Securing Australia's Future - Project 9
Translating research for economic and social benefit: country comparisons

Israel

A Study of Measures to Encourage the Translation of Public Sector Research for Economic and Social Benefit in Israel

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Overview

This brief is a snapshot description of some of the many ways the state of Israel is driving commercialisation of the products of the state funded research and development. The review is organised in three parts – First part describes some of the Office of Chief Scientist's (OCS) programs. Second part describes the main activities done by the universities, and last parts shed some light on the Defense system as a potential source for commercialisation.

The study tells the current status. It should be emphasised that all these venues were not "born" mature. A more in-depth study should pay attention to the evolution process as it captures the lessons learnt. For example, the OCS operates within the framework of Israel's Encouragement of Research and Development Law, 1984 (the "R&D Law"). Under the original version of this law an unlawful overseas transfer of Know-How was a criminal offense punishable by three years' imprisonment. In appendix A, which provides a brief outline of this law by a leading Israeli law firm, the careful authors made the following comment: "We are unaware that any person has been sentenced to imprisonment on such grounds.". These dead letters had been removed, as a result of political pressure, in 2005. Nevertheless, there is an important lesson to learn. One should recognise that the issue of policy enforcement is as crucial as setting the right policy in the first place.

Another aspect which evolved over time and a further study should analyse carefully is the evolution of the OCS requirements and conditions for support. Most notably, the change in the perception regarding the prior relations between the researcher in the academia and the co-funding industrial company. Does the change from being favourable to becoming an obstacle hints on a lesson to learn?

Evaluating these measures calls for a special attention to the following observation which was made by the Neaman Institute researchers, evaluating the Magneton program. The research says: "It was found that Elbit Systems succeeded in developing a mechanism to exploit the potential inherent in the program, allowing it to participate in a fifth of the projects in the program." - Did OCS programs turn into a "Byzantine system"?

Any review of the governmental efforts to commercialise cannot overlook the fact that a lot of commercialisation, or to put it more bluntly, privatisation, of public R&D went on, in the absence of governmental intervention. Some would say it was part of "turning a blind eye" policy, justified by "real world practicality" and some, like the state comptroller, would point to it as negligence. Naturally there is no public information regarding the "performance" of this "measure", nevertheless, it deserves attention either in order to mimic it or in order to extinguish it…

Office of Chief Scientist Commercialisation Measures

In order to grasp the amount involved - Appendix B details the public funding of R&D and shows that Government ministries' expenditure on civilian R&D amounted to NIS 6.5 billion in 2013. This expenditure includes commissioning of research from other institutions and transfers for financing of R&D in other sectors, including the General University Fund.

The following subset of OCS programs is targeted specifically to support the technology transfer from academia to the industry in the effort to enhance commercialisation of the public funded academic research.

Nuphar[1]- Guiding Principles[2]

Background

The "Nuphar" program addresses selected applications-oriented research in designated segments of Biotechnology, Nanotechnology, Medical devices, Water Technology and Energy. "Nuphar" is designed to foster applied research in research institutions in Israel, which is a continuation of the previous basic research.

The "Nuphar" program is part of the "Magnet" programs of the OCS.

Purpose

Purpose of the "Nuphar" is to serve as another bridge between basic research and applied research. In other words, allowing the research group continuing the study which began as basic research, and is no longer adequate to support from competitive research funds intended to promote basic research (such as the National Science Foundation), towards applied research and bringing it to the stage in which industrial entities show an interest in investment

It should be emphasized that the purpose of the program is a broad and deep extraction of scientific competence in the academic research institutions in Israel for the benefit of the industry in Israel. Continued cooperation can be made in the "Magnet" program for technology transfer of the scientific invention into a commercial product, or in a technology incubator, or setting up a new venture (a start-up), or implementing in an existing corporation, provided will be useful to the Israeli industry.

"Nuphar" track is open to the following fields of science and technology as defined hereby:

Biotechnology - "Industrial use of living cells or organisms or industrial application of biological methods that accompany the research plan."

Sub-sectors included in the definition above:

- Drug development based on a new active substance. This includes molecules RNA / DNA, proteins, antibodies, small molecules and bio-generic products. Not included in the definition development of formulations and extracts or generic drugs.
- Developing products based on the clinical uses of cells.
- Development of new and original products based on the identification and implementation of new biochemical / cellular pathways, including new markers (biomarkers).

[1] Hebrew for Nymphaeaceae

[2] http://www.magnet.org.il/uploads/attachments/687/עקרונות_מנחים__2014_נופר .doc,January 2014

- Development of products based on genetic engineering and transgenic manufacturing.
- Development of all GMO products

Nanotechnology - "Creating materials or devices or systems (other than chemical or biochemical reactions) in sizes not exceeding tens of nanometers or based on components which their dimensions do not exceed tens of nanometers."

Medical Devices – "Research on technologies that combine various technological fields, for equipment used for the treatment and / or medical diagnosis."

Water Technology – "Technologies used for biological, physical and / or chemical treatment of water, so the water quality is improved after treatment."

It should be emphasized that this course will not accept applications for technologies used by the water sector in general as safety, security, management, control and so on.

Energy related technologies – "Studies on energy storage and transmission of power by radiation".

Multidisciplinary research - Research which combines multitude of scientific disciplines, technologies (including medicine and exact science) and / or various engineering fields, operating in different faculties, and at least one of these areas is defined in paragraphs 1-5 above.

The method

Funding the advanced stages of the research which is preliminary conducted by a research team in an academic research institution in Israel, when there is an Israeli industrial corporation willing to co-fund at least 10% of the research as part of the commercialisation of academic knowledge. In return, at the end of the study period, the industrial corporation will have the Right of "first observation" on the findings of the study and the Right of "first negotiations" in good faith, for a predefined period.

Principles

- "Nuphar" research is an academic research and carried out in a research institution. The defined end goals of the study period should help business entity to make a decision to invest in, and promote, industrial product.
- In general, the research period is up to 12 months and should be determined at the time of submitting the application. The execution period may be set to 15 months, to accommodate for set-up time. Extension and / or approval for research for more than 15 months, as an exception, to be discussed and approved individually.
- Research found eligible for support, will receive a grant at a rate up to 90% of the approved budget.
- The grant will be used to finance expenses for personnel, materials and subcontracting in Israel only.
- Grant recipients will be exempt from payment of royalties, however, are required to preserve the knowledge in the country in accordance with the "Law for the Encouragement of Industrial Research and Development" (The R&D Law).
- There is a commitment of industrial/business corporation to finance at least 10% of the research program.
- The industrial / business corporation providing the supplementary funding has the professional ability to guide the research towards industrial applications.

- There is no business interest of any kind between the research institute and the industrial corporation that supports the research. In particular, the researcher is not compensated in any way by the corporation and / or does not carry a role in the corporation and / or its institutions.
- Innovation and originality, in terms of industrial application, are necessary conditions. In particular any research can be submitted only once.
- The research outcome is provided for industrial application in Israel, and is of high added value to the Israeli industry.
- The study allows the transfer of the knowledge which will be created to the industry for further development of the technology.
- There is interest in preserving the knowledge to benefit the industry in Israel, the researcher and the institution undertook to take the approach that the publication would not harm the ability to commercialise the research in Israel.
- A signed agreement before receiving funding, between the industrial corporation and the research institution, which determines the rights and obligations of each party, the commitment of the corporation to finance at least 10% of the cost of the research. The industrial corporation shall not be granted rights to knowledge but priority in negotiations "from the end of the study period".
- Complementary funding from Industrial Corporation is to be transferred within the approved period.
- The maximum amount of the "Nuphar" project budget is 500,000 NIS. The grant of the Ministry of Industry will be up to 90% of the research budget, and the remainder will be completed by the industrial corporation.
- Multidisciplinary research which involved research groups from various faculties, the maximum amount of the project budget is 660,000 NIS. Each research group in the project shall be provided not more than - 330,000 NIS.

Basic conditions for research as part of the "Nuphar"

- The research is in the field as defined above.
- Substantial research and knowledge barriers and substantial uncertainty that prevent industrial corporations from cooperation or developing commercial application.
- There is a corporation with industrial interest in the subject which is ready to make supplementary funding in the research.
- A qualified research group with knowledge and ability to perform the study.
- Research objectives are defined to an end in the time and budget defined above.
- The technology does not exist and / or is not developed in other industrial corporation operating in Israel.
- The study is financed in its entirety in the "Nuphar" program - Do not submit in parts to several funds.
- The researcher shall not undertake sabbatical 12 months after the end of the research period.

Criteria for proposals for research as part of "Nuphar"

- Technological innovation.
- Market potential
- Creating Competitive Advantage (Protection of patented research results)
- Feasibility of implementation and success by Israeli industry.
- Industrial corporation level of involvement in supporting the research
- The research added value to the future product

Principles of Knowledge agreement

In general, the agreement between the Research Institute and the industrial corporation that seeks to make use of product development is a commercial agreement. Therefore, the OCS has no interest to impose conditions on the collaboration agreement, provided that at the end of the study period, the industrial corporation will have the Right of "first observation" on the findings of the study and the Right of "first negotiations" in good faith for a predefined period, but will not be given any exclusivity or ownership Rights to the knowledge which is the research outcome.

Nuphar Evaluation Report[3]

Conclusions

The research conclusions were based on the interviews conducted and quantitative and qualitative analysis of the answers to questionnaires.

The study findings show the program to be a success and meeting its objectives. The program is highly appreciated by participants from both the academia and the industry. One of the most important study's finding is the high rate of projects which were continued after the finished the Nuphar period. As much as 63% of the projects approved for the academia in Nuphar framework continued after the project completion. The industrial participants reported that 36% of completed projects continued after the Nuphar period.

Additional findings pointing to the success of the program are reports on patent applications, research expansion carried out following the Nuphar project, development of technology prototype, and the possibility of leakage of knowledge from the project beyond the participating company.

2. The program creates a unique framework for promoting collaborations between academia and industry. The projects within the program have high contribution to the academia, to the industry, and to the technology transfer process between academia and industry. The program is almost the sole source to finance the researchers in academia for early stage applied research, when there is not enough information to justify raising funds from investors. The program allows the industry to test new technologies without a risk.

3. The framework was successful in supporting new ideas to the stage the development of these ideas could continue in other programs such as technology incubators, Magneton, continued cooperation between the researcher and the industrial corporation, and other frameworks.

4. Variables found to significantly affect the success of the project are:

A high degree of contribution by the industrial corporation, previous experience of the researcher with this industrial corporation, and maturity for commercializing. Too short time frame and insufficient funding were found as significant to reduce the chances of success.

In addition, most participants complained about "MAGNET" budget and reporting restrictions.

[3] Extract from a research conducted by The Samuel Neaman Institute, an independent multi-disciplinary national policy research institute. The activity of the institute is focused on issues in science and technology, education, economy and industry, physical infrastructure and social development which determine Israel's national resilience. http://www.neaman.org.il/ סקר הערכת נופר_דוח מסכם - נופר.pdf, December 2010

Recommendations

- Project duration is bounded by the program management to examine the research idea in the initial stage seems to be correct, however, I is recommended to explore the possibility for giving a specific extension for longer time.
- Participants should be informed, upon completion of the study, regarding open channels for them to continue the program. It is recommended to create a platform for direct, and easy, continuation of a Nuphar to "Magneton"
- More flexibility in transfers between budget items and easier administrative processes related to budget reports.
- In consideration of the high rate of project applications rejection, to allow for resubmission of revised proposals.
- To match the professional examiners, if possible, with the knowledge areas of the proposed projects and allow for evaluation by independent evaluators
- Consider Differential participation fee for the industrial corporation. The current fee is too high for small companies and reducing the amount will encourage them to expand their participation, while the current amount is insignificant for large companies and sometimes they take part in the program even if they have no interest in the study itself since it allows them to get access to laboratories in the academia.
- Consider to engage entrepreneurs in projects in a different framework, such as finance 6 months anyone who can commercialise technology and start a company based on it.
- Consider open Nuphar to include other areas beyond Biotechnology and Nanotechnology.
- Create mechanisms necessary to ensure much more involvement of the industrial corporation that accompany the project.

Kamin[4] - Program guidelines[5]

Background

The "Kamin" program addresses selected applications-oriented research and is designed to foster applied research in research institutions in Israel, which is a continuation of the previous basic research, and bringing it to the stage where business entities in the Israeli industry will be able to make a decision on commercialisation agreement with the institution.

The "Kamin" program is part of the “Magnet” programs of the OCS.

Purpose

Purpose of the "Kamin" is to serve as another bridge between basic research and applied research, which has not yet been recognized by business entities due to commercialisation. In other words, allowing the research group continuing the study which began as basic research, and is no longer adequate to support from competitive research funds intended to promote basic research (such as the National Science Foundation), towards applied research and bringing it to the stage in which industrial entities show an interest in investment. Hence, The objectives of the study will be characterized so that by the end of the period "Kamin" outcome will enable industrial entities show interest in further invest and cooperate with the Research Institute in collaboration towards commercialisation .

It should be emphasized that the purpose of the program is a broad and deep extraction of scientific competence in the academic research institutions in Israel for the benefit of the industry in Israel.

"Kamin" track is open to all fields of science and technology which have the potential implementation by Israeli industry. Namely, that an Israeli company that will take the technology as part of the commercialisation agreement can develop new products or improve existing products.

The method

Funding the advanced stages of the research which is preliminary conducted by a research team in an academic research institution in Israel, when there is no Israeli industrial corporation willing to co-fund the research, yet, as part of the commercialisation of academic knowledge. Accordingly, the complementary funding to be received from the academic institution or its technology transfer company will aim to achieve the objectives of the program.

Submission of joint research, conducted in two institutions is possible.

It is desirable to appoint a Business Project mentor. It should be that this person will have experience and knowledge in industrial R&D with emphasis on the area of activity which is the subject of the research. The business consultants will evaluate the business feasibility of the project (competing products in the market, potential applications, economic feasibility, the comparative advantage resulting from the development of technology, etc.), and define the final goals of the project objectives, which will be the base for deciding on investment for industrial entities.

[4] Kamin - The Hebrew word for Fireplace

[5] Based on OCS guidelines http://www.magnet.org.il/uploads/attachments/690/קמין_עקרונות_מנחים.doc, February 2015

Evaluation of all requests submitted by the research institute and the budget request will be subject to a study of the professional OCS consultants.

Decisions on the studies to be included in the work plan will be accepted by the “Kamin” Commission after hearing the opinion of the professional consultant. The committee may take any decision in accordance with its understanding and is not obliged to adopt the recommendation of the professional consultant.

Principles

"Kamin" research is an academic research and carried out in a research institution. The defined end goals of the study period should help business entity to make a decision to invest in, and promote, industrial product.

In general, the research period is up to 24 months and should be determined at the time of submitting the application. Extension of the research activity is possible up to additional 12 months. Decisions for extending the activity are to be made only near the end of the approved activity. The grant for the Extension Period will be reduced as explained in below.

