Technion - Israel Institute of Technology

The S. Neaman Institute

for Advanced Studies in Science and Technology

ANNUAL REPORT 1993-1994

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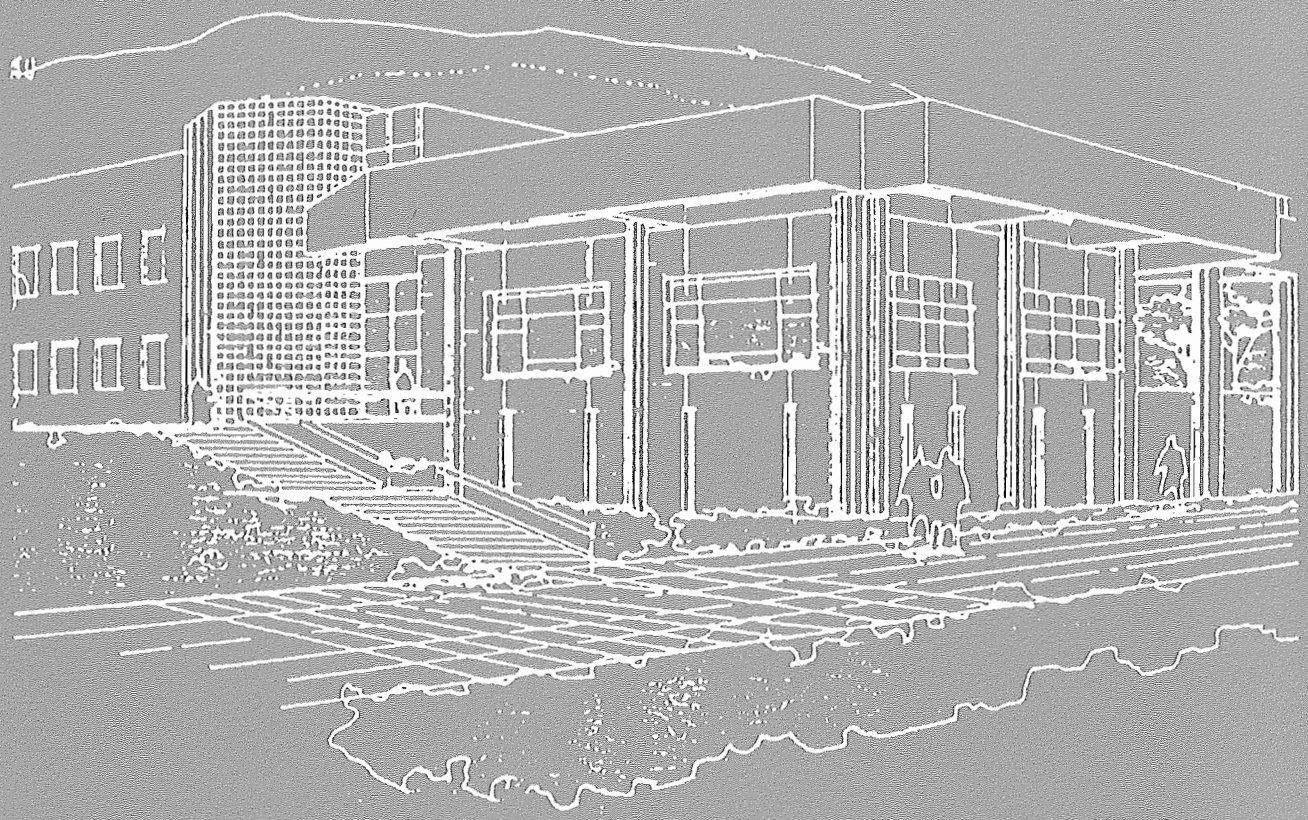
For Advanced Studies in Science and Technology



The Cornerstone Laying Ceremony of the new building for the Samuel Neaman Institute for Advanced Studies in Science and Technology, located on the Technion Campus, took place on June 15, 1993.
The new 16,000 sq.ft. building will house: office and seminar rooms for research, an administration wing, a library and a large auditorium.

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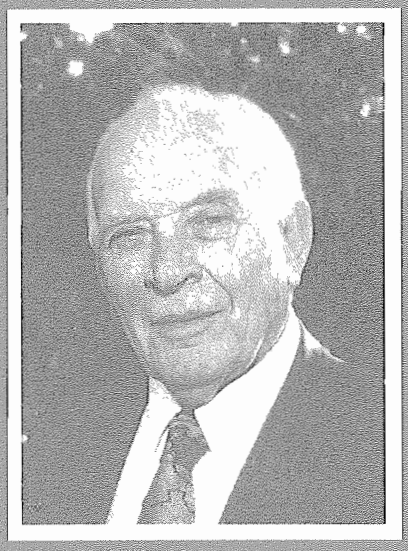
Vice-Chairman



Samuel Neaman
Chairman

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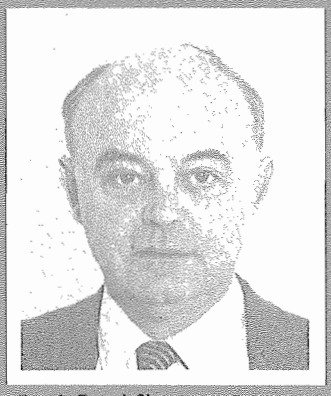

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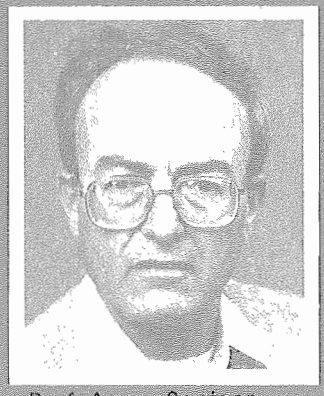

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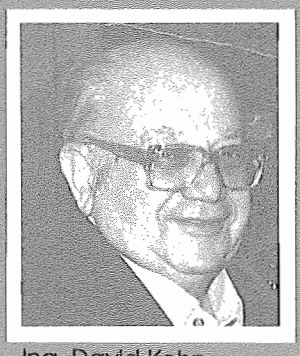

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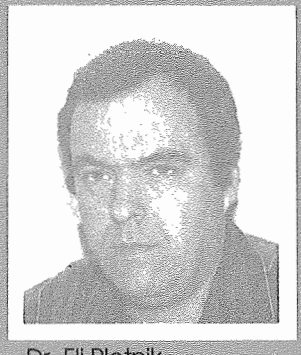


Dr. Eli Plotnik

THE SAMUEL NEAMAN INSTITUTE
FOR ADVANCED STUDIES IN SCIENCE AND TECHNOLOGY

ABOUT THE INSTITUTE

The Samuel Neaman Institute for Advanced Studies in Science and Technology is an independent public-policy research institute, established in 1978 to assist in the search for solutions to national problems in science and technology, education, economy and industry, and social development. As an interdisciplinary think-tank, the Institute draws on the faculty and staff of Technion, other institutions and scientists in Israel, and specialists abroad. The Institute serves as a bridge between academia and decision makers through research, workshops and publications.

The Institute pursues a policy of inquiry and analysis designed to identify significant public policy problems, to determine possible courses of action to deal with the problems, and to evaluate the consequences of the identified courses of action.

As an independent not-for-profit research organization, the Institute does not advocate any specific policy or embrace any particular social philosophy. As befits a democratic society, the choices among policy alternatives are the prerogative and responsibility of the elected representatives of the citizenry. The Samuel Neaman Institute endeavors to contribute to a climate of informed choice.

The Institute undertakes sponsored research, organises invitational workshops, implements continuing education activities on topics of significance for the development of the State of Israel, and maintains a publications program for the dissemination of research and workshop findings. Specific topics for research may be initiated by the Institute, researchers, government agencies, foundations, industry or other concerned institutions. Each research program undertaken by the Institute is designed to be a significant scholarly study worthy of publication and public attention.

