TEL AVIV UNIVERSITY

THE ARMAND HAMMER FUND FOR ECONOMIC COOPERATION IN THE MIDDLE EAST

EGYPTIAN-ISRAELI COOPERATION IN AGRICULTURAL DEVELOPMENT

by Elisha Kally
Edited by Meir Merhav

TEL AVIV UNIVERSITY

The objective of the Armand Hammer Fund for Economic Cooperation in the Middle East is to foster economic cooperation between Israel and her neighbours. Mutual economic relations can offer effective leverage in the political negotiations towards peace and–once it is attained–they can contribute to stabilizing it so that the countries concerned may become partners in prosperity. To this end the Fund seeks to identify areas of mutual economic interest and recommend specific joint economic projects.

The programme of the Armand Hammer Fund for Economic Cooperation in the Middle East was conceived and formulated in a series of meetings held during 1980 between Dr. Armand Hammer, Chairman of Occidental Petroleum Corporation, and Professor Haim Ben-Shahar, then President of Tel Aviv University. The project was made possible by a grant provided by Dr.Armand Hammer and with the help of his friends, colleagues and community leaders in Los Angeles.

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The Armand Hammer Fund for Economic Cooperation in the Middle East
Tel Aviv University, April 1986

Preface

The high degree of complementarity between the agriculture of Egypt and of Israel affords considerable opportunities for mutually beneficial cooperation between the two countries. However, cooperation in agriculture has more far-reaching political implications than economic relations in other areas .

This special dependence on the political considerations and attitudes of the two countries derives from two specific aspects of cooperation in agriculture, which distinguish it from many other fields of potential cooperation: firstly, agriculture in Egypt, as in many other countries, is inseparably intertwined with the social structure and the country's culture; and secondly, the disparities in the main characteristics of the agricultural sectors of the two countries would make cooperation in this area less symmetrical that in other areas of economic cooperation. While Israel's experience in the cultivation of arid lands, in the application of modern irrigation systems and in farm management techniques is applicable to the agricultural development of Egypt, particularly in her "new lands" outside the traditional areas of the Nile Valley and Delta, Egypt's present experience in agriculture does not seem to be applicable to Israel.

If Egypt should reach a political decision to encourage agricultural cooperation with Israel, three areas would seem to be the most promising: bilateral trade in complementary farm products; the transfer of Israeli know-how, particularly through joint research and development projects designed better to disseminate this know-how to Egypt; and thirdly, joint ventures in the setting up of farm and associated agro-industries in Egypt's "new lands."

The present report outlines these three potential areas of agricultural cooperation between Egypt and Israel. It was prepared by Mr. Elisha Kally within the framework of the Armand Hammer Fund for Economic Cooperation in the Middle East, and was edited by Dr. Meir Merhav as part of a forthcoming book on economic cooperation in the Middle East in conditions of peace. Particular thanks are due to Dr. Gideon Fishelson, Scientific Coordinator of the project.

We are indebted to the members of the Steering Committee and the Board of the Armand Hammer Fund for Economic Cooperation in the Middle East, and in particular to Dr. Armand Hammer, for their encouragement and support.

Professor Haim Ben-Shahar,
Chairman of the Steering Committee

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1. Introduction

The Middle East needs a stable peace which is more than the mere cessation of open warfare. A deep and lasting peace is difficult to establish wherever people with conflicting interests have no incentive to work together, and the key to peace is to create mutual interests that will generate tangible incentives to maintain peace once it is attained by political decision.

Economic issues must therefore be placed higher on the agenda of the Middle East peace process once it is resumed. Their neglect would be a serious omission of a most powerful tool for fruitful negotiations. Due attention to the economic issues can promote peace in two ways. Firstly, it can offer effective leverage in the political negotiations towards peace, and thus smooth over conflicts in the political sphere. Secondly, once peace has been established formally, economic relations can buttress and safeguard that peace.

The Middle East peace process, which for the time being is at a standstill, today needs the reinforcement that its economic aspects can provide in both of these peace-promoting roles -- as a bargaining tool in peace negotiations, particularly with respect to the West Bank, Lebanon, Syria and Jordan, and as an additional support and normalization of the peace that has already been concluded between Egypt and Israel.

Among the many and diverse areas in which Egypt and Israel might develop a highly beneficial cooperation, the development of agriculture occupies a prominent place, with a far-reaching potential. Each country might make a unique contribution to the other through joint efforts in agricultural development and of related agro-industrial projects, mainly because the agricultural sectors of the two countries are at present highly complementary to each other.

Israel's agriculture is highly capital-intensive; in 1981 its gross output per employed person was some $13,000 a year. Egypt's agriculture, by contrast, is highly labour-intensive, and the annual gross agricultural output per employee is some $1,200. Egypt's agriculture has since the dawn of time been based on the abundant waters of the Nile and the fertile silt which its annual floods carried with them until the Aswan High Dam was constructed. Israel's agriculture, by contrast, has developed in conditions of a scarcity of water and, initially, a shortage of land. It has therefore evolved in the direction of applying an advanced agro-technology for the intensive cultivation of arid and semi-arid lands.

In both countries agricultural output falls short of self-sufficiency in farm products, but at the same time both also produce for export. In both countries, the growth of agriculture is slower than that of other economic sectors -- a reflection of a development process that emphasizes industrialization -- and the share of agriculture in the gross national product is declining. However, while in Israel barely 6 per cent of the labour force are engaged in agriculture, in Egypt farming still occupies nearly 40 per cent of the labour force.

In Israel, the fall in the relative share of agriculture marks the approaching end of the quantitative expansion of agriculture, whereas in Egypt that process is still in its beginning. The problems of the agricultural sector in Israel, in terms of output, self-sufficiency, employment or the foreign trade balance, no longer rank at the top of the country's national priorities, while in Egypt they are still central to the country's development concerns.

However, the possibilities for cooperation in agriculture -- which is not only a productive occupation, but also a way of life in which the economic activity is inseparably intertwined with all aspects of the social structure -- are in

certain respects circumscribed by factors similar to those relevant for infrastructural projects. Cooperation in agriculture, as in the utilization of water or energy resources, is more dependent on top-level political decisions than mutual relations in industry, trade or services.

Given these differences, Egypt's experience in the cultivation of the Nile Valley and its Delta is not transmissible to Israel with its paucity of water and highly different resource endowment and factor proportions. By contrast, Israel's experience in the development of an agro-technology oriented towards the cultivation of arid lands, with expensive water and based on the use of advanced techniques of cultivation and irrigation and the intensive use of capital, is likely to be of interest to Egypt, where the cultivated area can be increased only by expanding from the "old lands" of the Nile Valley and Delta into the "new lands" of arid areas and marshlands.

Cooperation between Egypt and Israel in agricultural development is likely to find scope mainly in the commercial subsector, in which the social aspects are less important, and where the conditions of soil and climate require the adoption of new agro-technologies and preclude reliance on the cultivation methods handed down by a tradition of millenia.

It should therefore be recognized clearly that the marked differences in the characteristics of their agricultural sectors will necessarily make cooperation in agricultural development between the two countries asymmetrical. Cooperation would in practice mean a one-way flow of Israeli know-how to Egypt, mainly for the development of commercial farms in Egypt's "new lands". Israel's experience in the cultivation of arid lands, in the application of modern irrigation systems, in

farm management techniques and in related fields are applicable to these "new lands", whereas Egypt's traditional experience is not transmissible to Israel.

Other factors that might inhibit cooperation in this field should also not be overlooked. The difficulties of introducing new technologies in a traditional sector such as agriculture, where technical change has far-reaching implications for the entire social fabric, are a well-known phenomenon in developing countries. Perhaps one of the advantages from which the development of Israel's agriculture benefited was that it took place with virtually no prior experience and tradition and, given its resource constraints and the marked variation of soil and climate in so small a country, was therefore extremely open to innovation.

In addition to the dead hand of tradition which in many developing countries inhibits innovation, and therefore cooperation with technically more advanced countries, there is in the particular case of Egypt and Israel the residue of antagonism and suspicion born of more than three decades of enmity. This can be overcome only in the course of a long and gradual process, as mutual trust is built up step-by-step.

These obstacles to full cooperation determine the form and content of the initial efforts, the speed with which cooperation will develop, and the areas chosen for mutual exchanges and joint undertakings in the first stages of such cooperative efforts. They recommend, in the first place, that a third party -- American or European -- be coopted in joint ventures, so as to neutralize and smooth over difficulties arising from the persistence of mistrust and antagonism between the two countries.

In the second place, these stumbling blocks suggest -- particularly in view of the contrasting characteristics of the agricultural sectors of the two countries

-- that there is more room for cooperation in the development of Egypt's "new lands", her so-called "horizontal" development, than in the "vertical" development of the "old lands" with their traditional cultivations methods and the socio-economic structure of the traditional villages. Not only is the know-how and experience that Israel might contribute more suitable for the reclamation and cultivation of the new lands with their specific physical characteristics of soil and climate, but their development is also more commercially oriented and falls under Egypt's "open-door" policy that affords more scope for the involvement of foreigners there than in the traditional subsector of agriculture. In addition, the development of these new areas generally takes the form of relatively large-scale farms, so that cooperation in this subsector would economize on the foreign expertise and assistance that would be required.