The grant rates will be determined according to the duration of the study:

- Specific research for up to 12 months will be funded at a rate of 90%.
- Specific research for up to 24 months will be funded at a rate of 85%.
- Research Extension Period (up to 12 months extension) will be funded at a rate of 66% regardless of the Extension Period.

The grant will be used for paying the costs of personnel, materials, subcontracts, depreciation and miscellaneous equipment.

Grant recipients will be exempt from payment of royalties, however, are required to preserve the knowledge in the country in accordance with the “Law for the Encouragement of Industrial Research and Development" (The R&D Law).

There is a commitment of the academic institution and / or its technology transfer company for complementary funding to finance the implementation of the approved research, from independent sources.

Intellectual Property

It is the duty of the technology transfer company, institution and principal investigator to make sure that a study of the "Kamin" does not conflict Intellectual Property rights of others. This conflict does not prevent the implementation of the study, however, it might prevent or make it very difficult to commercialise.

The Intellectual Property generated by the research is of high added value to the Israeli industry.

The study allows for the transfer of the knowledge which will be created to the industry (including to start-up company to be established on the basis of this knowledge) for further development of the technology and for realizing attractive products in the global market.

There is interest in preserving the knowledge to benefit the industry in Israel, the researchers and the institution undertook to take the approach that the publication would not harm the ability to commercialise the research in Israel.

Grant

Amount of the maximum grant of the Chief Scientist:

- 360,000 NIS for one year study (90% of the requested research budget).

- 680,000 NIS for two years research, representing 85% of the budget stated in the requested study.

- Request to extend the study for a period of up to 12 months will receive a grant Maximum of 264,000 NIS, representing 66% of the budget stated in the requested study.

Research grant for joint research which has cooperation between two institutions will be 50% higher than specified above, provided that each institution grant does not exceeds the maximum that may be approved for research that is not cooperating.

Basic conditions for research as part of the "Kamin"

- The research is in the field of science and technology, has potential industrial application by an Israeli industrial company (existing or new).
- Substantial research and knowledge barriers and substantial uncertainty that prevent industrial corporations from cooperation or developing commercial application.
- There is not yet a corporation with industrial interest in the subject which is ready to make supplementary funding in the research.
- A qualified research group with knowledge and ability to perform the study.
- Research objectives are defined to an end in the time and budget defined above.
- The study is financed in its entirety in the "Kamin" program - Do not submit in parts to several funds.
- The researcher shall not undertake sabbatical 12 months after the end of the research period.

Criteria for proposals for research as part of "Kamin"

- Technological innovation.
- Feasibility of technology transfer to Israeli industry.
- commercialisation capacity and economic potential.
- Research Contribution to Industrial Development.
- Infrastructure and Conditions required for the research.
- "Maturity" of research.
- Existing relations with the intended industry

General comments

The "Kamin" is not only financing channel mechanism that helps academic research but targeted to extract the full research potential for the benefit of Israeli industry, and this is one of the basic criteria to which the applications will be assessed.

In particular, there will be no support if chief researcher has an interest in the potential commercialisation business partner.

No support will be given if the researcher or the institution intends to carry out the commercialisation themselves. That is to establish a company or otherwise attempt direct commercialisation.

In determining the specific start time must be considered a period of two months from the date of submission and to the decision.

Meimad[6] – General Guidelines[7]

Background

Defense and security industry are investing in R&D a large scale of defense budgets. The R&D activity is conducted mainly in the industrial sector, academia and research institutes.

Chief Scientist works to promote Israeli industry to improve competitiveness in international markets. Ideas and capabilities originated for security and / or military applications may be the basis of products in existing companies or start-up companies to be established.

Ministry of Finance, Ministry of Defense and Ministry of Trade and Industry decided to work together to promote the research and development of dual technologies that can contribute to the security of the state on the one hand and have economic potential to be deployed in the international commercial market.

Purpose

To promote creative and original ideas, including new and innovative technologies, which are not otherwise supported by a public financing framework, which could address operational needs and serve as the basis for the commercialisation of products in international markets.

The method

Established a joint "Meimad Fund" to support R&D activities that are not done in other framework.

Fund Steering Committee was appointed, headed by The Chief Scientist and head of The Research_and_Development_Agency_(Mafaat) The main duties of the committee are:

- Outline the policies and principles of operation of the Fund.

- Decide on projects approved for support under the fund.

There will be two deadlines a year, and requests received by deadline will be discussed two months later.

Each request will pass professional appraisal that combines the commercial side and the military side, this evaluation will be presented to the steering committee for the purpose of making the decision on approval / rejection of the application.

Project Features

- Helps resolve operational gap and has potential civilian market (including Home Land Security).
- Technological innovation.
- Economic business potential.
- The project is in the feasibility stage.
- The project was submitted by a small to moderate Israeli company (up to US$50M sales per year), or by a research institute.
- Israeli company = company registered in Israel and operates in Israel as an independent entity (intellectual property, financial management).
- Duration of the project - up to 30 months.
- The maximum project budget – 5M NIS for the whole period.

[6] Hebrew for "Dimension"

[7] http://www.magnet.org.il/uploads/attachments/686/מימד__עקרונות_מנחים.doc, June 2012

- Grant rate - 50% to 66% to project performed by industrial company, 50% to 90% for project performed by research institute
- The project could leverage technology developed by the military as part of a start-up company, including incubator company, provided the developers are civilians.

Prioritization parameters

- Priority to companies without strong financial backing from a big company.
- Technological innovation - technologies that have not yet been implemented.
- Innovative solutions.
- Full duality
- Conversion technologies.

Magneton – General Guidelines[8]

Background

The "Magneton" program is devoted to encourage Technology Transfer from the research institutions to industrial corporation using channels of "dual cooperation".

Purpose

Increase the access of the Israeli industry to the scientific research achievements which have economic potential to industrial corporations in Israel.

Performing research and development program to proof the feasibility of transferring the scientific invention which originated at the research institution into an industrial product.

We emphasize that the purpose of the "Magneton" is to encourage activities that are not carried out in other settings, and to maximize commercialisation of the breadth and depth of the technological capability Israeli academic research institutions have, for the benefit of Israeli industry.

The method

Dual cooperation between research group conducting a research at an academic Israeli research institute, and an industrial development team in an Israeli corporation to carry out a proof of technological feasibility of transferring the academic research achievements, after which the industrial corporation could make a decision regarding entering an independent process of industrial product development or the lack of the feasibility of a full scale development process.

Principles

- “Magneton" project is a joint project, part of which will be done by the research institute and part of which will be done by the industrial corporation. After the project completion, the industrial corporation should absorb the technology developed in the project. In other words, the industrial corporation should have the framework and the professional manpower which can precede the product development process based on the project technology.
- Project contents of the industrial corporation will only be what is required for the absorption of technology from the academia.
- "Magneton" project aims to strengthen the company's technology infrastructure and to advance the product development activity of the company. Importantly, company can submit no more than 1/3 of its R&D activity to the Magnet framework.
- A project eligible for support would receive a grant at a rate of up to 66% of the approved budget for the Industry and academia.
- Grant recipients will be exempt from paying royalties in respect thereof.
- The research institute is a full partner in implementing the project, but for the purposes of administrative convenience, the project grant request will be submitted by the industrial corporation which also will serve as the channel for the transfer of the academic grants.
- An agreement is signed before receiving funding between the industrial corporation and the research institution that regulates the relationship between the two bodies and their Rights and obligations and in particular the issue of addressing the Right to the use of the knowledge.
- The project duration of 12 to 24 months.

[8] http://www.magnet.org.il/uploads/attachments/689-2014_מגנטון__עקרונות_מנחים.doc

- The project budget up to 3,400,000 NIS for the two organizations and for the entire period

Fundamental condition for the project "Magneton"

- The basic technology exist already at the research institution lab before submitting the application to "Magneton", or alternatively, the subject is new and original idea which requires proof of technological feasibility. The academic research has a significant contribution but not exclusively in achieving the project objectives and the research group has proven experience in the field.
- The research institution is the owner of technological knowledge to be transferred, and no other entity has any additional property rights on this knowledge.
- Project has a significant technological uncertainty which prevents the industry from making a decision about entering into product development process.
- There is an industrial corporation that demonstrates an interest in the subject, and will carry from its own resources its share of complementary funding. (Chief Scientist grants is up to 66% of the approved budget)
- The industrial corporation, as a project partner, has capable personnel (scientific / engineering) for the assimilation of the project and to continue product development independently.
- The research group has the knowledge and ability to perform the major part of the study and no business connection whatsoever between this group and the industrial corporation. The plan has Priority for creating new contacts.
- Project has specific goals to be achieved in the time and budget defined above.
- The realization of the project may advance the product in international markets.
- The technology does not exist and / or is not fully developed in another industrial company that operates in Israel.
- The industrial corporation has the capability to realize the commercial potential of the product to be developed by it after completion of the project.

The principles of knowledge transfer agreement

Knowledge Transfer Agreement is a commercial agreement between the research institution and the industrial company that seeks to use the knowledge to develop commercial products.

Therefore, it is not the OCS interest to impose conditions, provided that after project completion it will be possible to use commercially the outcome of the program. Preferred route is that the industrial corporation will continue to develop and market the product. Alternatively, if the company does not want to commercialise the outcome, enabling the research institute to find another industrial company in Israel wishing to commercialise this technology.

General comments and insights

The "Magneton" project is not only a financing channel, but a mechanism that helps to carry out the transfer of Technology from one entity, who has it, to another, who needs it.

It is recommended to test the existence of this key element before applying. In particular: There it is not intended to support academic researchers who participate in a joint venture or have an interest in business and want to pass their knowledge as a researcher to the company. It is not "Magneton" goal to support academic research designed in order to solve industrial corporation problems which it does not know how to solve.

It is not a goal of "Magnaton" to finance existing commercialisation agreement already signed by the company and the institution.

Academic principal researcher is required not to go on sabbatical during the requested operation.

Magneton Evaluation Report[9]

The evaluation research conclusions were based on the interviews conducted and quantitative and qualitative research questionnaires as part of the study evaluating the "Magneton" program. The main conclusions were:

The “Magneton” program is much appreciated and gains recognition on the part of participants from academia as well as industry. The program succeeds to create a process and a supportive environment for promoting cooperation between academia and industry and the program manages to create a framework for transfer of technology and the projects contribute a great part to the process.

The program structure (academic researchers and industry company) and its content are unique to this program. This structure provides a frame to test ideas and technologies originating from academia and examine the possibility of realizing the transfer and integration of the knowledge into the industry. About half of the participants’ feedback stated that if the proposed project was not supported by the OCS they would give up the idea and would not test the feasibility of the technology for industrial application and commercialisation.

The program allows companies to promote high-risk projects and evaluate the feasibility of technology development.

The contribution of the program to promote the development of scientific and technological knowledge in Israel is statistically significant. About 80% of the “Magneton” projects were of high level of innovation and achieved breakthrough or new knowledge to improve existing knowledge.

The program outcome was in the form of brand new technology, development of prototypes, conferences / seminars presentations, developing new product lines in the industry. Patents and further research articles was an additional contribution. Most participants believed that as a result of the projects it is expected to have a flow of information that would benefit other fields.

Some discontent exists regarding several aspects of the program. The amount of forms and complexity of the programs administrative processes. There is a difficulty in the process of signing the contract between the parties, especially with respect to ownership of the Intellectual Property. In Specific areas the dedicated period of program time is too short. The money transfer process from industry to academy.

Findings of the study

- Characteristics that affect the success of projects:
- Previous participation in OCS Magnet programs.
- Previous experience of program participants in Academic- Industry affairs.
- Achieving a high level of cooperation within the framework of the project.
- Initial proof of technological feasibility before the start of the project.
- Projects in Communications, Life Sciences, Optics, and Electronics have high success rate.
- Characteristics of projects which have been linked inversely to their success:
- A high level of uncertainty in the project.
- Projects with high-risk levels high level of innovation.

[9] Extract from a research conducted by The Samuel Neaman Institute, an independent multi-disciplinary national policy research institute. The activity of the institute is focused on issues in science and technology, education, economy and industry, physical infrastructure and social development which determine Israel’s national resilience. http://www.neaman.org.il/ מגנטון - דוח מסכם_סקר הערכת מגנטון.pdf, March 2009

- Projects from the fields of Chemistry or Materials Science.

Recommendations

Below are the research recommendations based on the conclusions of the study and suggestions raised by some of the participants.

The industrial corporation and the research institution must sign an agreement between them to set their rights and obligations upfront. In order to facilitate the process of signing such an agreement, the use of particular template agreement containing guidelines for signing in case of a “Product-specific IP" and "Generic IP".

Some of the participants raised the need for longer projects, more than 24 to 12-month duration as is defined under the program. More flexible way to build the project program. Start with technological feasibility and allow to extend the program for two or three years.

The payment method for the Academy part in the program is based on the contract between the industrial corporation and the research institution in a form of a subcontractor. In many cased the money from the OCS was not transferred to the academia. Many complains and allegations were raised by many participants from academia related to funds transfer problems.

Program participants have raised claims against the bureaucratic process and the load of the administrative burden.

Academic R&D Commercialisation

University Technology Transfer Companies

Today, all the universities have a Technology Transfer company which is in charge of commercialisation. To name some:

- Bar–Ilan Research & Development Ltd.
- BGN Technologies (Ben-Gurion University of the Negev)
- BioRap Technologies Ltd. (Rappaport Research Institute of the Technion-Israel Institute of Technology)
- Carmel-Haifa University Economic Corp. Ltd. (University of Haifa)
- Gavish Galilee Bioapplications Ltd. (MIGAL Galilee Technology Center)
- Hadasit Ltd. (Hadassah Medical Organization)
- Mor Research Applications (Clalit Health Services)
- Ramot at Tel Aviv University Ltd.
- T3 – Technion Technology Transfer (Technion Research & Development Foundation)
- Yeda Research & Development Company Ltd. (Weizmann Institute of Science)
- Yissum Ltd. (Hebrew University of Jerusalem).

For the purpose of this report, a closer look[10] is provided at one of them, Yissum – The Research Development Company of the Hebrew University of Jerusalem Ltd. Yissum was founded in 1964 to protect and commercialize the Hebrew University's intellectual property. Ranked among the top technology transfer companies, Yissum has registered over 8,900 patents covering 2,500 inventions; has licensed out 800 technologies and has spun-off 90 companies. Products that are based on Hebrew University technologies and were commercialized by Yissum generate today over $2 Billion in annual sales.

Yissum's Goals & Objectives are defined as: To protect, promote and market commercially promising inventions and know-how developed at the Hebrew University of Jerusalem. To find the "right fit" for each intellectual property asset in our portfolio. To deliver, manage, and optimize knowledge transfer to the global market through a variety of business development activities and services.

Yissum's commercialization strategies - licensing, establishing a company, joint ventures, and collaborative research - enhance the market value and performance of HU's discoveries and increase their availability to a broad global marketplace.

Like many other technology transfer companies, Yissum do not usually sell the University's intellectual property to third parties, but instead grant licenses to exploit the inventions/patents.

A royalty-based license stipulates the payment cash royalties on the licensee's sales, together with other types of lump sum or performance-based cash payments.