Origins

The initiative for establishing this Institute in Israel was undertaken by Mr. Samuel Neaman. He nurtured the concept to fruition with an agreement signed in 1975 between himself, the Noon Foundation, the American Society for Technion, and Technion. It was ratified in 1978 by the Senate of the Technion. Mr. Neaman, a prominent U.S. businessman noted for his insightful managerial concepts and innovative thinking, as well as for his success in bringing struggling enterprises to positions of fiscal and marketing strength, has since retirement devoted his time to the activities of the Institute.

Organization

The Director of the Neaman Institute, appointed jointly by the President of the Technion and the Chairman of the Institute Board, is responsible for formulating and coordinating policies, recommending projects and selecting staff. The Institute Board is chaired by Mr. Samuel Neaman and includes ex-officio Technion's Vice-President for Development and Vice-President for Research. The Board is responsible for general supervision of the Institute, including overall policy, approval of research programs, and overseeing financial affairs. An Advisory Council made up of members of the Technion Senate and distinguished public representatives reviews research proposals and consults on program development.

Funding

The Institute's activities are partly financed by the fruits of the Samuel Neaman Research Fund, located at the American Society for the Technion. This ensures freedom and independence. At the same time, contract research is undertaken for government, public and private organizations, provided they are in accordance with Institute goals and objectives.

DIRECTOR'S REPORT

This has been an exciting and eventful year for us. The S. Neaman Institute celebrated its 15th Anniversary this year, and commemorated this milestone by laying the cornerstone for the permanent home of the Institute, to be built next to the new Faculty Club near the center of the Technion campus. This building will more than double the Institute's working space and will allow the concentration of all researchers and equipment under one roof. It will also have a facility for holding small to medium-sized meetings and symposia.

External events, mainly due to the developing peace process, resulted in a need to rethink many of the concepts basic to Israeli public policy. The Neaman Institute is joining government and other sectors to maximize the emerging opportunities to improve the economic and general well-being of Israel's population. This caused a change in emphasis towards increasing our interaction with industry, which will play a leading role in determining Israel's future position in the world economy; requiring high added value products to compete with cheap labor costs elsewhere.

For the past few years, our main areas of activity have been:
- Industry and Technology
- Science Policy
- Education and Culture
- Quality of Life and Natural Resources

In addition, we have added a special division dealing with **University-Industry Consortia**, in which the Neaman Institute is the academic center for pre-competitive, generic research into specific areas of interest, in close interaction with a group of companies. Two such consortia are already active, and two more are undergoing a preliminary feasibility study. The two existing consortia are in the fields of:
i) Ground stations for satellite communication: in which four leading industrial groups and the Neaman Institute are starting the second year of a planned five-year program.

ii) Digital communication receivers: in which there are

eight companies involved. This consortium began activity in January, 1994, and is scheduled to last up to four years.

These consortia are supported by the firms involved and the Ministry of Industry and Trade, as part of its Magnet program to enhance the competitiveness of Israeli industry by overcoming the limitations of Israel's size and small local market. We see this as a promising new way to increase interaction between the Technion and other university professors and local industry. It will benefit both the industrial partners and the quality and relevance of teaching at both undergraduate and graduate levels.

In the area of **Industry and Technology**, the Institute continued its multi-year program of in-depth examinations of various sectors of industry, in cooperation with the relevant government ministries and industrial associations. The purpose of these studies is to define long-term development strategies on a sectorial level. This year, we completed a follow-up study of the manpower requirements for the electronics and communications sector. The original investigation, completed last year, was the impetus for both this study and the founding of the digital communication consortium mentioned earlier. The first stages of a similar study - examining the chemical industry - were completed, in collaboration with the Manufacturers Association and the Ministry of Industry and Trade. A new study of future manpower requirements of software development companies began recently.

A four-year project on Technometric benchmarking of industrial products was concluded this year. A technique originally proposed by the ISI Frauenhofer Institute in Karlsruhe, Germany, was developed and used to test various industrial sectors. Over 10 technical publications resulted from this project, several of which appeared in leading journals.

The Ministry of Industry and Trade asked the Institute to formulate a method for examining the efficacy of its industrial research institutes (there are seven such organizations), and to apply it to them. As a first step, the Ceramics Research Institute is being monitored.

A third workshop on the subject of improving R&D efficiency, with the participation of leaders of R&D groups, was held at the Institute.

In the field of **Science Policy** studies, the Neaman Institute received a contract from the Ministry of Science and Arts to formulate a national program for research into space science and technology. This two-year project includes cost-effectiveness studies of the satellite programs already active and the formulation of new programs.

In collaboration with the Council for Higher Education, a study was completed on the effectiveness of selecting post-doctoral fellows through publication and citation analysis. A study of career patterns of Technion's medical school graduates and their level of satisfaction was undertaken jointly with the Faculty of Medicine.

The second annual SNI scientific conference on Signal and Image Representation in Combined Spaces was scheduled for May 1994; and two symposia, one on the next generation of information systems and technologies (NGITS 95), and the other on Hyperlipidemia in Israel (community, economic and research aspects) were selected and will be held in 1995.

The subject of education includes the continued production of videotaped science courses, adapted to current matriculation requirements at high-school level. This year, a new course on Vector analysis was distributed. The second, updated issue of our textbook-workbook combination - to teach technical Hebrew to newly immigrated scientists and engineers - has appeared. The first edition was awarded the Dori Prize by the Haifa Municipality last year.

A study of the progress of student candidates identified as "specially gifted" was completed, in order to determine the effectiveness of their training. It was found to be mainly useful for gifted children who took up scientific and engineering careers, and less so for other professions.

Following recommendations made by the Technion's Board of Governors, the Institute set up a select committee of five Technion faculty members - considered among the best teachers - to find ways of improving the teaching process to the satisfaction of both students and faculty.

As part of our effort to raise public awareness and interest in the environment, we initiated an exhibition of paintings by Haifa artists on the theme of air and water pollution. This falls under the heading of **Quality of Life and Natural Resources**. In this area, the examination of the feasibility of using coal ash from Israel's power stations to form artificial islands continues successfully, in a joint project with the Dutch government and the Israel Electric Corporation. Also in progress is the four-year project on the future development of law enforcement agencies; and the project on solid waste recycling, which is funded jointly with the Ministry of the Environment.