The three main areas in which cooperation between Egypt and Israel would seem to be promising in the first stage would be in bilateral trade in farm products, in the transfer of know-how, and in joint ventures.

The geographical proximity of the two countries affords possibilities of border trade in farm products and livestock. Egypt produces several exportable field crops which Israel imports from other countries, such as rice, long-staple cotton, and various fruits and vegetables, while Israel exports vegetal and animal products which Egypt imports from third countries. In addition, Israel might supply Egypt with agricultural machinery, irrigation equipment, structures and equipment for livestock breeding, as well as with chemical products.

The possibilities with respect to the transfer of know-how would seem to lie mainly in joint projects of research and development and in the transfer of Israeli know-how, including the associated consulting and engineering services,

for the development of arid and semi-arid lands as well as of the brackish marshlands in the new areas that Egypt plans to bring under cultivation.

The most promising and potentially largest area of cooperation is probably to be found in the undertaking of the joint establishment of farms and of the agro-industries associated with them. The economic rationale for the cooperative establishment of commercial farms rests on the optimal combination of Egyptian inputs of land, water and labour with Israeli inputs of technical know-how and professional management. Ventures of this kind would imply Israeli technical management in Egyptian territory, and would be concentrated in the areas within the purview of Egypt's policy of "horizontal" agricultural development.

In Egypt's traditional agricultural areas, government policy seeks to promote "vertical" development through the introduction of more advanced cultivation techniques so as to raise productivity, accompanied by a broad range of modernizing commercial, organizational and social changes from the village level up. This line of development may also hold a considerable potential for cooperation, but probably only in the more distant future. At present, agricultural development along these lines is undertaken by many different Egyptian authorities and involves a wide span of long-term and inter-disciplinary efforts, including engineering, vocational training, education, social work, rural organization, marketing, price policy and fiscal policy, and many others. Foreign agencies, such as the U.S. Agency for International Development (AID), the World Bank, and others, are also involved in these efforts.

Most of these development efforts take place in the traditional rural environment rather than in the form of commercial agro-business. They are therefore less open to cooperation between Egypt and Israel. An Israeli

involvement in this area of Egypt's agricultural development will, if at all, emerge only in the course of a lengthy process of mutual adaptation.

The following presents a summary survey of the physical and economic background, of the lessons to be learned from the few initial efforts at cooperation that have been made since the conclusion of peace between the two countries, and of the type of projects that might be embarked upon in the framework of peace.

1.1 Egypt's Agriculture -- Physical and Economic Background

Egypt's cultivated area is some 2.7 million hectares, or 2.7 per cent of the country's total area of about one million km^2. Of this total cultivated area, some 2.4 million hectares were already under cultivation before the 1952 revolution.

The old cultivated lands lie almost entirely in the valley and delta of the Nile. They consist of highly fertile, chalky alluvial soil with a high clay content. Most of these lands today suffer from drainage problems.

The new lands that are to be brought under cultivation are mostly in the arid fringes of the Delta as well as, in the future, in the Sinai peninsula. The soil in these areas is mostly sandy, with little clay content. The new lands are partly brackish marshlands in the Delta and on its margins, and some are in the oases of the Qattara depression.

The Nile is Egypt's almost only source of water. Its waters are today stored in Lake Nasser above the Aswan High Dam. Egypt's share in the Nile's total annual flow of about 85 billion cubic metres is, by agreement with the other riparian countries, some 55 billion cubic metres a year. The full regulation of the

Nile's flow became possible, for the first time in history, with the completion of the Aswan High Dam in 1968.

Out of her share in the Nile's flow, Egypt uses some 51 billion m^3 for irrigation. The net water consumption of agricultural crops (their evapotranspiration) is about 27 billion m^3 a year. Egypt's efficiency of irrigation is 53 per cent (27:51x100), which is quite low. Over-irrigation creates drainage problems and, by the same token, makes it possible to save large quantities of water.

With a target irrigation efficiency of 65 per cent, 12 per cent of the water now used (65-53=12), more than 6 billion m^3 a year might be saved. An additional 9-10 billion m^3 of water will become available as Egypt's share in the water to be supplied by the Jonglei Canal Project for the drainage of the Sudd in Sudan. Another possible source of additional water supplies are the quantities now released from Lake Nasser during the winter season, when irrigation requirements are low, to maintain the Nile at a navigable level and for the generation of hydroelectric power. Finally, the re-use of drainage water may further augment the total quantity of water available*).

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*) Successive droughts have in recent years diminished the annual flow of the Nile's waters from their sources in the Sudan and Ethiopia, where more land has at the same time been put under irrigation. As a result, the water level in Lake Nasser has declined. This has caused serious concern to Egypt, which depends totally on the regular supply of water from the Nile through Lake Nasser.

Several solutions for this problem are being considered: The first is, through cooperation with the Sudan and with international help, to dig a canal to drain and collect the waters of the Nile's sources, which are now lost on a vast scale in the extensive swamps of the Sudan. The second is to reach an agreement with Ethiopia and the Sudan for the long-term allocation of the Nile waters. The third is to increase the efficiency of irrigation in Egypt, where the present method of irrigation by flooding causes a tremendous waste of water. American and Israeli know-how, backed by international assistance, might help Egypt to raise the efficiency of water use substantially and assure the long-term availability of sufficient water to carry out the plans for the development of the "new lands" under irrigation.

The projects outlined in the report on a Middle East Water Plan, for supplying Nile water to the Gaza Strip, the West Bank and to Israel proper involve less than one percent of the Nile's waters, and are negligible in relation to the decline in the Nile's flow and to the ways to make up for it.

The main crops rotated in the "old lands" are: cotton with single-crop clover or vegetables, during a 12-month cycle; fruit plantations; sugar cane, which occupies the land for 3-5 years; multi-crop clover, taking up the land for half a year, followed by rice; winter wheat, with maize or sorghum following in the summer. The main crops, the cultivated areas and their changes in the last generation, are shown in Table 1.

Table 1. Egypt - Cultivated Areas by Main Crops, 1952, 1975 and 1980

Crop or Product	1952			1975			1980		
	Area, in '000 ha.	Crop, in '000 tons	Crop, in tons/ha.	Area, in '000 ha.	Crop, in '000 tons	Crop, in tons/ha.	Area, in '000 ha.	Crop, in '000 tons	Crop, in tons/ha.
Wheat	557	1,081	1.94	585	2,033	3.48	589	1,796	3.05
Clover	925			1,181			1,139		
Cotton, pickings	826	1,296	1.57	565	1,056	1.87	523	1,408	2.69
Rice	157	506	2.11	789	2,781	3.62	800	3,231	4.04
Sorghum	182	552	2.87	205	775	3.78	172	635	3.69
Sugar cane	39	3,258	83.50	91	7,902	86.60	106	8,544	80.60
Vegetables	396	1,810	4.93	715	6,395	8.90	877	6,889	9.02
Plantations	30			120			151		
Other Crops	364								
Physical Area Cultivated	2,400			(2,400)			2,700		
Intensity of Cultivation	1.75						1.89		
Heads of Cattle					4,306			4,259	
Eggs, millions		455			1,505			1,743	

Sources: (1), (5), (11)

Table 2. GNP by Economic Sector and Product per Worker in Egypt, 1981

GNP, Employment, and GNP per Worker / Sector	Agriculture	Industry	Services	Total and Average
GNP, $ millions	5,800	8,700	11,900	26,400
Employed Persons, '000	4,700	2,600	4,700	12,000
GNP per Employed Person, US$ per annum	1,230	3,350	2,530	2,200 (average)

Sources: (1), (10), (11).

The data in Table 1 show that the physical area under cultivation and the intensity of cultivation have both increased during the last generation -- together, by some 20 per cent -- but that output per unit of land has grown even more rapidly. The increase in productivity has mainly come from an increased use of fertilization (mostly nitrogenous), but also from improved crop varieties. However, in recent years the rise in output per unit of area has lagged and there productivity has even fallen -- mainly as a result of drainage problems.

It can further be seen that production for domestic consumption (vegetables, fruits, wheat, sugar, eggs) has increased more rapidly than that of export products such as cotton. They also show that animal fodder -- mainly clover -- is still the crop that occupies the biggest part of the cultivated area, since work animals still remain the main instrument of production, second only to human labour.