An equity-based license gives Yissum shares in the company (usually a joint venture in a new start-up company) in lieu of a part (or all) of license fee.

A research-based license combines a royalty- or equity-based license with a provision for the licensee to finance research carried out by the inventors at the University.

There is one additional and quite unique measure to drive commercialisation and this is The Annual Kaye Innovation Awards at the Hebrew University. Prizes are awarded annually for any innovation that shows potential for bringing profit or savings to the University principally through royalties.

10 Extracts from http://www.yissum.co.il

Applications must be well focused and accompanied by recommendations, but unlike grant proposals, anyone from the most senior to the most junior staff may apply – in fact students are always encouraged to submit proposals. The winners demonstrate not only good science, but also a focus on commercial viability and the benefits this brings to the University.

The Technology Transfer companies formed a non-profit organization, The Israel Tech Transfer Organization (ITTN)[11] serves as the umbrella organization for representing the interest of its members before the Knesset, government authorities, ministries, agencies, and committees. Advancing collaborative efforts between the technology transfer community in Israel and its counterparts around the world.

A detailed statistics regarding the Commercialization Companies in Israel is provided in Appendix C.

[11] http://www.ittn.org.il

Evaluation of Commercialisation of academic research in Israel

There are several studies regarding the commercialisation of academic research. Notable is a thorough study which was conducted by The Neaman Institute[12] in 2007 which addressed the question from legal and philosophical (the ethical approach to academic knowledge as common knowledge) aspects as well as comparison with the world.

In October 2012, the state comptroller's office published a report[13] concerning "Aspects of Intellectual Property Management at the Universities." The report notes that an examination of the current statutes of the universities in the field of intellectual property indicates that they lack information on principal and practical aspects relating to the management of intellectual property, such as the main goal of the university in knowledge transfer, the tendency to patent in any situation, the effects on basic research and knowledge sharing, the extent to which graduate students should take part in studies funded by industry and how their intellectual property rights will be determined, whether priority should be given to Israeli industry, and "how can intellectual property policy increase the institution's reputation and attract high-quality faculty and students."

A recent comprehensive research[14], published in 2013, is a must read. The following extract from it best summarises the state of this commercialisation measure.

Israel is at the forefront of the institutionalized commercialization of academic science. The mechanism of commercializing academic knowledge through patent registration and selling the license to use the patent in exchange for royalties was implemented in Israeli research institutes as early as the late 1950s. Starting in the 1970s, most universities were involved in the field in an organized fashion, using designated subsidiaries, which by the 1990s, began to be called "technology transfer companies".

In the 1980s and 1990s, these mechanisms of research commercialization were refined, and institutions such as the Weizmann Institute and the Hebrew University had impressive success stories with commercialized patents, such as the drug Copaxone (Weizmann Institute) and cherry tomatoes (Hebrew University), which ranks them among the most successful research institutes in the field of technology transfer to this day. Other Israeli universities, however, kept a low profile until the 2000s, when research colleges also entered the field of research commercialization, and a professional organization uniting the universities' companies was formed. It should be noted that contrary to the thriving debate in the United States, concerning the implications and potential hazards of commercialization, the issue enjoys wide consensus and almost no public debate in Israel.

Israel's activities in research commercialization relative to the size of the higher education sector are prominent compared to the United States, Canada, Australia, and the United Kingdom. The relative number of applications for intellectual property is higher in Israel, the total income from the sale of intellectual property and royalties in Israel is significantly higher than in Canada, Australia, and the United Kingdom and lower than in the United States. When total revenues from the sale of intellectual property are measured relative to R & D expenditures at universities, they are higher in Israel than in all the other countries compared. The number of patents per faculty member in Israel is more than double the average in the United States. Moreover, three out of the seven research

12 The Samuel Neaman Institute, an independent multi-disciplinary national policy research institute. The activity of the institute is focused on issues in science and technology, education, economy and industry, physical infrastructure and social development which determine Israel's national resilience. http://www.neaman.org.il/; http://www.neaman.org.il/Neaman2011/userdata/SendFile.asp?DBID=1&LNGID=2&GID=2174, העברת ידע באמצעות מסחור קניין רוחני, April 2007.

13 State Comptroller Annual report 63a, 2012.

14 Adi Sapir, The commercialization of academic science in Israel, Dissertation, Faculty of Management – The Leon Recanati Graduate School of Business Administration Tel-Aviv University, May 2013

universities – the Weizmann Institute, the Hebrew University, and the Technion - have developed “blockbuster” drugs, and the Weizmann Institute boasts three blockbusters to its credit. Accordingly, the Weizmann Institute and the Hebrew University are among the highest-earning universities in the international technology-transfer field.

Another important characteristic of the Israeli case is the absence of state policy or regulations. Unlike U.S. law, before the Bayh-Dole Act of 1980, Israeli law did not limit the right of higher education institutions to register intellectual property rights for the inventions of their employees, even when such inventions were developed as part of government-sponsored research. Furthermore, until today, there is no state or governmental policy concerning the principles and guidelines for research commercialization activity. The task of formulating, executing, and supervising policies remains with the management of the universities, which bear the responsibility of balancing their commercial and academic interests as well as the public interest.

The relationship between the university and academic scientists is crucial factor in the context of research commercialisation as the controversy is about WHO OWNS the right to commercialise!

The increased involvement with industry and the introduction of financial rewards into the university system has its inherent tensions and creates an arena for various conflicts and struggles between stakeholders. The conflict between scientists and the Technology Transfer Company has several dimensions:

Contested ownership of IP. The ownership of inventions and patents is one of the most controversial issues in the field of commercialisation. Academic faculty members in Israel are employees of the academic institutions in which they work. According to the Israeli Patent Law (1967), "An invention by an employee, arrived at in consequence of his service and during the period of his service (hereafter: service invention) shall, in the absence of an agreement to the contrary between him and his employer, become the employer’s property." The inventions of academic scientists can therefore be considered “service inventions.” The universities’ claims for IP ownership, their IP regulations, as well as the whole apparatus of “technology transfer,” are based on either terms of the “consequence” of service or “during the period” of the service that appear in the Patent Law. Yet, with the absence of an Israeli Bayh-Dole Act regulating universities rights in IP, this is a contentious topic, with rival claims from government, industry, and scientists.

Conflicts over royalties. This relates to the vulnerable position of graduate students and postdoctoral researchers with regard to their rights in inventions. The only IP statute that refers to cases in which the invention stems from a student's research is the Technion's. According to the Technion Bylaws of 1999, in such a case the income would be divided: 50 percent to the Technion, 25 percent to the instructor and 25 percent to the student. In the other institutes, the percentage given to students (and other research staff) depends on the principal investigator, with an option for an appeal before the VP for research. Technion's policy is intended to protect the student from dependence on the discretion of the instructor, which is prone to problems. The rights of students in inventions, their shares in royalties, and in fact in the ownership of the invention, should be regularized in statutes and not subject to the discretion or whims of professors.

Conflicts over the business of handling inventions. These conflicts revolve around the question of whether to patent an invention at all, whether to renew the patent application, whether the technology is ready for commercialization, the choice of industrial partner, and the terms of the commercial agreement. It should be noted that patenting the invention is not always the interest of the faculty… if the company decides not to patent, he has the option to pay for the patent from his own money and… FULLY OWN the invention.

Today, all Israeli universities have intellectual property rules intended to regulate the process of reporting inventions, their ownership in various circumstances, and the obligations and rights of faculty. These proactive policies designed to deal with potential conflicts of interest before they arise have been gradually adopted and modified over the years. This process of modification is still

in progress. In the 1940s, the usual compensation of inventors was up to 20 percent of profits. In the early 1960s, it was customary to pay the researchers 25 percent. At the Technion at this time, researchers were offered 50 percent. In 1969, the Hebrew University reached a compromise and gave the researcher one third of the royalties.

The late 1990s and 2000s were a period where universities all over the world, and in Israel, were examining and revising their rules and procedures. A growing concern was the universities' failure of enforcing their regulations. The Weizmann Institute was referred to as the only institute that had adopted a stricter enforcement policy.

As a result academic researchers may not disclose the existence of their inventions to their university's company and instead take them directly to private enterprises.

Would that count as Commercialisation?

Commercialisation of IP at the MoD and the IDF[15]

In view of the continuous strategic threat to the State of Israel, the MoD and the Defense Agencies make significant efforts to maintain Israel's qualitative edge over its enemies. Some of these efforts are reflected in the significant investment in research and development of innovative technologies which could be a "force multiplier" for the military. As a result, the Ministry of Defense and the IDF are key to Israel's large intellectual property, and are at the forefront of high technology in Israel and worldwide. However, this system requires high security clearance, which imposes restrictions on the dissemination of knowledge and its commercialisation, and yet it is embedded in many products Israel is exporting. In 2012, the volume of exports to the security market of the State of Israel was close to US$7.5 billion. MoD is also responsible for the training of a large number of employees in various areas of technology, and feeds them upon release or retirement to the Israeli high technology industry.

The Research and Development Agency (Mafaat) is the foundation for creating most of the intellectual property assets of the state in the field of security, based on cooperation among the three main groups: internal research and development bodies in IDF units, governmental defense industries - Israel Aerospace Industries Ltd. (IAI), Rafael Advanced Defense Systems Ltd. and Israel Military Industries Ltd. (IMI), and non-governmental defense industries, and institutions and research bodies and academic R & D projects which are funded by Mafaat.

In 2012 the R & D budget was about US$1.2 billion from the defense budget.

The IDF has many units that manufacture and develop intellectual property in various fields: from technological developments in gathering intelligence and cyber technology; through the development of weapons and protective measures and fortifications. All of the assets of the IDF, including its intellectual property assets are owned by the Ministry of Defense.

Commercialisation of Intellectual Property (IP) developed by Ministry of Defense (MoD) and by the Israel Defense Force (IDF) could be realized either directly through the sale of IP assets, goods which were developed, or receiving royalties on the use of these assets; Or indirectly by the establishment of companies which will make use of the knowledge and the product.

The state Rights to the IP developed at the MoD and the IDF are established and defined in various areas of legislation. Starting from primary legislation, including the Patents Act - 1967, the Copyright Act - 2007, Commercial Torts Law -1999; Continue with secondary legislation, such as Patents Regulations (notification Patented invention by security workers and soldiers) – 1969.

In order to facilitate commercialisation of Defense Research several laboratories and research institutes were incorporated into a state-owned companies, with the vision of maintaining their technological capabilities and continuing wide-scale R&D programs. Prominent among these are Rafael Advanced Defense Systems Ltd., and Isorad Ltd. of the SOREQ Nuclear Research Centre.

The review and evaluation of this measure is beyond of the scope of this report as no public information is available for that matter.

Nevertheless, this report suggest that the most powerful incentive for commercialising application of the research outcome was the fact that the publicly funded research entity abandoned its Intellectual Property Rights and let anyone take (commercial) advantage of it. Many did.

[15] Extract from State Comptroller Annual Report no. 64, *Intellectual property management at the Ministry of Defense and the IDF,* 2014
שם הדוח: ניהול הקניין הרוחני במשרד הביטחון ובצה"ל; מסגרת הפרסום: דוח שנתי 64ב; שנת פרסום: התשע"ד-2014

The unspoken policy of "Turning a Blind Eye" had been addressed by the State Comptroller in a report regarding the treatment of inventions developed in the Ministry of Defense and the IDF, i.e. the lack of their commercialisation by the state.

Main findings

The state Comptroller found that Ministry of Defense did not follow the Accountant General (i.e. Ministry of Finance) with regard to reporting all activities related to the management of knowledge products, in accordance with the provisions.

The State Comptroller examined these aspects of the treatment of MOD knowledge and published his findings in the mid-nineties and the beginning of the decade[16]. Following these audit reports and the resolutions received by Ministerial Committees, for a period of nine years, 2012-2004, nine different teams within the Ministry of Defense, and expert committees for examining the Defense Budget - highlighted overwhelmingly numerous deficiencies in the management of intellectual property in the Ministry of Defense, including: the Ministry of Defense does not exercise the economic potential of its intellectual property. Ministry of Defense does not protect his inventions through patents, and the accumulated knowledge and technology is not comprehensively mapped for the purpose of commercial exploitation. The Ministry of Defense does not have a full picture of the use of its knowledge y the industry.

Registration and documentation of the Ministry of Defense owned intellectual property assets

1. Registration of inventions at the end of the development process - the Ministry of Defense does not know when inventions are created in developing process; what kind they are; where are these assets, what is their value; and if there is a commercial interest or if MoD can leverage them financially in any way.

2. Registration of knowledge based tangible assets - It was found MoD does not document systematically most parts of concrete knowledge based products (i.e products which were developed with MoD funding). In addition, the Ministry of Defense does not have a body which has the responsibility to manage the intangible knowledge. As a result, there is no accurate, current and complete information whereby it can MoD charge industries accordingly.

3. Registration of the copyright to the IDF and Ministry of Defense and the collection of royalties in respect - There is no Ministry of Defense or IDF documentation of copyrights and therefore the Ministry of Defense is not keeping track of the use made of these rights and does not charge royalties for such use.

1. IDF Intellectual Property Management

It was found that the IDF fails to manage the Intellectual Property assets in his possession, it does not keep records of these assets and their use, and does not have the data to reflect on the actual situation in the IDF regarding the use of intellectual property, including current and accurate data on the amount, the type and value of the various existing intellectual property possession.

Treatment inventions developed by the Ministry of Defense and the IDF

1. The legislation imposes the obligation on civil servants, soldiers and civilian IDF employees, who developed by the way of their work and their service inventions, to notify the invention to the Sitting Invention Committee. It was found that the said committee was first appointed only in July 2012.

2. Despite the extensive activity of the Ministry of Defense and of the IDF in R&D and the potential inherent in this for inventions, the Ministry of Defense workers and soldiers do not report to their

[16] Annual Report no. 46, 1996

superiors or the Ministry of Defense regarding their inventions, except for some isolated cases (there were three cases from 2010 until the date of completion of the audit).

Interviews

Mr. Dan Vilenski - Mr. Vilenski is responsible for the successful integration in Israel of three independent subsidiaries for leading American high tech companies: Kulicke and Soffa (K&S), KLA Instruments and Applied Materials. Mr. Vilenski served (1993-1996) as Executive Director of the Israel - US joint Bi-national Industrial Research and Development (BIRD) Foundation, spearheading innovative industrial cooperation between Israeli and US high tech companies. Mr. Vilenski serves on the Board of Governors of the Technion and is a member of the Board of the Israeli National Nanotechnology Initiative. In this capacity, he is driving the commercialisation by Technion faculty.