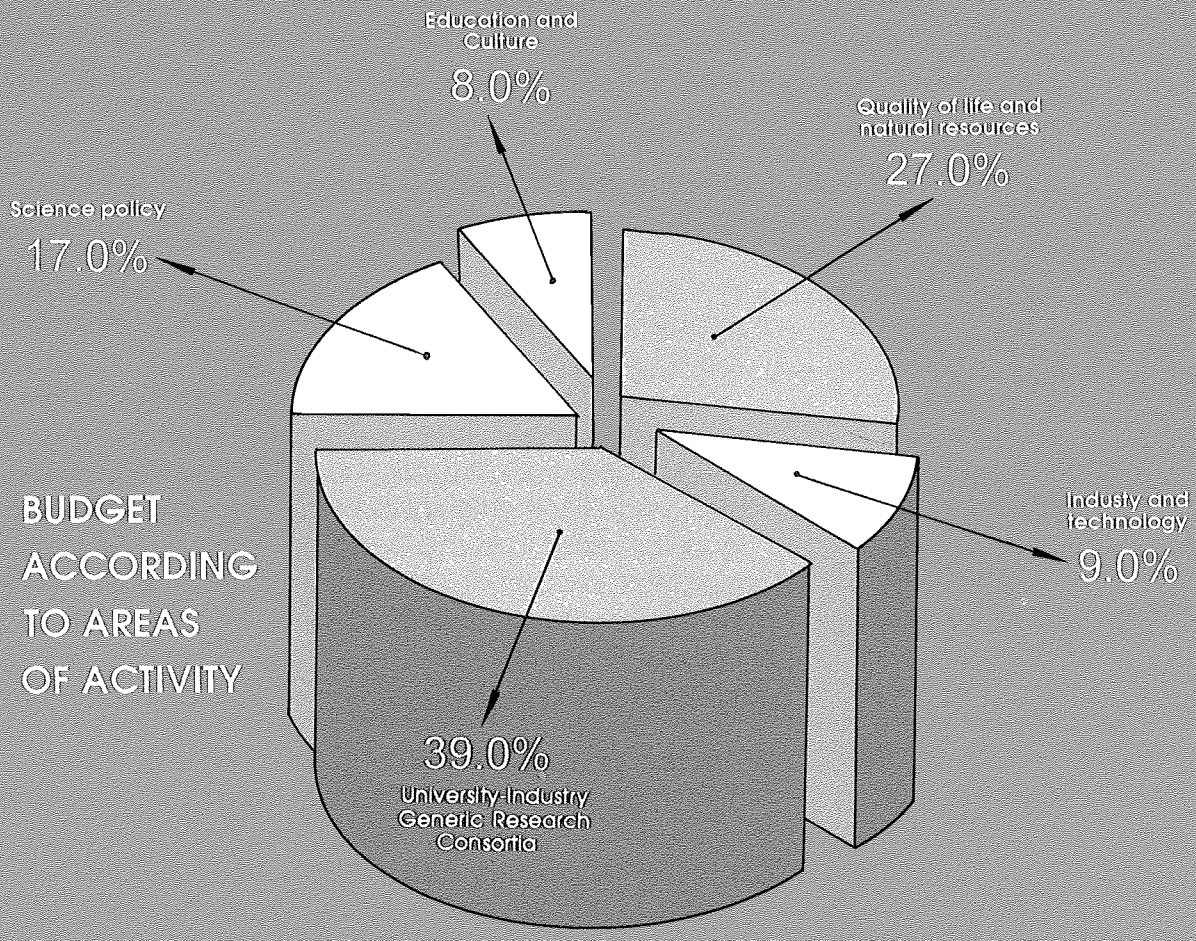
A study has been initiated of the medical histories of immigrants who came to Israel from the Chernobyl area in the Ukraine, where an accident in a large nuclear power station emitted severe radiation. A project was also begun on possible recycling and reuse of urban wastewater; and several proposals on improving the quality of life were submitted.

Over 120 researchers were involved in the Institute's activities (of which about 50 are Technion professors). This year the Institute published over 30 books, reports and articles and organized nine symposia and meetings. We also sponsored several conferences in subjects of interest held at the Technion by other groups.

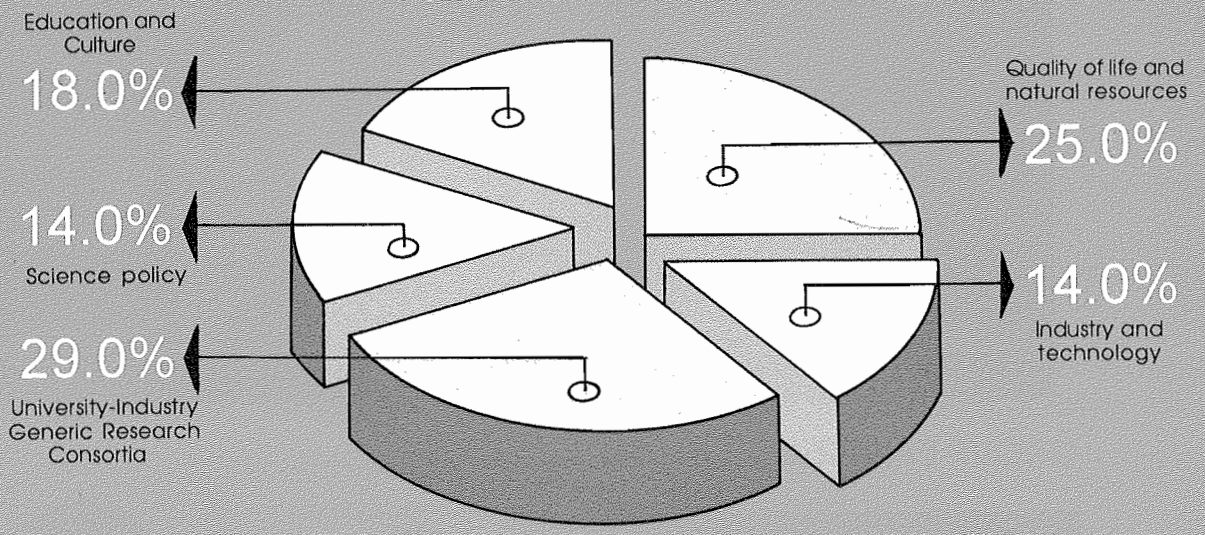
I would like to end this report by mentioning that this year marked the 80th birthday of the Institute's founder and chairman, Samuel Neaman. We wish him many more years of fruitful work with the Institute.

Professor Daniel Weihs
Director

BUDGET ACCORDING TO AREAS OF ACTIVITY



MANPOWER DISTRIBUTION ACCORDING TO AREAS OF ACTIVITY



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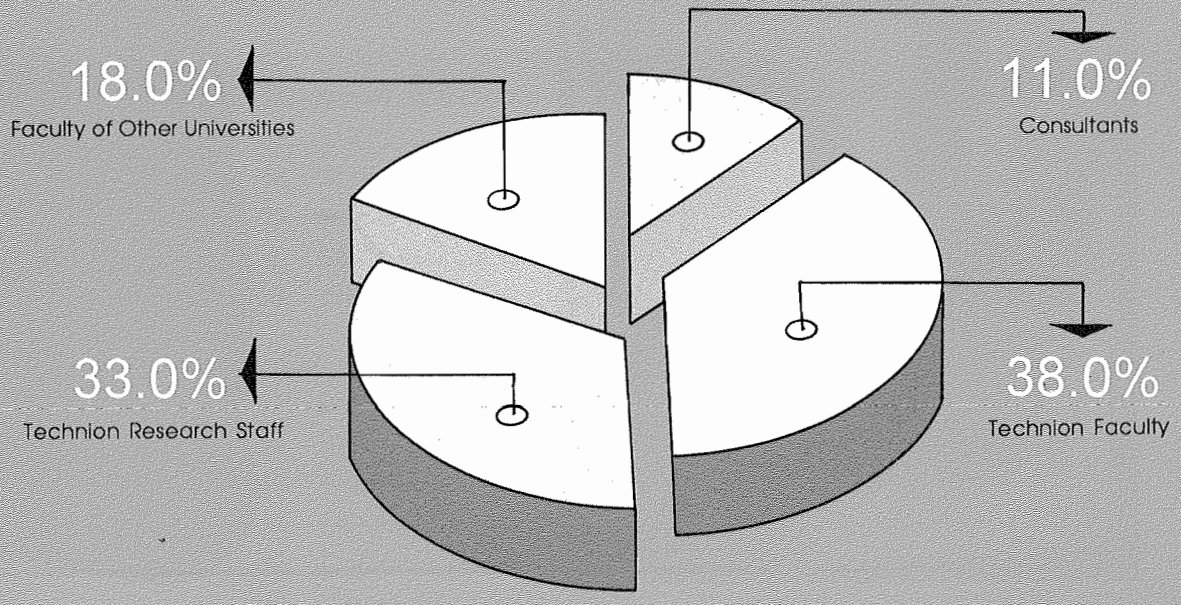

