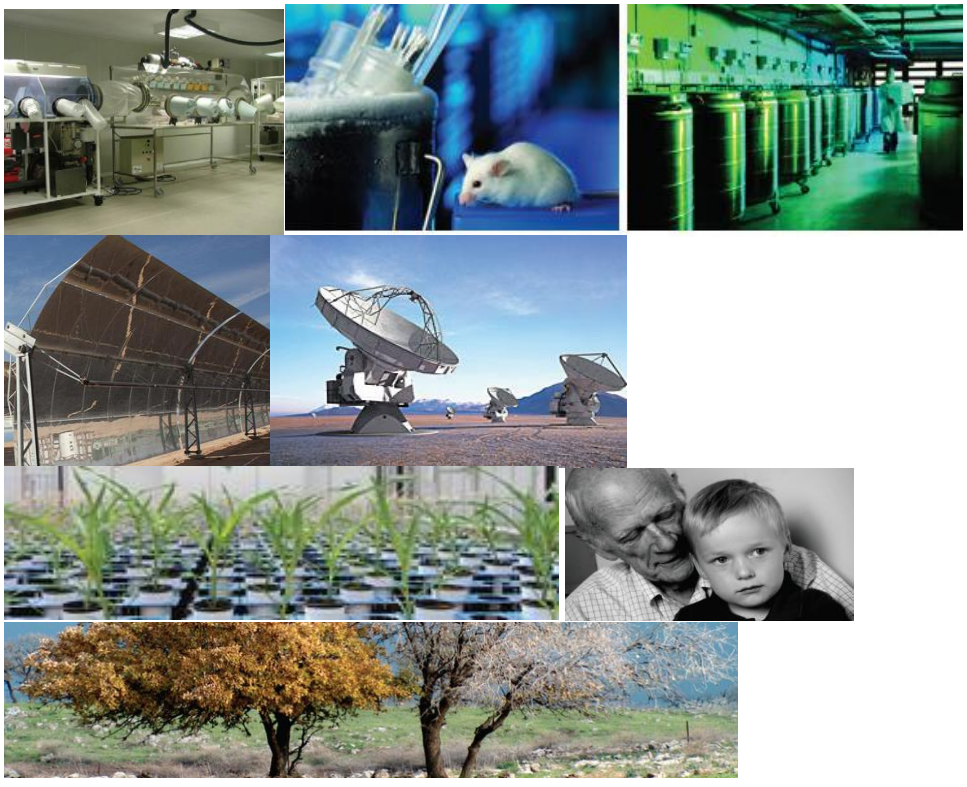
مجلس التعليم العالي
המועצה להשכלה גבוהה
COUNCIL FOR HIGHER EDUCATION

ROADMAP

of CENTRAL ACADEMIC

RESEARCH INFRASTRUCTURES

2013



Jerusalem – February 2014

P. Box 4037, 91040 Jerusalem

OPENING WORDS BY PROF. DAVID HORN

This document presents the first strategic planning of central academic research infrastructures in Israel. Such infrastructures are regarded in the western world both as the basis for growth of research and as a vehicle for economic growth. Therefore, in many countries national and international roadmaps of development and establishment of central research infrastructures are being drawn up. The Planning & Budgeting Committee has decided to join this trend and to prepare a roadmap of central academic research infrastructures in Israel. To this purpose the PBC appointed an advisory committee which, assisted by a number of sub-committees, has been working during the year of 2013 towards the formation of the plan. The Committee will continue its activity in the coming year aiming at the presentation of an updated edition of the roadmap in 2014.

The concept of ”central research infrastructures” at the disposal of all researchers is known at Israeli universities mainly within the international framework. Aside from such frameworks the single researcher will usually have access only to institutional or team related facilities, and often he/she is not able to use infrastructures belonging to a team from an institution other than his own unless he/she participates in a specific research taking place at that institution. The proposed roadmap is an attempt to introduce a revolutionary change and to establish a new culture of service to researchers from all institutions. It is important to make sure that its future implementation will, indeed, fulfill the expectations, and that the publicly financed infrastructures will be at the disposal of

the entire community of researchers and will provide them with proper service.

The Committee considers the roadmap to be the opening of a new era. We hope that the new infrastructures along with the existing ones will create a developing and dynamic academic environment that will significantly promote various fields of research, strengthen cooperation between researchers across institutions in Israel and abroad and encourage quality education for new researchers on whom our research future depends. The development of central research infrastructures in Israel should also enhance Israel's possibilities of joining international research infrastructures, strengthen the cooperation between the academic world and industry in Israel, enable technological breakthroughs and raise the level of both basic and applied research in Israel.

We would like to compliment the PBC on their initiative to undertake a planning process of this kind and to express our hope that it will bring blessing and benefit to the entire academic community and ensure the long term scientific standing of Israel. We would also like to thank the devoted staff of the PBC who has helped to promote, advise and navigate the entire process until its successful completion.

Sincerely,

Prof. David Horn
Chairman – the Advisory Committee for Central Academic Research Infrastructure

OPENING WORDS BY PROF. MANUEL TRACHTENBERG

Advanced scientific research depends on two crucial components: excellent researchers, who strive unceasingly to cross the existing boundaries of scientific understanding, and a state of the art research infrastructure. The long term plan of the PBC, which has guided our activity for over three years now, has focused on granting incentives and providing tools to enable the institutions to mobilize or bring back additional researchers, on dramatically increasing the budgets for competitive research and on building designated programs such as centers of excellence (I-CORE). For these efforts to be fruitful in the long term they must, without any doubt, be accompanied by a proper research environment, including the accessibility of an advanced research infrastructure.

For this purpose we have initiated the setting up of an advisory committee for central academic research infrastructures. The duties of the Committee is the mapping at intervals of existing infrastructures, a methodical investigation into the demands of each field and recommending a roadmap for investment in infrastructures that will reflect the priorities set by the Committee. Parts of the required infrastructures are uniquely directed at the world of academic research, while others are likely to be of interest to other sectors as well, e.g. industrial and security related R&D, and could therefore serve as basis for proposals to be referred to the Forum for National Research and Development Infrastructures. Such recommendations shall be brought before the PBC for discussion and decisions.

The PBC expresses its satisfaction with the completion of the report and the roadmap contained therein, achieved through a year's concentrated effort. The organizational structure established over the past year, which consists, besides the Advisory Committee, also of specialized sub-committees in various fields and involves engaging the entire academic community in the project, will continue to assist the PBC on an ongoing basis and will provide

stable scientific backing for activity in this important area. This will enable the PBC to reach rational decisions on advancing the area of central research infrastructures based on an all-encompassing database and clear-cut priorities rather than on sporadic proposals.

I would like to extend my warm thanks to the Committee chairman, Prof. David Horn, who has lead the process intelligently and firmly and has diligently drawn up the roadmap, as well as to all members of the Committee and its sub-committees, who have contributed generously of their time and expertise to promoting this vital project, each one in his/her field.

Sincerely,

Prof. Manuel Trachtenberg

Chairman – the Planning & Budgeting Committee

Contents

1. GENERAL BACKGROUND

Much attention is given to central academic research infrastructures in governmental planning and financing in the world. Those infrastructures, and in particular those destined for research in the Natural and Life Sciences, are considered to be the basis for potential research growth and innovation and a vehicle for economic and social growth. With time, advanced central research infrastructures are becoming increasingly expensive and complex, and they require large and varied human resources for establishment and running. Often cooperative efforts at national or international levels are needed for their establishment. Therefore, in many countries processes for the planning of central research infrastructures have been undertaken in the last decade within an overall systemic framework and order of priorities for the next several years.

That being the case, the PBC decided to initiate a process of medium and long term strategical thinking to enable the PBC proactively, and based on its set of priorities, to develop and establish (independently or together with possible partners) central academic research infrastructures, and to join existing international research infrastructures. Accordingly, on the 21st of November 2012 the assembly of the PBC decided to establish a permanent advisory steering committee under the PBC to deal with the issue of central academic research infrastructures. The tasks of the Committee were defined as follows:

A. Mapping the central research infrastructures in the universities.
   - Defining central research infrastructures in the universities.
   - Mapping existing infrastructures.
   - Creating a mechanism for an ongoing update of the mapping.