The following are the key Lesson Learnt as suggest by Mr. Vilenski:

1. It is highly recommended to appoint as CEO of the University Commercialisation Company an Operational Manager (bulldozer) to drive the process. In particular, Mr. Vilenski found that appointing lawyers rather than industry veteran is a common mistake.
2. The most effective mode of operation is – granting an exclusive right to commercialise certain technology for two year to a qualified industry veteran, no upfront license fee, just royalties.
3. It is highly recommended to classify the faculty into two categories – pure researchers and applied researchers. Focus on cooperation with the faculty that has tendency toward applied research.
4. Mr. applied successfully a “golden eggs quest” model in which he engaged experienced entrepreneurs as scouts – visiting the labs on a periodic basis, looking for hidden “golden eggs”. Once identified – the entrepreneur got the opportunity to be one of the founders of the new start-up company.
5. The Technion, like many other universities has a Donors Society, which has as members many successful and experienced industry veterans. It is advised to offer these members a unique track, subject to certain donation, of quarterly innovation report with the Right of First Look which will allow them to negotiate early cooperation in the commercialisation of certain innovations.

Mr. Vilenski expressed his readiness to further elaborate his experience with ACOLA team.

Dr. Eli Even - Dr. Even is the Head of Research Authority in Bar Ilan University. He has over 15 years' experience investing in advanced materials and Cleantech space. Dr. Even obtained his PhD in Applied Chemistry from the Hebrew University in Jerusalem.

Dr. Even co-founded Terra Venture Partners, an Israeli cleantech VC. Dr. Even developed his expertise in the local market of renewable energy, and water and environmental technologies. Dr. Even also served as the investment manager at the Millennium Materials Technology Fund (MMTF), the only Israeli venture capital investment vehicle focused primarily on investments in new materials. During Dr. Even's tenure at MMTF, the fund had $52 million under management, and held a portfolio of 17 mature companies. These companies focused on advanced materials, with applications varying from batteries to life science and semiconductors. Several investments identified and nurtured by Dr. Even are among the most promising companies in their respective sectors. Dr. Even also served as the Scientific Director of ATI Water and Environmental Technology incubator, as a representative of Dow Chemicals.

This vast experience in these fields makes Dr. Even one of the top consultants for VCs and other investment vehicles interested in cleantech, chemistry and materials, and nanotechnology.

More recently Dr. Even has become an Advisory Group Expert Risk Finance at the European Commission. He has a role as team leader for the technology transfer group within this committee.

The following are the key Lesson Learnt as suggest by Dr. Even:

1. Dr. Even estimates that only 5% of the IP developed by the university is being commercialised.
2. According to the data collected by Dr. Even none of the University Technology Transfer companies (with the exception of the Copaxone patent contribution) is economically viable operation.
3. From BIU experience, the OCS programs, such as Kamin, do not contribute to the commercialisation of the research as they are been used just to fund basic research. It seems like the OCS focus is not in supporting academia but rather the big industry actors.
4. Dr. Even is very experienced with the measures deployed by the EU to support small companies, methods which are similar to these used by the USA too. The key difference to note is the lack of "strings attached" to the grant. A company has to qualify in order to get a grant, but thereafter it has no obligations.
5. Dr. Even is actively promoting fund raising from the University Donors Society as well as from large international corporations in an effort to establish university own resources to fund the commercialisation of its IP.

Dr. Even expressed his readiness to further elaborate his experience with ACOLA team.

Appendix A – Overview of Israel's R&D Law and Funding by the Office of the Chief Scientist[17]

Introduction

This memorandum describes the major provisions under Israel's Encouragement of Research and Development Law, 1984 (the "**R&D Law**"), with respect to grants provided by the Office of the Chief Scientist of the Ministry of Industry and Trade (the "**OCS**"), and certain obligations and restrictions imposed by the R&D Law. These restrictions have important implications for technology-related transactions between Israeli and non-Israeli entities as detailed further below. A fifth amendment to the R&D Law was recently enacted under the Economic Arrangement Law, 2011-2012 (the "**Recent Amendment**"), and this memo takes into account the material provisions thereof.

Grants and Royalties

Purpose. Among the R&D Law's stated objectives is the creation of new employment opportunities in the technology industry through the encouragement of domestic research and development projects.

Grant application. A grant application must describe the research plan, the applicant company's business, and particularly the technology intended to be developed in the context of the research plan. Significantly, the application must indicate the portion of manufacturing of products developed with OCS assistance to be performed in Israel. Under the Recent Amendment, a grant applicant is required to undertake to ensure that all know-how derived from the research and development performed under an OCS-approved program, and all rights deriving therefrom, will be owned by the applicant from the time of the creation of such know- how.

Grant amount. Grants are available in amounts ranging from 20% to 50% of the approved budget. In practice, grants at the maximum rate of 50% are not awarded to companies reporting that more than half of the relevant manufacturing will be conducted outside Israel. Grants at a rate of 66% of the approved budget are available through the "Magnet/Magneton" program (a special program intended to encourage cooperation between industry and academia).

Reporting. Periodic reports must be submitted by the company to the OCS with respect to royalty accrual and application of grant monies to the approved budget. This often requires employees to itemize their time spent on particular research projects.

Royalty obligations. Royalties are payable on sales[1] of (i) products developed in the context of the research plan, (ii) associated services, and (iii) products developed with company (non-OCS) financing but based on core technology developed in the approved research plan ("Supported Products"). Royalties are paid at rates beginning at 3% of sales, depending on various criteria (see below). Royalties are payable until 100% of the amount of the grant has been repaid with interest as provided in the applicable regulations (or a higher percentage, if some of the manufacturing is transferred overseas – see below). Of particular importance to note is that restrictions on overseas transfer and manufacturing, discussed in detail below, continue to apply despite full payment of the grant. "Magnet/Magneton" grants are royalty-free.

Calculation of royalties on sales to affiliates. In case of sale by the applicant company to an affiliated company, followed by resale by the affiliated company to a third party customer, the "sale price" is deemed the consideration received upon such resale to a customer. An "affiliated entity" in this respect means (i) a directly or indirectly controlled or controlling entity, or an entity

[17] *Memo to Clients - RD Law and OCS (July 2011)* - Yigal Arnon & Co. - Law Firm, July 2011. www.arnon.co.il

under common control; or (ii) an entity which was granted manufacturing rights in the Supported Products.

Regarding sales to an affiliate which are not for resale, the law states that "*in special cases of sale for non-monetary consideration or a price affected by a proximate relationship, the [Research] Committee may determine the sale value according to the accepted market value*."

Calculation of royalties on "combined" products. The OCS recognizes that a Supported Product may constitute a part of a "combined" product or a system of products. In such cases, royalties are paid only with respect to the Supported Product, and the sale price subject to royalty obligations is calculated in one of two ways: (i) if the Supported Product has a separate market price, then that price applies; (ii) if the Supported Product does not have a separate market price, then the applicable sales price will be determined on the basis of the relative cost of production of the Supported Product and the remaining components of the combined product.

Commitment to own Know-How. The Recent Amendment requires that a grant applicant undertake to ensure that all know-how derived from the research and development performed under an OCS-approved program, and all rights deriving therefrom, will be owned by the applicant from the time of the creation of such know-how, unless provided otherwise in the R&D Law. The primary exception in this regard, also introduced in the Recent Amendment, relates to institutions of higher learning (as defined under Israeli law). The scope of this exemption, and the way in which this exemption will be implemented, however, depends on supporting regulations which have yet to be enacted.

1 Royalties are paid with respect to the "sale price" or Supported Products, defined in regulations as "*an amount of any kind entered or attributed by the company in its books or audited financial reports in the context of income from the sale of a product, as calculated and listed in [US] dollars according to the exchange rate published immediately prior to the sale, including agents' commissions, marketing commissions, and costs of shipping, travel, agency fees, and the like, and excepting purchase tax, VAT and exchange rate insurance."*

Manufacturing Rights

Manufacture of Supported Products outside of Israel; increased royalties. When submitting a grant application, the applicant must declare the manufacturing and added value[2] percentage in Israel with respect to products derived from the research program. As mentioned above, this declaration has a direct bearing upon determination of the size of the grant, and the royalty rate. Consequently, the R&D Law requires that Supported Products be manufactured in Israel in accordance with the percentage declared in the application.

The OCS has the discretion to permit overseas manufacture[3] in excess of the declared percentage. In the event of overseas manufacture, the rate of royalties are increased as follows: If the overseas manufacturing is performed by the company receiving the grant (or a related entity, as defined), then royalties on the sales of such products increase by 1%; in the event that the manufacturing is performed by *another entity*, the royalty rate is equal to (i) the grant amount divided by (ii) the amount of the grant plus the company's investment in the research project (this can be a very large percentage). In addition, the ceiling on royalties (ordinarily 100% of the grant amount) is increased as follows:

Relative portion of overseas manufacturing	**Increase of royalty ceiling (percentage of the grant)**
Up to 50%	120%
50% to 90%	150%
90% to 100%	300%

Alternatively, the R&D Law provides a mechanism whereby manufacturing rights may be transferred overseas in return for the transfer of other manufacturing rights into Israel, without incurring changes in royalty payments.

A grant recipient may increase the percentage of overseas manufacture in excess of the declared percentage without prior OCS approval provided that such increase is *less than* 10% (in the aggregate) of the declared percentage, so long as the OCS is notified of the change and does not does not object to such deviation within 30 days of receiving such notice.

Definition of "Manufacturing". In the case of software products, the OCS has opined that the place of "manufacture" does not have any real importance, because of the negligibility of costs and manpower associated with such activities. Thus, various "fulfillment" functions, such as

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2 "Percentage of Added Value" is defined as "*the amount of the manufacturing costs carried out in a particular country, less costs imported for the purpose of manufacturing in such country, against the price of the product ex works*".

3 "Transfer of manufacturing rights" is defined as "*an authorization to a third party to use know-how developed in the scope of, or resulting from, a [research] plan, for the purpose of manufacturing a particular product only, while all the remaining rights to use and exploit the know-how remain vested in the transferor in Israel*".

copying software, preparing packaging, printing manuals and the like, can be performed outside of Israel without penalty. In certain cases, where it is not possible to manufacture Supported Products in Israel, the OCS may waive the royalty increase.

Transfer of Know-How

Transfer of Know-How between Israeli entities. The OCS may approve transfers of "*know-how derived from research and development in accordance with an approved program … and all rights deriving therefrom*" ("Know-How") between Israeli entities, provided that the recipient undertakes all of the obligations in connection with the grant, including transfer restrictions and royalty payments. Approval for such transfers is easier to obtain when the recipient company intends to continue commercializing the Know-How.

Restriction on overseas transfer of Know-How. The R&D Law restricts the overseas transfer of Know-How, but the term "transfer" is not defined. Based on previous experience with the OCS, a transfer generally includes the assignment of legal rights in the Know-How (in other words, legal transfer) as well as the transfer of the substance of the Know-How (i.e., the source code in the case of software) together with rights to conduct follow on research and development work.

Authorized transfer of Know-How outside of Israel. The OCS is authorized at its discretion, to approve the overseas transfer of Know-How subject to the receipt of certain payments. The formulae for determining such payments are not always clear, and the amount to be paid may vary tremendously depending on the particular circumstances. The formulae provide as follows:

I. *Transfer of Know-How Only*. In the case of the transfer of Know-How (as opposed to the sale of a company or a company's assets), the GREATER of the following must be paid:

(i) the amount equal to the sale price[4] of the Know-How multiplied by a fraction, the numerator of which is the total of all grants[5] received by the recipient of the approval under the R&D Law, and the denominator of which is the total monetary investment in performing the research program. This ratio would normally correspond to the percentage of the program's budget financed by the OCS; or

(ii) the amount of the aforesaid grants, plus annual interest as provided by the R&D Law (based on LIBOR rates), less royalties paid.

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4 The law offers no guidance as to how to address a sale price that is unknown at the time of the sale, and will be received in instalments over time. In practice, the OCS tries to determine the present value of the Know- How, notwithstanding all of the inevitable uncertainties inherent in such a determination.

5 The numerator of the fraction that determines the amount to be paid to the OCS is stated to be the total of all grants received by the recipient under the R&D Law, and therefore would appear to include grants that have nothing to do with the know-how being sold. We suspect that this is simply a mistake, and that the intention was to take into account only grants that were related to the know-how being sold, but the wording of the law remains.

II. *Transfer of Entire Company.* When Know-How is transferred overseas as part of a sale of the grant recipient itself "*as a result of which the recipient of the approval ceases to be a legal entity incorporated in Israel*", the recipient of the approval will pay the GREATER of the following:

(i) The amount equal to the sales price of the grant recipient multiplied by a fraction, (x) the numerator of which is the total grants received by the grant recipient under the R&D Law, and (y) the denominator of which is the total monetary investment in the grant recipient (including OCS grants), less the amount of "net financial assets"[6]. Under the Recent Amendment, the denominator was amended to include all research and development expenses of the grant recipient, approved by the Research Committee of the OCS. This amendment is subject to the adoption of regulations in this respect, and will only come into effect upon the adoption of such regulations; or

(ii) the amount of the OCS grants, plus annual interest as provided by the R&D Law, less royalties paid.

III. *Depreciation.* The repayment amount derived from the formulae in *I* and *II* above, is reduced in accordance with the following depreciation formula: After three years have elapsed from completion of the research project, the repayment amount is gradually reduced, on a linear basis, over a seven-year period, to a minimum amount equal to the original grant amount plus interest, minus royalties actually paid. Thus, commencing ten years after the completion of the research project, the maximum payment will be the original grant, plus interest, less royalties paid. Under the Recent Amendment, this mechanism may be amended by the OCS by extending the depreciation term, subject to the adoption of applicable regulations to this effect. As of the date of this memo, no such regulations have been adopted.

IV. *Maximum Repayment Amount.* The Recent Amendment authorizes the Ministers to set guidelines with respect to a maximum repayment amount in the event of an authorized transfer of Know-How outside of Israel – applicable both to the transfer of Know-How only and the transfer of the entire company. As of the date of this memo, however, such guidelines have not yet been enacted.

V. *Sale of Company for Shares*. Special provisions apply to a sale of the company in consideration for shares in the acquiring company. These provisions are beyond the scope of this memo.

VI. *Sale to an Affiliated Entity*. In cases where no consideration is paid, where the transfer of Know-How is between affiliated entities, or by way of merger, or in the event the Research Committee believes the sale price is not "realistic", the OCS can determine the

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6 Regulations interpreting the term "financial assets" have not yet been promulgated, and accordingly such assets are not currently included in repayment calculations.

sales price on the basis of an expert opinion. An "affiliated entity" in this respect means (i) a directly or indirectly controlled or controlling entity or an entity under common control; or (ii) an entity which was granted manufacturing rights in the Supported Products.

VII. *Consideration in the form of know-how.* If consideration for the Know-How outside of Israel is in the form of know-how developed outside of Israel (i.e., the Know-How exits Israel and the consideration know-how is brought into Israel), the Research Committee can authorize such transfer without repayment.

VIII. *Exclusive license to Israeli transferor.* In connection with the transfer of Know-How only, if the overseas recipient of title to the Know-How grants back to the Israeli transferor a comprehensive, exclusive, irrevocable license, unlimited in time and territory, then the transfer can be approved without requiring any of the payments described above.

IX. *Liquidation-related transfer.* In the case of a sale in the context of the liquidation for insolvency of the grant recipient or in the case of receivership of the grant recipient, if the sales price for the Know-How is less than the amount payable to the OCS, the Committee is authorized to reduce the payable amount lower than the grant.

