Research Trends

Expert Opinion
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Research evaluation in Israel: Interview with Dr. Daphne Getz

In 2013, the Samuel Neaman Institute published a report covering the Israeli scientific output from 1990 to 2011, identifying the country's leading scientific disciplines and comparing them to countries around the world. With its unique geographical location and demographic composition, Israel presents an interesting case of scientific capabilities and output as well as collaborative trends. For this issue, we interviewed Daphne Getz, the lead investigator of this report.

Dr. Daphne Getz is the head of the CESTIP (Center of Excellence in Science, Technology and Innovation Policies), and has been a senior research fellow at the Samuel Neaman Institute (SNI) since 1996. Dr. Getz is a specialist in R&D policy, technology and innovation, policies on new and emerging technologies, and relationships between academia, industry and government, among others. She has represented the academia and the Technion (Israel Institute of Technology) in the MAGNET R&D Consortia and also represents Israeli academia

in several EU and UN projects. She has a D.Sc. from the Technion in Physical Chemistry and has served in several positions related to R&D management in the industry. Over the years, Dr. Getz has initiated numerous projects, including Israeli indicators for Science, Technology and Innovation, evaluation of R&D programs, and the evaluation of Israeli R&D outputs using Bibliometrics.

Could you briefly describe SNI (Samuel Neaman Institute), its core activities and role in informing science policy in Israel?

Samuel Neaman Institute (SNI) is an Israeli organization established in 1978 at the Technion (the Israel Institute of Technology). Its main objective is to conduct independent multi-disciplinary research and provide insights into Israel's Science, Technology & Innovation (STI), education, economy and industry as well as infrastructure and social development for policy makers. The institute has a key role in outlining Israel's national policies in science, technology and higher education and serves decision makers through its research projects and surveys. The institute operates within the framework of a budget funded by Mr. Samuel Neaman and external research grants from the Ministry of Science, Technology and Space, the Office of the Chief Scientist in the Ministry of Economy, the Ministry for Environmental Protection, the European Commission's Seventh Framework Programme grants, and more. SNI employees are highly professional analysts chosen because of their level of expertise in different disciplines. Each year, the institute conducts many projects and publishes numerous reports covering a variety of topics related to Israel's technological, economic and social capabilities.

What types of evaluation programs does SNI develop and conduct?

The institute is often called upon to provide evaluations of specific programs or institutions in Israel. Some examples of such evaluative research are:

1. Program evaluation:

In some cases, SNI is requested to evaluate specific scientific programs, for example, the Scientific Infrastructure Program of the Ministry of Science and Technology, which was launched in 1995 in an attempt to bridge the gap between basic and applied research. SNI was called to methodologically evaluate how and to what extent this program benefitted the Israeli economy and society. In addition, the institute set out to study the effectiveness of the program, its actual successes and failures, and to help decision makers set priorities in R&D policies and investments.

2. Evaluation of R&D programs supported by the Office of the Chief Scientist (OCS):

The OCS supports several scientific programs aimed to support technology transfer between academia and research institutions and the industry. SNI was called to evaluate some of these programs and analyze their effectiveness, success and future development to ensure well-constructed processes for technology transfer to industry.

3.Evaluation of individual institutions:

From time to time, SNI is called upon to evaluate specific institutions within academia. In such cases SNI uses quantitative and qualitative methodologies to evaluate their performance in terms of output, influence and contribution to science, economy and society.

4. Evaluation of the Israeli research output:

Since 2003, the institute uses advanced bibliometric methodologies and conducts in-depth studies on the quality and quantity of Israeli research outputs (especially relating to scientific publications and patent analysis). Specific fields such as Nanoscience and Nanotechnology, Aerospace Engineering, Energy, Environment, and Stem Cells are analyzed and benchmarked against the rest of the world.

What data does the institute collect and analyze in order to produce reports on Israel's STI capabilities?

SNI uses a variety of data sources in order to conduct its research and produce its reports, including intellectual property (such as patents and trademarks), human resources and demographics, as well as infrastructure and economic indicators. In addition, SNI established a Bibliometric department, which focuses on analyzing publication data such as number of journal articles, number of citations, conferences etc., as well as scientific collaborations with the international community.

Which indicators did the institute develop in order to be able to benchmark Israel's STI?

SNI developed and maintains a large and diverse database of indicators relating to the monitoring and evaluation of R&D activities, scientific capabilities and technological infrastructures and to the funding of such activities in Israel. This database has become the most reliable and trusted source for STI evaluation in the country. In 2013, SNI published the fourth edition of "Indices of Science, Technology and Innovation in Israel: An International Comparison". It contains key data on Israel's Science and Technology input and output and covers more than a decade of international comparisons, as well as many other indices, including position indicators. In the framework of patent research, SNI developed the "distinct

invention" indicator. This indicator is based on patent family data and is aimed at neutralizing double counting of identical patent applications (inventions) as a result of their filing in numerous patent offices around the world.