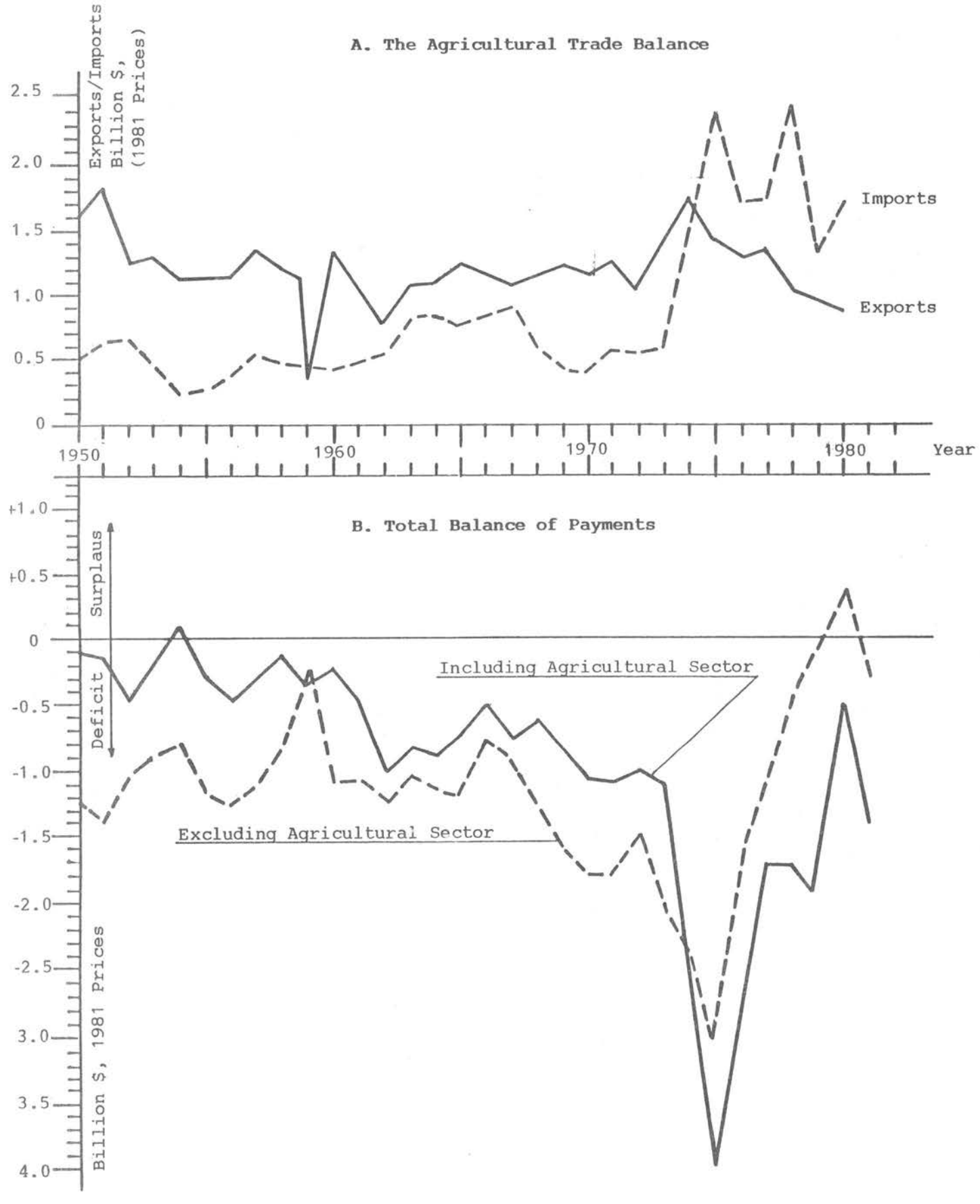
In terms of employment, agriculture is Egypt's biggest economic sector -- employing more people than industry and services, but in terms of its share in the

gross national product it is the smallest. Output per worker in agriculture is therefore also much lower than in the secondary and tertiary sectors, as can be seen from Table 2.

Until 1975, the agricultural sector made a positive contribution to Egypt's trade balance, but this turned negative as the rise in productivity slowed down since the mid-seventies. At the same time, there was a continued increase in the number of mouths that had to be fed -- and this while per capita consumption rose. The negative trade balance in the agricultural sector accounts for Egypt's overall negative trade balance. The efforts made during the sixties to increase the cultivated area, to regulate irrigation after the completion of the Aswan High Dam, and to improve drainage, have not had the results that might have closed the gap in the trade balance of the agricultural sector (see Fig. 1).

The negative trade balance of the agricultural sector and Egypt's overall deficitary balance of payments have impelled Egypt's policy to intensive efforts to raise agricultural output, not only with a view to improving the trade balance, but also to attain the national goal of self-sufficiency in food supplies. As already described, these efforts have taken two directions: improvements in existing agriculture ("vertical" development), and the opening of new areas for cultivation by non-traditional methods ("horizontal" development).

FIGURE 1 - THE BALANCE OF PAYMENTS AND TRADE BALANCE OF EGYPT'S AGRICULTURAL SECTOR (APPROXIMATE DATA)



As already stated, it is mainly the latter direction of development that affords scope for Egyptian-Israeli cooperation -- primarily because of the specific complementarities between the two countries, but also because Egypt's policy has since the mid-seventies opened this kind of agricultural development to foreign participation and involvement. The legal framework for this openness is embodied in the "Law 43" of June 1974 and its later amendments, which aimed at encouraging foreign investment in Egypt.

The relevant provisions of this law are that areas to be cultivated within its framework will be leased out for 50 years, with the possibility of prolongation, and will not be expropriable. Worker participation in management is not obligatory, and entrepreneurs are permitted to carry out foreign currency transactions freely, including the holding and transfer of foreign currency. Imports of inputs and exports of products are free, and require no government licenses or specific approvals. In addition, enterprises operating in this legal framework are exempt from business and construction taxes and, for a period of five years, from taxes on their profits.

This five-year period of tax exemption may in certain cases be extended to eight years. Foreign investors are permitted to repatriate their capital after five years if the operation of the project is delayed for reasons beyond their control or if the foreign capital is no longer required. The permission to repatriate capital may also apply to import-substituting ventures, subject to prior government approval. Finally, up to 50 per cent of wage and salary payments to foreign employees are exempt from income tax, and are transferable abroad.

The increase in agricultural output has fallen behind policy targets. In its "vertical" direction, the development effort has encountered the inertia of

traditional agriculture. In its "horizontal" thrust it has faced considerable difficulties in opening up new areas of cultivation and in the adoption of the modern agro-technologies required and suitable for these areas, which differ greatly from the physical and climatic characteristics of Egypt's traditional agricultural lands and methods of cultivation.

1.2 Main Characteristics of Israel's Agriculture

The main characteristics of Israel's agricultural sector contrast sharply with those of Egypt's. Israel's agriculture is highly capital-intensive and is based on the application of advanced know-how, with a high output per unit of labour, land and water. Its collective and cooperative form of organization has led to the development of management techniques appropriate for relatively large farms. At the same time, it has facilitated the incorporation of industrial activities, and has fostered the development of sophisticated techniques for the dissemination of research and development, with a system of rapid feedback from the farm level to the centres of research.

Comparative data for Israel's and Egypt's agriculture are shown in Table 3.

Table 3. Main Comparative Data for Agriculture in Israel and Egypt, 1981 [1]

Item	Egypt	Israel
Agricultural gross national product, $ millions	5,800	1,075
Agricultural employment, thousands	4,700	85
Irrigated area, thousands of hectares	2,550	230[2]
Water consumption, billions of m^3	50	1.69[3]
Product per employed person, $ per annum	1,234	12,647
Product per hectare, $ per annum	2,275	4,674
Product per m^3 of water, $	0.12	0.64

1) Approximate data, because of inaccuracies in the available statistics; see also notes 2 and 3.

2) Including a 15% addition to convert unirrigated lands to irrigated-land-equivalents, as estimated in a study by Zeev Kloner (ref. 9) on the respective contributions of irrigation and rainfall to the gross national product of agriculture.

3) Including effective precipitation, so as to put the water input of both countries on the same basis. Effective precipitation was estimated at 30% of the total water input in Israel. In Egypt this is negligible.

Sources: (1), (3), (9), (11).

Israel's contribution to Egypt's agricultural development efforts would mainly come from her ability to supply technical and management know-how -- primarily, in the development of the new lands. As already stated, the soil and climate in these areas are such that development there might benefit from the accumulated Israeli experience. Furthermore, the forms of organization for farming in these areas are more conducive to the introduction of the agro-technologies and management methods that Israel is able to provide than is the case in the traditional subsector of Egypt's agriculture. Development efforts in these new lands have been opened to foreign participation, as described earlier,

and this may further facilitate Israeli-Egyptian cooperation. Finally, the geographical proximity and relative ease of communication, as well as the complementarity of the two economies in general, which affords scope for cooperation in most economic sectors, may be of special importance in agriculture, where human effort must often cope with the vagaries of nature. The availability, at short notice, of close-by technical assistance, may therefore be a considerable advantage. The initial experience with cooperation since the conclusion of peace between the two countries, however limited so far, already seems to point strongly in this direction.

2. The Initial Experience with Egyptian-Israeli Cooperation

2.1 Three First Cooperative Projects

Agriculture is one of the few areas in which some initial experience has already been gained in cooperation between Egypt and Israel. Limited as it has been, this experience nevertheless holds some lessons for the future.

Three such cooperative projects are presented here as an illustration: a planning study for the development of 200,000 hectares of new lands in the north and to the east of the Nile delta, carried out by Israel's Tahal Consulting Engineers jointly with the investment concern known as the Eisenberg Group; an Egyptian-Israeli-American research project for farming arid lands; and the sale by Israel to Egypt of breeding stock for raising dairy cattle in the "new lands", including the provision of the associated veterinary services.

2.2 The Tahal-Eisenberg Planning Study

This undertaking had the objective of working out a master plan for the development of 200,000 hectares in the "new lands", and was based on a proposal submitted to the Egyptian authorities after several months of preparatory work by the consultants in early 1980.