Licensing Arrangements. Under the current regime established by the R&D Law, there is no mechanism to obtain OCS approval for the granting of licenses to Know-How to non-Israeli entities, a problematic reality in light of the fact that licensing transactions are widespread in the high-tech industry. The R&D Law does include, however, a provision permitting the Ministers to enact guidelines governing the granting of broad licenses (that is, exclusive, irrevocable, worldwide, etc.) to foreign licensees of OCS-supported Know-How, as well as arrangements regarding payment by the licensor/grant recipient to the OCS. The Recent Amendment clarified that these guidelines may also include payment by way of installments. While the technology industry has been waiting patiently for years for the OCS to enact licensing guidelines, we understand that the OCS is now more actively pursuing this goal. As of the date of this memo, however, it is not possible to predict when these guidelines will be formally enacted.

It should be noted that one possible exception to the foregoing lacuna is the case of a grant of a broad license (that is, exclusive, irrevocable, worldwide, etc.) where the OCS may consider such license as a "transfer of Know-How" provided that the licensor/grant recipient agrees to pay a one-time payment upfront to the OCS (based on the formulae described above) even where the entire consideration under the license agreement is not fully-paid in advance. This arrangement, however, is predicated on the assumption that it is possible to calculate the full consideration to be paid in respect of the license grant, something that is rarely possible to determine in most licensing transactions since consideration very often includes royalties and payments on sublicense income – future amounts that are impossible to determine upon license grant. It should also be noted that in the past, where recipients of OCS funding granted licenses that included the right to manufacture products based on or embodying OCS-supported technology,

approval could sometimes be obtained under the "transfer of manufacturing rights" track discussed above. Such approval, however, often depended on the specific nature of the transaction and was not applicable generally to the wide range of technology licensing transactions.

General

Changes of control in the grant recipient. Under the R&D Law, the OCS must be notified of any change of control in the recipient company. Foreign entities acquiring or becoming "interested parties" in the recipient company must execute a standard form of undertaking to observe the R&D Law. The terms of certain grants require prior approval for any change of control.

Liquidation and bankruptcy proceedings. According to the Recent Amendment, in the event that a liquidation proceeding is commenced against the recipient of an OCS grant, or a request for a bankruptcy proceeding or other arrangement with creditors is filed, or where the company elects to proceed with a voluntary liquidation, the OCS must be notified promptly in accordance with the timeframes set out in the R&D Law. In addition, where a liquidator, receiver or other court-appointed official is designated for the recipient company, the OCS must also be notified.

Appeals. Decisions of the Research Committee may be reconsidered at a "further hearing" before the same committee, or on appeal to an Appeals Committee.

Penalties. Under the R&D Law, unlawful overseas transfer of Know-How is a criminal offense punishable by three years' imprisonment. We are unaware that any person has been sentenced to imprisonment on such grounds. Other violations of the law are subject to fines and the repayment of the entire grant.

Appendix B – Israel Expenditure on Civilian R&D, 2013[18]

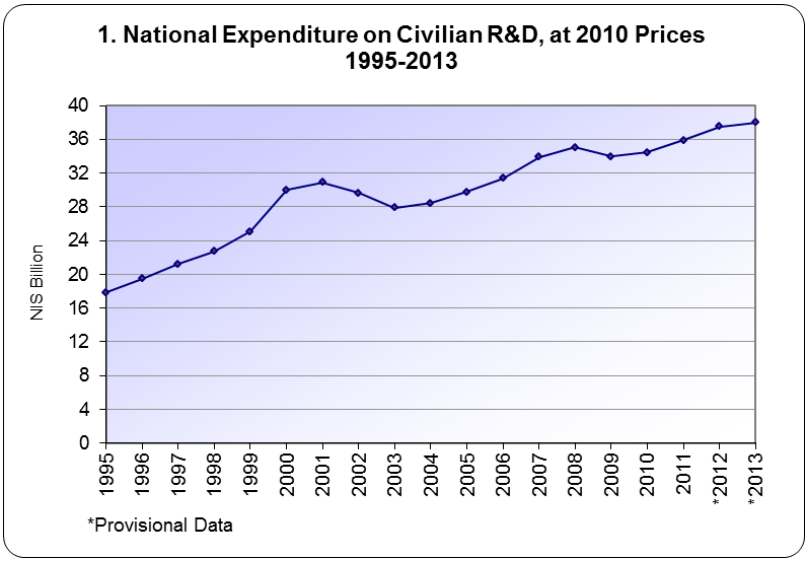
A Moderate Increase in the National Expenditure on Civilian R&D, in 2013

- National expenditure on civilian R&D in 2013 amounted to NIS 44.2 billion – 4.2% of the GDP. In 2012, National expenditure on civilian R&D amounted to NIS 41.2 billion and its share of the GDP was similar to the share in 2013.
- In the Business sector: Increase of 1.2%, at constant prices, in 2013, following an increase of 5.0% in 2012 and of 4.5% in 2011.
- In the General government sector: an increase of 3.6%, at constant prices, following an increase of 5.5% in 2012 and of 6.5% in 2011.
- In 2011, 46% of the R&D financing were from Funds from abroad and 39% were from the Business sector.
- The national expenditure on civilian R&D per capita, in 2013, amounted in Israel to 1,357 dollars (at current prices, in PPP terms of GDP). In 2012, the national expenditure on civilian R&D per capita amounted in Israel to 1,305 dollars – among the higher OECD member countries.
- The total number of full time jobs in R&D, in 2011, was 70,412.

National expenditure on civilian R&D, at current prices, amounted to NIS 44.2 billion in 2013, and comprised 4.2% of the GDP.

According to provisional estimates, in 2013 the national expenditure on civilian R&D, at constant prices, increased by 1.3%, following an increase of 4.5% in 2012 and of 4.1% in 2011.

Data for diag. 1



[18] Central Bureau of Statistics – Media Release 25 August 2014 - www.cbs.gov.il

TABLE 1. - NATIONAL EXPENDITURE ON CIVILIAN R&D COMPARED TO SELECTED MACROECONOMIC INDICATORS

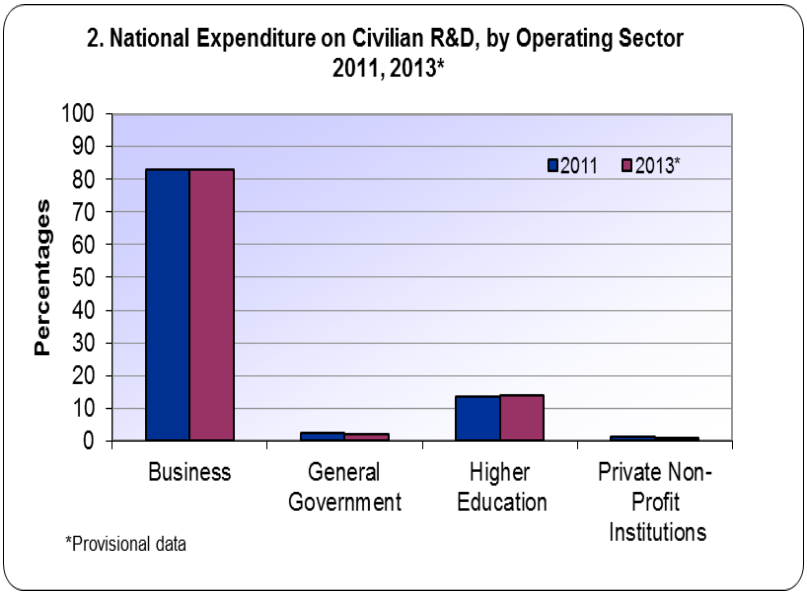
Percent

National expenditure on civilian R&D	2006	2007	2008	2009	2010	2011	2012*	2013*
Yearly change at fixed prices	5.6	7.9	3.4	-3.1	1.5	4.1	4.5	1.3
As a percent:								
Of gross domestic product (at current prices)	4.1	4.4	4.4	4.2	4.0	4.1	4.2	4.2
Of net domestic product (at current prices)	4.9	5.2	5.1	4.8	4.6	4.7	4.8	4.8
Of gross domestic investment in fixed assets	22.3	22.7	22.8	23.1	21.7	20.3	20.5	21.6
Of gross investment in economic industries	29.7	29.6	30.8	32.2	31.1	29.2	29.9	31.9
Thereof: Business Sector								
Yearly change at fixed prices	6.1	9.2	3.7	-3.8	1.4	4.5	5.0	1.2
As a percent:								
Of gross investment in capital formation	18.4	19.2	19.0	19.3	18.0	16.9	17.3	17.9

***Provisional data**

The expenditure on civilian R&D (at current prices), in the Business sector amounted to NIS 36.6 billion in 2013, comprising 83% of total national expenditure on R&D. The remainder was expenditure on R&D carried out at universities (14%), in the General government sector – 2% and in Privatenon-profit institutions – 1%. Data for diag. 2

Increase in R&D Expenditure in the Business Sector – Increase in the Development Centres of Multi-National Companies' Activity



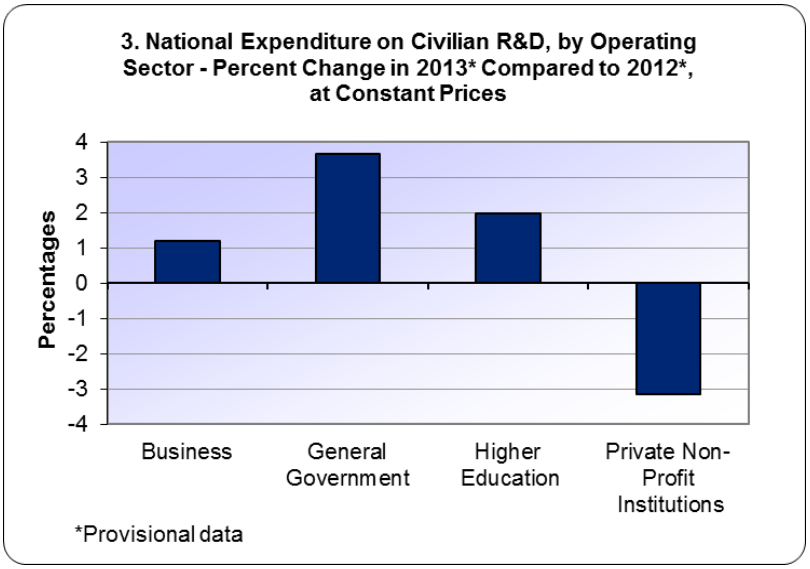
The development, at constant prices, reflects a 1.2% increase in expenditure on R&D in the business sector in 2013, following an increase of 5.0% in 2012, and of 4.5% in 2011.

The increase in the expenditure on R&D performed in the Business sector in 2013 mainly reflects an increase of 2.7%, at constant prices, in software companies, following an increase of 7.0% in 2012, and an increase of 1.8% in R&D companies (including start-up companies, international R&D centres, technological incubators and research institutes), following an increase of 6.1% in 2012.

The expenditure on R&D in development centers of multi-national companies (Including fixed capital formation, excluding payments to outside entities) amounted to NIS 15.8 billion in 2012, an increase of 13.7%, at current prices, compared to 2011. The entire R&D performed in these companies, was designated to be used abroad.

In manufacturing industries the expenditure decreased by 1.4% in 2013, 1after an increase of 0.6% in 2012.

The General government sector's expenditure on R&D increased by 3.6% in 2013, following an increase of 5.5% in 2012 and an increase of 6.5% in 2011. In Higher education institutions, R&D expenditures increased by 2.0%, following an increase of 1.8% in 2012. The expenditure in Private non-profit institutions decreased by 3.1% in 2013, following a decrease of 0.3% in 2012.



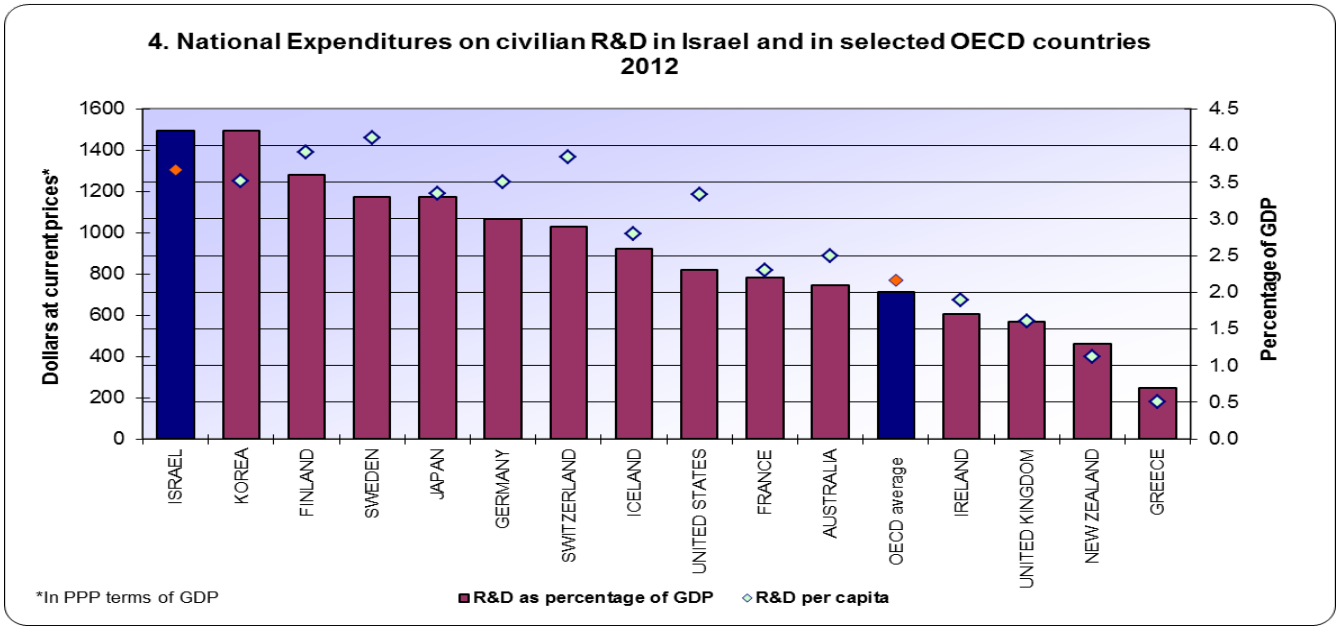
Data for diag. 3

The Major R&D Financing Sources – Funds from Abroad and the Business Sector

The most recent data on the distribution of financing, for 2011, show that the Business sector financed 39.3% of all civilian R&D expenditure in Israel, higher than in 2010 (37.6%). About 45% of the R&D operated in the business sector was self-financed and about 51% was financed by funds from abroad. The General government sector financed, mainly through transfers to higher education institutions and by self-financing, 11.1% of the expenditure, slightly lower than 2010(12.5%). Higher education institutions financed 2.2% of the total national expenditure. The General government sector financed about 45% or the R&D operated by the Higher education institutions. Private non-profit institutions financed 1.9% of the total expenditure. The R&D operated by this sector was mainly financed by funds from abroad (36.2%) and by the General government sector (31.4%). Funds from abroad financed 45.6% in 2011, similar to 2010 (46.4%). The financing from abroad was mainly allocated to the business sector.

