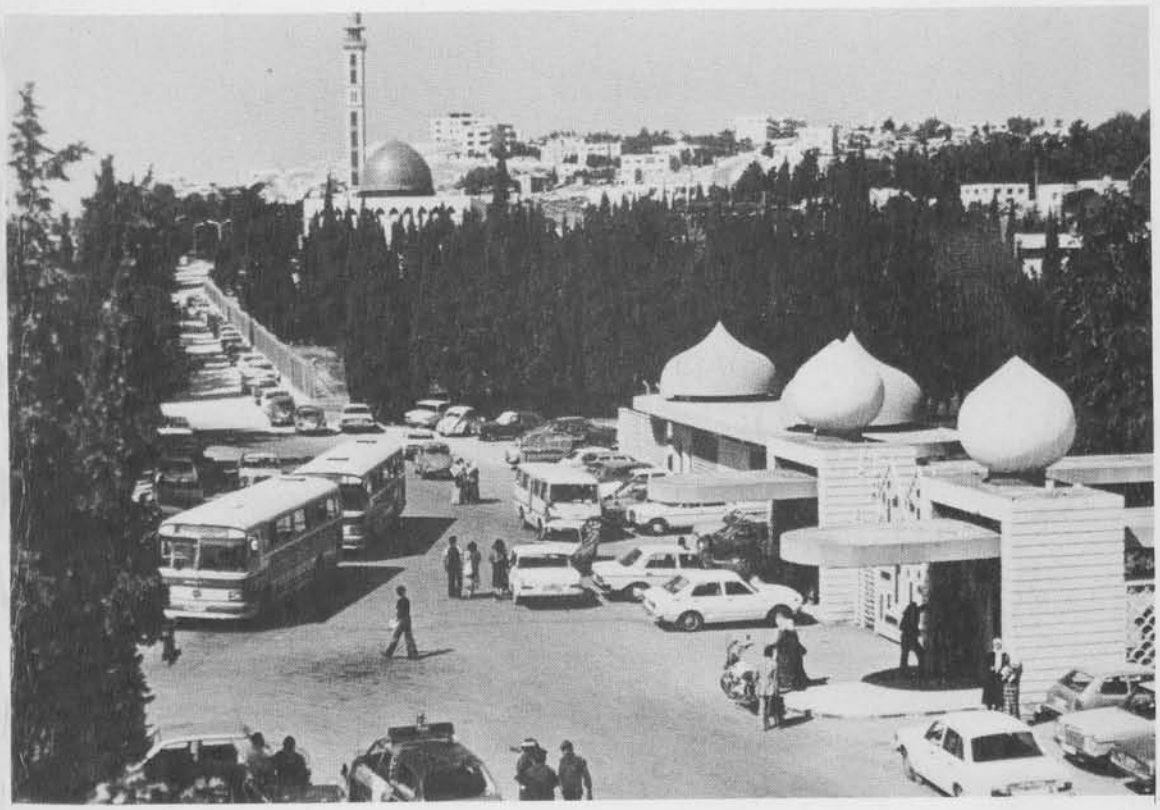
Report of a Mission to

JORDAN

FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF JORDAN, AMMAN

October, 1980



Delft University of Technology

Report of a Mission to

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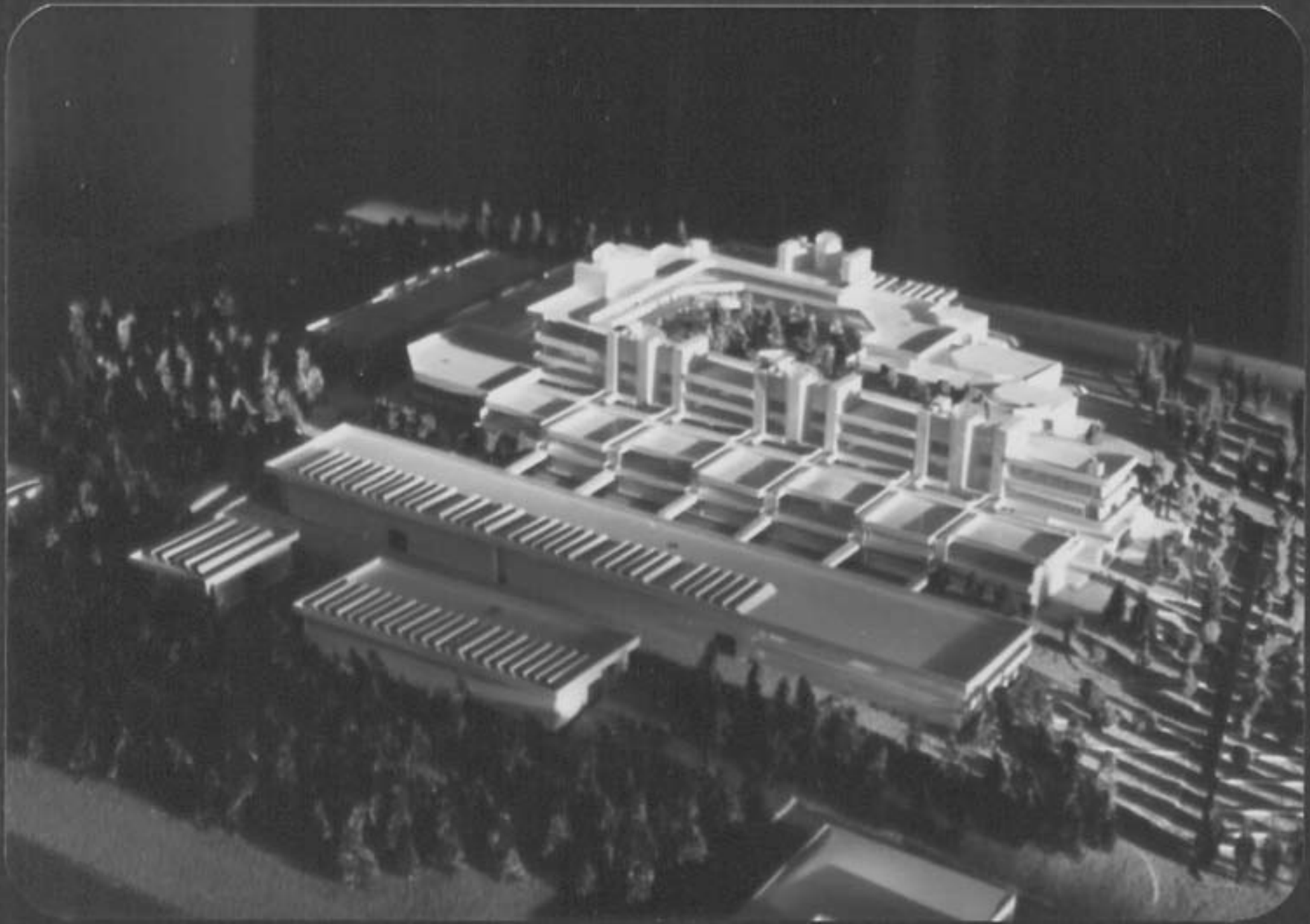
FACULTY OF ENGINEERING AND TECHNOLOGY
UNIVERSITY OF JORDAN, AMMAN

October, 1980

by
P.J. Galjaard, J.A.M. van Hest, P. Stroeven
at the request of the
Commission of the European Communities

Delft University of Technology/1981



Aerial survey of the buildings of the FET; photograph of a model, taken during the team's visit.

CONTENTS

CHAPTER 1 INTRODUCTION

1 INTRODUCTION

On 26 September 1978 the Cooperation Agreement between the European Economic Community (EEC) and the Hashemite Kingdom of Jordan (HKJ) was concluded. This agreement forms part of the EEC treaty of commerce with the Mashrak* States, as consequence of the broad EEC policy concerning the Mediterranean. Within this framework a financial proposal was drafted providing funds for the supply of equipment and technical assistance to the Faculty of Engineering and Technology (FET) of the University of Jordan, amounting to a total of 6,680,000 EUA** (see Chapter 5).

It was suggested that the technical assistance to FET in the form of fellowships and expert advice would be best secured within the framework of inter-university cooperation between this faculty and one or more similar institutions in Europe. With reference to this, the Government of Jordan had expressed a preference for the assistance to be provided through association with the Delft University of Technology (DUT). A formal letter from the Directorate-General for Development of the EEC, signed by Mr. van Hoek, was received by DUT in September 1980 (through NUFFIC), in which the university was requested to consider undertaking such commitments (App. I.I).

To investigate the possibilities of establishing inter-university cooperation between FET and DUT it was suggested that a preliminary short term mission should be made to Amman by a Delft' team. This mission would have to discuss with the FET the general development plans for the faculty within the framework of the EEC-Jordan agreement. In addition to this the team would have to gather as much information as possible for the benefit of advising the DUT concerning the desirability and feasibility of future inter-university cooperation with FET. For the preparation of this mission one of the members of the team travelled to Brussels to meet Mr. van Hoek who elaborated on the FET-request, the EEC-Jordan proposal and the EEC-financial conditions and regulations. Furthermore several documents were studied, in particular the assessment report, prepared by Prof. Wagner at the

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* Collective noun for Egypt, Syria, Jordan and Libanon.

** EUA: European Unit of Account. 1 EUA = fl. 2.77 (Dec. '80)

request of the EEC and based on the Jordanian requests for aid submitted to both the German Government and the EEC [see ref. 5-1, 5-2, 5-4]. The latter include aid requests regarding all departments of FET, viz. (in parentheses years of foundation):

- Architecture (1975)
- Civil Engineering (1975)
- Electrical Engineering (1976)
- Mechanical Engineering (1977)
- Chemical Engineering (1977).

The mission to Amman took place during the period of 10-25 October 1980. The team was composed of the following persons:

- ir. P.J. Galjaard, staff-member DUT Bureau for Foreign Relations;
- dr.ir. J.A.M. van Hest, academic staff-member Dept. of Chemical Engineering;
- dr.ir. P. Stroeven, academic staff-member Dept. of Civil Engineering.

Thanks to the cooperative and frank attitute of the Dean and the heads of department of the FET, added to the ample support offered by the EEC delegation in Amman, the team was able to satisfactorily complete its task in Jordan through a very intensive programme of activities (App. 1.II). The findings and conclusions of the team, supplemented by background information from several studies and official publications, are laid down in the various chapters of this report.
Chapter 2 gives a short outline of the socio-economic and political situation of Jordan. Chapter 3 describes in general the educational system in Jordan, while in Chapter 4 the attention is focussed on the University of Jordan, notably the FET. In Chapter 5 the requests for aid by FET and the EEC-financial proposal are described and analysed, followed in Chapter 6 by conclusions and recommendations.

This last chapter was presented seperately to the commission at an earlier stage, accompanied by a letter from the DUT Executive Committee (App.1.III) In this letter the situation with regard to

the planned follow-up procedure was outlined, indicating the desirability of a return visit to DUT by the heads of department of FET, and the intention to endeavour to complete a formal co-operation agreement, regarding the initial phase, by June/July 1981.

References

1. "De Europese Gemeenschap en de Arabische Wereld".
EEC, General Directorate for Information, Magazine "Ter Informatie" 169/78.

COMMISSION
OF THE EUROPEAN COMMUNITIES

Directorate-General for Development

VIII/D/4

Brussels, 1. IX. 1980

81820

NUFFIC
Badhuisweg 251
P.O. Box 90734
2509 LS THE HAGUE

Subject : EEC-Jordan Agreement : Education and Training project : Assistance to the Faculty of Engineering of the University of Amman (HKJ)

Dear Sirs,

During my last conversations with the Jordanian Government the Commission was requested to assist the University of Amman (HKJ) in developing and expanding its faculty of Engineering.

The Government expressed a preference for the assistance to be provided in the framework of an inter-university cooperation agreement between the Amman Faculty and the Technical University of Delft. Some studies have been already made both by the German Government and the Commission; these documents are available and within your hands.

I would suggest that you ask the University of Delft whether they would be willing to undertake such commitments.

I would, however, suggest that a preliminary short term mission could be made to Amman to clarify what are really the needs in equipment and technical assistance. A short term mission (3 persons, 2 weeks on the spot, with 2 weeks in Europe for the preparation and the completion of the report) could be the best means to achieve this first objective prior to envisaging a more long term commitment.

Please could you ask the University of Delft whether they are ready to undertake such mission and at which costs. According to your reply a formal request will be sent to you to finalize our agreement.

Yours sincerely,

F. van Hoek
Director

4 SEP. 1980

Ref. nr.: 3528

Nood/Actie GvdH

Kop./Inf. JEnkiaar vD/UDP

Doss. nr.: 1.05.02

Circ.

Appendix 1.II

Date	Time	Activities
Friday 10-10	18:30	Arrival airport near Amman; ride to Amman.
	19:00	Check in Hotel Intercontinental; preparation for interviews; general orientation.
	20:00	Dinner.
Saturday 11-10	9:00	Meeting with E. v.d. Linden, EEC delegation Amman. Visit dean of FET: Prof. Bassam Abu-Ghazalleh. First discussion; exchange of information.
	11:00	To office of EEC delegation. Talk with E. v.d. Linden concerning EEC-Jordan Agreement, request, etc.
	13:00	Reception by President of the University of Amman, Al Majali.
	13:30	Lunch with Al Majali, v.d. Linden, Abu-Ghazalleh and heads of the FET Departments.
	15:00	Office of EEC delegation. Discussion of framework of our mission in Amman: draft programme. Arrange appointments. Change hotel. Copy papers for mission.
	17:00	Check in Hotel Maryland.
	18:00	Walk down-town.
	20:00	Dinner.
	21:00	Evaluation discussions. Read E.C.P.D. report. Prepare coming interviews.
Sunday 12-10	9:30	Office of EEC delegation. Talk with v.d. Linden about background, history of request and EEC proposal. Work out tasks of the present mission.
	11:30	Talk with Abu-Ghazalleh.
	14:00	Lunch with Abu-Ghazalleh. Walk around FET campus.
	15:30	Hotel Maryland. Evaluate talks. Prepare (via E.C.P.D. report, among others) for talk with head of Architectural Engineering.
	18:00	Reception by E. v.d. Linden; cocktails.
	19:30	Dinner with Eric and Claire v.d. Linden.

Date	Time	Activities
Monday 13-10	9:30	Office of EEC delegation; arrange appointments; copy relevant papers.
	10:30	Meeting with O'Sullivan/v.d. Linden (EEC delegation); exchange of information and opinions, especially with regard to organization/realization EEC-funding of FET.
	11:30	To FET.
	12:00	Interview with Architectural Engineering staff member: Archie Walls.
	13:30	Lunch and discussion with Abu-Ghazalleh.
	16:00	Visit to Association of Engineers of Jordan. Interview with president, Mr. Massanat.
	17:30	Back to hotel.
	19:00	Dinner and interview with Jan Czejka, Head of Architectural Engineering.
	23:00	Hotel: evaluation of interviews.
Tuesday 14-10	9:00	Meeting with Dhihni Ra'fat, Under-Secretary of Education.
	10:00	Meeting with Aref Dahabra, Director of the Department of Professional Training, Ministry of Education.
	10:30	Pick up information at Ministry of Information.
	10:45	Mutual consultation in hotel.
	11:00	Office of EEC delegation, arrange appointments, etc.
	11:30	To FET. Interviews with Heads of Civil Engineering, Sabir Dahir (P. Stroeven) and Chemical Engineering, Nael Shalhoub (J. van Hest), respectively.
	15:00	To Polytechnic of Amman. Meeting with Director, Dr. M. Alia and staff members.
	17:30	Back to hotel.
	19:00	Evaluation discussions, exchange of information.
	20:00	Received at O'Sullivan's.
	23:00	Prepare for talks on 15-10.
Wednesday 15-10	9:00	Meeting with Dr. F.A. Daghestani, General Director of the Royal Scientific Society of Jordan.

Date	Time	Activities
	10:30	Tour of RSS Laboratories by Dr. Suradi and Dr. Gabay.
	12:00	To office of EEC delegation. Arrange appointments; exchange information/experiences.
	13:30	Back to FET; lunch. Interviews with Heads of Electrical Engineering, M. Hassan (P. Galjaard) and Mechanical Engineering, M. Al Sa'ad (J. v. Hest and P. Stroeven), respectively.
	16:30	To office of EEC delegation. Summing-up talks with O'Sullivan.
	17:30	Back to hotel.
	20:00	Dinner and evaluation.
Thursday 16-10	8:00	AVIS, pick up car.
	8:30	Ride to Potash Project by Dead Sea.
	12:30	Received by Civ. Eng. Ynus Madadha and M. Habashneh (adm.).
	13:30	Tour around Potash Project plant.
	15:30	Depart for Aqaba.
	17:30	Check in Hotel Miramar, Aqaba.
	20:00	Dinner.
Friday 17-10	7:30	Swim in pool; breakfast.
	9:00	In hotel: sorting, categorizing articles/reports, etc. Start bibliography.
	11:00	Beach, shopping, lunch.
	14:00	In hotel: "brainstorming"; outline report; swim in pool during pauses.
	20:00	Dinner.
Saturday 18-10	9:00	Visit "free zones" near Aqaba. Meeting with Falah Qudah (manager) and Michail El Naber (mech. eng.).
	11:30	Depart for harbor works of Aqaba. In spite of appointment, no admittance (political situation).
	13:00	Lunch; shopping.

