Obstacles in Nanotechnology Transfer from the Academy to the Industry in Israel

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ABSTRACT

Over the past decade, the Israeli Government has invested over 160 million dollars in the nanotechnology domain. Despite the clear potential of the nano domain, evidence suggests that the Israeli nano industry is far from realizing its full potential. This is mainly due to considerable difficulties in technology transfer from the academy to the industry. This research employs a wide range of methods to evaluate and the main challenges and problems in the transfer of nano technologies from the academy to the industry. The outputs of the research include a series of recommendations aimed at proposing possible solutions to improve the technology transfer from the academy to the industry.

METHODOLOGY

Research goal

The goal of the research is to evaluate the difficulties in the transfer of nano technologies from the academy to the industry and to offer possible solutions for overcoming these obstacles.

Research Methods

The research employed a wide range of quantitative and qualitative research methods including an analysis of nano outputs, structured interviews with stakeholders and a survey of nano researchers and nano industry executives. 37 interviews were held with various stakeholders from the Academy, the industry, the Technology Transfer Offices (TTO's) at the universities and the government. A total of 159 responses were received from an opinion survey, targeting stakeholders from the academy and the nano industry. The short questionnaire included open ended and close-ended questions focusing on obstacles in technology transfer from the academy to the industry and on possible directions for overcoming these hurdles. An analysis of S&T indicators, focusing mainly on publications, patents and EU framework programs was conducted in order to map the current status and potential of the nano domain in Israel.

RESEARCH FINDINGS

The nano potential: what do the indicators tell?

The analysis of S&T indicators outlines the potential of the nano domain. The indicators show linear growth in the number of nano publications (Figure 1), led by Israel's six research universities. This growth can be attributed to establishment of six nano centres at Israel's research universities. With the exclusion of a sharp rise in the number of nano patent applications in the past decade has remained almost constant (Figure 2). The inventive activity is led by the industry (51% share).

Figure 1: Nanoscience & Nanotechnology publications by year and institution 2004-13

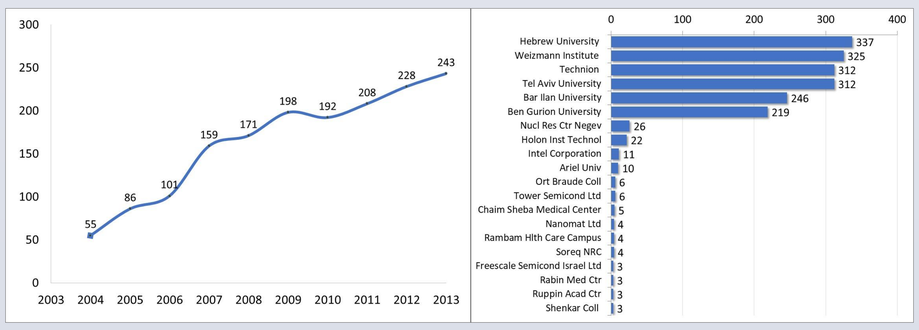
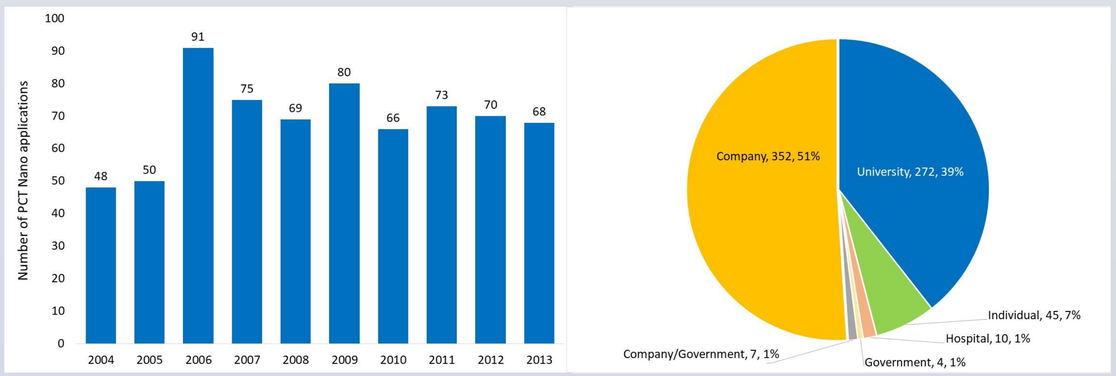


Figure 2: Nanoscience & Nanotechnology patents by year and sector 2004-13



The share of joint university-business sector patents (proxy for university-industry partnerships and cooperation) over the past decade is fairly low, comprising roughly 27% out of total sectoral cooperation in inventive activity (Table 1).