B. Formulating a proposal for a preferential roadmap of required infrastructures.
   - Giving expression to the needs as defined by the universities.
   - Recommending the prioritization of those needs and their solution in accordance with criteria to be proposed by the committee.
   - An ongoing update of the roadmap.

C. Examining proposals and opportunities for new infrastructures and for partnership in international infrastructures in an ongoing manner, and evaluating their compatibility to the roadmap.

In the discussion it was decided that the Committee shall present its recommendations on these issues to the PBC, following which the PBC shall decide how to proceed and which mechanisms to activate.

In January 2013 the Advisory Committee for Central Academic Research Infrastructures was appointed. The members of the Committee are:

- Chairman – Prof. David Horn, School of Physics & Astronomy, Tel Aviv University, Israeli member of ESFRI
- A representative for the PBC (as from November 2013): Prof. Yeshayahu Talmon, Faculty for Chemical Engineering, Technion
- Prof. Alfred Bruckstein, Computer Science Faculty, Technion
- Prof. Eithan Galun, Genetic Therapy Institute, Hadassah Medical Center, Ein Karem, and Hebrew University
- Prof. Moshe Deutsch, Department of Physics, Bar-Ilan University

- Prof. Shimon Yankielowicz, School of Physics & Astronomy, Tel Aviv University, Chairman – Israeli Centers of Research Excellence steering committee (PBC representative until October 2013)
- Prof. David Faiman, Solar Energy Center, Ben-Gurion University
- Prof. Asher Koriat, Department of Psychology, University of Haifa
- Prof. Orly Reiner, Department of Molecular Genetics, Weizmann Institute of Science

2. Work procedures of the Committee

2.1 Mapping central academic research infrastructures in Israel and abroad

Within the last few years the Committee for Research Infrastructure of the National Council for Civilian Research & Development has, through the Ministry of Science, Technology and Space, placed an order for mapping the research infrastructures in Israel with the "Samuel Neaman Institute for Advanced Research and Technology" at the Technion[1]. These reports contain a broad detailed description of research infrastructures in many areas of Israeli universities and industry. Most of the existing research infrastructures do not comply with the criteria for central research infrastructures as defined for this process, except for international research infrastructures with which Israel is associated. These include CERN - the European Organization for Nuclear Research in Geneva, ESRF - the European Synchrotron Radiation Facility in Grenoble, SESAME - a synchrotron radiation facility under construction in Jordan, GEANT – a network of national computer and teleprocessing networks, EMBL – the European Molecular Biology Laboratory, INSTRUCT – a network of laboratories for Structural Biology, ELIXIR – a European infrastructure for biological information, SHARE – the Survey of Health, Ageing and Retirement in Europe and ESSurvey – the European Social Survey. The four latter infrastructures appear in the ESFRI roadmap[2], ESFRI being the Strategy Forum on Research Infrastructures of the EU.

The 2013 roadmap presented here does not deal with existing central infrastructures except for two international infrastructures for the Social Sciences due to special arguments that were brought forward by the sub-committee for Social Science and Humanities.

2.2 Collecting and mapping demands for central academic research infrastructures

Due to the tight time limit set for the Committee's work (end of 2013) it was decided to collect the information concerning the central demands for research infrastructures of the scientific community using mainly the following methods:

- A centralized request to Vice Presidents for R&D to present proposals and ideas for required infrastructures for Israeli universities in general. They were instructed to present proposals for research infrastructures in all areas without stating prioritization.
- A broad range of consultations by the members of the Committee and the sub-committees with researchers, experts in various fields and office holders in Israeli universities.
- Examining roadmaps from various countries, including the European Union, in order to identify common demands and international partnerships that can be joined by Israeli researchers.
- Additional sources of information – roadmaps from various countries, inspections of various areas by the Israeli Academy of Science, reports from international committees which have performed quality evaluation for the HCE/PBC, specific international reports etc.

[1] http://www.neaman.org.il/Neaman2011/Templates/ShowPage.asp?DBID=1&TMID=581&LNGID=2&FID=646&IID=10440
[2] http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri-roadmap

From the outset of its work the Committee had to define the nature of the central research infrastructures in a manner which would fit the Israeli universities, to set the limits for government support for a central research infrastructure and the criteria for prioritization among the infrastructures. The Committee decided to adopt the definition and criteria outlined below. It should, however, be pointed out that due to the differences between various areas, and considering that this is the first time such a strategic process has been undertaken, the sub-committees showed flexibility by adapting the general criteria to the specific demands that were brought up.

What is a central research infrastructure?

The term "central research infrastructures" refers to infrastructures serving a large number of researchers from many institutions, including such infrastructures that are situated abroad, but are of interest and use for Israeli science. Usually, the infrastructure has expensive scientific equipment designated for a specific scientific subject and a technical staff for its operation. An infrastructure might also consist of a number of pieces of equipment which used as a whole contributes to a specific research area. Central infrastructures may also be collections valuable for specific research and databases serving large groups of researchers.

The threshold criteria for central research infrastructures were set as follows:

- Cost of establishment and operation, or cost of membership, exceeding amounts which a single institution of higher education can afford, relative to the area
- A leading position in international research
- Innovativeness and uniqueness (no similar infrastructure in Israel nor Israeli accessibility to such infrastructure)

Government support for a central academic research infrastructure will depend upon:

- Availability to all scientific researchers in Israel
- Providing proper and fair conditions to researchers and their research
- Guaranteeing sound management and operation and setting rules for pricing of use that will be agreed between the supporting government agency and the institution

Prioritization among central research infrastructures will depend, among others, on the following considerations:

- The expected contribution of the infrastructure to an academic area
- The existence of a critical mass of researchers and research activity in the area
- Broad ranging benefits to the country, society and economy

2.4 Examination of demands for central research infrastructures by areas

In order to understand the desirability and reality in the various academic areas and to formulate appropriate proposals of central research infrastructures, the Committee appointed six sub-committees for the different areas. The sub-committees consist of 27 researchers, representing a wide range of research areas and demands for research infrastructures. Most of the sub-committees are headed by members of the Advisory Committee guiding their work. The sub-committees gathered relevant information concerning each proposed infrastructure, examined its compatibility with the definition of "central research infrastructures" and the need for it in relation to existing infrastructures. They then assigned it a priority level in relation to other proposals according to the considerations outlined above. It should be noted that the roadmap prioritizes only among research infrastructures within each area and not among the various areas.

2.5 Integrating the work of the sub-committees into a roadmap

Each sub-committee submitted its recommendations to the Advisory Committee for Central Research Infrastructures. During the ensuing discussion each sub-committee presented its working rationale and the main proposals brought up in its conclusions. Each infrastructure was discussed and in conclusion it was decided which of them should be included in the 2013 roadmap.

3. Specific proposals in the roadmap

The 2013 roadmap contains only the proposals that were fully agreed on by the Committee. The Committee and sub-committees continue to work on the proposals and ideas that still require examination and processing and to incorporate them into the next roadmap if they are found suitable. The roadmap presented in this document is the first **roadmap for central academic research infrastructures. The Committee considers it to be the first milestone in a periodic process that will provide dynamic responses to arising demands for central infrastructures. The updating of the roadmap will begin within the coming year with the purpose of broadening the spectrum and involving a larger part of the community, additional areas, views and needs in the process.**

3.1 From the roadmap to the implementation of the Committee's recommendations

The roadmap produced by the Advisory Committee for Central Academic Research Infrastructures serves as an advisory document to the PBC, reflecting mainly the scientific considerations of the universities, while relating also, where relevant, to the benefits and demands of additional sectors in Israel. When having to decide on the promotion of the recommended infrastructures, the PBC will take into account various budgetary and planning considerations and will decide on general principles of priority (including among areas).

The costs of infrastructures listed in this document are to be considered as temporary evaluations only. They are likely to change significantly. The infrastructures were divided into three groups according to the estimated extent of cost of their establishment:

- Infrastructures group A – with an estimated establishment cost of up to NIS 10 million.
- Infrastructures group B – with an estimated establishment cost between NIS 10 and 20 million.
- Infrastructures group C– with an estimated establishment cost above NIS 20 million.

