools to increase sources of funding for small and medium-sized businesses and R&D oriented companies.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	High priority
Promotion/financing/co-ordination of SETI activities	Low priority
Application and transfer of SETI activities	Low priority
Assessment of SETI activities	Low priority
Advocacy of SETI activities	Low priority
General policy advice	Highest priority

Network of relationships in the country (SETI activities):

Upstream linkage	Prime Minister's Office
Downstream linkage	n/a
Collateral linkage	Central Bureau of Statistics

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Occasional
Other intergovernmental organizations	Occasional
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization: n/a

Additional comments: n/a

National Authority for Measurement and Evaluation in Education (RAMA)	
Organization details	
Address:	Bet Avgad 5 Jabotinsky Road, 3rd Floor, Ramat-Gan 5252006, Israel
Telephone number:	972-3-5205555
Website:	URL: http://cms.education.gov.il/EducationCMS/Units/Rama/
Contact person:	Hagit Glickman
Surname and first name of the executive head:	Hagit Glickman
Official administrative title of the executive head:	General Director
E-mail address:	rama@education.gov.il
Year of establishment of the organization:	2010
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	RAMA Department for the Tests and Statistics
Number of professional staff:	Men 13 Women 34
Last annual budget:	NIS 60 000 000 Budget year: 2013

SETI activities of the organization	
References of main legislative texts governing the organization in the context of SETI activities: • URL: http://cms.education.gov.il/EducationCMS/Units/Rama/OdotRama/hok_rama_2010.htm	
Objectives and responsibilities in the context of SETI activities: Measurement and evaluation of education	
Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	Low priority
Promotion/financing/co-ordination of SETI activities	Low priority
Application and transfer of SETI activities	Low priority
Assessment of SETI activities	Low priority
Advocacy of SETI activities	Low priority
General policy advice	High priority
Network of relationships in the country (SETI activities):	
Upstream linkage	Ministry of Education
Downstream linkage	n/a
Collateral linkage	Chief Scientist of the Ministry of Education
Frequency of professional contacts with the following organizations:	
Organizations of the UN system	Occasional
Other intergovernmental organizations	Occasional
International non-governmental organizations	Regular
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Occasional

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Providing accessibility of RAMA exams to the potential users	Including all RAMA tests and exams in an electronic meta-data base	n/a
Computerizing of exams/tests	The creation of the platform for building, transferring, examination and distribution of the computerized exams/tests	n/a

SETI policy publications of the organization:
- URL: http://cms.education.gov.il/EducationCMS/Units/Rama/MaagareyYeda/Publication_English.htm

Additional comments: n/a

The Central Bureau of Statistics (CBS)

Organization details

Address:	66 Kanfei Nesharim St., P.O.B 34525 Jerusalem, 9546456, Israel
Telephone number:	972-2- 6592666/ 5681933
Website:	www.cbs.gov.il
Contact person:	Yael Natan
Surname and first name of the executive head:	Danny Pfeffermann
Official administrative title of the executive head:	Chief Statistician
E-mail address:	msdanny@cbs.gov.il
Year of establishment of the organization:	1948
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Olivia Blum blum@cbs.gov.il.
Number of professional staff:	Men 500 Women 600
Last annual budget:	NIS 196 007 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- URL: http://www.cbs.gov.il/statistics_ordinance_e.pdf

Objectives and responsibilities in the context of SETI activities:
(1) to perform statistical activities and projects regarding the State and its population, in the fields of health, wellbeing, education, economy etc., as well as on the subjects of physical, geographic and ecological indices; and to publish the results; (2) to co-operate with State offices and other bodies in order to conduct statistical projects and to publish their results; (3) to prepare, in consultation with the Public Council for Statistics, multi-annual general schemes for the statistical activities of State offices; (4) to decide, in conjunction with the Public Council for Statistics and the bodies concerned, on uniform statistical classifications for the use of Government offices and (5) to collect and publish information on statistical projects that are performed or planned by or for the Bureau or State offices.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Low priority
Promotion/financing/co-ordination of SETI activities	Low priority
Application and transfer of SETI activities	Low priority
Assessment of SETI activities	Low priority
Advocacy of SETI activities	Low priority
General policy advice	Highest priority

Network of relationships in the country (SETI activities):

Upstream linkage	Prime Minister`s Office
Downstream linkage	n/a
Collateral linkage	Government offices, Bank of Israel

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Highly frequent
Other intergovernmental organizations	Highly frequent
International non-governmental organizations	Highly frequent
National SETI policy bodies in foreign countries	Occasional
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Highly frequent

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Twinning Project adoption	n/a	CBS will adopt European regulations in its various activities

SETI policy publications of the organization:
- www.cbs.gov.il

Additional comments: n/a

Bank of Israel		
Organization details		
Address:	Bank of Israel St. (Corner of Kaplan St.) Govt. complex. P.O. Box 780 91007 Jerusalem, Israel	
Telephone number:	972-2-6552211	
Website:	URL: http://www.boi.org.il/en/Pages/Default.aspx	
Contact person:	Ohad Bar-Efrat	
Surname and first name of the executive head:	Karnit Flug	
Official administrative title of the executive head:	Governor	
E-mail address:	ohad.bar-efrat@boi.org.il	
Year of establishment of the organization:	1954	
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Information and International Relations Division	
Number of professional staff:	Men Women	n/a n/a
Last annual budget:	n/a	
SETI activities of the organization		
References of main legislative texts governing the organization in the context of SETI activities: • URL: http://www.boi.org.il/en/aboutTheBank/Law/Documents/new_law_2010_eng.pdf		
Objectives and responsibilities in the context of SETI activities: The Bank Israel is not involved in SETI activities		
Priority level of the following functions:		
Planning/programming/budgeting of SETI activities	Low priority	
Promotion/financing/co-ordination of SETI activities	Low priority	
Application and transfer of SETI activities	Low priority	
Assessment of SETI activities	Low priority	
Advocacy of SETI activities	Low priority	
General policy advice	Highest priority	
Network of relationships in the country (SETI activities):		
Upstream linkage	n/a	
Downstream linkage	n/a	
Collateral linkage	n/a	
Frequency of professional contacts with the following organizations:		
Organizations of the UN system	n/a	
Other intergovernmental organizations	n/a	
International non-governmental organizations	n/a	
National SETI policy bodies in foreign countries	n/a	
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a	
The future challenges of the organization with regards to SETI policy:		
Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a
SETI policy publications of the organization: n/a		
Additional comments: n/a		

Israel Patent Office	
Organization details	
Address:	1 Agudat Sport Hapoel St. Technology Garden, Building No. 5, Jerusalem 9695101, Israel
Telephone number:	972-2-5651666
Website:	URL: http://index.justice.gov.il/En/Units/ILPO/Pages/default.aspx
Contact person:	Dikla Arinos
Surname and first name of the executive head:	Asa Kling
Official administrative title of the executive head:	Director of the Israel Patent Office
E-mail address:	patent@justice.gov.il
Year of establishment of the organization:	1948
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	International Relations
Number of professional staff:	Men 61 Women 92
Last annual budget:	NIS 50 521 000 Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- URL: http://index.justice.gov.il/En/Units/ILPO/Pages/Legalinfo.aspx
- URL: http://www.wipo.int/wipolex/en/text.jsp?file_id=128038

Objectives and responsibilities in the context of SETI activities:
Registration of Patents, Trademarks and Designs as a way to support Israel's innovation and technological strength.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	Low priority
Promotion/financing/co-ordination of SETI activities	Low priority
Application and transfer of SETI activities	Low priority
Assessment of SETI activities	Low priority
Advocacy of SETI activities	Low priority
General policy advice	Low priority

Network of relationships in the country (SETI activities):

Upstream linkage	Minister of Justice
Downstream linkage	IATI, AIPPI, LESI, AIPLA, Israel Bar Association
Collateral linkage	The Ministry of Economy, The Ministry of Justice

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Highly frequent
Other intergovernmental organizations	Occasional
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Highly frequent
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Regular

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
- URL: http://index.justice.gov.il/En/Units/ILPO/About/Pages/Annualreport.aspx
- URL: http://index.justice.gov.il/En/Units/ILPO/About/PatentAttorneys/Pages/default.aspx
- URL: http://index.justice.gov.il/Units/RashamHaptentim/about/Pages/statistika.aspx (Hebrew)

Additional comments: n/a

The Agricultural Research Organization (ARO)	
Organization details	
Address:	Macabim Road, Rishon Lezion, P. O. Box 6, Beit Dagan, 50250, Israel
Telephone number:	972-3-9683226
Website:	URL: http://www.agri.gov.il/en/home/default.aspx
Contact person:	Naama Rozenberg
Surname and first name of the executive head:	Yoram Kapulnik
Official administrative title of the executive head:	Head of the ARO
E-mail address:	kapulnik@volcani.agri.gov.il
Year of establishment of the organization:	1921
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Ada Refaeli
Number of professional staff:	Men n/a Women n/a
Last annual budget:	NIS Budget year: 2013

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities: n/a

Objectives and responsibilities in the context of SETI activities:

The Agricultural Research Organization (ARO) is the central governmental research institute for agriculture in Israel. ARO is among the best-known agricultural research centres in the world, with an infrastructure that supports both basic and applied research in agricultural and environmental sciences. ARO consists of six research institutes located at the main campus near Rishon LeZion and two regional research centres: Newe Yaar in the north and Gilat in the south. The institutes are addressing plant sciences; animal science; plant protection; soil, water and environmental sciences; postharvest and food sciences; and agricultural Engineering. ARO is also charged with fostering knowledge: it educates the next generation of scientists and extension workers in basic and applied agricultural research. The teaching experience enables the integration of active research scientists and state-of-the-art scientific methodologies for the advancement of education in the agricultural sciences. Graduate students and postdoctoral fellows from academic institutions in Israel and overseas undertake research.

ARO is mandated to develop knowledge, technologies and products for food security, environmental protection and the Israeli food industry, and to promote their adoption. It strives for excellence in research and development for the promotion of agriculture, and for the protection of the environment, and it focuses on solutions to today's farming hurdles while aiming to deliver on a high ideal of stewardship of agricultural resources.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	High priority
Promotion/financing/co-ordination of SETI activities	High priority
Application and transfer of SETI activities	High priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	High priority

Network of relationships in the country (SETI activities):

Upstream linkage	The ministry of Agriculture and Rural Development (Minister and CEO)
Downstream linkage	Six research institutions specializing in different fields
Collateral linkage	Other Ministry of Agriculture and Rural Development Units, for instant: OCS, Internal Audit, Fishery and Aquaculture

Frequency of professional contacts with the following organizations:

Organizations of the UN system	Regular
Other intergovernmental organizations	Highly frequent
International non-governmental organizations	Regular
National SETI policy bodies in foreign countries	Regular
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Regular

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Development and adoption of strategies and labour-saving technologies. increasing the integration of Israeli professional employees with fitting skills	Grants	n/a
Promoting Excellence of agricultural and environmental researches	Grants	n/a
Implementing applications in agriculture	Grants	n/a
Providing a solution for the problems of agriculture in Israel and promoting sustainable agriculture	Grants	n/a
Providing solutions for global challenges in the present and in the future for various domains such as food, water, energy and the climate.	Grants	n/a

SETI policy publications of the organization:

- URL: http://www.agri.gov.il/en/pages/220.aspx

Additional comments:

ARO is responsible for more than 70% of agricultural research in Israel. The institute currently employs 182 researchers, 390 research assistants, 140 administrative employees, about 220 graduate students and 40 trainees from abroad.

Israel Oceanographic and Limnological Research (IOLR)	
Organization details	
Address:	P. O. Box 8030, Haifa 31080, Israel
Telephone number:	972-4-8565220
Website:	URL: http://www.ocean.org.il/MainPageEng.asp
Contact person:	Lea Teitelbaum
Surname and first name of the executive head:	Barak Herut
Official administrative title of the executive head:	Director General
E-mail address:	barak@ocean.org.il
Year of establishment of the organization:	1967
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	n/a
Number of professional staff:	Men n/a Women n/a
Last annual budget:	n/a

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
n/a

Objectives and responsibilities in the context of SETI activities:
The IOLR conducts scientific research in the fields of oceanography, limnology, mariculture and marine biotechnology, addressing issues of national, regional and global relevance and importance. In fulfilment of its mandate as a national institution, much of IOLR's scientific effort is focused on research, monitoring and assessment of the environmental status of Israel's neighbouring sea areas (eastern Mediterranean and the Gulf of Aqaba/ Red Sea) and inland water bodies (Lake Kinneret – the Biblical Sea of Galilee – and the Dead Sea) and predicting their response to human and natural perturbations. IOLR's R&D effort in mariculture and marine biotechnology is focused on innovative technologies for the exploitation of marine organisms for food and biochemicals. This diverse programme of research, environmental monitoring and technology development bridges many different scientific disciplines including physics, chemistry, geology, biology and ecology, and involves collaboration with academic and research institutions within Israel and worldwide.

Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	n/a
Promotion/financing/co-ordination of SETI activities	n/a
Application and transfer of SETI activities	n/a
Assessment of SETI activities	n/a
Advocacy of SETI activities	n/a
General policy advice	n/a

Network of relationships in the country (SETI activities):	
Upstream linkage	Ministry of National Infrastructures, Energy and Water Resources
Downstream linkage	National Institute of Oceanography, Kinneret Limnological Laboratory, National Centre for Mariculture
Collateral linkage	Geological Survey of Israel, The Geophysical Institute of Israel

Frequency of professional contacts with the following organizations:	
Organizations of the UN system	n/a
Other intergovernmental organizations	n/a
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	n/a
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
- URL: http://www.ocean.org.il/Eng/Publications/Publications.asp

Additional comments: n/a

The Geophysical Institute of Israel (GII)	
Organization details	
Address:	6 Habashat St., Lod, 71100, Israel
Telephone number:	972-8-9785801
Website:	URL: http://www.gii.co.il/about.html
Contact person:	Uri Picciotto
Surname and first name of the executive head:	Uri Picciotto
Official administrative title of the executive head:	General Manager;
E-mail address:	urip@gii.co.il
Year of establishment of the organization:	1959
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	n/a
Number of professional staff:	Men n/a Women n/a
Last annual budget:	n/a

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
n/a

Objectives and responsibilities in the context of SETI activities:
The Geophysical Institute of Israel specializes in the application of diverse geophysical methods, mapping the structure and characteristics of the subsurface, for the oil and gas industry—worldwide. Its main mission is to create a qualified and better understanding of the subsurface, enabling a wise use of these natural recourses.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	High priority
Promotion/financing/co-ordination of SETI activities	n/a
Application and transfer of SETI activities	n/a
Assessment of SETI activities	High priority
Advocacy of SETI activities	n/a
General policy advice	High priority

Network of relationships in the country (SETI activities):

Upstream linkage	Ministry of national infrastructures, energy and water
Downstream linkage	n/a
Collateral linkage	The Geological Survey of Israel , Israel Oceanographic and Limnological Research

Frequency of professional contacts with the following organizations:

Organizations of the UN system	n/a
Other intergovernmental organizations	n/a
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	n/a
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a

SETI policy publications of the organization:
- Publications in scientific journals
- URL: http://www.gii.co.il/en/publications/publications-in-scientific-journals.html
- URL: http://www.gii.co.il/files/51f30f11bc53b6184d7f4384b1024a9a.pdf

Additional comments: n/a

The Israel Geological Survey (GSI)	
Organization details	
Address:	30 Malkhe Israel St., Jerusalem, 95501, Israel
Telephone number:	972-2-5314211
Website:	URL: http://www.gsi.gov.il
Contact person:	Ora Shapira
Surname and first name of the executive head:	Rivka Amit
Official administrative title of the executive head:	Director of the GSI
E-mail address:	rivka@gsi.gov.il
Year of establishment of the organization:	1949
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	Ora Shapira
Number of professional staff:	Men n/a Women n/a
Last annual budget:	NIS 20 000 000 Budget year: 2014

SETI activities of the organization	
References of main legislative texts governing the organization in the context of SETI activities: n/a	
Objectives and responsibilities in the context of SETI activities: The objectives of the GSI are: to document, study and conduct research in all aspects of the country's geology, to act as an advisory body to all government branches and major public and private enterprises, to maintain a national and regional earth sciences data base, and to maintain an analytical infrastructure.	
Priority level of the following functions:	
Planning/programming/budgeting of SETI activities	High priority
Promotion/financing/co-ordination of SETI activities	Low priority
Application and transfer of SETI activities	n/a
Assessment of SETI activities	High priority
Advocacy of SETI activities	n/a
General policy advice	Highest priority

Network of relationships in the country (SETI activities):	
Upstream linkage	Earth and Marine Sciences Research Administration
Downstream linkage	n/a
Collateral linkage	Israel Oceanographic and Limnological Research (IOLR), The Geophysical Institute of Israel

Frequency of professional contacts with the following organizations:	
Organizations of the UN system	Occasional
Other intergovernmental organizations	Highly frequent
International non-governmental organizations	Occasional
National SETI policy bodies in foreign countries	Regular
Other institutions in foreign countries dealing with science, technology and innovation policy studies	Highly frequent

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
n/a	n/a	n/a
n/a	n/a	n/a
n/a	n/a	n/a

SETI policy publications of the organization:

- Triassic Outcrops in the Negev NW Gondwana margin of the Neo-Tethys Guide Book
- URL: http://www.gsi.gov.il/_Uploads/ftp/GSI-02-2014b.pdf 2. Stratigraphy and
- Structure of the Timna Valley and Adjacent Ancient Mining Areas
- URL: http://www.gsi.gov.il/_Uploads/ftp/GSI152013.pdf
- The Geology of Elat Sheet
- URL: http://www.gsi.gov.il/Eng/_Uploads/465header.pdf
- Modelling of regional earthquakes, aseismic deformation and faults patterns with implication to the Dead Sea basin
- URL: http://www.gsi.gov.il/Eng/_Uploads/331GSI-30-2006.pdf

Additional comments:
Telephone interview

Israel Nature and Parks Authority (INPA)	
Organization details	
Address:	3 Am Ve'Olamo St., Jerusalem 95463, Israel
Telephone number:	972-2-5005403
Website:	URL: http://www.parks.org.il/Pages/default.aspx
Contact person:	Shaul Goldshteein
Surname and first name of the executive head:	Shaul Goldshteein
Official administrative title of the executive head:	Director of INPA
E-mail address:	u.lishka@npa.org.il
Year of establishment of the organization:	1964
Name of the administrative entity specifically in charge of exchange of information with foreign organizations:	n/a
Number of professional staff:	Men n/a Women n/a
Last annual budget:	n/a NIS Budget year: 2011

SETI activities of the organization

References of main legislative texts governing the organization in the context of SETI activities:
- URL: http://www.parks.org.il/ConservationAndheritage/LawAndEnforcement/Pages/AllRegulationsPage.aspx

Objectives and responsibilities in the context of SETI activities:
INPA has three main goals:
Protection of biodiversity, ecosystems and landscapes in national parks, nature reserves and open spaces.
Protection of heritage sites in national parks and nature reserves and fostering them for the benefit of visitors.
Education to install the values of protection of nature, landscape and heritage sites and to increase public awareness of these issues.

Priority level of the following functions:

Planning/programming/budgeting of SETI activities	High priority
Promotion/financing/co-ordination of SETI activities	High priority
Application and transfer of SETI activities	Highest priority
Assessment of SETI activities	High priority
Advocacy of SETI activities	High priority
General policy advice	High priority

Network of relationships in the country (SETI activities):

Upstream linkage	Ministry of Environmental Protection
Downstream linkage	n/a
Collateral linkage	n/a

Frequency of professional contacts with the following organizations:

Organizations of the UN system	n/a
Other intergovernmental organizations	n/a
International non-governmental organizations	n/a
National SETI policy bodies in foreign countries	n/a
Other institutions in foreign countries dealing with science, technology and innovation policy studies	n/a

The future challenges of the organization with regards to SETI policy:

Challenge	Proposed policy tool / instrument	Explanation
Recovery of habitats	Research grants for universities and research institutions	n/a
Protecting endangered Species	Research grants for universities and research institutions	n/a
Coping with non-indigenous (introduced) species of plants and animals	Research grants for universities and research institutions	n/a

SETI policy publications of the organization:
- URL: http://www.parks.org.il/ConservationAndheritage/Science/Pages/AllPolicyDocuments.aspx

Additional comments:
Data source: official website of INPA.

Inventory of Israel's legal framework for SETI

A country's legal framework represents a collection of legal processes and legal instruments, which embody a given policy or parts of it in the form of a law, decree or policy regulating an area of activity. Formal agreements such as contracts and international SETI co-operation treaties may also be included in this category. A legal instrument elaborates a policy by stipulating obligations rights rewards and penalties connected with its observance. The SETI legal framework of the State of Israel is presented hereafter.

NATIONAL LAWS AND ACTS

Laws pertaining to higher education and scientific research

COUNCIL FOR HIGHER EDUCATION LAW

Date of enactment: August 14, 1958

Description: The purpose of the law is to establish a public apolitical independent and professional body to stand between the Government and the institutions of higher education and to deal with all issues related to higher education in Israel. The law empowers the Council for Higher Education to grant a permit to open and operate an institution of higher education; to accredit an institution as an institution of higher education; to authorize an accredited institution to award academic degrees; and to approve studies under the academic auspices of an accredited institution and recommend to the Government regarding the establishment of additional institutions of higher education. The Council for Higher Education will consist of not less than 19 and not more than 25 members and they will be appointed by the President of the State of Israel at the recommendation of the Minister of Education after consultation with the institutions of higher education; the Minister of Education ex-officio will act as chair; two thirds of the members should be individuals of stature in the field of higher education. The institutions of higher education will be free to manage their academic and administrative affairs as they see fit within the allocated budget.

URL: http://www.moit.gov.il/NR/exeres/23EF518B-39A3-4365-A9E3-A9D600E509BA.htm

ISRAEL ACADEMY OF SCIENCES AND HUMANITIES LAW

Date of enactment: June 23, 1961

Description: The law mandates the structure, duties, and objectives of the Academy. According to law the objectives of the Academy are: to enlist as its members distinguished scholars and scientists resident in Israel; to cultivate and promote scholarly and scientific endeavour; to advise the Government on activities relating to research and scientific planning of national significance; to maintain contact with parallel bodies abroad; in co-ordination with institutions of the State, to ensure the representation of Israel scholarship and science at international institutions and conferences; to publish writings calculated to promote scholarship and science; and to engage in any other activity calculated to serve the aforesaid objects. The Academy shall consist of a Humanities Section and a Science Section each consisting of 35 members. The President of the Academy will be appointed by the President of the State of Israel upon the recommendation of the Academy.

URL: http://www.academy.ac.il/english/hp.asp?file=asp/about/about.asp?file=law

THE UNITED STATES-ISRAEL BINATIONAL SCIENCE FOUNDATION (BSF) LAW

Date of enactment: January 27, 1977

Description: The law mandates the operation of the Binational Science Foundation (BSF) designed for promoting scientific co-operation between the USA and Israel by supporting joint research projects in a wide area of basic and applied scientific fields for peaceful and non-profit purposes. The Foundation is supported by the US and Israeli Governments.

THE UNITED STATES-ISRAEL AGRICULTURAL RESEARCH AND DEVELOPMENT FUND (BARD) LAW

Date of enactment: December 27, 1979

Description: The law mandates the operation of the BARD programme designed for supporting applied research and technological development in the agricultural domain. The fund is supported by the US and the Israeli governments.

URL: http://www.nevo.co.il/Handlers/LawOpenDoc.ashx?id=4790

GERMAN-ISRAEL FOUNDATION FOR SCIENTIFIC-RESEARCH AND DEVELOPMENT LAW

Date of enactment: July 4, 1986

Description: The German-Israeli Foundation for Scientific Research and Development (GIF) was established in 1986 by an agreement between the Ministers of Science of the Federal Republic of Germany and the State of Israel as an additional instrument complementing the continuous fruitful ties in scientific and technological co-operation between the two countries. Both parties recognize that co-operation in scientific research will strengthen the bonds of friendship and understanding between the German and Israeli peoples and advance the state of scientific research and development to the benefit of both countries.

URL: http://www.nevo.co.il/Handlers/LawOpenDoc.ashx?id=4788

Laws pertaining to civilian and industrial R&D

COUNCIL FOR NATIONAL CIVILIAN RESEARCH AND DEVELOPMENT LAW

Date of enactment: November 19, 2002

Description: The purpose of this law is to establish a national council for (scientific and technological) research and development. The mission of the council is to advise the Government on S&T policy issues regarding the organization and regulation of civilian research, development and allocation of its budgets, and the appointment of chief scientists in government ministries; and to propose candidates for the appointment of directors in governmental research institutes.

URL: http://most.gov.il/Molmop/Documents/law.pdf

THE LAW FOR THE ENCOURAGEMENT OF INDUSTRIAL RESEARCH AND DEVELOPMENT

Date of enactment: April 4, 1984 (Updated June 2005)

Description: The objectives of the law are: creating jobs in industry and placing scientific and technological personnel; creating surplus yield for the Israeli economy; developing of high technology science-intensive industries by utilizing and expanding the technological and scientific infrastructure and existing human resources. This law was instrumental in improving the balance of payments of the State through export of high technology (primarily ICT) science-intensive products.

URL: http://www.moital.gov.il/NR/exeres/9F263279-B1F7-4E42-828A-4B84160F7684.htm

ENCOURAGEMENT OF CAPITAL INVESTMENTS LAW

Date of enactment: August 16, 1959

Description: The goal of this law is to attract capital to Israel and to encourage economic initiative and investments of foreign and local capital by giving priority to innovation and economic activity in Israel's peripheral regions. The objectives of the law are: to develop the productive capacity of the national economy to use its resources and economic potential efficiently and to fully use the productive capacity of existing enterprises; to improve the State's balance of payments to reduce imports and to increase exports; to absorb immigration; to distribute the population over the area of the State according to plan; and to create new sources of employment.

URL: http://www.financeisrael.mof.gov.il/financeisrael/docs/en/legislation/fiscalissues/5719-1959_encouragement_of_capital_investments_law.pdf

ISRAEL – USA BINATIONAL INDUSTRIAL RESEARCH AND DEVELOPMENT (BIRD) LAW

Date of enactment: January 26, 1978

Description: The purpose of this law is to stimulate, promote and support industrial R&D of mutual benefit to the USA and Israel. The law is aimed at generating mutually beneficial co-operation between the private sectors of the USA and Israeli high tech industries including start-ups and established organizations. BIRD's scope extends to agriculture, communications, life sciences, electronics, electro-optics, software, homeland security, renewable and alternative energy and other sectors of high-technology industry.

URL: http://www.nevo.co.il/law_html/law01/p203m3_001.htm

Laws Pertaining to the Promotion of Gender Equality

EMPLOYMENT (EQUAL OPPORTUNITIES) LAW, 5748–1988

Date of enactment: April 1, 1988

Description: The law states that an employer shall not discriminate among his employees or among persons seeking employment on account of their sex, sexual tendencies, personal status or because of their age, race, religion, nationality, country of origin, views, party or duration of reserve service, in any of the following: (a) acceptance for employment; (b) terms of employment; (c) advancement in employment; (d) vocational training or supplementary vocational training; (e) dismissal or severance pay; and (f) Benefits and payments for employees in connection with their retirement from employment.

URL: http://www.moital.gov.il/NR/rdonlyres/2654DA40-7F3A-44DE-AC90-813996BD7570/0/25.pdf

ENCOURAGEMENT OF THE ADVANCEMENT AND INTEGRATION OF WOMEN IN THE WORK FORCE AND THE ADJUSTMENT OF WORKPLACES TO WOMEN'S NEEDS LAW 5768–2008

Date of enactment: April 10, 2008

Description: the purpose of the law is to generate a change in the business culture in Israel and promote public awareness of women's rights in order to encourage employers to advance and integrate women in the workplace. Under this law, substantial monetary incentives and grants will be provided annually by the Minister of Industry, Trade and Labour to employers in the private sector who endeavour to integrate and promote women in their business, and who initiate programmes to that end. Such grants will also be given to employers who modify their workplace and work conditions to the needs of women and parents.

URL: http://mfa.gov.il/MFA/AboutIsrael/State/Law/Pages/Ensuring-equal-rights-for-women-in-Israel.aspx

Laws pertaining to public health and bioethics

PEOPLES' HEALTH (CLINICAL TRIALS IN HUMANS) REGULATIONS

Date of enactment: October 14, 1980

Description: This act regulates the terms for conducting clinical trials and experimentation on humans according to the guidelines of the Declaration of Helsinki. The implementing regulation sets out the duties and rights of those involved, while balancing between the right to preserve human dignity and the need to foster the advancement of medical research aimed at protecting human life and health. Every organization (e.g. university hospital) is mandated to establish a Helsinki Committee and to receive its approval for conducting clinical trials on human subjects.

URL: http://www.nevo.co.il/Handlers/LawOpenDoc.ashx?id=74731

THE ANIMAL EXPERIMENTATION LAW

Date of enactment: August 14, 1994

Description: This law regulates the terms for conducting scientific experimentation on animals. The law mandates the establishment of a council for animal experimentation that will formulate policy for conducting experimentation on animals and for the allocation of licenses to institutions requesting to carry out animal experimentation. The council will be composed of authorities from relevant ministries, researchers, representatives of organizations involved in the experiments and representatives of animal rights organizations. The law also states several basic principles regarding the conduct of animal experiments: The number of animals will be limited to the minimum necessary to carry out the experiment; every step will be taken to minimize the pain and suffering caused to animals; an license shall not be granted if a reasonable alternative method exists to carry out the research. The law sets up to one-year imprisonment for violation of its provisions.

URL: http://www.nevo.co.il/law_html/law01/p200m2_003.htm

GENETIC INFORMATION LAW

Date of enactment: December 13, 2000

Description: The purpose of this law is to regulate the conduct of genetic testing and the provision of genetic counselling and to protect the right to privacy of the person subject to such testing in respect of identified genetic information, without lessening the quality of the medical treatment, medical and genetic research, the advancement of medicine and the protection of public welfare.

URL: http://www.jewishvirtuallibrary.org/jsource/Health/GeneticInformationLaw.pdf

THE REGULATION OF RESEARCH INTO BIOLOGICAL DISEASE AGENTS ACT

Date of enactment: November 12, 2008

Description: The law organizes the legal framework by which all institutions and laboratories (universities research labs industry and hospitals) may hold and perform research with disease-causing biological agents. The law states that: (1) the Minister of Health will be in charge of enforcing this law in all institutions; (2) possessing conducting research or working with these biological agents requires an authorization from the Ministry of Health; (3) possessing, conducting research or working with these biological agents must be performed so as not to impinge upon safety or security concerns; (4) no one shall conduct research whose sole purpose is to cause or exacerbate a disease or illness or to impair the ability to prevent or treat it; (5) all institutions that possess disease-causing agents will establish an institutional committee whose purpose is to supervise the research conducted in that institution. The committees will include scientists as well as security and safety personnel from the institution; and (7) a council for biological disease-agent research will be created to advise the Minister of Health and will include professionals and members of relevant government ministries. The council's responsibilities will be to advise the Minister of Health regarding research authorization, to supervise the various institutions and to promote training workshops and courses in institutions that work with biological agents.

URL: http://www.nevo.co.il/Handlers/LawOpenDoc.ashx?id=73258

PROHIBITION OF GENETIC INTERVENTION (HUMAN CLONING AND GENETIC MANIPULATION OF REPRODUCTIVE CELLS) LAW

Date of enactment: March 1, 2009

Description: The purpose of this law is to prevent reproductive cloning in humans by establishing that certain kinds of genetic intervention shall not be performed on human beings in view of the moral, legal, social, and scientific aspects of the prohibited forms of intervention and their implications for human dignity, and to assess public policy regarding those kinds of interventions in view of those aspects, considering also freedom of scientific research for the advancement of medicine.

URL: http://bioethics.academy.ac.il/english/DocPage3-e.h

Laws pertaining to intellectual property rights

THE PATENTS AND DESIGNS ORDINANCE

Date of enactment: 1954

Description: This ordinance includes various aspects of applying for patents and designs the rights to use patents etc.

URL: http://www.wipo.int/wipolex/en/details.jsp?id=8193

THE PATENTS LAW

Date of enactment: August 17, 1967

Description: The law includes definitions of patents, criteria for applying for patents, the ways to defend inventors, and a description of the functions of the Israel Patent Office.

URL: http://www.wipo.int/wipolex/en/details.jsp?id=8199

APPELLATIONS OF ORIGIN (PROTECTION) LAW 5725-1965

Date of enactment: January 1, 2000

Description: The law includes various aspects regarding: definitions, registration, and use of Appellations of Origin.

URL: http://www.wipo.int/wipolex/en/details.jsp?id=2373

THE TRADEMARKS ORDINANCE

Date of enactment: August 6, 2003

Description: This ordinance includes various aspects regarding the registration of trademarks, the rights of their owners, and regulations and fees.

URL: http://www.wipo.int/wipolex/en/details.jsp?id=8200

MAIN IP LAWS: ENACTED BY THE LEGISLATURE

- Performers' and Broadcasters' Rights Law, 5744–1984 (consolidated version of 2015)
- Law for Making Works, Performances and Broadcasts Accessible for Persons with Disabilities (Law Amendments), 5774–2014 (2014)
- Patent Law, 5727–1967 (consolidated version of 2014)
- Patent Law (Amendment No. 10), 5775–2012 (2012)
- Appellations of Origin and Geographical Indications (Protection) Law, 5725–1965 (as amended up to April 1, 2012) (2012)
- Patents (Regulation of Israeli Patent Authority under the PCT), Amendment Law No. 9, 5771–2011 (2011)
- Copyright Act, 2007 (as amended on July 28, 2011) (2011)
- Trade Marks Ordinance (New Version), 5732–1972 (consolidated version of 2010) (2010)
- Law to Amend Intellectual Property Laws (Modifications to Implement the Provisions of the TRIPS Agreement), 5760–1999 (2000)
- Integrated Circuits (Protection) Law, 5760–1999 (1999)
- Plant Breeders Rights Law, 5733–1973 (as amended up to February 1996) (1996)
- Design Provision in the Patents and Design Ordinance (Patents and Designs Ordinance) (1954)

IP-RELATED LAWS: ENACTED BY THE LEGISLATURE

- Public Broadcasting Law (Amendment No. 2) 2015 (2015)

- Courts Act, 5744–1984 (consolidated version of 2014) (2015)
- Public Broadcasting Law, 5774–2014 (2014)
- Restrictive Trade Practices Law, 5748–1988 (as amended) (2014)
- Criminal Procedure Law, 5742–1982 (consolidated version of 2014) (2014)
- Penal Law, 5737–1977 (consolidated version of 2014) (2014)
- Customs Ordinance [New Version] (2014)
- Computers Law (Amendment), 5772–2012 (2012)
- Computers Law, 5755–1995 (as amended on July 17, 2012) (2012)
- Communications Law (Telecommunications and Broadcasting), 5742–1982 (2012)
- Pharmacists Ordinance (New Version) 1981 (consolidated version of 2014) (2010)
- National Library Law, 5768–2007 (Extract) (2007)
- The Encouragement of Industrial Research and Development Law, 5744–1984 (as updated on June, 2005) (2005)
- Film Law, 5759–1999 (2000)
- Merchandise Marks Ordinance, 1929 (as amended up to January 1, 2000) (2000)
- Commercial Torts Law, 5759–1999 (1999)
- Consumer Protection Law, 5741–1981 (1981)
- Unjust Enrichment Law, 5739–1979 (1979)
- Law on the Protection of Symbols, 5735–1974 (1974)

Other Laws

STATISTICS ORDINANCE

Date of enactment: April 9, 1972

Description: The law establishes the post of the Government Statistician and defines his functions. The law also defines the functions of the Central Bureau of Statistics: (1) to perform and publish the results of statistical collection and analysis relating to the population and its social, health, economic, commercial, industrial and other activities, and to the physical conditions of the country; (2) to co-operate with State agencies in performing statistical collection and analysis and in publishing their results; (3) to prepare in consultation with the Public Council for Statistics multi-annual general schemes for the statistical activities of State agencies; (4) to prescribe in consultation with the Public Council for Statistics and the agencies concerned uniform statistical classifications for the use of Government agencies; (5) to assemble and publish information on statistical activities which are performed or planned by or for the Bureau of State agencies.

