



ANNUAL REPORT 1985-1986



Technion — Israel Institute of Technology
THE SAMUEL NEAMAN INSTITUTE FOR
ADVANCED STUDIES IN SCIENCE AND TECHNOLOGY



Technion — Israel Institute of Technology

הטכניון — מכון טכנולוגי לישראל

THE SAMUEL NEAMAN INSTITUTE FOR

מוסד שמואל נאמן

ADVANCED STUDIES IN SCIENCE AND TECHNOLOGY למחקר מתקדם במדע ובטכנולוגיה

ANNUAL REPORT

June, 1986

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*Samuel Neaman, founder of **The Samuel Neaman Institute for Advanced Studies in Science and Technology**, is a businessman and philanthropist, committed to the concept that the creative exchange of information and ideas is the key to improving Israel's economy and quality of life. Mr. Neaman has received an Honorary Doctorate of Science and Technology from the Technion.*

***The Samuel Neaman Institute** continues to forge ahead with its dynamic, interdisciplinary studies designed to tackle problems of national importance. In such diverse areas as water policy, Project Renewal, energy policy, future engineering education, transportation policy, community health, etc., its academic task forces are at work applying their technological and scientific expertise toward developing policy-making guidelines. The **Institute** enables Technion scientists and researchers to participate in national decision-making and policy planning, while simultaneously providing political and governmental leaders with access to Technion's storehouse of knowledge.*

*In less than a decade of existence, **The Samuel Neaman Institute's** work has already yielded impressive results. But its achievements in research and planning could never have been attained without the foresight of the **Institute's** founder, Samuel Neaman. His involvement with and concern for Israel's future have been instrumental in helping Technion to expand the horizons of its research and thinking.*

Professor Josef Singer
President, Technion —
Israel Institute of Technology
May 1986

**THE SAMUEL NEAMAN INSTITUTE
FOR ADVANCED STUDIES IN SCIENCE AND TECHNOLOGY
OF THE TECHNION**

**Report on the Institute's Activities
1985/86**

1. General

The Samuel Neaman Institute for Advanced Studies in Science and Technology was founded at the Technion according to an agreement between the initiator, Mr. Samuel Neaman, the Noon Foundation, the American Society for the Technion, and the Technion — Israel Institute of Technology — on February 7, 1975. This agreement was ratified by the Senate of the Technion on February 5, 1978. The *Institute* was registered as a company, limited by guarantee and not having a share capital, with the Registrar of Companies, on May 4, 1979.

The objectives for which *The Samuel Neaman Institute* was incorporated are:

(1) To assist in the search for solutions to national problems in the fields of economic, scientific and social development in the State of Israel, the raising of the standard of living of its citizens, and the search for methods of facilitating Israel's integration into the Middle East by the following means:

(a) Providing aid for the enhancement of advanced research in subjects that will be chosen from those areas in which the Technion — Israel Institute of Technology — maintains academic activity.

(b) The organizing of scientific and academic meetings on an international scale and appropriate level in whose frameworks scientists from the Technion will collaborate with academic visitors from Israel and abroad for the advancement of human knowledge and with a view to implementing this knowledge in the interests of the State of Israel.

(c) Providing the means and creating the atmosphere in which scientists from outside, together with those from the Technion, will conduct research and contribute towards Israeli society, economy and industry.

(2) To search for medium- and long-term solutions to the problems of the State of Israel while utilizing the resources of scientific and technological personnel at the Technion and mobilizing teams composed of Technion personnel and personnel from outside the Technion for limited periods of time, who will devote their efforts to the subjects selected.

(3) To organize workshops on topics of significance for the development of the State of Israel and the solution to its problems, in which both scientists, technologists and businessmen will be invited to participate and to utilize

these workshops, inter alia, as aids to formulate research projects with which *The Neaman Institute* will deal.

(4) To do research in all fields of science, technology, economics and social sciences.

(5) To facilitate the absorption and integration into the academic community of the Technion of scientists and technologists from all parts of the world.

By publication of the results of its activities, the *Institute* hopes to make both state officials and the general public more aware and better informed of the problems and of the proposed solutions.

The *Institute's* activities are financed from the fruits of the Samuel Neaman Fund which is administered by the American Society for the Technion. This guarantees the *Institute's* freedom and independence. The *Institute* also enters into contractual relations for financing projects as long as the principle of independence of the *Institute* is not violated. During the period 1978 to 1984, the *Institute's* total budget was about 2.3 million U.S. dollars, of which about 1.8 million came from the Samuel Neaman Fund.

2. Organization

The Samuel Neaman Institute is organized as a non-profit corporation in the State of Israel but operates within the rules and procedures of the Technion. The Board of Directors formulates policy, approves programs and oversees financial affairs.

The Chairman of the Board, Mr. Samuel Neaman, is involved in the long-range planning and in special projects, and takes an active interest in the *Institute's* daily operations.

The Director of the *Institute* is appointed by the President of the Technion in consultation with the Board of Directors of the *Institute*. He is responsible for the *Institute's* day-to-day running, and prepares detailed programs of the projects. The Advisory Council's task is to assist the Director in evaluating the research projects, for the Board's final selection. The Council has twelve members — six from the Senate of the Technion, and six public figures. The Director is also responsible for the recruitment and appointment of project staff.

There are about 100 researchers in the various projects. There are the *Institute's* own employees, there are members of the Technion staff, and there are distinguished academicians from other institutions of higher learning in Israel and abroad. Researchers are also recruited from among leaders in public administration, industry and finance.

Project ideas may be initiated by the *Institute*, or by the researchers, government agencies, industry or other concerned institutions. Every project has its own leader, namely the Project Coordinator. The primary requirements for accomplishment of the project — namely staff, logistics and apparatus — are furnished by the *Institute*. To these the Technion has volunteered its resources — human, informational and material — at the disposal of the project team.

3. Resolutions regarding The Samuel Neaman Institute for Advanced Studies in Science and Technology, adopted by the Technion Board of Governors at its Annual Meeting on June 28, 1984

Resolutions of the Steering Committee

"The Board of Governors is grateful to *The Samuel Neaman Institute*, which undertook jointly with the Technion a project dealing with Future Targets of Technion Educational Policy, and expects that *The Samuel Neaman Institute* will continue working together with the Technion Administration. The Board requests an interim report on the progress of the project, and recommends that the project be continued vigorously.

The Board of Governors reiterates its appreciation to Mr. Samuel Neaman for his active and continuous support to the *Institute* and requests that additional funds be made available to *The Samuel Neaman Institute* in order to provide it with the means to expand its important activities."

Resolutions of the Academic Development Committee

(a) The Board of Governors warmly welcomes the report on *The Samuel Neaman Institute* prepared by its Director, Professor G. Hetsroni, and notes with satisfaction the increased interaction between the *Institute* and the Government departments, as well as its increased acceptance, both inside the Technion as well as outside, as an important contributor in the field of policy studies.

(b) The Board of Governors, in affirming its belief in the importance of *The Samuel Neaman Institute* both for Israel and for the Technion, recognizes the vision and initiative of its founder, Mr. Samuel Neaman. It regards the major thrust of the *Institute* to be the conduct of studies related to the impact of Science and Technology on Israeli society.

(c) The Board of Governors encourages the Director, the Advisory Council and the Board of *The Samuel Neaman Institute* to develop a strategy which would increase the influence of the *Institute* on national policies affected by science and technology. This strategy should identify those Israeli policies and challenges in which technology plays an important role and where the *Institute* could make a significant contribution through research.

The strategy should cover ways in which the *Institute's* ability to conduct policy studies could be strengthened; ways of involving the faculties of the Technion in cooperation with other institutions, if needed, in such studies; and ways of utilizing the various skills of policy analysis, technologists, and social and other scientists in these researches.

(d) The Board of Governors looks forward to receiving a progress report from the *Institute's* Director at its next meeting.

(e) The Board of Governors reiterates its appreciation to Mr. Samuel Neaman for his active and continuous support to the *Institute* and requests that additional funds be made available to *The Samuel Neaman Institute* in order to provide it with the means to expand its important activities.