The PBC discussed the recommendations of the Advisory Committee and decided upon the principles for advancing the implementation of the proposed infrastructures. It was decided that in the academic year 2013-2014 teams will be set up for all the relevant infrastructures to examine their implementation in the budgetary framework set by the PBC and to consider possible partnerships and various demands that might arise in the process of this examination.

The recommended infrastructures (further details to be found later in this document) are:

Area	Description of Infrastructure	Evaluation of cost
Physical Sciences and Engineering	Israeli membership in ESO (European Southern Observatory)	€ 14 million for joining € 2 million per year
Life Sciences and Medicine	Center for genetically modified mice Center for plant phenomics	Group C Group C
Energy	Center for alternative fuels based on hydrocarbons Center for research of utilization of solar radiation	Group B Group A
Social Sciences and Humanities	Membership in the European Social Survey The historical dictionary of Hebrew: the medieval period The Israeli database for the Social Sciences Membership in SHARE, the Survey of Health, Ageing and Retirement in Europe "CBS rooms": A system for remote access to the research room of the Central Bureau of Statistics	Group A Group A Group A Group A Group A
Computation and Communication	A service unit for cloud computing	Group A

3.2 The roadmap recommendations according to area

Physical Sciences and Engineering

In the area of physical sciences and engineering a broad infrastructure for research already exists in the Israeli universities, and some of the scientists can also enjoy the use of modern and expensive equipment. The area of nanotechnology has received an encouraging stimulus in the framework of a wide-ranging project initiated by the Forum for National Research and Development Infrastructures in the last decade. Nevertheless, there are also various institutional laboratories that suffer from old-fashioned equipment, and there are several requests for purchasing experimental equipment at a cost of a million dollars per piece that cannot be fulfilled in the existing frameworks (e.g. purchase of scientific equipment by the Israel Science Foundation). Some of those requests were forwarded to the Committee as requests for central infrastructures, which the Committee did not see fit to approve, since such equipment should be included in existing institutional infrastructures. Nevertheless, the Committee suggested responding to those requests by the establishment of a fund for special scientific equipment to enable the purchase of unique and expensive equipment in the framework of an existing institution, while ensuring its accessibility to researchers from other institutions as well.

Large central infrastructures such as a Synchrotron have not been established in Israel for a long time. The largest central infrastructure in Israel is the nuclear reactor in Nahal Soreq which was established more than fifty years ago. Israeli researchers of elementary Particle Physics are partners in the experiments that take place in the CERN laboratory in Switzerland, while those who are employing synchrotron radiation for their research in the areas of materials or biology make use of the ESRF facilities in France – Israel being a member of these two European infrastructures. The necessity of joining international infrastructures with its difficulties and complexity ensure that Israeli science can compete in the forefront of World science, which is, of course, a blessing. The Committee discussed membership in an additional European infrastructure and decided to recommend such membership in the 2013 roadmap. The infrastructure in question is the ESO (European Southern Observatory) which establishes astronomic observatories in Chile and will enable a selected team of Israeli astronomers to take part and to influence future central projects in this area.

Discussion of the following proposals for infrastructures will be continued in the near future: A. A central facility for three dimensional printing that will be able to perform various printing modes in the areas of electronics, optics, chemistry and biology. B. Central equipment for nuclear microscopy exceeding the standard of existing equipment in various institutions. C. Experimental platforms needed for research in the area of autonomous robotics.

Israeli membership in ESO (European Southern Observatory)

Scientific description:

ESO is the largest international astronomical organization in Europe. It operates the most advanced ground-based telescopes in the world (in the optical, IR and radio bands). At present, this is the world's most scientifically productive observatory. The "southern skies" are the more interesting ones scientifically (e.g. this is where the center of our Milky Way galaxy, and where the Magellanic Clouds, are located), and therefore ESO observatories are in Chile, which has the sites with the best conditions in the world for observing the southern sky. ESO has just inaugurated ALMA, a giant millimete-band radio telescope array, and is now beginning its next giant project, the European Extremely Large Telescope (EELT).

ALMA
המקור: (ESO/NAOJ/NRAO)/L. Calçada (ESO)/ H. Heyer (ESO)/H. Zodet (ESO)

Israeli membership in ESO will permit Israeli astrophysicists to submit observing proposals. The amount of observing time allocated to researchers from non-member states is limited. Israeli researchers presently obtain time through this channel (of non-member states), or by joining, as junior partners, research groups led by people from member states. ESO membership will allow Israeli researchers to lead programs. There is a consensus among the Israeli astrophysical community on the need to join ESO. Presently the group of relevant researchers in the inner circle numbers about 15 astronomers. The second circle comprises of the remaining community of astrophysicists: about 35 additional staff members, about 30 postdoctoral researchers and about 70 students for advanced degrees in the various universities and colleges in Israel.

Astrophysics is one of the flagships of Israeli science. If we do not join ESO, we risk falling behind during the coming decades, when the great new advances will occur with ALMA and E-ELT.

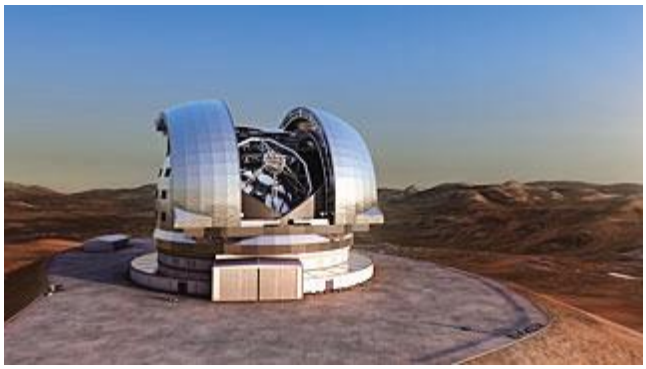
Membership type: ESO membership is at a national level. It allows all researchers in the institutions of a member state to compete for observing time, and the industries in these countries to compete for contracts. ESO management believes that Israel will benefit greatly from membership , because the high scientific level of Israeli astronomers will lead to an observing time allocation larger than its relative share in membership fees.

Academic level: Israeli astrophysics enjoys great international prestige: the citations per researcher in astrophysics are the highest in the world for Israelis; 6 astrophysicists have received EU ERC grants; and Israeli graduate students get a disproportionately large share of the most prestigious postdoctoral prize fellowships in the US. In contrast, Israel is the only western country without guaranteed access to the largest modern telescopes. The implications for "brain drain" are obvious. ESO membership will allow more Israeli scientists to remain in Israel, as well as attracting the best international scholars. There is no doubt that our ability will improve to both cooperate with the world's best scientists, but also to compete with them.

Broad implications: Membership will allow industries to compete in ESO bids for contracts. The EELT is a billion-euro project, that will be built over a decade, and will provide opportunities for industries in many fields -- advanced electro-optics, mirror coatings, software, electronics, composite materials, infrastructures, and more. Furthermore, astronomy is the science that is the most accessible to the general public, and advancing it will attract young people to science. The foreseen educational and social benefits are therefore numerous.

Cost estimate: Membership costs are set according to a state's national product. Currently the entrance fee for Israel is estimated at 14M euro, and annual fees will be about 2M euro.

Artist's impression of the E-ELT
ESO/L. Calçada



Life Sciences and Medicine

Widespread research activity exists in Israel in the areas of Life Sciences and Medicine, most of it in the framework of laboratories belonging to research teams in the universities and the university hospitals. Over the last decades the need for new and expensive equipment has grown, e.g. imaging apparatuses (such as fMRI) used for research in the fields of physiology, neurology and psychology and equipment for decoding genetic data. Such equipment already exists in many Israeli research institutions, but is mostly at standard levels only and cannot compete with the leading equipment in today's scientific world. The aspiration to become leaders in these areas was the source of a number of proposals presented to the Committee. It was decided not to take action in the genomic field at this stage because the Weizmann Institute has recently initiated the establishment of a national center for personalized medical treatment including four operative units providing services in the relevant areas. The center is being established through a very significant budgetary investment and will provide service both for Weizmann Institute scientists and for researchers from other institutions. Therefore the decision was to wait a few years and follow the development of this initiative. On the issue of imaging it was decided to continue the discussion on how to invigorate the existing system by establishing new imaging centers. In the meantime the Committee recommends joining the European infrastructure, Euro-BioImaging, when the conditions are right.