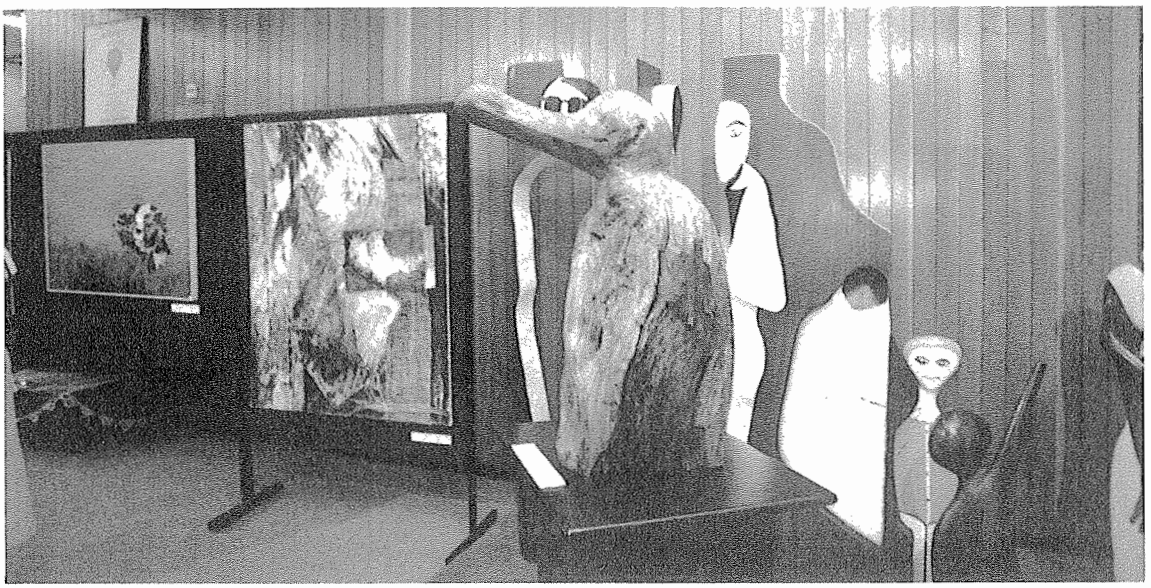

GROUP EXHIBITION ON ENVIRONMENT

Biran Shmuel - Distress
Woodcut, 79 x 45 cm

Kinreich Yehuda - Cormorant (Gulf War)
Wood, Height 70 cm

LIST OF ONGOING SNI PROJECTS

(Names of Researchers and Associates, appear on page 45)

I. INDUSTRY AND TECHNOLOGY

17 - Manpower Demand for the Software Industry (2610)
18 - Assessment of the Israel Ceramic and Silicate Institute (2590)
19 - Improving the Suitability of the Entrepreneur Support Infrastructure for New Immigrants (2560)
20 - The Chemical Industry 2000 (2380)
21 - Electronics 2000: The Israeli Electronics Industry (2040)
22 - R&D Quality and Productivity (1950)
23 - Technometric Analysis in Selected High-Tech Industries in Israel (1870)

II. UNIVERSITY-INDUSTRY GENERIC RESEARCH CONSORTIA

24 - Consortium on Digital Receivers (2410)
25 - Consortium on Earth Stations for Satellite Communication (2200)

III. SCIENCE POLICY

26 - A Comparative Study on University Governing (2570)
27 - A National Space Program for Israel (2550)
28 - Immigrant Absorption - The Interface between Research and Policy Making (2240)
29 - The Second SNI Annual Scientific Conference (2301)
30 - Hebrew for Technology and Sciences (2290)
31 - Science Indicators (1520)

IV. EDUCATION AND CULTURE

32 - Survey of Graduates from Technion's Faculty of Medicine (2600)
33 - Improving of Teaching at the Technion (2580)
34 - Scholastic Giftedness in Israel (2160)
35 - Career Patterns of Ph.D. University Graduates in Israel (2120)
36 - Group Exhibition on the Environment (2061)
37 - Teaching of Science and Mathermatics by Video (1840)

V. QUALITY OF LIFE AND NATURAL RESOURCES

38 - Evaluation of Congestion and Parking Toll on Travel Demand (2620)
39 - Health Aspects of Immigrants from the Chernobyl Area (2490)
40 - Wastewater Recycling in Municipal Areas (2360)
41 - Identification and Evaluation of Travel Time on Urban Roads (2260)
42 - Collection and Recycling of Municipal Solid Waste (2190)
43 - Utilization of Coal Fly Ash for Construction of an Offshore Island in Israel (2140)
44 - Law Enforcement System in the 21st Century (1560)

2610 MANPOWER DEMAND FOR THE SOFTWARE INDUSTRY

Israel's software industry is diverse and dynamic. Today, more than 150 software houses employ some 5,500 people, the majority of whom are computer scientists, systems engineers, industrial engineers and programmers. International software and hardware manufacturers have established joint projects and R&D centers in Israel following growing international recognition of talented Israeli professionals.

The object of the study is twofold:
1. To present a projection on manpower demand for the software industry (qualitative and quantitative aspects).
2. To explore the possibility of integrating new immigrants from the former Soviet-Union into this field.

The project is conducted in conjunction with the Israeli Association of Software Houses, the Ministry of Immigrant Absorption and the Ministry of Labor.

2590 ASSESSMENT OF THE ISRAEL CERAMIC AND SILICATE INSTITUTE

Located on the Technion campus, The Ceramic and Silicate Institute is a company that conducts basic and applied research, laboratory tests and experiments, and technology consultancy in the branches of ceramic, silicate, cement, glass, stonewool, fire-proof products and more. It operates under the supervision of industry representatives, the Ministry of Industry and Commerce and the Technion.

This study aims to analyze the Institute's activity and its contribution to industry. The study began in November 1993 and is scheduled to last approximately 6 months. It includes the following topics:

1. A comprehensive survey of the ceramic field and related branches from the point of view of R&D, technological, production and organization, covering:
- The local raw material industry and exploitation.
- The classic ceramic industry, mainly for construction and house appliances.
- Advanced engineering ceramics industry for use in electronics, communication, energy, medicine, aviation, space, defence, agriculture, metallurgy, mechanical equipment, tools etc.
- Academic and scientific institutions, research institutes, technological "incubators", engineering and consultancy services, test and prototyping laboratories.
- Government and public institutions providing related services to the branches in standardization, trading, financing, development and budgeting policy.

2. Analysis of the Institute's current share in the total local R& D activity from the technological and budgetary aspects.

This study was initiated and financed by the Ministry of Industry and Trade.

2560 IMPROVING THE SUITABILITY OF THE ENTREPRENEUR SUPPORT INFRASTRUCTURE FOR NEW IMMIGRANTS

The recent wave of immigration from the former Soviet Union has boosted the potential of the Israeli workforce. The current underemployment of this potential produces a need to find alternative ways to generate employment. One solution is viewed to be the promotion of entrepreneurial initiative.

Research goals:
1. To analyze the entrepreneurial potential of target immigrant groups (including immigrants over the age of 45; women; single parents; the disabled; medical science professionals; and immigrants with Ph.D. qualifications).
2. To evaluate the existing infrastructure for the promotion of entrepreneurship in order to determine its suitability for the special needs of target groups. 3. To recommend improvements. Research results will facilitate a more efficient use of resources allocated for the achievement of entrepreneurial objectives.

Research Method:
1. A review of international literature on the subject will be made, and a study of initiatives for its promotion.
2. The existing infrastructure in Israel will be investigated. By means of a questionnaire presented to new immigrants already receiving assistance, points of conflict between the entrepreneurial population and the support infrastructure will be determined. 3. Questionnaires will be presented to immigrants who opened businesses without using the support infrastructure. The reasons why they did not use existing services will be investigated. 4. Means for the exploitation of the entrepreneurial potential of the target groups defined will be investigated and described.

Expected results:
Policy recommendations will be made to improve the suitability of the support infrastructure for the successful exploitation of the entrepreneurial potential of target immigrant groups.

2380 THE CHEMICAL INDUSTRY 2000

The objective of this study is to identify alternative directions for the development of the Israeli Chemical Industry in the context of the international chemical industry. Based on such alternatives, the needs for educated manpower, research facilities, marketing efforts and raw materials in the near future and later will be identified.