4. Director's Report

In order to reach a rational decision in a complex reality, where there are many parameters and variables, one would expect to find a triangle made up of the decision-maker - expert - operational researcher. The decision-maker has been entrusted by society to make decisions affecting quality of life, natural resources, and the public welfare in general. The expert advises the decision-makers as to their options and the consequences of various decisions. The operational researchers help the decision-makers reach a rational decision in a very complex system.

The *Samuel Neaman Institute (SNI)* endeavours to supply the latter two apexes of this triangle, that is, to avail the policy-maker of the technological and scientific abilities of the Technion.

Towards this end the *SNI* increased the number of joint research projects with government ministries and other public institutions. The *SNI* now has joint projects with the Ministry of Energy and Infrastructure, Ministry of Economy, Ministry of Labor, Ministry of Education and Culture, Ministry of Agriculture, and Ministry of Communications. The *Institute* also has joint projects with the Jewish Agency, Kupat Holim (the Trade Union General Sick Fund), Haifa Municipality, The Armament Authority, and various industries. In all these projects, the client was required to bear about one half the total expenses. Though the volume of research stayed at about the same level as in previous years (which, in view of the adverse economical climate, in quite gratifying), there has been an intensification of the emphasis on issues of public policy.

In order to disseminate the knowledge generated in the *SNI*, or other knowledge which is pertinent and of importance to the public, the *SNI* continued to hold workshops and seminars. Some of the seminars were joint ventures with the Technion's Extension Division, while others were in cooperation with other institutions, e.g., MIT (Cambridge, MA). For example, we held:

- Workshop on management of research, development and technology-based innovation, with MIT.
- Workshop on pricing of crude oil and petroleum products.
- Joint international symposium on neighborhood policy — the state-of-the-art — at MIT.
- Workshop on organizational aspects of the water sector.

Currently the *Institute* is negotiating a number of projects with the Ministry of Police, the Water Commissioner, the Ministry of Finance, and others. For example, we are negotiating with the Ministry of Police for the establishment of a working group ("Think Tank") to define the goals of police in the year 2000, and what should be done in the nearer future to meet these tasks.

All in all, the *SNI* will continue to utilize the scientific and technological talents available at the Technion to aid the Israeli decision-makers. It is our strong belief that as the Israeli economy and society becomes more technologically oriented, and as the political environment becomes more scientific and more complex, the decision-maker will have to rely more and more on the Technion — the oldest and most prominent technological institute in Israel.

One would have to be more careful in the future in defining the goals, in outlining the options and policies, and in general in thinking through each decision — for we all know that, as so elegantly and simply stated by Rabbi Shlomo Halevi Elkavets (circa 1500) —

סוף מעשה במחשבה תחילה*

G. Hetsroni

* *The result of the deed comes from the thought at the beginning.*

5. Budgets

Since 1983, the *Institute* has become an independent administrative unit, handling its own accounting. The resultant streamlining is both faster and more economical, enabling the *Institute* to provide the Research Coordinators with up-to-date information on their budgets.

Table 1 summarizes the total budget since 1978, as approved by the Board of Directors of the *Institute*, including contractual funding by clients such as government ministries and other agencies.

The balance of research projects under contract, to 30.9.85:

Project		
No.	Balance	
102	Project Renewal	32,750
108	Productivity Measurement	4,000
113	Communication and Land Use	2,000
117	Primary Health Services	60,000
131	Technological Education Policy	15,000
132	Electric Vehicles	3,000
137	Methanol for Diesel Engines	10,000
140	Water Development in the Arab Sector	3,000
142	Omer Model	13,373
143	Introduction and Use of Microcomputers in Industry	10,000
	Total	153,123

Table 1
The Samuel Neaman Institute for Advanced Studies in Science and Technology
Budget for the Period 1.4.78 to 30.9.85 (in U.S. Dollars)

No. Project	Up to 1.10.80 (Calculated)	1.10.80- 30.9.81- (Calculated)	1.10.81- 30.9.82 (Balance sheet)	1.10.82- 30.9.83 (Balance sheet)	1.10.83- 30.9.84 (Balance sheet)	1.10.84- 30.9.85 (Balance sheet)	1.10.85- 30.9.86 (Estimate)
100 Administration	107,140	52,024	50,404	107,022	96,407	92,778	85,500
101 Neighborhood Rehabilitation		73,486	23,312	8,902	2,711		
102 Evaluation of Project Renewal			45,943	142,362	96,375	39,295	
103 Agricultural Aviation	43,211	23,977	56,681	24,309	2,254		
104 Water Policy		79,513	43,703	25,182	30,893	4,418	
105 Mathematics in Industry			-10,036	12,064	25		
106 Distributed Simulation Systems			8,468	741			
108 Productivity Measurement	1,147	13,366	20,244	7,527	8,558	4,853	
109 Energy Policy	2,914	86,409	34,242	201			
113 Advanced Communication on Location of Hi-Tech Firms				31,720	20,205	14,908	
114 Science-Based Industries				5,224	5,607		
115 Blood Substitutes				258	20,093	12,896	
116 Transportation Policy				4,406	7,908	2,005	
117 Primary Community Health						41,273	80,000
118 Israel Energy Economy					19,972	30,659	
119 High Technology Industry — Performance					12,303	5,531	
121 Underground Layout					2,826	4,690	
122 Energy Policy Alternatives					39,260	21,350	30,000
124 Higher Education Goals					14,269	17,013	74,000
125 Follow-up on Gifted Children					2,327	1,262	
126 Crisis Intervention Model						10,261	
127 Effect of Air Pollution on Lungs						12,049	100,000
128 Electric Sensor for Handicapped						3,456	9,000
129 Transportation Master Plan						12,335	
130 Traffic Measurements — Hagiborim						2,988	
131 Technological Education Policy						16,980	60,000
132 Electric Vehicles						8,235	
134 Computer-aided Education							25,000
135 Robotics in Building Industry						5,296	18,000
136 Wound Healing						3,972	9,000
137 Methanol for Diesel Engines						1,335	30,000
138 Robotics in Agriculture						575	2,000
142 Omer Model						1,339	7,000
143 Introduction and Use of Microcomputers in Industry						146	10,000
133, Workshops						8,497	10,000
139							
190 Projects from previous years	115,837	19,456	4,521	671	5,825		
191 Projects from previous years	28,038	39,735	5,907				
141 Socio-economic Alternatives for Developing Towns							40,000
146 Policy of Economic Relations Israel-US							35,000
149 Alleviating Brain Damage							9,000
Civil Aviation in Space							15,000
Hydrogen and Hydrogen Storage							10,000
Total	298,287	387,966	303,461	370,589	387,823	380,395	658,500

6. Research Projects

Most projects result in publications, issued by the *Institute*, which are distributed to interested groups and individuals, to decision-makers, etc. Thus far, some 85 reports, in about 8,500 copies, were published and distributed. Results of the research projects are also publicized in the professional-scientific literature, as well as through lectures, workshops, seminars and other means, in order to bring these results to the attention of the decision-makers and the public at-large. A list of the *Institute's* publications (in Hebrew and in English) is enclosed.

Some Research Contracts:

Mathematics in Industry — Technion

Evaluation of Project Renewal — Jewish Agency and Ministry of Housing

Plant Productivity Measurement — Israel Institute of Productivity

Extended Omer Model — Ministry of Energy and Infrastructure

Advanced Communication — Ministry of Communication

Low Cost Transportation Management — Ministry of Transportation

Health Services — Kupat Holim (Health Insurance Institution of the General Federation of Labor of Israel)

Effect of Gases on Lungs — The Committee on Prevention and Research in Occupational Health, Ministry of Labor and Social Affairs, and the Research Center for Work Safety and Human Engineering, Technion

Use of Methanol for Diesel Engines — Dor Chemicals Ltd.

Introduction and Use of Microcomputers in an Industrial Organization — Israel Armament Authority

Social-economic Development of Underdeveloped Towns — The Jewish Agency

Electric Vehicles — Israel Electric Corporation

High Education Goals — Technion

Technological Education Policy — Ministry of Education and Culture, Israeli Industry Center for R&D

7. Visitors

From time to time, the *Institute* invites distinguished persons from abroad to interact with the research teams of the *Institute*, to lead special workshops and seminars, and to contribute from their knowledge and experience.