Date	Time	Activities
	15:00	In hotel: work out data; swim in pool; read E.C.P.D. report and other documentation material.
	20:00	Dinner.
Sunday 19-10	7:30	Swim and breakfast.
	9:00-11:00	Work in hotel; analyse departmental data; determine what is still lacking; (includes) lunch, shopping and swim.
Monday 20-10	7:00	Swim and breakfast.
	8:00-17:00	To Amman via Petra and phosphate mines.
	18:00	Mutual consultation concerning conclusions for THD and EEC, including proposal for cooperation FET:THD.
	20:00	Dinner.
Tuesday 21-10	8:00	Breakfast.
	9:00	Depart by car for Jerash, Jordan Valley, irrigation works, Umqais, Irbid, Yarmouk University, industrial area of Zarka, Amman.
	20:00	Dinner and preparation for final meeting with Dean and Heads of FET Departments.
Wednesday 22-10	8:00	Breakfast. Arrangements for return trip (travel agencies); make appointments with Dean and Heads; shopping (souvenirs).
	12:00	Tour through Amman.
	15:00	AVIS, return car.
	16:00-	Sandwiches and final meetings with Abu-Ghazalleh, Hassan, Shaljoub (Sa'ad not available).
	21:00	Dinner.
Thursday 23-10	7:30	Breakfast.
	9:00	To National Planning Bureau. Meeting with Basil Jordani (asst. director).
	10:15	Meeting with Hannah Odeh (director) and O'Sullivan.

Date	Time	Activities
	11:15	To office of EEC delegation. Discussion with O'Sullivan about completing the mission.
	12:30	Back to hotel, sandwiches.
	14:00	At O'Sullivan's: Discussions with O'Sullivan and Abu-Ghazalleh about cooperative agreement with FET:THD and organizational realization of EEC-support of the FET.
	16:00	Back to hotel.
	18:00-22:30	Evening party at O'Sullivan's.
Friday 24-10	7:30	Breakfast.
	9:15	P. Galjaard to Amman Airport.
	10:00-17:00	Depart for car tour through desert along caliphs' castles (J. v. Hest and P. Stroeven).
	19:30	Dinner.
	22:00	P. Stroeven to Amman Airport.
Saturday 25-10	7:30	Breakfast.
	9:00	J. v. Hest to Amman Airport.

TECHNISCHE HOGESCHOOL DELFT
College van Bestuur (EXECUTIVE COMMITTEE)

Appendix 1.III

Mr. F.J. van Hoek,
Director VIII/D/4,
Commission of the EC,
Rue de la Loi 200,
B-1049 Brussels.

Uw kenmerk	Uw brief van	Ons kenmerk	Datum	Delft, Julianalaan 134
	03618	/OO/BB/G	23 DEC. 1980	Doorkiesnummer (015) 78

Onderwerp

Mission to Amman: conclusions of the Delft team

Dear Sir,

./. We have pleasure in presenting you the conclusions of the Delft team (Galjaard/v. Hest/Stroeven), recently sent on a short-term mission to Amman to investigate the possibilities of inter-university co-operation between the Faculty of Engineering & Technology (FET) of the University of Jordan and our University (THD), within the framework of the EEC-Jordan agreement.
The situation with regard to the inquiry and the decisionmaking process within our University, in reply to the FET-EEC request, is as follows:

- The feasibility and desirability of establishing a co-operative link with the FET was discussed during the meeting of the Board of Deans on 17/11/80.
  The first reaction of the Deans was quite positive, however it was felt that a detailed survey among the various faculty groups concerned would be necessary to get a clear picture of which groups are willing to contribute and what technical assistance our University will be able to provide;
- On 21/11/80 our University Council agreed in principle on the establishmen of an inter-university link between FET and THD, and authorized the Executive Committee to perform the various preliminary proceedings;
- In Jan. '81 a full report of the Delft mission to Amman will be completed;
- It is hoped that by the end of Feb. '81 it will be clear which Faculty Groups/Departments are interested and in a position to participate, in principle, within a future FET-THD cooperative link;
- If from this inventory it becomes apparent that THD cannot comply with the full request for technical assistance, other Universities of Technology will be approached and invited to participate;
- At this stage, (April 1981) it would be worthwhile if the heads of department of FET could plan a trip to the Netherlands to meet their colleagues and future counterparts, and to discuss and elaborate on the envisaged co-operation activities.

Algemeen telefoonnummer T.H. (015) 789111
Verzoeke Uw antwoord te richten aan College van Bestuur Technische Hogeschool Delft, Postbus 5, 2600 AA Delft

202.01.51 792435

Such mission could include, if appropriate, visits to the Universities of Technology in Eindhoven and Twente.

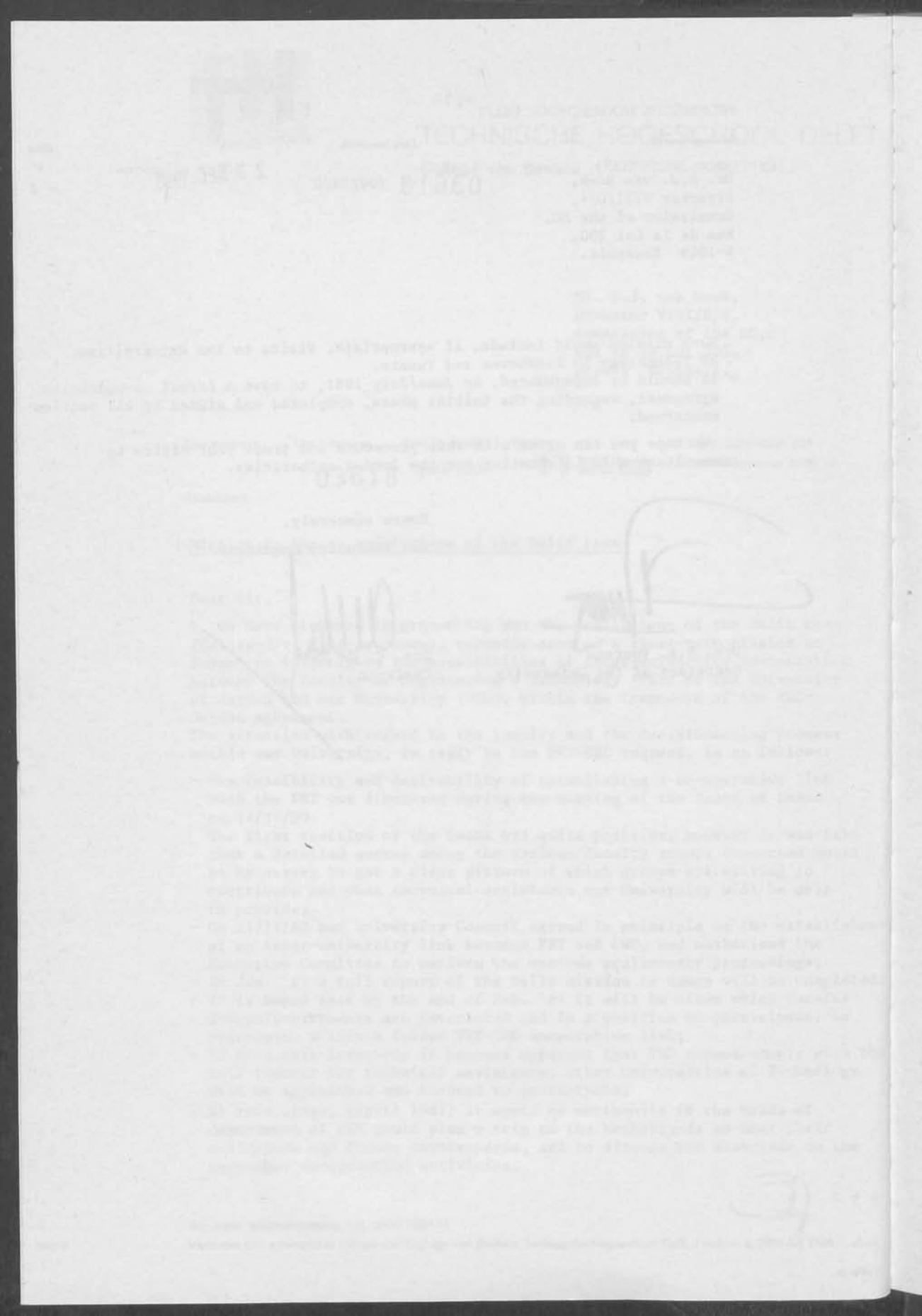
- It should be endeavoured, by June/July 1981, to have a formal co-operation agreement, regarding the initial phase, completed and signed by all parties concerned.

We hope you can agree with this procedure and trust your office to communicate this information tot the Jordan anthorities.

Yours sincerely,
the Executive Committee

Drs. P.A. Vuurens
Secretary of the University

Drs. C. de Hart
Chairman



CHAPTER 2 AN INTRODUCTION TO LIFE IN JORDAN AND ITS ECONOMIC BASIS

2 AN INTRODUCTION TO LIFE IN JORDAN AND ITS ECONOMIC BASIS

2.1 History

The Hashemite Kingdom of Jordan came under its present name into existence - due to the fall of the Ottoman Empire in the Second World War - on May 25, 1946, when the Legislative Council proclaimed King Abdullah a constitutional monarch. This date has since become Jordan's independence day. The country was enlarged in 1950 to include the districts of Samaria and part of Judea that had previously formed a part of Arab Palestine.

The history of modern Jordan is linked strongly with that of its founding dynasty, the Hashemites. The Hashemites gained their name from the great-grandfather of the Prophet Mohammed, who belonged to the noblest Arab tribe, the Quaraish of Mecca. The Hashemites are descendants in the male line of Mohammed's daughter Fatima. She had two sons: Hassan, whose descendants have been known as Ashraf (Arab plural of Sharif- "Honourable") and Hussein, ancestor of the Asyad (plural of Sayyed- "Master"). King Hussein is of the line Ashraf, for centuries lords of the Hejaz in the heart of the Arabian Peninsula and guardians of the holy cities of Mecca and Medina. He is the thirty-ninth in the direct line of descent from the Prophet.

2.2 Geography

The greater part of Jordan (Appendix 2.I) consists of a plateau some 1000 meters above sea level. This plateau extends into Syria, Iraq and Saudi Arabia. The western edge of the plateau has been tilted up to yield a mountaneous area ranging about 500 meters above the plateau level. It forms part of the Fertile Crescent that extends further into Syria and Iraq. The Jordan Valley is the northern extension of the East-African rift zone. Through large lateral shearing of continental plates (estimated at 80 km.) the plateau has been fractured and dislocated. The narrow zone between the faults has sunk, thus creating the Rift Valley. Its width varies from 5 to 20 kilometers, while the floor descends from 200 meters below sea level at Lake Tiberias to as much as 400 meters at the Dead Sea (with a depth of another 400 meters). Due to shearing, large quantities of lava have welled up covering wide areas in Jordan as well as Syria.

Climatologically, Jordan shows close affinity to its neighbours. Summers are hot. In the subtropical Rift Valley temperatures up to 50 °C have been measured. Normally temperatures are rising from north to south and from west to east. On the plateau the temperature can rise as high as 35 °C; however, it can drop in the winter to a few degrees below freezing. A lack of water is the main characteristic of the Jordan scenery. Seventy-eight percent of the country's total area receives an average annual rainfall of less than 200 millimeters, and only 1.3% receives more than 600 millimeters. This, however, is limited to the highest areas in the hills between Amman and the Syrian border. The residual part of the country east of the Hyaz railway and to the south of the line Petra-Ma'an is of a totally arid character. Precipitation is very low - less than 50 millimeters - and is highly seasonal all over Jordan, being virtually confined to the winter months and extremely variable in amount. About 80% of the water is lost through evaporation, and the remainder is lost below the surface and as surface runoff. Fortunately, half of the area drains directly or - more importantly - indirectly into the Jordan River and hence into the Dead Sea.

Jordan is basically still an agricultural country. However, agriculture is highly unstable because a large proportion of the total output is still derived from dry farming in areas subject to frequent droughts. This type of farming is spread over the hilly western side of the plateau, conditions being improved from south to north. The Jordan Valley, as the nation's greenhouse, is considered the most promising for future developments in agriculture. It has a favourable climate and rich soil that could provide for year-round agricultural production. Given sufficient water it will be capable of producing up to four harvests a year.

The main agricultural area is the floor of the Rift Valley. This is the so-called Ghor. Its width varies from two to six kilometers. The small transitional area where the Ghor agricultural land meets the steep valley slope - which rises 1000 meters to the highland plateau - is the corridor area where new communities, urban services and the main irrigation canal are located. The fertile, narrow flood plain of the meandering Jordan River is called the Zor.

2.3 Government

As mentioned, Jordan is a twentieth-century development. Throughout the centuries it never had a separate existence. Under its previous name, Transjordan, it was for the first time recognized as an independent constitutional state by Britain in 1923. Population in these early days amounted to 300,000-400,000 inhabitants, of which only 20% were town dwellers confined to four small cities. Abdullah, son of Sharif Hussein Ibn Ali, ruled the country as Amir until he was proclaimed King of Transjordan in 1946. A new constitution was promulated in 1952, followed by another one after the assassination of Abdullah.

Abdullah's first son, Talal, succeeded him to the thrown. Within a year he abdicated because of mental reasons in favour of his eldest son Hussein, who since then has ruled the Kingdom.

Though basically modelled according to the English parliamentary democracy, the state has developed into a feudal one in which the King has widespread powers. Hence, the Kingdom of Jordan can be classified as a centralized-system state. It is governed by a parliamentary system and a constitutional hereditary monarchy. Under the constitution the King exercises his power through the Prime Minister and the Council of Ministers. Legislative power resides in the National Assembly consisting of the Senate and the House of Deputies. Recently, King Hussein dissolved the Parliament by Royal Decree, but in 1978 he formed a National Consultative Council consisting of 60 members appointed by Royal Decree. The King has the right to dismiss any member or to dissolve the Council.

2.4 Demography

The country now has 2.2 million inhabitants. It measures about 90,000 square kilometers. In both data the West Bank is excluded. Forty-five percent of the population is concentrated in the three largest cities, Amman, Zarka and Irbid. The population of Amman alone accounts for 30% of the nation's total. Life in Jordan is still governed by two dominant features, i.e. Islam and strong family ties. Three different family units can be distinguished: the nuclear unit (consisting of

parents and unmarried children), the joint family or "Ēa'ila" (consisting of a nuclear unit, married sons with their wife and children, unmarried sisters and sometimes brothers of the father; this is a socio-economical unit headed by the grandfather or the oldest man), and the clan or "humūla" (consisting of all members of a group with the same traceable male ancestor).

Of demographic interest is the composition of the population. Due to the establishment of the State of Israel and the occupation by Israel of the West Bank in 1967, large numbers of Palestinian refugees have settled in Jordan. Together with a population growth of 3.2% per annum, this has caused a real population explosion; in 25 years (from 1948 to 1972) the population increased by 450%. Jordanians before 1948 were mainly Bedouin and mostly engaged in pastoral and even nomadic activities. They therefore had little in common with the Palestinians, many of whom established themselves in Jordan as traders and professional men. Although those differences have resulted in considerable stresses, the country has profited enormously from the situation. It was mainly due to the activities of the higher educated and better skilled Palestinians that modernization and fast economic progress have been achieved in Jordan. As a result of the high population growth the population is now composed of 50% young people up to the age of 15 years.

2.5 Employment

The educational system in Jordan is better than in any other Arab country. The boom in the petroleum producing countries of the Middle East has led to large-scale emigration of Jordanians, and there is a continuing large demand for Jordanian labour abroad in view of their high educational level, their skills, dicipline, and lack of political activism (...). It is estimated that about 300,000 labourers are working abroad, of which 75-80% is employed in Saudi Arabia. Although this emigration has substantially increased Jordan's foreign exchange earnings from remittances, it has also created a labour shortage and pressure on wages in Jordan. Wages in the oil producing countries are threefold those in Jordan.

The generally tight conditions in the labour market in recent years

has resulted in a substantial immigration of unskilled workers, mainly in the construction and agricultural sectors. Their number is now estimated at 70,000. Due to the relatively high educational level of Jordanians, these workers are not available in the required numbers on the Jordanian market; on the other hand, these imported workers are preferred because they are unorganized and their wages are lower (...).

The official policy is to discourage emigration. In order to continue the economic progress in Jordan, the loss of skills should be reduced. For that purpose the housing and transport facilities are being improved. Further, the social security benefits are being expanded. A similar problem between the public and private sectors also has to be tackled. Despite considerable increases the wages in the public sector still lag behind those of the private sector.

The government has also drastically improved the facilities for training. In particular the vocational training, almost lacking at the beginning of the 'seventies, has received primary attention. More than 70 schools are now operative. The oil price rise that took place in 1973 generated peak activities in the Arab oil producing countries. Thus, demand for labourers in Jordan increased distinctively, especially in favour of vocational and technical trades. The government is also encouraging women to participate in economic activities. An increase from 4.5% in 1975 to 15% in 1979 was recorded.

2.6 Economic development

Jordan's economic development has been jeopardized by the loss of the West Bank in 1967 during the Six Days War and by the subsequent events on the East Bank - among which was the destruction by Israeli commandos of the diversion system of the Ghor Canal, Jordan's principal irrigation project. In addition to seriously reducing the cereals production, the effects on fruit and vegetable cultivation were disastrous, ruining some 45% of the area under vegetables and 80% of the fruit-growing area. Also after 1967 the income from tourism fell dramatically.

Great efforts in the realization of irrigation works have gradually been able to compensate the loss. Tomato and banana production in 1967 amounted to 259.7 x 10^3 tons and 22.2 x 10^3 tons, respectively. Appendix 2.IIa shows that the production in 1978 approached this level. The cumulative effect of three preceding years' drought combined with the intensity of the drought during the 1978/79 winter, however, greatly reduced the production of all crops, particularly in 1979. A shortage of labourers in the Jordan Valley also hampered production. The higher-than-normal levels of precipitation during the winter of 1979/80 will probably result in a production above the 1967 level.

2.7 Agriculture

Agriculture has recently accounted for about 9% of the GDP (Appendix 2.IIIa), 25% of the domestic exports and employment for up to one quarter of the labour force. The two agricultural areas of Jordan are the east side of the Jordan Valley and the highlands. The latter have to rely mostly on direct rainfall, which fluctuates widely.