The Tahal-Eisenberg project had its origin in the personal acquaintance between the late President Sadat and Mr. Saul Eisenberg, the owner of the internationally well-known Eisenberg Group. At the time when this project was undertaken, the political climate was still favourable, at least at the top echelon. It was the "honeymoon" period after the conclusion of peace between the two countries, while President Sadat was still alive, when the evacuation of Sinai by Israel was proceeding as agreed, and before the Lebanon war.

The project was specified as a planning venture to be followed by the actual development of a new agricultural area. The size of the area was not initially determined and was left to be defined by the planners.

The Tahal-Eisenberg proposal was eventually rejected by the Egyptian government, mainly at the insistence of the technical echelons involved on the Egyptian side. The reasons for the project's failure were a premature (and possibly basically erroneous) application to Egypt of Tahal's experience with similar ventures in other countries. After the proposal was submitted to the Egyptian authorities, it emerged that there was a wide gap between what the Egyptians had expected from it and what it actually provided. In addition, the project was restricted to a broad preliminary planning effort, which afforded little scope for demonstrating the specific technological contribution that Israel might make to the development of Egypt's new agricultural sector. In the event, the Egyptians

considered the results of the study as having contributed little to what they had known before.

The Israeli group was to carry out its work -- which began in November 1979 and continued until March 1980 -- jointly with the relevant Egyptian authorities, such as the ministries of land reclamation, agriculture, and irrigation. The Israeli group insisted on this mode of operation, on the basis of its experience in other developing countries, where such collaboration with the local authorities and experts had not only provided the necessary information and familiarity with local conditions, but had also served to neutralize resistance to the involvement of a foreign planner and consultant.

The Egyptian Office of the President accepted the mode of operation preferred by the Israeli group and instructed the ministries concerned to participate. However, given the political circumstances, this imposition from above of close-knit collaboration with the Israeli group did not eliminate the political-emotional tensions at the technical level, and may even have reinforced them.

The generality of the project's terms of reference, which defined it as a "Plan of Operation" and which did not even reach the stage of detail of a pre-feasibility study, left no room for concrete planning. It permitted little more than a broad indication of the direction of development efforts and of the main topics that would have to be subjected to detailed planning at a later stage.

The report that was eventually submitted to the Office of the President (as a joint undertaking by the Israeli group, their Egyptian counterparts, and a number of officials from the U.S. Department of Agriculture who were associated so as to reduce possible friction between the Egyptians and the Israelis) was limited to an outline of the general shape of the development project, the main works that

would have to be undertaken (mainly irrigation and drainage works), the crop rotation, the agro-industries that might be considered, and the main forms of cultivation. Based on the relevant economic data, the project presented an initial estimate of the investment required and the expected expenditure-revenue flow and their implications.

This generality of the project, combined with an effort not to go beyond the conventional in this initial stage, imparted an appearance of routine to the results. It was perceived as saying little more, in many parts of the report, than what might be found in the standard literature. The lack of detailed plans and programmes left no room for the demonstration of specific professional expertise.

The disappointment of the Egyptian authorities with the report provided them with no incentive for further cooperation. The ministries involved, who had collaborated in the project only reluctantly and under the coercion of a presidential directive, had from the outset seen the project as a duplication of their own work and as competitive with it. They therefore apparently saw their original attitude as vindicated by the results.

2.3 The Tripartite Arid Lands Research Programme

Another cooperative effort between Egypt and Israel, together with the U.S., is the tripartite Arid Lands Research Programme begun in 1981, for simultaneous research projects in Ein Shams University of Cairo, San Diego University in California, and Ben Gurion University in Beer Sheva. The programme covers research into the irrigation of desert crops with brackish water, the cultivation of

animal feedstuffs and the breeding of livestock in desert conditions, as well as the adaptation of crops to conditions of aridity.

Information, data and findings obtained in each of the three research centres are systematically distributed to all three, and periodic meetings are held in the three centres. The project is guided by a tripartite steering committee which meets alternately in the three research centres; its activities are reported in the Newsletter of the Cooperative Arid Lands Agriculture Research Programme. The project employs some 40 researchers and has been funded by the U.S. Agency for International Development (AID) with $5 million for four years.

The participants in this project consider it as operating successfully and as attaining its objectives. Although the peace process between Egypt and Israel has gone into a freeze that has also not left this project entirely unaffected, it continues to function. The persons involved in it attribute this to the fact that the project responds to a real Egyptian need and is so perceived by influential Egyptian personalities. In addition, the tripartite agreement that set it up was reached at the highest political level and was signed before the relations between Egypt and Israel cooled off. Finally, the American participation in the project contributes to a lowering of tensions between the Egyptians and the Israelis, and to the prevention of confrontations between them.

2.4 The Export of Dairy Cattle Breeding Stock From Israel to Egypt

A third case of mutual relations between Egypt and Israel is that of the export of milch cows from Israel to Egypt. This venture goes beyond an ordinary export transaction since it involves the provision of the associated veterinary

services. Since 1982, Israel has sold Egypt 1,750 head of breeding cattle, to a value of over $2 million. The cattle is destined for the Salhiyeh development area in the eastern Delta and was purchased by the Osman Ahmed Osman Corporation. For the venture under consideration, this private enterprise firm practically acts as a government corporation since it is charged with the overall development of the Salhiyeh area.

The cattle is sold by the Israeli Association of Cattle Breeders, the roof organization of the collective and cooperative settlements (Kibbutzim and Moshavim) that specialize in cattle breeding. The export of the breeding stock takes the form of a free-market transaction, and the Egyptian buyers preferred the Israeli stock, despite its relatively high price, to that of competitors, because of the superior quality of the Israeli cattle. The sale of the cattle is accompanied by veterinary supervision in its new location.

This transaction has continued despite the cooling off of the relations between the two countries. This ability to weather the more difficult political atmosphere is ascribed to the persuasive economic advantages it has for Egypt, and to the fact that it depends on the decisions of people whose approach does not put political or ideological concerns before commercial considerations.

3. Possible Areas of Egyptian-Israeli Cooperation in Agriculture

3.1 Criteria for Cooperation

The background data presented earlier and the lessons to be learned from the few cooperative ventures undertaken so far suggest that future cooperation

between Egypt and Israel will have the best prospects of success in the directions and subject to the conditions and limitations to be described in the following.

It is obvious that the main area that holds promise for successful cooperation is, geographically, in the "new lands" and, institutionally, in the sectors defined in Egypt as open to private enterprise.

In those fields of action that are under direct government management, priority should be given to research projects, agricultural experiments and similar activities, in which the Israeli contribution would be mainly the transfer of know-how rather than direct involvement in organization and management involving the continuous presence of Israeli personnel in Egyptian territory.

Preference should be given to activities and transactions that fit into the existing framework of Egypt's "open-door" policy and of the policy of encouraging food production, and which do not require new government approval on issues of principle.

What has been said so far is particularly relevant for ventures involving the long-term management of enterprises, and less for one-time commercial transactions and for projects of planning and construction. The shorter the time within which a given project or transaction can be concluded, the less is it subject to the constraints indicated above.

Experience has shown that it is desirable to coopt a third party -- American or European -- in joint ventures; such participation tends to smooth over difficulties in the bilateral relations and to facilitate a more gradual adaptation to a new pattern of relations. Finally, all cooperative undertakings must be backed by bilateral government agreements.

These considerations make it possible to compile an initial list of transactions and ventures that might be candidates for cooperation. These include trade, consulting services and the transfer of know-how, involvement in Egypt's agricultural development efforts in the "new lands", and planning and consulting services in the private sector.

Table 4 lists the relevant items of the Standard International Trade Classification (SITC) imported and exported by both countries and indicates the directions in which trade relations might flow. The table and the indicated direction of possible trade flows relate only to trade diversion; they understate the real trade potential because output-creating trade is not considered.

In the field of consultancy services and the transfer of know-how, there is room for developing joint research projects, experimental and demonstration stations, and similar undertakings. Cooperation in this field would be more or less along the lines of ongoing activities.

Israeli involvement in the agricultural development efforts of the Egyptian government will be more restricted because these activities are predominantly within the purview of official agencies. These tend to be more susceptible to adverse political considerations than private enterprise. In any activity in this field, Israel's contribution might consist of transmitting the Israeli training method (the "Bar-On System"), which has been adopted by the World Bank, and in the application of the Israeli system of research-training-field services.