National Expenditure on Civilian R&D in Israel – among the Highest in OECD Member Countries

In 201**2**, national expenditure on civilian R&D in Israel, as a percentage of the GDP, was 4.2% - higher than in all OECD member countries. The national expenditure on civilian R&D per capita, which amounted to 1,305 dollars, was among the higher OECD member countries.



Data for diag. 4

R&D Finance by Government Ministries was Mostly Allocated to the Universities

Government ministries' expenditure on civilian R&D amounted to NIS 6.5 billion in 2013. This expenditure includes commissioning of research from other institutions and transfers for financing of R&D in other sectors, including the General University Fund. Most of the expenditure of government ministries was by the Ministry of Economy. The expenditure of this ministry, which constituted 63% of the overall expenditure of Government ministries on R&D (excluding GUF) in 2013, decreased, at current prices, by 3.9%.

The breakdown of expenditures on civilian R&D of government ministries, by objectives shows that in 2013 the share of grants for the advancement of research, which mainly includes the finance of the General University Funds, amounted to 56%. Expenditures for advancement of industrial technology amounted to 30%. The main expenditure in this field was for grants awarded by the Ministry of Economy to industrial companies; 7% of R&D expenditure, in 2013, was allocated to R&D in agriculture; 4% for research in social services - education, labor and social welfare, immigrant absorption, etc., and 1% of the expenditure was allocated to R&D in infrastructure (including research on transportation and on urban and rural planning).

TABLE 2. GOVERNMENT MINISTRIES' EXPENDITURE, BY OBJECTIVES, at current prices (Including General University Funds)

Objective	2006	2007	2008	2009	2010	2011	2012*	2013*
TOTAL *(NIS Million)*	4,184	4,121	4,539	5,557	5,345	5,807	6,171	6,540
	Percent							
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Advancement of research	**49**	**51**	**50**	**55**	**54**	**56**	**53**	**56**
Advancement of industrial technology	**36**	**33**	**35**	**33**	**33**	**31**	**33**	**30**
Development of agriculture, forestry and fishing	**7**	**8**	**7**	**6**	**7**	**7**	**6**	**7**
Social services	**5**	**5**	**5**	**4**	**4**	**4**	**5**	**4**
Development of infrastructures	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
All the rest	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**2**

***Provisional data**

85% of the R&D Full Time Jobs – in the Business Sector

The total number of full time jobs in R&D, In 2011, was 70,412. The distribution by sector shows that 85% were in the Business sector, 13% were in the Higher education sector, 1% was in the General government sector and 1% was in the Private non-profit institutions. Of the total number of full time Jobs, 23% were women's jobs, most of them in the Business sector (81%).

Of the total number of full time jobs, 73% were for academic professionals, of whom 90% were in the Business sector and 8% were in the Higher education sector. 22% of the academic professionals' full time jobs were women, of whom 87% were in the Business sector and 11% were in the Higher education sector.

The data is based on findings of the Survey on Research and Development in Government Institutions and in Research Institutions and Units 2009.

TABLE 3. FULL TIME JOBS IN R&D, BY SECTOR, SEX AND EDUCATION

2011

***In the General government sector, including students financed by scholarship.**

	Private non-profit institutions	Higher Education	General Government	Business	Percentages	Total
FULL TIME JOBS – TOTAL	554	9,220	837	59,800	100.0	70,412
Percentages	0.8	13.1	1.2	84.9		100.0
Thereof: women	**253**	**2,415**	**513**	**13,277**	**23.4**	**16,458**
Education						
Practical engineers and technicians	**23**	**2,766**	**123**	**8,898**	**19.0**	**11,810**
Thereof: women	**6**	**725**	**55**	**2,102**	**4.7**	**2,888**
Holders of academic degrees	**418**	**5,994**	**477**	**46,462**	**73.3**	**53,351**
Thereof: women	**217**	**1,570**	**336**	**9,432**	**15.8**	**11,555**
Other education*	**113**	**461**	**237**	**4,440**	**7.7**	**5,251**
Thereof: women	**30**	**120**	**122**	**1,743**	**2.9**	**2,015**

Appendix C - Survey of Commercialization Companies in Israel[19]

Survey of Commercialization Companies in Israel 2012-2013

Reports on Inventions, Patents, License Agreements, Revenues and Startup Companies

The survey of commercialization companies in Israel for 2012- 2013 includes those companies associated with research universities (eight companies for the eight universities), and companies associated with hospitals and research institutions. This is the third survey conducted on commercialization companies.

- Most patents that were commercialized by commercialization companies belong to Israeli companies; most of the royalties received came from Israel as well as most of the startup companies were established in Israel.
- In 2012-2013, approximately 1,**438** IP invention disclosure reports were submitted by the researchers of various universities and R&D institutions for examination by the commercialization companies; of those, the companies decided to protect **922**. About **1,019** of the reports were by companies at the universities, an increase of 2.2% compared to 2010-2011, and a 1% increase in 2010-2011 compared to 2008-2009.
- Commercialization companies filed 451 original patent applications in 2013, of which 51 were submitted in Israel, and in 2012, 516 original patent applications were submitted, 33 of which were submitted in Israel. The number of original patent applications rose over the period 2008-2013 by 34%.
- The dominant fields of the original patent applications were medicines (24%), bio-technology (17%), and medical equipment (13%). In 2012, these were 5**6**% of all applications, and in 2013, about **53**% of all applications.
- In the years 2012-2013, commercialization companies have been involved in the establishment of 72 start-up companies. The main industries of the start-up companies are scientific research and development (**81**%) and computer programming (**7**%).
- The revenues from sales of intellectual property and gross royalties amounted to NIS 1,8**81** million in 2012, compared to NIS 1,680 million in 2011, an increase of 11.9% (see notes A and B below). Most of the revenues from sales of intellectual property (IP) and gross royalties received in 2012 came from Israel - 72%. The dominant field of the received revenues was medicines (94%).
- The revenues from sales of intellectual property and gross royalties in universities in 2012 amounted to NIS 1,853 million in 2012, compared to NIS 1,658 million in 2011, an increase of 11.8%.
- Approximately 7**1**% of the professional employees in all the commercialization companies had a first or second degree; 2**4**% had a PhD degree. The dominant field of study of the professional employees was Life Sciences (23%); 37% of the employees worked on business development in the commercialization companies. The number of professional employees at the companies associated with the universities increased by 27%, compared to 2011, following an increase of 51% compared to 2009.
- Israel is high in all indicators of international comparison (after normalization): the number of invention disclosures, patent applications, license agreements, startups established and revenue from IP and royalties.

Definitions

[19] Central Bureau of Statistics – Media Release, August 26, 2014 - www.cbs.gov.il

Background

The survey for years 2012-2013, compared to previous surveys:

Notes:

A. One commercialization company was added to the commercialization companies associated with the universities in the current survey for the years 2012-2013, compared to previous surveys.

B. In 2012 and 2013, eleven companies were included in the survey from hospitals and research institutions, compared to six companies in 2010 and 2011. In the research institutions category, two colleges were included for reasons of statistical confidentiality.

C. The survey for the years 2008-2009 included only the companies associated with universities.

- The role of commercialization companies is to search out, develop, and market the knowhow accumulated in the institutions mentioned above, to turn a patent into a commercial product, and help in creating startup companies. Commercialization companies with these activities contribute substantially to the growth of the economy concomitant with increasing the income of the institutions they represent.
- This survey was initiated and supported by the Israel National Council for Research and Development, of the Ministry of Science, Technology and Space. The questionnaire deals with the following topics: expenditure and personnel in the field of managing IP (Intellectual Property), IP and its protection (inventions, patents, etc.), revenue from IP, startup companies and more.

The findings of the survey were as follows**:**

The Activity of Commercialization Companies

- Commercialization companies deal with the management of intellectual property (IP). IP is a generic term referring to rights associated with intangible resources that were a person's intellectual creations, such as patents, copyrights, and trademarks. These property rights enable the holder to form a monopoly on the use of the item for a certain period and in certain countries.
- There are different types of intellectual property: inventions, computer programs, databases, educational material, other means, industrial designs, un-registered trademarks (™) or registered trademarks (®), new varieties of plants, etc. This survey is about inventions which are usually protected by patents, since the first survey conducted by the CBS revealed that almost all the activities of the commercialization companies focuses on promoting this type of intellectual property.
- The commercialization process in these companies usually takes this form: Initially the companies approach the academic staff at the university, hospital or research Institution to receive the ideas, innovations and new inventions. Commercialization companies then examine whether the ideas, inventions or innovations are able to be legally protected and whether they have commercial potential that justifies a patent application. They decide to continue the process with selected ideas and reject others.
- In the continuation of the process, the companies submit patent applications to the appropriate authorities in Israel and abroad, and attempt to market the patent rights to companies in Israel and abroad. The companies may sell exclusive or non-exclusive rights on the use of the patent but usually do not sell their ownership of the patent.

Reports on Invention Disclosures

In 2012 and 2013, commercialization companies received 1,438 invention disclosure reports, about **1,019** from commercialization companies at universities; of all disclosures, it was decided to protect 922 cases, to reject 3**2**3 cases, and in 193 cases a decision was not yet reached.

Compared to 2010 and 2011, there was an increase of**20%** in total invention disclosures reports (see notes A and B in page 2) in all the institutions. In the companies at universities, there was an increase of 2.2%, compared to **2010-2011**.

The dominant fields in invention disclosures reports of the companies associated with the universities were: biotechnology, medicines, physics, electronics and electro-optics, and chemistry and nanotechnology.

The dominant field in invention disclosures reports of hospitals was medical equipment.

The dominant field in invention disclosures reports of research institutions and colleges was agriculture and plant genetics.

Table A: Invention Disclosure Reports (IP), 2012-2013

	Cases reported	Decided to protect	Decided to reject	Not yet decided
Total	1,438	922	323	193
Universities	**1,019**	**729**	**213**	**77**
Hospitals	**311**	**137**	**92**	**82**
Research institutions and colleges	**108**	**56**	**18**	**34**

Note: The commercialization companies receive invention disclosure reports. These invention disclosures undergo tests with multiple criteria. Ultimately, the commercialization companies decide to protect only the inventions that pass all the tests.

Table B: Invention Disclosure Reports (IP), by Field of Activity and Type of Institution, 2012-2013

Type of institute	Cases reported	Decided to protect	Decided to reject	Not yet decided
Total	**1,438**	**922**	**323**	**193**
Companies associated with Universities- total	1,019	729	213	77
Agriculture and plant genetics	28	18	4	6
Biotechnology	192	139	38	15
Medicines	201	138	50	13
Medical equipment	80	52	20	8
Mathematics and computer science including applications	127	106	15	6
Bioinformatics	17	13	3	1
Physics, electronics and electro-optics	136	104	25	7
Chemistry and nanotechnology	133	93	31	9
Clean technology and environment	38	27	8	3
Other	67	39	19	9
Companies associated with Hospitals- total	**311**	**137**	**92**	**82**
Agriculture and plant genetics	-	-	-	-
Biotechnology	14	10	1	3
Medicines	85	54	16	15
Medical equipment	199	70	69	60
Mathematics and computer science including applications	9	1	4	4
Bioinformatics	2	2	-	-
Physics, electronics and electro-optics	-	-	-	-
Chemistry and nanotechnology	-	-	-	-
Clean technology and environment	-	-	-	-
Other	2	-	2	-
Companies associated with Research institutions and colleges- total	**108**	**56**	**18**	**34**
Agriculture and plant genetics	48	15	12	21
Biotechnology	19	14	4	1
Medicines	14	11	1	2
Medical equipment	7	1	-	6
Mathematics and computer science including applications	-	-	-	-
Bioinformatics	1	-	-	1
Physics, electronics and electro-opticss	2	1	1	-
Chemistry and nanotechnology	4	3	-	1
Clean technology and environment	2	2	-	-
Other	11	9	-	2

Patent Applications

In 2013, 451 original patent applications were filed, and in 2012, 516 were filed. Most original applications were filed abroad: approximately 89% in 2013 and 94% in 2012. Moreover, most of the original applications were filed by universities, approximately 81% in 2013 and 84% in 2012. In 2012 and 2013, 967 original applications were submitted, similar to 963 applications submitted in 2010 and 2011, an increase of 0.4%.

Table C. Original Patent Applications in Israel and Abroad, 2012, 2013

Companies associated with -	Location of the application	2012	2013
Total		516	451
Universities	**Israel**	**30**	**48**
	Abroad	**401**	**316**
Hospitals	**Israel**	**3**	**-**
	Abroad	**61**	**66**
Research institutions and colleges	**Israel**	**-**	**3**
	Abroad	**21**	**18**

The dominant fields of the original patent applications in 2012 and 2013 were: medicines, biotechnology, medical equipment, physics, electronics and electro-optics, and chemistry and nanotechnology.