URL: http://www.cbs.gov.il/mifkad/mifkad_2008/ordinance_e.pdf

BANK OF ISRAEL LAW

Date of enactment: 2010

Description: The law mandates the functions of the Bank of Israel its objectives structure and ways to ensure its autonomy.

URL: http://www.bankisrael.gov.il/deptdata/pikuah/bank_hakika/eng/new_law_2010_eng.pdf

GOVERNMENT RESOLUTIONS

Government resolutions pertaining to higher education and basic research

ESTABLISHMENT OF THE PLANNING AND BUDGETING COMMITTEE

Government Resolution Number: 666

Adopted: June 6, 1977

Description: The Government hereby establishes the Planning and Budgeting Committee as a sub-committee of the Council for Higher Education (CHE) to fulfil the following missions:

1. To be an independent buffer entity between the Government and the Higher Education institutes in all matters of budgeting.
2. To recommend operational and development budgets based on national and social needs while protecting academic freedom and promoting research and education.
3. To perform budget disbursement between higher education institutes.
4. To recommend to the Government and to the CHE plans for the development of higher education.
5. To promote collaboration between the institutes in order to efficiently use public resources and funding.
6. To monitor spending.
7. To advise the CHE on new institutes and programmes.

PARTICIPATION OF THE STATE OF ISRAEL IN THE EU'S SEVENTH FRAMEWORK PROGRAMME FOR RESEARCH (FP7)

Government Resolution Number: 4139

Adopted: August 9, 2005

Description: This government resolution states that the extent of Israel's participation in the EU's Seventh Framework Programme shall not exceed NIS 300 million. The Ministry of Industry Trade and Labour (Ministry of Economy), the Ministry of Science and Technology, and the Planning and Budgeting Committee of the Council for Higher Education will allocate the budget.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2005/Pages/des4139.aspx

EXTENSION OF THE PROGRAM FOR FUNDING AGRICULTURAL R&D

Government Resolution Number: 578

Adopted: July 17, 2013

Description: This government resolution stresses the importance of continuing the programme to fund agricultural R&D within regional R&D centres.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2013/Pages/dec578.aspx

Government resolutions pertaining to the promotion of the industry

DEVELOPMENT OF THE INDUSTRY AND SERVICE SECTORS IN THE PERIPHERY

Government Resolution Number: 3967

Adopted: August 2, 2008

Description: As part of the measures taken by the Government to improve economic growth potential in general and to enhance economic development in peripheral areas in particular, the Government decided to initiate a plan to encourage the industry and service sectors in peripheral areas by improving and increasing the quality and quantity of R&D. The plan proposes to achieve these ends by implementing the following tools: providing assistance to firms for locating or enhancing their activities (in the form of a per worker grant to encourage employment in the periphery); providing grants to traditional industries or to medium-high technology firms located in the periphery which adopt new technologies and knowhow for manufacturing novel products or for introducing new services; examining the feasibility of establishing additional research institutes intended for the study of traditional and medium-high technology industries.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2008/Pages/des3967.aspx

PROMOTION OF INDUSTRY-ACADEMY RELATIONS

Government Resolution Number: 1986

Adopted: July 15, 2010

Description: This government resolution aims to establish a government support track to promote academic research with commercialization and industrial potential that may help create new jobs in industry and thus help place new scientific and technological workers.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2010/Pages/des1986.aspx

TAX INCENTIVES FOR THE DEVELOPMENT OF THE HIGH-TECHNOLOGY INDUSTRY

Government Resolution Number: 1990

Adopted: July 15, 2010

Description: This government resolution instructs the Minister of Finance to prepare a draft law that will offer tax incentives to investors in high tech industries.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2010/Pages/des1990.aspx

INCENTIVES TO ENCOURAGE DEVELOPMENT AND COMPETITIVENESS OF INDUSTRY IN ISRAEL

Government Resolution Number: 1991

Adopted: July 15, 2010

Description: This government resolution aims to encourage capital investments in new business initiatives giving priority to innovation in underdeveloped areas. The resolution is aimed at amending the 1959 Encouragement of Capital Investments Law giving priority to: developing production capacity; improving the business sector's ability to compete in international markets, and creating infrastructure for sustainable new workplaces.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2010/Pages/des1991.aspx

DEVELOPMENT OF WATER TECHNOLOGY

Government Resolution Number: 5243

Adopted: November 11, 2012

Description: This government resolution will guide the development of water technologies over the years 2012–2014. It establishes a steering committee for the advancement of water technologies and aims to stimulate firms' and others': investing in human resources in the water technology domain (academic research and faculty scholarships for students vocational training); implementing new technologies in local markets; using existing generic OCS R&D tools (MAGNET TNUFA Technological Incubators Programme etc.) in the water technology domain; and participating in national and international conferences.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2012/Pages/des5243.aspx

Government resolutions pertaining to the promotion of R&D in specific sectors or regions

PROMOTING R&D ACTIVITIES IN THE DRUZE COMMUNITY

Government Resolution Number: 1513

Adopted: February 23, 2010

Description: This government resolution aims at promoting research and development activities in the Druze community by the Ministry of Science and Technology including the intensification of research on topics relevant to Druze, employing researchers and purchasing equipment.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2010/Pages/des1513.aspx

ESTABLISHMENT OF NATIONAL CYBER COMPLEX AND TAX BENEFITS TO THE CYBER CAMPUS IN BEER SHEVA

Government Resolution Number: 1815

Adopted: July 6, 2014

Description: This government resolution calls for the establishment of a national cyber park, CyberSpark, in Beer-Sheva, with the specific aim of contributing to the development of the southern periphery (Negev) and the Greater Beer-Sheva metropolitan area. The new park will be a unique community of leading industries in the cyber domain with a state-of-the-art academic research institution and educational offerings intended for training students and employees in the cyber field. The aim is to provide the necessary conditions for a sustainable dynamic and attractive community of talent.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2014/Pages/dec1815.aspx

ENHANCEMENT OF HUMAN CAPITAL POTENTIAL IN THE CYBER DOMAIN VIA THE MASA – ISRAEL JOURNEY PROJECT

Government Resolution Number: 1985

Adopted: August 21, 2014

Description: This government resolution calls for the operation of the MASA project in the cyber field. MASA is a joint project of the Government and of the Jewish Agency, aimed at exposing young Jewish adults of the Diaspora to Israeli society. This initiative allows young professionals holding academic degrees in technological domains to receive high-level technological training/paid internship (grants and scholarships) in Israeli high-technology firms. These professionals will have the opportunity to integrate into the Israeli cyber industry once completing their internship.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2014/Pages/govdec1985.aspx

Government resolutions pertaining to the operation of SETI bodies

OPERATION OF CHIEF SCIENTISTS IN THE GOVERNMENT MINISTRIES AND THE ESTABLISHMENT OF THE FORUM OF CHIEF SCIENTISTS

Government Resolutions Number: 2982; 273; 657; 882

Adopted: 2000; January 17, 1985; January 14, 1973; August 3, 1969

Description: The government resolutions listed above set the framework for the establishment of the Chief Scientist post in the various government ministries (in addition to the OCS in the Ministry of Economy) with the specific aim of strengthening public R&D financed by the government. These government resolutions also set the framework for establishment of the Forum of Chief Scientists, which serves as a coordinating body among the various government ministries and bodies responsible for the promotion of civilian R&D.

ESTABLISHMENT OF THE EARTH AND MARINE SCIENCES RESEARCH ADMINISTRATION

Government Resolution Number: 4517

Adopted: February 19, 2009

Description: This government resolution calls for the establishment of the Earth and Marine Sciences Research Administration intended to operate three research institutes: the Geological Survey of Israel, Israel Oceanographic and Limnological Research and the Geophysical Institute of Israel. The Administration's main purposes are – with regard to land surfaces, subterranean layers, and marine areas—to create a useful technology knowledge base monitoring, research, and sustainable development; and to advise the government on them based on the needs of Israeli society and the Israeli economy.

URL: http://www.pm.gov.il/PMO/vadot/so-econo/des4517.htm

Government Resolutions Pertaining to Advancement of Women in Science & Technology

ESTABLISHMENT OF THE COUNCIL FOR THE ADVANCEMENT OF WOMEN IN SCIENCE AND TECHNOLOGY

Government Resolution Number: 2660

Adopted: December 7, 2000

Description: The Government hereby establishes the Council for the Advancement of Women in Science and Technology in the Ministry of Science and Technology.

1. The Council is committed to promote women as human resources engaged in science and technology research in Israel.
2. The council coordinates between government, public and private agencies
3. The council collaborates with the European Union.
4. The council acts to raise public awareness of problems connected with the promotion of women in science and Technology.

ADVANCEMENT OF GENDER EQUALITY AND THE IMPLEMENTATION OF GENDER MAINSTREAMING

Government Resolution Number: 2331; 1697 (6 August 2014) and 1526 (30 March 2014)

Adopted: December 14, 2014

Description: The decision introduces gender mainstreaming tools that take into account gender perspectives and their implications in policy-making with a view to increasing opportunities for women in all spheres (e.g. personal security, education, welfare, family life, employment, economy), enhancing their personal security and augmenting the representation in decision-making of women from diverse sectors of society. The key points of the decision are as follows:

a. The National Authority for the Advancement of Women is renamed the National Authority for Gender Equality. The Authority will be responsible for: planning government policy for gender equality; developing gender mainstreaming tools (including the development of methodologies for the implementation of gender mainstreaming, collection of data for supporting policy, conducting surveys and research) and related training in the public and private sectors; promoting equal representation in all spheres of life of men and women from diverse sectors of the population.
b. Information should be provided and training and guidance promoted for the implementation of gender mainstreaming to support the change of consciousness, language and organizational culture with respect to gender equality among policymakers.

c. Equal representation of women in the public and private sectors shall be advocated preventing discrimination and exclusion on the basis of gender in the public sphere; conducting specific activities for empowering women from various populations.

Other non-statutory decisions on gender issues

THE PLANNING AND BUDGETING COMMITTEE AND COUNCIL FOR HIGHER EDUCATION IN ISRAEL RESOLUTIONS

Approved by the PBC (January 2012) and the CHE (April 2012)

Description: (a) each university shall appoint an adviser to the President for the promotion of the status of women; (b) a policy of extending the duration of stipends for doctorate students (female or male) due to birth of children shall be promoted; (c) efforts to identify suitable female candidates to occupy academic positions and to promote suitable and appropriate alternatives for postdoctoral positions abroad shall be made; (d) the time between hiring and receiving a tenure track position shall be extended for women due to child birth; (e) appropriate representation of women in committees of higher education institutes shall be promoted; (f) the publication of annual reports on gender equality shall be promoted.

URL: http://che.org.il/?page_id=34332

THE ESTABLISHMENT OF A JOINT CHE–PBC STEERING COMMITTEE ON THE REPRESENTATION AND PROMOTION OF WOMEN IN INSTITUTES OF HIGHER EDUCATION

CHE resolution (September 8, 2013) and PBC resolution (September 11, 2013) for the promotion of women in science and technology and in institutes of higher education.

Description: In order to continue to advance the issue of the representation and promotion of women in institutes of higher education it was decided to establish a joint CHE–PBC steering committee headed by the President of the Israeli Academy of Sciences and Humanities. The committee serves also as a sub-committee of the National Council for the Promotion of Women in Science and Technology in the Ministry of Science, Technology and Space. According to the CHE–PBC decision, and in coordination with the Ministry of Science, Technology and Space, the mandate of the committee is as follows:

a. Mapping all bodies that are active in issues of the representation and promotion of women in the higher education system.
b. Monitoring and overseeing the implementation of the recommendations of the Carmi Committee.
c. Formulating further relevant recommendations and presenting them for discussion in the CHE and PBC.
d. Collecting and assembling contemporary data and monitoring the current situation and the progress of the issue in the institutes of higher education.
e. Reporting annually to the CHE, the PBC, and the National Council for the Promotion of Women in Science and Technology on the representation and promotion of women among the student population in different fields, in the academic staff of different disciplines, and in applications for and awarding of research grants.

The committee decided to examine three fundamental issues: directing women in advanced degrees toward research in academia; recruiting women as new staff and promoting women within the academic staff; and the applications for and awarding of research grants. At the same time, the committee urged all institutes of higher education to implement the recommendations of the Carmi Committee, which were approved by the CHE and PBC. In addition, aiming to support women continuing to postdoctoral research abroad, the PBC will continue to support the scholarship programme for outstanding women postdoctoral researchers. Furthermore, to encourage high quality yet flexible postdoctoral research, women who conduct their postdoctoral research partly in Israel and partly abroad will be eligible for this scholarship in upcoming years.

URL: http://che.org.il/wp-content/uploads/2012/05/HIGHER-EDUCATION-BOOKLET.pdf

Government Resolutions Pertaining to the Environment and Energy

REMOVING BARRIERS IN THE ENERGY SECTOR

Government Resolution Number: 2178

Adopted: August 12, 2007

Description: This resolution proposes to remove barriers in the energy sector and to set regulations for the distribution of licenses for the production of electricity by the private sector. The resolution also proposes to set up a committee that will promote the production of electricity from renewable sources.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2007/Pages/des2178.aspx

RESEARCH AND DEVELOPMENT OF POWER GENERATION TECHNOLOGIES IN THE RENEWABLE ENERGY DOMAIN

Government Resolution Number: 3954

Adopted: August 21, 2008

Description: In light of the global trend toward increased use of renewable energy demonstrated by high investment in R&D in the field of renewable energy, and due to the comparative advantage of Israel in this field of R&D, this government resolution proposes a five-year plan to develop research and technology in the field of renewable energy.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2008/Pages/des3954.aspx

PROMOTION OF GREEN CONSTRUCTION

Government Resolution Number: 1806

Adopted: March 14, 2010

Description: This government resolution specifies several actions to promote green construction in Israel over the years 2014–2015.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2014/Pages/dec1806.aspx

FORMULATING STRATEGY FOR A NATIONAL PLAN TO REDUCE GREENHOUSE GAS EMISSIONS

Government Resolution Number: 2508

Adopted: November 28, 2010

Description: This government resolution empowers the Committee for the Reduction of Greenhouse Gas Emissions to create a plan to reduce emissions by 20% by the year 2020.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2010/Pages/des2508.aspx

POLICY FOR RENEWABLE ENERGY

Government Resolution Number: 3484

Adopted: July 17, 2011

Description: This government resolution sets production quotas and goals for government policy in the domain of renewable energy production.

URL: http://www.sviva.gov.il/English/env_topics/energy/renewables/Pages/Renewable-Energy-Planning-And-Policy.aspx

NATIONAL PLAN FOR GREEN GROWTH

Government Resolution Number: 3768 3824

Adopted: October 23, 2011

Description: A year after the OECD Ministers adopted a coherent inter-committee strategy report on Green Growth, Israel adopted a resolution to promote green growth solutions. The scarcity of water, energy, and land resources has catalysed Israel's developing innovative technologies in a wide variety of fields including water management, seawater desalination, desert agriculture, and solar energy. The more fundamental change toward a green economy is the next challenge. This government resolution sets out a process including roundtables bringing together the government, industry, and civil society in order to plan innovative solutions for green growth.

URL: http://itrade.gov.il/oecd/israel-adopts-a-green-growth-strategy/

A PLAN TO MANAGE NATURAL GAS RESERVES IN MEDITERRANEAN SEA

Government Resolution Number: 4748

Adopted: June 10, 2012

Description: This government resolution calls for a detailed national master plan for managing gas reserves recently discovered in the Mediterranean Sea.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2012/Pages/des4748.aspx

SUSTAINABLE ECONOMIC DEVELOPMENT OF THE MARINE BIOLOGY AND AQUACULTURE FIELDS IN EILAT

Government Resolution Number: 4848

Adopted: July 1, 2012

Description: The Red Sea is a natural resource in the region of Eilat. In light of the unique advantages the region offers for marine biology, aquaculture research and economic activities derived from these, this government resolution seeks to examine the potential to enhance employment and economic opportunities in the region on the basis of the contribution marine biology and aquaculture make.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2012/Pages/des4848.aspx

PROMOTING COMPREHENSIVE NATIONAL POLICY OF RENEWAL AND DEVELOPMENT OF URBAN SPACE

Government Resolution Number: 376

Adopted: June 12, 2013

Description: This government resolution aims to increase the supply of housing, optimize land use, preserve open spaces, and improve the quality of life of Israelis.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2013/Pages/dec376.aspx

Government Resolutions Pertaining to Public Health

ESTABLISHMENT OF THE NATIONAL KNOWLEDGE CENTRE FOR TESTING THE EFFECTS OF NON-IONIZING RADIATION ON PUBLIC HEALTH

Government Resolution Number: 4738

Adopted: March 1, 2006

Description: This government resolution stresses the importance of establishing a national knowledge centre to test the effects of non-ionizing radiation on public health. The centre will be responsible for collecting reliable data on non-ionizing radiation from various sources in Israel and abroad, and for disseminating this data to the general-public.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2006/Pages/des4738.aspx

NATIONAL PROGRAM FOR PROMOTING ACTIVE AND HEALTHY LIFESTYLES

Government Resolution Number: 3921

Adopted: November 28, 2011

Description: This government resolution calls for a national programme to promote healthy lifestyles with the specific aim to reduce morbidity and mortality associated with obesity, heart disease, cancer, and diabetes in Israel. The proposed programme will address common risk factors for cardiovascular disease such as improper diet, lack of exercise and smoking.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2011/Pages/des3921.aspx

UTILIZATION OF KNOWLEDGE GENERATED THROUGH GOVERNMENT-FUNDED RESEARCH GRANTS

Government Resolution Number: 2575

Adopted: September 13, 2004

Description: This government resolution states that all R&D outputs, knowledge, knowhow, and IP that are generated through government-funded research grants by non-government employees will be under the ownership of the institution that conducted the research. The research institute will be permitted to register the IP (including patents) under its name in Israel or abroad if the IP generated in the course of the research will be used for the promotion and implementation of the technology. As a pre-condition for receiving the government grant, the research institute shall grant the State of Israel a non-exclusive license to use the IP and the research outputs for national objectives. Determination of whether use of the IP falls under these objectives shall be under the jurisdiction of the Minister of Science Technology and Space the Minister of Justice and the Minister of Finance. The research institute shall transfer 5% of all income to the State generated from the commercialization of the IP and the research outputs.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2004/Pages/des2575.aspx

ESTABLISHMENT OF THE ISRAELI PATENT OFFICE WITHIN THE MINISTRY OF JUSTICE

Government Resolution Number: 4722

Adopted: March 5, 2006

Description: Establishment of an independent Israeli patent authority within the Ministry of Justice.

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2006/Pages/des4722.aspx

AGREEMENT WITH WIPO ON THE FUNCTIONING OF THE ILPO AS AN ISA AND IPEA

Government Resolution Number: 1817

Adopted: June 17, 2010

Description: Approval of the agreement between the Government of Israel and the International Bureau of the World Intellectual Property Organization (WIPO) in relation to the functioning of the Israel Patent Office as an International Searching Authority (ISA) and International Preliminary Examining Authority under the Patent Cooperation Treaty (PCT).

URL: http://www.pmo.gov.il/Secretary/GovDecisions/2010/Pages/des1817.aspx

URL: http://www.wipo.int/export/sites/www/pct/en/texts/agreements/ag_il.pdf

IP IMPLEMENTING RULES/REGULATIONS

- Patent Regulations (Application of the Patent Cooperation Treaty) (Amendment No. 2), 7121–2012
- Patents Regulations (Authority Procedures, Documents, Procedure, and Fees) (amendment), 5772–2012 (2014)

- Plant Breeders' Rights Regulations (Registration in Israel of Orchid Varieties Cultivated in Taiwan), 5772–2011 (2014)
- Trademarks Regulations (Application of the Madrid Protocol), 5767–2007 (consolidated version of 2014) (2014)
- Patent Regulations (Extension of Period of Protection-Procedures for Application for an Order, for Opposition to an Order and for Application for Cancellation), 5758-1998 (consolidated version of 2014) (2014)
- Civil Procedure Regulations, 5744-1984 (consolidated version of 2014) (2014)
- Patent Regulations (Notice of a Patent Invention by a State Official), 5730-1969 (as amended 1983) (2014)
- Patent Order (Determination of Enterprises and Institutions for the purpose of section 137 of the Law), 5728-1968 (2014)
- Patents Regulations (Office Practice, Rules of Procedure, Documents and Fees), 5728-1968 (consolidated version of 2014) (2014)
- Patents and Designs Regulations (Procedures before the Appeal Committee), 5712–1952, as consolidated 2014 (2014)
- Trademark Regulations, 1940 (consolidated version of 2014) (2014)
- Trade-marks Order (Convention of Industrial Property), 1934 (2014)
- Design Rules, 1925 (consolidated version of 2014) (2014)
- Plant Breeders' Rights Regulations, 5734-1974 (consolidated version of 2013 (2013)
- Copyright Regulations (Public Performance in Education Institutions), 5770–2012 (2012)
- Patent (Application of the Patent Cooperation Treaty) Regulations, 1996 (as amended up to June 1, 2012) (2012)
- Trademarks (Appeal to District Court) Regulations, 5748-1987 (as amended on April 1, 2011) (2011)
- Copyright Regulations (Libraries and Archives), 5769–2008 (2008)
- Copyright (United States of America) (Amendment) Order, 2007 (2007)
- Copyright (United States of America) Order, 5713-1953 (as amended on October 29, 2007) (2007)
- Copyright, Performers and Broadcasters Rights Order (Rome Convention), 5763–2002 (2002)
- Performers' and Broadcasters' Rights Order (TRIPS Agreement), 5760-1999 (2000)
- Commercial Torts Regulations (Remedies and Procedures), 5760-1999 (1999)
- Patent Regulations (Application of the Patent Cooperation Treaty), 5756-1996 (1996)
- Plant Breeders' Rights Regulations (Extension of Term of Breeders' Right), 5753-1993 (1993)
- Appellations of Origin (Procedure before Appeal Committee) Regulations, 5727-1966 (as amended up to April 1, 1986) (1986)
- Copyright (Convention for Protection of Producers of Phonograms) Order, 5738-1978 (1978)
- Copyright Regulations (Rules of Procedure for the Committee on the Determination of Royalties), 5731-1971 (1971)
- Patents (Jurisdiction of District Court at Tel Aviv Yafo) Order, 5729-1969 (1969)
- Appellations of Origin (Procedure of Registration of Appellations of Origin Originating in a Foreign Country) Regulations, 5727-1967 (1967)
- Appellations of Origin (Procedure of Registration of Appellations of Origin Originating in Israel) Regulations, 5726-1966 (1966)
- Copyright (International Convention) Order, 5715-1955 (1955)
- Copyright (Bern Convention) Order, 5713-1953 (1953)
- Design Regulations (International Convention), 1935 (1935)

INTERNATIONAL AGREEMENTS ON SETI MATTERS

UNITED NATIONS EDUCATIONAL SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO)

United Nations Educational Scientific and Cultural Organization (UNESCO)

Date of enactment: 1949

Description: Israel participates in the World Heritage Committee, and in various environmental activities (Intergovernmental Oceanographic Commission, International Hydrological Programme) etc.

URL: http://www.unesco.org/nac/geoportal.php?country=IL&language=E

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Committee for Science and Technology Policy (CSTP)

Date of enactment: 2009

Description: The Committee for Scientific and Technological Policy is responsible to encourage co-operation among Members and as appropriate with non-members in the fields of science technology and innovation policy with a view to contributing to achievement of economic social and scientific aims including growth creation of skilled jobs, sustainable development, improved well-being of their citizens and advancing the frontiers of knowledge.

URL: http://www.oecd.org/science/sci-tech/

EUROPEAN COMMISSION

Seventh Framework Programme (FP7)

Adoption: 2007–2013

Description: The Seventh Framework Programme (FP7) bundled all research-related EU initiatives together under a common umbrella playing a crucial role in achieving the goals of growth competitiveness and employment. Four main objectives were identified corresponding to four specific programmes around which the European research effort was structured – Co-operation, Ideas, People, and Capacities. The Co-operation Programme aimed to stimulate co-operation and improve links between industry and research within a transnational framework. The Ideas Programme was intended to enhance exploratory research in Europe aimed at discovering new knowledge that fundamentally changes the vision of the world and the way of life. The People Programme harnessed significant financial resources to be used to improve the career prospects of researchers in Europe and attract more high-quality young researchers. The Capacities Programme was intended to give researchers powerful tools that will enable them to enhance the quality and competitiveness of European research.

URL: http://cordis.europa.eu/fp7/home_en.html

EUROPEAN COMMISSION

Horizon 2020

Adoption: 2014–2020

Description: Horizon 2020 is the financial instrument implementing the Innovation Union a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness and creating smart sustainable and inclusive growth and jobs. The programme's main goals are to assure that Europe produces excellent science to remove obstacles to innovation and to make it easier for the public and private sectors to work together in delivering innovation. The programme rests on three pillars: Excellent Science, Industrial Leadership, and Societal Challenges. Activities under Excellent Science are aimed at reinforcing and extending the excellence of the Union's science base and to make the Union's research and innovation system more competitive on a global scale. The Industrial Leadership pillar aims to speed up development of the technologies and innovations that will underpin tomorrow's businesses and help innovative European SMEs grow into world-leading companies. The Societal Challenges pillar brings together resources and knowledge across different fields technologies and disciplines including social sciences and the humanities. This domain covers activities from research to marketing with a new focus on innovation-related activities such as piloting demonstrations, test-beds, support for public procurement, and market uptake.

URL: http://ec.europa.eu/programmes/horizon2020/

WIPO – ADMINISTERED TREATIES

- Brussels Convention Relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite
- Nairobi Treaty on the Protection of the Olympic Symbol
- Patent Law Treaty
- Trademark Law Treaty
- WIPO Copyright Treaty
- WIPO Performances and Phonograms Treaty
- Protocol Relating to the Madrid Agreement Concerning the International Registration of Marks (September 1, 2010)
- Rome Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organizations (December 30, 2002)
- Patent Cooperation Treaty (June 1, 1996)
- Budapest Treaty on the International Recognition of the Deposit of Micro-organisms for the Purposes of Patent Procedure (April 26, 1996)
- Convention for the Protection of Producers of Phonograms Against Unauthorized Duplication of Their Phonograms (May 1, 1978)
- Strasbourg Agreement Concerning the International Patent Classification (October 7, 1975)
- Convention Establishing the World Intellectual Property Organization (April 26, 1970)
- Lisbon Agreement for the Protection of Appellations of Origin and their International Registration (September 25, 1966)
- Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks (April 8, 1961)
- Berne Convention for the Protection of Literary and Artistic Works (March 24, 1950)
- Madrid Agreement for the Repression of False or Deceptive Indications of Source on Goods (March 24, 1950)
- Paris Convention for the Protection of Industrial Property (March 24, 1950)

IPR – RELATED MULTILATERAL TREATIES

- Additional Protocol to the Multilateral Convention for the Avoidance of Double Taxation of Copyright Royalties
- Council of Europe Convention on the counterfeiting of medical products and similar crimes involving threats to public health
- International Agreement on Olive Oil and Table Olives, 2005
- Multilateral Convention for the Avoidance of Double Taxation of Copyright Royalties
- Protocol 1 annexed for Universal Copyright Convention as revised at Paris on 24 July 1971 concerning the application of that Convention to works of Stateless persons and refugees
- Protocol 2 annexed for Universal Copyright Convention as revised at Paris on 24 July 1971 concerning the application of that Convention to works of certain international organizations
- Stockholm Convention on Persistent Organic Pollutants
- Universal Copyright Convention as revised on 24 July 1971, with Appendix Declaration relating to Article XVII and Resolution concerning Article XI
- Kiev Protocol on Pollutant Release and Transfer Registers to the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (April 14, 2013)
- Convention on the Rights of Persons with Disabilities (October 28, 2012)
- Protocol (III) additional to the Geneva Conventions of 12 August 1949, and relating to the adoption of an additional distinctive emblem (May 22, 2008)
- WHO Framework Convention on Tobacco Control (November 22, 2005)
- International Plant Protection Convention (October 2, 2005)
- Kyoto Protocol to the United Nations Framework Convention on Climate Change (February 16, 2005)
- United Nations Convention on Contracts for the International Sale of Goods (February 1, 2003)
- Convention concerning the Protection of the World Cultural and Natural Heritage (January 6, 2000)
- United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (December 26, 1996)
- United Nations Framework Convention on Climate Change (September 2, 1996)
- Convention on Biological Diversity (November 5, 1995)
- Agreement establishing the World Trade Organization (WTO) (April 21, 1995)
- World Trade Organization (WTO) – Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) (1994) (April 21, 1995)
- International Covenant on Economic, Social and Cultural Rights (January 3, 1992)
- International Convention for the Protection of New Varieties of Plants (UPOV) (December 12, 1979)
- European Agreement concerning Programme Exchanges by Means of Television Films (February 15, 1978)
- European Convention relating to the Formalities required for Patent Applications (May 1, 1966)
- Convention relating to the Status of Stateless Persons (June 6, 1960)
- Protocol to the Convention for the Protection of Cultural Property in the Event of Armed Conflict (July 1, 1958)
- Convention for the Protection of Cultural Property in the Event of Armed Conflict (January 3, 1958)
- Protocol 1 annexed to the Universal Copyright Convention as signed at Geneva on 6 September 1952 concerning the application of that Convention to works of stateless persons and refugees (September 16, 1955)
- Protocol 2 annexed to the Universal Copyright Convention as signed at Geneva on 6 September 1952 concerning the application of that Convention the works of certain international organizations (September 16, 1955)

- Universal Copyright Convention of 6 September 1952, with Appendix Declaration relating to Article XVII and Resolution concerning Article XI (September 16, 1955)
- Protocol 3 annexed to the Universal Copyright Convention as signed at Geneva on 6 September 1952 concerning the effective date of instruments of ratification or acceptance of or accession to that Convention (April 6, 1955)
- Agreement on the Importation of Educational, Scientific and Cultural Materials (June 27, 1952)
- Convention (I) for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field (January 6, 1952)
- Convention (II) for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea (January 6, 1952)
- Convention (III) relative to the Treatment of Prisoners of War (January 6, 1952)
- Convention (IV) relative to the Protection of Civilian Persons in Time of War (January 6, 1952)
- Convention on International Civil Aviation (June 23, 1949)

IPR REGIONAL TREATIES

- Protocol Relating to Trade Negotiations Among Developing Countries Agreement (February 11, 1973)

BI-NATIONAL AGREEMENTS ON SETI MATTERS

PEOPLE'S REPUBLIC OF CHINA

Joint China-Israel Fund for Scientific and Strategic Research and Development

Date of enactment: 1995

Description: The objectives of the fund are to promote and fund scientific and strategic research and development projects of interest to both countries.

URL: http://most.gov.il/ExampleSite/CooperationAgreements/Documents/China.pdf

PEOPLE'S REPUBLIC OF CHINA

Joint China-Israel Program for Cooperation in Science and Technology

Date of enactment: 2012

Description: This programme is intended to expand and intensify bilateral co-operation in scientific research and development.

URL: http://most.gov.il/ExampleSite/CooperationAgreements/Documents/ChinaNewProgram.pdf

CZECH REPUBLIC

Israeli-Czech Joint Research Program Work Plan for Support of Czech-Israeli Joint Projects for the Years 2013–2015

Date of enactment: 2012

Description: The programme aims to enhance co-operation between the two countries in various research fields within the work plan for the years 2013–2015.

URL: http://www.vlada.cz/assets/media-centrum/aktualne/joint_statement_tisk.pdf

FRANCE

Israeli-French High Council for Scientific and Technological Research

Date of enactment: 2004

Description: This agreement seeks to develop and strengthen cooperative activities between teams and researchers in scientific fields that are of major interest to both parties.

URL: http://most.gov.il/ExampleSite/CooperationAgreements/Documents/%D7%A6%D7%A8%D7%A4%D7%AA.pdf

GERMANY

Agreement between Germany and Israel for Cooperation in Science (BMBF-MOST Cooperation)

Date of enactment: 1973

Description: This agreement is intended to promote and fund civil research and development projects of interest to Germany and Israel in basic and applied research.

URL: http://most.gov.il/ExampleSite/CooperationAgreements/Documents/%D7%94%D7%A1%D7%9B%D7%9D%20%D7%A7%D7%A8%D7%9F%20%D7%92%D7%A8%D7%9E%D7%A0%D7%99%D7%AA.pdf

INDIA

Agreement for Science and Technology Cooperation between Israel and India

Date of enactment: 1993

Description: The agreement aims to enhance co-operation between the two countries in the domains of agriculture, paramedical technologies, biotechnology, nanotechnology, electro-optics, and laser technologies.

URL: http://most.gov.il/ExampleSite/CooperationAgreements/Documents/IndiaHebrew.pdf

ITALY

Agreement between Italy and Ministry of Science Technology and Space of Israel for Science Cooperation

Date of enactment: 1975

Description: The purpose of this agreement is to enhance co-operation between the two countries in the science domains.