Table 4. Imports and Exports of Farm Products, Raw or Processed, and Agricultural Input Commodities, Egypt and Israel, 1981, in US$ '000, and Possible Directions of Trade

SITC Code	Product	Egypt		Israel		Possible Directions of Trade
		Imports	Exports	Imports	Exports	
A.	**Farm Products, Raw or Processed**					
11	Beverages	1,636	5,884	6,292	6,786	E>I, I>E
22	Oil seeds	20,319	5,974	170,474	15,024	E>I, I>E
262	Wool, animal hair	24,103	1,281	19,263	9,589	E>I, I>E
263.1	Raw cotton, excluding linters	--	457,091	30,890	121,833	E>I
421.3	Cottonseed oil	16,354	--	348	5,305	I>E
292.4	Vegetables used in pharmacy	2,754	6,231	6,038	--	E>I
292.5	Seeds for planting	5,276	1,184	5,182	7,153	I>E
011.4	Poultry, fresh, chilled or frozen	117,481	--	--	30,517	I>E
(013)	Meat, prepared, preserved	23,373	--	--	9,433	I>E
(023)	Butter	96,126	--	2,184	3,926	I>E
(025)	Eggs	12,372	--	2,994	3,080	I>E
042	Rice	--	42,608	18,805	--	E>I
054	Fresh & simply prepared veget.	56,936	46,975	11,378	43,201	E>I, I>E
057	Fresh and dried fruits and nuts	40,797	53,111	12,857	317,698	E>I, I>E
058.9	Fruit and vegetable juice	373	9,543	18,228	115,275	E>I
062	Sugar, candy, excl. chocolates	674	--	3,661	4,500	E>I, I>E
075.2	Spices, excluding pepper	987	5,643	1,233	263	E>I
081.3	Oilcake and other residues	29,936	1,998	--	13,406	I>E
061.2	Refined sugar	244,314	18,874	106,640	--	E>I
061.5	Molasses	--	7,587	4,222	--	E>I
B.	**Agricultural Inputs**					
562.1	Chemical nitrogenous fertilizer	70,460	--	6,250	420	E>I
562.2	Chemical phosphatic fertilizer	25,415	184	--	40,349	I>E
561.9	Fertilizer, various	4,090	--	158	123,998	I>E
721.1	Cultivating machinery	4,662	--	1,739	8,272	I>E
712.9	Harvesting machinery	2,636	--	10,147	1,957	I>E
721.3	Dairy machinery	913	--	5,707	182	I>E
721.9	Agriculture machines, various	12,660	--	1,088	2,169	I>E
727	Food machinery, non-domestic	20,950	--	6,898	5,328	I>E

Sources: (1), (2)

The main scope for an Israeli involvement in consultancy and planning services would seem to lie in the private sector, which accounts for about a fifth of the $500 million annually invested in Egypt's agriculture. Since several per cent of total investment outlays go for consultancy and planning services, the total potential market for them might amount to several tens of millions of dollars -- a market in which Israel might obtain a share.

Consulting and planning services by Israeli firms should preferably be carried out with the participation of a foreign firm. Such services should seek to exploit Israel's comparative advantage of experience with the cultivation of arid lands, with advanced irrigation systems, capital-intensive cultivation methods, and the ability to recruit simultaneously a large number of experts in diverse fields. As a close neighbour, Israel would also have the advantage of being able to supply expert staff at short notice, for brief periods, and at a relatively low cost.

Many of Egypt's development projects are financed by international and other foreign institutions. This may further facilitate Israel's access to the Egyptian market for consultancy, planning, and engineering services. The World Bank, for example, requires the planning of projects financed by the Bank to be put up for international bidding. Israeli consulting firms will, however, encounter a handicap not only in having to compete against Egyptian as well as other foreign firms, but will also have to overcome the particular obstacles to the acceptance in Egypt of cooperation with Israel, which may be reinforced by the tendency in Egypt to dispense altogether with foreign assistance.[1)]

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1) The World Bank describes the Egyptian reaction to the Bank's requirement that foreign experts be used, as follows: "The Government of Egypt agreed to this condition only with the greatest reluctance. They believed then -- and as explained by the Chairman of the Egyptian Authority for Drainage Projects to the mission -- still do, that an engineering organization that operates the oldest controlled irrigation system in the world, does not require permanently attached outside adivsers." Egypt: Nile Delta Drainage Project, IBRD, June 1982.

3.2 Cooperation in the Establishment of Agricultural Farms

Israeli cooperation in the establishment of new agricultural farms might well meet the conditions outlined above for successful cooperation. Such projects would be concentrated in Egypt's "new lands", would fit into the framework of her "open-door" policy, would contribute to the attainment of food self-sufficiency, and would permit the involvement of a third partner. In addition, projects of this type would require detailed economic and technical planning, which would afford scope for Israeli consultancy and engineering services, and where her technical expertise could be brought to bear.

Given Egypt's price control system, it would be necessary to establish whether it would be preferable to base these new farms on basic products such as field crops, which have a low profitability but a secure market, or on crops such as vegetables which are more profitable but have a more uncertain market.

The Egyptian system of price controls generally penalizes the farmer. Although land and water are provided free of charge, the prices of other inputs are mostly fixed above their free market levels while the prices of products are in many cases set below that level. Thus, the ratio of economic to private return (see reference 10) is 1.25 for wheat, 2.88 for rice, and 2.72 for cotton. Only for a few products is the ratio below 1 -- for example, maize, where it stands at 0.61.

Appendix (A) illustrates the potentialities of farms of the character mentioned above and presents an outline of the economic parameters for two types of farm -- a dairy farm that would also grow its own fodder, and a field crop farm.

The first example is that of a dairy farm with a herd of 500 milch cows. This implies that the farm would have an additional herd of 500 heads of female calves, male calves before sale, and dry cows. The farm would include a cattle enclosure covering some 5 hectares, with the necessary structures and installations, and a net area of 165 hectares for the growing of fodder crops under modern sprinkler irrigation. The total investment required for such a farm is estimated at $3.24 million, spread over a period of 4-5 years.

Annual milk production per cow in such a farm would be 7,500 kgs. -- a multiple of the present Egyptian average, but a yield that is the norm in comparable ecological areas in Israel, and which has also been attained in similar projects managed by Israelis in Iran and in Latin America. The cost-benefit calculation, based on present prices of inputs and outputs, shows that the economic performance of such a farm would be positive and that profits can be expected from the third year.

The second example, of a fieldcrops farm, is for an area of 2,000 hectares, also under modern sprinkler irrigation. This size has been chosen because it would be sufficient to attain economies of scale, particularly with respect to the main investment component -- the irrigation system -- and yet not so extensive as to impose upon the Egyptian economy burdensome problems of an organizational and institutional nature, or of the supply of infrastructure services (mainly of water and electric power). It is assumed that the farm will be at a higher elevation than the source of the water, and that its soil will be sandy.

The crop plan proposed for this farm is intended to be no more than an illustration of a reasonable possibility under existing conditions. Only more detailed economic planning will be able to establish the actual crop plan. The

main crop suggested for the farm is groundnuts, which are well suited for the sandy soil and the climate in the areas under consideration. Groundnuts can be grown on the same land year after year, have a ready market, and are a crop in which it is possible to exploit Israeli expertise in the application of advanced cultivation methods in similar ecological conditions.

Groundnuts being a summer crop, the land may be utilized for a complementary winter crop. The crop chosen for purposes of illustration is onions, to be planted to only 50 per cent of the area, so that the rate of land utilization of the farm will be 150 per cent. The rationale of this assumption is that a higher rate of land utilization may require organizational efforts that might strain available capacities.

Groundnuts are less profitable than onions, but they have nevertheless been preferred as the main crop because onions may encounter marketing constraints, depend heavily on seasonal labour and present ecological problems if grown year after year on the same land.

A real crop programme would be more diversified and would probably include fodder and vegetables, which are profitable but have a limited market. However, at the present level of detail, and without being able to take into account the specific soil conditions of a concrete area, it seemed preferable not to go beyond the schematic outline presented in Appendix (A).

The total annual water consumption of the proposed farm would be 10,600 m^3 per hectare. The size of the irrigation system required is determined by the water requirements of the peak month, which are estimated at 3.6 million m^3 a month. The plan for the irrigation system takes into account that soil conditions will require sprinkler or drip irrigation -- preferably the former, which is

cheaper. The investment required for the irrigation system, including the main feeder canals, pumping stations, stationary pipelines and mobile aluminium pipes, is estimated at $6.7 million. An additional $5.4 million will have to be invested in internal roads, electric power lines, levelling of the ground, farm structures, equipment and machinery, and the planting of windbreaks. The forecast of economic performance presented in Appendix (A) shows that under the conditions assumed, which seem to be reasonable, the farm will break even in its second year and will become profitable from its third year.

3.3 Cooperative Ventures in Agro-Industries

Cooperation in the establishment of commercial, relatively large-scale agricultural farms is likely to lead also to cooperation in the processing of farm products and other related industries. Cooperation in this field may be easier than in other fields of agricultural development, since most agro-industries are likely to be in the private sector. On the other hand, agro-industries are not necessarily confined to the "horizontal" development drive, but may also have to rely on, and to serve, the traditional sector of Egypt's agriculture. This may create difficulties arising from the specific requirements and constraints of the traditional sector.

The main candidates for cooperation between the two countries are food processing industries and plants for the processing and mixing of animal feedstuffs. The industries of interest in this field are: canning of tomatoes and citrus fruit, dehydration of fruits and vegetables, pickling and freezing of vegetables, the processing of potatoes, milk products, poultry products, the extraction of edible oil, packing houses for fresh fruit for export, drying of lucerne, and mixing plants for animal feedstuffs.

Agro-industries in Egypt may benefit from the price control system in that their raw materials, fresh farm products, are often priced below the free market price. In vertically integrated operations this may in certain cases offset the disadvantages created by the price controls for farm production by itself. Another advantage for these often highly labour-intensive industries is that Egyptian wages are low.