Some of these visitors were:

- Martin Greenberger, Professor of Mathematical Sciences, The Johns Hopkins University, Baltimore (Dec. 1978).
- Edgar A. Rose, Professor of Architectural Planning and Urban Studies, University of Aston in Birmingham, U.K. (Dec. 1979–Jan. 1980).
- Chester Rapkin, Professor of Urban Planning, Princeton University, Princeton, N.J. (Dec. 1979–Jan. 1980).
- Richard Zeckhauser, Professor, Kennedy School of Government, Harvard University (Jan. 1980).
- Harold J. Barnett, Professor of Economics, Washington University, St. Louis, Mo. (April–July 1980).
- Ernest R. Alexander, Professor of Urban Planning, University of Wisconsin, Milwaukee (Oct. 1979–Aug. 1980).
- W. Marcuse, Professor and Head, Economics Division, Brookhaven National Laboratory (Jan.–May 1980).
- Bernard J. Frieden, Professor, Department of Urban Studies and Planning, M.I.T., Cambridge, Mass. (July–Aug. 1980).
- Julius Aronofsky, Professor, School of Business Administration, Southern Methodist University, Dallas, Texas (May–Oct. 1980).
- Herbert J. Gans, Professor, Department of Sociology, Columbia University, New York (June 1981).
- Harvey Brooks, Professor, Kennedy School of Government, Harvard University (June 1983).
- Edward Shils, Professor, Committee on Social Thought, University of Chicago, U.S.A. (June 1983).
- Sir Bruce Williams, The Technical Change Centre, London, England (June 1983).
- Jack L. Zakin, Professor and Chairman, Department of Chemical Engineering, Ohio State University (Dec. 1983).
- Donald S. Remer, Professor and Director, Energy Institute, Harvey Mudd College, Claremont, California (Oct. 1983–Jan. 1984).
- P.G. de Gennes, Professor of Physics, College de France (Dec. 1984).
- A.W.J. Chisholm, University of Salford, U.K. (Dec. 1984).
- Prof. H. Brenner, Department of Chemical Engineering, M.I.T., Cambridge, MA. (Sept. 1985).
- Prof. S. Banerjee, Department of Nuclear Engineering, University of California, Santa Barbara (Jan. 1986).
- Prof. M. Adelman, Department of Economics, M.I.T., Cambridge, MA. (May 1986).

8. ONGOING RESEARCH PROJECTS

117. Family and Community Health

A/Professor Leon Epstein

The overall aim of this project is to promote the primary health care services in the community by the introduction of Community Oriented Primary Health Care in Family Medicine practices.

The accent is laid on all levels of prevention, i.e., health promotion, specific prevention, early diagnosis, treatment, follow-up and rehabilitation.

The project is, at present, operated in two Kupat Holim clinics — in Romema in Haifa and in the Misgav area of the Western Galilee. Another Haifa clinic (Even Sina) is used as control clinic. It is hoped that other clinics will be added in the future.

There are two major areas of the project:

I. Community Health Programs

At the start, two programs were chosen in order to test the feasibility of the project. More will be added in the future.

a.) Hypertension Program

Hypertension is one of the major public health problems in Israel and demands action at all levels of prevention (as above). To date, some 3,750 persons (age 10 and over) in Romema have been examined and the results transmitted to their physicians. Those who had high levels of blood pressure are being further treated while known hypertensives are having their degree of control reviewed if their measured levels were high.

b) Health of Women

Women are relatively "neglected" in health service priorities (if they are not pregnant). For this reason and following representation by the community and the knowledge of the great problem of cancer of the breast — the health of women was chosen as the subject of a community program. At present all women in the community age 20-60 in the Romema and Misgav areas are included.

In Romema some 350 women have already been examined. This includes a health questionnaire, E.C.G., blood pressure, weight, height, gynecological examination and Papanicolaou smear and breast examination. All the women are also offered the opportunity of learning the technique of self-examination of the breast.

The program has created a great deal of interest both in the community and beyond.

In Misgav, the framework is slightly different, and to date some 250 women have been examined.

II. Community Health Programs

Microcomputers have been introduced and, at present, the first stage of their utilization has begun, i.e., inputting the basic demographic data on the total community. The medical history of all the patients will be put into the computer and then the ongoing activities of the clinic (visits to team members, drugs, test results, follow-up, hospitalizations, etc.) will be introduced.

This will all form the basis of the ongoing identification of community health needs and the appropriate service actions.

The project is funded jointly with the Kupat Holim Health Fund of the Histadrut.

124. High Education Goals

Committee members: Professor Ze'ev Tadmor (chairman), Mr. David Kohn, Professor Avinoam Libai, Professor Paul Singer, Professor Yaacov Ziv

1. The Committee and its Program

The committee resumed its work last October. Soon thereafter, Prof. Y. Ziv resigned from the Committee upon his appointment to Chair the Committee on Budgeting and Planning of Higher Education in Israel. The Committee continued its work with four members until mid-March when Prof. Z. Kohavi of the Department of Electrical Engineering was appointed to replace Prof. Ziv.

According to the program, the Committee will concentrate on two central issues: (a) engineering education in the year 2000 and beyond, in view of the future needs of Israel, the worldwide development in engineering education and practices, and the foreseeable technological developments; (b) the development of a strategy for the Technion to meet the challenges of future engineering education. Further details of these subjects are given below.

2. The profile of the future engineer

The committee has studied the literature on the subject that was collected in the course of last year. Following this, it identified the following items for discussion and further study: trends in engineering disciplines; the impact of computers on engineering practices and reduction, structure and content of undergraduate engineering curricula; score and function of graduate studies and continuing education; creativity and honor programs; and oral and written communication.

From the various topics discussed, the one dealing with the impact of computers on engineering practices and education was given special attention and a subcommittee was set up for an in-depth study. It is felt that the computer impact in engineering has a revolutionary score and therefore deserves very careful attention.

3. The profile of the Technion

The profile the Technion ought to aspire to, in the year 2000 and beyond, depends not only on the profile of the engineers it will have to educate, but also on worldwide technological trends, on the structure and needs of the Israeli industry, and on developments in other Israeli universities.

In the course of the Committee's deliberating in the Technion, among the topics that will be examined are: trends in the Israeli university infrastructure; optimum size of the Technion and its Departments; the Technion in national technological policy making; and research at the Technion.

4. The Faculty

The profile of the future engineer as well as that of the Technion will depend in the final analysis on the Faculty. Therefore, the Committee has commissioned a research on Faculty attitudes, toward their work, the Institute and themselves, as well as toward a series of special relevant well-defined topics. The research will be carried out by Professors M. Mor (Technion) and Y. Hofman (Haifa University). The Van-Leer Institute will participate in funding this survey.

A three-day international conference is being planned to be held in Haifa in December 1986. The conference will deal with the various aspects of engineering education of the future and the measures needed to prepare for this task.

The project is supported by the Technion — Israel Institute of Technology.

125. Retrospective Follow-Up of Gifted Children

Malachi Ariel

This study follows up all the students — some 400 of them — who have attended the "Enrichment Courses for Gifted Students," held by the Technion during the years 1969-1973. These were the first four years the Technion held such classes.

The main research object is the academic, military and professional achievements of this population. These achievements will be compared, as far as possible, with those of members of control groups, such as the cohort, gifted children who studied during these years in the Tel Aviv University enrichment courses, and gifted children abroad.

There are two additional objects of research:

1. Identification of a possible typology of gifted children, based on the patterns of their interests during school age.
2. Examination of the opinion of the research group members regarding the various educational methods of answering gifted children's special needs. This will be compared with the opinion, regarding the same questions, of graduates of the special classes for the gifted, organized by the Ministry of Education within the formal schooling system, in Haifa and in Tel Aviv. The present stage of the research is that of statistical analysis of the data and preparations for the writing of the final work.