URL: http://most.gov.il/ExampleSite/CooperationAgreements/Documents/%D7%90%D7%99%D7%98%D7%9C%D7%99%D7%94%20%D7%90%D7%A0%D7%92%D7%9C%D7%99%D7%AA.pdf

JAPAN

Joint Program for Cooperative Israeli-Japanese Research

Date of enactment: 2008

Description: This programme aims to enhance co-operation between the two countries in the domains of brain disorders as well as in other fields.

URL: http://most.gov.il/ExampleSite/CooperationAgreements/Documents/Japan.pdf

RUSSIAN FEDERATION

Agreement for Science Cooperation between Israel and the Russian Federation

Date of enactment: 1994

Description: The purpose of this agreement is to foster collaboration between Russian-speaking scientists in both countries. Work plans were signed in 2005 between the Science and Technology Ministry and The Russian Foundation for Basic Research (RFBR). From 2006 to the present, there were three rounds of binational projects in mathematics, physics, geology, geophysics, nanotechnology, green energy and computer science.

REPUBLIC OF KOREA

Agreement for Science and Technology Cooperation between Israel and the Republic of Korea

Date of enactment: 1994

Description: This agreement is intended to foster scientific collaboration between the two countries. In recent years, joint collaborations were held in computer science, nanotechnology, semiconductors, life sciences and renewable energy.

URL: http://most.gov.il/ExampleSite/CooperationAgreements/Documents/Korea.pdf

UNITED KINGDOM

The Britain Israel Research and Academic Exchange Partnership (BIRAX)

Date of enactment: 1969

Description: BIRAX (Britain Israel Research and Academic Exchange Partnership) is a £10 million initiative by the British Embassy in Israel and the British Council in collaboration with the Pears Foundation and the UJIA. The programme funds cutting-edge research using stem cell therapies to tackle some of the world's most dreadful diseases.

URL: http://www.britishcouncil.org.il/en/programmes/science/birax

EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE

Agreement with European Marine Biological Resource Centre (EMBRC)

Date of enactment: 2013

Description: This is a scientific agreement with the European Marine Biological Resource Centre.

URL: http://cordis.europa.eu/result/rcn/150330_en.html

EUROPEAN MOLECULAR BIOLOGY CONFERENCE

Agreement with European Molecular Biology Conference (EMBC)

Date of enactment: 1970

Description: This is a scientific agreement with the European Molecular Biology Conference.

EUROPEAN MOLECULAR BIOLOGY LABOURATORY

Agreement with European Molecular Biology Laboratory (EMBL)

Date of enactment: 1974

Description: This is a scientific agreement with the European Molecular Biology Laboratory.

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Agreement with European Organization for Nuclear Research (CERN)

Date of enactment: Co-operation Agreement: 1990; Associate member: 2011

Description: This is a scientific agreement with the European Organization for Nuclear Research.

URL: http://index.justice.gov.il/Units/TergomOmanotBimLeumi/Maagar/maagaramana/1491.doc

BI-national agreements on INDUSTRY AND seti matters[61]

61 URL: http://www.matimop.org.il/

ARGENTINA

Argentina-Israel R&D Cooperation Program

Date of enactment: 2011

Description: The State of Israel is partnered with Argentina through the Ministry of Economy and Production (MECON) together with the Ministry of Science Technology and Productive Innovation (MINCYT) to support joint R&D projects.

URL: http://www.matimop.org.il/argentina.html

AUSTRALIA

Victoria-Israel Science and Technology R&D Fund

Date of enactment: 2005

Description: The Victoria-Israel Science and Technology R&D Fund (VISTECH) was launched on December 7, 2005 to promote facilitate and support jointly approved science and technology research and development (R&D) projects.

URL: http://www.matimop.org.il/australia.html

BRAZIL

Brazil – Israel R&D Cooperation Program

Date of enactment: 2000

Description: The State of Israel is partnered with Brazil through the Government of the Federative Republic of Brazil and the Ministry of Development Industry and Foreign Trade of Brazil (MDIC) to support joint R&D projects.

URL: http://www.matimop.org.il/brazil.html

CANADA

Canada – Israel Industrial R&D Collaboration

Date of enactment: n/a

Description: The Office of the Chief Scientist (OCS) Americas Operations initiates and develops partnerships with Canadian counterparts at the federal and provincial level as well as with stakeholders in the private sector. The relationship provides partner matching services as well as access to joint funding mechanisms dedicated to the development of business-driven partnerships of Israel- and Canada- based companies through joint innovation projects. These programmes reduce the risks inherent in international R&D ventures while creating new business opportunities.

URL: http://www.matimop.org.il/canada.html

CANADA

The Canada-Israel Industrial Research and Development Foundation (CIIRDF)

Date of enactment: 1995

Description: This foundation works to stimulate collaborative research and development among private sector companies – in both countries – with a focus on the commercialization of new technologies.

URL: http://www.ciirdf.ca/home/index.php

CHINA

China-Israel Industrial R&D Cooperation Framework

Date of enactment: 2010

Description: The China-Israel Industrial R&D Cooperation Framework aims to foster joint technological R&D co-operation projects between Chinese and Israeli industries in all technological sectors.

URL: http://www.matimop.org.il/china.html

INDIA

India – Israel Industrial R&D Cooperation

Date of enactment: 2005

Description: This agreement yields bilateral programmes providing financial support for collaborative industrial R&D ventures between Israeli and Indian companies.

URL: http://www.matimop.org.il/india.html

SINGAPORE

The Singapore-Israel Industrial R&D Foundation (SIIRD)

Date of enactment: 1997

Description: This agreement provides for co-operation between the Singapore Economic Development Board (EDB) and the Office of the Chief Scientist (OCS) in Israel to promote facilitate and support joint industrial R&D projects between companies from Israel and Singapore leading to successful commercialization.

URL: http://www.siird.com/#&panel1-2

REPUBLIC OF KOREA

Korea-Israel Industrial R&D Foundation (KORIL-RDF)

Date of enactment: 2001

Description: The Korea-Israel Industrial R&D Foundation was established by the governments of the Republic of Korea and Israel. KORIL-RDF supports industrial R&D projects that show commercial potential and may contribute to the economic progress of both countries.

URL: http://www.koril-rdf.or.kr/english/index.php

URUGUAY

Uruguay – Israel Industrial R&D Cooperation Program

Date of enactment: 2011

Description: The Uruguay–Israel Industrial Research and Development Programme is a governmental bilateral framework providing active support for collaborative R&D ventures between Uruguayan and Israeli companies.

URL: http://www.matimop.org.il/Uruguay.html

UNITED STATES OF AMERICA

USA-Israel Industrial R&D Collaboration

Date of enactment: n/a

Description: The Office of the Chief Scientist (OCS) initiates and develops partnerships with USA counterparts at the federal and state level as well as with stakeholders in the private sector. It provides partner matching services as well as access to joint funding mechanisms dedicated to develop business-driven partnerships between Israeli and USA-based companies through joint innovation projects. These programmes reduce the risks inherent in international R&D ventures while creating new business opportunities.

URL: http://www.matimop.org.il/usa.html

IP-RELEVANT BILATERAL TREATIES

- Agreement between the Government of the State of Israel and the Government of the Republic of Albania on Trade and Economic Cooperation (June 1, 2004)
- Agreement between the Government of the State of Israel and the Government of the Republic of Korea for the Reciprocal Promotion and Protection of Investments (June 19, 2003)

- Free Trade Agreement between the Government of the Republic of Bulgaria and the Government of the State of Israel (January 1, 2002)
- Free Trade Agreement between Israel and Mexico (July 1, 2000)
- Agreement between the Government of the State of Israel and the Government of the Czech Republic for the Reciprocal Promotion and Protection of Investments (March 16, 1999)
- Agreement between the Government of the State of Israel and the Government of the Republic of Moldova for the Reciprocal Promotion and Protection of Investments (March 16, 1999)
- Agreement between the Government of the State of Israel and the Government of the Republic of Turkey for the Reciprocal Promotion and Protection of Investments (August 27, 1998)
- Agreement between the Government of the State of Israel and the Government of the Republic of Argentina for the Promotion and Reciprocal Protection of Investments (April 10, 1997)
- Agreement between the Government of the State of Israel and the Government of the Republic of Kazakhstan for the Reciprocal Promotion and Protection of Investments (February 19, 1997)
- Agreement between the Government of the Republic of India and the Government of the State of Israel for the Reciprocal Promotion and Protection of Investments (February 18, 1997)
- Agreement between the Government of the State of Israel and the Government of the Republic of Albania for the Promotion and Reciprocal Protection of Investments (February 18, 1997)
- Agreement between the Government of the State of Israel and the Government of the Republic of Uzbekistan for the Reciprocal Promotion and Protection of Investments (February 18, 1997)
- Free Trade Agreement between Canada and Israel (January 1, 1997)
- Agreement on Scientific and Technical Cooperation between the European Community and the State of Israel (August 6, 1996)
- Free Trade Agreement between the EFTA States and Israel (January 1, 1993)
- Agreement between the Government of the Federal Republic of Germany and the Government of the State of Israel on Cooperation in the Area of Intellectual Property (February 26, 1990)
- Free Trade Agreement between the United States of America and Israel (August 19, 1985)

Inventory of SETI operational policy instruments in Israel

By March 2015, 53 different SETI operational policy instruments of high-impact[62] had been identified in Israel. These are presented in the tables overleaf. In general, each individual SETI operational policy instrument has either one or several specific objectives and goals, which correspond to the standard categories adopted within the GO→SPIN methodological approach. Figure 73 shows the distribution of SETI operational policy instruments by strategic objectives and goals in Israel which are now in operation.

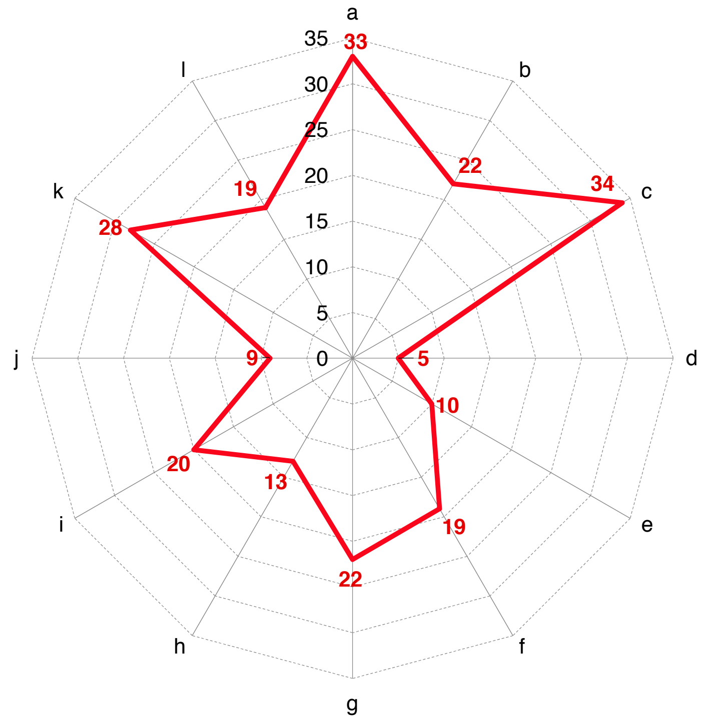


Figure 73: Distribution of SETI operational policy instruments in Israel according to the GO→SPIN categories of objectives and goals. Source: UNESCO

Key

a. Strengthening the production of new endogenous scientific knowledge
b. Strengthening the infrastructure of research laboratories in the public and private sectors
c. Human resources for research innovation and strategic planning. Capacity building education and training of specialized human capital for (1) the production of new scientific knowledge (2) development of new technologies (3) promotion of innovation within the productive and services systems and (4) management of the knowledge society
d. Strengthening gender equality for research and innovation
e. Strengthening the social appropriation of scientific knowledge and new technologies
f. Development of strategic technological areas and new niche products and services with high-added value. Promotion and development of innovation in the production of goods and services. Promotion of start-ups in areas of high technology
g. Strengthening programmes on science education at all levels (from primary school to postgraduate)
h. Promotion of the development of green technologies and social-inclusion technologies
i. Promotion of indigenous knowledge systems
j. Research and innovation ecosystem: strengthening co-ordination networking and integration processes which promote synergies among the different actors of the national scientific technological and productive innovation system (i.e. government university and productive sectors)
k. Strengthening the quality of technology foresight studies: to assess the potential of high-value markets; to develop business plans for high-tech companies; construct and analyse long-term scenarios; and to provide consulting services and strategic intelligence
l. Strengthening regional and international co-operation networking and promotion of SETI activities.

62 The country has another set of SETI operational policy instruments with funding mechanisms of smaller size, which are not listed here.

SETI OPERATIONAL POLICY INSTRUMENT 1

- **Title of the SETI operational policy instrument:** ISF – Individual Research Grants
- **Keywords:** ISF, research grants, exact sciences, life sciences, medicine, humanities, social sciences
- **Overview:** The Israel Science Foundation's main activities and budget are dedicated to the individual grants within the following fields of research: exact sciences and technology, life sciences and medicine, and humanities and social sciences. The grants are given to a single researcher, or to a group of up to four researchers, on the basis of excellence and competitiveness, for a period of up to four years
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Evaluate, select and support basic research proposals eligible for research grants based on quality and scientific excellence, regardless of institutional affiliation, in exact sciences and technology, life and medical sciences, social sciences and humanities
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity-building, education and training of specialized human capital for the production of new scientific knowledge
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Academic staff of Israeli universities and academic staff of other approved institutes such as hospitals and other research centres.
- **Target groups/Beneficiaries:** c. professionals / PhDs; e. universities; f. research centres; h. schools / colleges / institutes; o. individuals
- **Eligibility/Selection criteria:** Research innovativeness and impact. Adequacy of research methods and researcher's suitability for the research
- **Eligible costs:** Personnel (non-academic staff only), supplies and materials, equipment, miscellaneous
- **Source of funding:** The Planning and Budgeting Committee (PBC) and donations
- **Mode of disbursement of financial resources:** The ISF (Israel Science Foundation) manages the funding
- **Annual budget:** US$ 92 million
- **Continuity of the instrument in time:** n/a
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** In total, for the year 2011, the ISF funds funded around 1515 individual research grants, which make up more than 80% of the annual budget
- **Relevant links:** http://www.isf.org.il/english/path.asp?path_id=1

SETI OPERATIONAL POLICY INSTRUMENT 2

- **Title of the SETI operational policy instrument:** ISF – Equipment Grants for New Faculty
- **Keywords:** New faculty, equipment, grants
- **Overview:** This programme is intended for university researchers only during the first three years after they enter the academic system, and requires their institute´s to commit to match the ISF grant. Only an individual researcher may apply, including a personal research grant application for the same year. The maximum funding by the ISF is US$ 300 000
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** ISF aims to support new faculty members' acquiring scientific equipment for their scientific laboratories.
- **Specific objectives:** a. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge

- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** This programme is restricted to individual researchers in receipt of individual research grants or other ISF grants. Researchers may apply no later than three years after first joining the Israeli academic system. The programme is for university researchers only. They may apply for support to acquire new equipment for a total cost of up to US$ 600 000
- **Target groups/Beneficiaries:** c. professionals / PhDs; d. teachers / Researchers; e. universities
- **Eligibility/Selection criteria:** Research innovativeness and impact; necessity of the equipment to research; Proper infrastructures; Cost/benefit of the designated equipment related to other available equipment
- **Eligible costs:** Equipment up to total cost of US$ 600 000
- **Source of funding:** 50% ISF, 50% universities' own resources
- **Mode of disbursement of financial resources**: n/a
- **Annual budget:** US$ 8 600 000
- **Continuity of the instrument in time:** n/a
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** In 2011, the ISF funded the building of 32 new laboratories for new faculty members, at a total cost of US$ 5 500 000
- **Relevant links:** http://www.isf.org.il/english/path.asp?path_id=5

SETI OPERATIONAL POLICY INSTRUMENT 3

- **Title of the SETI operational policy instrument:** National BioBank
- **Keywords:** Biobank, Life Science, Medicine
- **Overview:** The Biobank is an organized collection of human biological material and associated information stored for one or more research purposes. Biobanks allow researchers to analyse data representing larger numbers of individuals than they could have had access to before, thus profoundly improving the efficient use of biological information and hastening new medical discoveries. Samples are to be collected and distributed by selected medical institutions around the country. The biological material will be available for academic researchers at a subsidized cost. Local for-profit entities will be able to access the materials at a cost. Foreign organizations will be able to purchase samples on a limited basis, according to established standards
- **Objectives of the plan (or the SETI policy) to which the instrument relates** improving the efficient use of biological information and hastening new medical discoveries
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; g. promotion and development of innovation in the production of goods and services
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** n/a
- **Target groups/Beneficiaries:** d. teachers / researchers; e. universities; f. research centres; i. corporations / foundations; l. private company; m. science and technology public or private non-profit organizations; o. individuals; p. small businesses
- **Eligibility/Selection criteria:** n/a
- **Eligible costs:** n/a

- **Source of funding:** Israeli Government via The Office of the Chief Scientist of the Ministry of Economy, The Office of the Chief Scientist of the Ministry of Science and Technology and The Planning and Budgeting Committee of the Council for Higher Education and The Ministry of Finance
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** NIS 35 million (approx. US$ 10 million) for the project, over a period of up to 5 years
- **Continuity of the instrument in time:** Since 2012
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** URL: http: //eng.sheba.co.il/Sheba_Hospitals/Acute_Care_Hospital/Laboratory/Tissue_Bank/
- **Relevant links:** http: //www.moital.gov.il/NR/rdonlyres/5E7A4322-4D0F-4320-953C-83F94024E7AA/0/RDspreads.pdf

SETI OPERATIONAL POLICY INSTRUMENT 4

- **Title of the SETI operational policy instrument:** Isragrid
- **Keywords:** Industrial R&D, Life Sciences, Start-ups
- **Overview:** The goal of this programme is to enable efficient e-science research in various fields by providing e-infrastructure taking advantage of grid and cloud computing technologies. Isragrid provides core services in various fields such as physics, life sciences and many more. The instrument is targeted to Israeli academics and R&D firms
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** The main objective of the programme is to create an infrastructure for R&D by taking advantage of grid and cloud computing and by addressing the needs of all R&D entities, including R&D and IT units in enterprises of all sizes, including both mature and global high technology companies and start-ups
- **Specific objectives:** b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the promotion of innovation within the productive and services systems; g. promotion and development of innovation in the production of goods and services; h. promotion of start-ups in areas of high technology; k. strengthening the quality of technology foresight studies to provide consulting services and strategic intelligence
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** d. creation of, and support for, technological poles and centres of excellence; f. technical assistance; j. information services
- **Conditions to apply for the instrument:** Firms and researchers from universities and research institutions in the relevant domains may apply.
- **Target groups/Beneficiaries:** a. technical and support staff at SETI; d. teachers / researchers; e. universities; i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** Attaining personal Grid certificate; joining a VO (Virtual Organization) in order to gain access to resources; opening an account in Isragrid UI (User Interface) server
- **Eligible costs:** n/a
- **Source of funding:** The programme is funded by TELEM, a voluntary partnership between organizations that support public R&D in Israel: the OCS in the Ministry of Economy, the Chief scientist in the Ministry of Science, Technology and Space, the Council for Higher Education, the Ministry of Defence and the Ministry of Finance.
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** n/a
- **Continuity of the instrument in time:** Since 2013

- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** https://www.isragrid.org.il/case-studies/

SETI OPERATIONAL POLICY INSTRUMENT 5

- **Title of the SETI operational policy instrument:** BARD (USA–Israel Binational Agricultural R&D)
- **Keywords:** Agricultural Research, Bio-Energy, Agricultural Production, Food / Water Quality, Genomics
- **Overview:** BARD is a competitive funding programme for mutually beneficial, mission-oriented, strategic and applied research of agricultural problems, jointly conducted by American and Israeli scientists. Most BARD projects focus on increasing agricultural productivity, particularly in hot and dry climates, and emphasize plant and animal health, food quality and safety, and environmental issues. BARD also supports international workshops. BARD offers fellowships for postdoctoral research, senior research scientists and graduate students. BARD is empowered to fund scientists affiliated with public or not-for-profit, private entities and to encourage the exchange of agricultural scientists, engineers or other agricultural experts. During its 30 years of operation, BARD has funded over 1200 projects with a total investment of more than US$ 300 million. In addition, it has administered collaborative research between agricultural scientists in Israel and their colleagues in Canada and Australia. Recently BARD established the MARD Programme to promote cooperative agricultural research and development activities between scientists in Israel, Jordan, the Palestinian Authority and the United States. During its five years of operation, MARD has funded numerous successful regional workshops, mutual visits, training seminars and similar activities that have enhanced the spirit of collaboration between Palestinian, Jordanian, Israeli and US investigators. MARD now offers Facilitating Grants to enable small multinational research groups to jointly prepare a detailed research proposal to be submitted to other international granting organizations
- **Objectives of the plan (or the SETI policy) to which the instrument relates**: increasing agricultural productivity, particularly in hot and dry climates, and emphasize plant and animal health, food quality and safety, and environmental issues
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge, development of new technologies, promotion of innovation within the productive and services systems; g. promotion and development of innovation in the production of goods and Services; i. promotion of the development of green technologies and social-inclusion technologies; j. research and innovation ecosystem; k. strengthening the quality of technology foresight studies to strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue; b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; g. scholarships
- **Conditions to apply for the instrument:** Affiliates of public or private non-profit research institutions that demonstrate the necessary research and development capabilities are eligible for funding
- **Target groups/Beneficiaries:** b. students; c. professionals / PhDs; e. universities; f. Research Centres; h. schools / colleges / institutes; m. science and technology public or private non-profit organizations; q. public institutions
- **Eligibility/Selection criteria:** The work has to be agriculturally relevant and scientifically meritorious. The Board of Directors identified the following areas as priority areas for the coming years: Increased efficiency of agricultural production; protection of plants and animals against biotic stress; agricultural

production challenges in increasing marginal conditions; food quality, safety and security; water quality and quantity; functional genomics and proteomics that deal with important agricultural issues; sensors and robotics; sustainable bio-energy systems

- **Eligible costs:** All project costs are eligible to receive funding
- **Source of funding:** Ministry of Agriculture and Rural Development in Israel, US Department of Agriculture, endowments from companies that are interested in the research.
- **Mode of disbursement of financial resources:** Awards are based upon the details of the budget justification, the number of funded institutions in the proposed project and the nature of the specific research programme. The maximum amount that can be requested is US$ 340 000 for a three-year award, the typical grant is US$ 300 000 for a three year award
- **Annual budget:** US$ 7 million
- **Continuity of the instrument in time:** Since 1977
- **Geographical coverage:** b. national; c. regional
- **Results, outcomes and evidence of success of a given measure:** URL: http//www.bard-isus.com/local.aspx?lfid=5 ; 20 year external review of the United States-Israel Binational Agricultural Research and Development Fund, BARD; 30 year external review of the United States-Israel Binational Agricultural Research and Development Fund.
- **Relevant links:** http://www.bard-isus.com

SETI OPERATIONAL POLICY INSTRUMENT 6

- **Title of the SETI operational policy instrument:** BSF (USA–Israel Binational Science Foundation)
- **Keywords:** R&D co-operation, USA, Bilateral Co-operation, Basic Research, Applied Research
- **Overview:** The USA-Israel Binational Science Foundation (BSF) promotes scientific relations between the USA and Israel by supporting collaborative research projects in a wide area of basic and applied scientific fields, for peaceful and non-profit purposes. Founded in 1972 by an agreement between the United States and Israel, the BSF is an independent body, directed by a board of governors consisting of five American and five Israeli members. Its base of operation is in Israel. BSF grants have been a major source of funding for Israeli scientists, and have facilitated access to leading USA researchers and to the unrivalled infrastructure of American science
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** The aim of the instrument is to facilitate the scientific ties between the US and Israel by supporting joint research projects
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge; ii. development of new technologies; vi. other: facilitate scientific co-operation between the US and Israel
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Applications are made jointly by US and Israeli permanent staff at non-profit research organizations/universities. Applicants must have obtained PhD/MD
- **Target groups/Beneficiaries:** c. professionals / PhDs; e. universities; f. research centres; h. schools / colleges / institutes; m. science and technology public or private non-profit organization
- **Eligibility/Selection criteria:** Selection is made by panels of US and Israeli scientists that are aided by external reviews from scientists from around the world.
- **Eligible costs:** All direct costs of the research, excluding salaries to the principal investigators
- **Source of funding:** Interest on an endowment formed by the US and Israeli governments.

- **Mode of disbursement of financial resources:** Grants to non-profit research organizations to support specific research projects
- **Annual budget:** US$ 18 million
- **Continuity of the instrument in time:** n/a
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** Several thousand scientific publications authored jointly by US and Israeli scientists.
- **Relevant links:** http://www.bsf.org.il/BSFPublic/Default.aspx

SETI OPERATIONAL POLICY INSTRUMENT 7

- **Title of the SETI operational policy instrument:** BSF Energy – Binational Science Foundation
- **Keywords:** Solar Power, Bio-Fuels, Wind Energy, Smart Grid, Renewable Energy/Energy Efficiency technology, Energy Research
- **Overview:** The United States-Israel Binational Science Foundation (BSF) promotes scientific relationships between the two nations, by way of supporting joint research projects in various fields of basic and applied science, with non-profit and peaceful intentions. This programme focuses on energy research.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** n/a
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity-building, education and training of specialized human capital for the production of new scientific knowledge; f. development of strategic technological areas and new niche products and services with high added value; i. promotion of the development of green technologies and social-inclusion technologies; j. research and innovation ecosystem; k. strengthening the quality of technology foresight studies to construct and analyse long-term scenarios; v. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** The programme is limited to research in Alternative Energy, Renewable Energy and Energy Efficiency.
- **Target groups/Beneficiaries:** d. teachers / Researchers; e. universities; f. research centres; g. technical training centres; q. public institutions
- **Eligibility/Selection criteria:** n/a
- **Eligible costs:** Innovation in research in alternative energy, renewable energy and energy Efficiency.
- **Source of funding:** It is supported by a special contribution by the Israeli Ministry of Infrastructure, and the USA Department of Energy
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** The first round of applications was in 2010, and resulted in six three-year grants, each for about $ 200 000. A second round was initiated in early 2011 with 1.2 million to be distributed in grants
- **Continuity of the instrument in time:** Programme started in 2010
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** Examples of researches: Biofuel Producing Fungi Tolerating/Degrading Inhibitory Compounds Generated via Pre-Treatment – Hebrew University of Jerusalem. Self-Sustainable, U233-Th Fuel Cycle for Light Water Reactors – Ben-Gurion University. Energy-Efficient, Large DC-Gain Switched-Capacitor-Based Converters for Alternative Sources – Holon Institute of Technology

- **Relevant links:** http://www.bsf.org.il/BSFPublic/DefaultPage1.aspx?PageId=27&innerTextID=27

SETI OPERATIONAL POLICY INSTRUMENT 8

- **Title of the SETI operational policy instrument:** GIF – German-Israeli Foundation for Scientific Research and Development
- **Keywords:** Collaboration, Israel, Germany, Academic R&D
- **Overview:** The GIF Regular Program supports cooperative research projects conducted jointly by German and Israeli scientists. Projects must involve active collaboration between Israeli and German scientists, such as interdependent research conducted between two laboratories, sharing of research facilities, materials, equipment and/or services, exchange of scientific and technological knowledge and/or exchange of research personnel
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** GIF's objective is to promote and fund basic and applied scientific research projects for peaceful purposes in both countries (Israel and Germany) conducted jointly by teams of scientists
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge; development of new technologies; strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Projects must involve active collaboration between Israeli and German scientists, such as interdependent research conducted between two laboratories, mutual visits at the partner's lab sharing of research facilities, materials, equipment and/or services, exchange of scientific and technological knowledge, and/or exchange of research personnel
- **Target groups/Beneficiaries:** c. professionals / PhDs; e. universities
- **Eligibility/Selection criteria:** Research proposals submitted to GIF are evaluated according to the following criteria: originality and innovation; adequacy of methods; suitability of investigators' scientific background to the project; adequacy of overall budget; adequacy of salary budget; equipment (if applicable): is the specified equipment, in all its parts, essential for the project, mode of co-operation between the teams
- **Eligible costs:** 1. salaries (except for Principal and Cooperating Investigators); 2. travel (within and between Germany and Israel only); 3. equipment / material / operating expenses; 4. symposia (in Germany and Israel only); 5. publications; 6. external subcontracting of services
- **Source of funding:** n/a
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** In the past two years, GIF distributed about EUR 12 million per year for grants in the two programmes it offers
- **Continuity of the instrument in time:** start date 1986
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.i-core.org.il/Files-Documents

SETI OPERATIONAL POLICY INSTRUMENT 9

- **Title of the SETI operational policy instrument:** I-CORE: Israeli Centres of Research Excellence
- **Keywords:** I-CORE, Research Excellence
- **Overview:** An Initiative designed by the Planning and Budgeting Committee and the Government of Israel, which gradually established leading research centres specializing in a range of disciplines. The Centres of Excellence and the programme's vision are aimed at fundamentally strengthening the long term positioning of Israel's academic research and its stature among leading researchers in Israel and abroad
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Strengthening scientific research in Israel and establishing Israel's standing as a world leader in scientific research; 'brain gain': attracting excellent researchers back to Israel, as a central means of fortifying the research capabilities and the academic faculty of the institutions of higher education. Creating a critical mass and intensifying the relative advantages in selected fields in the different institutions; improving and upgrading the research infrastructure in the universities; encouraging academic innovation, including integration between different fields of knowledge (multidisciplinary); maintaining and promoting advanced programmes of instruction and training in selected fields; encouraging research collaboration between institutions of higher education, both universities and colleges; strengthening scientific research in Israel in disciplines of system-wide and national importance; promoting collaboration with leading researchers and research institutions worldwide
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning; capacity-building, education and training of specialized human capital for the production of new scientific knowledge; development of new technologies; e. strengthening the social appropriation of scientific knowledge and new technologies; j. research and innovation ecosystem; k. strengthening the quality of technology foresight studies to construct and analyse long-term scenarios; strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue; b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; d. creation of, and support for, technological poles and centres of excellence; g. scholarships; k. other: special budgets dedicated governmental budget, PBC, universities, strategic partners (NIS 705 million)
- **Conditions to apply for the instrument:** The research topics selected for the Centres were selected in a wide bottom-up process of consultation with the Israeli academic community, reflecting genuine priorities and scientific interest of researchers in Israel. Out of the large number of suggestions received by researchers, specific topics were chosen by designated committees. Once the topics were announced, a call for proposal was issued inviting groups of researchers to submit proposals for the establishment of I-COREs in these topics. The I-CORE research groups are comprised of academic staff members and researchers from institutes of higher education (at least one member of each Centre must be affiliated with an Israeli university), medical centres and research centres. Outstanding researchers will be recruited to the centres within three years of their establishment. These researchers also receive positions within one of the institutes, where they join the academic staff and acquire tenure according to the standard procedures. Each Centre will be directed by a Scientific Directorate of 3–5 members, including the scientific administrator. The university with which the Scientific Administrator is affiliated shall be referred to as the coordinating university. The Coordinating University shall be responsible for all administrative co-ordination with the Israel Science Foundation and the programme's steering committee. Participating institutions can be universities, colleges, hospitals and research institutes. Most of the research infrastructure of the Centre will be established within the leading university

- **Target groups/Beneficiaries:** b. students; c. professionals / PhDs; d. teachers / researchers; e. universities; f. research centres; h. schools / colleges / institutes; k. SETI local groups; m. science and technology public or private non-profit organizations; q. public institutions; s. other: medical centres
- **Eligibility/Selection criteria:** The evaluation and assessment processes of the proposals are carried out by the Israeli Science Foundation via international evaluation committees, which examined the proposals on a competitive basis. The evaluation and assessment processes are carried out in two stages – preliminary proposals and full proposals. The following criteria are considered while evaluating the full applications (their full description appears at URL: http: //www.i-core.org.il/Files-Documents). Quality of the research planned for the proposed Centre: the scientific quality of the application, including its degree of innovativeness and its potential for significant breakthroughs; credentials of the members of the proposed centre – both new and existing researchers; the research potential that may be achieved by supporting their combined research at the proposed Centre; coherence of the proposed research programme and the expected academic synergy between members of the proposed centre; importance and innovativeness of the subjects of research that the proposed centre will focus on. The participating institutes' capability of conducting the proposed research and the infrastructure currently available to them: the participating institutes' current ability to conduct the research in question, its existing infrastructure and its past achievements. The degree to which the proposed Centre's suits the general I-CORE programme**:** its participating institutes' proven ability to recruit new outstanding researchers for the centre and their ability to identify potential candidates who have expressed their willingness to join the centre in the future; relationships and collaboration with other institutes in Israel; ability to establish and promote international relationships to advance the topic of research conducted at the Centre; expected contribution to graduate students' training and educational programmes; interaction with other fields of research; contribution to Israeli society and Israel's potential sustainable growth, including collaboration with the industry when relevant. The proposed Centre's pertinence to the relevant field of research as defined by the steering committee
- **Eligible costs:** Each I-CORE receives a five-year budget defined according to the type of research that the Centre conducts. Experimental research centres will be allocated up to NIS 50 million and theoretical research centres will be allocated up to NIS 25 million
- **Source of funding:** The government, PBC (through Israel Science Foundation) and the Universities
- **Mode of disbursement of financial resources:** The Israel Science Foundation manages the funding to the centres
- **Annual budget:** Total budget of the PBC for 16 centres is NIS 450 million. The budget is distributed to the centres through their 5 years of activity. In the first years of operation, PBC budget was NIS 30.7 million the first year, NIS 54.1 million the second, and NIS 91.89 million the third year 2013/14 an additional NIS 255 million was added from the participating institutes and from external strategic partners
- **Continuity of the instrument in time:** 16 centres were established in two waves: the first wave of four centres started operating on October 2011, and the second wave of 12 I-COREs started operating on May 2013. Each Centre enjoys government funding during the first five years of it activity. The selection and establishment of the I-CORE's has been completed.
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** On the one hand, it is too early to report about significant scientific results. On the other hand, centres of Research Excellence have initiated common programmes with Simons Institute for Computing at Berkeley and with some Israeli companies, and have employed 60 young researchers, mainly Israeli citizens that were attracted back from foreign research centres ('brain-gain').
- **Relevant links:** http://www.i-core.org.il/Files-Documents

SETI OPERATIONAL POLICY INSTRUMENT 10

- **Title of the SETI operational policy instrument:** The Humanities Fund
- **Keywords:** Humanities Research
- **Overview:** A joint venture of the Planning and Budgeting Committee of the Council for Higher Education in Israel (VATAT) and Yad Hanadiv. The Fund was established in 2008 with the purpose of helping to improve the quality and reach of humanities programmes at Israeli universities. Following international review and local discussions with the Deans of Humanities and university leaders, it was decided to extend the operation of the Fund for an additional three years, while significantly increasing its budget.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Increasing the number of outstanding students studying the humanities; promoting a balance between specializations with broad based general education for undergraduate students; supporting the creation of high quality, structured and collaborative graduate programmes.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge; e. strengthening the social appropriation of scientific knowledge and new technologies; k. strengthening the quality of technology foresight studies to: iii. Construct and analyse long-term scenarios; vi. other: new graduate programmes; Establishment of new dual degree BA programmes with one degree in the humanities and the second in another faculty; innovations in humanities teaching
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue; b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; g. scholarships
- **Conditions to apply for the instrument:** Institutions: Must provide at least 25% of the funding for every approved program; must demonstrate long-term sustainability. This includes demonstration of sufficient permanent staff to maintain program, taking into account existing commitments. Universities: Must commit to maintaining existing levels of investment in relevant programmes throughout the grant period. Funding may only be used towards new activities. In some cases, the Academic Committee may accept applications from existing programme provided they are within the first two years of their establishment. All proposals will undergo external evaluation.
- **Target groups/Beneficiaries:** b. students; c. professionals / PhDs; d. teachers / researchers; e. universities;
- **Eligibility/Selection criteria:** Attracting new and outstanding students to the humanities – Applications that meet the following criteria will be considered: they create new dual degree BA programmes with combining a humanities degree with one from another faculty; programmes must involve courses at the intersection of humanities and other disciplines (e.g. computer science and linguistics, literature and law etc.), and demonstrate an ability to attract a high calibre of students; proposals should include appointment of a permanent staff member to head the programmes and administrative staff that will pay special attention to bureaucratic challenges facing students in the programmes; programmes of study will be given priority in submission for approval by the CHE. Innovations in humanities teaching – The ideal course of studies in humanities strikes a balance between deep disciplinary knowledge and a broad intellectual framework. Funding will be provided to programmes that build bridges between disciplines in the humanities and encourage intellectual contact among students from departments with shared disciplinary or cultural interests.