As in other areas of potential cooperation, it would seem desirable to involve a third party. Tripartite ventures might, in addition to relieving the strains between the Egyptian and Israeli partners, draw upon the potential afforded by other bilateral activities (Egyptian-European, Egyptian-American) that are being undertaken. The Israeli contribution would be know-how and experience in ecologically similar conditions, geographical proximity and the possible economies of scale attainable by cooperation with the near-by Israeli food industries, such as by joint employment of experts, acquisition of equipment, etc. Last but not least, cooperation may eventually enable Egypt to benefit from the Israeli marketing system in Europe, while Egypt might give Israel access to the markets of Eastern Europe and the Third World. Table 5 presents the main economic and engineering data for some representative agro-industries.

Table 5. Approximate Data for some Representative Agro-Industries

Industry	Data for a Plant of Representative Size					Infrastructure Inputs		Remarks
	Investment, $m.	Material consumption, $ p.a.	Annual output, tons	Annual sales, $m.	Employment	Water, m^3/hr	Electric power, MW	
Fruit and vegetable canning	10.0	35,000	25,000	23.0	250-650	150	0.6	Possible fruits: apricots, plums, peaches, mangoes, citrus fruit, green vegetables
Vegetable pickling	2.5	25,000	20,000	9.0	120-220	50	0.2	Mainly cucumbers, eggplant, peppers, onions, olives
Vegetable dehydration	12.5	100,000	10,000	19.0	150	400	1.5	Mainly onions and garlic
Vegetable freeezing	10.0	20,000	13,000	11.0	250-450	100	0.8	Cauliflower, carrots, onions, peas, maize
Fruit drying	5.0	15,000	3,500	6.5	420	200	0.25	Mechanical drying after sun-drying
Dairy	28.0	150,000		115.0	480	200	1.7	Pasteurized & sterilized milk and various milk products
Chicken farm and slaughterhouse	15.0	10.5-36m. chickens		48.0	450	70	5.8	Including mechanized coops, breeding coops, laying batteries, slaughter-house, refrigeration facilities
Packing house	70.0	750,000	700,000		5,000	400	14.0	To serve a given agricultural region
Animal feed mixing plant	13.0		320,000	115.0	75	15	2.0	For chicken and cattle farms
Edible oil extraction plant	25.0	300,000	70,000 oil; 230,000 animal feed	135.0	235	60	3.8	Raw materials: soybeans, sun-flower and safflower seeds, groundnuts, cottonseed. Output: oil and oil cake for animal feed.

Sources: (8), (11), (13).

4. Summary

The objective facts speak in favour of Egyptian-Israeli cooperation in the development of Egypt's agriculture. Close and increasing mutual relations might develop in trade, in the transfer of know-how, in the establishment of agricultural farms and in agro-industries associated with them or covering a broader field.

Bilateral trade might develop in farm products, not only by way of trade diversion, but also by way of output-expanding trade between the two countries. In addition, there is room for mutual trade in agricultural inputs, such as chemicals, irrigation equipment and farm machinery and similar products.

The transfer of know-how might take two main directions: firstly, in research projects along the lines of the present tripartite Arid Lands Agricultural Research Programme, and of agricultural experiments; and secondly, through the establishment of joint planning and consultancy services.

Joint projects for the establishment of agricultural farms would be based on Egypt's goal of expanding her agriculture beyond the traditional areas by the development of new lands and the introduction of modern cultivation methods -- areas in which Israel has a considerable fund of successful experience.

An Israeli involvement in such agricultural ventures, as well as in agro-industrial enterprises, would be based on Egypt's policy of attracting foreign enterprise to the expansion of her food production, and on the comparative advantage that Israel has in these fields as a result of her accumulated experience as well as because of the geographical proximity of the two countries.

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Appendix (A)

(A) 1. Outline of a Proposed Dairy Farm

The proposed dairy farm is for a producing herd of 500 milch cows. This implies an additional herd of 500 heads of female calves, male calves before sale, and dry cows. The farm would grow its own fodder.

The cattle enclosure, covering some 5 hectares, would contain the following structures: 4 sheds for producing cows, with an area of 2,000 m^2 each; a shed for dry cows; sheds and enclosures for calves; a hayloft with a capacity of 3,000 m^3 (not needed in areas where annual rainfall is less than 100 mm.); a silage pit (divided in two); a milking station; a refrigeration plant with a capacity of 1,500 kgs.. of milk per hour; a milk storage facility for 10,000 kgs.; a fodder store; a weighing scale; offices, services and accommodation for the workers; a machinery shed for the equipment used to cultivate the areas under fodder crops. The breakdown of the required investment is given in Table (A) 1.3 below.

The farm is to have a gross area of 190 hectares, of which 25 will be taken up by internal roads, windbreaks etc., leaving a net area of 165 hectares. Irrigation is to be by a sprinkler system with stationary asbestos-cement pipes and mobile aluminium pipes.

Table (A) 1 describes a possible feeding system for the herd, on the assumption of a daily requirement of 4.6 units of total digestive nutrient (TDN) per cow of 600 kgs., and 0.304 units of TDN for the production of one kg. of milk with a fat content of 3.5 per cent. The adult-cow equivalents of these values for the entire herd (milch cows + calves + dry cows) result in a total annual feeding requirement

of 2,632,000 units. This assumes an annual milk production of 7,500 kgs. per cow -- a quantity that is a multiple of the present Egyptian average, but which is the norm in Israel, under similar ecological conditions, and which has also been attained in similar projects managed by Israeli dairy farm experts in Iran and in several Latin American countries.

Table (A) 1. Feedstuffs, by Kind and Origin, and Area Required

Feedstuff	Nutritive value, %	'000 units of TDN p.a.	Dry material, tons	Expected crop, tons dry material per ha.	Area needed for growing of fodder
Purchased concentrated food	20.0	526			
Additional purchased food	8.5	224			
Hay (lucerne), silage	12.5	329	598	18.7	32
Fodder (maize)	12.5	329	506	13.3	38
Green fodder(Lucerne and clover)	46.5	1,224	1,974	21.0	94
Total	100.0	2,632			164

Sources: Information supplied by Dr. Moshe Mizrahi, formerly of Tahal and Planimex, and Dr. J. Danin of Tahal.

(A) 1.1 Irrigation of the Feedstuff Crops

The irrigation system is the biggest component in the total investment required. It is also the least conventional and will therefore be described in some detail. The cost of irrigating the feedstuff crops is estimated on the basis of the following data and assumptions:

It is assumed that the Egyptian authorities will supply the water free of charge, by a main canal to within about 1 km. from the farm. From there, the water will be conveyed to the area and distributed by an excavated, concrete-lined feeder canal with a capacity of 750m^3/hour and raised to an elevation of 60

metres by a pumping station with the same capacity . Distribution and irrigation will be by a network of stationary asbestos-cement pipes and portable aluminium pipes.

The annual water requirement is estimated at 13,000m^3/hectare -- a total of 3 million m^3, and during the peak month at 2,400m^3 per hectare, or a total of 0.4 million m^3 for the entire area.

Also to be supplied by the Egyptian authorities is an electric power line for the pumping of the water and the operation of the farm.

The investments required are estimated as follows:

Water conveyance system (feeder canal and pumping station)	$ 320,000
Irrigation network	$ 650,000
Various supplementary installations	$ 100,000
Total	$1,070,000

(A) 1.2 Labour Requirements and Costs

Labour costs will be the biggest component in the farm's current operating costs. Labour requirements were estimated on the basis of the following assumptions:

Except for the Israeli management team during the first few years of establishing the farm, the labour force will be Egyptian. The management team will include a farm manager, his deputy and technical experts who will come periodically and as required (a veterinary, an expert in the management of dairy farms, an agronomist). In view of the special requirements, the salaries of the management team will be higher than the Egyptian levels.

Although the project is to be based on Israeli technology, it has been assumed that labour productivity will be lower than in Israel and that the farm will require 20 per cent more workers than a similar farm in Israel. The breakdown of the labour force by occupation, and its annual cost, is presented in Table (A) 2.

Table (A) 2. Labour Requirements by Occupation and Annual Labour Costs in US $

Occupation	Number of Workers	Average Annual Cost including Social and Fringe Benefits	Total Labour Costs, in US$ per year
Manager and foreign consultants	2	36,000	72,000
Local professionals (veterinary, agronomist)	2	10,000	20,000
Technicians (management assistants, dairy foreman, feedstuffs foreman)	4	6,000	24,000
Skilled workers (driver, foreman, teamleaders)	8	3,500	28,000
Farm workers	24	2,500	60,000
Total	40		204,000

(A) 1.3 Revenue and Expenditure Flows

Table (A). 3 presents the itemized expenditure and revenue flows. They are based on the following assumptions: (1) the project will be completed within two years; (2) most of the herd will be purchased in the first year; (3) during the first two years, most of the feedstuffs will be purchased and only from the third year on will they be mostly grown on the farm; (4) the projected output of milk will be attained only by the fourth year; prices of inputs and outputs will be at the present level.

Table (A) 3. Projected Revenue and Expenditure Flows for a Dairy Farm, '000 US$ p.a.