Much of the biomedical research is based on the use of animal models. They are mostly mice with specific genetic characteristics, and the research attempts to reveal the connection between them and biological mechanisms (e.g. a specific illness). A proposal that was discussed and included in the roadmap was the establishment of a center for genetically modified mice. It will serve hundreds of Israeli research teams and will have three components: A laboratory for producing genetically modified mice, an animal farm which will supply tissue and mice on request, and a clinic where it will be possible to perform experiments with a variety of devices and with the assistance of leading experts in diagnosing various aspects of the observed biology.

Another organism that is suitable for model studies is the zebra fish. Currently a laboratory at Tel Aviv University produces zebra fish with geneticmodificatons and satisfies the demands of tens of researchers all over Israel as a service or research partnership. A proposal to expand this activity and turn it into a central infrastructure was brought before the Committee. This proposal will be further examined in the course of 2014.

The second proposal that was included in the roadmap is the establishment of a center for plant phenomics. This center will satisfy the demand of some scores of research teams in the areas of botany and agriculture and will raise the level of research of the environment of growing plants unique to Israel. It is supposed to include a stationary, robot driven plant measuring station to measure plant development under various conditions by the use of modern tools for analysis and imaging. It will also have a mobile unit for collection of data under field conditions.

A center for genetically modified mice

While most of the known medical treatments were found by coincidence, medical research has produced new abilities of understanding disease mechanisms. This has caused radical changes in drug development and treatment procedures. More and more of the drugs administered today are based upon a better particular – it is nowadays possible to decode the response of cells and tissue to stimulations and to investigate the genetic deficiencies that cause human diseases. This attitude has exposed new paths into cancer research that have led to development of new treatments; it has provided insights into the formation of diabetes and it has revolutionized our

understanding both of the causes of the disease and of the biological patterns that are responsible for the pathological conditions. By implementing practical analyses and genetic modifications in research of model animals – mice in	approach towards understanding infectious diseases and disorders connected to the degeneration of the brain.

An exemplary central facility serving as a pool of genetically modified species of mice exists in the US. It is known as the "Jackson Laboratory", established in 1929. This center supplies scientific resources, methods, software and data to scientists all over the world. The center modifies various species of mice, manages their production lines and supplies them to a number of laboratories and research institutes. The center keeps a variety of more than 7,000 mice ready to be used for breeding, frozen fetuses or DNA samples. In its pool the Jackson Laboratory maintains production line batches of mutant mice – more than 2,500 that were produced with genetic modification and 1,200 transgenic mice, representing models of most human diseases. Over 600 production line batches are added annually to the pool. There are also national and university laboratories in other countries that are active in this field and are able to produce model mice upon request.

In the Weizmann Institute there exists a laboratory supplying modified mice for local consumption. Israel has over 200 research teams that will benefit from the establishment of a new center with the ability to manipulate mice genetically and to keep and maintain the various species, and to perform complex experiments within a modern animal clinic.

The advantages gained by establishing the center will be:

A. Lowering the costs for the researcher: Today the cost of a pair of mice can reach tens of thousands of dollars. The establishment of the new service in Israel will reduce the cost significantly.

B. Reducing the waiting time: There is a long waiting list for the supply of breeding mice. In addition, transportation of animals by sea is a sensitive issue and can cause a demand for quarantine lasting months.

C. Long term support for research: Israeli researchers may order mice from abroad. However, they have neither facilities for performing complex experiments nor facilities for keeping mice and genetic material for future experiments at their disposal.

D. Development of innovative methods and technologies in the area: Scientists looking to introduce new methods of modifying mice will benefit considerably from the establishment of this center.

Source: https://www.infrafrontier.eu/sites/infrafrontier.eu/files/upload/public/axenic_picture01.jpg

Source: https://www.infrafrontier.eu/sites/infrafrontier.eu/files/upload/public/slideimage/slide_1.jpg

The center will include three separate units:

1. A laboratory for modifying the mouse genome, which will deal with genetic manipulation of mice stem cells, with producing genetically modified mice and with the freezing and thawing of cells. The center will host genetic modification experts who will incorporate new technologies, as well as experts in manipulation of mouse fetuses. The center will have at its disposal all the equipment needed in order to function at the high standards applied in the scientific world, including high resolution microscopes, technology for cell manipulation and access to available imaging systems. The laboratory will include an extensive farm for housing new genetically modified mice and will supply frozen sperm and IVF for effective treatment.

2. A unit for breeding mice (animal farm), that will supply tissues for genetic research and will, upon request, supply mice with specific required genetic traits to Israeli researchers and possibly also to other countries.

3. A clinic for performing complex experiments with mice. It will include advanced imaging technologies, evaluation devices and tools for analyzing physiological results in mice, pathology, metabolism, mutual influences and behavior of the host and disease cause. The clinic will be able to manipulate mice (micro-surgery, follow-up on drug kinetics etc.). It will also include a state of the art system, e.g. micro PET-CT and an Echo-Doppler device for scanning mice hearts.

The activities of the laboratory, animal farm and clinic have to be supervised by experts. These experts include veterinarians, bio-medical scientists, clinicians involved in model animal research as well as experts in all the relevant biological areas (Microbiology, Biochemistry, Pathology and Imaging).

Management: The units will be independent or belong to an existing animal farm. The activities will be carried out under guidance of a service minded national council. Reports shall be submitted to an external scientific authority, including financial reports.

Supervision: Each unit will have an ethical committee dealing with animal experiments and with active bio-medical environments of human diseases. The animal farm will function according to SPF conditions (free of particular pathogens). The animal farm must have pathology, biochemical and imaging backups. The academic community will have free access to the clinic and limited access to the unit for genetic modification. The animal farm will have restricted access to its professional team only.

The three units may be established separately, thus enabling a modular building process of the center.

This infrastructure is costly and it is estimated to belong to group C.

The Plant Phenomics Center

The breakthroughs of molecular biological research, which have emerged in the wake of the understanding of the structure of the genome, indicate a promise of arriving at profound insights within the Life Sciences. They have, however, also revealed the gap between Genomics and Phenomics – the general description of the characteristics of living species. This gap is becoming narrower due to the development of technological breakthroughs in phenotype analysis and in particular of plants, which, being immobile organisms, possess a wide range of flexibility at the levels of life cycle, organ development, structure and reproduction that depend on environmental factors. The efforts to characterize the phenome of an organism in order to establish a relationship between the activities of a specific gene and specific characteristics require tools destined to tracking those characteristics in a controlled environment. For that purpose non-destructive technology producing high output with high resolution along with manageability of data and analyses is needed.

The implementation of technologies for phenomics has supported the establishment of such research centers of animals and plants. The high cost of the required technologies have caused the phenomics infrastructure in certain countries to be established on a national level, e.g. in Australia, Great Britain, the Netherlands, France and Germany. The phenomic systems were initially planned for greenhouses and plant growing laboratories, and the researchers recognized that the phenotypic results obtained from the plants that grew in a controlled environment in many cases did not reflect the phenotypic results obtained in the wild. Therefore, tools were developed for defining characteristics of crops also under field conditions by technology enabling remote sensing both at the level of the entire plant and that of its organs. The study of phenomics of plants under field conditions at a specific site requires appropriate technology on one hand, but also needs devices and tools for supplying information concerning specific crops in designated geographical areas. Plant phenomic research in Israel is nowadays carried out by manually, and does not include the range of variables that could be measured using state-of-the-art technology.

The phenomics infrastructure will include four components:

A. **Stationary monitoring center:** computer controlled, sensor-based plant monitoring station with robotized plant movement from / to sensor station (resolution ~ 1 cm). The computer should control plant movement, sensor operation, data collection, and plant treatment, such as irrigating and fertilizing individual plants based on real-time measured parameters and experimental design.

B. **Computer-based data collection, storage, management, image processing and analysis facility (hardware and software):** This should be located on-site the "stationary monitoring center" and will process and analyze the data collected by the stationary sensors (A) and by the mobile monitoring system (D).

C. **Modern growth facility associated with stationary monitoring center:** this state-of-the art facility will provide fully controlled environmental conditions such as temperature, light and humidity for growing plants subjected to phenotypic analysis.