Diagram 1. New Patent Applications, by field, 2012, 2013

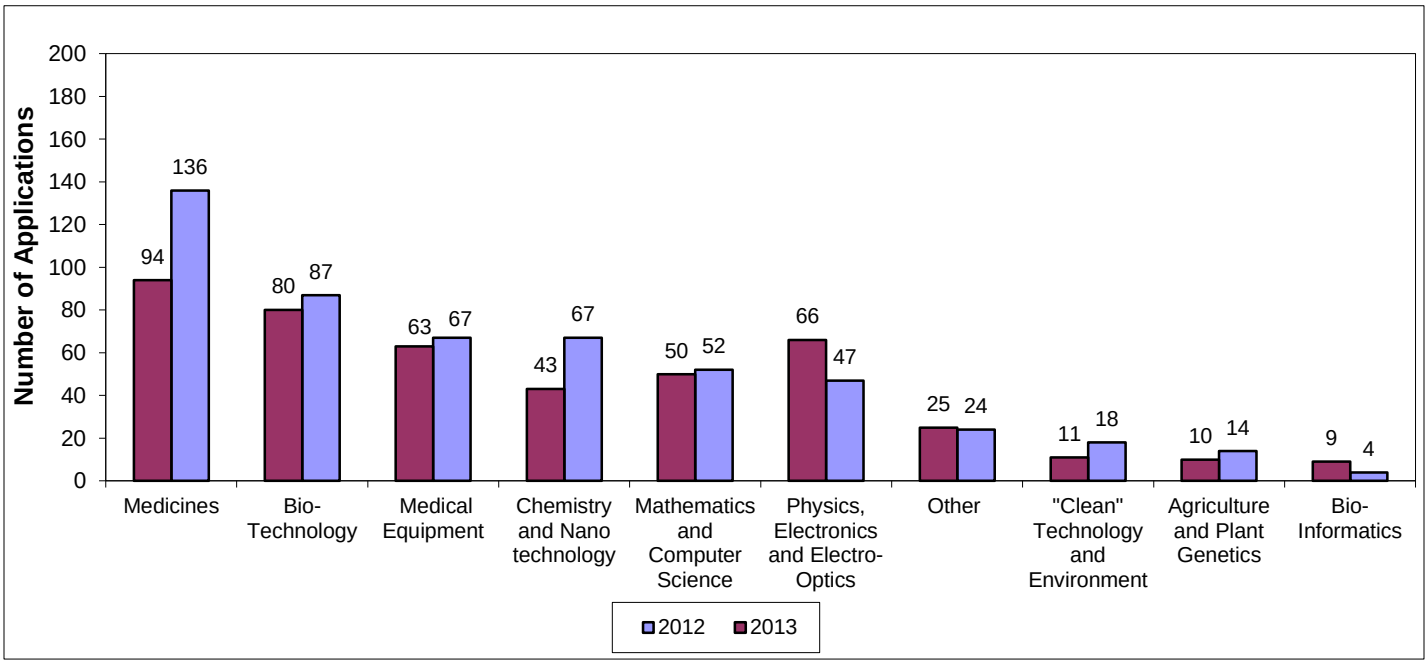


Table D. Original Patent Applications, by Field of Activity and Type of Institution, 2012, 2013

Type of institute	2012	2013
Total	**516**	**451**
Companies associated with Universities- total	431	364
Agriculture and plant genetics	12	9
Biotechnology	81	64
Medicines	96	66
Medical equipment	37	28
Mathematics and computer science including applications	52	49
Bioinformatics	4	8
Physics, electronics and electro-optics	46	65
Chemistry and nanotechnology	66	41
Clean technology and environment	18	11
Other	19	23
Companies associated with Hospitals- total	**64**	**66**
Agriculture and plant genetics	-	-
Biotechnology	3	8
Medicines	31	23
Medical equipment	30	33
Mathematics and computer science including applications	-	1
Bioinformatics	-	-
Physics, electronics and electro-optics	-	1
Chemistry and nanotechnology	-	-
Clean technology and environment	-	-
Other	-	-
Companies associated with Research institutions and colleges- total	**21**	**21**
Agriculture and plant genetics	2	1
Biotechnology	3	8
Medicines	9	5
Medical equipment	-	2
Mathematics and computer science including applications	-	-
Bioinformatics	-	1
Physics, electronics and electro-optics	1	0
Chemistry and nanotechnology	1	2
Clean technology and environment	-	-
Other	5	2

The main fields of activity in the universities were: Medicines (20%), Bio-Technology (18%), Physics, Electronics and Electro-Optics (14%).

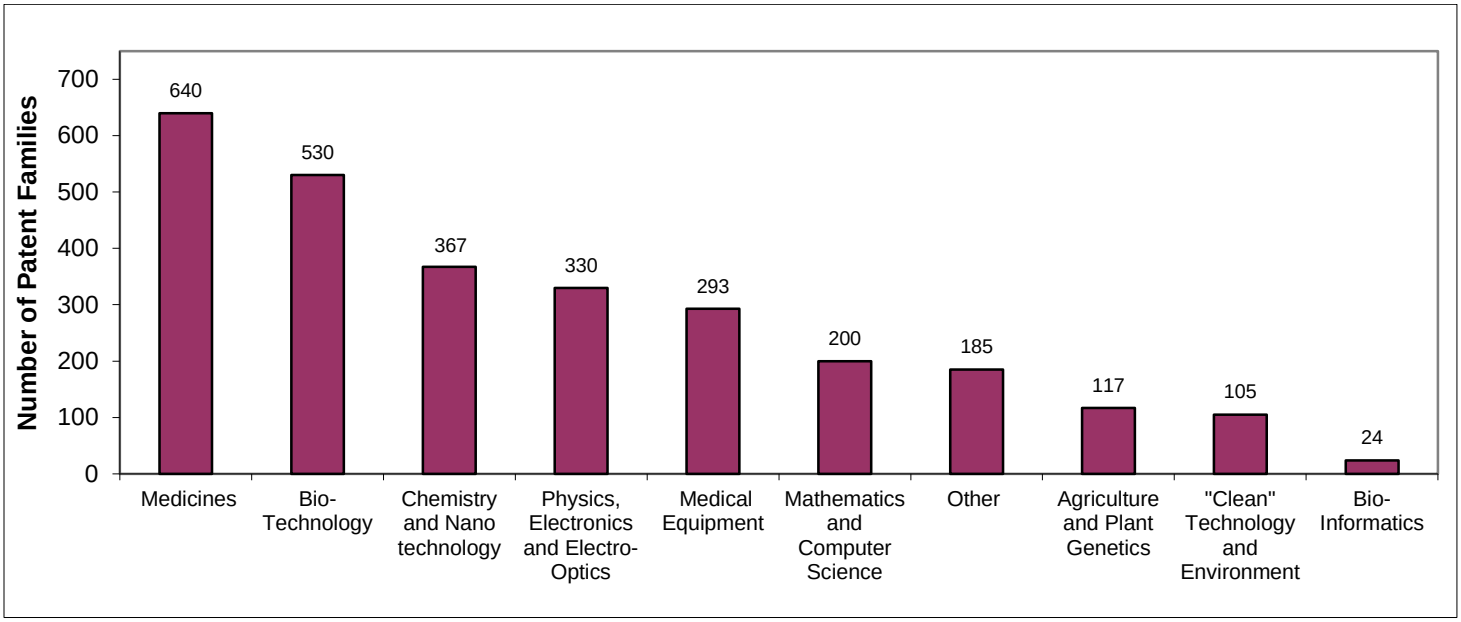
The main fields of activity in hospitals were: Medical Equipment (48%) and Medicines (42%).

The main fields of activity in research institutions and colleges were: Medicines (33%) and Bio-Technology (26%).

Patent Families

During the years in which the commercialization companies were active under the auspices of the institutions included in the survey, the companies accumulated a large inventory of current patents that were marketed or yet remain to be marketed. This inventory is the inventions portfolio of each company represented here by patent families.

Diagram 2. Patent Families in the Active Portfolio*, by Field, 2013



To diagram 2 data

*Active portfolio - meaning one patent out of the family patent is operative.

The dominant field of the active portfolio in 2013 was medicines, which was 23% out of total patent families. In 2011, the dominant field was bio-technology, medicines and medical equipment, which was 51% out of total patent families.

Table E: Patent Families in the Active Portfolio, 2013

Companies associated with:	Total	Medicines	Bio-Technology	Chemistry and Nano-Technology	Physics and Electro-Optics	Medical Equipment	Mathematics and Computer Science	Other	"Clean" Technology and Environment	Agriculture and Plant Genetics	Bio-Informatics
Total	**2791**	**640**	**530**	**367**	**330**	**293**	**200**	**185**	**105**	**117**	**24**
Universities	**2276**	480	422	362	330	146	197	144	105	67	23
Hospitals	**342**	142	54	-	-	143	2	-	-	-	1
Research institutions and colleges	**173**	18	54	5	-	4	1	41	-	50	-

License Agreements

The role of commercialization companies is to market and deliver the knowledge generated in universities, hospitals and research institutions. The conventional way is through license agreements.

The number of license agreements that were valid or active or producing royalties in 2012-2013 was 1,966. Most of the agreements were signed with commercialization companies from Israel (71%) and in the second place with companies from the United States (17%). Most of the new agreements were signed with companies at universities (80%). In the last two years, 2012 and 2013, 259 new license agreements were signed. Of all license agreements, 263 were valid license agreements that produced royalties in 2012-2013; of those, 174 companies in Israel and 89 abroad.

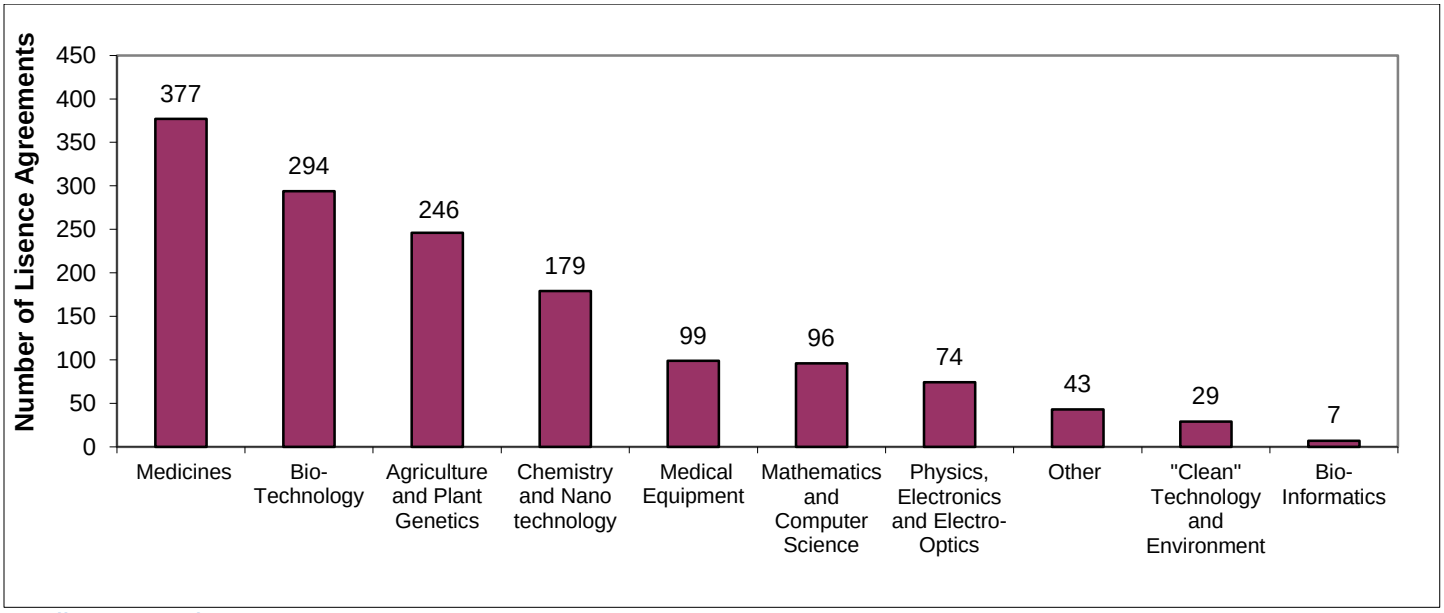
Table F: License Agreements, by Geographical Area, 2012-2013

	Companies associated with:	Total	Israel	United States and Canada	Europe	Asia	Other
	Total	1,966	1,395	340	180	20	31
New license agreements	Universities	206	138	37	24	3	4
	Hospitals, research institutions and colleges	53	45	4	3	1	-
Active license agreements	Universities	1,159	805	220	115	8	11
	Hospitals, research institutions and colleges	285	233	24	15	4	9
Number of license agreements producing royalties	Universities	181	107	48	22	2	2
	Hospitals, research institutions and colleges	82	67	7	1	2	5

Table G: Active License Agreements, by Field, 2013

Companies associated with:	Total	Medicines	Bio-Technology	Agriculture and Plants Genetics	Chemistry and Nano Technology	Medical Equipment	Mathematics and Computer Science	Physics and Electro-Optics	Other	"Clean" Technology and Environment	Bio-Informatics
Total	**1,444**	**377**	**294**	**246**	**179**	**99**	**96**	**74**	**43**	**29**	**7**
Universities	**1,159**	322	270	134	177	38	91	74	20	28	5
Hospitals, research institutions and colleges	**285**	55	24	112	2	61	5	-	23	1	2

Diagram 3. Active License Agreements, by Field, 2013



To diagram 3 data

The dominant fields of the active license agreements in 2012-2013 were fields which are related to life science: medicines (26%), bio-technology (20%) and agriculture and plants genetics (17%).

Nonetheless, fields related to the Israeli high-tech industry, such as physics, electronics, electro-optics and mathematics and computer science, totaled about 12% of the active license agreements.

Commercialization companies Revenues

Total revenues from the sale of IP, which include patents, gross royalties, options, license fees and other income from IP, amounted to NIS 1,881 million in 2012. The main sources were the companies associated with the universities (99%). The revenues of companies associated with the universities increased by 11.8% in 2012, compared to 2011 (one university was added to the survey in 2012).

Table H: Companies Revenues, by Type of Revenue, 2012

NIS million

Companies associated with:	Total	Revenues from selling IP: Royalties, license fees, options and other income from IP	Income from ownership of start-up companies (dividends, options, profits from the sale of start-ups, etc.)	Income from other activities of the company: contracts and research grants, foreign studies, labs, chief scientist transfers, expenses reimbursements, licenses, etc.
Total	2,535	1,881	24	630
Universities	2,393	**1,853**	**21**	**519**
Hospitals	87	**2**	**3**	**82**
Research institutions and colleges	55	**26**	**-**	**29**

Table I: Companies Revenues from the Sale of IP and Royalties, according to Geographical Areas, 2012

NIS million

Companies associated with:	Total	Israel	United States and Canada	Europe	Asia	Other
Total	1,881	1,359	157	348	13	4
Universities	1,853	**1,351**	**145**	**347**	**10**	**-**
Hospitals	2	**1**	**1**	**-**	**-**	**-**
Research institutions and colleges	26	**7**	**11**	**1**	**3**	**4**

Most of the revenues from IP came from the commercialization companies at universities. Also, most of the revenues from selling IP came from Israel - 72%, similar to the result from the last survey (2011).

Table J: Revenues from the Sale of IP, by Field, 2012

NIS million

Companies associated with:	Total	Medicines	Mathematics and Computer Science	Agriculture and Plants Genetics	Physics and Electro-Optics	Bio-Technology	Chemistry and Nano Technology	Medical Equipment	Bio-Informatics	"Clean" Technology and Environment	Other
Total	**1,881**	**1,770**	**46**	**35**	**11**	**6**	**5**	**4**	**2**	**1**	**1**
Universities	**1,853**	1,752	46	26	11	6	5	4	2	1	-
Hospitals	**2**	2	-	-	-	-	-	-	-	-	-
Research institutions and colleges	**26**	16	-	9	-	-	-	-	-	-	1

As can be seen from Table J, the main field which produced revenues from IP was medicines (94%), while other fields related to the Israeli high-tech industry, such as physics, electronics and electro-optics and mathematics and computer science, totalled 3%.

Table K: Revenues from Research Contracts and Grants, by Financing Source, 2012

NIS million

Companies associated with:	Total revenues from research contracts and grants	Thereof:			
		The Chief Scientist of the Ministry of Economy	From the business sector in Israel	From the business sector abroad	From other sources
Total	267	83	89	79	16
Universities	229	**78**	**79**	**70**	**2**
Hospitals	9	**3**	**1**	**-**	**5**
Research institutions and colleges	29	**2**	**9**	**9**	**9**

Some of the research projects at the universities are business orientated and have IP potential. They are treated administratively by the commercialization companies at the universities and are performed at the universities together with the other research projects performed there.

An examination of the data indicates the presence of connections between industry and research projects with industrial orientation. It should be noted, however, that data on the EU R&D program regarding R&D with business orientation are lacking, as this program was not dealt with by the commercialization companies, and therefore the picture of connections with industry is incomplete.