  Structured Graduate Programmes: The Fund will support the creation of graduate programmes where the following can be demonstrated: the graduate programme will be of outstanding academic quality, competitive internationally, and capable of drawing graduate students from abroad; there is a sufficiently large potential pool of outstanding graduate students available to sustain a vibrant research community; participating institutions have a critical mass of outstanding researchers available to teach and advise students; the programmes take full advantage of resources within and across all universities; preference will be given to programmes with a significant inter-university collaboration. Graduate students in these programmes will be expected to receive full fellowships, as is the model in the natural and exact sciences. Programmes may include direct path PhD programmes (including the MA) or PhD programmes (without the MA).

- **Eligible costs:** For attracting new and outstanding students to the Humanities: limited support for interim teaching needs, undergraduate scholarships, extra-curricular activities, programme administration, faculty time towards course development. For innovations in humanities teaching: teaching hours, materials, administration and course development. For Structured Graduate Programmes: development of courses and curriculum, graduate student fellowships, conferences, extra-curricular activity, travel grants for students, visiting professors, administration
- **Source of funding:** Rothschild Foundation-Yad Hanadiv fund, PBC and the Universities.
- **Mode of disbursement of financial resources:** NIS 30 million divided equally between the Rothschild Foundation and the PBC, in which it operated twenty five programmes across four cycles at a total cost of NIS 29 million (US$ 8.3 million) according to the following breakdown: Seven collaborative projects between – universities; Eleven programmes of innovation in teaching humanities; Seven scholarships tri-annual researchers returning from abroad.
- **Annual budget:** Attracting new and outstanding students to the humanities – maximum grant NIS 1.5 million (approx. US$ 430 000) over 3 years.; innovations in humanities teaching – maximum grant NIS 1.0 million (approx. US$ 290 000) over 3 years; structured graduate programmes – maximum grant NIS 6.5 million (approx. US$ 1.9 million)
- **Continuity of the instrument in time:** 2008–2012 extended in 2013
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** By the end of the first stage of the programme, the needs of humanities faculties were evaluated. The assessment was carried out in collaboration with the deans of the humanities, as well as with the academic committee of the fund. The conclusions indicate success of the programme in returning researchers to Israel, refreshing teaching faculties and particularly commended success in creating inter-universities curricula that enable the expansion of a number of fields taught in Israel, while maximizing existing resources in the system.
- **Relevant links:** Call for Proposals 2014 http://che.org.il/wp-content/uploads/2012/12/Call-for-Proposals-2014.pdf

SETI OPERATIONAL POLICY INSTRUMENT 11

- **Title of the SETI operational policy instrument:** Pluralism and Equal Opportunity in Higher Education – Expanding Access for Arabs
- **Keywords:** Pluralism, Arab minority, Opportunity in Higher Education
- **Overview:** The programme addresses all the barriers that inhibit integration of the Arab minority in the higher education system, from high school guidance through preparation for academic studies and comprehensive support to students in the first year of studies (a stage normally characterized by high dropout). The programme also includes continued operation of the Ma'of Fund that supports outstanding young Arab lecturers in higher education institutions. The Ma'of programme has opened tenure track opportunities to nearly 100 Arab lecturers, who are to be role models for younger lecturers and researchers at the beginning of their own academic careers. The programme is based on two basic principles, 1. addressing the entire continuum of the student's career, from secondary school through employment after graduation, or continued studies and a senior position in academia, 2 . providing a comprehensive response to the barriers faced by Arab students, including language difficulties, learning skills, and cultural differences.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Expanding access for the integration of the Arab minority in Higher Education

- **Specific objectives:** c. innovation and strategic planning. Capacity-building, education and training of specialized human capital for the production of new scientific knowledge; management of the knowledge society; e. strengthening the social appropriation of scientific knowledge and new technologies; k. strengthening the quality of technology foresight studies, l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants**;** b. donations (individuals/companies); g. scholarships; k. other: subsidizing activities
- **Conditions to apply for the instrument:** n/a
- **Target groups/Beneficiaries:** e. universities; g. technical training centres; h. schools / colleges / institutes; n. ad hoc associations; o. individuals
- **Eligibility/Selection criteria:** n/a
- **Eligible costs:** n/a
- **Source of funding:** Planning and Budgeting Committee (PBC)
- **Mode of disbursement of financial resources:** Institutions are budgeted according to the new model, which includes the following elements: preparatory programmes; pre-academic preparation for students admitted to first degree studies; programmes for integration into academia; continued implementation of the Ma'of programme to integrate outstanding Arab staff into institutions; promoting the integration of minorities into the faculty and managing staff in the managing institutions and internal committees of the institutions.
- **Annual budget:** Within multi-year programme for 2010–2016 PBC allocated approximately NIS 300 million (approx. US$ 75–80 million) over six years. Budget of 2013/14 – NIS 32,343,000 (approx. US$ 9.24 million)
- **Continuity of the instrument in time:** First multiyear programme of PBC: 2010–2016
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://che.org.il/wp-content/uploads/2013/03/Pluralism-and-equal-opportunities-in-higher-education-FINAL.pdf

  http://che.org.il/wp-content/uploads/2013/05/SCHOLARSHIP-FUND-FOR-ARAB-ISRAELI-UNDERGRADUATES-final-draft.pdf

SETI OPERATIONAL POLICY INSTRUMENT 12

- **Title of the SETI operational policy instrument:** Pluralism and Equal Opportunity in Higher Education – Expanding Access for Ultra-Orthodox Jews
- **Keywords:** Pluralism, Ultra-Orthodox Jews, Opportunity in Higher Education
- **Overview:** The programme is based on two basic principles addressing the entire continuum of the student's career, from secondary school through to employment after graduation and to a senior position in the academic institutions; providing a comprehensive response to the barriers faced by Ultra-Orthodox students, including learning skills, cultural and educational differences.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Expanding access for integration of Ultra-Orthodox Jews in higher education
- **Specific objectives:** c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for iv. management of the knowledge society; e. strengthening the social appropriation of scientific knowledge and new technologies; k. strengthening the quality of technology foresight studies to strengthening regional and international co-operation, networking and promotion of SETI activities

- **Sectoral and horizontal approach of the instrument:** a. sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants; b. donations (individuals/companies); g. scholarships; k. other: subsidizing the activities
- **Conditions to apply for the instrument:** n/a
- **Target groups/Beneficiaries:** e. universities; g. technical training centres; h. schools / colleges / institutes; n. ad hoc associations; o. individuals
- **Eligibility/Selection criteria:** n/a
- **Eligible costs:** n/a
- **Source of funding:** Planning and Budgeting Committee (PBC)
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** 2013/14 budget NIS 111.2 million (approx. US$ 31.8 million)
- **Continuity of the instrument in time:** Since 2012
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** As to October 2013, 2 Universities and 6 Academic Colleges opened courses for Ultra-Orthodox Students
- **Relevant links:** http://www.neaman.org.il/Neaman2011/Templates/ShowPage.asp?DBID=1&LNGID=1&TMID=581&FID=646&IID=10480

SETI OPERATIONAL POLICY INSTRUMENT 13

- **Title of the SETI operational policy instrument:** National Infrastructure Program
- **Keywords:** National Infrastructures, Research, Academy, Grants, Scholarships, Knowledge centres
- **Overview:** The National Program for the Development of Israel's Scientific and Technological Infrastructures of the Ministry of Science, Technology and Space seeks to utilize the country's professional personnel and to realize the economic potential of those science and technology fields where Israel has a comparative advantage. The programme provides a framework for Ministry investment in research projects in national priority fields, based on a comprehensive strategic view of Israel's medium- and long-term economic needs. Over 80% of the Ministry's budget is channelled toward research in academic institutions and research institutes, and toward cultivating human and physical scientific infrastructures. The aim of this investment is to create a critical mass of knowledge in national priority fields and to nurture the younger generation of scientists, thereby ensuring Israel's ability to face the challenges of the future.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** The Ministry's investment in the programme is manifested in three main ways (a) research grants: the programme is meant to serve as a bridge between basic and applied research, and to reduce the amount of time needed for technological ideas to be translated into practical use; Scholarships (from the undergraduate to the post-doctoral levels). Some of science and technology scholarships honour the legacy of distinguished public figures such as Prime Minister Levi Eshkol, Professor Yuval Ne'eman and astronaut Ilan Ramon, while others are aimed at increasing the representation of specific populations, e.g. women and minorities, in Israel's academic and scientific spheres; infrastructural knowledge centres: each year the Ministry establishes Infrastructural Knowledge centres (IKC) at existing research institutions and endows these centres with special equipment that is beyond the individual institutions' financial reach. The centres are intended to reinforce Israel's scientific research infrastructure. Infrastructural Knowledge centres develop and upgrade technology and make it available to research teams.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge; development of new

technologies; d. Strengthening gender equality for research and innovation; e. strengthening the social appropriation of scientific knowledge and new technologies; f. development of strategic technological areas and new niche products and services with high added value; i. promotion of the development of green technologies and social-inclusion technologies; j. research and innovation ecosystem; k. strengthening the quality of technology foresight studies, l. strengthening regional and international co-operation, networking and promotion of SETI activities

- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants; d. creation of, and support for, technological poles and centres of excellence; g. scholarships
- **Conditions to apply for the instrument:** Proposals can be submitted only by accredited higher-education institutions or research institutions. They must include a feasibility study and describe the economic potential of the proposed study or project.
- **Target groups/Beneficiaries:** a. Technical and support staff at SETI; b. students; c. professionals / PhDs; d. teachers / researchers; e. universities; f. research centres; h. schools / colleges / institutes; m. science and technology public or private non-profit organizations
- **Eligibility/Selection criteria:** In the first stage of the evaluation, the proposals will be examined upon meeting prerequisite criteria. The next phase will be carried out by a committee of professional evaluators that will be appointed by the Ministry. The committee will examine, evaluate and rank the proposals according to various academic standards.
- **Eligible costs:** Funding will be provided for research expenses of up to NIS 2 million (approx. US$ 570 000) for all study period. Eligible costs include salaries, equipment costs, materials costs and other expenses.
- **Source of funding:** Ministry of Science and Technology and Space budget.
- **Mode of disbursement of financial resources:** Yearly disbursement conditioned upon the submission of financial and scientific reports.
- **Annual budget:** In 2012, the total support of the Ministry of Science, Technology and Space for the National Infrastructure programme summed up to NIS 64 million (approx. US$ 18.3 million). Individual research proposals can receive a grant totalizing up to NIS 2 million (approx. US$ 570 000); every year, the Ministry provides one thousand scholarships totalizing to NIS 10 million (approx. US$ 2.9 million); each knowledge centre can receive up to NIS 5 million (approx. US$ 1.4 million).
- **Continuity of the instrument in time:** The programme has been operating since 1995
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** Expected outcome in the long term of research funds are scientific publications, citations, patents, technology transfer and commercial exploitation. Increase of critical mass of human infrastructure for a given field.
- **Relevant links:** http://most.gov.il/ProgramTashtiot/Pages/defaultResearch.aspx

  http: //most.gov.il/Information/Calls/Pages/computers-communication.aspx (Hebrew)

SETI OPERATIONAL POLICY INSTRUMENT 14

- **Title of the SETI operational policy instrument:** Bi-National Scientific Programmes
- SETI Operational Policy Instrument
- **Keywords:** Bi-national programmes, international scientific organizations
- **Overview:** A central goal of the Ministry of Science, Technology and Space (MOST) is to foster international relations, which enable it to uphold the highest levels of scientific research in Israel. The need for strong international scientific relations increases because of the growing trends of globalization as well as the fast pace of scientific and technological advancements. To reach its goal,

the Ministry broadens and deepens bi-national relations by providing a budget dedicated to joint research, which may eventually result in multi-national research. In addition, the Ministry actively identifies countries with which to enter into joint agreements. Currently Israel, through MOST, holds collaboration agreements with several countries. These countries include Germany, China, Japan, Republic of Korea, France, Italy, Canada, United Kingdom, Russia, The Czech Republic, the United States of America, and others. The Ministry also represents Israel (alone or jointly with other national bodies) in international organizations, such as CERN, EMBL and EU R&D framework programmes.

- **Objectives of the plan (or the SETI policy) to which the instrument relates:** The main goal of the Bi-national Scientific Program is to foster and strengthen the international scientific collaboration network of Israel with other countries for the intention of advancing and developing scientific research in Israel.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge; development of new technologies; d. strengthening gender equality for research and innovation; e. strengthening the social appropriation of scientific knowledge and new technologies; i. promotion of the development of green technologies and social-inclusion technologies; j. research and innovation ecosystem; k. strengthening the quality of technology foresight studies to construct and analyse long-term scenarios; l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** grants and scholarships
- **Conditions to apply for the instrument:** The following institutions are eligible to participate: recognized higher education institutions, not for profit public institutions such as governmental research institutions, hospitals and regional R&D centres.
- **Target groups/Beneficiaries:** a. technical and support staff at SETI; b. students; c. professionals / PhDs; d. teachers / researchers; e. universities; f. research centres; h. schools / colleges / institutes
- **Eligibility/Selection criteria:** The research proposals are peer reviewed by scientists and international experts of the two countries. Final decision is made by the bi-national steering committee with the participation of the relevant ministries on both sides.
- **Eligible costs:** Salaries of technical and research staff (excluding tenured academic staff), consumables, scholarships for graduate students and post-docs, travel costs.
- **Source of funding:** Government budget
- **Mode of disbursement of financial resources:** Advance payment, yearly disbursement conditioned upon the submission of financial and scientific reports.
- **Annual budget:** NIS 50 million (approx. US$ 14.3 million) for three years.
- **Continuity of the instrument in time:** Each project runs up to three years.
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** Joint publications in scientific peer-reviewed journals, citations, conference presentations and proceedings.
- **Relevant links:** http://most.gov.il/Information/Calls/Pages/default.aspx

SETI OPERATIONAL POLICY INSTRUMENT 15

- **Title of the SETI operational policy instrument:** Regional R&D centres
- **Keywords:** R&D Centres, Periphery.

- **Overview:** The central goal of the Ministry of Science, Technology and Space (MOST) is to promote science and technology in Israel, with an emphasis on peripheral areas. In accordance, the ministry established eight Regional Research and Development Centres that are spread in all the geographic and demographic peripheries of the country. The Ministry is a partner in the establishment of these centres, in guiding their scientific activity and substantially participates in their funding. The Regional Research and Development Centres were established in the periphery to draw young, leading scientists into these areas and to contribute to the improvement of local society and to raise the level of local education. The R&D centres focus on the periphery's local challenges, conditions and resources to clarify solutions for local needs.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To create Regional R&D centres as a basis for the social and economic development of the periphery; to initiate R&D using local infrastructure with high scientific and economic value; to expose the local peripheral population to science and technology, increase their welfare and education level; to extend the scientific basis of the State of Israel; to develop infrastructure for the absorption of Israeli scientists and immigrants in the periphery; to encourage scientific co-operation between researchers in the periphery and researchers in the main research universities in order to increase the level of regional R&D and integrate it within the general applied research in Israel; to conduct educational activities within the R&D centres and expose the local community, especially children and teenagers to science.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge; ii. Development of new technologies; management of the knowledge society; d. Strengthening gender equality for research and innovation; e. Strengthening the social appropriation of scientific knowledge and new technologies; i. promotion of the development of green technologies and social-inclusion technologies; k. strengthening the quality of technology foresight studies, l. strengthening regional and international co-operation, networking and promotion of SETI activities
- S**ectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants; d. creation of, and support for, technological poles and centres of excellence
- **Conditions to apply for the instrument:** Government support will be given to Regional R&D centres that carry out R&D activities that have applied research potential; carry out educational activities and advance community-science relationships; the body eligible for support must be a legally organized institution' located at the periphery (Negev, Galilee, or at least 20 kilometre distant from a university) acting for non-profit purpose; the R&D Centre must employ at least 5 active researchers at the PhD or MD level.
- **Target groups/Beneficiaries:** a. technical and support staff at SETI; b. students; c. professionals / PhD; d. teachers / researchers; f. research centres
- **Eligibility/Selection criteria:** The R&D centres are funded on the basis of excellence. The criteria for the selection: academic excellence: number of academic publications of the R&D Centre (normalized by impact factor), number of patent applications and granted patents, competitive research grants (sum in US$); contribution to the region: total sales of scientific and technological services of the R&D Centre to firms in the region, co-operation with industrial firms, scope of educational activities conducted by the R&D Centre (e.g. scientific conferences, number of scientific activities with students and youth), degree of co-operation with universities research institutions, technological incubators, municipalities etc.
- **Eligible costs:** Salaries of technical and research staff, equipment and materials, travel costs.
- **Source of funding:** Government budget, local or regional authority grant, competitive research grants.
- **Mode of disbursement of financial resources:** The R&D centres receive annual grants from the budget of the Ministry of Science, Technology and Space. The grant varies according to the excellence standards specified above.

- **Annual budget:** The government support for the regional R&D centres was approximately NIS 25 million in 2013 (approx. US$ 7.1 million)
- **Continuity of the instrument in time:** The R&D centres receive government support (from the Ministry of Science, Technology and Space budget) on a yearly basis.
- **Geographical coverage:** c. regional
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** Golan Research Institute, URL: http://golanres.haifa.ac.il/main_en_all.htm
  Galilee Society R&D Centre, URL: http://rd.gal-soc.org/?LanguageId=1
  Triangle Regional R&D (MESHULASH), URL: http://www.trd-center.org
  Samariah and Jordan Valley R&D, URL: http://www.ariel.ac.il/research/rd/about-rd
  Judea Regional R&D, URL: http://en.mopyehuda.org.il/
  Dead Sea and Arava R&D, URL: http://www.adssc.org/en
  Migal – Galilee Research Institute, URL: http://www.migal.org.il/

SETI OPERATIONAL POLICY INSTRUMENT 16

- **Title of the SETI operational policy instrument:** Tnufa-Pre-Seed Fund
- **Keywords:** Pre-Seed Programme, Start-ups, Individuals.
- **Overview:** Tnufa is the national pre-seed fund, assisting individual inventors and nascent start-up companies during the earliest stages of their projects. This includes evaluation of the technological and commercial potential of a project, filing for a patent, building a prototype, drafting a business plan and initial business development.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To provide assistance to entrepreneurs or start-up companies to advance their technological initiatives towards a stage that will allow them to raise significant capital for conducting additional R&D and for the commercialization of the technology/product.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge, development of new technologies, promotion of innovation within the productive and services systems; f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and Services; h. promotion of start-ups in areas of high technology; k. strengthening the quality of technology foresight studies to develop business plans for high-tech companies.
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Support will not be provided to a company that was previously supported by the Office of the Chief Scientist. The initiative must lead to the development of a new product, procedure or technology or to the improvement of existing technology that has significant business potential.
- **Target groups/Beneficiaries:** o. individuals
- **Eligibility/Selection criteria:** Eligible beneficiaries to participate in the programme are private entrepreneurs (Israeli citizens), new Israeli start-up companies, or companies owned by an Israeli academic or medical institution. A start-up company must be under the ownership of the entrepreneurs (cannot be owned by VC fund) and not exhibit any significant sales. The first stage of selection includes early screening of the proposal by TNUFA committee. In the second stage, each proposal is peer reviewed by a professional evaluator. The main criteria for selecting the winning proposals (by a vote of

TNUFA committee members) is based on the quality of the entrepreneurs and the development team, the degree of innovation and technological depth of the product, the presence of a viable business model, the feasibility of developing and marketing the product in foreign markets (in terms of price, competition with similar products, prospect exports, etc.), the existence of a patent and the ability to protect the IP and the prospect for raising additional venture capital for R&D.

- **Eligible costs:** The eligible costs are costs of materials and perishable components, costs of patent attorney, cost of contractual advisors in Israel, participation in conferences.
- **Source of funding:** OCS – Ministry of Economy
- **Mode of disbursement of financial resources:** Grants of up to 85% of approved expenses are available to a maximum of NIS 250 000 (approx. US$ 70 000) per project. Every grant must be fully used within one year.
- **Annual budget:** NIS 10 million (approx. US$ 2.85 million)
- **Continuity of the instrument in time:** Since 2001
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** Argo Medical Technologies (Yokneam, Israel), supported by the TNUFA fund, developed commercial bionic walking assistance system (ReWalk), using powered leg attachments to enable paraplegics to stand upright, walk, and climb stairs. The ReWalk exoskeleton suit uses a patented technology with motorized legs that power knee and hip movement. Battery-powered for all-day use, ReWalk is controlled by on-board computers and motion sensors, restoring self-initiated walking without needing tethers or switches to begin stepping; http:// www.rewalk.com

  First Care Products, supported by the TNUFA fund, develops innovative products for pre-hospital emergency care that work to immediately and effectively apply direct pressure on wounds, controlling the bleeding and forestalling shock and death. The emergency bandages feature a number of consolidated functions that make application and treatment easy; URL: http: //firstcareproducts.com/

  Kornit Digital Ltd., supported by the TNUFA fund, develops, manufactures and markets state of the art solutions for the garment and apparel printing industry. The Kornit line of high-speed digital inkjet printers, are known to be the first digital industrial printers, and print Direct-To-Garment. Printing offers custom printers a complete and wide-ranging solution, enabling them to effectively and efficiently reach optimum digital printing results on a large variety of textile applications and finished garments; URL: http://www.kornit.com/

  Link (in Hebrew) to other success stories of the TNUFA fund, URL: http://www.moital.gov.il/NR/rdonlyres/9B42F074-72B3-436C-9315-1053C5571931/0/tnufa.pdf
- **Relevant links:** http://www.moit.gov.il/NR/exeres/7B06EA3D-1E63-46D6-A029-5C3D3FFA69FB.htm

SETI OPERATIONAL POLICY INSTRUMENT 17

- **Title of the SETI operational policy instrument:** Technology-Based Industrial Incubators
- **Keywords:** Industrial R&D, Incubator, Start-ups.
- **Overview:** Technology-based industrial incubators support the ongoing operations of start-up companies in order to lead them toward commercialization and market penetration.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** to lead start-up companies toward commercialization and market penetration.
- **Specific objectives:** g. promotion and development of innovation in the production of goods and Services
- **Sectoral and horizontal approach of the instrument**: b. Horizontal: the benefits go to all the disciplines, areas and sectors

- **Mode of support/Type of mechanism:** k. other: the company will pay the government 3%–5% royalties from revenue generated, until the full amount of grant (plus interest) is paid back.
- **Conditions to apply for the instrument:** Industrial companies and start-ups in the commercialization stage can apply.
- **Target groups/Beneficiaries:** l. private company; s. other: Start-ups
- **Eligibility/Selection criteria:** The idea is innovative and unique; the idea has significant commercial potential; the company employs the personal with the abilities to successfully bring the new product to market and it is the only employer of the personal; the company has the abilities to protect the intellectual property; the company can raise 33%–50% of the budget, needed for the project
- **Eligible costs:** OCS finances 50%–66% of approved expenses for 2 years, up to NIS 2 million (approx. US$ 570 000)
- **Source of funding:** The Office of the Chief Scientist (OCS) in the Ministry of Economy.
- **Mode of disbursement of financial resources:** n/a.
- **Annual budget:** There is no special budget. OCS finances all relevant projects.
- **Continuity of the instrument in time:** Since 1991
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** URL: http//www.incubators.org.il/article.aspx?id=1868&catid=604
- **Relevant links:** http://www.economy.gov.il/NR/exeres/81B656CE-29E8-4DE3-A11A-2723E29E4B75.htm

SETI OPERATIONAL POLICY INSTRUMENT 18

- **Title of the SETI operational policy instrument:** MAGNET
- **Keywords:** Generic R&D, Industry-Academy Co-operation, Innovative Technologies
- **Overview:** MAGNET (The acronym in Hebrew for Generic Pre-Competitive R&D) programmes encourage collaboration among industrial companies, and between the companies and researchers from academic institutions, through several instruments that deal with innovative technologies. These instruments seek to develop Israel's industrial infrastructure by supporting the R&D activities and sharing technological knowledge between the participants. The MAGNET Consortia Supports the formation of consortia made up of industrial companies and academic institutions, in order to jointly develop generic, pre-competitive technologies
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To encourage Israel's long-term competitive edge by the creation of clusters, business corporations and research institutions
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge, development of new technologies, promotion of innovation within the productive and services systems; f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and services; i. promotion of the development of green technologies and social-inclusion technologies; j. research and innovation ecosystem; k. strengthening the quality of technology foresight studies to assess the potential of high-value markets; l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants

- **Conditions to apply for the instrument:** Formation of Consortium (a legal entity) made up of industrial companies and academic institutions. Each partner must have technological or scientific capabilities pertinent to the themes of the consortium's project. Each consortium must submit a yearly joint work plan, present milestones and deliverables. The activity of the consortium is financially monitored by external CPAs and scientifically assessed by OCS evaluators. After three years, the consortium can apply for a grant for an additional three years of activity. After this period the consortium is dissolved.
- **Target groups/Beneficiaries:** d. teachers / Researchers; e. universities; f. research centres; i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** The following criteria are used in the evaluation of proposals to the programme: is the technology in the project generic and innovative; is the technology vital for the firms involved; the survival capabilities of the firms, competitive advantage and their ability to enter world markets (the strategic level criteria); availability and cost of operations (operations level criteria); advantages to the local economy such as commercialization and export potential of future products; existing capabilities and resources, including whether the consortium members have adequate capabilities and resources to perform the proposed tasks; prospects in world markets for the intended future products.
- **Eligible costs:** Salaries of personnel (industrial companies) and academic researchers, scholarships and stipend for students (in academic institutions only), overhead costs, materials, infrastructure and equipment costs, contractor costs in Israel and abroad, patent application costs.
- **Source of funding:** Government grant, a portion is funded by the industrial company.
- **Mode of disbursement of financial resources:** Grants are up to 66% of the approved budget for industry and up to 80% for the academic institution. No royalty payments are mandated. Technical and financial reports must be submitted.
- **Annual budget:** The programme budget is NIS 123 million in 2014.
- **Continuity of the instrument in time:** Duration of each MAGNET consortium is 3-5 years. The programme was first introduced in 1994.
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.magnet.org.il/article.aspx?id=685

SETI OPERATIONAL POLICY INSTRUMENT 19

- **Title of the SETI operational policy instrument:** MAGNETON
- **Keywords:** Technology Transfer, Academia, Industry
- **Overview:** The MAGNETON programme promotes technology transfer from academia to industry via co-operation between an individual company and specific academic research group, in order to offset the costs of uncertainty before the firm develops and uses the technology.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To foster technology transfer, increasing the likelihood that technology resulting from academic research can be developed.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge; ii. Development of new technologies, promotion of innovation within the productive and services systems; f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and Services; h. promotion of start-ups in areas of high technology; k. strengthening the quality of technology foresight studies to assess the potential of high-value markets
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue

- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Submission of financial and scientific report.
- **Target groups/Beneficiaries:** e. universities; i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** A technology has been developed in a university or in academic laboratory; the university is the sole owner of the IP; there is a level of technological uncertainty that prevents industry in adopting the technology; the proposed project allows the transfer of technology from the academy to the industrial company; the existence of legal agreement between the university and the industrial partner, specifying mutual goals and the rights and responsibilities of each partner.; the proposed project is innovative and is not an incremental or continuing research; the industrial corporation is interested in the technology and has the financial means to finance its participation (34% of the costs); the industrial firm has the technical skills both to adopt and further develop the technology; the project is feasible within the specified time and budget framework; an examination of feasibility has been conducted; the proposed technology has not been presented to other OCS frameworks; the technology has potential in the international markets; the technology does not exist in elsewhere in an Israeli company; the industrial partner has the skills and infrastructure to make good use of the technology.
- **Eligible costs:** Salaries of personnel (industrial companies) and academic researchers, scholarships and stipend for students (in academic institutions only), overhead costs, materials, infrastructure and equipment costs, contractor costs in Israel and abroad, patent application costs.
- **Source of funding:** Government grant, a portion is funded by the industrial company.
- **Mode of disbursement of financial resources:** Grants are up to 66% of the approved budget. No royalty payments are mandated. Technical and financial reports must be submitted.
- **Annual budget:** The programme budget in 2014 is NIS 27 million. Each Project's budget is of up to NIS 3.4 million (approx. US$ 975 000).
- **Continuity of the instrument in time:** Duration of each project 24 months. The programme was first introduced in 2000.
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** URL: http://www.magnet.org.il/category.aspx?id=694
- **Relevant links:** http://www.magnet.org.il/article.aspx?id=689

SETI OPERATIONAL POLICY INSTRUMENT 20

- **Title of the SETI operational policy instrument:** NOFAR – Industrial Application of Academic Research
- **Keywords:** Pure Academic Research, Basic and Applied Research, Technology Transfer
- **Overview:** The instrument is designed to support applied academic research in specific technological areas (biotechnology, nanotechnology, medical devices, water and energy storage, multidisciplinary research).
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To constitute a bridge between basic and applied research, yet to be recognized by the industry as having commercial potential. To adapt academic research for relevant applications in the industry, and promote the transfer of these technologies to the industry.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge, development of new technologies; f. development of strategic technological areas and new niche products and services with high added value; i. promotion of the development of green technologies and social-inclusion technologies

- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants; i. trust funds
- **Conditions to apply for the instrument:** Research centres that did not receive any other support can apply; submission of financial and scientific report.
- **Target groups/Beneficiaries:** e. universities; f. research centres
- **Eligibility/Selection criteria:** The research must be conducted in one of six specified themes; there is a level of technological uncertainty that prevents industry in adopting the technology; there is an industrial corporation that is interested in the technology and has the financial means to finance its participation (10% of the costs); the proposed technology does not exist and is not developed in other firms operating in Israel; The proposed project is innovative and is not an incremental or continuing research; the project is feasible within the specified time and budget framework; the proposed project allows the transfer of technology from the academy to the industrial company; the outputs of the project are of high value to the Israeli industry.
- **Eligible costs:** Salaries of personnel (industrial companies) and academic researchers, scholarships and stipend for students (in academic institutions only), overhead costs, materials, infrastructure and equipment costs, contractor costs in Israel and abroad, patent application costs.
- **Source of funding:** n/a
- **Mode of disbursement of financial resources:** Government grant, a portion is funded by the industrial company accompanying the project.
- **Annual budget:** Grants are up to 90% of the approved budget, to be complemented by the industrial company. No royalty payments are mandated. Technical and financial reports must be submitted.
- **Continuity of the instrument in time:** Duration of each project – 15 months. The programme was first introduced in 2002.
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** URL: http: http://www.magnet.org.il/category.aspx?id=694
- **Relevant links:** http://www.magnet.org.il/article.aspx?id=687

SETI OPERATIONAL POLICY INSTRUMENT 21

- **Title of the SETI operational policy instrument:** MEIMAD
- **Keywords:** Dual Use, Civilian, Military Technologies
- **Overview:** MEIMAD is a collaborative programme between the Ministry of defence, the OCS at the Ministry of Economy and the Ministry of Finance, to jointly promote new ideas and new technologies that can serve both commercial applications and military needs.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To jointly promote new ideas and new technologies that can serve both commercial applications and military needs.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; i. promotion of the development of green technologies and social-inclusion technologies
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Israeli companies with the abilities of their own R&D performing and with annual sales turnover of 50 million and down or research centres can apply
- **Target groups/Beneficiaries:** e. universities; f. research centres; l. Private company; q. public institutions

- **Eligibility/Selection criteria:** The product should be highly innovative with significant commercial potential; it should offer an added-value to a solution of special military problem; technology and financial abilities of company are ensured for the period needed in order to execute the programme.
- **Eligible costs:** 50% of the allowed budget
- **Source of funding:** The Office of the Chief Scientist (OCS) of the Israeli Ministry of Economy, Ministry of defence, Ministry of Finance.
- **Mode of disbursement of financial resources:** 50% of the allowed budget up to NIS 5 million (US$ 1.4 million) – for private companies.
- **Annual budget:** The programme budget in 2014 is NIS 21 million (approx. US$ 6 million), 66% of the allowed budget up to NIS 5 million (approx. US$ 1.4 million) – for common projects of private companies and research centres, 90% of the allowed budget up to NIS 500 000 (approx. US$ 140 000) – for research centres projects.
- **Continuity of the instrument in time:** Since 2012
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** New programme. Significant outputs yet to be achieved.
- **Relevant links:** http://www.magnet.org.il/article.aspx?id=686 (Hebrew)