Phase A of the project was completed. The report in this phase includes two parts: A. A study of the characteristics of the international chemical industry and a more detailed look at a few large chemical companies. Data for the past two decades were presented and some long-term trends were analyzed. B. A study of the characteristics of the Israeli chemical industry, including long and short term trends.

The project is partially funded by the Ministry of Industry and Trade.

2040 ELECTRONICS 2000 - THE ISRAELI ELECTRONICS INDUSTRY

Completed this year, this project was carried out in conjunction with the Electronics Industry Association. It consisted of four stages:

a. The electronics industry in the world and in Israel.
b. Identification of areas and subjects of interest.
c. Educational trends in electronics engineering,
d. Manpower demand for the electronics industry.

The last stage, which was conducted during April-June, 1993, included a survey of 21 enterprises employing more than 100 people each. The data received from the questionnaire included: enterprise budgets; R&D and manpower distribution according to specializations; and manpower shortages. The results show a high percentage of computer engineers (software and hardware) employed by these enterprises. The manpower intake of the enterprises included in the survey was 545 engineers in 1992 and 690 in 1993. There is an additional demand for 1000 engineers mainly specializing in software and system engineering. The total supply of engineers and computer science graduates in Israel is about 900 per year. The results predict a shortage of engineers and computer science graduates in forthcoming years.

1950 R&D QUALITY AND PRODUCTIVITY: Measurements and the Improvement Process

The third of four annual workshops on "R&D Quality and Productivity" was held at the S. Neaman Institute in June 1993. The aim is to provide a framework through which a high-tech company can evaluate and improve its R&D quality and productivity. A comprehensive system for the evaluation of R&D quality and productivity was presented and simulated.

The system incorporates two feedback loops:

1) Resources feedback loop: a long-term cycle through which R&D resources are evaluated and improvement decisions are taken. Four types of R&D resources were identified: human, technological, managerial and organizational.

2) Procedural feedback loop: a short-term cycle which provides an "on-line" assessment of the R&D process. Process characteristics were classified into three groups: structure, behavior and expressiveness. Each is separately evaluated through a set of surrogate measures and guidelines.

The resources feedback loop takes place only when the overall success of the developed product can be determined. The procedural feedback loop takes place at each milestone of the project with respect to six stages: concept demonstration, pre-development, full scale development, pre-production, production and support.

These workshops provide a unique forum for R&D managers to explore fundamental issues in R&D activities. A fourth follow-up workshop is planned for May 1994, in which preliminary results of the system's implementation will be presented and analyzed.

1870 A TECHNOMETRIC ANALYSIS OF COMPARATIVE ADVANTAGE IN SELECTED HIGH-TECHNOLOGY INDUSTRIES IN ISRAEL

This three-year project applied "Technometric" techniques to the quantitative measurement of the comparative advantage of Israeli science-based products compared to those of Europe, Japan, and the U.S. in two selected high-tech industries: biotechnology (specifically, biodiagnostic kits) and sensors.

Technometrics is a new approach to benchmarking (quantitative comparison of the performance of products, processes and services from industry and global leaders), developed in 1986 by Dr. Hariolf Grupp. Key attributes of a product are identified and measured and then assigned a value on a (0,1) scale (with "0" representing the simplest technology and "1" representing the "state-of-the-art") The (0,1) metric permits aggregation and comparison across firms, sub-industries and countries, and allows the creation of a useful "product profile", which graphically portrays a product's strengths and weaknesses relative to its competitors'.

The project led to a series of broader studies on the entire innovation process, from basic research through to the export of knowledge-based products. Using a system of integrated indicators, we showed empirically that compared to 11 European Community nations, Israel excels at using resources to generate scientific and technological excellence, but is relatively inefficient in generating knowledge-based exports.

A workshop was held in which results from the three-year project were explained and summarized to an audience including senior management from the biodiagnostic and sensor firms that took part in the study and other high-tech firms.

The project was partially funded by the German-Israel Foundation (G.I.F.) and resulted in six published papers in English, two working papers and a Hebrew monograph and article.

2410 THE CONSORTIUM FOR DIGITAL COMMUNICATION

The communications market has grown rapidly since the beginning of this decade, both in terms of customers and variety of services provided. Personal Communication Services (PCS); high definition television; and integration of data, voice and video services in computer and communication networks are a few examples of this evolving area.

The research and development activities within the consortium framework include:

1. Cellular communication technology.
2. Development of digital receivers based on Digital Signal Processors (DSP) chips for versatile use.
3. Development of low cost units.

The S. Neaman Institute is responsible for academic research in the consortium and for building the central database for use by consortium members.

The Consortium for Digital Communication was founded at the beginning of 1994 by Raphael, Tadiran, Elisra, Elta, DSPT, Gilat, Orckit, Shiron and the S. Neaman Institute, and is supported under the Magnet program by the Ministry of Industry and Trade.

2200 CONSORTIUM: EARTH STATIONS FOR SATELLITE COMMUNICATION

Communication via satellites has grown rapidly in recent years, as technological developments have broadened its accessibility. It is now also available to the "small business" sector (banks, offices, department stores), and the consumer market.

The consortium of Earth Stations for Satellite Communication was founded by Raphael, Israel Aircraft Industries, Elisra, Gilat and the S. Neaman Institute to establish a joint venture that will enable Israeli industry to compete in this market. The consortium is supported by the Chief Scientist of the Israeli Ministry for Industry and Trade and the companies involved.

The basic research activities are the responsibility of the S. Neaman Institute. Work in the following areas is carried out at the laboratories of the Electrical Engineering Department at Technion. Subjects covered include:

1. Advanced modulation, coding and compression techniques for efficient utilization of the satellite channel.
2. New access and routing methods between earth stations and satellites
3. Image compression and image processing for satellite communications.
4. Antennas for low-cost front end units of earth stations.

In addition to this research, the Institute is responsible for building and handling the database in satellite communications for use by all consortium members.

Several workshops and technical meetings were organized by the S. Neaman Institute in 1993/94.

2570 A COMPARATIVE STUDY ON UNIVERSITY GOVERNING BODIES IN ISRAEL

This project compares characteristics of the main governing bodies of the seven Israeli universities: Technion, Bar-Ilan, Ben-Gurion, The Hebrew University, Tel Aviv University, the Weizmann Institute and Haifa University.

The governing bodies included in the study were the following: the Board of Governors and its subcommittees; the Council; the Senate; the Steering Committee; and the functions of President and Rector. For each function there is a full description of its authority and responsibility, its election mode and term of office. The study was presented to the Joint Board of Governors Senate Committee appointed by the Board of Governors to update organization at the Technion.

2550 A NATIONAL SPACE PROGRAM FOR ISRAEL

Space sciences and space technologies represent an important element of the technological strength of developed countries. Most high-tech industries in those countries are involved in space development projects and have acquired their expertise and experience in the framework of a national space program.

For those industries, space-related development activities act as a technology driver, the importance of which is increasing in view of worldwide reductions of defense budgets and military developments, which until now were dominant in pushing the technological edge of those high-tech industries. Civilian space-related developments therefore represent an important alternative technological activity which contribute to the technological and competitive strengths in the rapidly growing space business.

The importance of involvement in space activities and development is recognized by most developed countries and a growing number of third world countries. National budgets dedicated to develop this field form part of overall policies in science and technology.

With the growing possibility of achieving real peace in our region, it is becoming increasingly important for Israel to succeed in developing space technology as part of its conversion of high-tech industries into civilian markets, thus preparing them for an era of peace and the world of tomorrow.

This study aims to evaluate the benefits of space activities for Israel. It will formulate goals and a framework for a realistic long-term space program which could effectively contribute to the preparation of Israel's scientific and technological community for the technological challenges of the future. Its aim is to enable Israel to compete globally with space-related technologies, applications, space utilization and in all related markets.

The project is funded by the Ministry of Science and Arts.

2240 IMMIGRANT ABSORPTION: THE INTERFACE BETWEEN RESEARCH AND POLICY MAKING

World experts in disciplines ranging from political sciences to human geography met for two days of presentations and discussions and one day of touring immigrant absorption enterprises in Israel.