Although the Jordan Valley only comprises 0.6% of the country's land area, it produces half of the country's fruits and vegetables and 90% of its export crops. Attempts to intensify farming have centered on irrigation schemes in the Jordan Valley, based on the diversion of rivers flowing directly into the Jordan from the eastern highlands, into canals along the valley floor (Appendix 2.IIb). Irrigation targets are being met mainly by extensions to the East Ghor Canal and by the Zarqa River Project. The East Ghor Canal runs parallel to the Jordan carrying water diverted from the Yarmouk River. Completion of the King Talal Dam in the Zarqa River has provided for a further extension of the East Ghor Canal. When completed, the Yarmouk River Maqarin Dam Project will bring the Canal to the Dead Sea. A doubling of the irrigated area is expected to be achieved in the 'eighties. The most important component in development of the valley is increasing the farming population, now being 70,000. A maximum population of 150,000 is foreseen for this area. A next move would be the irrigation of Wadi Araba, the vast, barren valley that runs 200 kilometers south of the Dead Sea to Aqaba. At present two-thirds of the consumption food in Jordan is imported. The final aim is to close the gap between exported and imported food products (Appendix 2.IVa).

2.8 Industry

In the Jordanian industry the service sector holds an extremely important place (two-thirds of the GNP in 1979) (Fig. 1).

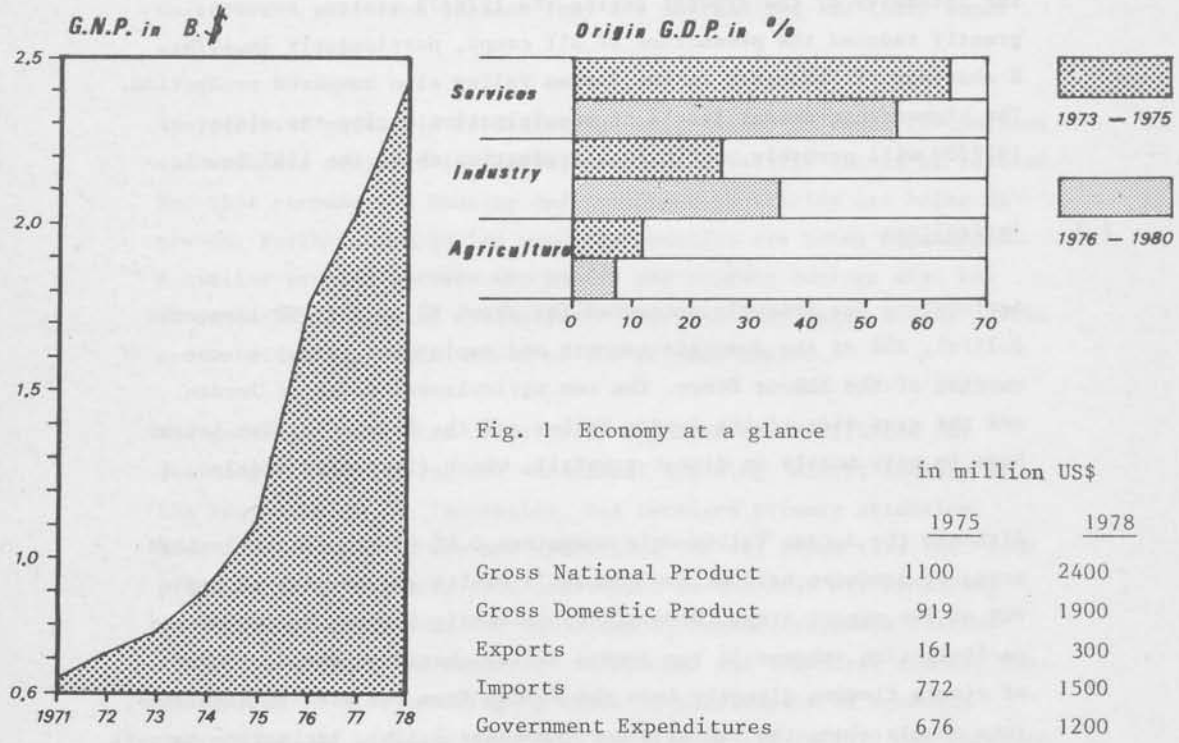


Fig. 1 Economy at a glance

in million US$

	1975	1978
Gross National Product	1100	2400
Gross Domestic Product	919	1900
Exports	161	300
Imports	772	1500
Government Expenditures	676	1200
Domestic Revenues	273	537
Foreign Receipts	385	492
Gold and Foreign Exchange Reserves	577	1200

Source: Central Bank of Jordan Statistical Bulletin, August 1979

In the order of their contributions to the GNP, we find within this category the governmental services, wholesale and retail trade (including the restaurant and hotel branch), financial services, and transportation and telecommunications. The tourist industry is stimulated by the decline of Beirut. Many Arabs come in the summer to the climatologically milder Jordan. Charter flights carry West Europeans to Aqaba, where the hotel accomodations are being greatly expanded.

The most dynamic sector is that of transportation and telecommunications (Appendix 2.IVb). The re-opening of the Suez Canal has led to an increase in the harbor traffic (from 1974 to 1979 a tripling of freight and quadrupling of the number of ships), for which expansion of the harbor was necessary several times. The installation of a "free zone" near Aqaba has greatly stimulated transit traffic. Additionally, "free zones" are planned near Zarka and at the Jordanian/Syrian border. Together with an extension of the area in Aqaba this will cover an area of 1370 ha. 6400 kilometers of modern highways crisscross the country. A railroad connects the harbour of Aqaba with Syria in the north.

Communication offers direct telephone and colour television transmission via satalites with the USA, Europe and Asia. The latest innovation in communications is a 130-unit roadside emergency telephone system. Completely wireless, the phones are powered by solar energy. A new national airport is being constructed near Amman. A second airport for domestic flights is situated near Aqaba.

Middle-sized and small companies make by far the largest contribution to employment in industry; however, the most important contributions to the GNP come from a very limited number of large industries. The smaller companies are directed to a great extent toward food-processing and the clothing industry. They are primarily concentrated in the area around Amman-Zarka.

These small-scale plants have an annual turnover between 5 and 25 million US$. Appendix 2.V gives a survey of the principal industries of Jordan. Due to war actions in Lebanon a large number of companies has been transferred from Beirut to Amman (260 new companies were registered in 1979). A new industrial trade zone, the Sahab, is in development near Amman. When completed it will facilitate the settlement of 700 small and medium-sized industries.

The three largest industries are phosphate extraction, cement manufacture and oil refinery. Three phosphate mines are producing at present with a total capacity of 4.5×10^6 tons in 1980 (mines in Rusaifa, Wadi Husa and Al Hasa). A large phosphate fertilizer plant

is under construction near Aqaba. The building of two sulphuric acid plants (1800 tons/day capacity) and a second fertilizer plant is foreseen for the coming period of five years. Transport of the ore takes place at present by rail to Aqaba. A new phosphate extraction area near Shadiya is in development.

The cement factory at Fuheis has recently been expanded and now has a yearly production of 1.1×10^6 tons, which will be expanded to 1.6×10^6 tons in 1981. A second factory is projected near Aqaba.

Petroleum refining takes place near Zarka. The present production level is 2.4×10^6 tons/year; this will be increased to 3.5×10^6 tons/year, covering domestic needs.

Glass and ceramics industries have developed on the basis of domestic raw materials. Further, copper and manganese ore deposits are known. Uranium and vanadium are apparently present in small amounts in the phosphate ore. A large potash-plant will be completed near the Dead Sea in 1981 (full production around 1984/85). In the last few years American, French and Japanese concerns have been active in oil exploration. Shale oil production is only in the study stage. The most comprehensive aerial survey of Jordan ever made is presently taking place. The purpose is the localization of mineral and water resources and the estimation of their full extent.

The building sector has undergone an important development, although stabilization seems recently to be reached. This development is partially a result of real estate investments by Jordanians who were employed abroad. The transfer of businesses from Lebanon has also been a stimulating factor. And finally the growth of the tourist industry should be mentioned.

2.9 Budget

Two important sources of earnings for the country are the savings which are transferred from Jordanians working abroad to family members, and the gifts and loans from a great many countries (U.S.A., U.K., Saudi Arabia, Libya, Iraq and Kuwait). These latter contributions compose roughly half of the state income (Appendix 2.VI).

The GNP per capita income was estimated at US$ 1,300 in 1979. This is much higher than in many of the developing countries of the "Third World". Nevertheless, wages are so low for large groups of the Jordanian society that poverty is an integral part of it. Since Jordan basically is a capitalistic society where prices are determined by supply and demand, the standard of living is only high for a small part of Jordan's citizens. Therefore, the government intervenes in three different ways in the establishment of consumer prices: by government procurement and subsidy, by price fixing and by operation of governmental retail shops. It is expected that these shops will break existing brand monopolies by introducing new brands of equal quality at lower prices and will discourage other retailers from hoarding. The cost-of-living index, nevertheless, rose the last two years by 17 and 11.7%, respectively (Appendix 2.VII).

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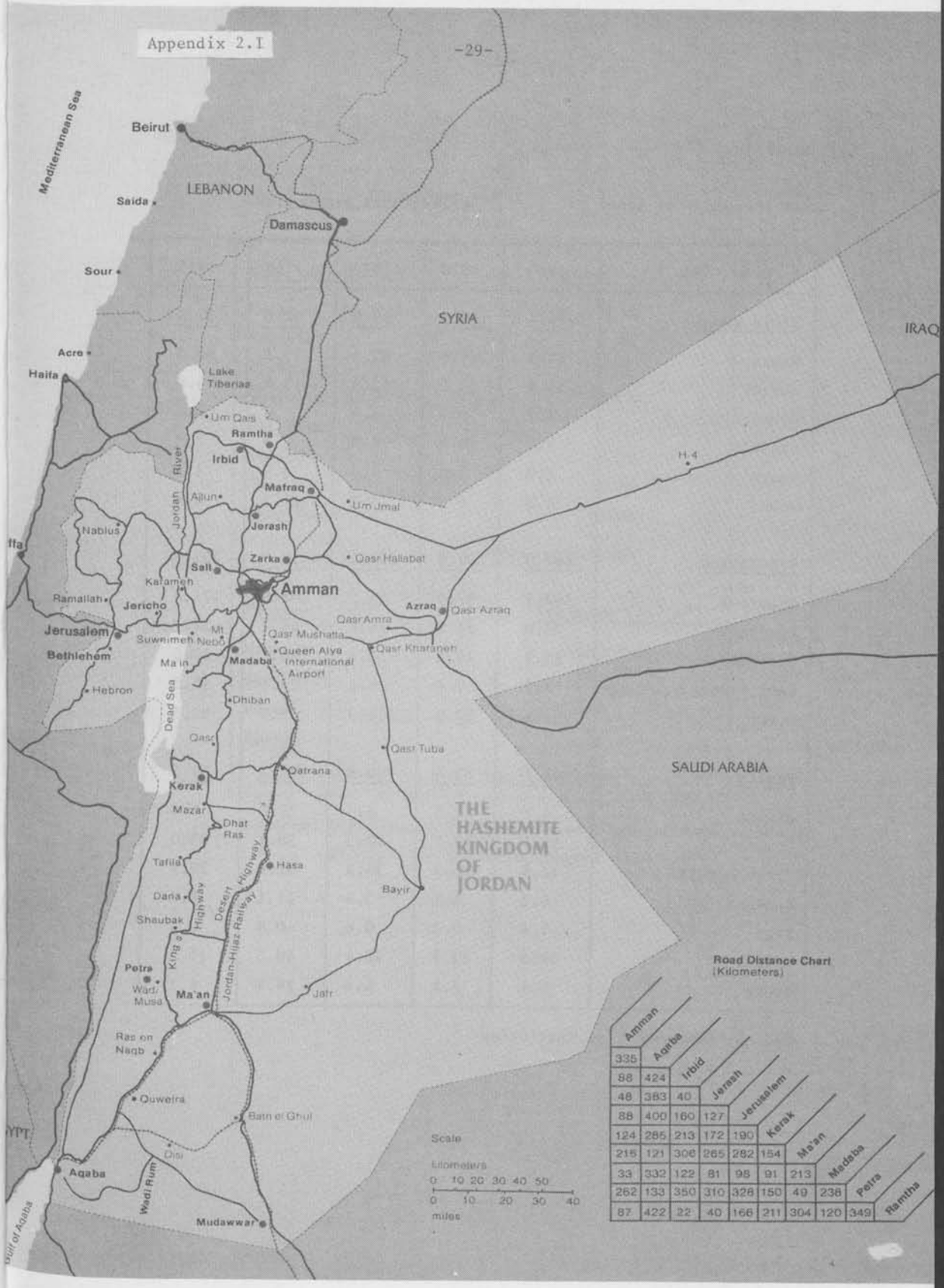

Road Distance Chart
(Kilometers)

Amman	Aqaba	Irbid	Jerash	Jerusalem	Kerak	Ma'an	Madaba	Petra	Ramtha
335									
88	424								
48	383	40							
88	400	160	127						
124	285	213	172	190					
215	121	306	265	282	154				
33	332	122	81	98	91	213			
262	133	350	310	328	150	49	238		
87	422	22	40	166	211	304	120	349	

Appendix 2.IIa

(In thousands of tons) Agricultural production

Crop	1975	1976	1977	1978	1979 *
Field crops	74.1	100.7	93.8	92.8	32.4
Wheat	50.0	66.6	62.5	53.3	16.5
Barley	11.8	13.2	12.0	15.6	4.8
Tobacco	1.1	0.2	0.4	0.4	0.4
Lentils	5.2	10.4	6.0	8.3	0.8
Vetch	2.0	2.0	1.9	3.0	1.1
Other	4.0	8.3	11.0	12.2	8.8
Vegetables	262.3	201.8	204.4	410.0	353.3
Tomatoes	145.1	87.9	85.7	208.8	171.8
Eggplant	39.6	41.9	24.6	64.1	52.7
Cucumbers	21.3	13.5	13.6	30.1	22.0
Cauliflower & Cabbage	8.7	7.7	6.2	27.7	16.5
Other	47.6	50.8	74.3	79.3	90.3
Fruits	91.7	83.4	103.6	177.2	89.7
Olives	4.7	22.5	8.3	37.0	6.8
Grapes	11.1	13.7	22.3	30.7	23.0
Citrus fruit	12.8	16.5	36.5	32.9	29.9
Bananas	6.3	4.5	3.4	21.1	8.0
Figs	1.4	0.3	0.6	0.8	0.4
Melons	50.3	23.1	28.1	40.3	15.5
Other	5.1	2.8	4.4	14.4	6.1

Source: Department of Statistics

* : Preliminary

Appendix 2.IIb

Irrigation works

Dams constructed	Capacity (10^6 m^3)
Kufrain	4.30
Shu'eib	2.30
Ziglab	4.30
Sultani	1.25
Katraneh	4.20
Sama Sdud	1.70
Um Jmal	1.80
King Talal	52.00
Total	71.85

Proposed dams	Capacity (10^6 m^3)
Maqarin	400 (approx.)
Wadi Araba	20
Hasa	12
Rumeil	30
Total	462

Sources: Ministry of Information and Central Bank of Jordan Statistical Bulletin, August 1979

(In millions of JDs) Industrial origin of Gross Domestic Product

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978*	1979*
1) Industries											
- Agriculture, forestry and fishing	22.5	15.6	23.9	26.6	17.6	30.3	26.0	37.3	41.7	51.0	48.0
- Mining and quarrying	2.5	3.7	2.3	3.3	4.0	10.8	16.3	17.8	19.9	22.9	30.8
- Manufacturing	16.3	12.2	14.1	15.2	17.2	29.7	30.5	54.7	65.1	61.4	79.6
- Electricity and water supply	1.6	1.9	2.2	2.5	2.8	3.0	3.1	3.6	4.1	5.2	7.8
- Constructions	10.7	7.7	7.4	9.2	15.2	16.8	16.1	23.3	27.0	35.0	43.0
- Wholesale and retail trade restaurants and hotels	34.3	32.2	33.0	35.7	38.1	42.3	46.3	64.9	66.3	87.0	105.0
- Transport en communication	14.4	14.3	14.6	17.3	17.9	22.8	24.9	32.5	35.9	67.3	79.0
- Financing, redestate and business services	15.3	19.3	19.8	21.0	22.5	25.2	29.7	33.4	43.6	53.1	67.0
- Community, social and personal services	2.7	3.0	2.9	3.7	3.9	4.3	8.5	6.1	8.8	10.2	15.0
- Less: imputed bank servicecharge	-1.5	-1.3	-1.4	-1.4	-1.6	-2.7	-2.9	-3.0	-3.4	-12.4	-13.8
2) Producers of government services	40.5	42.5	43.6	45.9	46.7	54.3	65.2	81.7	84.4	95.0	112.0
3) Non-profit institutions	2.6	3.0	3.0	3.2	4.0	4.9	5.0	5.5	9.1	10.5	13.2
4) Domestic services of households	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1.6
Total G.D.P. at factor cost	162.5	154.7	166.0	182.8	188.9	242.2	269.4	358.5	403.3	487.1	588.2
+ Net indirect taxes	20.9	19.7	20.2	24.4	29.4	4.9	9.2	43.2	74.3	82.0	97.0
= Total G.D.P. at market prices	183.4	174.4	186.2	207.2	218.3	247.3	278.6	401.7	477.6	569.1	685.0
+ Net factor incomes from abroad	14.0	12.6	13.2	13.8	23.2	32.0	63.9	140.8	145.9	145.0	168.0
= Total G.N.P. at market prices	197.4	187.0	199.4	221.0	241.5	279.3	342.5	542.5	623.5	714.1	853.2
Less: depreciation allowances	7.7	7.7	7.9	8.1	8.3	8.5	9.0	10.0	11.0	12.0	17.9
Less: net indirect taxes	20.9	19.7	20.2	24.4	29.4	4.9	9.2	43.2	74.3	82.0	97.0
= Net national product (at factor cost)	168.8	159.6	171.3	188.5	203.8	265.9	324.3	489.3	538.2	620.1	738.3