A. EXPENDITURES	Total	1st Year	2nd Year	3rd Year	4th Year &ff.
Investment in infrastructure of irrigation system	320	160	160	---	---
Investment in irrigation network	750	400	350	---	---
Investment in infrastructure other than irrigation	110	30	80	---	---
Investment in acquisition of cattle herd	865	700	125	40	---
Investment in farm structures	770	550	220	---	---
Investment in farm machinery	325	175	150	---	---
Various supplementary investments	100	50	50	---	---
Purchased feedstuffs	---	280	430	165	165
Wages and salaries	---	140	204	204	204
Electric power[1])	---	26	45	45	45
Various inputs for dairy	---	15	26	26	26
Total Expenditures	3,240	2,534	1,855	495	455
B. REVENUES					
From sale of milk[2])	---	100	700	1,000	1,200
From sale of meat[3])	---	50	185	215	233
Total Revenues	---	150	885	1,215	1,433

1) At 7 US cents per kwh.
2) At 32 US cents per kg.
3) At $1.35 per kg.

(A) 2. Outline of a Farm for Fieldcrops

The area considered for a fieldcrops farm is 2,000 hectares. It is assumed that this is sufficient to attain economies of scale, particularly with respect to the investment in the irrigation system. At the same time, its size would not be so large as to burden the Egyptian economy and its administration with significant problems of infrastructure services (mainly the supply of water and electric power), or with undue organizational and institutional difficulties. It is assumed that the area of the farm will lie at a higher elevation than the source of the water, and that its soil will be sandy.

The key input for the development of a farm of the proposed type is the irrigation system with its expenditures on the initial investment, the energy required for pumping the water, and the labour of moving the network of portable irrigation pipes. A second major input is fertilization, in view of the low fertility of the soil in the areas under consideration.

(A) 2.1 The Crop Plan

The crop plan proposed here is intended to illustrate a reasonable possibility in the existing conditions, but it should be regarded as no more than an illustration. The main crop suggested is groundnuts, which are well suited to the sandy soil and the climatic conditions in the areas under consideration. Groundnuts can be grown on the same land year after year. They have a ready market, and are a crop in which Egypt might take advantage of Israel's experience with it in similar ecological conditions, and of her expertise in the application of advanced cultivation methods.

Groundnuts being a summer crop, the area may be utilized for a supplementary winter crop. For purposes of illustration this is assumed to be onions, to which half of the farm's area is to be planted. The rate of land utilization will be 150 per cent. The rationale of this assumption is that a higher rate of land utilization is likely to require organizational efforts that may be strain existing capacities.

Onions are more profitable than groundnuts, but the latter have been preferred as the main crop since onions may encounter market constraints, and depend highly on seasonal labour. They also present ecological problems if grown year after year on the same land.

It should be observed that a real crop programme would be more diversified and would probably include vegetables (which are profitable but have a limited market), and fodder. However, at the present level of detail, and without considering a concrete site with its specific soil conditions, it seemed preferable not to go beyond the schematic outline presented here. In a concrete case it is possible that conditions would indicate an initial crop, for one year or more, of lucerne -- a legume that binds nitrogen and thus helps to improve the soil.

(A) 2.2. The Irrigation System

The water consumption of the suggested summer and winter crops, by months, are set out in Table (A) 4. The size of the necessary irrigation system is determined by the water requirements of the peak month, which are 1,800m^3 per hectare, or a total of 3.6 million m^3 per month for the entire area. The plan for the irrigation system takes into account that soil conditions require sprinkler or drip

irrigation -- preferably the former, which is cheaper. Irrigation will therefore be by portable aluminium pipes. Considering the low cost of labour in Egypt, it is more economical to move these pipes manually than to invest in mechanized sprinkler installations such as centre pivots. With a general rise in Egyptian wages, or if labour becomes scarce in the area, it may become necessary to shift to a mechanized system in which the pipes are towed by tractor.

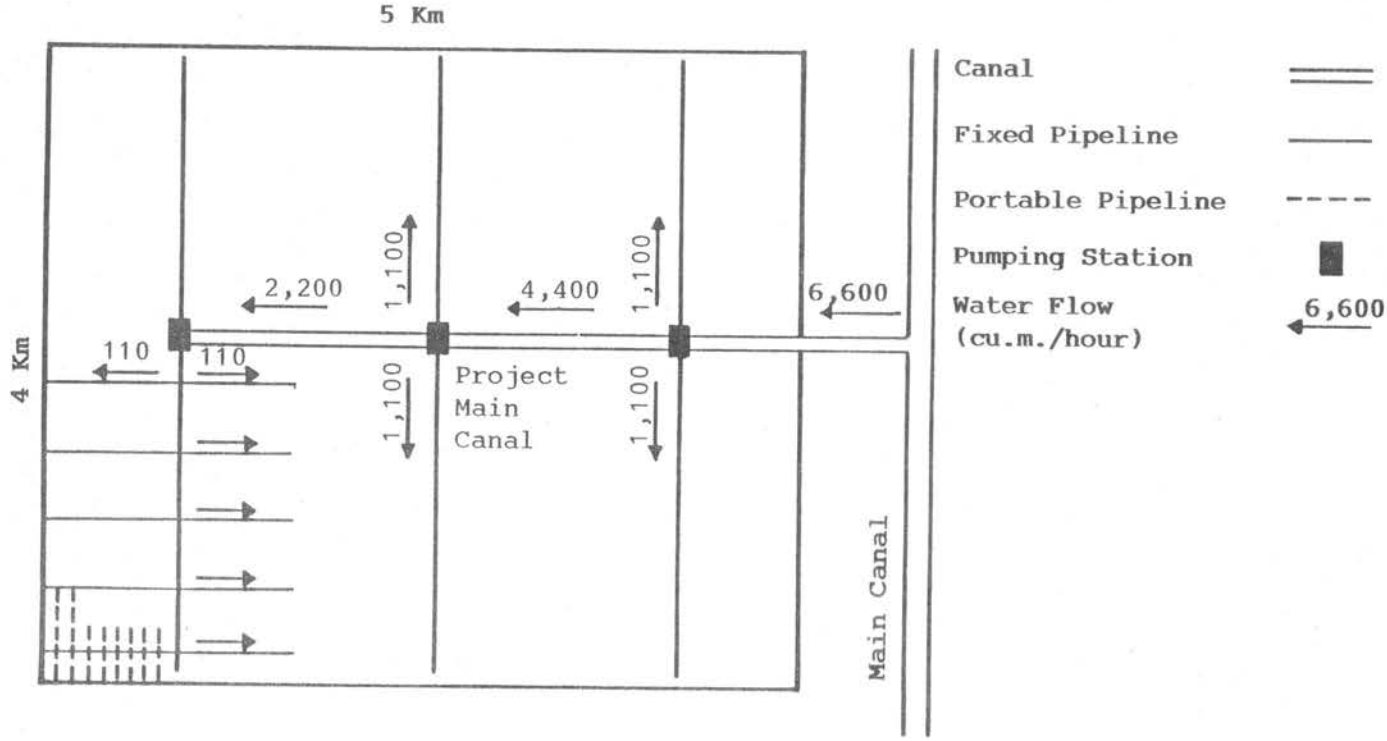
Table (A) 4. Water Consumption, by Month of Cultivation, Groundnuts and Onions, m^3/ha.

Crop \ Months of Cultivation	1	2	3	4	5	6	7	8	9	10	11	12	Total
Groundnuts	-	-	-	1450	1500	1700	1800	550	-	-	-	-	7000
Onions	350	760	740	-	-	-	-	-	-	1080	350	350	3630
Total	350	760	740	1450	1500	1700	1800	550	-	1080	350	350	10630

During the peak month sprinkler irrigation will be needed for 22 hours a day during 25 days. In other months, when water requirements are lower, the decision when to irrigate will depend on the hours during which there is no wind, and on labour costs (if night labour is more expensive). The water for the irrigation system will be supplied to the farm by a main canal on the slope of the area, and from there by feeder canal with several segments with pumping stations to raise the water to the area's elevation. Pressure lines, stationary and mobile, will distribute the water from the terminal point of the feeder canal, in the centre of the area, to the irrigation network (See Fig. 2). The investment required for the irrigation system is detailed in Table (A) 5.