126. Policy of Health Promotion — Crisis Intervention Model for Populations at High Risk in the General Hospital

Professor J.M. Brandes and Dr. C.S. Tadmor

The objective of the research is to formulate policy of health promotion for populations at high risk of developing emotional dysfunction in the general hospital. The underlying assumption is that there should be a holistic approach in the management of the patient, taking into account his physiological as well as his psychological needs. The crisis intervention model that is implemented at Rambam Medical Center by the medical and nursing staff is designed to enhance the individual's perceived personal control and is based on the following principles: 1) training of the medical and nursing staff in charge of the target population; 2) training of the target population; and 3) system analysis and introduction of a health-promoting policy for the target population. The crisis intervention model focuses on the following populations:

Women who deliver spontaneously: Recent findings indicate that 50%-70% of women manifest symptoms of mood disturbance in puerperium. In order to enhance the quality of coping with this population, the crisis intervention model focuses on the following interventions: 1) training of the nursing staff in charge of this population; 2) training of the pregnant women while they are waiting in the delivery room and after birth; 3) introducing changes in the policy of the department designed to enhance the mental health of this target population. Consequently, a battery of questionnaires was developed, designed to assess the quality of coping with the pregnant women before and after intervention and the attitude and level of knowledge of the nursing staff before and after training.

Women who deliver prematurely: The rate of prematurity reaches 8%-10%, and 80% of all infant mortality is attributed to prematurity. Furthermore, prematurity entails physical and psychological risks for the premature baby as well as its mother. For the premature baby, the risk consists of high mortality and morbidity rate as well as the risk of being abused. For the mother, the risk consists of future premature deliveries as well as an impaired self-image. The questionnaires employed to assess the risk for premature delivery consist of medical and demographic items only and they predict but 40% of all premature deliveries, leaving about 60% of unexplained variance. The objective of the research is twofold: 1) to identify pregnant women at high risk of delivering prematurely; and 2) to formulate an intervention policy designed to reduce the prematurity rate. The research is being conducted prospectively in the baby clinics in the community.

Hematology-oncology patient: In order to enhance the quality of crisis outcome of this population, the following interventions were undertaken: 1) training of the medical and nursing staff; 2) training of the patient and his family; and 3) introducing changes in the Hematology out-patient clinic designed to enhance the quality of crisis outcome for the patient population, their family and the medical and nursing staff. Booklets were published to

promote these objectives.

Children undergoing elective surgery and their parents: This research, which has been completed, internalized and is being implemented by the medical and nursing staff of the Pediatric Surgery Department at Rambam Medical Center, has received wide publicity in the television and news media, as well as increased interest on the part of the Ministry of Health and other pediatric surgery departments in the country, as well as other departments at Rambam Medical Center. A film, which was recently completed, was instrumental in raising the awareness and promoting the research findings that have significant implications for policy making in the pediatric surgery departments: namely, that for children under 5½ years of age anesthesia should be administered in the presence of parents, while children aged 5½ years up to 12 years should receive psychological preparation based on the principles of the Crisis Intervention Model.

127. The Effect of Gaseous Pollutants on the Metabolic Activity of the Lung

Professor M.B.H. Youdim, Dr. A. Bomzon, Dr. R. Barkey and Dr. L. Mor

The aim of this project is to examine the effects of gaseous pollutants such as sulphur dioxide and carbon monoxide on the metabolic activity of the lung. The metabolic activities include inactivation of biogenic amines such as noradrenaline, the conversion of non-vasoactive angiotensin I to vasoactive angiotensin II, prostaglandin synthesis and breakdown as well as surfactant synthesis. Such activity will be measured in lung homogenates, lung slices and the isolated perfused lung. It is envisaged that this work will be the basis of an early warning diagnostic test for the detection of impending lung damage after exposure.

A considerable amount of time has been spent to improve the perfusion of the isolated rat and guinea pig lung. Using this improved system, the lung can be perfused for up to 4 hours under physiological conditions without causing perfusion-induced damage. Moreover, the system allows us to use single-pass or recirculation perfusion which considerably enhances our experimental approach. Although a considerable amount of time has been spent to improve the lung perfusion technique, we believe that this time investment has been worthwhile since it allows us to change the mode of perfusion with respect to the specific enzyme under assessment. For example, for the study of the kinetics of fast reactions such as monoamine inactivation, e.g. serotonin, noradrenaline and phenylethylamine, the single-pass mode can be used; for slow reaction rates such as the conversion of angiotensin, the recirculation mode is preferred. In addition, the improved system allows greater differentiation between those factors that can modify pulmonary biochemical activity, which include the perfusion pressure and the size of the vascular bed being perfused. At this stage, we have established normal values for the activities of monoamine metabolism and angiotensin conversion in normal rat and guinea pig lung.

This project is supported by The Committee for Prevention and Research in Occupational Health.

128. Development of a Controller for a Human Leg Functional Neuromuscular Stimulation

Professor Gideon Inbar

The project deals with the development of a system with the aim of restoring control of locomotion and manipulation in paraplegic and quadraplegic individuals. The project deals specifically with the development of a closed-loop controller system of functional electrical stimulation (FNS) system, to restore postural stability and simple gain pattern in paraplegic individuals.

The project is developed in two parallel lines. In one, the human body in posture and locomotion is modeled, and computer algorithms are being tested for body postural stability and locomotion. The algorithms indicate the sensory elements necessary to achieve the control objectives and the preferred control strategies. The laboratory set-ups provide the second line of work, to yield the necessary information for the stimulation studies and to test the proposed algorithms. The experimental set-ups include a computer to control the stimulation parameters and to gather and process the experimental results.

To date the experimental results provided the necessary gain and dynamic parameter information to stimulate the knee joint. Similar information is being derived for the ankle joint. Stimulations have been carried out on a simple single-joint model and currently stimulations are being carried out on a two-damped-joints model, in addition to investigations into the control of postural stability with and without measurements of ground forces, i.e., with and without measurements of motion of the body center of gravity.

131. Consolidation of Policy for Technological Education in Israel

Dr. Shlomo Waks

The main purpose of the study is to determine the professional profile of the technologist and technician according to their occupational activities in the various economic sectors in Israel, aiming to develop a model for systematic updating of curricula in high-technology.

The characteristics of the profile are based mainly on three domains: skills, knowledge of contents, and instrumentation required of a technologist at work in the electronics and machinery branches. The following activities have been carried out during the first year (phase I):

- Development of a mapping sentence according to Guttman's facet theory.
- Preparation of 4 questionnaires (194 items in each) for structured interviews of the technologists and their direct professional supervisors.
- Construction of a representative sample of technologists and their supervisors based on the 1983 Israel Census.
- Carrying out of about 1000 interviews in 40 industrial enterprises and institutions in the civilian sector as well as in the armed forces.
- Data analysis according to the WSSA1 method through the HUDAP-statistical package.

The final report of phase I is being published.

Work has begun on phase II, which will concentrate on determining detailed contents of the curriculum. Four disciplinary expert groups will be activated through the Delphi technique, using the findings of phase I.

The research is supported by the Israeli Industry Center for R&D and the Ministry of Education and Culture.

132. Electric Vehicles in Israel — A Feasibility Study

Dr. Irit Hocherman

The research team has conducted an extensive literature survey on Electric Vehicles (EV) development, uses and experiments. The environmental ramifications of the use of EV was also investigated.

A feasibility study concerning purchasing costs, maintenance and operation of electrical vans as compared to conventional vans was carried out, under present customs regulations as well as taking into account possible variations in taxation, fuel and electricity prices.

The main conclusions of the study were:

Electrical vehicles have obvious environmental and energetic advantages. However, under present conditions, such vehicles will be suitable for limited uses especially as service vehicles for short distances and many stops. The type of vehicle recommended is a light van or small truck. No environmental impacts are expected following the use of EV.

From an economic point of view, EV will be feasible only under reduced taxation, similar to taxation laws for trucks. New developments in the field of batteries will probably enhance the uses for EV. It is recommended, despite the above restrictions, that the use of electric vans be encouraged in order to acquire experience in their implementation.

It is also recommended that the possibility of constructing electric or hybrid buses be studied. This will improve noise and pollution levels in the main municipal centers.