D. **Mobile monitoring technology:** The sensors for the plants growing in the field (at a resolution of 1 cm) shall be placed on mobile earthbound and/or low flying devices for remote sensing. While this facility will serve researchers from academia, it will be most useful to researchers and developers from governmental institutes, seed companies and ag-biotech companies that require field performance parameters.

The staff required for the establishment and maintenance of the phenomics infrastructure for plants includes:

- Head of Phenomics Infrastructure & Services: Senior academic researcher: unpaid position, on a rotation basis.
- Senior research associate for technical responsibility of the entire infrastructure setup and maintenance
- One technician for managing stationary infrastructure services:
- One technician for running mobile Phenomics in field studies.
- One bioinformatician and data manager

This infrastructure will serve about 30-40 academic research teams and also a large number of teams from government research institutes and from private companies. It is estimated that some 100 research teams from the various sectors will make use of this infrastructure.

The cost of the infrastructure is classified in group C.

Source: / http://www.plantphenomics.org.au

Energy

Lately, after the discovery of gas deposits along the shores of Israel, the training of the required energy engineers and also of oceanic researchers has been boosted in Israeli universities. It is important to note that modern energy research emphasizes other aspects, in particular the development of alternative energy resources, enabling the use of durable sources in the long run. An example that of is solar energy. An existing infrastructure in this area is the sunray absorbing mirror ("solar dish") in S'deh Boker, whose extension is recommended here, to serve Israeli research teams in photovoltaics. Another infrastructure on the roadmap is a center for alternative hydrocarbon based fuels to satisfy the demand for research of liquefaction of natural gas and for research of animal and plant materials rich in energy.

Teams involved in research of batteries have requirements overlapping those of scientists in the area of Material Science: a large quantity of equipment has to be exchanged and upgraded. It is recommended to increase the budgetary framework of the "Program for Basic Equipment" in the Israel Science Foundation to satisfy these demands. The proposed fund for special equipment (see recommendations of the sub-committee for physical sciences and engineering) is also relevant in this context. A special requirement for the research of batteries is dry rooms, and this will be further discussed during 2014. Additional issues include laboratories for diagnosing materials in biological fuels and a center for alternative carbon based fuels.

Center for alternative carbon based fuels

Background: Climate change and soaring oil prices in the last decades have created new challenges of developing alternative sources of energy. In order to satisfy the demand caused by growth of the population and increase in production of new cars it is necessary to produce alternative fuels for transportation. There are several criteria one needs to consider in the search for supplements or replacement fuel sources for current available crude oil based transportation fuels such as: energy density, efficiency and storage. As a replacement fuel natural gas is a relatively clean source of energy that has been used as transportation fuel since the 1930's and has grown to about 1.5% of the total vehicles worldwide. However, one of its significant drawbacks is the requirement for special storage containers. To achieve a sufficient energy density, natural gas for transportation can be stored in a compressed form (CNG) in high pressure tanks (200-250 bar) or in special cryogenic containers. Alternatively natural gas can be used as a feedstock in the synthesis of synthetic gasoline, diesel, jet fuels and lubrication chemicals via the Fischer-Tropsch (FTP) process. This is a key stage in the process of liquefaction of gas (Gas to Liquid=GTL) for converting synthetic gas, carbon monoxide (CO) and hydrogen (H_2) or biological raw materials into liquid hydrocarbon originating from natural gas or biomass feedstocks. However, because of the complexity of the feedstocks, prior to the use of FTS one must use preliminary high temperature chemical processes to transform the feedstocks into syngas. This can be performed using processes such as steam and dry reforming of natural gas or gasification of biomass. However, because of the intense initial capital investment and harsh conditions required for FTS and accompanying steps this route is only financially viable when the price of crude oil rise above that of natural gas, as is the current status and future forecasts. Therefore, the introduction of natural gas to the Israeli market creates opportunities for the development and production of synthetic fuels derived from it.

Overall importance: The discovery of the large gas deposits along the shores of Israel creates a national necessity and at the same time creates a rare opportunity for the development of a small-sized research and infrastructure of FTS and the accompanying technologies. In addition, development of a GTL infrastructure will enable research and development of attached technologies, e.g. chemical substitution of molecules derived from biomass into energy rich fuel additives.

Current activity: Academic research into these reactions and processes is being pursued in many laboratories in Israeli universities. Similar R&D activity is taking place in industrial companies. However, due to the high cost involved in development of these technologies, larger mini-pilot scale processes and even lab scale ones are only limited to a number of companies, funded mostly by the private sector outside Israel.

The proposed infrastructure: In order to promote GTL and chemical processing of biomass for the production of carbon based liquid fuels, a new infrastructure containing the following equipment is proposed:

1. analytical equipment for analysis of the feedstock, catalyst preparation and characterization and analysis of reaction products relevant to liquid transportation fuels.
2. Lab scale reactor systems suited for running FTS, reforming and biomass upgrading.
3. Mini pilot scale reactor system that will allow scale up of relevant processes and evaluation of catalyst.

As the growing activity in this area is taking place in several universities, the future center could be a distributed complex rather than located at a single site.

The cost of the infrastructure is classified in group B.

Facility for research of harvesting the sun radiation

Background: Since the Kyoto Protocol in 1997, there has been increasing international agreement on the need to reduce atmospheric carbon-dioxide, which is currently rising at a rate that exceeds 2 ppm per year. This is approximately equal to 30% of the annual emissions from fossil fuel, and has accordingly given rise to a realization of the need to replace fossil fuels with renewable sources of energy as urgently as possible. Solar energy is one of the principal avenues of research into renewable fuels, with emphasis being placed upon high conversion efficiency, low system costs, and storage. An example of high conversion efficiency are the multi-junction photovoltaic solar cells, which, have recently achieved conversion efficiencies close to 45% but with further research could approach 70%. Organic photovoltaic cells are an example of low cost cells, but their conversion efficiency reaches only 10%. The purpose of the facility is to increase the possibilities for research of new cells.

Some twenty Israeli teams perform research in solar energy. The available infrastructure for experiments under conditions of strong sun radiation is the laboratory in S'deh Boker which includes the solar dish of Ben-Gurion University, known also as BGNSEC. It is a unique infrastructure, planned to enable quantitative research in Physics, Chemistry and Materials in conditions of natural sunlight, concentrated to an intensity of 30,000 times that of midday sun on a bright day.

High level solar concentration leads to high conversion efficiency and lower cost of material, but poses many challenges at the basic and technological level. One of the central challenges is that many highly efficient types of solar cells behave differently in natural light and in artificial light, and particularly at extreme light concentrations. They must therefore be tested in a central facility rather than at university research laboratory conditions.

In spite of the unique properties of BGNSEC, it lacks equipment for the testing of photovoltaic cells and comparing their activities under both solar conditions, artificial radiation respectively and simulations. The proposed infrastructure is an enhancement of the abilities of BGNSEC by the establishment of a laboratory for testing of solar cells, including tools for connecting between laboratory testing and outdoor testing. The proposed equipment is vital in order to test innovative cells with low stability in all systems within one laboratory. It is also recommended to widen the scope of solar research and include the possibility of research of thermo-electric conversion and fuel cells. The research infrastructure comprising the two existing concentration facilities and the added laboratory for diagnosing solar cells will be a leading infrastructure in the area of solar energy and it will be attractive to both Israeli and foreign scientists. The required equipment includes an atomic microscope AFM, a Versa Lab system, a Raman spectrometer and more.

The cost of the infrastructure is classified in group A.

Source: Ben-Gurion University in the Negev, the Ben-Gurion National Center for Solar Energy, in.bgu.ac.il/en/solar/Pages/default.asp

Environmental Science

Environmental Sciences comprise four central areas: The atmosphere and air pollution, ecological systems of the earth, ecological systems of oceans and flowing water (including pollution, its treatment, prevention and removal, water desalination and hydrology). The proposals discussed by the sub-committee dealt with the establishment of presently lacking infrastructures in these areas, in order to advance Israeli Environmental Science.