Source: Department of Statistics

* : Preliminary estimates

: According to the new United Nations System at 1968

Appendix 2.IIIb

Development expenditure estimates
Five-year plan, 1976-80
(JD million)

Agriculture	40.0
Water	97.4
Mining and industry	229.1
Tourism and antiquities	24.4
Electricity	42.8
Trade	3.8
Transport	119.9
Communication	20.1
Culture and information	2.9
Education and welfare	34.6
Health	9.0
Social welfare	1.0
Work and vocational training	3.8
Housing and government buildings	88.0
Municipal and village affairs	38.8
Miscellaneous	11.4
Total	765.0

Source: National Planning Council

External trade

Principal commodities

(JD'000)

Imports	1976	1977	1978
Animals and products	11,781.0	14,414.0	22,903.0
Grains and legumes	19,498.0	18,878.0	19,916.0
Vegetables	3,336.0	3,502.0	3,554.0
Fruits	10,554.0	9,924.0	9,369.0
Spices	2,677.0	4,827.0	5,621.0
Other agriculture	5,548.0	7,310.0	8,630.0
Forestry products	4,832.0	5,739.0	6,139.0
Mining and quarrying	35,470.0	37,995.0	44,747.0
Food manufactures	34,135.0	23,548.0	27,283.0
Textiles	15,290.0	18,395.0	19,349.0
Clothing	5,250.0	8,945.0	10,599.0
Wood and cork	2,429.0	3,523.0	5,213.0
Paper and products	4,479.0	7,534.0	6,025.0
Printing and publishing	714.0	1,233.0	1,697.0
Rubber and products	4,177.0	5,605.0	4,785.0
Chemical products	19,688.0	26,956.0	26,406.0
Petroleum (refined)	2,538.0	5,790.0	3,269.0
Non-metallic minerals	7,782.0	16,658.0	20,513.0
Metallic minerals	36,102.0	55,854.0	48,020.0
Non-electric machines	38,942.0	44,850.0	10,268.0
Electric machines	16,080.0	24,783.0	29,758.0
Transport equipment	45,930.0	86,925.0	53,000.0

Exports	1976	1977	1978
Phosphates	19,232.8	17,304.0	19,400.0
Tomatoes	2,516.9	2.480.0	3,000.0
Lentils	243.6	1,374.0	28.0
Water melons	69.5	7.0	6.0
Other vegetables and fruit	11,543.1	12,994.0	10,534.0
Cigarettes	808.6	997.0	1,227.0
Bananas	29.9	7.0	2.0
Raw hides and skins	230.6	252.0	313.0
Electric accumulators	69.4	71.0	33.0
Olive oil and prepared olives	613.1	194.0	733.0

Appendix 2.IVa

Principal trading partners

(JD'000)

Imports	1976	1977	1978
China, People's Repub.	3,231.9	7,425.0	7,199.0
Egypt	9,575.1	9,589.0	8,544.0
France	10,534.9	13,424.0	16,839.0
Germany, Fed. Repub.	52,985.6	63,564.0	60,125.0
India	13,238.8	4,112.0	2,778.0
Italy	19,534.4	25,973.0	30,489.0
Japan	21,512.3	28,717,0	30,819.0
Lebanon	7,346.4	11,656.0	18,782.0
Netherlands	7,770.0	10,268.0	9,349.0
Romania	9,464.9	20,333.0	22,871.0
Saudi Arabia	34,448.0	37,144.0	43,449.0
Syria	7,449.7	11,097.0	11,930.0
U.S.S.R.	1,698.4	2,586.0	3,120.0
United Kingdom	23,720.1	33,016.0	36,549.0
U.S.A.	31,047.3	67,355.2	33,636.0

Exports	1976	1977	1978
China, People's Repub.	1,998.1	-	780.0
Czechoslovakia	1,521.4	318.0	301.0
India	1,711.5	3,891.0	3,531.0
Iraq	2,327.5	4,304.0	3,446.0
Kuwait	3,281.5	2,796.0	4,211.0
Lebanon	1,660.0	2,921.0	1,824.0
Saudi Arabia	7,466.4	15,091.0	17,695.0
Syria	6,392.2	7,542.0	10,425.0
Turkey	1,365.3	1,362.0	2,293.0
Yugoslavia	189.9	142.0	1,064.0

(JD'000)

	1974	1975	1976	1977	1978
Imports	156,507	234,013	339,458	454,518	458,943
Exports	49,752	49,143	69,445	60,289	64,136

TRANSPORT

Railways

(East Bank only)

	1976	1977	1978
Passengers carried	96,649	64,949	53,135
Freight carried (tons)	12,329	606,311	1,173,994

Shipping

(East Bank only)

(Aqaba port)

	1976	1977	1978
Number of vessels calling	1,064	944	1,197
Freight loaded ('000 tons)	1,636.8	1,389.4	1,551
Freight unloaded ('000 tons)	1,368.6	1,722.3	2,108

Road Traffic

(motor vehicles registered, East Bank only)

	1976	1977	1978
Cars (private)	28,615	39,613	50,905
Taxis	7,258	9,312	10,072
Buses	862	1,024	918
Lorries and vans	12,493	16,419	20,033
Total (incl. others)	60,455	79,493	97,402

Civil Aviation

(East Bank only)

	1976	1977	1978
Passengers (number)	475,00	580,464	710,414
Freight ('000 tons)	9,680.0	14,436.4	19,067

TOURISM

(East Bank only)

	1976	1977	1978
Visitors to Jordan	1,063,294	1,772,894	1,184,290

COMMUNICATIONS MEDIA

(East Bank only)

Telephones (1977)	43,109
Radio sets (1974)	200,000

Jordan: Production of principal industries, 1975-79 1/

Product	Unit	Weight	1975	1976	1977	1978	1979 2/
Phosphates (dry)	1,000 tons	33.5	1,352.5	1,701.8	1,769.4	2,320.2	2,828.1
Cement	1,000 tons	5.1	572.2	582.4	537.6	553.0	623.2
Petroleum products	1,000 tons	16.2	828.2	1,145.5	1.145.5	1,396.6	1,612.4
Sole leather and wool	tons	0.4	531.4	162.5	345.6	197.9	190.7
Upper leather	million sq.ft.	1.0	2.2	2.2	2.5	2.8	2.4
Detergents	1,000 tons	2.0	4.2	5.0	6.0	7.0	10.6
Liquid batteries	1,000 units	0.4	44.4	47.0	51.1	44.3	62.9
Cigarettes	1,000 tons	10.6	1.8	2.2	2.5	2.6	3.4
Spirits and alcoholic drinks	million liters	2.0	5.5	6.3	5.7	5.6	7.2
Paper	1,000 tons	0.7	4.2	5.4	5.2	4.6	7.1
Electricity	million kwh	7.9	374.4	386.0	472.6	571.5	774.1
Fabricated iron forms	1,000 tons	8.3	31.3	62.4	63.8	65.3	81.0
Textiles	1,000 yards	3.1	952.6	915.5	869.8	1,140.9	1,416.7
Fodder	1,000 tons	6.2	41.4	50.9	42.0	51.8	51.7
Pharmaceutical products	1,000 liters	1.2	358.9	440.0	485.2	496.7	607.0
Liquid products							
Ointments, tablets, and others	tons	1.4	113.4	99.7	125.7	142.8	158.1
					(1975 = 100)		
Index of principal industries 3/			100.0	125.0	129.7	159.2	188.0
					(In per cent)		
Rate of change 4/			7.4	25.0	3.8	22.7	18.1

Source: Central Bank of Jordan

1/ East Bank only

2/ Preliminary estimates

3/ Weights used in the index are based on 1975 values

4/ The former index was used to calculate the rate of change in 1975

Appendix 2.VIa

(In millions of SDRs) 3/

Balance of payments					Prov.
Trade balance	-475.4	-697.7	-958.9	-950.9	-1,207.8
Exports (f.o.b.)	(126.4)	(177.5)	(212.1)	(234.9)	(312.4)
Imports (c.i.f.)	(-601.8)	(-875.2)	(-1,170.8)	(-1,185.8)	(-1,520.2)
Workers' remittances (net)	137.7	334.9	361.2	360.2	404.1
Other services (net)	32.0	80.5	162.7	93.8	-14.0
Transfers (net)	361.2	327.1	428.6	275.2	820.7
Current account balance	55.6	44.7	-6.5	-221.7	3.1
Capital transactions (net)	114.0	-38.0	129.7	229.7	178.8
Errors and omissions (net)	-44.3	-40.6	41.6	88.1	-17.6
Overall balance	125.3	-33.9	165.1	96.1	164.3
	(As per cent of GNP)				
Imports of goods (c.i.f.) and services	88.8	81.4	90.5	88.6	102.1
Exports of goods (f.o.b.) and services	54.2	61.3	63.5	61.7	65.0
Current account balance (deficit-)	6.3	3.2	-0.4	-12.0	0.1
	(In millions of SDRs) 3/				
Gross international reserves (end of period)	419.5	472.0	589.8	732.8	950.6
Ratio to average monthly imports during the year (in months)	8.1	6.5	6.3	7.7	7.6

3/ Converted on the basis JD1 = SDR 2,584

Appendix 2.VIb

(In millions of Jordan dinars)

Government finance	1977	1976	1977	1978	Premlim. Actuals 1979	Budget Est. 1980
Receipts	183.3	173.8	264.4	238.5	376.9	423.9
Domestic revenues	(82.6)	(107.6)	(142.2)	(156.8)	(181.9)	(218.6)
External grants	(100.6)	(66.2)	(122.2)	(81.7)	(195.0)	(205.3)
Expenditures	202.0	258.9	331.3	326.2	484.7	517.5
Current	(125.7)	(185.9)	(195.6)	(211.1)	(291.5)	(301.3)
Capital	(76.3)	(73.0)	(135.7)	(115.1)	(193.2)	(216.2)
Overall deficit (-)	-18.8	-85.1	-66.9	-87.7	-107.8	-93.6
Foreign financing	13.3	16.3	54.9	31.8	56.1	83.6
Domestic financing	-2.6	25.7	7.1	24.8	-6.6	10.0
	(As per cent of GDP at market prices)					
Domestic revenues	29.6	26.8	29.8	27.5	26.5	
External grants	36.1	16.5	25.6	14.4	28.5	
Current expenditures	45.1	46.3	41.0	37.1	42.5	
Capital expenditures	27.4	18.2	28.4	20.2	28.2	
Overall decifit (-)	6.8	21.2	14.0	15.4	15.7	

Budget estimates*

(East Bank only)

(JD'000)

Revenue	1976	1977	1978	Expenditure	1976	1977	1978
Direct taxes	17,830	24,640	27,023	Education	16,350	20,299	24,360
Indirect taxes	31,250	58,889	68,506	Health and social welfare	6,626	8,738	10,025
Fees	12,231	25,436	30,239	Defence and police	60,000	78,000	95,300
Other internal receipts	45,680	28,335	33,049	Other current expenditure	52,254	71,463	71,839
	107,000	137,300	158,817	Development expenditure	127,770	153,700	170,289
Grants and loans	144,000	97,000	198,000				
Total	251,000	234,300	356,817	Total	263,000	332,600	371,813

* Total expenditure comprises regular, military and development budgets

1979: Revenue JD 401,5 million; Expenditure JD 513 million

1975 = 100 Cost of living index

Period	All items	Food	Drinks & tobacco	Housing	Clothings & footwear	Other goods & services
(Weight)	(100.0)	(48.2)	(4.4)	(21.8)	(10.2)	(15.4)
Average 1976	111.5	114.6	105.8	106.8	107.6	112.1
Average 1977	127.7	131.0	112.0	114.8	139.3	132.8
Average 1978	136.6	135.7	116.8	126.7	146.1	152.6
Average 1979	156.0	143.6	125.5	162.8	180.5	177.9
July 1979	153.9	137.5	127.2	166.3	179.1	178.7
August	155.8	138.2	127.6	168.6	181.4	183.2
September	156.7	139.1	127.6	168.7	181.4	186.8
October	164.4	151.8	127.6	168.8	185.4	194.0
November	169.3	159.9	128.0	169.4	192.8	194.8
December	170.5	162.1	128.1	169.5	188.3	198.3
January 1980	170.0	160.3	129.5	169.7	190.7	198.4
February	175.1	163.0	129.7	175.8	190.7	214.5
March	173.5	159.4	129.8	175.8	191.3	214.9
April	176.1	164.8	129.9	175.8	191.3	214.9
May	172.5	156.8	138.8	175.8	191.3	214.9
June	172.9	157.5	137.8	175.8	191.3	214.9
July	174.8	161.5	136.1	175.8	191.3	214.9

Source: Department of Statistics

CHAPTER 3 EDUCATION AND TRAINING IN JORDAN

3 EDUCATION AND TRAINING IN JORDAN

3.1 Introduction

Education in Jordan started with the foundation of the Emirat in 1921 (called the State of Transjordan). The legacy of the Ottoman Empire consisted of several primary schools (three-year courses) and four elementary schools (six-year courses). The private schools consisted of Christian missionary schools and Muslim religious schools, the so-called "Kuttabs". A comprehensive expansion program was therefore launched. The first secondary school was founded in Salt in 1923. The first Ministry of Education, established in 1940, designed an educational structure of the Emirat. This consisted of a seven-year elementary cycle and a four-year secondary one, as well as a technical cycle comprising a two-year course. At the end of the elementary and the secondary cycles there were government-sponsored general examinations.

In 1950, when the West and East Banks were united the number of schools amounted to nearly 700, with over 123,000 students. Recent figures (of the year 1979/80) are 2,700 schools and 740,000 students (Appendix 3.I). They demonstrate the strong progress achieved in the Kingdom of Jordan.

Education in Jordan is provided by both the public and the private sectors. Schools run by the Ministery of Education accomodate more than two-thirds of the student population. The UNRWA (United Nations Relief and Works Agency) provides education for another 18% of the students, while private schools account for 9% of the total student enrolment. The Universities of Jordan and Yarmouk account for about 1.5%. The remaining part of the students uses facilities provided by various other governmental authorities (about 1%).

3.2 Compulsory education cycle

Fig. 2 shows the structure of the educational system in Jordan. Children normally start the six years of elementary education at the age of six. It is followed by a three-year cycle of preparatory education. This nine-year period is free of charge and compulsory.

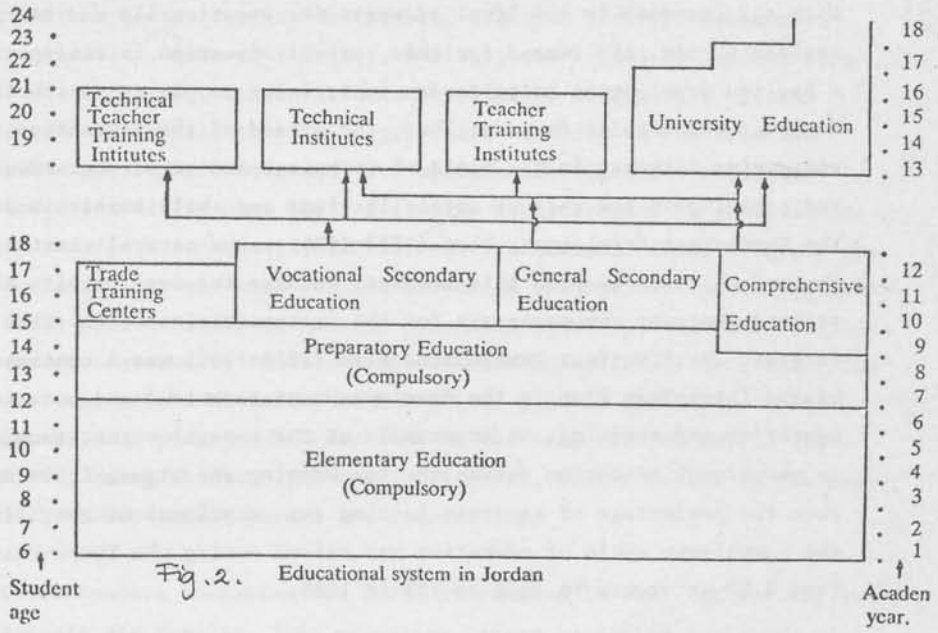

Fig. 2 Educational system in Jordan

Education was provided during the year 1979/80 by 1,095 (elementary) and 992 (preparatory) schools, respectively. The attendance of the elementary cycle was almost 100% (448,411 students) and of the preparatory cycle 84.4% (158,590 students).

Promotion from elementary to preparatory education is not based on examination results. Most of the sixth grade students are therefore promoted.

3.3 Pre- and post-compulsory cycles

Kindergartens are run by private agencies. Children are accepted if they are over three and a half years old. The 187 schools provided pre-school education to 16,930 pupils.

The secondary education level consists of three years. The first year

With the increase in the level of wages for vocationally and technically trained people, the demand for this sort of education is rising. Such a healthy development helps Jordan in training people to meet both domestic and foreign demands. Thus, the decade of the 'seventies is witnessing interest in the field of technical and vocational education and training in the various specializations and skill levels in Jordan. The Three-Year Development Plan (1973-1975) was a natural starting point for an ambitious leap in this respect, because the availability of trained manpower was necessary for the implementation of the Plan's targets. The Five-Year Development Plan (1976-1980) was a continuation of the Three-Year Plan in the development of technical and vocational education and training. As an example of the expansion that took place in vocational education during the two Development Plans, it is noted that the percentage of students joining the vocational stream, after the compulsory cycle of education was raised during the Three-Year Plan, from 8.5% as it was in 1972 to 15% in 1975.