The project is supported by the Israel Electric Corporation.
A final report is being published.

134. Computer-Aided Instruction

Dr. Ehud Bar-On

The purpose of this project is to try to alleviate the three-year military duty education hiatus.

The major objective of this project is to develop an educational system incorporating computer-tutors and independent-learning material and to introduce it to Tsahal in order to enable soldiers to prepare for undergraduate studies in their off-duty hours.

Up until this point most of the existing material-curriculum, textbooks, educational software and other resources have been evaluated to assess its extent of compatibility with this project. Contact with army officials has also been established in order to achieve close cooperation in carrying out this project. These preliminary steps have led us to a number of short range and long range recommendations, as to what should be the first subject to develop, what existing material should be ordered and what form a pilot test should take.

The team is now at the stage of developing written material for independent study of mathematics accompanied by microcomputer software. The project is supported by the American Society for the Technion.

135. Policy of Incorporating Robots in Building Construction Activities

A/Professor Abraham Warczawski

The purpose of the study is to determine the possibilities of employing robots in building processes, and to develop guidelines to indicate the recommended level of automation of a construction project in dependence on its size, nature and environment, and the organization system for its employment.

The study includes the following parts:

- a) Analysis of alternative building technologies and their adaptability to robotization. This stage includes systematic evaluation of building materials and methods for each of the various building components.
- b) Analysis of robotic systems adaptable to building tasks. The systems will be characterized by their main components (arm effector, locomotion, etc.), and the autonomy of their operation.
- c) Development of a model which will indicate the optimal technological-robotic solution, considering the particular parameters of a given building. In parallel with this study, another project is carried out with an aim to examine the various problems of robotization on a scaled model of a robot and its building environment.

136. Angiogenically Assisted Wound Healing

Dr. Ella Lindenbaum, Dr. Nicholas Maroudas and Orly Cabili

Angiogenins are newly discovered hormones with potency to stimulate the growth of capillary blood vessels and thus accelerate repair in animals. The first angiogenins were purified from tumors by Prof. Judah Folkman and associates at Harvard, after 20 years of work plus a long-term multimillion dollar grant from Monsanto. The expected availability of pure angiogenins is said to have "mindboggling" implications for therapy, because the basic laws of physicochemical hydrodynamics dictate that all bodily maintenance and repair processes depend on transport through the microcapillary network. For human use, neither tumor nor animal sources are really satisfactory. One gram of tumor tissue yields less than a microgram of pure hormone. At the

moment, a new source of human angiogenin, abundant for production, and not cancerous, is desirable. This laboratory has found an abundant, nontumor source, in the waste products from routine gynecological operations. One gram of decidua yields enough activity for positive assays in 1,000 eggs. After partial purification it has been found that the angiogenic activity of human decidua is readily soluble, and of molecular weight below 30,000 and above 3,000. The factor is assayed with a standard method (CAM test) by incorporating it into a polymer sponge and observing the stimulation of capillary growth after implantation of the sponge in the chick egg. The extract is filtered through a molecular sieve ($\sim 30,000$), then purified through a heparin column with fraction collector. The collected fractions yield activity enough for 50-200 eggs. These figures suggest that the source is 10 to 50 times richer than tumor sources.

For experiments on angiogenin-assisted wound healing, an animal model is being developed. Painless chemical burns are induced on the flanks of mice. Also, the angiogenic factor will be implanted in polymer sponges under the skin. The development of new capillaries and repair tissue will be studied relative to controls.

137. Use of Methanol as Additional Fuel for Diesel Engines

Professor Arthur Shavit, Dr. Marcel Gutman

The main purpose of the research is to investigate the possibility of decreasing the smoke emission of a diesel engine by using methanol as part of the fuel supplied to the engine. Some other features of the use of methanol are to be investigated as well: influence on energy output, engine functioning and pollution level.

After a detailed analysis of the existing methods, the fumigation of methanol in the intake manifold has been chosen. Methanol is atomized (pulverized) into the intake air stream in order to: a) minimize changes in the construction of the engine; and b) maximize control over the methanol quantity and supply.

Measuring system

The engine has been installed on the test bench which is comprised of an eddy current dynamometer, temperature measuring instruments at several points, pressure measuring devices, intake air flow rate and fuel consumption meters. The test bench includes all measurement facilities usually used in internal combustion engine research. For the indicator diagram $[p = t(v)]$, a digital oscilloscope is used.

The first tests were performed with the engine running on diesel fuel and the next ones with fuel having different percentages of methanol. Working points at 50%, 60%, 70 and 80% of the nominal load, and at engine speeds in the range of 1,500 to 3,600 rpm, have been checked and compared to manufacturer's data. After a 10-hour run-in, two series of identical tests were conducted at the above-mentioned points. These tests were performed with pure diesel fuel. Currently the use of several percentages of methanol is being investigated. There are also other problems to be solved.

The project is supported by Dor Chemicals Ltd. and Dan.

138. Robotics in Agriculture

Dr. Yael Ilan

A literature survey was conducted and the role of robots in industry and agriculture was explored. The survey convinced us that it was necessary to develop an economic model in order to evaluate robots in agriculture.

Two economic models were formulated, one for the anticipated user of the robot, and the other for the producer of the robot. The user's model considers the anticipated savings and the improvement in quality due to the introduction of a robot. A financial analysis has been made to determine the range of prices and specifications under which the robot is profitable for the user. Similarly, the producer model defines the level of investment and production cost required to produce a robot under a specific specification. The overlap between the profitable ranges of these two models determines the economic feasibility. The user's model has been tested empirically on orange selection.

142. Extending the Omer Model

Professor Mordechai Avriel, A/Professor Paul Feigin and Avishai Breiner

Progress in this project has concentrated in the following areas:

a) Application of the Omer Model

There were three areas in which the Adjudicating Committee for the IEC Development Program used the Omer Model. They were:

- (i) forecasting the development of various sectors of the economy;
- (ii) forecasting electricity demand;
- (iii) investigating the impact of the forecasts on alternative investment programs in the electricity sector.

Two reports were presented to the committee. These reported results are based on various assumptions that were appropriate in the summer of 1985 before the fall in world oil prices. In view of developments in the last half year, there is a need to update these assumptions and check their impact on the forecasts, and indeed the Adjudicating Committee has approached us in this matter.

b) Data Collection and Processing

A start has been made in the collection and processing of data in order to update the data bases of the existing model and adjust its first calibration year to 1985. The data includes: input-output matrices; population growth forecasts; capital formation matrix; capital-output coefficients; labor force coefficients; electricity consumption coefficients; and investment costs in electricity generation technologies.

c) Development of Omer-Macro

In its current form, the Omer Model consists of 15 energy-consuming sectors and one extra sector — the energy sector which is described in great detail. For many general questions concerning forecasting macro economic parameters, there is no need for such a detailed description of the energy sector. This excess detail may lead to complications in solving the model as well as

distracting attention from the control processes involved in the development of the economy. The aim of the Omer-Macro model is to deal with these types of questions.

The main characteristic of the Omer-Macro formulation is flexibility: the model's planning horizon will be determined by the user by setting the number of periods and their lengths which may change from period to period; the level of aggregation in the description of sectors of the economy will be determined by the user and will also be adaptable from period to period.

In general terms, the intent is to retain a detailed description for the short and medium term and to reduce this detail for the long term. The model will allow one to check various assumptions concerning substitutes between the various production factors and end uses in an endogenous or exogenous manner.

These checks were not possible in the current version of the model. Furthermore, the model is designed to ascertain the consequences of various policy alternatives on the future development of the economy.

At the moment, the main effort is being devoted to developing the methodology for the extended model and to preparing its data base. The methodology includes: (i) defining the model characteristics; (ii) the mathematical definition of the model; (iii) the solution method; (iv) the methodology for determining the various levels of aggregation — methods of grouping sectors at different levels of aggregation and for determining the number and length of periods in the planning horizon. The maximum level of detail of the model depends on the data base, and therefore the methodological development. Collection of data and model construction are being carried out simultaneously.