Oceanic Sciences have gained large support in recent years through the establishment of the Mediterranean Sea Research Center in Haifa and the purchase of a research ship and a robot for underwater research. For research of the atmosphere one needs aircrafts, and research of the earth must be based on dedicated imaging equipment. In Israel there are presently no observation systems for the earth or for the atmosphere. This is true also for the entire ecological space in which Israel is situated. Therefore, the sub-committee will examine an infrastructure proposal suggesting a regional observatory with tools for tracking changes in the Earth within our region. The data supplied by the observation and imaging systems of such an observatory will serve Israeli researchers and become a basis for extending the training in Environmental Sciences of students and of decision makers. The equipment of the observatory will include a remote sensory system that can be airborne and various atmospheric sensors. The managing staff of the observatory will maintain ongoing contact with laboratories specializing in these areas in most Israeli universities.

The sub-committee was set up at a relatively late stage and its recommendations for new infrastructures will be part of the next roadmap.

Source: http://www.hamaarag.org.il/sites/default/files/styles/inner-page/public/media/images/inner/field_inner_main_image/partners-back_0_3.png?itok=R4m0ZY-a

Social Sciences and Humanities

The information age has led to many revolutions in the methods and work processes within the Social Sciences and Humanities. In the modern era it is possible to digitize documents, to store vast quantities of information, to search, to reconstruct and to keep this information while sharing it in cyberspace across physical and cultural boundaries. A beautiful example of a recently established central infrastructure in the area of Jewish culture is the digitization project of documents that were initially discovered in an ancient synagogue in Cairo and then dispersed into many different archives around the world. In the past, researchers who wished to study the Cairo Archive (g'nizah) documents had to travel to various countries and to spend time in their academic libraries, whereas today they have direct access to most documents at any available internet site.

Social Science researchers enjoy nowadays the possibility of keeping and processing data from public opinion polls and comparing them with data from previous years or from different cultures. These possibilities contribute to the success of European social infrastructures, e.g. the European Social Survey, and the survey of the elderly population, SHARE – Survey of Health, Ageing and Retirement in Europe. Israeli researchers have in the past taken part in these two infrastructural projects, and the sub-committee's recommendation is to foster and formalize the continued Israeli participation in order to ensure that the Israeli population will be included in the comparative European studies and that Israeli researchers will be partners of these studies.

The sub-committee examined 21 proposals and decided to give priority to infrastructures that will make national or international databases accessible to Israeli researchers in order to extend the basis for quantitative studies in all areas of the social sciences. These databases are vital not only for basic research, but also for establishing future policies on social and economic issues. The sub-committee recommends to examine cooperation with other relevant bodies (National Insurance, government offices etc.) that may leverage and extend the use of the infrastructures. These infrastructures include, in addition to the two aforementioned surveys, the establishment of an Israeli database for the Social Sciences and remote access systems tothe Central Bureau of Statistics.

In the area of Humanities, the sub-committee decided to recommend advancing the project of the Historic Dictionary of the Hebrew Language. This is due to the great importance that the sub-committee attaches to the development and completion of a full, scientific dictionary of the Hebrew language. During the coming year the sub-committee will discuss digital research infrastructures for the Humanities, enabling content transfer to digital files, development of digital research tools, expanding information and data networks and improvement of the inter-researcher network. The sub-committee will examine the requirements and the overall advantages of the establishment or the joining of digital research infrastructures, either through local infrastructures or partnerships in international infrastructures (e.g. the European infrastructure EU-DARIAH).

Membership in the European Social Survey

The proposal: Recognition of Israel's participation in the European social survey (ESSurvey) as an infrastructural project for the Social Sciences and requesting the financing of Israel's participation in the European Research and Infrastructure Consortium (ERIC) that was established recently to enable the continued functioning of this research project.

The European Social Survey is a multi-national bi-annual survey. In its first round (2002-3) it included 22 countries, today it covers 30 countries. The overall purpose of the survey is creating a data base of attitudes, values, behaviors and the changes they undergo over time by repeating the survey every second year. The survey is carried out by face to face interviews with people from the age of 15 and it constitutes a social science infrastructure both for researchers interested in basic research and for governments and policy developers. ESSurvey is the outcome of an initiative of a European research team (including Israel), supported by the European Science Foundation and the European Union. The Foundation and the Union have until recently covered the central cost of the survey, while each participating country financed its local implementation.

The population's attitudes and values are of great significance in democratic societies. They reflect the beliefs of the citizens, their wishes, their fears and their priorities. Long term changes in attitudes and values of the population are important for sound government and for social understanding, exactly like changes in the demographic profile and in economic trends. This is the rationale behind the European social survey and directs its activity. The social survey project focuses on long term changes in the cultural and social structure in Europe and its adjacent neighbors in the following three core areas:

(1) People's values – their world-view, including religious devotion, socio-political values and ethical attitudes.
(2) Cultural/national inclinations – the sense of national and cultural belonging and feelings towards external groups and multi-national government.
(3) The basic structure of society – people's placement in society including social status, education, level of social remoteness, as well as basic background characteristics, e.g. age, family structure and gender.

The data are today being collected in Israel and in 30 other countries and organized in a common database in an archive situated in Bergen, Norway (http://ess.nsd.uib.no/). In that manner a huge and constantly growing international database has been created and it serves as research infrastructure for researchers of the social sciences as well as an important source for the instruction and training of students. The database can be accessed by every researcher and student at no charge. It is beneficial not only for academic researchers but also for decision makers, who can examine the development over time of a wide range of processes in comparison to other countries. Many tens of research papers including data from Israel have been published based upon the European social survey. Israeli researchers played an important part in the planning of the survey. Moreover, European Social Science researchers have repeatedly emphasized the importance of Israel's inclusion in the survey because it offers a unique perspective in relation to central social processes. There exist about a hundred Israeli researchers who are users or are interested in becoming users of this infrastructure. It serves also as an important basis for research students' papers in seminars and courses in methodology.

The cost of the infrastructure is classified in group A.

Source: http://www.europeansocialsurvey.org/img/papirspiral_DS22492_306.jpg

The Historic Dictionary of the Hebrew language: the medieval period

When the Academy of the Hebrew Language was established in 1953 it was decided to create a historical dictionary that should document the development and meaning of all Hebrew words. This is a national project that is meant to encompass a period of about 3,200 years – from the writing of the Bible and the ancient inscriptions to modern Hebrew. The purpose is composing a historic, scientific authoritative dictionary, for the use of all researchers.

The project is accompanied by developing unique computer programs for processing the material for the dictionary. In 2005 the Academy established the "Ma'agarim" site and began uploading all material from the ancient literature to the internet. On this site the dictionary entry for each Hebrew word includes its grammatical analysis (verbal stem, conjugation, tense) and variations in its meanings. The "Ma'agarim" site serves researchers in Israel and abroad who are involved in the research of the Hebrew language in particular and in Judaism research in general.

The historic dictionary project is the largest project in the world for building a research infrastructure and an ongoing management of research in Judaism. It serves and will serve researchers of the Hebrew language and linguists in Israel and in the world as well as researchers in all areas of Judaism, including researchers of the Second Temple period literature and the Dead Sea scrolls, researchers of the Talmudic period and early Christianity, Jewish Philosophy and Bible commentaries. It will also serve researchers of literature and poetry. Some 20 researchers emphasized the academic importance of the project, and expressed their support for the proposed project in writing. According to an update from the Academy of the Hebrew Language, a new version of "Ma'agarim" will be introduced by the beginning of 2014. This version includes also modern literature (up to now only material from ancient literature was presented on the site). In addition, it will be possible to access the site without charge (up to now the access has not been free) so that the number of users can be expected to increase significantly.

So far more than twenty million words have been stored in the dictionary databank. Most of the words in the bank belong to two sections. The first section comprises all Hebrew scripts until the Ge'onim Period, and the second comprises a selection of writings from the Enlightenment Age until the establishment of Israel. Two periods have so far not gained adequate representation. One is the Biblical period, because the initiators decided to postpone dealing with this period until a later time, as it had already been researched more than any other period in the history of Hebrew. The other period, that to which the present proposal relates, is the medieval period from the mid-eleventh to the mid-eighteenth century.

The purpose of the project is advancing the scientific infrastructural work on the historic dictionary while focusing on the medieval period from 1050 to 1750 in order to present a complete database. The project is planned to last for five years of unprecedented progress in the history of the dictionary project so as to rapidly reduce the gap that needs to be closed and to start writing the dictionary.

The cost of the infrastructure is classified in group A.