Technical and vocational education and training may be classified into two main categories:

1. The institutional type which covers technical and vocational education at the various levels, and which is implemented mainly in educational establishments.
2. The non-institutional or in-plant type which is implemented mainly outside educational establishments, in factories, work-shops and work sites, such as apprenticeship training.

Technical and vocational education in Jordan was exclusively of the organised institutional type until 1973. The Ministry of Education then adopted a plan to experiment with the non-institutional type through special programmes of apprenticeship and in-plant training in industrial establishments under the supervision of qualified instructors and according to specified training standards. In 1977, the Vocational Training Corporation took over the responsibility for non-institutional vocational training. The responsibility for institutional technical and vocational education, on the other hand, remained with the Ministry of Education and other concerned agencies.

offers a common curriculum (Arabic, English, history, geography, mathematics, general sciences, biology, vocational education, physical education, art education and religious education). General secondary schools specifically prepare students in the next two years for higher education. Two options are offered - a literary and a scientific one. One's direction is determined by achievements in the first secondary year. Secondary vocational schools supply the Jordanian society with skilled labour in the various specializations. Final-year students in general secondary education take the Tawjihiya (general secondary education certificate examination) held under the auspices of the Ministery of Education. Student enrolment in the general and vocational areas were in the year 1979/80 80,173 and 9,880, among which 34,882 and 3,224 girls, respectively. In the year 1978/79 two-thirds passed the examination.

Comprehensive education was first introduced in 1975. At present two schools are running. This education offers basically a mixture of academic and vocational courses.

3.4 Vocational and technical cycles

The major development in vocational and technical education and training took place in the last decade (Appendix 3.II). This was due to the change in the Jordanian economy - revealing an increasing contribution of industry and mining - and the boom in activities after 1973 in the Arab oil-producing countries. The need for more trained labourers in Jordan and the region formed a strong impetus to develop the facilities for education and training.

Trainees are secondary school graduates, preparatory school graduates and unskilled labourers. Another major source is women, whose share in economic activity has in the past been limited. With the social change which occurs, many people are acquiescing in or approving women's participation in the labour force in Jordan. Labour participation rate in Jordan is 20 per cent. This low rate is mainly caused by high birth rates (3.2 per cent) and by the limited employment of women. The participation rate is expected to increase, especially with the growth of training institutions in Jordan.

Technical and vocational education and training consists of a number of levels defining the skill content involved. These are:

1. The "Limited Skill" level. This applies to labourers of limited training and skill who do not need a long period of training for the work they plan to undertake.
2. The "Skilled" level. This applies to workers of relatively high skills and long training (i.e. 2-3 years). This level is catered for in Jordan in secondary vocational schools, trade training centres, and apprenticeship schemes.
3. The "Technician" level. This applies to such groups as assistant engineers, foremen, site supervisors and the like. In the industrial establishment the technician is the link between the engineer and the skilled labourer. This level is catered for in Jordan in post-secondary institutes (i.e. institutes admitting students after twelve years of education).
4. The "Professional" level. This applies to specialists in the various fields (i.e. engineering, medical, management, agriculture, ...etc.). This level is catered for in colleges and universities.
   In Jordan there exists at present a shortage of labour at the "technician" level and sometimes the "skilled" level. This is due to the abundance of job opportunities abroad as well as inside Jordan. The shortage is more prominent in certain specializations such as nursing and some enigineering trades.

3.5 Training institutions

Educational and training institutions in the field of industry and craft, excluding the university level, can be classified within the following groups:

a) Technical and Engineering Institutes. (Appendix 3.IIIa)

b) Secondary Industrial Schools. (Appendix 3.IIIb)

c) Trade Training Centres. (Appendix 3.IIIc)

d) Apprenticeship Centres. (Appendix 3.IIId)

e) Vocational Adult Education Centres.

f) Labour Upgrading Centres.

a) Technical and Engineering Institutes

Admittance to these institutes is open to holders of the General Secondary Certificate of Education or its equivalent. The objective of such institutes is to graduate technicians in industrial and engineering specializations. The curriculum, which extends over two years, includes cultural, scientific and engineering subjects in addition to workshop practice and laboratory work.

b) Secondary Industrial Schools

Admittance to these schools is open to students who successfully completed the third preparatory class (i.e. nine years of general compulsory education) or its equivalent. The objective of such schools is to graduate skilled labourers in the various industrial specializations. The curriculum, which extends over three years, includes cultural, scientific, technical, and practical subjects in the ratios 12%, 18%, 25% and 45% respectively.

c) Trade Training Centres

Admittance to these centres is open to students who successfully complete the third preparatory class (i.e. nine years of general compulsory education). The objective of such centres is to graduate skilled labourers in the various crafts and industrial specializations. The curriculum, which extends over two years, includes cultural, technical and practical subjects in the ratios 8%, 17% and 75% respectively.

d) Apprenticeship Centres

Apprenticeship is relatively long term training given to young people before they join work. The objective of apprenticeship centres is similar to that of trade training centres. The apprentice acquires most of his skills through in-plant training according to specified training standards. The duration of training varies between two and three years.

e) Vocational Adult Education Centres

Adult education centres have an important role in the field of vocational training and contribute towards fulfilling some of the

needs for skilled labour and technicians. The work of adult education abide by curricula and conditions specified by the Ministry of Education, including the duration of courses, the qualifications of instructors, the educational level of the students, and the availability of educational facilities.

f) Labour Upgrading Centres

The main objective of labour upgrading centres is to raise the efficiency of labourers through training courses which consist of practical training and relevant technical theory. Such courses are usually held in the evenings after working hours, and consist of about 150 hours of training in six months. Frequently, the employer pays his labourers' participation in symbolic fees which amount to ten dinars.

Along with building new schools and expanding existing facilities, Jordan has given equal attention to producing the teachers needed to staff its continually growing educational system. Of the nine teacher training institutes that sypply elementary and preparatory schools with qualified teachers, six are run by the Ministry of Education, one by UNRWA, and two by the private sector.

To obtain a teacher's certificate, students must complete a two-year course in general and professional education, as well as in a field of specialization, such as languages (Arabic or English), sciences, mathematics, art, economics, etc. The result is that each year some 2,000 teachers become qualified and are added to Jordan's corps of educators.

As more and more students pour out of Jordan's secondary schools, the demands for higher education increase.

Education at a Glance (1979)

Literacy rate: 70 percent
Student population: 30 percent of total population
Education budget in 1979: $118 million, or 7 percent of national budget
Free compulsory education: to age 16
Free education: through secondary level and at technical and vocational training institutes
Number of schools: 2,584
Number of students: 698,205
Number of teachers: 25,855
Student/teacher ratio: 27
Technical and vocational training institutes: 70
Universities: 2, with a 1979-80 total enrolment of 13,500
University education: government-sponsored, at nominal fees
Jordan university students abroad: over 40,000

Sources: Ministry of Education and Ministry of Information

3.6 University education

His Majesty King Hussein issued a Royal Decree for the establishment of the University of Jordan in September 1962. On December 15 of the same year the teaching of first-year students began in the Faculty of Arts, which was the first faculty to be established. Despite time and space limitations, quick and effective measures were taken to secure the necessary number of teaching staff. Accordingly, an old three-story building at the Jubeiha Agricultural Station near Amman was used for teaching-staff offices, classrooms and a library. In that year the government contributed JD 25,000 to the University. The number of students who enroled in the first year was 167, of whom 18 were women students. They were taught by eight faculty members, five of whom were part-timers.

The University of Jordan has since grown into a full-fledged institution with 95 percent of its faculty holding doctorates. It now accommodates 10,000 students, 40 percent of whom are women.

The University of Jordan is a national institution that does not belong to any particular ministry; it is an independent institution whose budget consists of a special tax issued according to law, the tuition and fees paid by students, and the contributions and donations made by others. Appendix 3.IV gives a survey of the relative importance of the various sources of income and their developments in the course of the history of the University. In light of this conception, the University is not a government university; it is not a private institution either. Rather it is a national or state university. The University has a Board of Trustees whose primary task is to maintain the University's independence, to take care of its financial matters including financing, and ratification of the University budget. The general policy and decisions at the University are made on the various levels by five councils.

Jordan's second university, Yarmouk, which opened three years ago in the northern city of Irbid and is geared towards an emphasis on science and technology, now has a student body of almost 3,500. Its campus, comprehensively planned to accommodate 20,000 students, is under construction and due for completion by 1985. Meanwhile, some 40,000 determined Jordanians are busy earning their university degrees abroad.

3.7 Goals of education

Since its establishment, the University has been working towards achievement of well-defined objectives. Thus the University meets the requirements of the Jordanian community and responds positively to its various needs by producing specialized manpower in the various fields of knowledge. It conducts scientific studies and research work particularly in the fields that pertain to existing problems facing the community. The University also shows great concern for quality, and hence it accepts the best candidates. During their enrolment at the University, students are encouraged to seek knowledge, to employ research techniques and to engage in intellectual debates. Equally important is the University's interest in the proper development of the students' moral character. Indeed, students are viewed as the future leaders of the nation which they will be serving. Moreover, the University views itself as an integral part of the Jordanian community. Naturally, then the University probes into the problems of the community and attempts to solve them and it seeks to meet the social needs of people. Both the present and the past are taken into consideration when future planning is made by the University. When the past is reviewed the good aspects of the nation's legacy are selected, disseminated and developed. Meanwhile, the University is exposed to the "new", from which it selects the good and useful lest it should become a closed, static institution. In view of the geographical location of Jordan and its historical ties, the University also serves neighbouring Arab countries.

The Law of Education No. 16 of 1964 has defined the philosophy of education in Jordan together with the general objectives of education, the specific objectives of the compulsory (elementary and preparatory) and secondary cycles of education and the educational institutes.

The philosophy of education in Jordan is comprehensive and clear. It is an eclectic philosophy that integrates elements of the idealism of the Arab Islamic Culture with elements of the pragmatism of the contemporary Western Culture as well as the current revolution in science and technology. It emphasizes the concept of change of the individual and the society in a constantly changing world, an interacting human community, and a common human civilization. It is con-

cerned with the human growth of the individual in all its dimensions: physical, intellectual, emotional and social, in a democratic society. It is also concerned with the process of development of the Jordanian society along its cultural variables from the present cultural state of development to a more advanced and modernized state of development through the scientific approach and the positive and voluntary participation of the various sectors of citizens in the society.

The general objectives of education in Jordan elucidate the elements of the educational philosophy in more details within certain objectives for all the educational cycles. These general objectives of education specify the basics of the concepts, skills, habits, attitudes and values, the knowledge and development of which are required for the future citizens in a changing and developing Jordanian Society.

The specific objectives of each educational cycle emphasize what is relevant in the educational philosophy and the general objectives of education to each of the compulsory, secondary and institutes cycles in such a way that is compatible with the principles of the students' growth in each educational cycle, their interests, developmental tasks, needs and capabilities, as well as with the requirements of their surrounding communities and the entire Jordanian society in terms of preparing the trained manpower required in a rapidly changing society.

Educational curricula at all educational levels respond in their detail to the principles of learning and to the specific objectives of each cycle, as well as to the general objectives of education and the educational philosophy in terms of the behavioural objectives of each curriculum, its content, methods of teaching and methods of evaluation. Such details are followed clearly in the curricula development of Arabic and English Languages (and French on an experimental basis), social studies, humanities, natural sciences, mathematics, physical education, art education and vocational education in the compulsory cycle. In the secondary cycle the curricula vary between academic and vocational studies with emphasis on general education in both. This stress on general education continues to be important at the institutes cycle in addition to the professional and specialized education.

In view of the fact that the Jordanian society is in a state of constant change, and in the light of the continuous revolution in knowledge, the Board of Education in Jordan keeps supervising the process of modernizing the educational curricula which are being carried by the Department of Curricula in the Ministry of Education, through conducting researches and benefiting from the expertise of other countries and appropriate international organizations.

3.8 In practice

It is worth noting a report by Dr. Tuqan (CESO) who critically analysed the educational system and practice in Jordan. He is quite negative about the achievements as to what extent the objectives are attained. Of course the numbers are definitely rising. Knowledge and skills are improved.

The educational system functions, however, in a technocratic society; what is more, it is an integral part of it and in fact strengthens its foundations. It is based on the assumption that social progress can be realized and social conflicts can be solved through techological achievements.

Hence, education is dominantly focusing on cognitiv skills. The affective goals are neglected. Education supresses knowledge and skills that are not effective in a technological sense. Though the rational and scientific approach is a goal, criticism is far from being promoted.

Selection and recruiting are dominating features of the system. Power, authority, status and materialistic profits are the student's and their family's goals for passing through the educational cycles. Accumulation of facts proves to be the best key to open the door to the future. Therefore,individualism and competitive materialism are strongly stimulated, which is in contrast with the spirit of social concern said to be pursued by the educational system. A self-generating system that benefits a privileged class cannot match with goals and phylosophy of the education.

3.9 RSS and Syndicate

The present chapter describes the educational framework in which the

Faculty of Engineering and Technology fits. Technical and academic staff as well as the students of the FET will be confronted with the Royal Scientific Society as well as with the Association of Engineers. The RSS can be compared with TNO in the Netherlands. It is concerned with research and development for governmental institutions as well as for the industry. Further, courses are given and it also owns the nation's printing press. Among others, the school books are printed here.

Founded in 1970 by H.R.H. Crown Prince Hassan, the RSS is an independent, nonprofit organization whose principal purpose is the effective transfer of technology. It undertakes research in a variety of fields and advocates the selective importation of foreign technology compatible with Jordan's indigenous social and economic capabilities.

Working within the framework of the Jordan Government's overall development plans, RSS is making significant contributions and has initiated specific projects to help in the achievement of planning goals.

Looked upon as a top-level operations centre, it provides scientific, technological and administrative consulation on many subjects to any Jordanians who need it.

The Association of Engineers was founded in 1958. It is comparable with the KIVI in the Netherlands. In 1972 the so-called Engineering Association Ordinance was issued by the government, legalizing the developments and guaranteeing its independent position. The Association has laid down prerequisites for practicing the engineering profession in Jordan. The following objectives are exclusively mentioned in the ordinance (art. 6).

The Association shall perform its activities aiming at the achievement of the following objects:

a) organizing the practice of the profession to improve its educational and professional standard in order to yield economic, cultural and national mobilization;

b) defending the interests of the members and their dignity and maintaining the profession's tradition and honour;

c) developing the educational and professional standard of the engineers and supporting and activating engineering scientific research;

d) participating in the planning and development of educational and engineering industrial and professional training programmes, and also in improving the efficiency of those working in the engineering field;

e) participating in studying subjects of a common nature among Arab states and exchanging information, experience and engineering publications among themselves;

f) securing a better life for the engineers and their families in the case of disability, old age and emergency situations;

g) doing all that may achieve the Association's professional objects.

In 1973 the Association established a pension fund and a social security fund for its members. It invests its capital in construction work in the country. Concerning educational activities it organizes training courses, is involved in accrediting the university degrees, gives an impetus to the university curriculum. The association's revenues are derived from fees, aids, grants, fines and a pro rata part of the income of practicing engineers.

No one may practice the engineering profession in the Kingdom unless he has been duly registered in the Association (art. 20).
Engineering design work and studies are not allowed to be performed except by engineering study offices or consulting engineering offices, or by consulting engineering companies registered by the Association (art. 23).
Every member shall not fully occupy more than one post at one and the same time (art. 63).
The latter two articles in fact prevented scientific staff members in governmental functions or employed at universities from performing consulting work.
The Association had 6,000 registered members in 1980.

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Appendix 3.I

Statistical data on educational systems

Comparative data by sex & authority
for the years 78/79, 79/80

% of increase	79/89	78/79	Sex	Controlling authority
6.3	742265	698205	T.	Grand total
5.2	399495	379837	M.	
7.7	342770	318368	F.	
7.2	525651	490569	T.	Min. of Educ.
8.5	245383	226075	F.	
7.2	5155	4811	T.	Other govt.
7.7	1467	1362	F.	authorities
2.0	131145	128564	T.	U.N.R.W.A.
3.6	63083	60881	F.	
7.1	68557	64007	T.	Private
7.8	28135	26091	F.	schools
14.6	11757	10254	T.	Jordan
18.8	4702	3959	F.	universities

Students & population data per cycle

Perc.	Students	Population	Age group	Cycle
34.5	742265	2152273	all ages	Grand total
7.3	17160	236300	3-5	Kindergarten
102.1	448411	439200	6-11	Elementary
84.4	158590	187800	12-14	Preparatory
60.1	90053	149800	15-17	Secondary
14.5	27526	189900	18-23	Higher ed.

Appendix 3.I

Percentage of students from the grand total by controlling authorities

% Female	% Male	% Total	Controlling authority
46.2	53.8	100	Grand total
33.1	37.7	70.8	Min. of Educ.
0.2	0.5	0.7	Other govt. authorities
8.5	9.2	17.7	U.N.R.W.A.
3.8	5.4	9.2	Private schools
0.6	1.0	1.6	Jordan universities

Percentage of students from the grand total by cycle

% Female	% Male	% Total	Cycles
46.2	53.8	100	Grand total
1.0	1.3	2.3	Kindergarten
28.7	31.7	60.4	Elementary
9.7	11.7	21.4	Preparatory
5.1	7.0	12.1	Secondary
1.7	2.0	3.7	Higher ed.