SETI OPERATIONAL POLICY INSTRUMENT 22

- **Title of the SETI operational policy instrument:** KAMIN – Promotion of Selected Applied Research
- **Keywords:** Industrial Companies Association, Dissemination of Generic Technology
- **Overview:** The KAMIN programme is designed to be an additional bridge between basic and applied research that is not yet ready for commercial investment. KAMIN offers an opportunity for academic research groups whose research programme having reached an applied phase (and may no longer eligible for basic research funds) to be enabled to continue in the applied direction for up to two years at a level of support of 85–90%. The remainder of the R&D costs to be borne by the research institute. No royalty (refund) payments are required
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To constitute an additional bridge between basic and applied research that is not yet ready for commercial investment.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge, development of new technologies
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Academic groups whose research is no longer eligible for basic research funds
- **Target groups/Beneficiaries:** e. universities; f. research centres
- **Eligibility/Selection criteria:** The product should be highly innovative; potential for its development toward industrial research in Israeli industry; its commercial potential; its added value to the Israeli industry; the entities' involved should have the technological, commercial and financial abilities to promote the research and eventually to bring it to a market; the level of progress (patents etc.); its industry orientation
- **Eligible costs:** Eligible project expenditures include labour, materials, subcontractors, equipment deprecation and other costs that are directly attributable to the project.
- **Source of funding:** The Office of the Chief Scientist (OCS) of the Ministry of Economy

- **Mode of disbursement of financial resources:** 90% of the eligible costs: up to the maximum NIS 360 000 (approx. US$ 100 000) for one-year projects, 85% of the eligible costs: up to the maximum NIS 680 000 (approx. US$ 195 000) for two-year projects. In special cases research groups can receive an additional grant for the third year 66% of eligible costs: up to NIS 264 000 (approx. US$ 75 000)
- **Annual budget:** The programme budget in 2014 is NIS 53 million (approx. US$ 15 million).
- **Continuity of the instrument in time:** Since 2011
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** New programme. Significant outputs yet to be achieved
- **Relevant links:** http://www.magnet.org.il/article.aspx?id=690 (Hebrew)

SETI OPERATIONAL POLICY INSTRUMENT 23

- **Title of the SETI operational policy instrument:** Users Association
- **Keywords:** Industrial Companies Association, Dissemination of Generic Technology
- **Overview:** A Users Association is an association of industrial companies for the dissemination and assimilation of generic advanced technology, and for the sharing or use of a common technology. This instrument enables the creation of a demonstration site, for the service of the Users Association's members, in their development of the activity
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** 1. dissemination and assimilation of generic advanced technologies, developed in Israel and abroad, 2. sharing/utilizing a common technology, 3. creation of suitable infrastructure for such technologies
- **Specific objectives:** j. research and innovation ecosystem; k. strengthening the quality of technology foresight studies; l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; technical assistance; g. scholarships
- **Conditions to apply for the instrument:** Israeli Industrial Companies are eligible to apply for the programme. Academia researchers can participate
- **Target groups/Beneficiaries:** i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** The agreement between all the members of association include the purposes in the dissemination and assimilation of generic advanced technology, or/ and in the sharing or utilizing of a common technology; the association has to prove that it made all possible efforts to enjoy other industrial companies that use the same or close technology
- **Eligible costs:** The funding is provided for the promotion and exploitation activities
- **Source of funding:** The Office of the Chief Scientist (OCS) in the Israeli Ministry of Economy
- **Mode of disbursement of financial resources:** 66% of the approved budget. Members (companies) match 34% of the total cost. The instrument covers all costs for the organization of activities
- **Annual budget:** The programme budget in 2014 is NIS 2 million (approx. US$ 0.57 million).
- **Continuity of the instrument in time:** Since 1995
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** No quantitative criterion that can be measured, but the number of companies that renew their membership is a good index – if they see contribution to their R&D activity. And actually, most of the members continue and members and the total number is in constant growth
- **Relevant links:** http://www.magnet.org.il/article.aspx?id=688

SETI OPERATIONAL POLICY INSTRUMENT 24

- **Title of the SETI operational policy instrument:** TZATAM
- **Keywords:** Life-Sciences, Bio-Medicine, Stem-Cell, Equipment
- **Overview:** TZATAM – Life-Sciences R&D Supporting-Equipment Purchase Grants. This TELEM instrument is designed to assist experienced companies specializing in providing research services in the field of Life Sciences by enabling them the purchase expensive equipment, thus strengthening the domestic life sciences R&D capabilities. Entities both in industry and academia are able to broaden the scope of the research they conduct. OCS equipment-purchase grants assist in the validation of scientific and technological feasibility of discoveries and in the receipt of approvals to perform clinical trials
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To assist experienced companies who provide research services in the field of life sciences
- **Specific objectives:** b. strengthening the infrastructure of research laboratories in the public and private sectors
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Experienced companies who engage and specialize in providing research and development services in the life-sciences
- **Target groups/Beneficiaries:** e. universities; f. research centres
- **Eligibility/Selection criteria:** Added value of the service to Israeli R&D, the adviser's quality – authorization, previous experience in R&D service, other services, supplied by the adviser, professional personnel, commercial and financial abilities to provide service to clients. The support is subject to the work procedures of The Planning and Budgeting Committee – (for academic institutions) or the Ministry of Health (hospitals)
- **Eligible costs:** Covers only equipment purchase costs (higher than US$ 150 000) for researches in the life sciences (especially in biomedicine and stem cell research)
- **Source of funding:** The Office of the Chief Scientist (OCS) in the Ministry of Economy
- **Mode of disbursement of financial resources:** 50% of the equipment costs (75% for hospitals)
- **Annual budget:** The programme budget for 3 years is US$ 20 million (including US$ 10 million that has been allocated specifically for stem-cell research equipment).
- **Continuity of the instrument in time:** Since 2012
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** New programme. Significant outputs yet to be achieved.
- **Relevant links:** http://www.magnet.org.il/article.aspx?id=30716 (Hebrew)

SETI OPERATIONAL POLICY INSTRUMENT 25

- **Title of the SETI operational policy instrument:** Basic and Applied Nano-Technology Research
- **Keywords:** Research Centres, Nano-Technology, Basic Research, Applied Research
- **Overview:** During the years 2005–2012 six academic research centres in the field of nanotechnology have been created and put into operation, first at the Technion and then at the Tel Aviv University, the Hebrew University, Bar-Ilan University, Ben-Gurion University, and the Weizmann Institute of Science. The budget will be equally divided between investment in infrastructure and focused investment for Focal Technological Areas

- **Objectives of the plan (or the SETI policy) to which the instrument relates:** to establish a strong nanotechnology industry by transferring technologies from academia to industry and by creating a pool of skilled PhD and MSc graduates in nanoscience
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity-building, education and training of specialized human capital for the production of new scientific knowledge and development of new technologies; i. promotion of the development of green technologies and social-inclusion technologies
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** The centres were established by universities
- **Target groups/Beneficiaries:** c. professionals / PhD; e. universities; f. research centres
- **Eligibility/Selection criteria:** Evaluation the potential use of the equipment and involvement of new researchers' staff
- **Eligible costs:** n/a
- **Source of funding:** Universities, Israeli Government through TELEM, Russell Berry Foundation
- **Mode of disbursement of financial resources:** The specific criteria differ from project to project
- **Annual budget:** In the first stage, US$ 220 million were invested
- **Continuity of the instrument in time:** First stage: 2005–2012, follow-up stage: 2012–2016
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** The programme's notable achievements were the return of over 50 scientists to Israel, as a result of the new research opportunities created in the new centres. Hundreds of scientific papers were published and dozens of patents were registered. See URL: http://rbni.technion.ac.il/
- **Relevant links:** http://www.moital.gov.il/NR/rdonlyres/6F1E9C21-8F2C-4E7C-8796-88AFF4031157/0/RD.pdf

SETI OPERATIONAL POLICY INSTRUMENT 26

- **Title of the SETI operational policy instrument:** Large Companies R&D centres in Israel's Periphery
- **Keywords:** R&D centres, International Companies, Periphery
- **Overview:** Operated since 2010, this track aims to bridge the gap between Israel's Centre and Periphery, by convincing large companies to bring their R&D centres to areas with slower economic growth. This creates a mechanism of increased quality employment and economic activity within the target geographical area. This track is designed for large companies
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To bridge the gap between Israel's Centre and periphery
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; k. strengthening the quality of technology foresight studies, other: Strengthening the periphery
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants

- **Conditions to apply for the instrument:** Large companies with an annual turnover of US$ 100 million or more that is generated from business activities within Israel; for 50% of the project's production activities will take place in Israel; The project should demonstrate a high level of innovation, in accordance with existing OCS guidelines; The company must commit to hiring a substantial number of employees living in Israel's periphery, reaching 50% of total approved personnel
- **Target groups/Beneficiaries:** i. corporations /foundations; o. individuals
- **Eligibility/Selection criteria:** The technology level of company has to be significantly higher than average.
- **Eligible costs:** Grants given amount to up to 75% of the approved budget for a period of 2–3 years
- **Source of funding:** The Office of the Chief Scientist (OCS) in the Ministry of Economy
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** NIS 300 million (approx. US$ 75 million) for a period of three years.
- **Continuity of the instrument in time:** Since 2010
- **Geographical coverage:** c. regional
- **Results, outcomes and evidence of success of a given measure:** See URL: http://www.ecitele.com/abouteci/Pages/Default.aspx
- **Relevant links:** http://www.moital.gov.il/NR/rdonlyres/6F1E9C21-8F2C-4E7C-8796-88AFF4031157/0/RD.pdf

SETI OPERATIONAL POLICY INSTRUMENT 27

- **Title of the SETI operational policy instrument:** Long-term R&D Support for Large Companies with Substantial R&D Investment
- **Keywords:** Long-term R&D, Grants
- **Overview:** This programme is designed to encourage long-term R&D – which is typically of higher risk and more expensive – in companies with more than 200 R&D employees or an annual R&D budget of at least $ 20 million and yearly revenues exceeding $ 100 million
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To encourage long-term R&D
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** The Israeli companies with more than 200 R&D employees or an annual R&D budget of at least $ 20 million and yearly revenues exceeding $ 100 million can apply
- **Target groups/Beneficiaries:** i. corporations / foundations
- **Eligibility/Selection criteria:** Grants are allocated according to OCS Commission decision. At least one of two conditions has to be met: the R&D project is intended for long-term R&D; the R&D project is made in co-operation with other Israeli company.
- **Eligible costs:** Up to 50%% of the approved R&D budget and up to 20% of total R&D budget of the company
- **Source of funding:** The Office of the Chief Scientist (OCS) in the Israeli Ministry of Economy
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** NIS 65 million (approx. US$ 18.5 million)
- **Continuity of the instrument in time:** Since 2002
- **Geographical coverage:** b. national

- **Results, outcomes and evidence of success of a given measure:** See, for example: Orbotech Ltd, URL: http://www.orbotech.com/Eng/Default.asp and URL: http://www.verint.com/erinet; Systems Inc. URL: http://www.verint.com/
- **Relevant links:** http://www.moital.gov.il/NR/rdonlyres/5E7A4322-4D0F-4320-953C-83F94024E7AA/0/RDspreads.pdf

SETI OPERATIONAL POLICY INSTRUMENT 28

- **Title of the SETI operational policy instrument:** BIRD Israel – USA
- **Keywords:** Industrial R&D, R&D co-operation, USA, Bilateral Co-operation
- **Overview:** BIRD is an acronym for Israel-USA Binational Industrial Research and Development. BIRD activities include matchmaking services between Israeli and American companies in the field of Research and Development. BIRD takes no equity in the joint projects and all its services are free of charge. The BIRD Foundation was established by the USA and Israeli governments in 1977 to generate mutually beneficial co-operation between the private sectors of the USA and Israeli high tech industries, including start-ups and established organizations. BIRD's scope extends to Communications, Life Sciences, Electronics, Electro-optics, Software, Homeland Security, Renewable and Alternative Energy and other sectors of the hi-tech industry. BIRD supports approximately 20 projects annually. The cumulative sales of products developed through BIRD projects have exceeded 8 billion
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To stimulate, promote and support industrial R&D of mutual benefit to the USA and Israel
- **Specific objectives:** f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and Services; h. Promotion of start-ups in areas of high technology
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** l. Grants
- **Conditions to apply for the instrument:** Any pair of companies, one Israeli and one USA-based, may apply jointly so long as they can demonstrate the combined capabilities and infrastructure to define, develop, manufacture, sell and support an innovative product based on industrial R&D
- **Target groups/Beneficiaries:** i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** R&D co-operation between two, unrelated companies, one registered in the USA and the other in Israel; the companies should jointly apply for BIRD support; the jointly developed technology or product(s) must have considerable innovation capability and significant commercial potential
- **Eligible costs:** All development expenses to be incurred during the course of the project, including direct labour and its associated overhead, materials, subcontractors, consultants, travel, depreciation (33% per year) on new or used equipment employed, and marketing expenses related to the development effort
- **Source of funding:** URL: http: //www.birdf.com/?CategoryID=368
- **Mode of disbursement of financial resources:** Each partner directly receives the portion of the total grant that is relative to its share in the budget. Payments are made after receipt and approval of a joint technical report and a separate fiscal report submitted by each partner at the end of each segment (generally every 6 months). These reports cover the development progress and the actual expenses incurred during the segment
- **Annual budget:** 50% of R&D costs up to US$ 1 000 000 per project
- **Continuity of the instrument in time:** Since 1977
- **Geographical coverage:** b. national

- **Results, outcomes and evidence of success of a given measure:** URL: http://www.birdf.com/?CategoryID=313 ; URL: http://www.birdf.com/?CategoryID=319
- **Relevant links:** http://www.birdf.com/

SETI OPERATIONAL POLICY INSTRUMENT 29

- **Title of the SETI operational policy instrument:** BIRD Energy – Bi-National Industrial R&D Foundation
- **Keywords:** Solar Power, Bio-Fuels, Advanced Vehicle Technologies, Wind Energy, Smart Grid, Renewable Energy/Energy Efficient technology
- **Overview:** BIRD is an acronym for Israel-USA Binational Industrial Research and Development. BIRD is a key catalyst for joint R&D between American and Israeli companies. BIRD brings together promising Israeli and US companies focusing on emerging industries and novel technologies. The programme focuses on energy domain
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** The BIRD Foundation's missions are to stimulate promote and support industrial R&D of mutual benefit to the USA and Israel. BIRD's activities include matchmaking services between Israeli and American companies in the field of research and development
- **Specific objectives:** b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning; Capacity-building, education and training of specialized human capital for development of new technologies; Promotion of innovation within the productive and services systems; f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and Services; h. Promotion of start-ups in areas of high technology; i. promotion of the development of green technologies and social-inclusion technologies; k. strengthening the quality of technology foresight studies to develop business plans for high-tech companies; l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** A pair of companies, one Israeli and one American, may jointly apply for BIRD support as long as they have the combined capability and infrastructure to define, develop, manufacture, market, sell and support an innovative product based on industrial R&D.
- **Target groups/Beneficiaries:** a. technical and support staff at SETI; l. private company; o. individuals; p. small businesses
- **Eligibility/Selection criteria:** 1. R&D co-operation between two companies or co-operation between a company and a university/research institution (one from the USA and one from Israel); 2. innovation in areas such as: solar power, bio-fuels, advanced vehicle technologies, wind energy, smart grid, or any other renewable energy/energy efficiency technology; 3. significant commercial potential; the project outcome should lead to commercialization
- **Eligible costs:** The maximum conditional grant per project is up to 1 million (up to 50% of the R&D costs associated with the joint project)
- **Source of funding:** Israel and US governments
- **Mode of disbursement of financial resources:** DOE \Ministry of National Infrastructures, energy and water resources
- **Annual budget:** Governors of the Israel-USA approved US$ 3.4 million
- **Continuity of the instrument in time:** 2009 – unlimited
- **Geographical coverage:** b. national

- **Results, outcomes and evidence of success of a given measure:** Examples of funded projects HCL CleanTech Ltd., Tel Aviv, Israel and Virent Energy Systems, Madison, Wisconsin: will develop and test a process to produce biogasoline from cellulosicnon-food sources; IQwind Ltd., Bazra, Israel and Ricardo, Inc., Detroit, Michigan will design, test and commercialize a variable ratio wind turbine gearbox; OMAT Ltd., Jerusalem, Israel and General Dynamics Ordnance and Tactical Systems, Inc., Scranton, Pennsylvania will develop and implement a system to monitor, control, and economize energy consumption in metal machining industries; Panoramic Power, Ltd., Kidron, Israel, and Mazzetti Nash Lipsey Burch and (MNLB), San Francisco, CA will develop and pilot self-powered, wireless current sensor that will facilitate load management strategies in commercial buildings; Ram Power, Ltd., Herzliya Pituach, Israel and Turbine Air System (TAS), Houston, TX will develop, engineer, and commercialize an integrated cycle power block that will improve the efficiency of solar thermal power plants and reduce the need for water cooling
- **Relevant links:** www.birdf.com , www.tride-f.com

SETI OPERATIONAL POLICY INSTRUMENT 30

- **Title of the SETI operational policy instrument:** CIIRDF Israel – Canada
- **Keywords:** Industrial R&D, R&D co-operation, Bilateral Co-operation, Canada
- **Overview:** The Canada-Israel Industrial Research and Development Foundation (CIIRDF) stimulates collaborative research and development between private sector companies in both countries, with a focus on the commercialization of new technologies. CIIRDF-supported R&D partnerships have generated a wealth of direct and indirect economic benefits for both nations. The foundation has financed more than 90 bilateral technology partnerships that engage more than 160 Canadian and Israeli companies. These alliances have enabled the joint development, marketing and sales of more than 50 technologically improved new products over the last 18 years
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** to promote the benefits of Canada-Israel R&D collaboration; to offer a matchmaking service that brings together Canadian and Israeli companies seeking R&D partners; to invest in bilateral R&D initiatives
- **Specific objectives:** f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and Services; h. promotion of start-ups in areas of high technology
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Companies operating in Canada and in Israel that are equipped to conduct joint research, development and innovation activities, and that can demonstrate their ability to achieve the stated objectives of the proposed project, are eligible to receive CIIRDF funding
- **Target groups/Beneficiaries:** i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** n/a
- **Eligible costs:** Eligible CIIRDF project expenditures include labour, material and other costs that are directly attributable to the project. Overhead expenditures such as indirect labour, materials and supplies, and general and administrative expenses are also eligible. Specialized equipment for the project may be eligible as well
- **Source of funding:** Government of Canada and MATIMOP – The Israeli Industry Centre for R&D, acting on behalf of the Office of the Chief Scientist (OCS), Ministry of Economy.
- **Mode of disbursement of financial resources:** 1/3 in the beginning of a project, 1/3 in the middle of project and 1/3 in the end.
- **Annual budget:** 50% of R&D costs up to 800 000 Canadian Dollar per project

- **Continuity of the instrument in time:** Since 1995
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** Based on conservative data provided directly by participating companies, CIIRDF-enabled technologies has generated a minimum hundreds of millions in economic value for Canadian and Israeli companies over the past decade. URL: http://www.ciirdf.ca/what_we_do/Results/index.php
- **Relevant links:** http://www.ciirdf.ca/home/index.php

SETI OPERATIONAL POLICY INSTRUMENT 31

- **Title of the SETI operational policy instrument:** SIIRD Israel – Singapore
- **Keywords:** Industrial R&D, R&D co-operation, Bilateral Co-operation, Singapore
- **Overview:** The Singapore Israel Industrial R&D Foundation (SIIRD) is a co-operation between the Singapore Economic Development Board (EDB) and the Office of the Chief Scientist (OCS) in Israel. Through joint R&D collaboration, companies have created new/enhanced products and technology, expanded product portfolio for customers, created new markets, and Shortened time to bring new/enhanced products and technology into the market
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To promote, facilitate and support joint industrial R&D projects, between companies from Israel and Singapore, which would lead to successful commercialization
- **Specific objectives:** f. areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and Services; h. Promotion of start-ups in areas of high technology
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** The grant application must be jointly submitted by a Singapore-registered company and an Israel-registered company.
- **Target groups/Beneficiaries:** i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** 1. either company must not have more than 20% shareholding in the partnering company; 2. the R&D work must be conducted both in Singapore and Israel by the respective partners, and each company must contribute at least 30% of the total R&D work; 3. the proposed product or technology to be co-funded by SIIRD must be commercializable
- **Eligible costs:** The qualifying cost items include direct R&D personnel, expendable materials and supplies, consultancy services, subcontractors, travel expenses between Singapore and Israel, and the depreciation or leasing costs of capital equipment essential to the project.
- **Source of funding:** Singapore Economic Development Board (EDB) and the Office of the Chief Scientist (OCS) in Israel
- **Mode of disbursement of financial resources:** Up to 30% of the allowed budget in the beginning of a project, 30% in the middle of project, 40% in the end
- **Annual budget:** US$ 3 000 000 (US$ 1 500 000 from Israel government and US$ 1 500 000 – from the Singapore government)
- **Continuity of the instrument in time:** Since 1997
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** URL: http://www.siird.com/funded_projects
- **Relevant links:** http://www.siird.com/#&panel1-2

SETI OPERATIONAL POLICY INSTRUMENT 32

- **Title of the SETI operational policy instrument:** Bilateral Industrial R&D Cooperation Programs (Argentina)
- **Keywords:** Bilateral Co-operation, Argentina, R&D Co-operation
- **Overview:** Co-operation with Argentina-based corporations is facilitated through the Global Enterprise Cooperation Programme. These co-operation agreements and industrial R&D programmes provide the necessary bridge to enter international markets, gain access to funding and receive assistance in partner matching.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Providing active support and funding for collaborative R&D ventures between Argentinean and Israeli companies
- **Specific objectives:** g. promotion and development of innovation in the production of goods and Services; h. Promotion of start-ups in areas of high technology; i. promotion of the development of green technologies and social-inclusion technologies; k. strengthening the quality of technology foresight studies; l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; j. Information services; k. other: grants are refundable if project is successful
- **Conditions to apply for the instrument:** R&D-performing companies from the respective countries should express a desire to co-operate in the research and development of a new and technologically innovative product or process; the project may involve more than one company from each side; academic /research entities are eligible to join as sub-contractors; the solution being developed should be highly innovative with significant commercial potential. The joint industrial R&D project should aim at development of products / processes leading to commercialization in the global market; the project partners should agree in advance on the IP rights and on the commercialization strategy of the product or process; the project should demonstrate the contribution of the participants from both countries; the project must be balanced between participants and significant to both partners
- **Target groups/Beneficiaries:** i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** The product should be highly innovative; the product has to have significant commercial potential; it will offer added value to the Israeli economy; the entities should have the technological, commercial and financial abilities to successfully bring the new product to market; the partners should agree in advance on the IP rights and on the commercialization strategy of the product
- **Eligible costs:** Eligible and approved costs of the R&D, in accordance with the national laws and regulations
- **Source of funding:** MINCyT, The Ministry of Sciences Technology and Innovative Production in Argentina and MATIMOP, Israeli Industry Centre for R&D, on behalf of the Office of the Chief Scientist
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** There is no special budget. OCS finances all relevant projects
- **Continuity of the instrument in time:** Since November 2006
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.matimop.org.il/argentina.html

SETI OPERATIONAL POLICY INSTRUMENT 33

- **Title of the SETI operational policy instrument:** Bilateral Industrial R&D Cooperation Programs (Asia-Pacific – Australia)
- **Keywords:** Bilateral Co-operation, Asia-Pacific, Australia, Victoria, R&D Co-operation
- **Overview:** MATIMOP implements bilateral co-operation agreements with established and emerging leaders in the global economy, including Australia. Such co-operation agreements and industrial R&D programmes help facilitate partnership between Israeli companies and foreign enterprises in these leading economies, providing access to funding and assistance in partner matching for industrial R&D projects in all fields. These countries – and the Asia Pacific region in general – offer enormous opportunities for industrial R&D co-operation to Israeli companies
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Promoting and marketing the benefits of joint market-oriented Australian-Israeli R&D collaboration.
- **Specific objectives:** c. innovation and strategic planning. Capacity building, education and training of specialized human capital for: ii. development of new technologies, management of the knowledge society; f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and Services; i. promotion of the development of green technologies and social-inclusion technologies; k. strengthening the quality of technology foresight studies; l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** All organizations (private sector and public sector), with interests in biotechnology, small technologies, information and communication technology (ICT), Cleantech and Advanced Manufacturing
- **Target groups/Beneficiaries:** e. universities; i. corporations / foundations; k. SETI local groups; l. private company
- **Eligibility/Selection criteria:** Collaboration between an Israeli company and an Australian (Victorian, for Victoria-Israel agreement) company to jointly develop a new product or process; the product should be highly innovative; significant commercial potential; Added Value to the Israeli and Australian Economy; the entities should have the technological, commercial and financial abilities to successfully bring the new product to market; the partners should agree in advance on the IP rights and on the commercialization strategy of the product
- **Eligible costs:** Cost of materials, consumables and other supplies; rental of specific equipment items, where such equipment is unavailable to the project partners; necessary travel expenses; outlays for business planning and knowledge transfer to industry and other end users. For Israeli expenses, eligible expenses are based on the rules and guidelines of the Office of the Chief Scientist
- **Source of funding:** The Office of the Chief Scientist of the Israeli Ministry of Economy; Government of Victoria, through the Department of Innovation, Industry and Regional Development (DIIRD)
- **Mode of disbursement of financial resources:** In Israel: funding will be provided in the form of a conditional grant (returnable soft loan) to the projects selected under the Call for proposals. The total funding from the Government of Israel via the Office of the Chief Scientist will not exceed 50% of the eligible and approved costs of the R&D, in accordance with the national laws and regulations. When a project results in sales of a product, service or process, the financial support must be repaid to the Office of the Chief Scientist according to its regulations (In general, royalties are paid at rates beginning at 3% of sales, depending on various criteria. Royalties are payable until 100% of the amount of the grant has been repaid with interest as provided in the applicable regulations). In Victoria: the maximum grant amount is AUD$ 250 000 excluding GST. Companies can apply for less than this amount. Companies are required to make a co-contribution of an equal or greater value than the

grant amount requested. That is, the funding is up to 50% of the project expenses. Successful Victorian applicants are awarded grant funds by DSDBI. Projects that create an ongoing liability for the Victorian Government will not be funded

- **Annual budget:** US$ 500 000
- **Continuity of the instrument in time:** Since December, 2005
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** 5 projects approved to-date. For example URL: http: //www.jwire.com.au/news/israeli-company-to-reduce-victorian-aluminium-costs/12349
- **Relevant links:** http: //www.matimop.org.il/australia.html

SETI OPERATIONAL POLICY INSTRUMENT 34

- **Title of the SETI operational policy instrument:** Bilateral Industrial R&D Cooperation Programs (Brazil)
- **Keywords:** Bilateral Co-operation, Brazil, R&D Co-operation
- **Overview:** Co-operation with Brazil-based corporations is facilitated through the Global Enterprise Cooperation Programme. These co-operation agreements and industrial R&D programmes provide the necessary bridge to enter international markets, to gain access to funding and to receive assistance in partner matching
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Co-operation in R&D that results in the development of new products, processes or services of industrial application leading to commercialization in the domestic and/or global markets.
- **Specific objectives:** g. promotion and development of innovation in the production of goods and Services; h. Promotion of start-ups in areas of high technology; i. promotion of the development of green technologies and social-inclusion technologies; k. strengthening the quality of technology foresight studies; l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; j. Information services; k. other: Grants are refundable if project is successful
- **Conditions to apply for the instrument:** R&D performing companies from the respective countries should express a desire to co-operate in the research and development of a new and technologically innovative product or process; the project may involve more than one company from each side; academic /research entities are eligible to join as sub-contractors; the solution being developed should be highly innovative with significant commercial potential. The joint industrial R&D project should aim at development of products / processes leading to commercialization in the global market; the project partners should agree in advance on the IP rights and on the commercialization strategy of the product or process; the project should demonstrate the contribution of the participants from both countries; the project must be balanced between participants and significant to both partners
- **Target groups/Beneficiaries:** i. corporations / foundations; l. Private company; p. Small businesses
- **Eligibility/Selection criteria:** The proposal for co-operation must involve at least one company in each country (Brazil and Israel), which should jointly develop a new product, process or service of industrial application; the new product/process/service must be innovative, with commercial potential and add value to the economies of both countries; companies must demonstrate a strategy that, given its technological, commercial and financial aspects, highlights its potential to introduce the new product/process/service into the markets of both countries and/or third countries; the partners of the proposal for co-operation must submit a document to formalize the partnership (Collaboration Agreement)

signed or being signed before the receipt of financial aid. This document should include, among other information, the prior consent on the rights of intellectual property (IP); the proposal for co-operation must demonstrate a balanced technological contribution between the partners from both countries

- **Eligible costs:** Eligible and approved costs of the R&D, in accordance with the national laws and regulations
- **Source of funding:** FAPESP – São Paulo Research Foundation, on behalf of the State of São Paulo, Brazil and MATIMOP –The Israeli Industry Centre for R&D, acting on behalf of the Office of the Chief Scientist (OCS), Ministry of Economy
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** There is no special budget. OCS finances all relevant projects
- **Continuity of the instrument in time:** Since February 2007
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.matimop.org.il/brazil.html

SETI OPERATIONAL POLICY INSTRUMENT 35

- **Title of the SETI operational policy instrument:** Bilateral Industrial R&D Cooperation Programs (Canada)
- **Keywords:** Bilateral Co-operation, Canada, R&D Co-operation
- **Overview:** Co-operation with Canada-based corporations is facilitated through the Global Enterprise Cooperation Programme. These cooperation agreements and industrial R&D programmes provide the necessary bridge to enter international markets, to gain access to funding and to receive assistance in partner matching
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Promoting the benefits of Canada-Israel R&D collaboration, specifically in areas of mutual strengths or interest; offering a matchmaking service that brings together Canadian and Israeli companies seeking R&D partners; investing in bilateral R&D initiatives that could be commercialized in global markets
- **Specific objectives:** i. promotion of the development of green technologies and social-inclusion technologies
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; j. Information services; k. other: Grants are refundable if project is successful
- **Conditions to apply for the instrument:** R&D performing companies from the respective countries should express a desire to co-operate in the research and development of a new and technologically innovative product or process
- **Target groups/Beneficiaries:** i. corporations / foundations; k. SETI local groups; l. private company
- **Eligibility/Selection criteria:** Novelty of the proposal and possible impact on the industrial activities as a technological innovation; qualifications of the applicants in performing the specific tasks and the added value of the co-operation between project partners; expected economic results from the realization of the project; relevance of the proposal to the main strategic objectives in industrial R&D of the respective Canadian and Israeli Governments; the capability of the partners (R&D personnel, infrastructure, finance, marketing, etc.) will also be taken into consideration
- **Eligible costs:** Eligible and approved costs of the R&D, in accordance with the national laws and regulations
- **Source of funding:** Government of Canada and MATIMOP, acting on behalf of the Office of the Chief Scientist (OCS), Ministry of Economy

- **Mode of disbursement of financial resources:** Differs from project to project.
- **Annual budget:** There is no special budget. OCS finances all relevant projects.
- **Continuity of the instrument in time:** Since 1995
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** URL: http://www.ciirdf.ca/what_we_do/Results/index.php
- **Relevant links:** http://www.matimop.org.il/canada.html

SETI OPERATIONAL POLICY INSTRUMENT 36

- **Title of the SETI operational policy instrument:** Bilateral Industrial R&D Cooperation Programs (Asia-Pacific-China)
- **Keywords:** Bilateral Co-operation, Asia-Pacific, China, R&D Co-operation
- **Overview:** MATIMOP implements bilateral co-operation agreements with China. Such co-operation agreements and industrial R&D programmes help facilitate partnership between Israeli companies and foreign enterprises, providing access to funding and assistance in partner matching for industrial R&D projects in all fields. The Asia Pacific region offers enormous opportunities for industrial R&D co-operation to Israeli companies. Through R&D alliances, Israeli companies not only benefit from the unique strengths and skills of their partner company, but can also take advantage of market opportunities unique to the Asia Pacific region, which has shown unprecedented growth over the last decade
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** The China-Israel Industrial R&D Cooperation Framework is aimed at fostering joint technological R&D co-operation projects between Chinese and Israeli industries in all technological sectors
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and Services; k. strengthening the quality of technology foresight studies, l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; j. Information services; k. other: grants are refundable if project is successful
- **Conditions to apply for the instrument:** At least two science and technology companies from the respective countries should express a desire to co-operate in the project.
- **Target groups/Beneficiaries:** i. corporations / foundations; j. professional Institutes; k. SETI local groups; l. private company; p. small businesses
- **Eligibility/Selection criteria:** The project may involve more than one company from each side; R&D under the joint project should focus on either developing products that are highly innovative with significant commercial potential, or adapting/customizing to the needs and conditions of the Chinese market existing product/process that belong to the Israeli company partner. The project partners should agree in advance on the IP rights and on the commercialization strategy of the product or process. The project should demonstrate the contribution of the participants from both countries. The project must be balanced between participants and strategically significant to both partners
- **Eligible costs:** Adapting / customizing product/process; adapting to regulations; beta site establishing; utility patent application; international travels (according to international rules)

  Israel – up to 50% of the approved R&D expenditures, refundable if project is successful. China – up to 50% of the approved R&D expenditures as a grant.