The workshop goals were as follows:

- To present accumulated knowledge regarding the absorption (or non-absorption) of immigrants in industrialized and developed societies;
- To analyze the implications for policies designed to enhance cultural, social, political and economic integration; taking into consideration the well-being of individual immigrants and the welfare of the absorbing society with its various groups of citizens.
-To develop an agenda for research that will strengthen the interface between immigration research and policy making while considering the differences between the various countries.

The organizer and program head of the workshop was Prof. Naomi Carmon, Director of the Klutznick Center for Urban and Regional Studies at the Technion. A collection of papers submitted to the workshop entitled Immigrants: Liability or Asset? - Innovative Research and Policy Implications has been published.

The workshop was carried out in conjunction with the Center for Urban and Regional Studies at the Technion's Faculty of Architecture and Town Planning, and was supported by the estate of the late Ladislav and Vilma Segoe.

2301 THE SECOND SNI ANNUAL SCIENTIFIC CONFERENCE

The Workshop on Signal and Image Representation was selected as the second scientific annual conference sponsored by SNI under the program to support scientific meetings related to research carried out at the Technion.

Recent developments in mathematical techniques, offering efficient tools for signal and image representation and processing, have prompted considerable interdisciplinary activity between mathematicians, physicists and engineers. This is especially apparent in research related to the wavelet type approach, which provides a unified framework for a number of multiresolution techniques. Related to this general theme of representation in combined spaces are the Gabor and Zak transforms, the Wigner distribution, etc. These transforms, which are most important for representation and analysis of images and signals that by their nature are nonstationary, highlight a relation between quantum mechanics and the group theoretic approach to the analysis of the structure of natural signals and images.

The topics presented at the workshop included: orthogonal wavelets; semi-orthogonal and non-orthogonal wavelets; multiresolution techniques; wavelet-type transforms; Gabor representation; and the Zak and Zak-Gabor Transforms; relations between quantum mechanics and image represention techniques; irregular sampling and frames; applications to signal and image representations; and applications to compression.

The Workshop was organized in conjunction with the Ollendorf Center, the Institute of Advanced Studies in Mathematics and the Technion Institute for Theoretical Physics.

2290 HEBREW FOR TECHNOLOGY AND SCIENCES

In 1993, an updated edition of the two textbooks Hebrew for Technology and Sciences (Intermediate Level) and Hebrew for Technology and Sciences (Advanced Level) were published in the framework of this project. These books were written specifically for the teaching of Hebrew to new immigrants whose professions are related to the sciences and to various engineering and technological fields.

Both books are based on a unique instruction method which was designed and developed by the Hebrew Unit of the Technion's Department of General Studies. This method utilizes identified language patterns resulting from the project's research data. The contents include specially selected texts, scientific vocabulary and varied original exercises targeted to achieve specific language skills and learning outcomes.

Since publication, the books serve as textbooks at the Technion for all Hebrew language instruction. They have also been adopted by the network of Israeli Technical Colleges, and are used in vocational high-schools, technical retraining programs, pre-academic studies and more. Over 3000 copies have been distributed.

1520 SCIENCE INDICATORS

Utilizing a variety of statistical and computerized data processing tools, the Science Indicators Project attempts to quantify the quality and scale of operation of Israel's scientific research. The processed data are supplied to several science policy decision-making bodies, such as the Planning and Grants Committee of Israel's Council for Higher Education (CHE), the Israel Academy for Sciences and Humanities, the Ministry of Science and others.

During 1993, we received the ISI updated database including articles up to mid-1992. This enabled us to perform analyses at the individual level of faculty productivity at the Technion and other Israeli universities.

Two projects on quantitative evaluation of university departments in Israel were performed for the Planning and Grants Committee. These projects quantify publications and citations of faculty members from mathematics, medicine and science departments in Israeli universities.

2600 SURVEY OF GRADUATES FROM THE TECHNION FACULTY OF MEDICINE

Twenty years ago, the degree of Doctor of Medicine (M.D.) was awarded to the first graduates of the Technion's Rappaport Faculty of Medicine.

The academic program of the faculty extends over a period of six years, plus one year of internship. The curriculum includes basic, preclinical and clinical sciences.

Since its establishment, more than 1000 students have graduated from the Faculty of Medicine. The aim of this survey is to study the background, the professional success and the attitudes of the graduates in order to enhance the attractiveness of the Faculty for potential candidates, and improve training. Detailed questionnaires were sent out to all graduates and we are now in the process of analysing the answers.

The study is conducted in conjunction with the Technion's Rappaport Faculty of Medicine.

2580 IMPROVING TEACHING AT THE TECHNION

A committee to examine teaching in the Technion was set up in response to requests from Technion's Board of Governors.

The committee's tasks include:
a) Examination of the various aspects of teaching in leading universities: organization; evaluation of teaching; methods of keeping high standards; and methods of training and increasing the incentive to faculty members (and teaching assistants) for good teaching.
b) Evaluation of the situation in the Technion based on the findings of the above.
c) Recommendations to the Technion President and the Vice President for Academic Affairs on how to maintain high standards of teaching at the Technion.

A computerized literature survey was carried out in order to identify papers and reports that are related to the committee's investigations.
Meetings were held with undergraduate representatives at the Technion.
The committee invited comments and suggestions from faculty on the subjects of interest. The addressees were asked to either appear before the committee or submit written comments.

2160 SCHOLASTIC GIFTEDNESS IN ISRAEL

The outcome of this study is a descriptive profile of people who were defined as having high scholastic potential in their twenties. The profile includes descriptions of the subjects' environmental and personal characteristics, as well as their academic and occupational achievements.

The definition of giftedness in this study was based on the subjects' performance in the Psychometric Entrance Test (PET - required by all Israeli universities). The group studied included 456 subjects whose scores were in the upper percentile (1%) of all scores obtained on PET in the years 1984 and 1985. The control group included 750 subjects sampled randomly from the examinees of the remaining range of ability. Through a questionnaire, detailed information was gathered on the subjects' background.

The gifted are characterized as follows: the majority are males (80%), with a strong tendency toward the sciences and technological fields; they have a strong socioeconomic background (especially in regard to their parents' education); they experienced a supportive and intellectually enriching environment in childhood; and have less social involvement and self-confidence. Among the main reasons given by some of the gifted for not realizing their potential were laziness; lack of persistence and determination; and lack of skill to take advantage of opportunities. The gifted reported a great appreciation of the contribution of extra-curricular enrichment activities to their intellectual development. In terms of vocational motivation, they ranked originality and creativity higher than control, influence and income.

While the gifted perceived themselves to be lucky to a greater degree than the control group, there was no difference found in the degree to which they perceived themselves to be happy.

This project was carried out by a team from the National Institute for Testing and Evaluation.

2120 CAREER PATTERNS OF Ph.D. UNIVERSITY GRADUATES IN ISRAEL

The purpose of this research is to investigate the career patterns of Ph.D. graduates in the light of potential competition in the labor market with immigrants from the former Soviet Union holding Ph.D.degrees.

330 Ph.D. graduates in engineering and sciences in Israel who received their degrees in 1987, 1989 and 1992 were asked to fill out a research questionnaire.

The questionnaire included four groups of variables:

a) Biographical data and personal characteristics.
b) Information on work setting and job opportunities.
c) Career variables, including motives, goals, and career commitment.
d) Career success, including status of employment, publications, salary and work satisfaction.