FIGURE 2 - SCHEMATIC IRRIGATION PLAN FOR
A 2000 HECTARE CROP FARM

a. Area Plan



b. Cross-Section Along the Project Main Canal

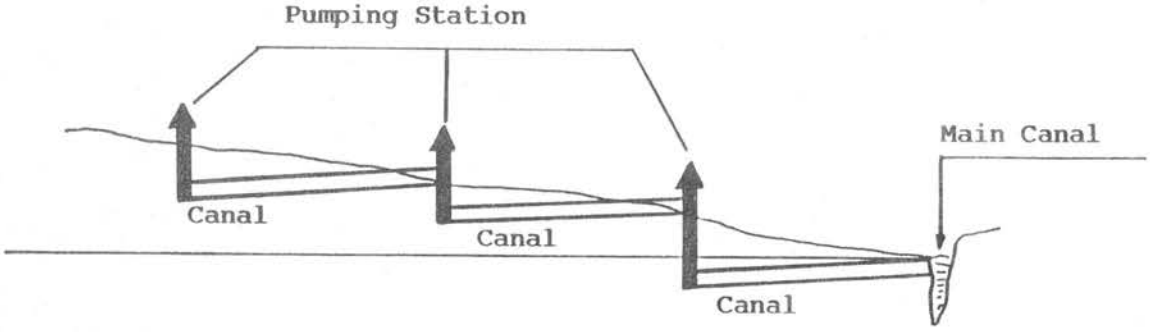


Table (A) 5. Estimated Investment in Irrigation System for a Fieldcrops Farm, in US$

Investment Component	Estimated Cost
Canals, by excavation and filling, concrete-lined	500,000
Pumping stations with a total capacity of 2,000 HP	1,800,000
Stationary pipelines, asbestos-cement, of 12-20" diameter and a total length of 62 kms., including fixtures	2,500,000
Portable aluminium pipes	800,000
Subtotal	5,600,000
Additional investment (20%) for unforeseen topographical and other requirements	1,120,000
Total investment	US$ 6,720,000

(A) 2.3. Labour Requirements and Costs

The optimal employment of unskilled labour on the proposed farm depends on the ratio of labour costs to the cost of mechanization, as well as on the availability of labour. The low cost of labour in Egypt is likely to preclude the use of expensive mechanization, but the unskilled labour which is only seasonally required may not be available. For illustration purposes such a possible bottleneck has been ignored here.

Labour requirements in the proposed farm will be: for groundnuts -- 75,000 mandays a year, of which a third is for harvesting during one month, in August; for onions, labour requirements will be 71,000 mandays a year, of which two-thirds are required for harvesting in March. The breakdown of total labour costs and total labour requirements by occupation is given in Table (A) 6.

Table (A) 6. Labour Requirements for a Fieldcrops Farm, by Occupational Level, and Total Annual Labour Costs, in US$

Occupation	Manyears	Cost per manyear	Total annual Cost
Foreign managers and consultants	4	36,000	144,000
Local professionals (agronomist, agricultural engineer)	5	10,000	50,000
Technicians	10	6,000	60,000
Skilled workers	20	3,500	70,000
Permanent farm workers	60	2,500	150,000
Seasonal workers	430	1,500	645,000
Total	529		1,119,000

(A) 2.4. Additional Inputs, and Expenditure-Revenue Flow

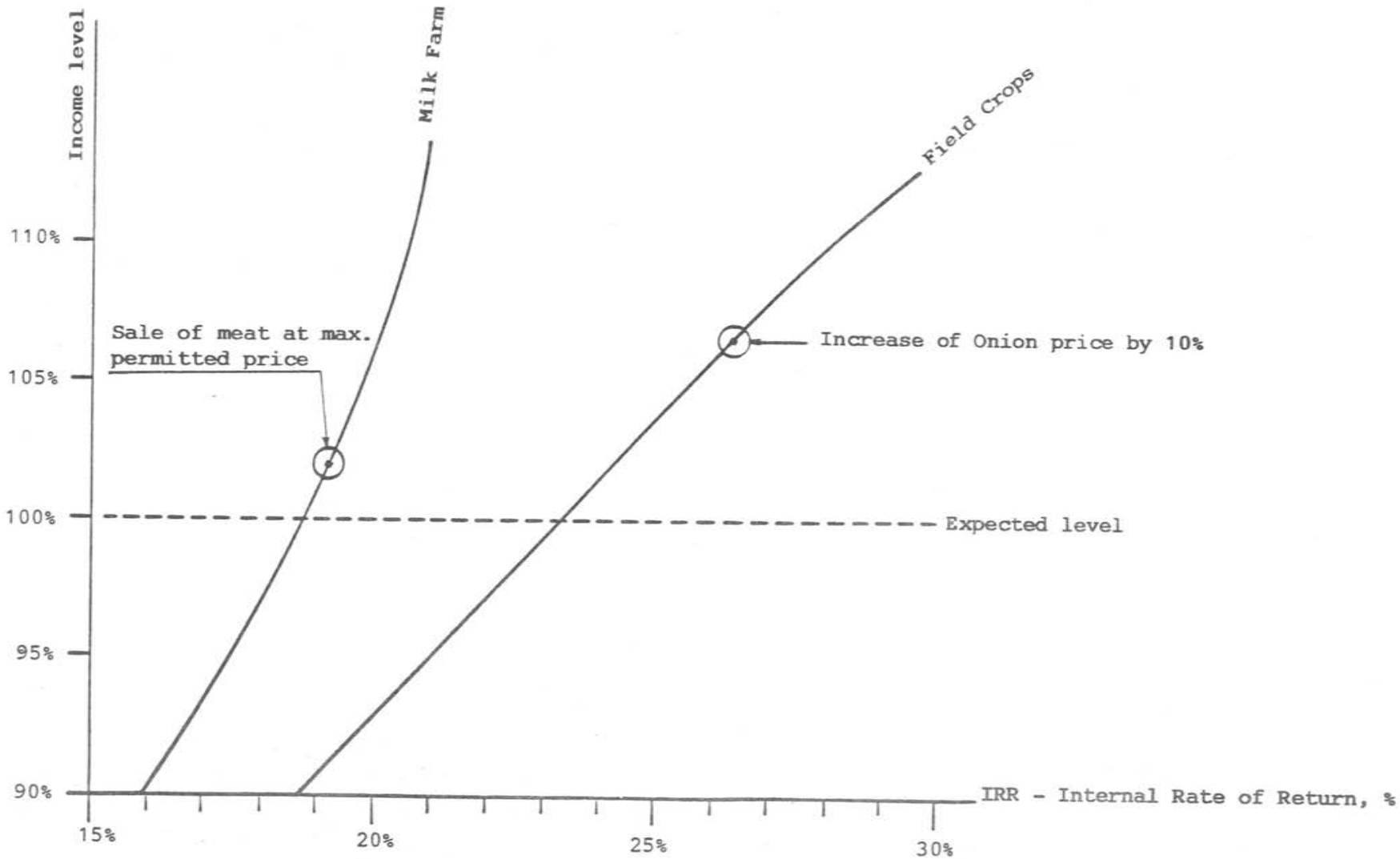
In addition to the investment in the irrigation system, it is estimated that some $5.4 million will have to be invested in internal roads, electric power lines, levelling of the ground (which is marginal with a sprinkler system), farm structures and the planting of windbreaks. This assumes that the major infrastructure systems (access roads, energy supply, main canal, and telecommunications facilities up to the area of the farm) will be supplied by the government. The estimate of $5.4 millions of investment other than in the irrigation system includes the cost of machinery -- $0.8 million each for tractors and other equipment, including trucks. The total projected expenditure-revenue flow is given in Table (A) 7. Figure 3 shows the internal rate of return of the two types of farms as a function of the project income level.

Table (A) 7. **Projected Expenditure-Revenue Flow for a Fieldcrops Farm, in US$ millions, at 1982 Prices**

Item	Total[1]	1st Year	2nd Year	3rd Year	4th Year	5th Year &ff.
A. EXPENDITURES						
Investment in irrigation system	6.7	3.3	3.4	-.-	-.-	-.-
Other infrastructure investments[2]	3.5	2.2	0.8	-.-	0.5	-.-
Investment in equipment, tractors & trucks	1.6	-.-	1.6	-.-	-.-	-.-
Various supplementary investments	0.3	0.1	0.1	0.1	-.-	-.-
Wages and salaries	--	-.-	0.3	0.6	1.1	1.1
Energy for pumping station[3]	--	-.-	0.1	0.2	0.4	0.4
Current inputs (fuel, fertilizers, pesticides, etc.)	--	--	0.4	1.8	3.5	3.5
Total Expenditures	12.1	5.6	6.7	3.2	5.0	5.0
B. REVENUES						
From sale of groundnuts[4]	-.-	-.-	0.3	1.3	2.5	2.7
From sale of onions[5]	-.-	-.-	0.7	2.8	5.8	5.8
From sale of groundnuts' greenstuff	-.-	-.-	-.-	0.1	0.2	0.2
Total Revenues	-.-	-.-	1.0	4.2	8.5	8.7

1) Average life expectancy of investments -- 30 years.
2) Includes ground levelling, roads, electric power line, farm structures, windbreaks.
3) At 7 US cents per kwh.
4) At US$ 300 per ton.
5) At US$ 130 per ton.

FIGURE 3 - INTERNAL RATE OF RETURN VS. PROJECT INCOME LEVEL.



Acknowledgments

In addition to the literature cited in the references, valuable oral information was received from several Israeli experts: Dr. Moshe Mizrahi, formerly with Tahal Consulting Engineers Ltd. and Planimex, Dr. J. Danin of the Hebrew University and Tahal, and Mr. Haim Ben-Ezra from the B.E.C. Company. Various Egyptian economic and agricultural experts have also supplied valuable data during visits to Egypt by the author between 1979 and 1982.

Interim Reports

- "First Quarterly Report" (May–July 1981), August 1981
- "Quarterly Report" (August–October 1981), December 1981
- "Quarterly Report" (November 1981–January 1982), February 1982 (Hebrew)
- "First Annual Report" (April 1981–March 1982), May 1982
- "Periodic Report" (April–July 1982), August 1982 (Hebrew)
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- "Egypt-Israel Gas Pipeline Project", June 1984 (Revised)
- "Private Sector Agricultural Ventures on Egyptian Reclaimed Lands", June 1984 (Revised)

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