- **Source of funding:** Israel – OCS
- **Mode of disbursement of financial resources:** Differs from project to project.
- **Annual budget:** There is no special budget. OCS finances all relevant projects.
- **Continuity of the instrument in time:** Since 2008
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** See URL: http://www.matimop.org.il/blog_Visualead.html
- **Relevant links:** http://www.matimop.org.il/china.html

SETI OPERATIONAL POLICY INSTRUMENT 37

- **Title of the SETI operational policy instrument:** Bilateral Industrial R&D Cooperation Programs (Asia-Pacific – India)
- **Keywords:** Bilateral Co-operation, Asia-Pacific, India, R&D Co-operation
- **Overview:** MATIMOP implements bilateral co-operation agreements with established and emerging leaders in the global economy, including India. Such co-operation agreements and industrial R&D programmes help facilitate partnership between Israeli companies and foreign enterprises in these leading economies, providing access to funding and assistance in partner matching for industrial R&D projects in all fields
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To facilitate and implement access to funding schemes dedicated to the development of R&D-driven partnerships between Israeli and Indian companies
- **Specific objectives:** f. areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and Services; i. promotion of the development of green technologies and social-inclusion technologies; k. strengthening the quality of technology foresight studies, l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; j. information services; k. other: grant, Refundable if project is successful
- **Conditions to apply for the instrument:** Industry may seek support for joint bilateral research and development (R&D) projects, involving at least one Indian and one Israeli company.
- **Target groups/Beneficiaries:** i. corporations / foundations; l. private company; p. small businesses
- **Eligibility/Selection criteria:** Two or more companies, with at least one from India and one from Israel, each of which will be responsible for the development and submission of the joint application within their province or country, may apply. From India, the company must be registered under the Indian Companies Act 1956, and maintain a minimum of 51% Indian ownership. Project leaders (from India and Israel) must both be for-profit companies. The lead Indian company shall be known as the Indian Project Lead (IPL). At least two companies from the respective countries should express a desire to co-operate in the research and development of a new product or a new process. The project may involve more than one company from each side; academic/research entities are eligible to join as co-researchers/ partners or as subcontractors. The project duration should be between 12 and 36 months. The product should be highly innovative with significant commercial potential. The joint industrial R&D project should aim at development of products/processes leading to commercialization in the global market. The project should articulate clear commercial goals and associated commercialization strategies. The project should demonstrate the joint India-Israel project team's capacity to manage the proposed project. The project should demonstrate that all partners contributing to the R&D project have agreed in advance on the IP rights and the commercialization plan for the jointly developed product or process.

- **Eligible costs:** Cost of materials, consumables and other supplies; rental of specific equipment items, where such equipment is unavailable to the project partners; necessary travel expenses; outlays for business planning and knowledge transfer to industry and other end users. For Israeli expenses, eligible expenses are based on the rules and guidelines of the Office of the Chief Scientist)
- **Source of funding:** The Office of the Chief Scientist of the Israeli Ministry of Economy; Department of Science and Technology, Government of India
- **Mode of disbursement of financial resources:** In Israel funding will be provided in the form of a conditional grant (returnable soft loan) to the projects selected under the call for proposals. The total funding from the Government of Israel via the Office of the Chief Scientist will not exceed 50% of the eligible and approved costs of the R&D, in accordance with the national laws and regulations. When a project results in sales of a product, service or process, the financial support must be repaid to the Office of the Chief Scientist according to its regulations (in general, royalties are paid at rates beginning at 3% of sales, depending on various criteria and royalties are payable until 100% of the amount of the grant has been repaid with interest as provided in the applicable regulations). In India: funding will be limited to 50% of the eligible national cost with a limit of US$ 250 000 per project on the Indian side. This means, if the Indian Project costs total 100 units, the Indian applicants would be eligible for an overall support of 50 units only. Moreover, the overall project support of 50 units is a maximum from Government of India, irrespective of its receipt from DST/GITA and/or any other Government Funding Agency support. Once a project is funded with 50 units by DST/GITA, the project applicants are not entitled to request further funding support from any other government funding-agency for the same project, with similar product/process and commercialization. Industry may receive up to 50% of the eligible national costs in the form of a soft loan repayable upon successful completion of the project.
- **Annual budget:** There is no special budget. OCS finances all relevant projects.
- **Continuity of the instrument in time:** Since May 2005
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** I4 RD (India-Israel Initiative for Industrial R&D): Nine projects were approved of the 49 candidates since the start of the programme; KIRD (Karnataka-Israel Industrial R&D Programme): Nine joint projects were launched in the framework of the first call for proposals (June 2013). The programme will approve its first joint projects during the second quarter of 2014. See URL: http://diplomacyandforeignaffairs.com/joint-indian-israeli-rd-ventures-receive-government-support/
- **Relevant links:** http://www.matimop.org.il/india.html

SETI OPERATIONAL POLICY INSTRUMENT 38

- **Title of the SETI operational policy instrument:** Bilateral Industrial R&D Cooperation Programs (Uruguay)
- **Keywords:** Bilateral Co-operation, Uruguay, R&D Co-operation
- **Overview:** Co-operation with Uruguay-based companies is facilitated through the Global Enterprise Cooperation Program. These co-operation agreements and industrial R&D programmes provide the necessary bridge to encourage firms to enter international markets, by offering access to funding and assistance in partner matching
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** n/a
- **Specific objectives:** g. promotion and development of innovation in the production of goods and Services; i. promotion of the development of green technologies and social-inclusion technologies
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants; j. Information services; k. other: grants are refundable if project is successful

- **Conditions to apply for the instrument:** The programme is open to all projects based on merit that include science and technology (S&T) development potentially leading to commercial success and benefit to both countries
- **Target groups/Beneficiaries:** i. corporations / foundations; l. private company; p. small businesses
- **Eligibility/Selection criteria:** At least one S&T company from the respective countries should express a desire to co-operate to conduct R&D for a new; product/ process/service/application; the subject of the R&D should be a highly innovative development with significant commercial potential; the companies should have the technological, commercial and financial capability to successfully bring the new product to the global market; there should be an academic/research entity as a sub-contractor
- **Eligible costs:** Eligible and approved costs of the R&D, in accordance with the national laws and regulations
- **Source of funding:** ANII, The National Research and Innovation Agency of Uruguay and MATIMOP, the Israeli Industry Centre for R&D acting on behalf of the Office of the Chief Scientist (OCS), Ministry of Economy
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** There is no special budget. OCS finances all relevant projects.
- **Continuity of the instrument in time:** n/a
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.matimop.org.il/Uruguay.html

SETI OPERATIONAL POLICY INSTRUMENT 39

- **Title of the SETI operational policy instrument:** Support for Traditional Industry
- **Keywords:** Traditional Industry
- **Overview:** A special track is dedicated to traditional industries (characterized by relatively low investment in R&D). This track offers separate evaluation and discussion for projects. Private consultations are offered to traditional industry companies applying to the OCS for the first time
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Strengthening research and innovation in traditional industries
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity-building, education and training of specialized human capital for development of new technologies, promotion of innovation within the productive and services systems; g. promotion and development of innovation in the production of goods and Services
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** This programme is open only to traditional industry companies applying to the OCS for the first time
- **Target groups/Beneficiaries:** i. corporations / foundations; l. Private company
- **Eligibility/Selection criteria:** Quality and innovation level of the project
- **Eligible costs:** Grants in amounts of up to up to 50% of the approved budget are offered for: new pattern development – up to NIS 500 000 (approx. US$ 140 000); knowledge purchase (if the knowledge is an integral part of the R&D programme – up to NIS 250 000 (approx. US$ 70 000); salaries of 3 partly (up to 10%) employed R&D workers; professional training courses – up to NIS 25 000 (approx. US$ 7 000)
- **Source of funding:** Office of the Chief Scientist – Ministry of Economy

- **Mode of disbursement of financial resources:** Similar to most OCS programmes, resources are disbursed based on the basis of filing expense reports, according to the approved budget
- **Annual budget:** There is no special budget. OCS finances all relevant projects (e.g. through the R&D Fund budget). In 2013, NIS 1.023 billion (approx. US$ 290 US$ Million) were provided to beneficiaries
- **Continuity of the instrument in time:** Since 2005
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** See, for example: Hanita Coating, URL: http://www.hanitacoatings.com/
- **Relevant links:** http://www.moital.gov.il/NR/rdonlyres/0BA7755A-4F76-4520-9A67-A4216C30E071/0/mopspreads.pdf

SETI OPERATIONAL POLICY INSTRUMENT 40

- **Title of the SETI operational policy instrument:** Encouragement of R&D in Space Technologies
- **Keywords:** Space Technologies, R&D
- **Overview:** Israel has knowledge and development capabilities in many areas in the field of space technology. Due to the technological complexity of the space environment, development of systems and assemblies which could function in space involves high technological risk, as well as high development and production costs. In order to respond to these unique market conditions, the Ministry of Science and Technology and The Office of Chief Scientist in the Ministry of Economy have jointly initiated a dedicated programme encouraging research and development of various space technologies. The programme is subject to the terms of the R&D Law regarding the payment of royalties and intellectual property transfer rules
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To respond to Israel unique market conditions – knowledge and development capabilities of Israel companies in many areas in the field of space technology
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Companies eligible for this instrument include those developing: products to be installed in satellites or in earth stations, products designated for the reception or transmission of data from satellites, instruments designed for testing and calibration, and equipment to be installed in satellites or relating to their operation, including adjustment of satellite versions for export
- **Target groups/Beneficiaries:** i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** The level of innovation and uniqueness of the product; The ability of the product to improve different types of satellites and/or their activity; The commercial potential of the product (in present and in future) to the Israeli and the global market; The company should have the well-formulated business-programme for the realization of the commercial potential of the product
- **Eligible costs:** Up to 85% of approved R&D budget, up to 36 months.
- **Source of funding:** OCS and Israel Space Agency (ISA)
- **Mode of disbursement of financial resources:** Similar to most OCS programmes, resources are disbursed based on the basis of filing expense reports, according to the approved budget.
- **Annual budget:** There is no special budget. OCS and ISA finance all relevant projects. Overall government funding per project shall not exceed NIS 20 million (approx. US$ 5.7 million)
- **Continuity of the instrument in time:** Since 2012
- **Geographical coverage:** b. national

- **Results, outcomes and evidence of success of a given measure:** New programme. Significant outputs yet to be achieved
- **Relevant links:** http://www.moital.gov.il/NR/rdonlyres/A882F88E-0814-4F46-8306-39AC99938701/0/OCSPrograms.pdf

SETI OPERATIONAL POLICY INSTRUMENT 41

- **Title of the SETI operational policy instrument:** Support for Israeli Life Sciences and Traditional Industry Research Institutes
- **Keywords:** Research centres, Applied Research, Industrial Research
- **Overview:** This programme assists research institutions with clear links to industry in strengthening their technology infrastructure.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Strengthening technology infrastructure of research institutions with clear links to industry and developing relevant technologies and products.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Any research institute can apply if it is an independent legal entity; employs a team of researchers with proven scientific and technological abilities; has equipment for conducting and testing industrial R&D; and earns at least 30% of its revenue by providing services to industry.
- **Target groups/Beneficiaries:** f. research centres
- **Eligibility/Selection criteria:** n/a
- **Eligible costs:** n/a
- **Source of funding:** Office of the Chief Scientist – Ministry of Economy
- **Mode of disbursement of financial resources:** Similar to most OCS programmes, resources are disbursed based on the basis of filing expense reports, according to the approved budget.
- **Annual budget:** There is no special budget. OCS finances all relevant projects (e.g. through the R&D Fund budget). In 2013, NIS 8.2 million (approx. US$ 2.3 million) were provided to beneficiaries
- **Continuity of the instrument in time:** Since 1984
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** 265 projects received the support since 2000
- **Relevant links:** http://www.moital.gov.il/NR/rdonlyres/5E7A4322-4D0F-4320-953C-83F94024E7AA/0/RDspreads.pdf

SETI OPERATIONAL POLICY INSTRUMENT 42

- **Title of the SETI operational policy instrument:** Program to Encourage the Establishment of R&D centres in Israel for the Service of the International Financial Community
- **Keywords:** R&D centres, foreign companies

- **Overview:** The levels of government support within the framework of this programme are 40% of the total budget approved by the research committee for the first and second years, then 30% for the third and fourth years and 25% for the fifth year. Projects executed in Israel's periphery will enjoy support levels of 50% for the first and second years, 40% for the third and fourth years and 35% for the fifth year
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To advance development of the financial sector by encouraging leading multinational financial institutions to establish R&D centres in Israel in order to serve the international financial community
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge, development of new technologies
- **Sectoral and horizontal approach of the instrument:** b. Horizontal: the benefits go to all the disciplines, areas and sectors
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Multinationals financial institutes can apply to the programme
- **Target groups/Beneficiaries:** i. corporations / foundations
- **Eligibility/Selection criteria:** Main criteria – institution size, quality of the R&D plan submitted including degree of innovation. The method—submission of request, evaluation by OCS evaluators, approval by the OCS Research Committee
- **Eligible costs:** n/a
- **Source of funding:** OCS – Ministry of Economy
- **Mode of disbursement of financial resources:** Similar to most OCS programmes, resources are disbursed based on the basis of filing expense reports, according to the approved budget.
- **Annual budget:** The approved grants to the companies were NIS 10 992 587 (approx. US$ 3.2 million) for the first year, NIS 25 million (approx. US$ 7.1 million) for the second year
- **Continuity of the instrument in time:** Since 2011
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.moital.gov.il/NR/rdonlyres/6F1E9C21-8F2C-4E7C-8796-88AFF4031157/0/RD.pdf

SETI OPERATIONAL POLICY INSTRUMENT 43

- **Title of the SETI operational policy instrument:** Project Centres for Multinational Companies
- **Keywords:** Multinational Companies, Research Centres, R&D collaboration
- **Overview:** This programme encourages multinational companies to establish a Project Centre in Israel. A Project Centre is an Israel-based company, which may be wholly owned by the multinational company, which functions as the representative of the multinational company in Israel. The main functions of the Project Centres are: to identify and form R&D collaborations between an Israeli partner and the multinational company; to create and implement these R&D projects; and to provide financial and other assistance to the Israeli partner.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Encouraging multinational companies, especially those from traditional industry and/or operating in the periphery, to conduct R&D in Israel and in collaboration with Israeli partners.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; j. research and innovation ecosystem
- **Sectoral and horizontal approach of the instrument:** a. Sectoral

- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Multinational Company: a company that complies with all the following conditions: the overall turnover of the company exceeds 2.5 billion in the calendar year prior to the submission of the application; an industrial company in the traditional or mixed industry sectors. Israeli Company: A company or academic institute that is carrying out the project and is not connected to the multinational company
- **Target groups/Beneficiaries:** i. corporations / foundations; l. private company
- **Eligibility/Selection criteria:** Research Commission headed by the Chief Scientist in the Ministry of Economy decides about support of every project according to the criterions that are determinate by the Knesset Finance Commission
- **Eligible costs:** n/a
- **Source of funding:** Office of the Chief Scientist – Ministry of Economy
- **Mode of disbursement of financial resources:** Similar to most OCS programmes, resources are disbursed based on the basis of filing expense reports, according to the approved budget. The Research Commission provides the license (and budget) for 5 years and may terminate at any time. The license may be renewed after 5 years
- **Annual budget:** There is no specific budget. OCS finances all relevant projects (e.g. through the R&D Fund budget). In 2013, NIS 9.2 million (approx. US$ 2.6 million) was allocated.
- **Continuity of the instrument in time:** Since 2008
- **Geographical coverage:** regions from the country
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.economy.gov.il/NR/exeres/0062683B-A19D-4273-8F94-2BDC35EAA01F.htm

SETI OPERATIONAL POLICY INSTRUMENT 44

- **Title of the SETI operational policy instrument:** NIBN – National Institute for Biotechnology in the Negev
- **Keywords:** Biotechnology, Long-term R&D, Research Centre, Periphery
- **Overview:** The NIBN was established within Ben-Gurion University in 2005 with the co-investment of several government entities, including the OCS, to create a more effective multidisciplinary bridge between basic and applied research in biotechnology and for the emergence of a successful biotechnology industry in Israel and the Negev (Israel's southern periphery). The focus of the institute's research includes structural biotechnology, computational biotechnology, human genetics, functional genomics, nano-medicine and immune system biotechnology. The OCS is part of the NIBN's Steering Committee
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To create a more effective multi-disciplinary bridge between basic and applied research in biotechnology, for the emergence of a successful Biotech industry in Israel and the Negev
- **Specific objectives:** b. strengthening the infrastructure of research laboratories in the public and private sectors; other: strengthening the development of the periphery
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Not Relevant
- **Target groups/Beneficiaries:** b. students; c. professionals / PhD; d. teachers / researchers; e. universities
- **Eligibility/Selection criteria:** n/a
- **Eligible costs:** n/a

- **Source of funding:** The Office of the Chief Scientist – Ministry of Economy and Ben-Gurion University
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** NIS 126 million (approx. US$ 36 million) for 7 years
- **Continuity of the instrument in time:** Formal contract between Ben-Gurion University and the Government was signed in 2009
- **Geographical coverage:** c. regional within Israel
- **Results, outcomes and evidence of success of a given measure:** URL: http: //cmsprod.bgu.ac.il/Eng/Centers/nibn/default.htm
- **Relevant links:** http: //www.moital.gov.il/NR/rdonlyres/5E7A4322-4D0F-4320-953C-83F94024E7AA/0/RDspreads.pdf

SETI OPERATIONAL POLICY INSTRUMENT 45

- **Title of the SETI operational policy instrument:** Development of Technological Solutions for People with Special Needs
- **Keywords:** Special Needs, Technological Solutions, Adopting Technologies
- **Overview:** A new track of the OCS, designed to encourage the development of technological solutions for People with Special Needs, defined as 'physical, psychological, mental or cognitive disability – temporary or permanent, resulting in a fundamental disruption of essential daily functions'
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** to encourage the development of technological solutions for People with Special Needs
- **Specific objectives:** g. promotion and development of innovation in the production of goods and services
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:**
- Candidates must be non-profits companies established for fewer than 2 years, working in the field with a proper management certificate; having its own research staff of at least 2 persons
- **Target groups/Beneficiaries:** l. Private company; m. science and technology public or private non-profit organizations; n. ad hoc associations; o. individuals
- **Eligibility/Selection criteria:** A special committee will consider, on a case-by-case basis, an application of either non-profit or for-profit organizations with a project not meeting the eligibility criteria other OCS support programmes. Non-profit organizations are exempt from Royalty Payments
- **Eligible costs:** Grants given amount to up to 85% of the approved budget (for the non-profits) or up to 65% for the companies
- **Source of funding:** The Office of the Chief Scientist – Ministry of Economy
- **Mode of disbursement of financial resources:** According to R&D performance
- **Annual budget:** Each grant is limited to NIS 600 000 (approx. US$ 170 000) per project per year for no more than two years
- **Continuity of the instrument in time:** Since 2012
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.moital.gov.il/NR/rdonlyres/6F1E9C21-8F2C-4E7C-8796-88AFF4031157/0/RD.pdf

SETI OPERATIONAL POLICY INSTRUMENT 46

- **Title of the SETI operational policy instrument:** KIDMA – Advancement of Israeli Cyber Security
- **Keywords:** Cyber Security, Cyber Defence Solutions
- **Overview:** As the Internet plays an increasingly significant role in every life aspect, cyber threats rapidly become more complex and challenging, and their global influence increases. This raises the threshold for successfully developing adequate protection systems. The government, wishing to maintain and enhance Israel's abilities is this sector, issued Decision 3611 in mid–2011, calling for 'The advancement of national capabilities in the field of cyber security'. Following this Decision, the Office of the Chief Scientist (OCS) and the Israeli National Cyber Bureau (INCB) jointly allocated NIS 80 million (approx. US$ 20 Million) to a joint programme aiming to promote development of advanced cyber defence solutions and establish cyber-security knowledge centres. The programme will be executed through existing OCS programmes.
- **Objectives of the plan (or the SETI policy) to which the instrument relates: t**he advancement of national capabilities in the field of cyber security.
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge, development of new technologies, promotion of innovation within the productive and services systems; f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and services; h. promotion of start-ups in areas of high technology; k. strengthening the quality of technology foresight studies to assess the potential of high-value markets; l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants; d. creation of, and support for, technological poles and centres of excellence
- **Conditions to apply for the instrument:** Projects funded by the KIDMA instrument must show economic feasibility (in local and especially foreign markets) in the cyber field. The OCS will fund cyber projects that will improve the competitive ability of the Israeli Industry. The KIDMA instrument encourages bilateral co-operation of Israeli companies with foreign firms.
- **Target groups/Beneficiaries:** e. universities; f. research centres; i. corporations / foundations
- **Eligibility/Selection criteria:** Companies or start-ups in the fields of information security, cyber security, and computer and IT security. Both Israeli and foreign companies (co-operation with Israeli firms) are eligible to participate in the programme
- **Eligible costs:** personnel costs (researchers, technicians and other supporting staff), costs of instruments and equipment and materials, cost of contractual research. Additional funding is available for advanced training in the cyber field, market research, marketing consulting, business plan preparation and participation in cyber technology events, up to NIS 125 000 (not to exceed NIS 25 000 per individual activity) and participation in international conferences (including flights, hotels and other costs)
- **Source of funding:** The Office of the Chief Scientist – Ministry of Economy
- **Mode of disbursement of financial resources:** The OCS funding (grant) may account up to 50% of the approved budget (50% of the project will be financed by the company). Young companies (up to 10 employees and within the first three years of existence) are additionally entitled to 25% of overhead costs. Funding is available for returning resident scholars (Senior R&D) to be incorporated in the budget as a standard deviation of the maximum salary, up to NIS 35 000. An aggregate amount of at least 80% from the total expenses of the approved programme shall be granted for salaries of R&D personnel
- **Annual budget:** NIS 80 million (approx. US$ 23 million)

- **Continuity of the instrument in time:** The programme started in 2013. Duration of individual project – up to 24 months
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** New programme. Significant outputs yet to be achieved
- **Relevant links:** http: //www.moital.gov.il/NR/exeres/6DD6216E-4EFA-4CB1-B0AC-4F146B833A70.htm

SETI OPERATIONAL POLICY INSTRUMENT 47

- **Title of the SETI operational policy instrument:** Masad Program – Dual Cyber R&D
- **Keywords:** Cyber Security, Dual Civilian and defence Usage
- **Overview:** The National Cyber Bureau in the Prime Minister's Office and Maf'at (Directorate of defence R&D) in the Ministry of Defence recently launched the Masad Program: Dual Cyber R&D. This programme has a dual objective to promote defence R&D and to advance national non-military infrastructures in the cyber field, with the purpose of contributing to the development of military and non-military cyber
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** The goal of the programme is to advance projects in the field of cyber R&D that will serve a dual function with regard to defensive capabilities and with regard to national-civilian needs in the cyber field
- **Specific objectives:** c. innovation and strategic planning. Capacity building, education and training of specialized human capital for development of new technologies, promotion of innovation within the productive and services systems; f. development of strategic technological areas and new niche products and services with high added value; g. promotion and development of innovation in the production of goods and services k. strengthening the quality of technology foresight studies to assess the potential of high-value markets
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Projects funded by the "Masad" instrument must show economic feasibility (in local and especially foreign markets) in the cyber field. The OCS will fund cyber projects that will improve the competitive ability of the Israeli Industry
- **Target groups/Beneficiaries:** e. universities; f. research centres; i. corporations / foundations; l. private company; p. small businesses
- **Eligibility/Selection criteria:** Companies or start-ups in the fields of information security, cyber security, computer and IT security. Both Israeli and foreign companies (cooperating with Israeli firms) are eligible to participate in the programme
- **Eligible costs:** Personnel costs (researchers, technicians and other supporting staff), costs of instruments, equipment and materials, cost of contractual research
- **Source of funding:** The National Cyber Bureau in the Prime Minister's Office and Maf'at (Directorate of defence R&D) in the Ministry of defence
- **Mode of disbursement of financial resources:** The funding (grant) may account up to 50% of the approved budget (50% of the project will be financed by the company)
- **Annual budget:** The programme has a preliminary budget of NIS 10 million for 2013 allocated from the budgets of both offices
- **Continuity of the instrument in time:** n/a
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** New programme. Significant outputs yet to be achieved

- **Relevant links:** http://www.pmo.gov.il/English/PrimeMinistersOffice/DivisionsAndAuthorities/cyber/Documents/Masad%20Program.pdf

SETI OPERATIONAL POLICY INSTRUMENT 48

- **Title of the SETI operational policy instrument:** Academic–Technological Education Program for Teenagers
- **Keywords:** Technological education, academic education, teenagers, computers, R&D
- **Overview:** Designed to encourage teenagers with extraordinary potential, to become R&D experts in computers, and particularly in cyber
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** n/a
- **Specific objectives:** innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge; ii. development of new technologies, promotion of innovation within the productive and services systems; g. promotion and development of innovation in the production of goods and services
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** k. other: government involvement in the creation and funding of the educational programme
- **Conditions to apply for the instrument:** Relevant for research universities which have substantial educational programmes for teenagers and computer science and/or computer engineering faculties.
- **Target groups/Beneficiaries:** e. universities; h. schools / colleges / institutes
- **Eligibility/Selection criteria:** n/a
- **Eligible costs:** n/a
- **Source of funding:** n/a
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** n/a
- **Continuity of the instrument in time:** n/a
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** Project has just started
- **Relevant links:** n/a

SETI OPERATIONAL POLICY INSTRUMENT 49

- **Title of the SETI operational policy instrument:** Funding Academic R&D
- **Keywords:** Energy research, water resources research, academic R&D
- **Overview:** n/a
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** To develop knowledge in energy and water domains
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; c. human resources for research, innovation and strategic planning. Capacity building, education and training of specialized human capital for the production of new scientific knowledge; i. promotion of the development of green technologies and social-inclusion technologies; k. strengthening the quality of technology foresight studies to iii. Construct and analyse long-term scenarios, provide consulting services and strategic intelligence; vi. other: development of knowledge in energy and water domains

- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** The programme is limited to research in Alternative Energy, Renewable Energy and Energy Efficiency.
- **Target groups/Beneficiaries:** b. students; c. professionals / PhD; d. teachers/researchers; e. universities; f. research centres
- **Eligibility/Selection criteria:** Development of knowledge in energy and water domains
- **Eligible costs:** Human resource, technological equipment, materials, training and professional conferences in Israel and the abroad, consultants
- **Source of funding:** Governmental grants
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** Earth and Sea domains: approx. US$ 1 million. Energy domain approx. US$ 4 million
- **Continuity of the instrument in time:** The project started in 1990. The research must be conducted in 3 years and there is option for one-year extension
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://energy.gov.il/english/Pages/default.aspx

SETI OPERATIONAL POLICY INSTRUMENT 50

- **Title of the SETI operational policy instrument:** D-CURE: Bridging Grants for Diabetes Research in Israel
- **Keywords:** D-Cure, Type II Diabetes
- **Overview:** All clinical and basic research in the area of diabetes and its complications will be eligible for support. D-CURE encourages applications from younger physicians and researchers at an early stage of their career
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** n/a
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity-building, education and training of specialized human capital for the production of new scientific knowledge; development of new technologies; promotion of innovation within the productive and services systems; d. strengthening gender equality for research and innovation; e. Strengthening the social appropriation of scientific knowledge and new technologies; f. development of strategic technological areas and new niche products and services with high added value
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants; b. Donations (individuals/companies); g. scholarships; i. trust funds
- **Conditions to apply for the instrument:** The D-Cure Organization is dedicated to promoting research activities of young investigators and physicians. Their aim is to recruit enthusiastic young people to the field of Diabetes research, thus expanding the potential of future Israeli leaders in this vital area; research grants of $ 15 000 each are available for four Israeli researchers; young researchers from any academic institution, hospital or research centre within Israel may apply
- **Target groups/Beneficiaries:** b. students; c. professionals / PhD; d. teachers / researchers; e. universities; f. research centres; h. schools / colleges / institutes
- **Eligibility/Selection criteria:** n/a

- **Eligible costs:** Scholarship to students, cost of technicians, ingredients and consumables, cost of animals, overhead (10%), up to US$ 20 000 for 1 year
- **Source of funding:** D-CURE Organization
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** The 2014 **Annual budget:** was NIS 700 000
- **Continuity of the instrument in time:** n/a
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.d-cure.org/English/

SETI OPERATIONAL POLICY INSTRUMENT 51

- **Title of the SETI operational policy instrument:** Nitzan Program
- **Keywords:** Smart agriculture
- **Overview:** The programme is intended to promote co-operation between the academy and the industry in the agricultural domain.
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** Development of herbs with an emphasis on plant extracts; promotion of smart agriculture; development of smart and biodegradable packaging solutions; treatment and utilization of agricultural waste; development of environmentally friendly pesticides; development of protein substitutes for human and animal consumption
- **Specific objectives:** b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity-building, education and training of specialized human capital for the production of new scientific knowledge; development of new technologies; promotion of innovation within the productive and services systems; e. Strengthening the social appropriation of scientific knowledge and new technologies; f. development of strategic technological areas and new niche products and services with high added value; j. research and innovation ecosystem; k. strengthening the quality of technology foresight studies, l. strengthening regional and international co-operation, networking and promotion of SETI activities
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** The participating academic or research institute must be recognized, accredited and eligible for funding by the Chief Scientist of the Ministry of Agriculture
- **Target groups/Beneficiaries:** b. students; c. professionals / PhD; d. teachers / researchers; e. universities; f. research centres; j. professional Institutes; l. private company
- **Eligibility/Selection criteria:** Proven technological innovation (50%), market potential (20%), competitive advantage for the Israeli industry, promotion of domestic and global agricultural R&D (30%)
- **Eligible costs:** Personnel expenses, materials and research costs.
- **Source of funding:** The government provides 90% of the total funding and the industrial company provides 10% of the funding
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** Maximum budget per a single project is US$ 145 000
- **Continuity of the instrument in time:** 2014–2017
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** Not yet
- **Relevant links:** http://www.science.moag.gov.il/forms/kkNitsan.pdf

SETI OPERATIONAL POLICY INSTRUMENT 52

- **Title of the SETI operational policy instrument:** Research Funds and Scholarships in Food and Nutrition Affecting Public Health
- **Keywords:** Food, nutrition, public health
- **Overview:** This Research Fund operates under the Research Foundation of the Ministry of Health (MOH). The fund awards research grants, grants for feasibility studies, scholarships for practitioner-researcher and scholarships for post-doctoral and doctoral students
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** n/a
- **Specific objectives:** a. strengthening the production of new endogenous scientific knowledge; b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning. Capacity-building, education and training of specialized human capital for the production of new scientific knowledge; development of new technologies; promotion of innovation within the productive and services systems; d. strengthening gender equality for research and innovation; e. strengthening the social appropriation of scientific knowledge and new technologies; f. development of strategic technological areas and new niche products and services with high added value
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants; b. donations (individuals/companies; g. scholarships; i. trust funds
- **Conditions to apply for the instrument:** n/a
- **Target groups/Beneficiaries:** b. students; c. professionals / PhD; d. teachers / researchers; e. universities; f. research centres; h. schools / colleges / institutes
- **Eligibility/Selection criteria:** The Proposal must fully comply with the call for proposal by the MOH – Israel
- **Eligible costs:** Student scholarships cost of technicians, ingredients and consumables, cost of animals, overhead (10%)
- **Source of funding:** Ministry of Health – Research Foundation
- **Mode of disbursement of financial resources:** n/a
- **Annual budget:** The 2014 **Annual budget:** was NIS 2 million. This sum was awarded to four research proposals that were selected from 10 applications
- **Continuity of the instrument in time:** n/a
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** n/a
- **Relevant links:** http://www.health.gov.il/Subjects/research/Pages/Food.aspx

SETI OPERATIONAL POLICY INSTRUMENT 53

- **Title of the SETI operational policy instrument:** STARTERGY Fund
- **Keywords:** Alternative energy, renewable energy, energy efficiency.
- **Overview:** The STARTERGY fund is an instrument intended from supporting innovative, early stage start-up companies in the fields of energy efficiency, hydrogen technologies, energy storage using electrochemical means and renewable energy (e.g. wind and solar energy)
- **Objectives of the plan (or the SETI policy) to which the instrument relates:** to make Israel a Centre of Excellence in the fields of alternative energy, renewable energy and energy efficiency

- **Specific objectives:** b. strengthening the infrastructure of research laboratories in the public and private sectors; c. human resources for research, innovation and strategic planning Capacity-building, education and training of specialized human capital for development of new technologies; h. Promotion of start-ups in areas of high technology; i. promotion of the development of green technologies and social-inclusion technologies; k. strengthening the quality of technology foresight studies to develop business plans for high-tech companies
- **Sectoral and horizontal approach of the instrument:** a. Sectoral: the benefits go to a specific knowledge discipline, technological area, productive sector or a specific issue
- **Mode of support/Type of mechanism:** a. grants
- **Conditions to apply for the instrument:** Only Israeli citizens and corporations registered in Israel can apply for funding. An individual whose proposal has been accepted within this tender will be required to legally register as a commercial entity in Israel, as a condition for receiving the grant
- **Target groups/Beneficiaries:** l. private company; p. small businesses
- **Eligibility/Selection criteria:** n/a
- **Eligible costs:** Personnel and training costs, costs of instruments, equipment and materials
- **Source of funding:** Governmental grants
- **Mode of disbursement of financial resources:** Participation by up to 65% of the approved, up to a limit of NIS 625 000 (approx. US$ 180 000)
- **Annual budget:** n/a
- **Continuity of the instrument in time:** Since 2011
- **Geographical coverage:** b. national
- **Results, outcomes and evidence of success of a given measure:** New programme, significant output has not been reported yet
- **Relevant links:** http://energy.gov.il/english/Pages/default.aspx

SWOT analysis of Israel's research and innovation system

This section focuses on the strengths, weaknesses, opportunities and threats (SWOT) which characterize Israel's research and innovation system. These characteristics are summarised in Table 39 on page 302. The analysis, which follows, is based and organized according to the information and data presented in preceding sections. The sequence of items in each of the four individual dimensions of the SWOT analysis follows the order of the different chapters, starting with the contextual factors – which influence the implementation on any policy – and continues with more specific items associated with SETI policies.