Table 1. Sectoral cooperation in PCT nano science and nano-technology patent applications 2004-2013

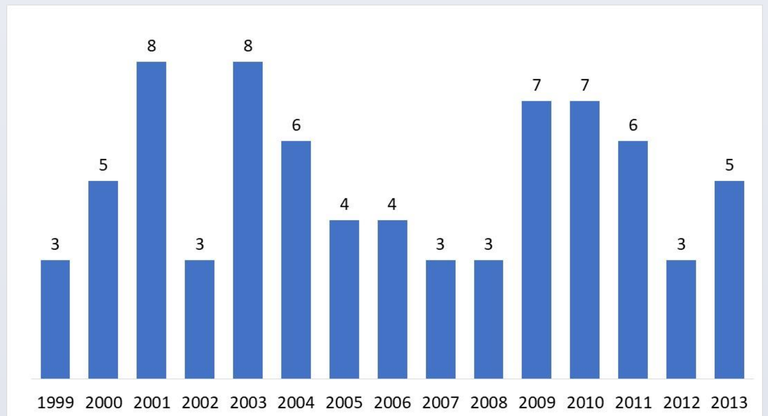
Sector 1	Sector 2	Number of cooperations	% out of joint sector cooperations	% out of total PCT applications (N=690)
University	University	27	35%	4%
Company	University	21	27%	3%
Hospital	University	15	19%	2%
Company	Company	8	10%	1%
Hospital	Hospital	2	3%	0.3%
Company	Hospital	2	3%	0.3%
Government	Company	1	1%	0.1%
Government	University	1	1%	0.1%
		77	100%	11%

The participation of Israeli nano companies in EU research projects has sharply increased during the Seventh Framework Program (Table 2). It seems that the potential of the nano domain, as demonstrated by some of the S&T indicators, is not being sufficiently utilized for the commercialization of technology (e.g. low share of cooperation between the universities and the business sector in Table 1), to the establishment of new firms (Figure 3) and for attracting investment from incumbent firms due to the perception of this domain to be of high risk.

Table 2. Participation of Israeli institutions in EU framework programs 2003-2013

	FP-6	FP-7
Number of projects with Israeli participants	56	82
Number of Israeli Participants	73	141
Industry (companies)	26	48
Academy	41	68
Other sectors	6	25
Research grants received by Israeli institutions in Millions of Euros	20.3	45.3
Industry (companies)	5.5	16.3
Academy	14	24.3
Other sectors	0.8	4.8
Total cost of nano projects with Israeli industry participation	248	316
Total cost of nano projects with Israeli participation	500	563

Figure 3: Establishment of Nano companies by year



Obstacles in technology transfer

Based on the analysis of the structured interviews and survey, four main obstacles in the transfer of nano technologies from the academy to the industry were identified:

- **Lack of mechanisms for entering and financing the "intermediate stage" in technology transfer** (e.g. difficulties in identifying specific application for generic technology; insufficient dialogue between the academy and the industry; difficulties among researchers in understanding the business environment; reluctance on behalf of the private sector and VC to invest in "high risk" nano projects.
- **Academy** - lack of entrepreneurial drive among researchers; commercialization process is perceived as too complex and time consuming; fear that the process may hinder academic promotion due to possible restrictions on publication; lack of flexibility in part of the TTO's regrading IP rights and commercialization.
- **Industry** – lack of critical mass in the Israeli industry for absorbing nanotechnologies; large Israeli companies and multinational firms are unwilling to invest due to high risk factor.
- **Regulation and nano safety** - lack of regulation and standardization regarding nano-technology safety and environmental repercussions of nano production processes.

CONCLUSIONS AND RECOMMENDATIONS

- There is a need for establishing an administrative body, as well as applied research institutions and technological incubators to improve coordination and to bridge gaps between the academy and the industry.
- Establishment of VC funds in the nano domain could aid companies in entering the "intermediate stage".
- Universities must be more assertive in encouraging researchers to engage in the commercialization of nano technologies. Recognizing commercialization activity and technology transfer as criteria for academic promotion could assist in achieving this end.
- TTOs must be more flexible in working with the industry with regards to IP rights and licensing issues.
- There is a need to accentuate the potential of nano domain as an engine for industrial growth to attract further investment.
- Government policy should be targeted at promoting applied research and development of new products.
- There is much to learn from the experience of American and European institutions in nano safety. Suitable regulation and standardization should be adopted and applied in Israel based on these experiences.

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