Among the findings:

a)Biographical background: Of all the respondents, 25% graduated in 1987, 30% in 1989 and 45% in 1992. 26% graduated in mathematics and physics, 19% in engineering, and 55% in life sciences. 62% of the respondents were male with an average age 38.6 years.

b) Work Setting: 59% of the graduates have jobs and 25% have postdoctoral positions. Of those who are employed, 51% are in academic institutions, 13% in R&D, 5% in the private industry, 9% in the high-tech industry,15% in the public and service sector and 5% in the private service sector. 75% of the respondents live in Israel and 19% in the US.

c) Job Opportunities and Level of Satisfaction: About 80% of respondents believe that in recent years there are less job opportunities in academic institutions than in the past and are satisfied with the opportunities for growth, with the challenge in their job and with the matching of their qualifications to job requirements.

2061 GROUP EXHIBITION ON THE ENVIRONMENT

The S. Neaman Institute sponsored a group art exhibition on the environment. Exhibited in Haifa at the Chagall House of the Israel's Painters and Sculptors Association House during September 1993 and in Tel-Aviv's Ariela Library exhibition hall during November 1993, it included the work of 35 artists belonging to the northern district of the Painters and Sculptors Association.

The aim of the exhibition was to increase public awareness of the environment, specifically in the areas of air and water pollution. Some of the paintings and sculptures exhibited used symbols and allegories to convey their message, while others focused on environmental disasters or the improvement of the landscape. The catalogue of the exhibition with its cover, printed on recycled paper, was displayed at the Print Exhibition in Tel-Aviv, November 1993.

1840 TEACHING OF SCIENCE AND MATHEMATICS BY VIDEO

This project aims to improve the quality of science teaching in high-schools. The concept is to have course material presented in the schools by the best teachers at university level. The most practical way to achieve this goal is to videotape entire courses in high-school physics, mathematics and chemistry, using the Technion's best teachers; and then to use the videotaped lectures in high-schools. The project began four years ago, and in this academic year, the following activities were initiated:

(1) Additional sets of physics and mathematics courses were distributed to about 50 high-schools and a dozen preparatory schools.

(2) A course in Calculus is under preparation.

(3) A number of workshops for teachers, principals, supervisors and students were organized in which the program was presented by the S. Neaman Institute.

(4) A paper on Teaching Sciences by Video, including the results of a survey on using video-cassettes to improve the quality of science teaching, was presented at the Hypermedia Conference in Vaasa, Finland, on May 24, 1993.

The program is partly funded by the Association for the Advancement of Education.

2620 EVALUATION OF CONGESTION AND PARKING TOLL ON TRAVEL DEMAND

Congestion toll is a payment aimed at reducing travel demands. It is imposed on drivers traveling at peak time. At present, drivers do not pay the full cost of their journey, particularly in terms of the delay they cause to other drivers. The new, achieved equilibrium - characterized by a smaller number of trips - is more justified economically.

The present research aims to evaluate the traffic impacts of congestion tolls or parking fees at destinations. The travel demand function will be estimated from field data. The Technion campus will be selected as a case study. The questionnaire will be based on the methodology of Stated Preference (SP), in which drivers are asked to rank their preferences to hypothetical alternatives. A logit model will be estimated for the data.

2490 THE ISRAELI CHERNOBYL HEALTH EFFECTS STUDY

This study analyzes the relative health risk level for immigrants from irradiated areas from the former Soviet Union.

The study has entered its third year of operation. During last year, the number of immigrants from the exposed areas increased to about 7,000 (out of an undefined target population of 50,000 to 100,000).

The survey of these immigrants is conducted using three methods:

- Self reporting of health events by immigrants.
- Reports from primary care physicians.
- Linkage with health data bases for hospitalization, morbidity and mortality.

One control group of 7,000 immigrants from areas known to be outside the irradiated zone (Moscow, St. Petersburg) was sampled. Questionnaires for self reporting of health status will be sent to these immigrants, and a similar validation and linkage process to other data sources will be done thereafter.

Primary results in the study group point at an increased self reporting of malignant diseases and benign thyroid diseases. These findings have to be handled with caution as their validation is still in process. Another limitation is the lack of reference data as the reports from immigrants from non-irradiated areas have not yet come in.

In the coming year, the validation process will be finalized and the basis will be laid for the calculation of expected mortality rates in the non-exposed Russian immigrant population. The relative levels of health risk for immigrants from irradiated areas will then be calculated.

2360 WASTEWATER REUSE IN THE URBAN SECTOR

Water is a scarce resource in Israel and there is competition between municipal and agricultural water use. With the increase in Israeli population, demands on water resources for urban use are increasing. Water reclamation and reuse have become a beseeched option for conserving and augmenting water supplies. Indeed, reuse of treated sewage effluent for agricultural irrigation has been practiced in Israel for some time now.

The purpose of this project is to study the feasibility of extending water reclamation and reuse beyond merely agricultural irrigation to urban uses in municipalities throughout Israel.

Many urban uses can be satisfied with water of less than potable quality. The economics of source substitution with reclaimed water are site specific. The project outlines a systematic approach to planning for nonpotable reuse and assesses costs and benefits for reuse alternatives. It also addresses major technical and nontechnical issues involved in water reclamation and reuse programs. This will serve as a basis for a workshop in which different aspects of nonpotable water reuse will be evaluated under the common goal of meeting our future water demands in the best possible manner.

2260 IDENTIFICATION AND EVALUATION OF THE RELATIONSHIP BETWEEN THE MEAN AND THE VARIANCE OF TRAVEL TIME ON URBAN ROADS

Travel time on road segments is an important indication of the quality of traffic flow and gives a decision variable for forecasting traffic volumes in assignment programs. In those programs, it is assumed that drivers minimize their travel cost function when choosing their path. The cost function includes all factors that affect drivers' preferences. It is commonly believed that the variance of travel time is also considered by drivers when they choose a path.

A model for the variance of travel time will be estimated for different geometry, traffic and control conditions. The model will be based on field data gathered from freeways, arterials and collectors. The travel time data will be calculated from a survey matching license plates extracted from video films taken at both ends of each road segment.

Once the data has been transformed to the normal distribution, a regression model will be adapted. The independent variables will be selected, based on graphical and goodness-of-fit tests.

This study is funded by the Ministry of Transport.

2190 COLLECTION AND RECYCLING OF MUNICIPAL SOLID WASTE - ANALYSIS OF ALTERNATIVES

The disposal of municipal solid waste (MSW) causes economic and environmental burdens in both developed and developing countries. Recycling and the incineration or composting of organic matter are the means through which these burdens can be minimized. Recycling of waste materials is an issue discussed, evaluated and examined all over the world. Israel is presently considering various strategies and alternatives.

Recycling is often more expensive than the cheap alternative of landfilling. Source separation can reduce recycling costs, but presently, there is neither direct nor indirect incentive for the individual household to reduce, reuse or recycle waste. There is a need to devise initiatives, regulations and education.

The comparison and analyses of alternative means to be implemented in Israel as a part of a national integrated waste management policy are evaluated in this study.

The study is carried out by a team of researchers from the Technion and Haifa University and is partially funded by Israel's Ministry of the Environment.

2140 APPLICATION OF COAL FLY ASH FOR CONSTRUCTION OF AN OFFSHORE ISLAND IN ISRAEL

The construction of an artificial island off the coast of Tel-Aviv is developing into an international and interdisciplinary project. Following the agreement with the Dutch delegation for technical cooperation, the Dutch government authorized its participation in this stage of the project for a period of 18 months. A joint Israeli-Dutch program was established. This program deals with various engineering and environmental aspects of the island. Preliminary geotechnical aspects of the island and the possible effects of silt and clay layers at the sea bottom on the stability of the island have been recognized and considered. Potential sources for fill material are also being considered.

To this end, geological data concerning the structure of layers at the sea bottom containing sand and silt is being evaluated. These layers can be the source for dredged sand to be used as the main fill material which is supplemented by coal fly ash. The engineering economic study of the project indicates ways to optimize size, shape and distance of the island from the shore. Although a rectangular shape oriented parallel to the shore is expected to cost less, it is not the preferred environmental solution. Alternative land designations offer different economic incentives. A preliminary, conservative estimation of the value of land in a selected combination of its uses shows that it can be $2000/m2, for example, as compared to costs of construction which could be only one-third of sales value. The island project has been linked with a master plan to develop shore extensions and marine structures off the coast of Israel. In this framework, preliminary architectural programmes have been presented.