Strengths

- **Positive long-term trends in human development indicators:** In the past four decades, life expectancy at birth has increased by 12 years (see Figure 4, page 8) while the Human Development Index has progressed in a logistic fashion from a value of 0.727 in 1975, to 0.894 in 2014 (see Figure 3, page 7). Specific programmes for social mobility were implemented (see Box 1, page 11). The number of years of schooling among the population in the principal working age range (25–64 years), which is an indicator of the stock of human capital in the economy, grew in Israel from an average of 10.1 years in 1974 to 16 years in 2014. Enrolment in tertiary education has risen almost exponentially (see Figures 33 and 34 pages 64–65). The public expenditure in education was 5.6% of the GDP in 2014.
- **Excellence in higher education and in academic research:** Israel has eight research universities (see Box 5, page 53). Common to all Israeli universities is their striving for excellence. This is reflected in the high impact of their scientific publications and citations (see Table 25, page 105; Table 29 page 109 and Table 30, page 110), their high-ranking at global level (see Figures 27, page 57), and the number of prestigious international awards for Israeli researchers including five Nobel Laurates in the past decade (see pages 139–141). Israeli academic researchers have a high rate of success in winning research grants (Figures 28 and 29, page 59), strong inventive performance in term of patents (see Figures 59–60, page 112 and Figures 61–62 page 117) and the intense and rigorous activity of Technology Transfer Offices (see Box 8, page 70) in the commercialization of IP. The Office of the Chief Scientist's MAGNET programme has successfully supported knowledge transfer since 1994 through grants for new pre-competitive consortia (see pages 41, 189, 261 and 262). In the past five years, there was a rise of 30% within the budget of the Council for Higher Education (see page 52). The Six-year Planning and Budgeting Committee Plan is increasing research budgets and retaining more researchers. The system is benefitting from the recent I-CORE programmes for centres of research excellence.
- **Exceptional labour force and entrepreneurial culture:** Israel boasts one of the most highly educated, entrepreneurial, and multi-cultural workforces in the world, producing cutting-edge technologies and innovations. Israel's resourceful workforce is particularly competitive because of its informal but effective get-down-to-business culture; exceptional ingenuity and entrepreneurial spirit (see Box 1, page 11).
- **Solid innovation ecosystem:** In the past two decades, the country succeeded in establishing a knowledge-intensive economy with high- and medium-tech products contributing significantly to the trade balance (see Figures 19 and 20, page 35). Israel achieved top ranks in terms of Gross Expenditures on R&D (see Figure 43, page 85), Business Expenditure on R&D (see Figures 44 and 45, page 86), and venture capital as a percentage of GDP (see Tables 12 and 13, pages 37–38). It has the second highest concentration of high-tech companies in the world and is a major player in development and application of technology, cyber security, and innovative capacity (see Figure 22 page 39 and Table 14, page 40). Israel is a world leader in research collaboration between the academia and industry (see pages 60–61). The close ties between academia, industry and government enable scientific innovation to be swiftly translated into marketable products and business initiatives. The MAGNETON programme promotes existing industry-science co-operation for a period of up to 2-years and the NOFAR programme aims to advance applied research in biotechnology and nanotechnology (see pages 41 and 263).

- **Government support for R&D:** Preserved in its legislation through laws for the encouragement of capital and industrial R&D, the State of Israel seeks to offer maximum support for companies seeking to invest in Israel (see pages 212–240). Israel encourages international and local entrepreneurial investment by offering generous grants, reduced tax rates, tax exemptions and other tax-related benefits through the Law for the Encouragement of Capital Investments (see inventory of operational policy instruments pages 349–410).

- **Flourishing venture capital market:** Israel is ranked second (after the USA) in terms of venture capital availability, thus ensuring a threshold condition required to foster entrepreneurship and innovation by small companies in all sectors. In this way, Israel's thriving start-up industry is complemented by a flourishing venture capital market, which attracted a total of US$ 2 346 million in 2013. Government insures 25% of the risk of Israeli institutional investors who join high-tech funds as limited partners.

- **Strategic clusters of specialisations:** Israel has developed a series of strategic programmes to occupy technologically-specialised niches in the global economy. The Cyber-Security Initiative, promised US$ 50 million for 2012–2014 (see pages 199, 287–289) to strengthen human capital in the cyber security field by transferring military expertise to industry. Another area of expertise in knowledge-intensive industries is defence exports (see Box 3, page 44). The Government has been promoting the pharmaceutical and biotechnology industry with a relative success via the Office of Chief Scientists' policy instruments. New areas have been identified, and specific policy instruments and funding allocations have already been established (i.e. Cleantech, nanotechnology and the Fuel Choices Initiative, see Box 4, page 49).

- **SETI globalization and increasing international co-operation:** Israel has made international co-operation a policy priority (see for example the inventory of international agreements, pages 230–240). Competitive grants have been offered to support the internationalization of research and innovation and to encourage high-tech exports (see inventory of operational policy instruments, pages 241–293). International co-authorship increased from 35% to 47% in the past two decades (see Figure 56, page 102) and the percentage of GERD financed from abroad increased from 19% to 49% in the same period (see Figure 44, page 86). Israel received almost US$ 800 million from the European Union Seventh Framework Programme (see Figures 28 and 29, page 59) of which almost two thirds went to universities, and the country has just arranged its participation in the European Union's Horizon 2020 research financing scheme. Israel's SETI ecosystem relies on foreign multinationals and large R&D corporate investors. In 2012, Israeli inventors ranked 10th in the number of patents applications in the United States Patent and Trademark Office (USPTO) of which patents most are owned by multinational companies which have research centres in Israel (Table 33, page 119). The I-CORE programme – which began in 2011 – includes the establishment of 16 centres of excellence in Israeli universities to improve their competitive position globally and to promote networking and *brain-gain* by attracting back to the country senior researchers (see Box 18, page 160). MATIMOP (a governmental non-profit organization) promotes the development of advance technologies in Israel with the purpose of creating fruitful international partnerships through industrial co-operation and joint ventures.

Weaknesses

- **Negative values on selected governance indicators:** The *government effectiveness* indicator had positive values between 1996 and 2013. However, the *political stability over absence of violence* had negative values over the same period (see Figures 9 and 10, pages 21–22). This was caused by the series of conflicts – over the past decades – between the Arab and Israeli communities. This situation diminishes societal stability and increases internal antagonisms, resulting in adverse contextual factors for implementing policies. Over the past two decades the *Corruption Perception Index* shows increased perceptions of corruption, and, in global comparisons, the country has dropped from 14 in 1995 to 37 in 2014 (see Figure 11, page 22). These issues might discourage foreign direct investment.

- **High-tech innovation, but a divided economy:** On the one hand, Israel's economy includes a relatively small, excellent high-tech sector, which serves as its engine (see Figure 14, page 27). On the other hand, a much larger, less efficient traditional industry and services sector exists. The country's technology-driven growth was not sufficiently inclusive; poverty and inequality have risen (see Table 7, page 15). The dual economic structure results in a well-paid labour force living at the 'core' of the country, namely the Tel Aviv metropolitan area, and a poorly paid labour force living primarily on the periphery (see pages 30–33).

- **Barriers in the environment for doing business:** Israel is at the bottom of OECD countries (with a world rank of 53) on the *Ease of Doing Business Index* (see Table 11, page 34), showing the need for a significant improvement in various aspects of the regulatory framework for doing business. The business community identified 'inefficient government bureaucracy' as the major difficulty for promoting innovation and competitiveness (see Figure 12, page 26).

- **Zero-growth in the number of tenure track positions in research universities:** the number of R&D personnel working within the higher education and academic sectors has remained almost constant for more than two decades (see Table 20, page 79). This fact has promoted a drain of talent to the private sector or to other countries.

- **Declining scientific productivity:** The number of articles by Israeli scientists listed in the Science Citation Index, Social Science Citation Index and Arts & Humanities Citation Index shows a linear-growth over the past five decades (R^2=0.99). At the same time, the number of articles per capita exhibits an asymptotic behaviour, reaching saturation (R^2=0.97) at around 1 570 articles per million inhabitants (See Figure 52, page 100). Since the late 1960s, Israel long had the highest worldwide productivity in terms of articles per million inhabitants. This position was lost in 1994. In 2014, Israel occupied the 12th rank for countries with a population of over one million inhabitants (see Figure 53, page 101). The number of articles per capita against the GDP per capita in constant US dollars also showed a saturation behaviour (R^2=0.94) at around 1 570 articles per million inhabitants for a GDP per capita over US$ 20 000 (see Figure 54, page 101). Consequently, the yearly shares of Israel's articles relative to all articles worldwide have also been decreasing by 30% over the past two decades (see Figure 55, page 102). Moreover, while in the Republic of Korea and China the distribution pattern of scientific articles across major fields of science reveals that 80% of the publications fall in the natural sciences or engineering and technology fields, in Israel this share is only 60%. In the past two decades, the share of articles in the natural sciences fell by 5% while there was an increase of 5% in the social sciences field (see Figure 57, page 106). This publication pattern is the result of the zero-growth policy in the number of full-time equivalent academic researchers and the reductions that Higher Education Expenditures on R&D suffered in the past decade, from 0.69% in 2003 to 0.59% in 2013 (see Figure 44, page 86).

- **Lack of strategic and normative SETI goals:** Israel has neither formalized SETI policies by endorsing medium- and long-term plans, nor formalized any R&D master plan that lays out long-term strategies for the entire research and innovation ecosystem with strategic goals and quantitative targets (see pages 155–158).

- **Absence of any formal governmental co-ordination structure for SETI policies:** Research and innovation is a crosscutting activity, which requires the co-ordination of different governmental bodies for the correct implementation of its policies. Since the elimination of the Ministerial Committee for Science and Technology (MCST) in the late 1960s (see pages 129–131), there is no formal governmental structure for the co-ordination of the different SETI policies (see pages 162–170). There is a lack of any formal platform for all governmental stakeholders to work as a clearing-house of national SETI policies. In order to foster synergies and avoid duplication of efforts, a new holistic R&D framework involving the various actors of the SETI system — including the OCS; the Chief Scientists in the various government ministries; the Ministry of Science, Technology and Space; Israel's research universities; research centres of excellence; hospitals and academic medical centres; and corporate R&D laboratories — is required.

- **Gaps in the promotion of women in science and engineering:** In the past 25 years, there was a drop in women's tertiary enrolment in physical sciences, mathematics & computer sciences and biological sciences disciplines (see Figure 36, page 68). Moreover, the shares of women in the academic staff reach only 11% of the whole in physical sciences, 10% in mathematics and computer sciences, 14% in engineering and architecture, 27% in biological sciences, 34% in medical sciences, 36% in social sciences and 39% in humanities (see Figure 37, page 69). The participation of women in scientific research is only 22%, one of the lowest in the world, including their participation in the business enterprise sector (Figure 40, page 83). Only in 5 out of 53 operational policy instruments are there any (few) mechanisms for the promotion of gender equality (see pages 214–215, 223–224 and Box 10, page 80).

- **Lack of reliable statistics on R&D personnel:** Israel R&D statistics have been focused over the years on expenditures and investment. However, Israel does not collect a reliable temporal series of indicators on R&D personnel (i.e. researchers, technicians and administrative staff engaged on R&D activities) organized according to the different classifications proposed at the Frascati Manual (OECD, 2002 and following editions). The information available is scarce and is not disaggregated (see pages 78–83). The gap in this information prevents decision-makers from adequately planning future policy interventions.

Opportunities

- **Diversify innovation beyond ICT:** This is a complex challenge involving not only creating new infrastructure for research, but also adapting/coordinating human skills and bringing together the financial means and incentives to realize commercial potential. The creation of the biotech venture capital fund (see pages 60–61) introduces a new set of policy instruments in that direction. This presents tremendous challenges as well as important opportunity for the Israeli high-tech industry. Delivering innovation and value in the coming years could represent a huge opportunity, because multinational companies continuously seek new ideas and unique products that serve unmet needs. Between 1999 and 2013, 16% of Israel's patent applications were related to medical technologies (see Box 13, page 113 and Figure 60, page 112).

- **Better research infrastructure to meet the challenges of the 21st Century:** Big projects associated with fundamental sciences (i.e. human genome, nuclear physics laboratories, space sciences, etc.) usually require large investments in infrastructure, which allows the emergence of new technologies and unexpected commercial niches. In order to become a global innovation player the higher education system should be prepared to attract global talent and financial resources by fostering strategic alliances in 'big science' projects. Israel's universities are neither equipped nor funded sufficiently to meet the challenges of the 21st Century (see Figure 26, page 56). New SETI policy instruments should be implemented to address these issues.

- **Developing emerging technologies and transdisciplinary scientific fields:** The state-of-the-art technologies and knowledge frontier are in a new set of interdisciplinary and transdisciplinary fields representing emerging research areas, such as sustainability science, bioinformatics, synthetic biology, nanobiology, computational biology, tissue biology, biomaterials, system biology, and neuroscience (see Box 6, page 58). These interdisciplinary and transdisciplinary fields have the potential to bring about new global technological niches that will foster the growth in Israeli high-tech and knowledge industries. In 2014, Israel launched the Grand Challenges Israel programme to encourage innovation to solve global health and security challenges in the developing world (see pages 36–43). Fields like pharmacogenomics is opening new high added value markets by combining genomics with personalised medicine.

- **Mobilizing and strengthening green-tech industries:** Israel is facing challenges from water scarcity and security resource scarcity, climate change threats, the need for energy security and independence, as well as changing demographics. These drivers are becoming more and more important in their influence on everyday life. The Government approved in 2011 the proposal of the Minister of

Environmental Protection and the Minister of Economy to prepare a national green growth strategy for the years 2012–2020. The decision defines green growth as 'socio-economic growth and development that does not harm the environment, makes efficient economic and sustainable use of natural resources, and creates jobs while maximizing opportunities for the use of clean growth engines' (see Box 4, page 49). In 2012, the shares of OCS grants to Cleantech were of only 5% (see Figure 24, page 43). In order to achieve long-term sustainability goals, a plan to expand the public support for developing these green technologies is required.

- **Science for peace:** In recent years, the SESAME project (see Box 9, pages 73–76) showed how an international laboratory on basic sciences in nuclear physics could be a tool for consolidating peace among antagonistic communities. For almost six decades, the Israel Academy of Sciences and Humanities as well as the research universities have been promoting excellence in scholarly research at natural and social sciences, as well as within the humanities. Internationally recognized scholars are working in Israel in all these areas. Peace research is a thematic field, which requires interdisciplinary and transdisciplinary approaches. There is room to create an International Centre of Excellence in Peace Research Studies with the aim of developing new knowledge, better understanding and eventually disembodied technologies for the promotion of peace among the different communities of the Middle East Region and all over the world. At global level there are only few hundred scientists working on peace research issues — a community a thousand times smaller than the number of researchers working on defence R&D. Peace among Israelis, Palestinians and the Arab States could greatly contribute to the achievement of political and economic stability in the region that will benefit all the communities. Science and scientific co-operation are extraordinary tools to achieve those goals; scientists and doctors have made such efforts. This aim will improve the mutual relationship between Israel and its neighbours by opening new development opportunities.

Threats

- **Rising poverty levels:** Israel has a poverty rate of 21%, the highest among OECD countries. The gap between the rich and the poor is one of the highest have been increasing over the past decades (see Tables 6 and 7, page 15). The growing level of poverty in Israel represents a clear danger to the Israeli economy and society. It is necessary to encourage the integration of specific sectors into the workforce, particularly Ultra-orthodox men and Arab women.

- **Low labour productivity:** The gap between Israel and developed countries in labour productivity has widened substantially in the past decades (see Figure 18, page 31). In Israel labour productivity – in GDP per hour worked in 2014 – was US$ 37.5, a small value compared with US$ 85.1 in Norway or US$ 67.2 in the USA. Moreover, in Israel, there is a clear dichotomy between labour productivity in the high technology versus the medium-high technology sectors. Traditional industry suffers from low productivity per employee and from a slow rate of improvement in productivity. Due to its considerable share in the national production and in employment, long-term economic growth cannot be attained without improving the productivity of traditional industry. The key to achieving this objective is to provide incentives to employers to implement innovations, including by assimilating advanced technologies, opening up to organizational and business model changes, and increasing exports as a share in output (see Box 2, page 32).

- **Lagging educational system:** the high investments made in primary, secondary and tertiary education during the first three decades of statehood were not maintained over the past decades. In particular, there is a trend of substantial decreases in higher education investment (see Figures 26 and 47, pages 53 and 91). Data from recent years show that educational achievements in core curriculum subjects (mathematics and science) are low in comparison to OECD countries, e.g. PISA scores (se Figure 25, page 51); they also show that public spending on primary education has fallen below the OECD average level. The worrying state of the Israeli education system also stems from the deteriorating quality of teachers (primary and secondary level) and college teachers, as well as from the lack of stringent demands from the students.

- **Shortage of critical human skills:** The decline in the availability of high calibre human capital will be a major obstacle for the Israeli SETI ecosystem in the coming years. The demand of engineers and technicians is already higher than the supply. The current low rate of secondary level graduates with scientific qualifications suggests that this gap will grow. Over the past twenty years, investment in vocational education has been drastically reduced.

- **Over dependence on ICT:** The explosive growth of ICT companies at global level is over. Israel has been implementing a series of incentives and SETI policy instruments to maintain competitiveness in this sector. However, they have been reaching the saturation stage. New policy instruments are needed to address other technological niches, which will also require the creation of new research infrastructure, human skills and financial mechanisms, so as to introduce Israeli innovations in global markets.

- **Over dependence on private and foreign R&D financing:** In 1991, the major sources of R&D financing were a combination of business enterprise and foreign sectors (50%), and the combination of government and higher education sectors (49%). In 2012, the shares were 84% and 12% respectively, meaning a substantial decrease in the public funding component (see Figure 44, page 86). The foreign financing component alone has also been increasing over time, reaching 49% in 2012. In order to address the various weaknesses of the research and innovation system and to assert leadership in conducting and implementing new SETI policies, the participation of public funding should be increased to around 30%.

- **The rise of global competition:** The second decade of the 21st century is witnessing a further sharp rise in global competition (especially from BRIC countries and the new emerging economies in Asia) that is based on innovative advantages. Israel urgently needs to adjust to this new global challenge and must increase its investments in R&D and education.

- **Loss of intellectual property to multinationals and foreign R&D centres:** The rate of transfer of Israeli IP, know-how and technology to the possession of multinational companies has substantially increased in the past decade. In the period 2001–2011, foreign R&D centres in Israel filed at least 9 800 patent applications around the world. In 2011, the inventive activity of foreign R&D centres in Israel constituted 27% of total number of patent applications (as compared to 10% in 1990) and 61% of total foreign-owned distinct inventions attributed to the business sector (as compared to 24% in 1990). In the period 1990–2010, at least 1 360 distinct inventions were transferred from the ownership of Israeli companies or start-ups to the possession of foreign R&D centres due to acquisitions or mergers. These inventions constituted approximately 13.5% out of the total patent portfolio of the R&D centres (see pages 110–121). Although the Israeli economy benefits from these acquisitions, and from the activity of the multinationals' subsidiaries through job creation and other means, the advantages are relatively small compared to the potential economic gains that might have been achieved if this intellectual property been utilized to support and foster expansion of the 'R&D chain' from start-ups and seed companies to mature Israeli-owned companies of a considerable size.

- **Brain drain:** A large number of Israeli engineers and scientists are employed in foreign companies, especially high technology professionals who are employed by multinational companies and universities abroad. According to a study published by Central Bureau of Statistics, more than one in every seven Israelis with doctorates in science or engineering is living abroad. That is 5% of the total number of Israelis who graduated from university during the period 1985 to 2005, or some 18 025 individuals. There are three main reasons for the migration of many of Israel's leading researchers. These include insufficient positions for young PhD researchers, relatively low salaries in comparison with employment possibilities abroad and inadequate funding of research laboratories (e.g. in comparison to the state-of-the-art labs in Europe and North American universities).

Table 39: SWOT analysis of Israel's research and innovation system

Strengths	Weaknesses
• Positive long-term trends in human development indicators • Excellence in higher education and in academic research • Exceptional labour force and entrepreneurial culture • Solid innovation ecosystem • Government support for R&D • Flourishing venture capital market • Strategic clusters of specialisations • SETI globalization and increasing international co-operation	• Negative values on selected governance indicators • High-tech innovation, but a divided economy • Barriers in the environment for doing business • Zero-growth in the number of tenure track positions in research universities • Declining scientific productivity • Lack of strategic and normative SETI goals • Absence of any governmental co-ordination structure for SETI policies • Gaps in the promotion of women in science and engineering • Lack of reliable statistics on R&D personnel
Opportunities	**Threats**
• Diversify innovation beyond ICT • Better infrastructure to meet the challenges of the 21st Century • Developing emerging technologies and transdisciplinary scientific fields • Mobilizing and strengthening green-tech industries • Science for peace	• Rising poverty levels • Low labour productivity • Lagging educational system • Shortage of critical human skills • Over dependence on ICT • Over dependence on private and foreign R&D financing • The rise of global competition • Loss of intellectual property to multinationals and foreign R&D centres • Brain drain

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Glossary

I. Glossary of main terms used in R&D surveys

Sectors covered by R&D surveys

Business enterprise sector: (a) all firms, organisations and institutions whose primary activity is the market production of goods or services (other than higher education) for sale to the general public at an economically significant price, including both public and private enterprises; (b) the private non-profit institutions mainly serving them.

Government sector: (a) all departments, offices and other bodies which furnish, but normally do not sell to, the community, those common services, other than higher education, which cannot otherwise be conveniently and economically provided, as well as those that administer the state and the community's economic and social policy; (b) public enterprises mainly engaged in market production and the sale of goods and services are included in the business enterprise sector; (c) non-profit institutions controlled and mainly financed by government, not administered by the higher education sector.

Higher education sector: (a) all universities, colleges of technology and other institutions providing tertiary education (see below for details), whatever their source of finance or legal status; (b) all research institutes, experimental stations and clinics operating under the direct control of, or administered by, or associated with, higher education institutions.

Private non-profit sector: (a) Non-market, private non-profit institutions serving households (i.e. the general public) and (b) private individuals or households.

Definition of research and experimental development

Research and experimental development (R&D): comprises creative work undertaken on a systematic basis, in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications. The term R&D covers three activities: basic research, applied research and experimental development.

Basic (or fundamental) research: is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.

Applied research: is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

Experimental development: is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed towards producing new materials, products or devices, towards installing new processes, systems and services, or towards improving substantially those already produced or installed. R&D covers both formal R&D in R&D units and informal or occasional R&D in other units.

Definition of personnel

R&D personnel: all persons employed directly in R&D, as well as those providing direct services such as R&D managers, administrators and clerical staff. Persons providing an indirect service, such as canteen and security staff, should be excluded.

Head count: data reflect the total number of persons employed in R&D, independently of the focus of their work. These data allow links to be made with other data series, such as education and employment data, or the results of population censuses. They also serve as the foundation for calculating indicators which analyse the characteristics of the R&D labour force, with respect to age, gender or national origin.

Full-time equivalent (FTE): may be thought of as one person-year. Thus, a person who normally spends 30% of his/her time on R&D and the rest on other activities (such as teaching, university administration and student counselling) should be considered as 0.3 FTE. Similarly, if a full-time R&D worker is employed at an R&D unit for only six months, this results in an FTE of 0.5. However, for reporting purposes, the total sum of FTEs should be rounded to the next integer to avoid the reporting of decimals.

Researchers: are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in managing the projects concerned. Postgraduate students at the PhD level engaged in R&D should be considered as researchers.

Technicians: and equivalent staff are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, physical and life sciences (technicians) or social sciences and humanities (equivalent staff). They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers.

Support staff: includes skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with such projects (or providing services to researchers involved therein).

International Standard Classification of Education (ISCED) levels

UNESCO developed the International Standard Classification of Education (ISCED) to facilitate comparisons of education statistics and indicators across countries on the basis of uniform and internationally agreed definitions.

The ISCED levels that were in use at the time of the Government of Malawi's 2013 *National Survey of Research and Innovation* were those from the 1997 revision of ISCED levels, namely:

ISCED 6 programmes: tertiary programmes leading to the award of an advanced research qualification. The programmes are therefore devoted to advanced study and original research and are not based on coursework only. They typically require the submission of a thesis or dissertation of publishable quality which is the product of original research and represents a significant contribution to knowledge. They usually prepare graduates for faculty posts in institutions offering ISCED 5A programmes, as well as research posts in government, industry, etc.

ISCED 5A programmes: tertiary programmes that are largely theoretically based and are intended to provide sufficient qualifications for gaining entry into advanced research programmes and professions with high skills requirements. They must satisfy a sufficient number of the following criteria: (a) a minimum cumulative theoretical duration (at tertiary) of three years' full-time equivalent, although typically they are of four or more years; (b) faculty with advanced research credentials; (c) may involve completion of a research project or thesis; (d) provide the level of education required for entry into a highly skilled profession (theoretically based/research preparatory, such as history, philosophy, mathematics, etc., or giving access to highly skilled professions, e.g. medicine, dentistry, architecture, etc.) or an advanced research programme. This level includes all the research programmes which are not part of a doctorate, such as any type of master's degree.

ISCED 5B programmes: are tertiary programmes which are typically shorter than those in 5A and focus on giving participants occupational skills and a relevant qualification for the labour market, although some theoretical foundations may be covered. The content of ISCED level 5B programmes is mainly designed to give participants the practical skills and know-how needed for employment in a particular occupation or trade, or class of occupations or trades.

ISCED 4 programmes: are post-secondary, non-tertiary education programmes that straddle the boundary between upper-secondary and post-secondary education from an international point of view, even though they might clearly be considered as upper-secondary or post-secondary programmes in a national context. ISCED 4 programmes cannot, considering their content, be regarded as tertiary programmes. They are often not significantly more advanced than programmes at ISCED 3 level but they serve to broaden the knowledge of participants who have already completed a programme at level 3. Typical examples are programmes designed to prepare students for studies at level 5 who have completed ISCED 3 but did not follow a curriculum which would allow entry to level 5, i.e. pre-degree foundation courses or short vocational programmes. Second-cycle programmes can be included as well.

ISCED 3 programmes: are (upper) secondary education programmes typically beginning at the end of full-time compulsory education for those countries that have a system of compulsory education. The entrance age to this level is typically 15 or 16 years. The educational programmes included at this level typically require the completion of some nine years of full-time education (since the beginning of level 1) for admission, or a combination of education and vocational or technical experience, with, as minimum entrance requirements, the completion of level 2 or a demonstrable ability to handle programmes at this level.

The new International Standard Classification of Education

In 2011, UNESCO member states formally adopted a revision of ISCED. The product of extensive international and regional consultations among education and statistical experts, ISCED 2011 takes into account significant changes in education systems worldwide since the last ISCED revision of 1997.

ISCED 2011 counts four levels of tertiary education, as compared to two in the current version. The aim of the revision is to reflect the tertiary education structure found around the world better (bachelor's, master's and doctorate). This structure has been generalised across Europe since the Bologna Process got under way in 1999.

The first data collection based on the new classification began in 2014. The UNESCO Institute for Statistics is working closely with Member States and partner organisations (such as OECD and Eurostat) to map education systems using the new classification and revise statistic-gathering instruments.

The four new levels of tertiary education (effective as of 2014) are:

ISCED level 5 – Short-cycle tertiary education;

ISCED level 6 – Bachelor's degree or equivalent level;

ISCED level 7 – Master's degree or equivalent level;

ISCED level 8 – Doctoral or equivalent level.

Source: UNESCO Institute for Statistics (UIS) – UIS/RD/2012M
For details of ISCED 2011, see: www.uis.unesco.org/Education/Documents/isced-2011-en.pdf

II. Glossary on intellectual property rights

Applicant: An individual or other legal entity that files an application for a patent, utility model, trademark or industrial design. There may be more than one applicant in an application. For the statistics presented in the present publication, the name of the first-named applicant is used to determine the owner of the application.

Application abroad: For statistical purposes, an application filed by a resident of a given state/ jurisdiction with an IP office of another state/jurisdiction. For example, an application filed by an applicant domiciled in France with the Japan Patent Office (JPO) is considered an 'application abroad' from France's perspective. This differs from a 'non-resident application', which describes an application filed by a resident of a foreign state/jurisdiction from the perspective of the office receiving the application.

Industrial design: applies to a wide variety of industrial products and handicrafts. It refers to the ornamental or aesthetic aspects of a useful article, including compositions of lines or colours or any three-dimensional form that gives a special appearance to a product or handicraft. The holder of a registered industrial design has exclusive rights concerning unauthorised copying or imitation of the design by third parties. Industrial design registrations are valid for a limited period. The term of protection is usually 15 years for most jurisdictions. However, differences in legislation do exist, notably in China (which provides for a 10-year term from the application date) and the USA (which provides for a 14-year term from the date of registration).

Intellectual property (IP): refers to creations of the mind: inventions, literary and artistic works, symbols, names, images and designs used in commerce. IP is divided into two categories: industrial property, which includes patents, utility models, trademarks, industrial designs and geographical indications of source; and copyright, which includes literary and artistic works such as novels, poems and plays, films, musical works, artistic works such as drawings, paintings, photographs, sculptures and architectural designs. Rights related to copyright include those of performing artists in their performances, producers of phonograms in their recordings and those of broadcasters in their radio and television programmes.

Invention: a new solution to a technical problem. To obtain patent rights, the invention must be novel, involve an inventive step and be industrially applicable, as judged by a person skilled in the art.

Non-resident: for statistical purposes, a 'non-resident' application refers to an application filed with the IP office of, or acting for, a state/jurisdiction in which the first-named applicant in the application is not domiciled. For example, an application filed with the JPO by an applicant residing in France is considered a non-resident application from the perspective of this office. Non-resident applications are sometimes referred to as foreign applications. A non-resident grant or registration is an IP right issued on the basis of a non-resident application.

Patent: a set of exclusive rights granted by law to applicants for inventions that are new, non-obvious and commercially applicable. It is valid for a limited period of time (generally 20 years), during which patent holders can commercially exploit their inventions on an exclusive basis. In return, applicants are obliged to disclose their inventions to the public in a manner that enables others, skilled in the art, to replicate the invention. The patent system is designed to encourage innovation by providing innovators with time-limited exclusive legal rights, thus enabling innovators to appropriate a return on their innovative activity.

Patent Co-operation Treaty (PCT): an international treaty administered by WIPO. The PCT system facilitates the filing of patent applications worldwide and makes it possible to seek patent protection for an invention simultaneously in each of a large number of countries by first filing a single 'international' patent application. The granting of patents, which remains under the control of the national or regional patent offices, is carried out in what is called the 'national phase' or 'regional phase'.

Registration: a set of exclusive rights legally accorded to the applicant when an industrial design or trademark is 'registered' or 'issued'. (See also Industrial design or Trademark.) Registrations are issued to applicants so that they can make use of, and exploit, their industrial design or trademark for a limited period of time; in some cases, registration can be renewed indefinitely, particularly in the case of trademarks.

Resident: for statistical purposes, a 'resident' application refers to an application filed with the IP office of, or acting for, the state/jurisdiction in which the first-named applicant in the application has residence. For example, an application filed with the JPO by a resident of Japan is considered a resident application from the perspective of the JPO. Resident applications are sometimes referred to as domestic applications. A resident grant/registration is an IP right issued on the basis of a resident application.

Trademark: a distinctive sign that identifies certain goods or services as those produced or provided by a specific person or enterprise. The holder of a registered trademark has the legal right to exclusive use of the mark in relation to the products or services for which it is registered. The owner can prevent unauthorised use of the trademark, or a confusingly similar mark, so as to prevent consumers in particular and the public in general from being misled. Unlike patents, trademarks can be maintained indefinitely by paying renewal fees. The procedures for registering trademarks are governed by the rules and regulations of national and regional IP offices. Trademark rights are limited to the jurisdiction of the authority that registers the trademark. Trademarks can be registered by filing an application at the relevant national or regional office(s), or by filing an international application through the Madrid system.

Utility model: a special form of patent right granted by a state/jurisdiction to an inventor or the inventor's assignee for a fixed period of time. The terms and conditions for granting a utility model differ slightly from those for normal patents (including a shorter term of protection and less stringent patentability requirements). The term 'utility model' can also describe what are known in some countries as 'petty patents', 'short-term patents' or 'innovation patents'.