The project is supported by the Ministry of Energy and Infrastructure.

143. The Introduction of Microcomputers Into an Industrial Organization

Dr. Yael Ilan and Dr. Zur Shapira

Units which already bought microcomputers (MCs) or made purchase orders for MCs were identified and questionnaires pertaining to MC use and adoption were sent to them. Fifty-four users returned completed questionnaires and, based on their responses, the diffusion process and MC use were analyzed.

In addition, different questionnaires were sent to potential users in order to sample their attitudes before receiving MCs. The purpose is to reach these users again six months after they receive MCs, to compare their attitudes while using the MCs with their prior expectations.

Various interviews were conducted with key personnel and managers in the different units to develop measures for the utility and productivity resulting from the use of MCs.

The project is supported by the Israel Armament Authority.

9. COMPLETED RESEARCH PROJECTS

101a. Neighborhood Rehabilitation (1978-1981)

Dr. Naomi Carmon and Professor Moshe Hill

Researchers: Professor Ernst Alexander (Wisconsin, U.S.A.), Dr. Rachelle Alterman, Dr. Eliahu Borukhov, Dr. Arza Churchman, Dr. Anat Gonen, Dr. Hubert Law-Yone, Arch. Michael Meyer-Brodnitz, Dr. Robert Oxman, Professor Chester Rapkin (Princeton, U.S.A.), Professor Edgar Rose (Birmingham, England) and Professor Daniel Shefer.

Close to the announcement of Project Renewal — the national program for social and physical rehabilitation of distressed neighborhoods in Israel — the SNI initiated the founding of an interdisciplinary team of researchers to assist decision-makers in formulating the policy and guidelines of operation in the neighborhoods. The team studied the following subjects:

- The causes of urban neighborhood deterioration: social, physical, economic, legal and institutional;
- Learning from urban renewal experience in the U.S.A. and Great Britain;
- Administrative-institutional organization for multi-goals, multi-implementation-bodies project;
- Housing and neighborhood services for the elderly;
- Development of open spaces as a means of neighborhood rehabilitation;
- Analysis of the process and causes of in-migration and out-migration of distressed neighborhoods;
- Residents' participation in decision-making processes.

All these were published in a series of research reports and discussed in workshops organized in collaboration with other scholars and planners and Project Renewal decision-makers at both the central and local level.

The studies were supported by the Ministry of Construction and Housing and the Ministry of Labor and Welfare.

101b. Self-Help Housing Rehabilitation in Israel (1980-1984)

Dr. Naomi Carmon, Dr. Robert Oxman, Mrs. Tamar Gavrieli and Mrs. Ariella Winberg

It is commonly stated that the inhabitants of distressed neighborhoods in Israel tend to be unwilling or incapable of helping themselves except in one way: the stronger among them gather enough resources to leave the neighborhood, while those who cannot leave wait apathetically until aid

filters down to them from the various authorities. In contrast to this image, it has been found in a survey of the neighborhoods which have been stated for rehabilitation that, in the majority of them, there has occurred substantial activity of self-help rehabilitation, at least with respect to the rehabilitation of the dwelling units.

For the purposes of the current study, self-help housing rehabilitation was defined as the addition of building area in permanent form to the original dwelling, which has taken place through a process initiated by the residents and funded by their savings or by loans. Generally, the inhabitants have either designed the addition themselves or have participated in its design, and sometimes did the building on their own or took some part in it.

In the first stage of this study (1980-81), the latent potential of standard types of public housing in Israel has been demonstrated. An initial survey of 70 distressed neighborhoods revealed that 90% of them are composed of public housing and two-thirds of those have a large stock of 1-2-story houses, which are immediate candidates for self-help rehabilitation. It was found that the process had spread in over half of those. An in-depth study of one of them enabled the analysis of the benefits of this process.

Stage 2 of this study (1981-82) was based on a field research which compared the costs and benefits of the two most common methods of government-subsidized housing improvement in Israel: relocating households by public companies (mostly Amidar and Amigur) and self-help rehabilitation. We found that the latter one was preferable, and that about half of the households that were subject to the former one would have wanted to try the latter. Recommendations regarding ways to enable them to fulfill this wish for their benefit as well as for the public benefit were the results of this stage.

The first two stages focused on self-help housing rehabilitation of 1-2-storey buildings, while the third one (1983-84) studied the factors which may encourage the spread of this positive process to 3-4-storey blocks. It found two groups of factors: those which determine the potential and those which make the potential materialize. Most of the latter can be manipulated by Project Renewal system, which is in a process of learning the conclusions of the study and may implement some of its recommendations in the near future.

This study was supported by the Ministry of Construction and Housing.

102. Comprehensive Evaluation of Israel's Project Renewal

Dr. Rachelle Alterman, Dr. Naomi Carmon, and Professor Moshe Hill,
Dr. Arza Churchman, Prof. Mordechai Schechter, Mr. Amnon Frenkel

Project Renewal comprehensive evaluation was based on the Integrated Evaluation methodology which was developed by the research directors. It integrates elements from different evaluation traditions which were independently developed in different disciplines, such as sociology, political science, economics, management sciences and urban planning, and which can be used for the evaluation of various kinds of broad-aim social programs. Integrated evaluation encompasses the following tasks:

- **Process evaluation:** description of the planning and decision-making processes and their evaluation, especially with regards to administrative effectiveness and public participation.
- **Implementation evaluation (monitoring):** description of activities (outputs), and the extent to which they reach their target population.
- **Cost effectiveness evaluation:** measurement of the efficiency of programs by comparing the cost of their provision and their effectiveness in reaching target populations.
- **Impact evaluation:** evaluation of the planned and the un-planned outcomes of the program and the extent to which it achieved its goals.

The researchers gathered data in a sample of 10 neighborhoods, out of the 84 neighborhoods included in Project Renewal. The data collection covered the period 1979 to 1984.

The data analysis shows that the Project contributed significantly to the achievement of its stated goals. It improved living conditions considerably by improving housing conditions, physical infrastructure, educational services and leisure-time services in many neighborhoods. It had some success in enhancing personal social mobility by providing more equal opportunities, especially equal educational opportunities. (Of course, equal opportunities do not imply equal results.) It had a partial success in providing for citizen participation in local decision-making processes, through the local steering committees in which residents had 50% of the voting power. It was a relatively small percentage of the residents who really participated, but even this is an important innovation in the democratic life of Israel, and it is an expression of the intention of Project Renewal to help people help themselves. Another expression can be found in the self-help housing rehabilitation program, which encouraged housing enlargements by owner-occupants. The Project increased the motivation of tenants to improve their housing and established mechanisms for this, which may well continue even after the Project leaves the neighborhood.

Project Renewal is expected to have a long lasting impact on Israeli society. Measurements have shown that neighborhoods have been stabilized, and further deterioration is not expected in most Project neighborhoods. The influence of the Project on reducing disparities in the distribution of services and in life style is expected to enhance processes of social integration in the Jewish population of Israel. The innovations in the institutional-administrative aspects, especially decentralization and citizen participation, may leave their traces in the Project neighborhoods as well as spread to other localities. Last, but not least, the consequences of this Project on the relationships between Israel and the Jewish Communities in the Diaspora may be significant and enduring.

Since it was found to be a generally effective enterprise, the researchers recommend the continuation of Project Renewal. In accordance with the findings, several important modifications are suggested. More emphasis should be put on the integrative role of the Project, i.e., on coordination within social services and among neighborhood services on the one hand, and on ways to link the neighborhood and its residents to their broader urban

environments on the other. The provisional character of the Project should be stressed, and much more attention should be paid to maintenance functions and to organizational mechanisms which will facilitate and encourage continuous improvements when the Project is terminated. Development towns which are included in the Project have different needs, compared to neighborhoods which are part of bigger cities; their renewal should involve major emphasis on economic development and unique forms of citizen participation.

This project was supported by the Jewish Agency and Israel Government, through the "International Committee for the Evaluation of Project Renewal."