Appendix 3.I

Students													Schools																		
Handi-capped & orphanage	Higher education					Secondary			Preparatory	Elementary	Kindergarten	Grand total	Handi-capped & orphanage	Higher education					Secondary			Preparatory	Elementary	Kindergarten	Grand total	Sex	Controlling authority
	Others	Vocational	T.T.institutes	University	Total	Vocational	General	Total						Others	Vocational	T.T.institutes	University	Total	Vocational	General	Total						
525	182	6966	8621	11757	27526	9880	80173	90053	158590	448411	17160	742265	8	3	18	10	16	2	18	31	25	44	341	25	385	992	1095	189	43	2700	T.	
208	76	924	6211	4702	11913	3224	34882	38106	72131	212971	7441	342770	2	-	5	-	5	-	5	5	13	17	137	13	154	373	310	2	18	846	F.	Total
-	-	-	-	-	-	-	-	-	-	-	-	-	5	2	9	9	8	2	9	21	-	1	18	-	19	198	450	186	9	879	Co.Ed.	
-	-	1181	4718	-	5899	9078	72654	81732	117199	320785	36	225651	-	-	4	2	8	-	4	10	22	37	300	22	337	858	907	1	26	2113	T.	
-	-	204	3702	-	3906	3109	32642	35751	52785	152933	8	245383	-	-	3	-	3	-	3	3	12	14	126	12	140	324	270	-	15	737	F.	Min. of Education
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-	-	4	-	-	11	-	11	169	349	1	-	534	Co.Ed.	
359	182	776	-	-	958	39	702	741	927	1976	194	5155	6	3	1	4	-	-	1	7	1	2	5	1	7	8	-	1	2	29	T.	
155	76	238	-	-	314	35	164	199	198	514	87	1467	2	-	1	-	-	-	1	0	1	1	1	1	2	1	-	-	1	5	F.	Other govt. author-ities
-	-	-	-	-	-	-	-	-	-	-	-	-	3	2	-	4	-	-	-	6	-	1	-	-	1	4	-	1	-	15	Co.Ed.	
-	-	306	558	-	864	630	-	630	34587	95064	-	131145	-	-	4	1	2	-	4	3	-	2	-	-	2	103	95	-	4	203	T.	
-	-	111	260	-	371	56	-	56	16374	46282	-	63083	-	-	1	-	1	-	1	1	-	1	-	-	1	44	39	-	1	85	F.	U.N.R.W.A.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	1	-	-	-	-	-	8	12	-	1	21	Co.Ed.	
166	-	4703	3345	-	8048	133	6817	6950	5877	30586	16930	68557	2	-	9	3	6	-	9	9	2	3	36	2	39	23	93	187	11	353	T.	
53	-	371	2249	-	2620	24	2076	2100	2774	13242	7346	28135	-	-	-	-	1	-	-	1	-	1	10	-	11	4	1	2	-	19	F.	Private schools
-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	8	3	5	-	8	8	-	-	7	-	7	17	89	184	8	307	Co.Ed.	
-	-	-	-	11757	11757	-	-	-	-	-	-	11757	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	2	T.	
-	-	-	-	4702	4702	-	-	-	-	-	-	4702	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F.	Jordan univer-sities
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	2	Co.Ed.	

Development of secondary industrial schools

1970-1980

Year	Number of schools	Annual intake	Total capacity	Number of specializations	Notes
1970	2	248	597	6	
1973	2	304	738	8	Beginning of Three-Year Development Plan
1974	2	309	806	8	
1975	3	468	993	10	End of Three-Year Development Plan
1976	4	603	1321	13	Beginning of Five-Year Development Plan
1980*	8	1400	3200	17	End of Five-Year Development Plan

* As planned by the Ministry of Education

Development of trade training centres

1970-1980

Year	No. of centres		Annual intake		Total capacity		No. of specializations		Remarks
1970	2	-	250	-	500	-	13	-	
1973	6	3	410	160	750	300	15	2	Beginning of Three-Year Plan
1974	6	3	450	180	850	330	15	2	
1975	8	4	530	220	960	380	15	2	End of Three-Year Plan
1976	12	5	1080	340	1580	540	18	2	Beginning of Five-Year Plan
1980*	22	8	2000	500	3800	900	22	6	End of Five-Year Plan

* As planned by the Ministry of Education

Technical and Engineering Institutes

1977

Institute	Location	Concerned agency	Established	Annual intake	Total capacity	Specializations
Technical Engineering Institute	Amman	Ministry of Education	1975	270	540	Electrical, mechanical, architectural, chemical, lab technicians, voc. instructors
Wadi Seer Training Centre	Amman	UNRWA	1960	150	250	Architectural drawing, mechanical drawing, Land surveying, quantity surveying, voc. instructor
Arab College* Inst. (Eng. Sec.)	Amman	Private	1975	160	320	Civil, architectural
Computers Institute	Amman	Royal Scientific Society	1977	40	80	Computers
Civil Aviation Centre	Amman	Ministry of Transport	1971	40	80	Electronics, ground traffic control

* This institute started in-service courses in 1977

Secondary Industrial Schools

1977

Location	Concerned agency	Year of establish-ment	Annual intake	Total capacity	Specializations
Amman	Ministry of Education	1952	250	750	Radio & tv, electricity/utilization, air conditioning & refrigeration, machining, welding & blacksmithing, auto mechanics, plumbing & central heating, carpentry
Irbed	Ministry of Education	1960	200	600	Radio & tv, electricity/utilization, auto mechanics, machining, welding & blacksmithing, heavy machine-mechanics, plumbing & central heating, carpentry
Zarka	Ministry of Education	1975	150	450	Electricity/utilization, electricity/ generation, electricity/transmission & distribution, welding & blacksmithing, air conditioning & refrigeration
Swaileh	Ministry of Education	1976	150	450	Building & reinforcing, tiling & plas-tering, carpentry, welding & black-smithing, electricity/utilization

Appendix 3.IIIc

Trade Training Centres for Boys

1977

Location	Concerned agency	Year of establishment	Annual intake	Total capacity	Specializations
Irbed (Sec. Industrial School)	Ministry of Education	1971	85	170	Electricity/utilization, auto mechanics, heavy machines, mechanics, welding & blacksmithing, machining, carpentry, plumbing & central heating, office machines mechanics
Ma'an	Ministry of Education	1973	30	60	Electricity/utilization, plumbing & central heating
Wadi Seer Electricity/ Utilization	Ministry of Education	1973	30	60	
Mafraq	Ministry of Education	1975	35	70	Electricity/utilization, plumbing & central heating
Zarka (Sec. Industrial School)	Ministry of Education	1976	60	120	Electricity/utilization, welding & blacksmithing, air conditioning & refrigeration
Amman/Marka	Ministry of Education	1976	150	300	Electricity/utilization, air conditioning & refrigeration, machining, welding & blacksmithing, carpentry, auto mechanics, building
Swaileh (Sec. Industrial School)	Ministry of Education	1976	100	200	Building & reinforcing, tiling & plastering, carpentry, welding & blacksmithing, electricity/utilization, auto mechanics
Jarash	Ministry of Education	1976	30	60	Electricity/utilization, plumbing & central heating
Amman/ Ashrafiya	Ministry of Education	1977	70	140	Electricity/utilization, welding & blacksmithing, plumbing & central heating
Salt	Ministry of Education	1977	30	60	Electricity/utilization, plumbing & central heating
Wadi Seer	UNRWA	1960	300	600	Electricity/utilization, building & reinforcing, tiling & plastering, carpentry, machining, welding & blacksmithing, auto mechanics, radio & tv, air conditioning & refrigeration, office machines mechanics, forging, plumbing & central heating, heavy machines mechanics, car body repair, auto electricity
Amman Um Al-Hussein Mabarrah*	Charitable Organization	1975	5	10	Carpentry
Amman Schneller	Private	1964	30	90	Carpentry, electricity/utilization, auto mechanics, welding & blacksmithing
Armed Forces Centres	Armed Forces		300	600	Electrical & mechanical trades, storekeepers

* The Mabarrah was established in 1958

Apprenticeship centres

1977

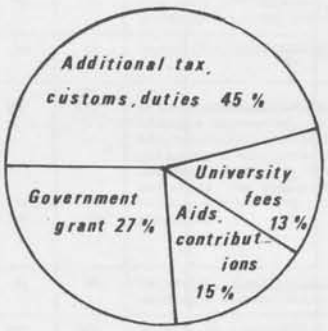
Location	Concerned agency	Worked site	Year of establish-ment	Annual intake	Total capacity	Specializations
Amman	Vocational Training Corporation	Jordan Electrici-ty Company	1974	50	100	Electricity/ transmission & distribution
Wadi Seer	Vocational Training Corporation	Ministry of Public Works/Dept. of Mechanics	1974	40	80	Auto mechanics, heavy machines mechanics

Appendix 3.IV

Budget of the University of Jordan

The amount in JD which has been received by the University from the four financing sources, and the percentage of each source during three periods of time for 1962-1976.

Period of time	Total	Government grant	Per-centage	Customs duties and univ. tax	Per-centage	Univ. fees and tuition	Per-centage	Aids and contri-butions	Per-centage
62-66	1478018	375000	26%	595078	40%	65550	4%	442390	30%
67-71	2786159	1025000	37%	1116400	40%	219538	8%	425221	15%
72-76	8409488	2025000	24%	4036143	48%	1285927	15%	1062418	13%
Grand total	12673665	3425000	27%	5747621	45%	1571015	13%	1930029	15%



1962-1976
(JD 12673665)

Projected revenues from the main sources of finance for the years 1977-1980, estimated in JD

	1977	1978	1979	1980
Duties customs and the government grant	2000000	2500000	3000000	3000000
The additional tax	600000	600000	700000	700000
University tuition and fees	380000	400000	450000	500000
Contributions and aids donations for the Faculty of Engineering Building	312000			
Revenues and public utilities	320000	350000	380000	435000
Total:	3902000	3875000	4555000	4635000
Grand total:	16968000			

CHAPTER 4 UNIVERSITY OF JORDAN, FACULTY OF ENGINEERING AND TECHNOLOGY (FET)

4 UNIVERSITY OF JORDAN, FACULTY OF ENGINEERING AND TECHNOLOGY (FET)

4.1 The University of Jordan

The University was established by a Royal Decree issued in September 1962. It is a State University which serves not only Jordan, but also neighbouring Arab countries.

The University has 10 schools (year of foundation in parentheses):

- Arts (1962) with 5 departments
- Islamic Studies (1964) with 2 departments
- Science (1965) with 5 departments
- Economics and Commerce (1965) with 5 departments
- Education (1972) with 5 departments
- Medicine (1973) with 2 departments
- Agriculture (1973) with 4 departments
- Nursing (1973) with 1 department
- Engineering and Technology (1973) with 5 departments
- Law (1978) with 2 departments.

In the 1978-1979 academic year the student enrolment in the University was about 9,000 students and the full-time teaching staff amounted to about 500 members.

The campus of the university occupies a pleasant open site which previously belonged to an agricultural experimental school. It is situated on a tree-covered hill in the Jubeiha area about seven kilometers north of the centre of Amman.
The site (1.2 square kilometers) also has an area of archaeological interest, and the Faculty of Engineering and Technology buildings are planned to encircle this area.

A map of the university is included in Appendix 4.I.

4.2 The Faculty of Engineering and Technology (FET)

4.2.1 Introduction

Jordan started its first planned development programme in 1973 by commencing the implementation of its three-year development plan (1973-1975). A second programme, the five-year development plan (1976-1980) started in 1976. (The third five-year plan (1981-1985) will be issued by January 1981). In the course of formulation of these plans and later in the course of their implementation, it was realized that a great demand on locally trained manpower - including engineers - would be needed. Among other actions taken by the authorities, a study for the establishment of a Faculty of Engineering and Technology was conducted. This study justified the establishment of such a faculty.

4.2.2 Aims and objections of the FET

The Faculty of Engineering and Technology was established as an addition to the campus of the University of Jordan by a Royal Decree issued in June 1973 to fulfil the following aims:

- Serve the over-all national objectives in education by providing university education in various fields of engineering.
- Provide engineers who can easily respond to the particular needs of Jordan and the neighbouring countries through the specification of curricula designed for that and other purposes.
- Establish a core where the exploration and exploitation of natural resources can be given proper attention through conducting basic and applied research related to them, and by producing the qualified manpower to implement findings.
- Facilitate the inflow of foreign experience and technology through the attraction of highly qualified personnel, and through the media of publication, literature, seminars and visiting professors.
- Upgrade the standards of engineering education and the practice of the profession by:
  1. Providing a base for uniformity of practice to replace diversified practices of engineers graduating from different backgrounds.

2. Conducting seminars and offering courses for practicing engineers.
3. Providing a library with references, documents and periodicals.
4. Providing research facilities and testing services for the profession.
5. Assuming a positive leading role in educational programmes of all vocational institutions in Jordan.

The FET consists of the following five departments (year of foundation in parentheses):

- Architecture (1975)
- Civil Engineering (1975)
- Electrical Engineering (1976)
- Mechanical Engineering (1977)
- Chemical Engineering (1977).

4.2.3 Curricula

The structure of courses is such that the first-year students follow a common curriculum (General Engineering) which is composed of basic sciences, engineering workshops and graphics. The only exceptions are the first-year undergraduates in Architecture, who follow a specific architectural programme in accordance with a new curriculum since the 1979-1980 academic year. Thereafter, students are accepted into the various specialization departments, study core courses and a set of general educational interest courses.
The curricula of the two-semester common basis studies and of the following eight-semester specialized studies are modelled on the American and British patterns. The programmes of the five departments are such that a student can normally finish the 172 semester credit hours (189 in the case of architecture) in five years to graduate with a bachelor's degree in the area of his specialization. Studies leading to the master's degree do not exist at the moment but are planned for later. A description of the curricula is given in Appendix 4.II.

In the following part of this section the areas of instruction and research of each of the five departments are outlined.

1. Civil Engineering Department

This department instructs its students in the following areas: residential and industrial structures, highways and bridges, earth structures (dams, harbours, etc.), irrigation and drainage, and sanitation. The students take a number of courses in each of these areas and run relevant laboratory tests.

The faculty members of this department have the following research interests: foam concrete, dams (geophysical, investigation and foundation problems), the finite element method in the design and analysis of structures, traffic problems in congested areas and reinforced concrete.

2. Electrical Engineering Department

This department instructs its students in a number of areas of communications/electronics at present. There are plans to add a specialization in electrical powers in the near future. The major groups of subjects of instruction are: communications and telephony, general electronics, biomedial electronics, lasers, computers and microprocessors, control systems, power systems, machines, measurements, installations, and acoustics and illumination.

The areas of research of interest to the faculty members of this department are: electrocardiographic signal analysis, telephone network planning, semiconductor radiation detectors and their applications in medicine, detection of incipient faults in power systems, Walsh analysis of non-linear stochastic systems, and acoustical properties of materials.

3. Mechanical Engineering Department

This department instructs its students in the following engineering areas: thermal systems, fluid mechanics and hydraulics, machine design, energy conversion and production. It is possible to start a production engineering branch when need arises.

The areas of research of interest to the faculty members of this department are: conventional and non-coventional energy systems, new

designs of heat exchangers, elastohydrodynamic properties of lubricants, acoustical properties of materials, aerodynamic and industrial noise, traffic noise, vibration analysis and damping of machinery, assembly lines and queuing theory, linear and non-linear programming optimization theory, problems in metal cutting and metal forming, problems in machine tool design, non-Newtonian fluid dynamics.

4. Chemcial Engineering Department

This department instructs its students in the following engineering areas: transport phenomena, chemical thermal systems, chemical reactions, the dynamics and control of chemical processes, chemical plant technology, modelling and optimization of chemical processes, and plant design.

The areas of research of interest to the faculty members of this department are: reactor design, modelling and optimization of chemical processes, fertilizer technology, pollution of native area, computer aided design.

5. Architectural Department

This department graduates architects who can practice in both architecture and urban planning. The main areas of instruction in this department are: design (including basic design), technology (structural design, environmental design and building construction), history of the environment, urban design and landscaping.

The areas of research of interest to the faculty members of this department are in the following broad topics: housing and planning, environmental design, and Islamic architecture.

4.2.4. Student population

Among those who pass the Tawjihayi (Science section General Secondary Education Certificate Examination) and apply for enrolment in Engineering, only a certain number can be accommodated. Students are admitted to engineering on competitive basis according to their cumulative grade average on the Tawjihayi. In 1979-1980, 160 students were admitted out of a total of 9,000 applying for admission to the University of Jordan.

Those accepted for engineering had a minimum score of 93.3 out of 100 pts. A small number (approximately 10%) is added through special admission which has less restrictive regulations. However, no student may be admitted with a Tawjihayi score less than 80 out of 100 pts.

A small percentage of students is admitted with less competitive grades on the Tawjihayi based on several considerations (e.g. talented athlete, son/daughter of a faculty member, political reasons). However, it is a condition that the admitted student must compete fairly with other students and maintain passing grades, otherwise he will not be allowed to continue.

Some students who are transferred from an accredited university may be accepted provided that their Tawjihayi score was above 80 and that they had acquired at least 33 credit hours in an engineering program accepted by the University of Jordan, and that their score in these credits averages B (80%). These students do not have to compete for admittance into engineering at the University of Jordan.

The faculty admitted the first group of 99 students in October 1975. The current student enrolment in the faculty is about 800. The student population expected until 1985 will be about 1,100 with a annual intake of 300.

The enrolment data for the faculty as a whole and for the departments separately from 1975-1976 are shown in Appendix 4.III.

The first bachelor degrees of the faculty were conferred in 1980. There were 60 in Civil Engineering (included 6 girls) and 13 in Architecture. These will be followed by the first bachelor degrees conferred in Electrical Engineering in 1981. Finally those in Chemical Engineering and Mechanical Engineering will be conferred in 1982.

The expansion plans of the faculty lead to a future annual output of a maximum of 300 engineering graduates, which lies within the actual indigenous annual requirements of about 300 to 400 engineering graduates.

4.2.5 Faculty staff

At the present time the faculty's academic staff members of the grade of lecturer and above total 36. The distribution by department can be seen in the following tabulation:

Department	Academic staff (Lect. + Prof.)	Teaching assistent	Lab. eng.	Technician
Architecture	8	4	0	0
Civil Eng.	9	5	2	3
Electrical Eng.	9			5
Mechanical Eng.	5	1	?	11
Chemical Eng.	5	1	1	0

In addition there is an administrative staff of 10 persons.