This year a specific, preliminary design of the island; a forecast of the availability of coal fly ash and its application; and utilization and drainage systems to protect the island from potential leakages, were also presented. This study is jointly funded with the Israel Electric Corporation.

1560 LAW ENFORCEMENT SYSTEM IN THE 21ST CENTURY

This project, jointly sponsored by the Ministry of Police and the Jerusalem Center for Public Affairs, seeks to define the future objectives of the Israeli law enforcement system and to specify the tools required to achieve those objectives. For this purpose, developmental trends found in different areas of Israeli society are to be explored by teams of experts. Once possible scenarios have been given for each relevant field, criminologists and experts from the major law enforcement agencies will consider the implications of the predicted trends on the Israeli law enforcement system.

During 1993, considerable progress was made with the project's first stage. A report on the future of Israel's economy was completed by Ben-Ezra Consultants and an additional assessment is being prepared by Prof. Yakir Plessner of the Hebrew University. Prof. Mordechai Kremnitzer, Dean of the Hebrew University Law School, submitted a report on predicted trends in the Israeli legal system. The future of minority groups in Israel was assessed by Prof. Mordechai Abir, Prof. Raphael Israeli and Dr. Avraham Sela of the Hebrew University and Mr. Boaz Ganor of Tel-Aviv University. Dr. Sarah Hershkovitz, a researcher for the Strategic Planning Unit of the Municipality of Jerusalem, prepared a report on future developments in social geography; and Dr. Moshe Sherrer of Tel-Aviv University and Dr. Shmuel Lehman-Wilzig of Bar-Ilan University each submitted reports on social-demographic trends in Israel. Dr. Yochanan Vozner is preparing a comprehensive report on the societal issues facing Israel that will include material analyzed by Dr. Sherrer and Dr. Lehman-Wilzig. Six experts in political science are currently assessing the future of Israeli politics and government.

Plans for the project in 1994 include the establishment of a team of experts on security issues to deal with the problem of terrorism and a team that will assess future trends in science and technology, relevant to law enforcement.

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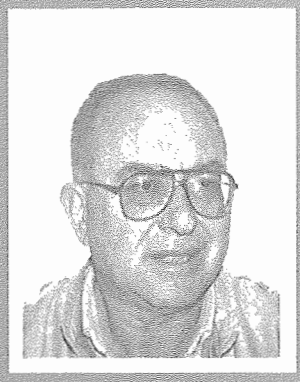

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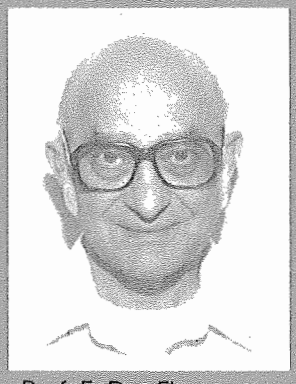

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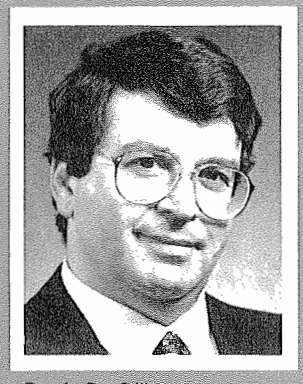

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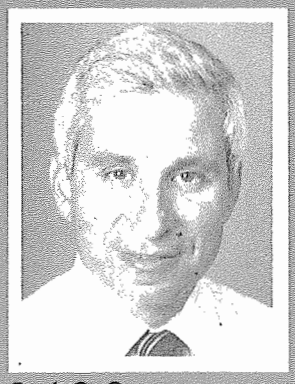

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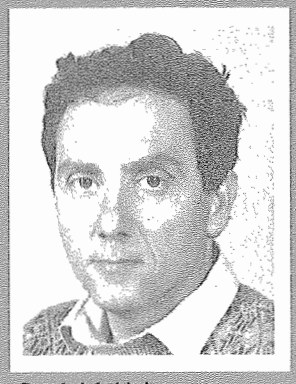

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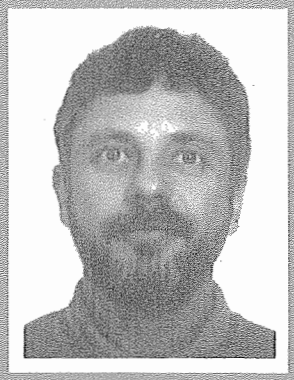

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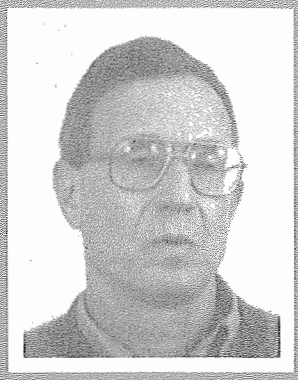

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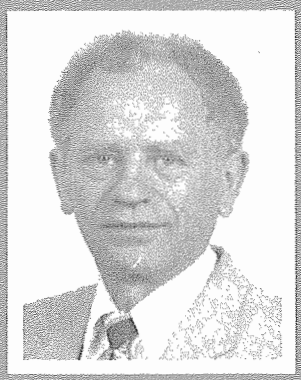

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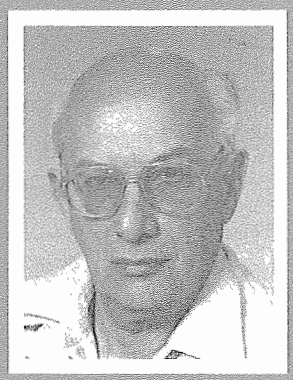

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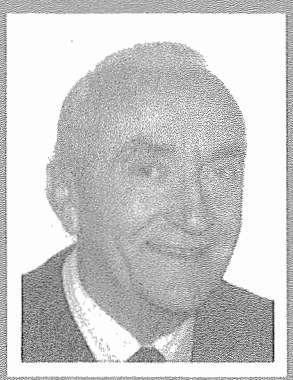

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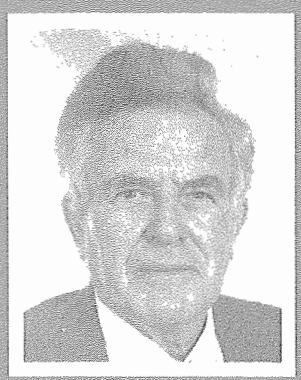

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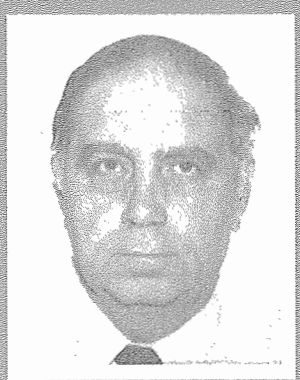

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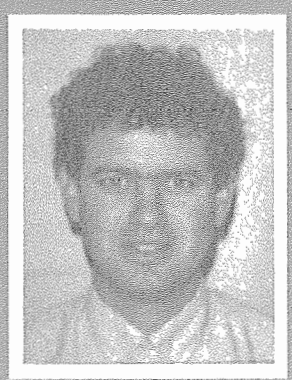

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  Dan Sharon, Ph.D., Advisor to Minister of Education and Culture
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Abraham Zaks, Professor of Mathematics, Technion
Shmuel Zaks, Assoc. Professor of Computer Sciences, Technion
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* *Yehoshua Zeevi*, Professor of Electrical Engineering, Technion (2301)
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* *David Zilag*, Professor of Mathematics, Technion (2580)
* *Yoram Zimmels*, Assoc. Professor of Civil Engineering (2140)
* *Yaakov Ziv*, Distinguished Professor of Electrical Engineering, Technion (2302)

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IV. Communication Networks, February 2, 1993.
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