Source: WIPO (2013)

Annex 1: Higher Education Careers

RESEARCH UNIVERSITIES

BAR-ILAN UNIVERSITY

Date of recognition: 1955

Type of funding: Public

Address: 1 Campus on Ramat Gan 1 Campus in Safed

URL: http://www.biu.ac.il/

Faculty	Bachelor level degrees	Postgraduate degrees
Medicine		• Master Research in Medicine • Medicine
Jewish Studies	• Bible Studies • Jewish History • Literature of the Jewish People • Middle Eastern Studies • Hebrew and Semitic Languages • Jewish Art • Jewish Thought • Land of Israel Studies and Archaeology • Talmud	• Bible Studies • Jewish History • Literature of the Jewish People • Middle Eastern Studies • Hebrew and Semitic Languages • Jewish Art • Jewish Thought • Land of Israel Studies and Archaeology • Talmud
Life Sciences	• Biophysics • Biotechnology • Computational Biology – Bioinformatics • Multidisciplinary Brain Research	• Biochemistry • Biophysics • Biotechnology • Botany • Computational Biology • Ecology • Human Biology • Microbiology • Zoology

Engineering	• Computer Engineering • Electrical Engineering • Electrical Engineering and Physics	• Electrical Engineering
Exact Sciences	• Chemistry • Computer Science • Mathematics • Physics	• Chemistry • Computer Science • Mathematics • Physics
Social Sciences	• Communication • Criminology • Economics • Education • Geography and Environment • Logistics Management • Management • Political Studies • Psychology • Social Work • Sociology and Anthropology	• Accounting • Business Administration • Criminology • Economics • Education • Geography and Environment • Health Administration • International MBA • Logistics Management • Management • Political Studies • Psychology • Social Work • Sociology and Anthropology
Humanities	• Arabic • Asian Studies Programme • Classical Studies • Comparative Literature • Creative Writing • English Literature and Linguistics • French Studies • General History • General Philosophy • Information Science • Linguistics in Clinical Research Programme • Multidisciplinary B.A. in the Humanities	• Arabic • Classical Studies • Comparative Literature • Creative Writing (MA only) • English Literature and Linguistics • French Studies • General History • General Philosophy • Information Science • Linguistics in Clinical Research Programme • Translation and Interpreting Studies
Law	• Law	• Law
Interdisciplinary Studies	• Brain Sciences • Conflict Management and Negotiation • Hermeneutics and Cultural Studies Programme • Nanotechnology	• Brain Sciences • Conflict Management and Negotiation • Gender Studies • Hermeneutics and Cultural Studies Programme • Nanotechnology • Science, Technology and Society
Advanced Torah Studies		• Advanced Torah Studies

BEN-GURION UNIVERSITY OF THE NEGEV

Date of recognition: 1969

Type of funding: Public

Address: Beer-Sheva

URL: http://in.bgu.ac.il/en/Pages/default.aspx

Faculty	Bachelor level degrees	Postgraduate degrees
Faculty of Engineering Sciences	• Computer Engineering • Biomedical Engineering • Biotechnology Engineering • Chemical Engineering • Communication Systems • Dual BSc in Geology and Structural Engineering • Electrical and Computer Engineering • Engineering and Life Sciences • Industrial Engineering and Management • Information Systems • Materials Engineering • Mechanical Engineering • Structural Engineering	• Biomedical Engineering • Biotechnology Engineering • Chemical Engineering • Communication Systems • Cyber Space Security • Electrical and Computer Engineering • Electro-Optical Engineering • Environmental Engineering • Industrial Engineering and Management – Data Sciences and Business Analytics • Information Systems • Management and Safety Engineering • Materials Engineering • Mechanical Engineering
Faculty of Natural Sciences	• Biology and Psychology • Brain Sciences • Chemistry • Computer Sciences & Bioinformatics • Geological and Environmental Sciences • Life Sciences • Mathematics • Nanotechnology • Physics	• Chemistry • Computer Sciences and Bioinformatics • Geological and Environmental Sciences • Life Sciences • Mathematics • Physics
Faculty of Health Science	• Emergency Medical Services • Health Systems Management • Medical Laboratory • Medical Sciences • Nursing • Pharmacy • Physiotherapy	• Emergency Medical Services • Gerontology • Medical Doctor • Medical Sciences • Nursing • Physiotherapy • Public Health
Faculty of Business and Management	• Hotel and Tourism Management • Management	• Business Administration • Health Systems Management • Hotel and Tourism Management • Public Policy and Administration • Social Leadership
Faculty of Humanities and Social Sciences	• Arts , Fine Arts, Theory and History of Music • Brain and Cognitive Sciences • Communication Studies • Economics • Education • Foreign Literatures and Linguistics • Geography and Environmental Development • Hebrew Language • History • Jewish History • Jewish Thought • Middle East Studies • Philosophy • Politics and Government • Psychology • Social Work • Sociology and Anthropology	• Art History • Brain and Cognitive Sciences • Communication Studies • Economics • Education • Foreign Literatures and Linguistics • Geography and Environmental Development • Hebrew Language • History • Jewish History • Jewish Thought • Middle East Studies • Philosophy • Politics and Government • Psychology • Social Work • Sociology and Anthropology

THE HEBREW UNIVERSITY OF JERUSALEM

Date of recognition: 1925

Type of funding: Public

Address: 3 Campuses in Jerusalem; 1 Campus – Rehovot

URL: http://new.huji.ac.il/en

Faculty	Bachelor level degrees	Postgraduate degrees
Faculty of Humanities	• Arabic Language and Literature • Archaeology and the Ancient Near East • Asian Studies • Bible • Classical Studies • Cognitive Science • Comparative Religion • Education • English • General and Comparative Literature • German, Russian and East European Studies • Hebrew Language and Jewish Languages • Hebrew Literature • History • History of Art • History, Philosophy and Sociology of Science • Interdisciplinary Studies – General studies • Islamic and Middle Eastern Studies • Jewish Studies Programme • Linguistics • Musicology • Philosophy • Roman and Latin American Studies • The School of Education • Theatre Studies	• Arabic Language and Literature • Archaeology and the Ancient Near East • Asian Studies • Bible • Classical Studies • Cognitive Science • Comparative Religion • Education • English • General and Comparative Literature • Hebrew Language and Jewish Languages • Hebrew Literature • History • History of Art • History, Philosophy and Sociology of Science • Islamic and Middle Eastern Studies • Jewish Studies Programme • Linguistics • Musicology • Outstanding Doctoral Students Programme • Philosophy • Roman and Latin American Studies • Special Education • The School of Education • Theatre Studies
Natural Sciences	• Chemistry • Computer Sciences • Earth Sciences • Engineering and Computer Science • Environmental Sciences • Life Sciences • Mathematics • Physics	• Atmospheric Sciences • Biochemistry • Biotechnology • Botany • Brain and Behavioural Sciences • Cell Biology • Chemistry • Computer Sciences • Earth Sciences • Ecology, Evolution • Engineering and Computer Science • Environmental Sciences • Genetics • Geology • Hydrology • Life Sciences • Nanoscience and Nanotechnology • Oceanography • Physics

Agriculture, Food and Environment	• Agricultural Economics and Management • Agroecology and Plant Health • Animal Sciences • Biochemistry and Food Sciences • Biotechnology • Hotel Food and Tourism Management • Nature Conservation and Landscape • Nutrition Sciences • Plant Science In Agriculture • Soil And Water Sciences	• Agricultural Economics and Management • Agroecology and Plant Health • Animal Sciences • Biochemistry and Food Sciences • Biotechnology • Field And Vegetable Crops • Graduate Programme of Animal Sciences and Veterinary Sciences • Horticulture • Hotel Food and Tourism Management • Hydrology and Water Resources • Nature Conservation and Landscape • Nutrition Sciences • Plant Science In Agriculture • Soil And Water Sciences • Veterinary Medicine • Veterinary Public Health
Medicine	• Biomedical Research • Biomedical Sciences • Nursing • Occupational Therapy • Pharmacy	• Biomedical Research • Biomedical Sciences • Clinical Epidemiology • Dental Medicine • Health Systems Management • Medicine • Nursing • Occupational Therapy • Pharmacy
Social Sciences	• Communication and Journalism • Economics • Geography • International Relations • Labour Studies • Philosophy, Sciences and Economics • Political Science • Psychology • Public Policy • Sociology and Anthropology • Statistics	• Applied Neuropsychology • Cognitive Science • Communication and Journalism • Conflict Management and Resolution • Culture Studies • Economics • European Studies • Gender Studies • Geography and Environmental Planning • German Studies • Local Community Development • Political Science • Psychology • Public Policy • Sociology and Anthropology • Statistics • Urban Studies
Social Work	• Social Work	• Social Work • Early childhood • NGO`s Management
Faculty of Business Administration	• Business Administration	• Business Administration
Law	• Law	• Criminology • Law

THE OPEN UNIVERSITY OF ISRAEL

Date of recognition: 1973

Type of funding: Public

Address: Raanana (main campus)

URL: http://www-e.openu.ac.il/

Department	Bachelor level degrees	Postgraduate degrees
• Department of History, Philosophy and Judaic Studies • Department of Literature, Language and the Arts • Department of Education and Psychology • Department of Management and Economics • Department of Sociology, Political Science and Communication • Department of Mathematics and Computer Science (including studies in Engineering) • Department of Natural Sciences • The English Unit	**Humanities** • African Studies • Arts • Cognitive Science • Film Studies • History • History of the Middle East and its Cultures • Judaic Studies • Literature • Philosophy **Social Sciences** • Cognitive Science • Communication • Economics • Education (Curriculum and Instruction Studies) • Education (Learning Disabilities) • Management • Political Science and International Relations • Psychology • Sociology **Sciences** • Chemistry • Cognitive Science • Computer Science • Computer Science – Systems and Applications • Life Sciences • Mathematics • Physics	• Biological Thought • Business Administration • Computer Science • Cultural Studies • Democracy Studies • Education: Technologies and Learning Systems • Educational Administration, Policy and Leadership • Social Psychology

TECHNION – ISRAEL INSTITUTE OF TECHNOLOGY

Date of recognition: 1912

Type of funding: Public

Address: Technion City, Haifa 3200003

URL: http://www.technion.ac.il/en/

Faculty	Bachelor level degrees	Postgraduate degrees
Aerospace Engineering	• Aerospace Engineering	• Aerospace Engineering
Biology	• Biology	• Biology
Biomedical Engineering	• Biomedical Engineering • Biomedical Engineering and Physics	• Biomedical Engineering • Biomedical Engineering and Physics
Biotechnology and Food Engineering	• Biotechnology and Food Engineering	• Biotechnology and Food Engineering • Biotechnology
Chemistry	• Chemistry	• Chemistry
Chemical Engineering	• Chemical Engineering	• Chemical Engineering
Civil and Environmental Engineering	• Civil and Environmental Engineering • Environmental Engineering • Mapping and Geo-Information Engineering	• Civil and Environmental Engineering • Energy • The Interdisciplinary Energy Graduate Programme
Computer Science	• Computer Science • Computer Science and Mathematics • Computer Science and Physics • Education in Technology and Science	• Computer Science
Electrical engineering	• Electrical engineering	• Electrical engineering • Polymer Engineering
Industrial Engineering and Management	• Industrial Engineering and Management • Information Systems Engineering	• Business Administration • Industrial Engineering and Management
Mathematics	• Mathematics • Mathematics with Computer Science • Mathematics with Statistics and Operations Research • Mathematics – Physics	• Mathematics
Materials Engineering	• Materials Engineering and Biology • Materials Engineering – Chemistry • Materials Engineering – Physics	• Materials Engineering and Biology
Mechanical Engineering	• Mechanical Engineering	• Mechanical Engineering
Physics	• Physics	• Physics
Education in Technology and Science	• Education in Technology and Science	• Education in Technology and Science
Architecture	• Landscape Architecture	• Architecture • Design and Manufacturing Management • Landscape Architecture • Urban and Regional Planning
Nanotechnology		• Nanoscience and Nanotechnology
Medicine	• Medical Laboratory Sciences • Medical Sciences • Molecular Biochemistry	• Medical sciences • Medicine

TEL AVIV UNIVERSITY

Date of recognition: 1956

Type of funding: Public

Address: 1 Campus in Tel Aviv

URL: https://www.tau.ac.il/

Faculty	Bachelor level degrees	Postgraduate degrees
Engineering	• Biomedical Engineering • Electrical and Electronics Engineering • Electrical and Electronics Engineering and Computer Science • Electrical and Electronics Engineering and Physics (Dual degree) • Industrial Engineering • Materials Science and Engineering • Mechanical Engineering	• Biomedical Engineering • Electrical Engineering Systems • Environmental Engineering • Industrial Engineering • Materials Science and Engineering • Mechanical Engineering
Exact Sciences	• Chemistry • Computer Science • Geosciences • Mathematics • Physics	• Astrophysics • Chemistry • Computer Science • Geosciences • Mathematics • Physics
Faculty of Life Sciences	• Bioinformatics • Biology • Life Sciences and Medicine	• Biochemistry and Molecular Biology • Cell Research and Immunology • Genetics • Microbiology • Molecular Biology and Ecology of Plants • Molecular Microbiology and Biotechnology • Neurobiology • Zoology
School of Neuroscience	• Brain Sciences • Neuroscience	• Neuroscience
Medicine	• Medical Sciences	• Dental Medicine • Medical Sciences • Medicine
School of Health Professions	• Communication Disorders • Nursing • Occupational Therapy • Physical Therapy	• Biostatistics • Disaster Medicine • Environmental and Occupational Health • Epidemiology and Preventive Medicine • Health Promotion • Nursing • Nursing Education • Occupational Health • Occupational Therapy • Physical Therapy • Public Health
Humanities	• African Studies • Arabic and Islamic Studies • Archaeology and Ancient Near Eastern Cultures • Classics—Greece and Rome • East Asia Studies • English and American Studies • Geography and Human Environment • Hebrew Culture Studies • Jewish History • Linguistics • Middle Eastern and African History • Philosophy • Women and Gender Studies Programme	• African Studies • Arabic and Islamic Studies • Archaeology and Ancient Near Eastern Cultures • Child and Youth Culture • Classics—Greece and Rome • East Asia Studies • English and American Studies • French culture • Geography and Human Environment • Hebrew Culture Studies • History and philosophy of Sciences • Jewish History • Linguistics • Middle Eastern and African History • Philosophy • Women and Gender Studies Programme

Arts	• Architecture • Art History • Film and Television: Production, Theory, History, Criticism, Scriptwriting • Multidisciplinary Programme in the Arts • Music: Performance, Composition, Orchestral or Choral Conducting, Musicology • Theatre Arts	• Architecture • Film and Television : Production, Theory, History, Criticism, Scriptwriting • Music: Performance, Composition, Orchestral or Choral Conducting, Musicology • Theatre Arts
Social Sciences	• Communication • Economics • Labour Studies • Political Science • Psychology • Public Policy • Social Work • Sociology and Anthropology	• Communication • Economics • Labour Studies • Political Science • Psychology • Public Policy • Sociology and Anthropology
Management	• Accounting • Management	• Management
Law	• Law	• Law

UNIVERSITY OF HAIFA

Date of recognition: 1972

Type of funding: Public

Address: Haifa

URL: http://www.haifa.ac.il/index.php/en/home-eng

Faculty	Bachelor level degrees	Postgraduate degrees
Faculty of Humanities	• Arabic Language and Literature • Archaeology • Art History • Asian Studies • Biblical Studies • Byzantine and Modern Hellenic Studies • English Language and Literature • Fine Arts • Hebrew and Comparative Literature • Hebrew Language • History • Philosophy	• Arabic Language and Literature • Archaeology • Art History • Biblical Studies • Byzantine and Modern Hellenic Studies • Culture and Film Studies • English Language and Literature • Fine Arts • French Language and Literature • Gender Studies • General (Western) History • Hebrew and Comparative Literature • Hebrew Language • Jewish History • Jewish Philosophy • Land of Israel Studies • Maritime Civilizations • Middle East History • Philosophy
Faculty of Social Sciences	• Communication • Computer Sciences • Criminology • Economics • Geography and Environmental Studies • Information systems • Political Sciences • Psychology • Sociology and Anthropology • Statistics	• Anthropology • Child Development • Communication • Computer Sciences • Economics • Geography and Environmental Studies • Management • Peace and Conflict Management • Political Sciences • Psychology • Sociology • Statistics

The Faculty of Natural Sciences	• Biology • Evolutionary and Environmental Biology • Human Biology • Marine Biology • Marine Geosciences • Marine Technologies • Mathematics • Medical Sciences • Neurobiology • Science Education – Exact Science	• Bioinformatics • Evolutionary and Environmental Biology • Human Biology • Marine Biology • Marine Geosciences • Marine Technologies • Mathematics • Neurobiology
Faculty of Social Welfare and Health Sciences	• Communication Sciences and Disorders • Human Services • Nursing • Occupational Therapy • Physiotherapy • Social Work	• Communication Sciences and Disorders • Community Mental Health • Creative art therapy • Gerontology • Human Services • Nursing • Occupational Therapy • Public Health • Social Work
Faculty of Education	• Counselling and Human Development • Leadership and Policy in Education • Learning, Teaching and Supervision • Special Education	• Counselling and Human Development • Leadership and Policy in Education • Learning, Teaching and Supervision • Special Education
Faculty of Law	• Law	• Law
Faculty of Management		• Business Administration • Information and Knowledge Management

WEIZMANN INSTITUTE OF SCIENCE

Date of recognition: 1934

Type of funding: Public

Address: Herzl St 234, Rehovot, 7610001

URL: http:// www.weizmann.ac.il/

Faculty	Postgraduate degrees
Biochemistry	Biological Chemistry Biological Services Molecular Genetics Plant and Environmental Sciences
Biology	Biological Regulation Immunology Molecular Cell Biology Neurobiology
Chemistry	Chemical Physics Earth and Planetary Sciences Materials and Interfaces Organic Chemistry Structural Biology
Department of Science Teaching Mathematics and Computer Science	Science and Mathematics Teaching Computer Science and Applied Mathematics Mathematics
Physics	Complex Systems Condensed Matter Physics Particle Physics and Astrophysics

* Weizmann Institute of Science has only post-graduate degree programmes

ACADEMIC COLLEGES

ACADEMIC CENTRE OF LAW AND BUSINESS

Date of recognition: February 18, 2007

Type of funding: Private

Address: P.O. Box 852, Vita Towers, Bene-Brak 51108

URL: http://www.clb.ac.il/english/index.html

Bachelor level degrees	Master level degrees
Accounting	
Business Administration	
Law	
Integrated Bachelor's Degree in Law (LL.B.) and Business Administration (B.A.)	

ACADEMIC COLLEGE OF ISRAEL IN RAMAT-GAN

Date of recognition: June 17, 2010

Type of funding: Private

Address: 87 Pinhas Rotenberg St., Ramat-Gan 52275

URL: http://www.iac.ac.il/

Bachelor level degrees	Master level degrees
Nursing	Educational Counselling
Management of Information Technology	Health Management
Management in Health Systems	

ACADEMIC COLLEGE OF SOCIAL SCIENCES AND ART

Date of recognition: May 10, 2012

Type of funding: Private

Address: 10 Ha-Orzim Street, Netanya

URL: http://www.asa.ac.il/english/

Bachelor level degrees	Master level degrees
Behavioural Sciences	Society and the Arts
	Art Therapy
	Drama Therapy
	Psychodrama
	Dance and Movement Therapy

ACADEMIC COLLEGE OF TEL-AVIV – YAFFO

Date of recognition: December 19, 1996

Type of funding: Public

Address: Rabenu Yeruham St., Yaffo 86162

URL: https://www.mta.ac.il/en-us

Bachelor level degrees	Master level degrees
Computer Science	Computer Science
Society – Politics	Rehabilitative Neuropsychology
Economics and Management	Clinical Psychology
Behavioural Sciences	Medical Psychology
Computer Sciences	Vocational Psychology
Management of Information Systems	

ACHVA ACADEMIC COLLEGE

Date of recognition: n/a

Type of funding: Public

Address: Shikmim Mobile Post 79800

URL: http://english.achva.ac.il/

Bachelor level degrees	Master level degrees
Life Sciences	Educational Organization Administration
Special Education	Israeli Culture and its Instruction
Mathematics	Special Education
English	Mathematical Education for Primary Schools
Primary Education	
History	
Literature	
Psychology	

AFEKA TEL AVIV ACADEMIC COLLEGE OF ENGINEERING

Date of recognition: May 25, 1999

Type of funding: Public

Address: 218 Benei Ephraim St., Tel-Aviv 69107

URL: http://english.afeka.ac.il/

Bachelor level degrees	Master level degrees
Mechanical Engineering	Systems Engineering
Medical Engineering	Energy Engineering
Electrical Engineering	Engineering and Management of Service Systems
Software Engineering	
Industrial Engineering and Management	

ASHKELON ACADEMIC COLLEGE

Date of recognition: February 22, 2007

Type of funding: Public

Address: 12 Yitzhak Ben-Zvi St., Ashkelon 78211

URL: http://www.ash-college.ac.il/index.php?cmd=about_us.262

Bachelor level degrees	Master level degrees
Computer Sciences	
Economics and Banking	
Sociology and Anthropology	
Psychology	
Politics and Government	
Economics and Logistics	
Economics and Management	
Criminology	
Social Work	

AZRIELI – COLLEGE OF ENGINEERING JERUSALEM

Date of recognition: February 18, 2003

Type of funding: Public

Address: Ramat Beit Hakerem, P.O. Box 3566, Jerusalem 91035

URL: http://english.jce.ac.il/

Bachelor level degrees	Master level degrees
Pharmaceutical Engineering	Engineering of Telecommunications Systems
Electronics Engineering	Master of Business Administration (MBA)
Engineering of Communication Systems	
Software Engineering	
Industrial Engineering and Management	
Computer Sciences	
Applied Physics / Medical Engineering	
Physics / Electro – Optic Engineering	
Electrical and Electronics Engineering	
Advanced Materials Engineering	
Software Engineering	
Industrial and Management Engineering	
Mechanical Engineering	
Nursing	
Accounting and Information Systems	
Management and Technological Marketing	
Accounting and Information Systems	

BEZALEL – ACADEMY OF ARTS AND DESIGN

Date of recognition: March 25, 1980

Type of funding: Public

Address: P.O. Box 24046, Mt. Scopus, Jerusalem 91240

URL: http://english.jce.ac.il/

Bachelor level degrees	Master level degrees
Architecture	Urban Design
Industrial Design	Industrial Design
Visual Communication	Fine Arts
Art	
Screen Arts	
Ceramic Design	
Gold – and Silver smoothing	
Photography	

CARMEL ACADEMIC CENTRE

Date of recognition: April 12, 2011

Type of funding: Private

Address: 43 Derech Haatzmaut, Haifa

URL: http://my.carmel.ac.il/?CategoryID=884

Bachelor level degrees	Master level degrees
Law	
Business Administration	
Public Administration	
Economics	
Logistics	
Multidisciplinary	

COLLEGE FOR ACADEMIC STUDIES IN OR YEHUDA

Date of recognition: March 4, 2010

Type of funding: Private

Address: 2 HaYotzrim St., Or Yehuda

URL: http://www.mla.ac.il/

Bachelor level degrees	Master level degrees
Education	Business Administration (MBA)
Business Administration	Education
Health Systems Administration	Education, Specialization in Management and Organization of Educational Systems
Psychology	Educational Counselling

COLLEGE OF MANAGEMENT – ACADEMIC STUDIES

Date of recognition: May 121, 1986

Type of funding: Private

Address: Yitzhak Rabin Blvd., P.O. Box 25074, Rishon Letzion 75190

URL: http://www.colman.ac.il/english/Pages/default.aspx

Bachelor level degrees	Master level degrees
Computer Science	Law
Bachelor of Law (LL.B)	Business Administration (MBA)
Interior Design	Communication
Economics and Management	Applied Economics
Behavioural Sciences	Organizational Counselling and Development
Business Administration	Family Studies
Criminology and Law Enforcement	
Communication	
Theatre and Performance	
Psychology	
Business Administration and Economics	

HADASSAH ACADEMIC COLLEGE

Date of recognition: July 7, 1998

Type of funding: Public

Address: P.O. Box 1114, Jerusalem 91010

URL: http://www.hadassah.ac.il/

Bachelor level degrees	Master level degrees
Optometry	Computer Science
Medical Laboratories Science	Optometry
Inclusive Industrial Design	Communications Disorders
Biotechnology	
Environmental Health Sciences	
Computer Sciences	
Communications Disorders	
Politics and Communication	
Management of Service Organizations	
Photographic Communication	

HOLON ACADEMIC INSTITUTE OF TECHNOLOGY

Date of recognition: April 11, 2002

Type of funding: Public

Address: P.O. Box 305, Holon 58102

URL: http://www.hit.ac.il/en

Bachelor level degrees	Master level degrees
Technologies for Learning Systems	Electrical and Electronics Engineering
Instructional Technologies	Management of Technology
Electrical Engineering and Electronics	Electrical and Electronics Engineering
Applied Mathematics	Management of Technology
Management of Technology	Integrated Design
Electrical and Electronics Engineering	
Computer Science	
Applied Mathematics	
Visual Communication	
Industrial Design	
Interior Design	
Visual Communications	

INTERDISCIPLINARY CENTRE HERZLIYA

Date of recognition: April 26, 1998

Type of funding: Private

Address: P.O. Box 167, Herzliya 46150

URL: http://portal.idc.ac.il/en/main/homepage/pages/homepage.aspx

Bachelor level degrees	Master level degrees
Computer Science	Law
Combined Bachelor's Degree in Law (LL.B.) and Psychology (B.A.)	Business Administration (MBA)
Government	Organizational Behaviour and Development
Business Administration	Government
Psychology	
Economics	
Communications	

JERUSALEM ACADEMY OF MUSIC AND DANCE

Date of recognition: June 10, 1974

Type of funding: Public

Address: Givat Ram, Jerusalem 91904

URL: http://www.jamd.ac.il/en

Bachelor level degrees	Master level degrees
Bachelor of Arts in Dance	Master of Music
Bachelor of Music Education	
Bachelor of Music	
Bachelor of Dance	

JERUSALEM COLLEGE OF TECHNOLOGY – LEV ACADEMIC CENTRE

Date of recognition: December 24, 1980

Type of funding: Public

Address: 21 HaVa'ad HaLeumi St., P.O. Box 16031, Jerusalem 91160

URL: http://www.jct.ac.il/en

Bachelor level degrees	Master level degrees
Electro-Optics Engineering	Telecommunication Systems Engineering
Electronic Engineering	Business Administration (MBA)
Industrial Engineering and Management	
Software Engineering	
Computer Science	
Communication Systems Engineering	
Accounting and Information Systems	
Business Administration	
Nursing	
Bio – Informatics	

KINNERET ACADEMIC COLLEGE IN THE JORDAN VALLEY

Date of recognition: April 24, 2008

Type of funding: Public

Address: Zemach, Emek HaYarden Mobile Post 15132

URL: http://www.kinneret.ac.il/Web/En/Default.aspx

Bachelor level degrees	Master level degrees
Software Engineering	
Engineering of Information Systems	
Quality and Reliability Control Engineering	
Engineering of Water Industries	
Electrical and Electronics Engineering	
Information Systems	
Software Engineering	
Information Systems Engineering	
Water Industry Engineering	
Quality and Reliability Engineering in the Electronics Industries	
Electrical and Electronic Engineering	
Communication	
Behavioural Sciences	
Tourism and Hotel Studies	
Land of Israel Studies	
Tourism and Hotel Management	
Communication	
Land of Israel Studies	
Behavioural Sciences	

MAX STERN ACADEMIC COLLEGE OF EMEK YEZREEL

Date of recognition: August 21, 1997

Type of funding: Public

Address: Emek Yezreel Mobile Post 19300

URL: http://www.yvc.ac.il/en/

Bachelor level degrees	Master level degrees
Education	Organizational Counselling and Development
Economics	Educational Counselling
Economics and Management	
Multidisciplinary Studies	
Behavioural Sciences	
Political Science	
Health Systems Administration	
Management Information Systems	
Criminology	
Sociology and Anthropology	
Nursing	
Psychology	
Human Services	

NETANYA ACADEMIC COLLEGE

Date of recognition: January 13, 1998

Type of funding: Private

Address: 16 Kibbutz Galuyot St., Kiriat Yitzhak Rabin, Netanya 42365

URL: http://www.netanya.ac.il/englishsite/Pages/default.aspx

Bachelor level degrees	Master level degrees
Computer Sciences	Business Administration (MBA)
Computer Sciences and Mathematics	Organizational Behaviour
Law	Communication
Insurance	Law
Banking and the Capital Market	
Behavioural Sciences	
Business Administration	
Communication	

ONO ACADEMIC COLLEGE

Date of recognition: July 11, 2006

Type of funding: Private

Address: 104 Tzahal St., P.O. Box 759, Kiriat Ono 55000

URL: http://www.ono.ac.il/?lang=en

Bachelor level degrees	Master level degrees
Occupational Therapy	Law
Law	Business Administration (MBA)
Communications Disorders	
Advertising and Marketing Communications	
Business Administration	

ORT BRAUDE COLLEGE OF ENGINEERING

Date of recognition: June 18, 1996

Type of funding: Public

Address: P.O. Box 78, Karmiel 21101

URL: http://www.braude.ac.il/english/

Bachelor level degrees	Master level degrees
Biotechnology Engineering	Systems Engineering
Electrical and Electronics Engineering	Biotechnology
Mechanical Engineering	Software Engineering
Information Systems Engineering	Industrial Engineering and Management
Applied Mathematics	
Optical Engineering	
Software Engineering	
Industrial Engineering and Management	

PERES ACADEMIC CENTRE

Date of recognition: August 21, 2008

Type of funding: Private

Address: 8 HaNeviim St., P.O. Box 328, Rehovot 76120

URL: http://www.pac.ac.il/English

Bachelor level degrees	Master level degrees
Business Administration	Business Administration (MBA)
Health Systems Management	Educational Psychology
Behavioural Sciences	
Bachelor of Laws (LLB)	

RUPPIN ACADEMIC CENTRE

Date of recognition: March 12, 1980

Type of funding: Public

Address: Emek Hefer 40250

URL: http://www.ruppin.ac.il/english.aspx

Bachelor level degrees	Master level degrees
Computer Engineering	Clinical Psychology
Industrial Engineering and Management	Logistics and Maritime Systems
Marine Environmental Sciences	Immigration and Social Integration
Medical Engineering	Business Administration (MBA)
Marine Biotechnology	
Electrical Engineering and Electronics	
Business Administration	
Economics and Management	
Behavioural Sciences	
Economics and Accounting	
Nursing	

SAMI SHAMOON COLLEGE OF ENGINEERING

Date of recognition: May 25, 1999

Type of funding: Public

Address: P.O. Box 950, Beer Sheva 84100

URL: http://www.sce.ac.il/eng/

Bachelor level degrees	Master level degrees
Civil Engineering	Software Engineering
Chemical Engineering	Industrial Engineering and Management
Electrical and Electronics Engineering	
Mechanical Engineering	
Software Engineering	
Industrial Engineering and Management	

SAPIR ACADEMIC COLLEGE

Date of recognition: April 21, 1998

Type of funding: Public

Address: Shaar HaNegev Educational Campus, Ashkelon Beach Mobile Post 79765

URL: http://eng.sapir.ac.il/

Bachelor level degrees	Master level degrees
Applied Economics and Management	Public Policy and Administration
Logistics	
Multidisciplinary	
Public Policy and Administration	
Software Systems	
Management of the Human Resource	
Industrial Management and Control	
Technology Marketing	
Culture, Creativity and Production	
Economics and Accounting	
Communication, Creativity and Criticism	
Social Work	
Law	
Audio and Screen Arts	

SCHECHTER INSTITUTE OF JEWISH STUDIES

Date of recognition: June 28, 2005

Type of funding: Private

Address: P.O. Box 18600, Jerusalem 91160

URL: http://schechter.edu/default.aspx

Bachelor level degrees	Master level degrees
Jewish Studies	

SHA'AREI MISHPAT – THE ACADEMIC CENTRE OF LAW AND SCIENCE

Date of recognition: February 18, 2001

Type of funding: Private

Address: Aliyat Ha'noar St. P.O. Box 261, Hod Hasharon 45101

URL: http://en.mishpat.ac.il/

Bachelor level degrees	Master level degrees
Law	Jewish Law
Administration, Governance and Law	
Accounting	
Psychology	

SHENKAR – COLLEGE OF ENGINEERING AND DESIGN

Date of recognition: March 2, 1997

Type of funding: Public

Address: 12 Anna Frank St., Ramat-Gan 52526

URL: http://www.shenkar.ac.il/en

Bachelor level degrees	Master level degrees
Chemical Engineering	Plastics Engineering
Electronics Engineering	Fashion
Plastics Engineering	Textiles
Software Engineering	Jewellery and Accessories
Industrial Engineering and Management	
Multidisciplinary Art	
Fashion	
Textiles	
Interior Design – Building and Environment	
Industrial Design	
Jewellery	
Visual Communication	

TEL-HAI ACADEMIC COLLEGE

Date of recognition: August 21, 1997

Type of funding: Public

Address: Upper Galilee Mobile Post 12210

URL: http://english.telhai.ac.il/

Bachelor level degrees	Master level degrees
Biotechnology	Biotechnology
Zootechnology	Social Work
Food Sciences	
Computer Sciences	
Environmental Sciences	
Nutritional Sciences	
Education	
Economics and Management	
Human Services	
Multidisciplinary Studies	
Computer Sciences	
Social Work	
Psychology	

THE WESTERN GALILEE COLLEGE

Date of recognition: July 29, 2009

Type of funding: Public

Address: P.O. Box 2125, Acco 24121

URL: http://www.wgalil.ac.il/category/English

Bachelor level degrees	Master level degrees
Criminology	
Conservation Studies	
Theatre Studies	

ZEFAT ACADEMIC COLLEGE

Date of recognition: June 23, 2011

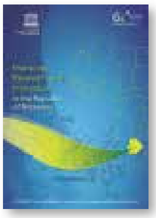
Type of funding: Public

Address: 11 Jerusalem St., P.O. Box 160, Zefat

URL: http://www.zefat.ac.il/?CategoryID=637

Bachelor level degrees	Master level degrees
Bachelor of Law (LL.B)	
Study of Art, Literature and Music	
Physical Therapy	
Community Information Systems	
Multidisciplinary	
Behavioural Sciences	

Titles in this series



Mapping Research and Innovation in the Republic of Botswana.
G. A. Lemarchand and S. Schneegans, eds. UNESCO (2013)

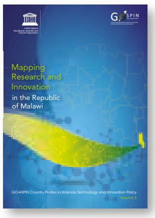
GO→SPIN Country Profiles in Science, Technology and Innovation Policy, vol.1.

United Nations Educational, Scientific and Cultural Organization: Paris.
URL: http://unesdoc.unesco.org/images/0022/002247/224725e.pdf

Mapping Research and Innovation in the Republic of Zimbabwe.
G. A. Lemarchand and S. Schneegans, eds. UNESCO (2014)

GO→SPIN Country Profiles in Science, Technology and Innovation Policy, vol. 2.

United Nations Educational, Scientific and Cultural Organization: Paris
URL: http://unesdoc.unesco.org/images/0022/002288/228806e.pdf



Mapping Research and Innovation in the Republic of Malawi.
G. A. Lemarchand and S. Schneegans, eds. UNESCO (2014)

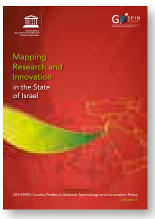
GO→SPIN Country Profiles in Science, Technology and Innovation Policy, vol. 3.

United Nations Educational, Scientific and Cultural Organization: Paris
URL: http://unesdoc.unesco.org/images/0022/002288/228807e.pdf

Mapping Research and Innovation in the Republic of Rwanda.
G. A. Lemarchand and A. Tash, eds. UNESCO (2015)

GO→SPIN Country Profiles in Science, Technology and Innovation Policy, vol. 4.

United Nations Educational, Scientific and Cultural Organization: Paris
URL: http://unesdoc.unesco.org/images/0023/002347/234736e.pdf



Mapping Research and Innovation in the State of Israel.
E. Leck, G. A. Lemarchand and A. Tash, eds. UNESCO (2016)

GO→SPIN Country Profiles in Science, Technology and Innovation Policy, vol. 5.

United Nations Educational, Scientific and Cultural Organization: Paris

The Global Observatory of Science, Technology and Innovation Policy Instruments (GO→SPIN) series of country profiles are designed to expose – through the rigorous application of an assessment lens—usable insights about science, engineering, technology and innovation (SETI) policies and their context. This is meant to encourage choices that harness research and innovation to achieve national goals.

Israel is home to top level scientists (among them five Nobel laureates in recent years), and its gross expenditures on R&D as a percentage of Gross Domestic Product are the highest in the world (4.2% for civilian R&D). High R&D investments in Israel have delivered a strong inventive performance in terms of patents and technologies transferred to market; a country with scarce natural resources has indeed transformed its economy by applying research and innovation. In the past two decades, Israel succeeded in establishing a knowledge-intensive economy with high- and medium-tech products contributing significantly to the trade balance. A vibrant venture capital market fosters innovation by small and start-up companies.

Yet, the resulting economic growth has not been sufficiently inclusive. Traditional industry and services sectors are still to assimilate innovations, and workforce trends are worrying: recent data show mathematics and science scores of Israeli 15-year-olds are lower than in comparable countries, while shortages of specialist labour are felt in SETI fields. Talent and receipts from intellectual property are mobile in a globalized economy.

Israel faces many challenges, ranging from water and energy scarcity and security, climate change threats, to changing demographics. This country profile shows, among other things, that the Government has a healthy diversity of policy instruments offering support to companies and research universities for their R&D and innovation activities, and that these are addressing a range of needs. It also suggests that formalizing a strategic plan and improving coordination could multiply the impact of policies.

In 2012, the Israel Academy of Sciences and Humanities proposed collaboration with UNESCO to prepare an evidence-based policy analysis of Israel's unique situation, and invited the Samuel Neaman Institute for National Policy Research, to join this effort. Mapping Research and Innovation in the State of Israel is the result. The present profile has been produced within the Global Observatory of Science, Technology and Innovation Policy Instruments (GO→SPIN), a UNESCO initiative applying a new methodology to mapping research and innovation at country level.

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