The Israeli Database of Social Sciences

Background: Much of the research done on the Israeli society is based upon databases that have been collected over the years. The findings of this research influence public policies in areas such as economics, education, higher education, health, poverty, pensions etc. All research demands high quality databases that have been logically tested and are conveniently organized to enable secondary analysis for a variety of research purposes that might differ from the original aims of those who collected the data. The data enable long term research for examining trends and changes over years and can serve as a basis for international comparisons in the area of social sciences in Israel. Around the world there are many national social science databases as well as international partnerships that connect the data of all the databases and make them accessible for the purpose of comparative research (the European umbrella organization uniting many databases – CESSDA -- has been recognized as a central infrastructure on the European roadmap).

Present research practices do not guarantee that data produced for a particular researcher will be available to other researchers or will be kept for repeated usage. Parts of the data from various governmental sources are not presented in a way that guarantees their being used in repeated research, and are kept for a long time. Many data are lost over time and some of them are difficult to obtain for analysis. The database will correct these practices and contribute also to efficiency with regard to the cost involved, because collected data will be conserved so they do not have to be reproduced. The existence of an Israeli Database for the Social Sciences will serve a large number of researchers in all areas of social science. The databank will encourage empirical research of the population, the society and the economy of Israel. It will motivate researchers and public institutions to deposit their data in the database and to open them to other users. All this along with strict adherence to copyrights and to the rules of statistical confidentiality.

Purpose of the proposed infrastructure: The purpose of the Israeli Database for the Social Sciences is enhancing the research possibilities in the social sciences and ensuring its high quality. To this end the database will pursue the collection of data files from social surveys conducted in Israel, improving them and making them accessible to researchers and to students within the academic world or outside.

The main tasks of the Database are:

1. To continuously collect social and economic data about the Israeli society from various sources.
2. To process and improve the raw data received from various sources in order to ensure the high quality of the data before archiving it for the by researchers.
3. To collect and to keep data from publicly financed surveys and make them accessible to researchers.
4. To act as the central agent for requests of data from researchers and to mediate between them and government offices, institutions, authorities and others for this purpose.
5. To act as the central agent ensuring strict adherence to copyrights and to the rules of statistical confidentiality.

Data relevant to the Database and their use: The Database will serve as an agent collecting data from various sources for their future use. These data will come from independent studies in the area of social sciences, mostly financed by public or governmental institutions. It will also contain data collected by government offices, e.g. the Ministries of Finance, Social Affairs, Education, Interior and Absorption, and by public institutions, e.g. the National Insurance Institute, the Police, the National Authority for Measurement and Evaluation in Education, the Tax Authority and other public authorities. The Database will check the conditions for invoking the Freedom of Information Act in order to obtain data from public authorities and store them for the benefit of the researchers and of the Israeli public in general.

The Database will cooperate with the Central Bureau of Statistics (CBS). It will contain data from most of the surveys conducted by the CBS in the most detailed manner permissible by the Statistics Ordinance. The mutual relationship between the Database and the CBS will be defined by the Public Council for Statistics. The Database will endeavor to have the budgeting bodies instituting rules to ensure that the collection of data will be conducted in a trustworthy manner, that the documentation for the data collection and the logical tests at the initial processing will be professionally performed, and that the data will be accessible to the community of researchers on the completion of the financed research.

The Database should be a dynamic institution and develop according to the leading trends in the Social Sciences and the needs of the researchers in Israeli universities. It is therefore suggested that at certain intervals an examination should take place as to the direction in which the Database should develop and which databases are deserving of being included in it, this examination to be conducted in cooperation with development committees and researchers in the field.

The cost of the infrastructure is classified in group A.

Membership in SHARE – Survey of Health, Ageing and Retirement in Europe

The proposal: Recognition of Israel's membership in this project as a central infrastructure for the Social Sciences and ensuring continued Israeli membership in the project. The project began operating in 2004 and it is recognized as an infrastructural project of Social Sciences on the European roadmap ESFRI. It was the first research infrastructure to be organized as a new legal entity ERIC (European Research and Infrastructure Consortium).

A description of the Survey of Health, Ageing and Retirement in Europe (SHARE): The Survey was created as a long-term research to study the changing demographic trends in Europe and to prepare properly towards the challenge of an ageing population across various areas and matters.

Questions which are studied include: Will there in the future be enough working people to enable the continued system of transfer payments to provide a secure income for pensioners? Will elderly employees be required to extend their working years beyond the present pension age in order to support themselves? Will the extent of functional disability among the elderly in the population increase and last longer? Who will look after the disabled elderly in an era of demographic change? What is the recipe for a pleasant old age and for personal comfort at old age?

The survey is meant to investigate through regular tracking the economic, health-related and social processes that accompany the ageing population and their inter-relationships. SHARE conducts a longitudinal survey enabling the monitoring of changes taking place as a result of the ageing of the population.

The European SHARE Survey has so far conducted four waves of data collection, including a retrospective wave where information was collected concerning the childhood of the respondents based on their memory. The fifth wave of data collection is now under way. Israel joined SHARE in 2005 and has completed two waves of data collection. The third wave of data collection from the Israeli sample is being conducted presently, parallel to the fifth wave in Europe. The survey of SHARE-Israel includes more than 2,500 respondents, aged 50 and above from all sectors and their spouses. It is conducted in three languages, Hebrew, Arabic and Russian. The first wave included over 2,500 respondents. The second wave in 2009-2010 had a similar number of respondents, of whom more than 1,800 had also taken part in the first wave and can therefore be regarded as a longitudinal sample. As previously stated, the third wave of data collection is presently under way and is expected to be completed towards the end of 2013.

The database that is accessible to researchers free of charge is being used by academic research institutions, by research divisions of government institutions and by students towards advanced degrees. Already, a large number of articles and chapters in leading journals in a variety of disciplines have been published based upon data from the Israeli sample. In March 2011 SHARE was selected as a central research infrastructure (ERIC) for policy decisions in an era of accelerated ageing. In October 2012 the Israeli government decided to initiate procedures towards joining SHARE-ERIC. Israel's joining process was headed by the Ministry for Senior Citizens (today: Social Equality) and an inter-ministerial steering committee was established to accompany the project.

The development of the SHARE-Israel project and conducting the two first waves of data collection was supported by the National Institute of Aging under the National Institutes of Health in the US (NIH), the Ministry for Senior Citizens, the National Insurance Institute, the German-Israeli Foundation for Scientific Research and Development (GIF) and the Seventh European Framework Program for R&D of the European Union. The research data in the two waves were collected by the B.I. and Lucille Cohen Institute for Public Opinion Research of Tel-Aviv University, who is also collecting the data of the present wave.

The cost of the infrastructure is classified in group A.

CBS rooms: A remote access system to the research room of the Central Bureau of Statistics

The Central Bureau of Statistics (CBS) is the official institution in Israel authorized to conduct ongoing collection of statistical data related to the various demographic, social and economic aspects of the population of Israel. The CBS databases supply valuable information to researchers in many areas of social science and important information is obtained from cross checking individual data from different databases. There is a difficulty in the use of these data: CBS does not allow free use of very detailed data of individuals due to its commitment to protecting privacy and confidentiality. This is has to be conducted in person in the CBS offices in Jerusalem. Many researchers abstain from using CBS data because of these limitations.

The proposed infrastructure is the establishment of a remote access system, through which it will be possible to increase the accessibility of the CBS data to researchers in the academic institutions, and in particular those institutions that are far from the CBS offices in Jerusalem. It is a technological project that includes a central infrastructure in the CBS offices and work stations ("CBS rooms") in the academic institutions that will be connected to it. The CBS rooms will be guarded according to strict requirements of information protection. The remote access system will enable continuous use of CBS data for academic research, basic, applied or goal oriented. In this manner it will be possible to turn the CBS database into a real central academic infrastructure.

This project has a large research potential measured by the number of areas and of potential researchers that are going to use the infrastructure. The accessibility of the CBS data from within academic institutions will contribute greatly to the development of basic research in many areas of the Social Sciences and in additional areas, including Economy, Sociology, Education, Social Work, Medicine, Political Science, Communication etc. In addition, the infrastructure may extend the pool of researchers who use CBS data to develop a broad and varied range of applied research, thereby enhancing the interface between the academic community and policy makers in the government offices in various areas. Cross-checking data from different databases will enable researchers to deal easily with questions pertaining to relations between different areas, e.g. economy and education or economy and health.