The data in the table K shows that most of the revenues from research contracts and grants with industry orientation were received at the universities - 86%. The main financing sources were the business sector in Israel (33%) and the Chief Scientist Office (31%).

The total revenues of universities for research grants from the business sector in Israel in 2012 are quite similar to the total revenue from the business sector abroad (30%). Alongside the business sector in Israel, the projects financed by the Chief Scientist Office of the Ministry of the Economy should be taken into account. The Chief Scientist Office supports universities in most cases of collaborative projects with businesses or business concerns in Israel. However, as stated, there is data missing as to the extent of EU support in joint research projects with foreign business entities and, at times, with business firms in Israel.

Ownership of Startup Companies in Israel and Abroad

A startup company is a company that has been previously founded with the aim of developing a unique product or idea, usually in the field of high tech. It ceases to be considered a startup company after it is sold to an established company or after it becomes established itself (i.e., the company begins to sell its products or services).

Startup companies are usually financed by venture capital funds, technological incubators or private investors (angels), as the initial capital serves to establishing the company, recruiting staff, developing products or services and selling them. Startups (Table L) were established according to the technology developed by researchers of these institutions in 2012-2013, even if the commercialization company had no ownership.

Table L: Establishment of Startup Companies, 2012–2013

Total- Israel and Abroad	72
Universities	**57**
Hospitals	**11**
Research institutions and colleges	**4**

As is shown in Table L, in 2012-2013, 72 startup companies were established in Israel and Abroad; 57 companies were established by universities, compared to 11 in 2011, or 5.2 times more. The main industries of the established companies in Israel were: Scientific research and development (81%) and computer programming (**7**%). Of the companies which were established abroad, three were established by the universities, compared to two in 2010–2011, or 1.5 times more.

These startup companies are characterized by the low average number of employees per company, which was considerably lower than the average in that industry.

Expenditures and Personnel in Commercialization companies

In 2012, the number of professional employees which were engaged with IP in commercialization companies was **123**, compared to 85 in 2011, an increase of 45% (see notes A and B, page 2). The number of FTEs (Full Time Equivalent employees) in commercialization companies was 94 in 2012, compared to 75 in 2011, an increase of 25% (see notes A and B, page 2).

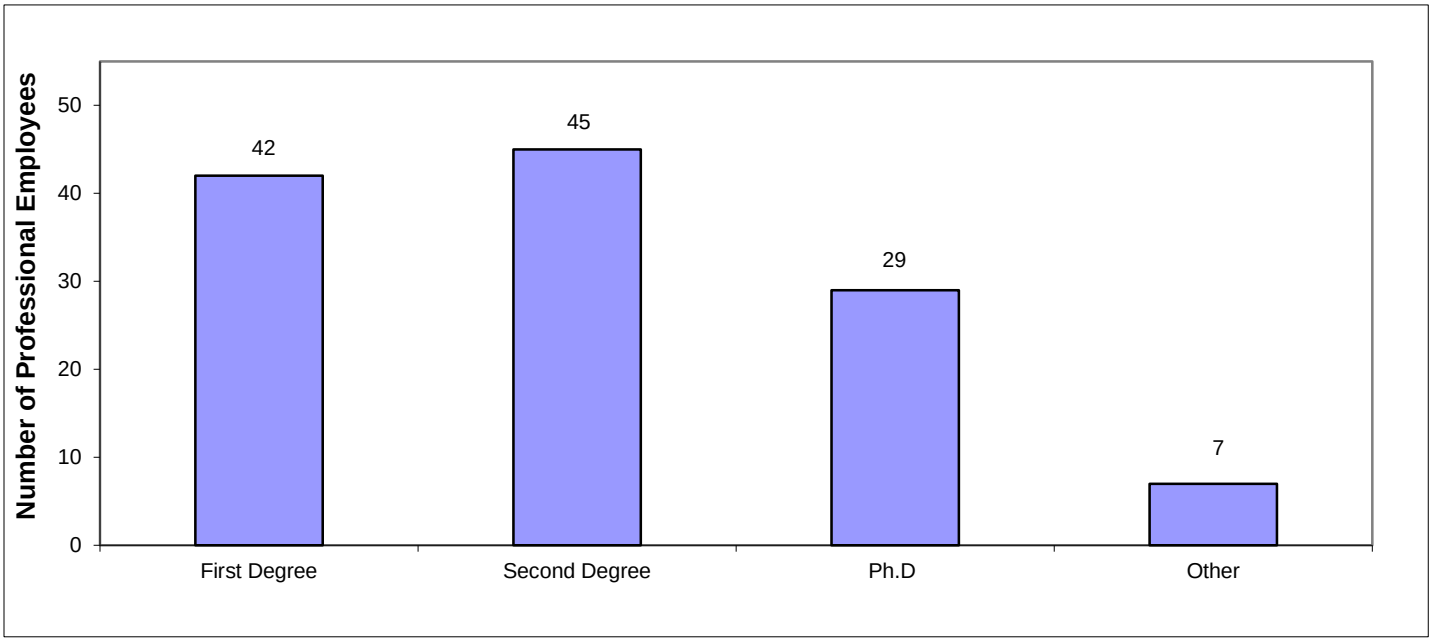
Table M: Number of Professional Employees, 2012

Companies associated with:	Number of Professional Employees	Number of Full Time Equivalent Employees
Total	123	94
Universities	**71**	**58**
Hospitals	**20**	**14**
Research institutions and colleges	**32**	**22**

Five of the commercialization companies employed more than 10 professional employees, each. Of those, three are companies associated with the universities.

In 2012, 71% of the employees held a first or a second degree, compared to 65% in 2011. In 2012, 24% of the employees held a PhD, similar to 25% in 2011.

Diagram 4. Number of Professional Employees in the Commercialization companies, by Degree, 2012



To diagram 4 data

Table N: Professional Employees, by Years of Experience in IP Management, 2012

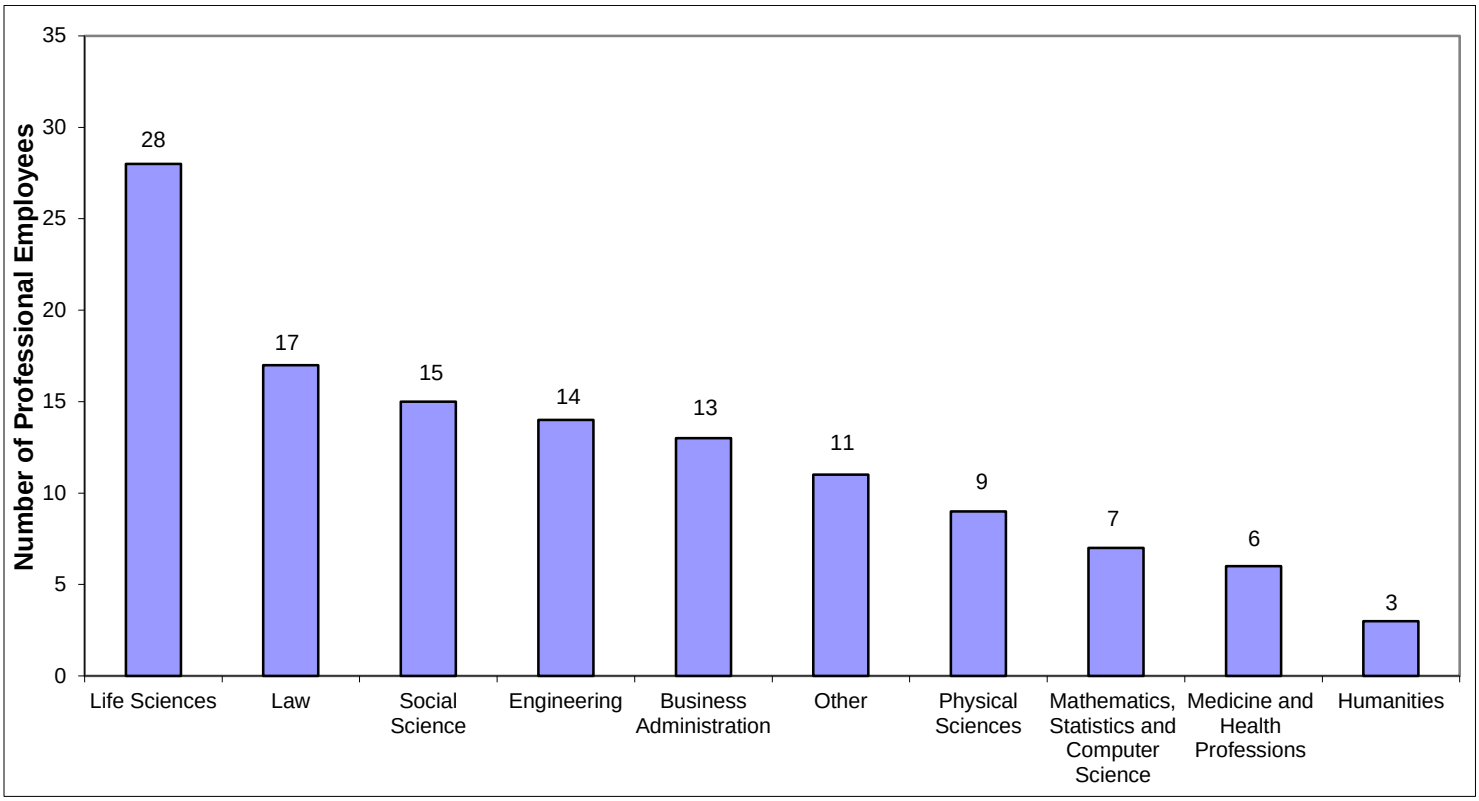
Years of experience in IP management	Total	0	1-2	3-4	5-9	10-14	15-19	20 and over
Total	123	2	20	13	35	26	17	10
Universities	71	**1**	**14**	**5**	**20**	**18**	**8**	**5**
Hospitals	20	**1**	**4**	**3**	**4**	**5**	**1**	**2**
Research institutions and colleges	32	**0**	**2**	**5**	**11**	**3**	**8**	**3**

In 2012, about 57% of the professional employees had experience of 0-9 years in managing IP, compared to 65% in 2011.

The distribution of the professional employees in commercialization companies by field of activity was as follows: Business development - 37%, management - 15%, finances - 12%, legal department - 10%, and other - 26%.

The dominant field of study of the professional employees was Life Sciences (23%).

Diagram 5. Number of Professional Employees in the Commercialization companies, by field of study, 2012



To diagram 5 data

In 201**2**, total expenditure for the management of intellectual property in Israel was NIS 80,954 thousand, compared to NIS 72,556 thousand in 2011, an increase of 12%. Of this expenditure, payments to external factors amounted to NIS 49.212 million, compared to NIS 40,727 thousand in 2011, an increase of 21%. Most of the payments to external factors were for patent editing and fees connected to patent registration.

In 2012, the average annual expenditure per employee was NIS **6**58 thousand, a decrease of 23% compared to 2011. (The average annual expenditure includes wages, fees for patents and registrations, etc.).

International Comparison - Israel, United Kingdom, United States and Japan

(The data presented are for companies associated with universities only)

Table O. International Comparison, 2012

	Israel	United Kingdom	United States	Japan
Invention disclosures	**528**	**4,300**	**23,741**	**8,949**
Patent applications	**431**	**1,942**	**14,224**	**6,962**
License agreements	**1,056**	**4,300**	**5,130**	**8,808**
Startup companies	**29**	**191**	**705**	**54**
Revenue* from IP (million $)	**481**	**111**	**2,600**	**410**

*One must be careful in interpreting the data of revenues from IP, since in some of the countries royalties only are included, and in some countries the definition is broader.

Table P: Indicators for International Comparison, Normalized by the R&D Expenditure of the Higher Education Sector, 2012

	Israel	United Kingdom	United States	Japan
Expenditures on R&D by the higher education sector (million dollars, PPP)	**1,224**	**10,361**	**62,723**	**20,336**
Invention disclosures	**0.43**	**0.42**	**0.38**	**0.44**
Patent applications	**0.35**	**0.19**	**0.23**	**0.34**
License agreements	**0.86**	**0.42**	**0.08**	**0.43**
Startup companies	**0.02**	**0.018**	**0.01**	**0.003**
Revenue* from IP (million dollars)	**0.39**	**0.01**	**0.04**	**0.02**

*One must be careful in interpreting the data of revenues from IP, since in some of the countries royalties only are included, and in some countries the definition is broader.

Israel is high in all indicators (after normalization) of international comparison (to the countries presented here): the number of invention disclosures, patent applications, license agreements, startups

established and revenue from IP and royalties. This is after normalizing by the R&D expenditure of the higher education sector.

Definitions

- Intellectual property (IP) - IP is a generic term referring to rights associated with intangible resources that were a person's intellectual creations, such as patents, copyrights, and trademarks. The legal proceedings begin with a court decision that determines the owner in each branch of the IP, the conditions of protection, and the scope of the rights. These property rights enable the holder to form a monopoly on the use of the item for a certain period and in certain countries.
- Patents - Patents are rights granted by states to inventors to prevent others from illegal use of their inventions.
- Original patent - the first request for protecting a new invention with a patent, submitted to the appropriate authority in Israel or abroad (such as the Patent Office, Designs and Trade Marks of Israel, USPTO, EPO, etc.) - National or international track (PCT).

  A particularly important role of the commercialization companies is the protection of the invention by submitting patent applications.

  A patent is an exclusive right of use granted by the state to the owner of the invention for the use of the invention for a limited time, whether a product or a process in a technical field. To receive a patent on an invention one must submit an application to the appropriate authority in that country – a patent is valid only in the countries where it is registered.

  An application for a patent may be submitted in several countries, and therefore a patent is often registered in more than one country in order to obtain maximum protection for the idea or innovation.
- PCT (Patent Cooperation Treaty) - Another way of commercialization is to submit new applications through the PCT (Patent Cooperation Treaty) – a pact established in 1970. It provides a uniform procedure to apply for patents to protect inventions in each of the countries. A patent application submitted in the framework of the PCT is called an international application or PCT application. Applications for patents intended for Israel which were submitted through the PCT are included within the category of patents submitted in Israel. The rest of the PCT applications are included within the category of patents submitted abroad.
- Patent families - includes the original patent granted in a certain country and the rest of the patents granted in its wake, for that same invention, idea, or piece of knowledge, in other countries with an affirmation of the precedent of the initial patent.
- Commercialization of knowledge - a signed agreement between the Commercialization companies and a company or institute, through which the Commercialization companies transfers the intellectual property rights to the authorized Company.
- License Agreement - an agreement signed between the commercialization company and a company or institute for product development according to new knowledge or patent, which through the commercialization company transfer the rights to use intellectual property to the authorized Company.
    - New agreement - an agreement that was not valid prior to 2012.
    - Active agreement - an agreement exists and is valid in 2012-2013.
    - License agreements producing royalties - agreements which generated revenues/royalties during 2012-2013.

- Startup Company - a startup company or a startup is a company which aims to develop an innovative product or service usually high-tech. A startup company exists in several situations:
    1. Stage of examining the feasibility of the concept and preliminary research.
    2. Stage of product development, repairs and transition to production.
    3. Stage of finished product and increasing sales.