103. Agricultural Aviation

Professor Shmuel Merhav, Professor Daniel Weiss, A/Professor Asher Sigal, Dr. Arthur Grunwald and Mrs. Ayala Merari-Farbman

1. Flight Safety and Control

(a) The Hazards of the Hedgehopper

The low-flying cropspraying pilot has exceptionally difficult tasks, controlling his aircraft while keeping to a complicated spray pattern over the fields and at the same time watching out of the corner of his eye for sudden hazards like trees, telephone wires or farm buildings.

The pilot's task is not made any easier by a psychological phenomenon known as "tunnel vision." This "vision narrowing" is caused by a person's natural tendency to concentrate on difficult tasks by focusing his visual field into an area directly in front of himself, an area known as "the cone of attention." This "cone of attention" is a sort of mental searchlight which gets more powerful but narrower as the difficulty of one's task increases. This also increases the hazard to the pilot, because it prevents him from reacting to events which appear suddenly out of the corner of his eye.

A flight simulator was built in order to present a visual scene at an angle identical to the actual visual field in flight. Two experienced pilots are presently participating in an experimental program, together with two inexperienced subjects. The simulation setup included actual components of the agricultural aircraft, such as pilot seat, control stick, rudder pedals and throttle lever.

Results from these simulation experiments, thus far obtained, show clearly the existence of the "cone of attention" and its narrowing.

(b) Low-cost Sensors for Attitude Angle

A novel technique has been developed for determining attitude angles and other state variables by means of relatively low cost sensors. The technique used *a priori* knowledge of aircraft dynamics; hence, its accuracy depends on knowing the aircraft parameters exactly. At present, the sensitivity to errors is being investigated. Preliminary results show that the technique is accurate enough and cheap enough for control of agricultural aircraft.

2. Preliminary Design of Advanced Agricultural Aircraft

A data base of advanced propulsion systems and advanced General Aviation

airfoils has been compiled. A computer program matches aerodynamic characteristics to the size and weight of an agricultural aircraft. The data base and computer routine are being used for parametric studies on required mission and performance.

3. The Parameters of Efficient Spraying

Turbulent air in the wake of the aircraft entrains spray droplets before they can reach the ground. Assuming that the aircraft wake is fully developed, we can calculate the pattern of spraying as a function of droplet size.

Significant results were achieved. The program showed that spray droplets from a large part of the wing (30-50%) do not reach the ground in the required flight path. This means that future spray systems can be designed to cover only the active parts of the wing span (thus reducing wing drag and increasing fuel efficiency). Also, at the present time there are various add-on kits being marketed. Our computer program can now assess their effectiveness with regard to efficiency of spray spreading and uniformity.

104. Water Policy for Israel

Professor Uri Shamir, Professor Jacob Bear, Dr. Nathan Arad, Professor Yitzhak Gal-Noor, Mrs. Nina Selbst and Mr. Yaacov Vardi

In this study we developed a methodology for comparing alternative policies for management of national resources in general, and water in particular.

Twelve policy areas were identified, among them: (1) Total production from all sources; (2) Quality of water in the sources and main system, and of the water supplied; (3) Pricing; (4) Allocations for agriculture; (5) Geopolitical issues; and (6) Organization and management of the water sector. The policy areas were divided into components — a total of almost 90 — and a few alternative decisions (policies) were identified for each. Selection of an alternative for each and every component constitutes a complete water policy. Evaluation of alternative policies is with respect to about 20 "measures," which are well defined expressions of a stated hierarchy of objectives: physical, economic, environmental and social. The decision-making is carried out with the aid of a multi-objective decision analysis method.

The research report lasted over five years, and a report was issued in April, 1985. Some of the detail is contained in eleven special reports which appeared over these years.

The report concludes with the recommendation that policy formation and evaluation should be carried as an ongoing policy, by a permanent team, designated by the Water Commissioner. Subsequent to this report, the Commissioner appointed a Policy Formulation Committee to advise him. This committee — made up of experts, interest-group representatives and public figures — is using the methodology developed in our study.

The project was supported by the Water Commissioner.

105. The Use of Mathematics in Industry

Research Coordinator: Professor Abraham Zaks

The research team also included A/Professor A. Berman, A/Prof. M. Pollatchek and Dr. Z. Rozberg

The research team conducted an investigation into the amount of saving to be gained by central storage. This was done using game theory. At the same time, preparations were made for centralizing storage at the Technion Chemical store and the electronic parts store.

The project was supported in part by the Technion.

The Use of Coal as a Substitute for Oil in Industry in Israel

Research Coordinator: Professor Arthur Stotter

The research team has undertaken a survey of the possibilities of using coal instead of oil in various industries. The team has studied the problems involved in the substitution, such as sources and availability, inland transportation, ash disposal, combustion, ecological problems, etc. This research was part of the project on alternative energy policies. A final report was issued.

108. Manual for Productivity Control at the Plant Level

A/Professor Yaacov Roll and Yochanan Arzi

Productivity control is a part of the managerial control system in a plant or organization. Unlike the conventional control aspects, productivity control points out the extent to which a plant utilizes its potential and the existing possibilities for further rationalization and raising of productivity. This component of the managerial control system is of importance in periods of success for pointing out possibilities for further improvement, and more so in periods of difficulty for locating areas for recovery steps.

The manual for productivity control at the plant level presents the principles for the structure of such a control system, as well as the way in which it can be built and implemented. The various topics touched upon are demonstrated by a systematic working out of a case study. The case was constructed so that as many aspects as possible, of the discussed issue, are reflected in its solution. Separate chapters in the manual discuss the various stages in setting up a productivity control system. Among these: constructing an optimal production plan, setting input standards, calculating productivity indices and obtaining cost accounting data. Most of the chapters are divided into two levels. The first is the managerial level in which each stage in setting up the system is introduced and the general principles governing this stage as well as a discussion of the practical steps for its implementation. The second level is the technical one, in which the various operational details are introduced, the pertinent mathematical formulations presented, and the calculations for working out the case study presented. Readers interested in the managerial aspect may follow level one; those about to implement a productivity control system should follow both levels.

The "engineering approach" to productivity measurement is adopted, by which actual performance is compared to a set of input standards representing the optimal capability of the plant at the time. Thus, changes in performance due to changes in capability (e.g., following investments, changes of process, etc.) are separated from changes in the extent to which these capabilities are utilized. This characteristic of the engineering approach facilitates carrying out comparisons between plants in between different periods in the same plant. In such comparisons, it is important to distinguish between differences in potential and differences in the extent to which this potential was put to use in the compared states.

The proposed system enables the acquisition of "local indices," reflecting performance with respect to local standards, as well as "comparison indices" relative to some other state (e.g., other periods, other plants, etc.). Productivity indices can be defined at the desired level of aggregation: from "total factor indices," expressing in a single number the overall input productivity, through "partial indices" for each of the main input factors, down to separate productivity factors for individual input components.

A separate chapter lays down the steps necessary for the development and introduction of a productivity control system in a plant or a firm. Instructions are provided for developing the computer software to back up such a system. The manual may serve for presentation purposes and course text on the subject of productivity control, as well as a practical guide book for implementing productivity control systems.

113. The Effect of Advanced Means of Communication on the Operation and Location of Hi-Tech Firms in Israel

Professor Daniel Shefer and Mr. Amnon Frenkel

Most Israeli hi-tech firms are in the private sector, but the majority of those located in development areas are publically owned.

Research infrastructure and availability of skilled manpower seem to be central considerations in the siting of a hi-tech firm in Israel. About half the firms that receive financial aid are located in the central areas of the country or close to research institutions. Half their workforce is vocationally skilled, 13% work in research and development and the remainder in administration. By contrast, firms in the development areas tend to be large and not very labor intensive, and engaged in production. Thus, a policy for attracting more hi-tech industries to the development areas must take into account their special needs: firstly, for worker training, and secondly, for improving the telecommunications infrastructure so as to provide a local advantage in urgent concerns like contacts, sales, service, etc.

At present the impact of ACM (Advanced Means of Communication) on electronics and computer firms is greater than the effect of ACM on a group belonging to the communications industry itself. The electronics industry maintains closer connections abroad, with the U.S.A. and Europe, while the communications industry is connected more with the local market. The increasing expenditure on ACM by younger firms should be taken as prescriptive for the development of telecommunications in Israel.