The cost of the infrastructure is classified in group A.

Source: http://socialscienceil.blogspot.co.il/2013/blog-post_6919.html

Computing

Computing demands in Israeli universities are usually met by clusters of computers managed within each university. Clusters with hundreds or up to thousands of cores enable today's users of HPC – High Performing Computing - to do their research.

The international computing infrastructures available to Israeli universities today are EGI and PRACE. The Israeli participation is administered by the Inter-University Computation Center (IUCC). PRACE is a network of supercomputers that can be used by Israeli researchers who need to employ particularly large resources, but they must wait for half a year before their request is approved. ISRAGRID is a grid project run by IUCC, established at the initiative of TELEM, and it serves as the Israeli portal to the European Grid Infrastructure, EGI. The Israeli team of physicists working on the Atlas detector at CERN is the main consumer of grid computation. This decentralized computing method has not become popular among other branches of the academic community in Israel.

Cloud computing has been developed over the last years by commercial companies. It enables the creation of a virtual computing environment for HPC. Although this method is gaining popularity in the world, its use in the Israeli academic community is being held up due to managing and computing obstacles: Today, users who are interested in cloud services must purchase the service from an external supplier using. Israeli research contracts are not geared to cover costs of external computing services. The users are supposed to install their own scientific software and to personally adjust the cloud system to their needs, but many users do not know how to do this properly. Other problems include software license transfer to the cloud and finding solutions for saving large quantities of data.

The prevailing understanding in the world's HPC community is that both local computing clusters and cloud services should be available to customers in order to ensure flexibility and optimal utilization of their resources. It is therefore proposed to establish a new unit that will provide access to cloud services and serve as an information and service center for researchers regarding the use of cloud computing and its optimization. In addition, the sub-committee related to a number of problems connected to the internet services and their broadband, and it recommended that the PBC opens negotiations with the IUCC and the universities in order to solve these problems.

Cloud Service Unit (CSU)

The principles guiding the proposed unit:

- The unit will establish master agreements (MSA) with cloud service providers in Israel and abroad granting favorable conditions.
- It will establish MSAs with providers of counseling services for cloud computing granting counseling, training assistance and providing solutions to problems, including that of storage.
- It will develop an internet interface through which the academic consumer can choose the cloud service from a list of these providers.
- It will provide the infrastructure for these services and will ensure constant connectivity for users from the Israeli academic community.
- It will make sure that academic software licenses will be expanded to include cloud services.

- It will function as a service center providing knowledge and support concerning cloud services and assistance to researchers requesting it.
- It will make sure that the academic consumers will enjoy maximum flexibility and freedom of action when approaching these services.

The cloud service unit can negotiate favorable prices in the master agreements due to the large number of academic consumers. It will develop an interface that will ease the business commitment of the academic consumers towards the cloud provider of their choice. Within the first year it will develop an expertise allowing it to provide counsel and assistance with storage, connectivity and computing power, but will leave room also for the use of external counseling services for these needs. Based on the experience that will be accumulated by cloud users in various academic areas, the unit will suggest virtual computer configurations to specific groups of consumers. This will be helpful to new consumers and will expand the cloud services within the Israeli academic community.

Some expected outcomes of the establishment of the CSU are:

- Modernize research methodologies in fields like big data, genetics, astronomy and many other disciplines in sciences and engineering.
- Shorten the gap between computational practices in academia and industry
- Allow interoperability between research groups.
  Allow research groups to operate simultaneously on multiple platforms.
  Optimize computational platforms to scientific needs, including customization, scalability and redundancy

Source: byod-mobile-sync-and-share-31_11292642.jpg

Proposed budgeting model: The computing costs in the proposed system will be covered by the researchers. The unit must develop a smoothly running procedure for collection of payments that will be activated every time a researcher opens a cloud account in it. The amount to be paid by the consumer will include an overhead charge which, over time, will cover the cost of the new unit. The price to the consumer must be competitive compared to the market. The researchers will have free choice of the cloud service most compatible to their demands, whether in the framework of the unit or outside. It is suggested that the main financing of the unit during the first year will come from the PBC in order to support the initial stage of its establishment. Provided all works out well, the CSU should be able to cover its expenses on its own after the establishment period.

With costs of cloud services covered by academic researchers, the future of the CSU will be determined by their consensus. It is of course critical that researchers will have the means to exert their wishes. Hence it is proposed that the Israel Science Foundation will allow its grant recipients to pay for computational cloud services (both within and outside CSU) and charge these expenses to their contracts. Such expenses can partially replace the purchasing of computational equipment.

Other services: It should be noted that university administration relies heavily on computational resources. The PBC may consider it beneficiary to have the CSU propose new platforms, through cloud services, that will increase performance/cost of administrational needs.

The cost of the infrastructure is classified in group A.

APPENDIX: MEMBERS OF THE SUBCOMMITTEES

A. Subcommittee on the area of Physical Sciences and Engineering
   1. Chairman - Prof. Shimon Yankielowicz, School of Physics & Astronomy, Tel Aviv University, Chairman – Israeli Centers of Research Excellence steering committee
   2. Prof. Moshe Deutsch, Department of Physics, Bar-Ilan University
   3. Prof. Avishai Dekel, The Racah Institute of Physics, Hebrew University
   4. Prof. Yaron Silberberg, Department of Physics of Complex Systems, Weizman Institute of Science
   5. Prof. Yeshayahu Talmon, Faculty of Chemical Engineering, Technion, Member of Planning & Budgeting Committee

B. Subcommittee on the area of Life Sciences and Medicine
   1. Chairman - Prof. Eithan Galun, Genetic Therapy Institute, Hadassah Medical Center, and Hebrew University
   2. Prof. Oded Beja, Faculty of Biology, Technion
   3. Prof. Hillel Fromm, Faculty of Life Sciences, Tel Aviv University
   4. Prof. Orly Reiner, Department of Molecular Genetics, Weizman Institute of Science
   5. Dr. Noam Shomron, Faculty of Medicine, Tel Aviv University

C. Subcommittee on the area of Energy
   1. Chairman - Prof. David Faiman, Solar Energy Center, Ben-Gurion University
   2. Prof. Doron Aurbach, Department of Chemistry, Bar-Ilan University
   3. Prof. Edward Bayer, Department of Biological Chemistry, Weizman Institute of Science
   4. Prof. Gideon Grader, Faculty of Chemical Engineering, Technion
   5. Prof. Abraham Kribus, Faculty of Engineering, Tel Aviv University

D. Subcommittee on the area of Environmental Science
   1. Prof. Dan Yakir, Faculty of Chemistry, Weizman Institute of Science
   2. Prof. Yohai Carmel, The Faculty of Civil and Environmental Engineering, Technion

E. Subcommittee on the area of Social Sciences and Humanities
   1. Chairman - Prof. Asher Koriat, Faculty of Social Sciences, University of Haifa
   2. Prof. Noah Lewin-Epstein, Faculty of Social Sciences, Tel Aviv University
   3. Prof. Yohanan Friedmann, Faculty of Humanities, Hebrew University
   4. Prof. Ayal Kimhi, Faculty of Agriculture, Hebrew University
   5. Prof. Yaacov Choueka, Department of Computer Sciences, Bar-Ilan University

F. Subcommittee on the area of Computerization and Communication
   1. Chairman – Prof. Alfred Bruckstein, Faculty of Computer Science, Technion
   2. Prof. David Horn, School of Physics & Astronomy, Tel Aviv University
   3. Prof. Haim Wolfson, Faculty of Computer Science, Tel Aviv University
   4. Prof. David Peleg, Department of Computer Science & Applied Mathematics, Weizman Institute of Science
   5. Prof. Scott Kirkpatrick, School of Computer Science and Engineering, Hebrew University
   6. Mr. Edward Aronovich served as consultant to the Committee

The work of the Committee and all the subcommittees was coordinated by Ms. Noah Binstein, member of the professional staff of the Council for Higher Education/Planning & Budgeting Committee.

Prof. David Horn participated in most of the subcommittee meetings.