More detailed information about the academic staff members, i.e. rank, specialization, education and presented courses is given in Appendix 4.IV.

Difficulties have been experienced by the university in attracting qualified staff members. As a result the departments are understaffed. Therefore the faculty is sponsoring its own future academic staff. Bright students are given the opportunity for further study abroad to get their master's and Ph.D. degrees. In return they are obliged by contract to teach on the faculty for a certain number of years. At present a number of Jordanian students (25) who had their basic education abroad have been sent by the faculty to various universities in the U.S.A. and the U.K. After obtaining their Ph.D. they will be appointed assistant professor.

Information about these future staff members, i.e. specialization, educational institute and date of return, is given in Appendix 4.V.

4.2.6 Buildings

The faculty has been using temporary facilities available in the

university and in the Amman area.
Teaching is conducted in temporary accommodations mainly within the Department of Geology and Minerology. Also within the same building temporary laboratory classes have commenced, using some of the delivered laboratory equipment. The faculty has also benefited by the use of laboratory facilities placed at its disposal by the Polytechnic of Amman and by the Royal Scientific Society. The library facilities are concentrated within the university's main library. The existing library situation should be noted as a serious problem.
The permanent facilities of the faculty have been designed by local and international consultants with continuous advice from the staff members of the faculty.
The construction of the building complex will be completed in three phases.

Phase I : central workshops and heavy laboratories for all departments;

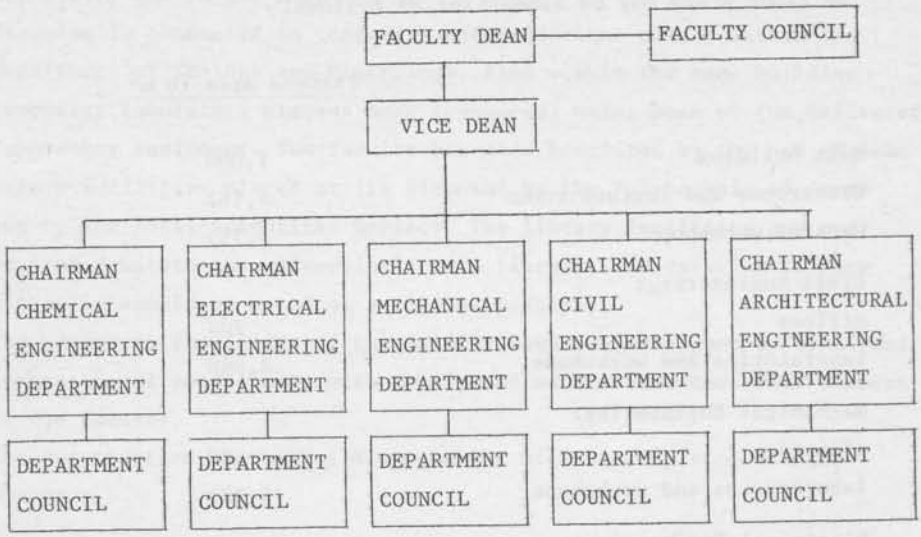
Phase II : three auditoria, administrative accommodation and the departments of Architecture and Civil Engineering;

Phase III: reading area, student facility area and the departments of Electrical, Mechanical and Chemical Engineering.

The initial part of Phase I, the construction of the mechanical workshops, has been completed. The rest of Phase I will be completed in January 1981. This enables the Chemical and Mechanical Engineering academic staff to take up temporary office accommodations. These workshops and heavy laboratories are partly to be used for temporary laboratory facilities.
Phase II will be completed in 1983.
By 1984 it is expected that full facilities for all departments in the faculty will be provided by this new building complex. The estimated cost of its construction is about 3 million Jordanian Dinars.
The model of the faculty buildings is shown in Appendix 4.VI.

The floor areas may be summarized as follows.

	Planned area in m^2
Main building	1,000
Classrooms and lecture rooms	4,167
General workshop	1,755
Civil Engineering:	
offices	704
laboratories and workshops	2,468
Mechanical Engineering:	
offices	580
laboratories and workshops	3,323
Electrical Engineering:	
offices	583
laboratories and workshops	3,368
Architecture:	
offices	522
laboratories and workshops	1,344
Chemical Engineering:	
offices	551
laboratories and workshops	2,447
Circulation area	4,786
Total	28,098



4.2.7 Governance

The governance of the faculty lies in the hands of the Faculty Council. The chairman is the Acting Dean. The members are two staff members from each department in the faculty; one of them is the chairman of the department and the other is a staff member yearly nominated by the Department Council.

The Faculty Council passes recommendations and resolutions to the Deans' Council of the university, to the Vice President for academic affairs and to the University Administration.

References

1. University of Jordan, Faculty of Engineering and Technology, Present status and planning report, Amman 1977.

2. University of Jordan, Report No. 2 of the FET, Dec. 1978.

3. The University of Jordan, Achievements and Aspirations, Amman, Feb. 1978.

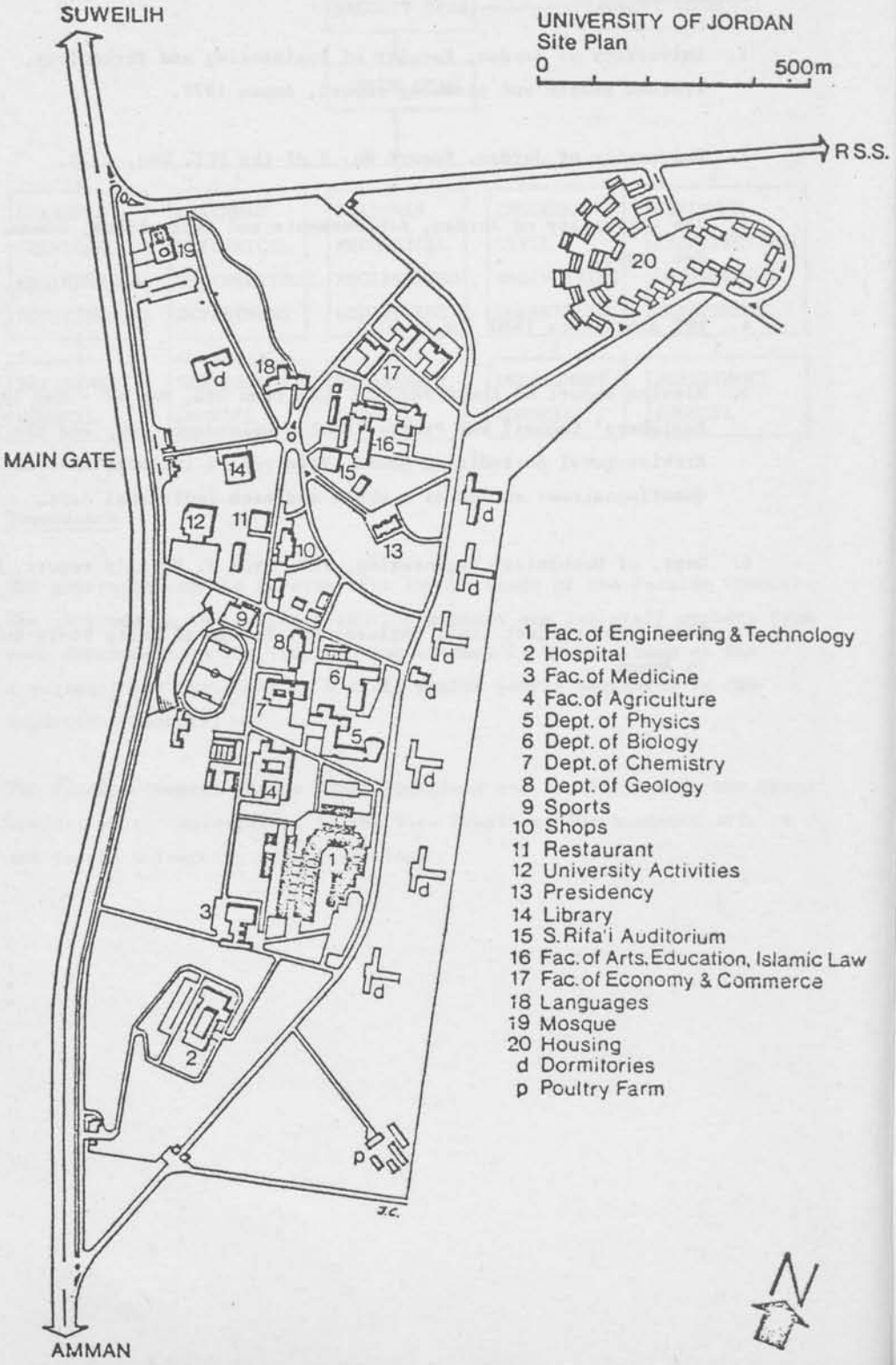
4. FET statistics 1980 (in Arabic).

5. Mission Report of the ECPD/NAAB team from USA, May 17 - May 28, 1980. Engineers' Council for Professional Development, Inc. and the National Architectural Accrediting Board. This report includes several completed questionnaires: on FET as a whole and each individual dept.

6. Dept. of Mechanical Engineering, FET, from J. Young's report, May 1980.

7. Final year project Civil Engineering: Design of Multy Story Building in Amman.

Appendix 4.I


SUWEILIH
UNIVERSITY OF JORDAN
Site Plan
0
500m
R.S.S.
MAIN GATE
AMMAN
1 Fac. of Engineering & Technology
2 Hospital
3 Fac. of Medicine
4 Fac. of Agriculture
5 Dept. of Physics
6 Dept. of Biology
7 Dept. of Chemistry
8 Dept. of Geology
9 Sports
10 Shops
11 Restaurant
12 University Activities
13 Presidency
14 Library
15 S. Rifa'i Auditorium
16 Fac. of Arts, Education, Islamic Law
17 Fac. of Economy & Commerce
18 Languages
19 Mosque
20 Housing
d Dormitories
p Poultry Farm
N

Appendix 4.IIa

Curriculum description

Civil Engineering

Semester	Course (Dept. & No.)	Category (Credit Hours)					
		Math	Basic Sci	Engr Sci	Engr Design	Hum & Soc Sci	Other
1	Math 101 - Calculus I	3					
	Chem 101 - Chemistry I		4				
	Phys 101 - Physics I		4				
	GE 131 - Engr. Graphics I			3			
	GE 101 - Communication and professional Orientation						3
	ME 111 - Workshop I			1			
2	Math 102 - Calculus II	3					
	Chem 102 - Chemistry II		4				
	Phys 102 - Physics II		4				
	GE 132 - Engr. Graphics II (Descriptive Geometry)			3			
	ME 112 - Workshop II			1			
3	Math 201 - Calculus III	3					
	G 101 - Geology		4				
	ME 221 - Statics			3			
	EE 303 - Electrical Engineering			4			
	Univ. Requirements (Soc.Hum. elective)					3	
4	Math 203 - Differential (Eqns)	3					
	Math 222 - Computer Science	3					
	CE 201 - Engr. Geology			3			
	CE 221 - Surveying I			3			
	ME 222 - Dynamics			3			
	Univ. Requirements (Soc.Hum. elective)					3	
4-5*	CE 222 - Surveying II			3			
5	Math 321 - Numerical Analysis	3					
	CE 331 - Strength of Materials			4			
	CE 321 - Surveying III			2			
	CE 322 - Photogrammetry			2			
	AE 323 - Building Construction				4		
	Univ. Requirements (Soc.Hum. elective)					3	

* A required Summer course

(continued next page)

Semester	Course (Dept. & No.)	Category (Credit Hours)					
		Math	Basic Sci	Engr Sci	Engr Design	Hum & Soc Sci	Other
6	Math 231 - Statistics	3					
	CE 332 - Materials of Construction			4			
	CE 341 - Structures I			3			
	AE 371 - Town Planning				2		
	ME 241 - Thermodynamics			3			
	Univ. Requirements (Soc.Hum. elective)					3	
7	CE 451 - Concrete I				3		
	CE 441 - Structures II			3			
	CE 461 - Fluid Mechanics			4			
	CE 471 - Soil Mechanics			4			
	Univ. Requirements (Soc.Hum. elective)					3	
8	CE 452 - Concrete II				4		
	CE 442 - Structures III			3			
	CE 446 - Metallic Constr.				4		
	CE 481 - Hwy Engr. I				3		
	CE 472 - Foundations			2			
	Univ. Requirements (Soc.Hum. elective)					3	
8-9*	8-week Summer Training in Industry						
9	CE 531 - Methods of Constr.			3			
	CE 551 - Concrete III				3		
	CE 561 - Sanitary Engr.				4		
	CE 581 - Hwy Engr. II				3		
	CE 591 - Design Project				2		
10	CE 501 - Specifications and Quantities			3			
	CE 562 - Irrigation & Drainage				3		
	CE 563 - Hydrology			3			
	CE 582 - Traffic & Transportation			3			
	CE 592 - Design Project				3		

* A main requirement in the CE programme-No credit hours given

One semester or quarter credit hour normally represents one class hour or three laboratory hours per week. One academic year normally represents at least 28 weeks of classes, exclusive of final examinations. Any differences should be indicated.

Appendix 4.IIb

Curriculum description

Electrical Engineering

Semester	Course (Dept. & No.)	Category (Credit Hours)					
		Math	Basic Sci	Engr Sci	Engr Design	Hum & Soc Sci	Other
1	Phys 101 - Physics I		4				
	Chem 101 - Chemistry I		4				
	Math 101 - Calculus I	3					
	ME - Workshop I			1			
	ME - Engr. Graphics I			3			
	GE - Communication and Pro-ession Orientation						3
2	Phys 102 - Physics II		4				
	Chem 102 - Chemistry II		4				
	Math 102 - Calculus II	3					
	ME - Engr. Graphics II			3			
	ME - Workshop II			1			
3	EE 211 - Circuits I			4			
	EE 251 - EM I			3			
	Math 201 - Caculus III	3					
	EE 201 - Engr. Analysis I	3					
	100 - Univ. Requirement					3	
4	EE 212 - Circuits II			3			
	EE 261 - Electronics I			3			
	EE 271 - Elect.Machines			2.5	0.5		
	EE 202 - Engr. Analysis II	3					
	100 - Univ. Requirement					3	
5	EE 351 - EM II			3			
	EE 361 - Electronics II			1.5	1.5		
	EE 371 - Elect.Machines			2.5	0.5		
	EE 381 - Elect.Power			3			
	EE 301 - Engr. Analysis III	3					
	100 - Univ. Requirement					3	
6	EE 321 - Communication I			3			
	EE 341 - Control I			3			
	EE 342 - Measurements I			2	1		
	EE 382 - Elect.Power II			3			
	ME 241 - Thermodynamics			3			
	100 - Univ. Requirement					3	

(continued next page)

Semester	Course (Dept. & No.)	Category (Credit Hours)					
		Math	Basic Sci	Engr Sci	Engr Design	Hum & Soc Sci	Other
7	EE 401 - Acoustics / Illum.			1.5	1.5		
	EE 421 - Communication II			3			
	EE 431 - Computers I			1.5	1.5		
	EE 451 - EM III			2	1		
	EE 461 - Electronics III			3			
	100 - Univ. Requirement					3	
8	EE 402 - Maint. / Install.			1.5	1.5		
	EE 411 - Circuits III			1.5	1.5		
	EE 422 - Communication III			3			
	EE 441 - Control II			2.5	0.5		
	EE 442 - Measurements II			3			
	EE 462 - Electronics IV			1.5	1.5		
9	EE 521 - Communication IV			1	2		
	EE 531 - Computers II			1	2		
	EE 551 - EM IV			1.5	1.5		
	EE 561 - Electronics V			1	2		
	EE 591 - Project I			1.5	1.5		
	100 - Univ. Requirement					3	
10	EE 522 - Communication V			1	3		
	EE 541 - Systems			1	2		
	EE 562 - Electronics VI			1.5	1.5		
	EE 592 - Project II				6		

Appendix 4.IIc

Curriculum description

Mechanical Engineering

Semester	Course (Dept. & No.)	Category (Credit Hours)					
		Math	Basic Sci	Engr Sci	Engr Design	Hum & Soc Sci	Other
1	Phys 101 - Physics I		4				
	Chem 101 - Chemistry I		4				
	Math 101 - Mathematics I	3					
	ME 111 - Workshop Technology I			1			
	GE 131 - Engineering Drawing				3		
	GE 101 - Communication & Profession Orientation						3
2	Phys 102 - Physics II		4				
	Chem 102 - Chemistry II		4				
	Math 102 - Mathematics II	3					
	GE 132 - Descriptive Geometry				3		
	ME 112 - Workshop Technology II			1			
	100 - Univ. Requirement					3	
3	Math 201 - Mathematics III	3					
	ME 221 - Statics			3			
	EE 303 - Electrical Engr. I			4			
	ME 270 - Metallurgy			3			
	100 - Univ. Requirement					3	
4	Math 203 - Mathematics IV	3					
	ME 222 - Dynamics			3			
	EE 263 - Electrical Engr. II			3			
	ME 241 - Thermodynamics I			3			
	M 222 - Computer Programming	3					
	100 - Univ. Requirement					3	
4-5	100 - Univ. Requirement					3	
5	M 321 - Numerical Analysis	3					
	ME 311 - Production Engr. I			3			
	ME 331 - Mechanics of Materials I			4			
	ME 342 - Thermodynamics II			3			
	100 - Univ. Requirement					3	

(continued next page)

Semester	Course (Dept. & No.)	Category (Credit Hours)					
		Math	Basic Sci	Engr Sci	Engr Design	Hum & Soc Sci	Other
6	ME 332 - Mechanical Vibrations			3			
	CE 345 - Metal Construction			3			
	ME 312 - Introduction to Engineering Metrology			3			
	ME 341 - Heat Transfer I			3			
	ME 231 - Theory of Machines				3		
	100 - Univ. Requirement					3	
6-7	Summer Training for minimum of 8 weeks						
7	ME 441 - Internal Combusion Engines			4			
	ME 433 - Machine Design				4		
	CE 461 - Fluid Mechanics			4			
	ME 442 - Heat Transfer II			4			
	ME 410 - Mechanical Maintenance			1			
	ME 452 - Fluid Mechanics II			4			
	ME 401 - Management & Engr. Economy			3			
8	ME 434 - Machine Design				4		
	EE 373 - Electrical Engr.			3			
	ME 400 - Plumbing			3			
	EE 443 - Control Systems			3			
	ME 581 - Refrigeration and Air Conditioning			4			
9	Mechanical Engr. Elective			3			
	Course from ME 581 to 589			3			
	ME 591 - Project I			4			
10	ME 592 - Project II			5			
	ME 502 - Factory and Production Planning			3			

One semester or quarter credit hour normally represents one class hour or three laboratory hours per week. One academic year normally represents at least 28 weeks of classes, exclusive of final examinations. Any differences should be indicated.