Please list some of the main findings of the latest report on Israel's STI on the following:

1. Leading disciplines by quality:

According to the latest report, Israel's leading scientific disciplines are Space Science, Material Sciences, Molecular Biology & Genetics, and Biology & Biochemistry. Leading sub-disciplines are Cell & Tissue Engineering, Biomaterials, Biophysics, Biochemistry & Molecular Biology, Biomedical Engineering, Composite Materials, and Nanotechnology. A significant growth by quantity was seen in disciplines such as Economics and Social Sciences.

2. Developing disciplines:

Some of the leading trends found, based on both quantitative and qualitative measures, are Tissue Engineering, Physics (Particles & Fields), Astronomy & Astrophysics, Cell Biology, and Biochemistry & Molecular Biology. In some of the sub-disciplines within these areas of research, Israel has a leading global role.

3. Main collaboration trends worldwide:

Overall, of Israel's scientific publications in 2011, 46% was the result of international collaboration (40% in 2007). The main countries with which Israeli scientists collaborate are the USA, Germany and France. In addition to these, we found a significant growth in collaborations with South East Asian countries such as Singapore. An analysis of USPTO patent data relating to the 1999-2008 time period revealed that 83% of the cooperation in inventive activity was conducted with American inventors (highly influenced by the scope of US multinational firms' activities in Israel), 10% with inventors from EU-27 countries (mainly Germany, France and the UK) and 7% with inventors from the rest of the world.

4. Main challenges in the current state of Israel's STI and your recommendations:

An appropriate distribution of funding is always a challenge for decision makers. In our report we demonstrated that although highly funded disciplines such as Neuroscience did perform well, other - less funded - areas such as Space Science and Cell & Tissue Engineering showed significant growth and development. This enabled us to highlight areas that will need policy and funding attention in the coming years.

SNI produces numerous studies on Israel's STI; could you please mention one or two of such studies (e.g. environmental conservation, energy) and their main results?

One of the research reports we produced in 2013 was "Science & Technology Education in Israel", which aimed to provide indicators to inform strategy makers in education, and to help prepare them for a possible shortage in Science and Technology teachers in high schools. A unique report titled "Success stories" features 78 success stories that depict ultra-orthodox individuals in Israel, both men and women, who have successfully integrated into the world of academic education, employment and the military. Another "hot" topic is Energy; we have an ongoing project named "Energy Master Plan", responsible for evaluating the environmental impacts of the different potential energy scenarios as well defining environmental indicators to the energy market. The Energy Forum Meetings aim to provide a platform where professionals can discuss specific energy related topics. At the same time, the forum allows multilateral discussions encouraging projects in the fields of renewable energy and energy conservation. The forum meetings serve as a platform for defining professional, applicable positions, to be used by relevant decision makers. Other reports and findings can be found on our website: http://www.neaman.org.il/Publications.

Given the variable delays and uncertain linkages between R&D inputs and outputs (and ultimately, economic development), how do you draw conclusions (if indeed you do) on the impact of STI activities on the Israeli economy?

The question of causation or causality between R&D inputs and economic outputs is a well-known and researched problem in the R&D economic literature. The main criticism is that a large number of models dealing with the relationship between technological change and economic growth probe the linkage directly by simply looking at the inputs (e.g. scientific publications, patents) and outputs (e.g. firm sales, GDP), without analyzing or understanding the process binding them.

In the process of our work in SNI, we place great emphasis on qualitative methodologies (interviews, surveys and unstructured questionnaires using open-ended questions) that to our best knowledge are better suited to understanding and probing the mechanism (the "black box") linking scientific inputs and economic performance.

A number of quantitative studies dealing with the relationship between R&D investments and economic growth were conducted in SNI (see "R&D Outputs in Israel – A Comparative Analysis of PCT Applications and Distinct Israeli Inventions"; "Investments in Higher Education and the Economic Performance of OECD Countries: Israel in an International Perspective"). In both of these studies we addressed the question of causality by developing a two-stage model of scientific and technological innovation. In this model R&D investments

generate scientific and technological outputs (e.g. patents) and these technological outputs turn back into inputs which explain economic performance. In the process of this work much emphasis was placed on the quality of the R&D indicators. For example, we extracted patent application data by priority date (which is the earliest filing date of the patent application anywhere in the world), as opposed to application or grant date, in order to more accurately represent the time of invention. Concurrently, the use of temporal bias (time lag) between R&D inputs and economic outputs is actually essential to correctly represent the real-world relationship and sequence between stimulus and response.

Currently, the institute's investigators are working on several reports focusing on technology transfer and collaboration between industry and academia, international scientific collaborations, and energy sources.

For more information please visit http://www.neaman.org.il/Science-and-technology