The project was supported by the Ministry of Communications.

114. Policy Choice for Industrial R&D in Israel

Research Coordinators: Dr. Steven E. Plaut and Dr. Benjamin Bental

In many industrialized countries it is common to find government supporting commercial research and development, allegedly because of failures of the open market to support this particular area of economic activity. In particular, it is claimed that the market does not reward the researcher for the public benefits produced by his findings, and that the risks are too high for private corporations to bear on their own.

Following an exhaustive survey of the theoretical literature on R&D, we discuss some specific policy decisions by countries such as Great Britain and France. We conclude that the government policies do not remedy the market failures, and indeed may enhance the problem rather than diminish it.

Israeli policy is carefully examined. Here too it is shown that the policy does not compensate for the market failures. It does not deal properly with benefits (where they exist), nor does it remove the risk problems. As a pure subsidy, there are indications that the government supports less-than-successful ventures.

The report ends by suggesting alternative approaches. In particular, it is recommended that policies be adopted which aim at the specific goals of the government (e.g., export enhancement) rather than use indirect measures such as the support of hi-tech industries.

118. Prices of Crude Oil and Petroleum Products — Israel in an International Perspective — A statistical survey (1978-1985)

Dr. Abraham Mandel

Pricing, taxation and subsidization policies in the country's fuel economy have always been a central topic of public interest and discussion in Israel, as well as a permanent item on the agenda of Government and Knesset decision-makers — especially in the recent decade, after two oil price shocks in the years 1973-74 and 1979-80.

The legislative and organizational framework of the Israel fuel economy took shape in principle in the late Fifties, when the foreign oil companies departed and the Government placed the fuel economy under strict control. Modifications were occasionally effected over the years, but the system remained basically the same in spite of the recent changes on the international scene.

Although the fuel pricing topic is claiming close attention, it is quite difficult to reach clear-cut conclusions in view of its complexity. The main objective in undertaking the present study was to create a reliable and up-to-date information base with a view to a clear picture of the price structure of crude oil and petroleum products in Israel in the years 1978-1985. This statistical survey is regarded as the first stage of a comprehensive comparative analysis of the pricing, taxation and subsidization policies in Israel's fuel economy in the recent years versus other industrialized and developing countries.

Not all relevant data are presented here in explicit form. For example, the

extra burden on the Israel fuel economy due to the necessity of maintaining substantial strategic reserves, and the accounting between the oil companies and the Equalization Fund, owing to fluctuations in the value of crude oil stocks — could not be referred to openly. Nor were we able to compile and present properly part of the other relevant information, but it is hoped that this will be improved during the next stage of the study.

The survey comprises four sections. The first section describes pricing trends in the international oil markets and shows the import prices for Israel against appropriate data for the U.S.A. and Western Europe. The second section presents a broad picture of the ex-refinery prices of the principal petroleum products in Israel versus two neighboring regions — the Mediterranean basin and the Arab/Persian Gulf. The third section describes in detail the changes which have taken place in the pricing structure of the principal products in Israel over the period reviewed, and reveals the breakdown of taxes, duties and subsidies, including transfers from the Treasury to the Fuel Economy Clearing Accounts (Equalization Fund). The fourth section gives a worldwide comparison of the consumer prices of the principal products in current dollars and in real terms, after adjusting prices in national currencies for local inflation.

Two workshops on the above subject were organized at the Technion in January 1986, with the participation of decision-makers from the energy and finance sectors.

130. Hagiborim Bridge — A Case Study on Traffic Flow in Haifa

Dr. Yehuda Gur

Hagiborim is a two-lane bridge serving as the main eastern gateway to the metropolitan center of Hadar. The closure of one lane for one month for repairs was studied for its effect on traffic in the city of Haifa (pop. 450,000). During closure, inbound bridge traffic was limited to public transport, with free outbound traffic. A study of the impact of the closure was conducted. Direct traffic impact was significant but modest. It included increased travel times and queues, mainly for public vehicles during the periods, traffic rerouting, a total decrease in the number of entering vehicles, and slight improvements in bus travel times and ridership.

The indirect impacts seemed more significant. A major portion of the reduction in entering vehicles was due to visiting, rather than crossing vehicles. This resulted in a daily decrease of about 900 entrances of employee-carrying vehicles and about 1800 entrances by other visiting vehicles.

Based on these findings, two recommendations are made:

- a) Only buses should be allowed to enter Hagiborim Bridge during the morning rush. The advantages would be quicker and more punctual bus service, less parking by employees, hence more for visitors, and decreased congestion in Hadar.
- b) Attention should be focused on the worrying decrease found in visitors who seemed particularly discouraged by the reduced service levels. This

indicates that future congestion, caused mainly by increased auto ownership, might dissuade visitors and depress business. Positive action should be taken on this problem.

In addition to studying a particular case of urban traffic — Hagiborim Bridge in Haifa — this project also contributed to the methodology of traffic engineering, by developing techniques for measurement of queue lengths and their use in the estimation of delays.

191. Mineral Resources in Israel's Economy

A/Professor Mordechai Schechter and A/Professor Israel Linn

The political and economic aspects of minerals in Israel — both indigenous and imported — were investigated under the following headings:

- Uses
- Costs
- Likely effects of shortages
- Possible substitutes
- Alternative manufacturing processes
- Recycling.

A comprehensive report has been published, concentrating on two important minerals: phosphate and cement.

A final report was issued.

190a. A Framework for the Formulation of Income Policy in Israel

Mr. Aharon Wiener and A/Professor Eliezer Rosenstein

A new institute is designed to provide the framework within which all the parties concerned — Government, Histadrut and employers — can participate to decide income policy. The framework will include all three stages — discussion, negotiation and joint decision-making. A special feature of the institute will be to provide realtime economic modeling: namely, during negotiations, the parties will be supplied with systematically updated spreadsheets, so that they can see at once the likely effect of each demand on the economy as a whole.

A final report was issued.

190b. Preventive Intervention in Labor Relations

Research Coordinators: Professor B. Mannheim and Professor E. Rosenstein

The purpose of this research was to introduce a method of labor relations at the level of the individual corporation, as a supplement to the existing process of mass collective bargaining. The research team aimed to develop and test a cooperative process of preventive intervention.

A procedure was formulated and tested in certain organizations. Further tests are recommended.

A final report was issued.

190c. Institutional Feeding in Israel

Professor Chaim Mannheim and Professor Zeki Berk

Eating patterns are changing rapidly in modern society because more people are working and unable to eat meals in the traditional home environment. The research team has carried out a preliminary investigation of institutional feeding patterns in schools, factories, universities, hospitals, etc. A workshop was organized with participants from government and private enterprise.

A final report was published.

190d. Vocational and Technical Education in Israel

Professor Shmuel Avital and Professor Adir Bar-Lev

The importance of vocational training for the development of the State of Israel is generally recognized. The research team has conducted a preliminary study on the following questions:

- What are the needs of Israeli society with regard to vocational education?
- What are the objectives of vocational training in school at grades 10–12?
- What system of vocational education in other countries can serve as a model for Israel?

190e. Regulation of Daily Activity Hours

Eng. Elisha Kally

This research was initiated in response to a decision of the Economic Cabinet of the Government. It examines the idea of regulating the hours of daily activities, as a means towards enhanced efficiency and convenience.

The interdisciplinary research team has surveyed the following topics:

- Traffic, both by public and by private transport
- Distribution of working hours
- Peak demands for electricity and possibilities of peak reduction
- Popular times for shopping, personal and public services, etc.

A final report was published.

190f. Improvement in Policymaking in Israel

Professor Yehezkel Dror

From the experience of Israel and other countries, the research team claims that Israel has significant scope for planning its future, but at present is inadequately equipped for high quality policymaking. Therefore, the team has formulated a number of recommendations, some of them long range, designed to improve policymaking procedures.

A final report was published.

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הטכניון – מכון טכנולוגי לישראל
מוסד שמואל נאמן
למחקר מתקדם במדע ובטכנולוגיה



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