Appendix 4.IId

Curriculum description

Chemical Engineering

Semester	Course (Dept. & No.)	Category (Credit Hours)					
		Math	Basic Sci	Engr Sci	Engr Design	Hum & Soc Sci	Other
	The B.Sc.degree program requires the completion of 173 Cr Hr consisting of:						
2-10	A) UNIV. REQUIREMENTS: 18 Cr Hr distributed as follows:						
	A.1. OBLIGATORY (9 Cr Hr)						
	Arb 11100 - Arabic Proficiency Exam					3	
	Engl 12100 - English Proficiency Exam					3	
	Milt 10100 - Military Training					3	
	A.2. ELECTIVES (9 Cr Hr) The student elects three of the courses below:						
	Phil 16100 - Principl. Philosophy & Logics					3	
	Soc 17100 - Principl. Sociology					3	
	Phil 16101 - History Sci. Method					3	
	His 13100 - History Civilization					3	
	Psy 81100 - Principl. Psychology					3	
	Pol 27100 - Palestine Question					3	
	Adm 24100 - Principl. Administration					3	
	Eco 21100 - Principl. Economics					3	
	Sci 30100 - Principl. Gen. Sci.					3	
	Shar 41100 - Islamic Philosophy					3	
	Shar 42100 - Islamic Culture					3	
	Biol 50100 - Principl. Public Health					3	

(continued next page)

Semester	Course (Dept. & No.)	Category (Credit Hours)					
		Math	Basic Sci	Engr Sci	Engr Design	Hum & Soc Sci	Other
	B) FACULTY REQ.:						
1	Phys 101 - Gen. Physics I		4				
	Chem 101 - Gen. Chem. I		4				
	Math 101 - Calculus I	3					
	GE 131 - Engr. Graphics			3			
	ME 111 - Engr. Workshop I			1			
	GE 111 - Communication & Profession Orientation						3
2	Phys 102 - Gen. Physics		4				
	Chem 102 - Gen. Chem. II		4				
	Math 102 - Calculus II	3					
	GE 132 - Descript. Geometry			3			
	ME 112 - Engr. Workshop II			1			
	C) DEPT. REQ.:						
	C.1. OBLIGATORY (116 Cr Hr)						
3	Math 201 - Calculus III	3					
	Math 222 - FORTRAN Progr.	3					
	Chem 241 - Phys. Chem. I		3				
	ME 203 - Engr. Mechanics			4			
	ChE 211 - Chem. Engr. Principl. I	0.5		2.5			
4	Math 203 - Ord. Diff. EQ.	3					
	Chem 211 - Anal. Chem.		3				
	Chem 341 - Phys. Chem. II		3				
	ChE 201 - Chem. Engr. Materials		0.5	2.5			
	ChE 212 - Chem. Engr. Principl. II	0.5		2	0.5		
5	Chem 231 - Organic Chem. I		4				
	Chem 343 - Pract. Phys. Chem.		3				
	ChE 321 - Thermodynamics I			3			
	ChE 331 - Chem. Engr. Analysis I	2		0.5	0.5		
	ChE 341 - Transport Phenom.			3			
6	Chem 234 - Organic Chem. II		4				
	EE 303 - Elect. Engr.			4			
	ChE 322 - Thermodynamics II			3			
	ChE 342 - Fluid Mechanics			3			
7	CE 331 - Strength Materials			4			
	ChE 421 - Chem. React. Engr. I			1	2		
	ChE 441 - Heat & Mass Trans. I			2.5	0.5		
	ChE 471 - Dynamics & Control			3	1		

(continued next page)

Semester	Course (Dept. & No.)	Category (Credit Hours)					
		Math	Basic Sci	Engr Sci	Engr Design	Hum & Soc Sci	Other
8	ChE 422 - Chem. React. Engr. II			1	1		
	ChE 431 - Chem. Engr. Analysis II	2		0.5	0.5		
	ChE 441 - Heat & Mass Trans. II			2.5	0.5		
	ChE 443 - Separation Processes			2.5	0.5		
	ChE 451 - Chem. Technology			1			3
	ChE 461 - Chem. Engr. Lab. I			2			
9	ChE 501 - Plant Management				3		
	ChE 552 - Petroleum Refiniry			2	1		
	ChE 561 - Chem. Engr. Lab. II			2			
	ChE 581 - Plant Design & Econ. I				3		
	ChE 591 - Expt. I. Project				2		
	ChE 592 - Design Project I				2		
10	ChE 571 - Fuel & Power			1.5	0.5		
	ChE 582 - Plant Design & Econ. II				3		
	ChE 593 - Design Project II				4		
9-10	C.2. ELECTIVES (6 Cr Hr) The studeny elects two courses from the following list:						
	ChE 521 - Biochem. Engr.			3			
	ChE 551 - Mineral Extraxt & Refin.			3			
	ChE 572 - Chem. Engr. Sci.			3			
	ChE 573 - Environment. Engr.			3			

Curriculum description

Architecture

	FIRST YEAR			SECOND YEAR			THIRD YEAR			FOURTH YEAR			FIFTH YEAR	
	F	S	SUM	F	S	SUM	F	S	SUM	F	S	SUM	F	S
TECHNICAL	MATHEMATICS I II PHYSICS I II			STRUCTURAL MECH	STRUCTURAL ANALYSIS		STRUCT I	DESIGN II		ARCHITECTURAL MANAGEMENT I	II		ARCHITECTURAL MANAGEMENT III	IV
				INTRO TO ENV SYSTEMS	BLDG CONSTR I	BLGD WORK-SHOP	BUIDLING CONSTRUCTION I	II						
						SURVEY PROP. OF MAT'S								
	WORK-SHOP I	WORK-SHOP II		COMPUTER STUDIES	SANITARY SYSTEMS		HEVAC	ILLUM & ACOUS-TICS						
VISUAL	DESIGN I			DESIGN II			DESIGN III			DESIGN IV			DESIGN V	
	ARCH. GRAPHICS I II												THESIS	
HUMANITIES	ORIEN-TATION & COMM.		UNIV. REQ.	HISTORY OF ARCHITECTURE I	II		HISTORY OF ARCHITECTURE III	IV		URBAN AND REGIONAL PLANNING I&II			THESIS RESEARCH	
		UNIV. REQ.	UNIV. REQ.							THEORY OF ARCHITECTURE I	II		THEORY OF ARCHITECTURE III	
			UNIV. REQ.							LANDSC. ARCH.	UNIV. REQ.		EXP. FORM	UNIV. REQ.

NEW CURRICULUM

Appendix 4.III

Enrolment data

Faculty as a whole

Year	Enrolment year				
	1st	2nd	3rd	4th	5th
75-76	124	-	-	-	-
76-77	112	92	-	-	-
77-78	144	113	84	-	-
78-79	164	125	109	84	-
79-80	199	142	112	120	73
80-81	230	-	-	-	-

Electrical Engineering

Year	Enrolment year				
	1st	2nd	3rd	4th	5th
75-76	-	-	-	-	-
76-77	-	-	-	-	-
77-78	-	13	-	-	-
78-79	-	11	13	-	-
79-80	-	25	11	13	-

Civil Engineering

75-76	-	-	-	-	-
76-77	-	77	-	-	-
77-78	-	76	71	-	-
78-79	-	85	76	71	-
79-80	-	62	71	88	60
80-81	-	80	60	70	85

Mechanical Engineering

75-76	-	-	-	-	-
76-77	-	-	-	-	-
77-78	-	-	-	-	-
78-79	-	7	-	-	-
79-80	-	15	7	-	-
80-81	-	12	14	5	-

Architecture

75-76	-	-	-	-	-
76-77	-	15	-	-	-
77-78	-	24	13	-	-
78-79	-	15	20	13	-
79-80	40	25	16	19	13

Chemical Engineering

75-76	-	-	-	-	-
76-77	-	-	-	-	-
77-78	-	-	-	-	-
78-79	-	7	-	-	-
79-80	-	15	7	-	-
80-81	-	19	12	7	-

Academic staff

Civil Engineering

Name	Rank	Specialization	Degree	Year	Place	Courses
Yousef M. Masannat	Asst.prof.	Geology & appl. geology	B.Sc. M.Sc. Ph.D.	1966 1971 1973	Ain Shams U. Cairo University of Arizona	CE 201 CE 222 CE 471 (lect.+pract.) CE 472
Raafat Helmy	Prof.	Surveying highways	B.Sc. Ph.D. Asst.prof. Resr.fellow Asst.prof. Prof. Consultancy	1949 1957	Alexandria ETH Zürich Alexandria Karlsruhe Cairo Khartoum Switzerland	CE 221, CE 222 }(lect.+pract.) CE 322, CE 321 }(instr.+exerc.) CE 481 (lect.+design)
Bassam N. Abu-Ghazaleh	Asso.prof. (acting dean)	Structures	B.Sc. M.Sc. Ph.D. research/ teaching/ consultancy	1956 1963 1966	Ain Shams U. Cairo }Berkeley (Ca) USA & }Middle East	CE 441, CE 442 }(lect.+disc.) CE 591 (design proj.)
Ahmed Afifi Aglan	Asst.prof.	Struct. engineeering	B.Sc. M.Sc. Ph.D. teaching/ research/ design	1962 1966 1972	Ain Shams U. Cairo Manchester (UK) Windsor (Canada) Manchester/ Windsor/ Mansoura (Eg.) Garyounis (Lib.)	CE 451 (lect.+disc.) CE 452 (lect.+disc.) CE 446 (lect.+disc.) CE 531

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Academic staff

Civil Engineering

Name	Rank	Specialization	Degree	Year	Place	Courses
Krishna D. Marty	(visiting) Prof.	Civ. engineering (prestressed) concrete	B.Sc. M.Sc. Ph.D. Consultancy/ teaching/ research	1958 1962 1969	S.V. Univ. India Calcutta Glasgow } India } Iraq	CE 452 (lect.+demonstr.) CE 551 (lect.+design) CE 591 (design proj.)
Mohammed B. Khalil	Prof.	Irrigation, fluid mech., river hydr.	B.Sc. M.Sc. Ph.D. teaching	1957 1961 1963	Alexandria Imp.Coll. U. London Egypt	CE 561 (lect.+lab.+ disc.) CE 562 }(lect.+disc.) CE 563 CE 331 CE 332
Sabir H.M. Dahir	Prof. (head of department)	Civ. engineering transportation highways	B.Sc. M.Sc. Ph.D	1966 1968 1970	North }Carolina State U.	CE 581 CE 582 (lect.+lab.)

Academic staff

Electrical Engineering

Name	Rank	Specialization	Degree	Year	Place	Courses
Mahmoud A. Hassan (1944)	Asst.prof. (acting chairman)	Medical electronics Digital systems and computers Nuclear electronics	B.Sc. M.Sc. Ph.D.	1968 1974 1976	Cairo U.K. U.K.	EE 431 (computers I) EE 402 (installation & maintenance) EE 462 (electronics IV) EE 531 (computers II)
H.M. El-Zayyat (1939)	Asst.prof.	Electric power systems	B.Sc. Ph.D.	1963 1971	Alexandria U.K.	EE 381 (elect. power I) EE 342 (measurements & instrument. I) EE 382 (elect. power II)
J.N. Ayoub (1940)	Asso.prof.	Communication networks	B.Sc. M.Sc. Ph.D.	1964 1965 1969	Nebrasca Nebrasca Univ. of Calif.	EE 461 (electronics III) EE 422 (communications III) EE 521 (communications IV)
C.H. Halasa (1944)	Asst.prof.	High voltage electrical engineering	B.Sc. M.Sc. Ph.D.	1970 1974 1976	Murray Missouri Missouri	EE 251 (elect. magn. theory I) EE 202 (engr. analysis II) EE 271 (electr. mach. I)
M.K. Abdelazeez (1946)	Asst.prof.	Telecommunication	B.Sc. M.Sc. Ph.D.	1970 1972 1976	Assuit Illinois Illinois	EE 321 (communication I) EE 401 (acoustics/ illumination) EE 451 (electr. magn. III) EE 442 (measurements II)

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Academic staff

Electrical Engineering

Name	Rank	Specialization	Degree	Year	Place	Cources
I.H. Zabalawi (1950)	Asst.prof.	Microwaves circuits/filters	B.Sc. M.Sc. Ph.D.	1974 1976 1979		EE 212 (electr. circuits I) EE 351 (electr. magn. II) EE 301 (engr. analysis III) EE 411 (electr. circuits II) EE 561 (electronics V)
B. Kahhaleh (1957)	Lecturer	Electronics	M.Sc.	1979	Missouri	EE 261 (electronics I) EE 361 (electronics II)
M. Maqusi (1945)	Asso.prof.	Communication signal processing	B.Sc. M.Sc. Ph.D.		New Mexico New Mexico New Mexico	Not known
Abdel Aziz	Lecturer	Microwaves	Ph.D.			EE 551 (electr. magn. IV)

Academic staff

Mechanical Engineering

Name	Rank	Specialization	Degree	Year	Place	Courses
Abbas Moh. Sadek	Prof.	Prod. engr. machine & tools	B.Sc. M.Sc. Ph.D.	1951 1956 1960	Alexandria Cairo Munich	M 270 (metallurgy) M 331 (theory of machines)
Mahmoud S. Audi	Asst.prof.	Strength of materials fluid mech. & hydraul.	B.Sc. M.Sc. Ph.D.	1965 1971 1974	Beirut Syracuse U. (USA)	CE 331 (strength of materials) CE 461 (fluid mech.) MG 452 (fluid mech.) M 332 (mech. vibrations)
Mohammad A. Alsaad	Asst.prof. (head of department)	Thermodynamics heat transfer	B.Sc. M.Sc. Ph.D.	1966 1972 1976	Cairo George Wash. Univ. (USA) Georgia Tech. (USA)	ME 222 (statics/dynam.) ME 241 (thermodynamics) ME 342 (thermodynamics) ME 341 (heat transfer) ME 442 (heat transfer)
Munif A.M. Hyazi Hijazi	Asst.prof.	Prod.engr. prod.management	B.Sc. Ph.D.	1975 1978	Nottingham (U.K.)	ME 311 (intr.prod.engr.) GE 101 (commun. and prof. orient.) ME 312 (engr. metrology) ME 221 (statics)
Jamal Khalil	Asst.prof.	-	Dipl.Ing. Ph.D.	1973 1978	T.U. Aachen Ruhr U. Bochum	-

Note: Information is inaccurate and incomplete

Academic staff

Chemical Engineering

Name	Rank	Specialization	Degree	Year	Place	Courses
Shalhoub, Nael G.	Asst.prof. (head of department)	Separation processes	B.Sc. Ph.D.	1972 1975	Univ.of Aston Birmingham "	ChE 201 + lab. experiments ChE 321; ChE 322 + lab. experiments
Tobgy, Ahmad H.	Asst.prof.	Reaction engr.	B.Sc. M.Sc. Ph.D.	1960 1964 1977	Cairo " Univ. of Exeter	ChE 331 ChE 421; ChE 422 ChE 431
Khayyat, Ahmad N.	Asst.prof.	Solids handling	B.Sc. Ph.D.		Univ.of Aston Birmingham "	ChE 341; ChE 342 + lab. experiments ChE 443
Lahalih, S. ⁎	Asst.prof.	Polymer engr.	Ph.D.			
Hamad, O.A. ⁎	Asst.prof.	Heat and mass transfer	Ph.D.			ChE 211; ChE 212 ChE 441, ChE 442

⁎ Appointed September 1980

Academic staff

Architecture

Name	Rank	Specialization	Degree	Year	Place	Courses
Quantrill, Malcolm	Prof. (head of department)	Design				
Abdine, Abdle E.	Asso.prof.	Hist.of build. construction	Dr.Arch.	1966		
Heikal, Namir	Asso.prof.	Design	Arch. D.P.L.G.	1971		
Cejka, Jan	Asst,prof.	Theory of arch., arch.communi-cation, hist.of arch.	Dr.-Ing.	1978		
Frederickon, Mark P.	Asst.prof.	Inter.design. graphics	M.Arch.	1977		
Tewfik, Maqdy	Asst.prof.	Urban & reg. planning	Dr.Techn.	1976		
Walls, Archibald G.	Asst.prof.	Hist. of arch.	Ph.D.	1979		
A'Amiry, Suad	Lecturer	Urban planning	M. Urban planning.	1979		
Amireh, Omar	Instructor	Architecture	B.Sc.	1978		
Al-Zoubi, Yahia	Instructor	Hist. of arch.	Ph.D.	1974		
Mahadin, Kamel O.	Instructor	Housing design	B.Arch.	1979		
Sadoun, Camille	Instructor	Part-time	Arch.	1976		

Appendix 4.V

Future academic staff

Civil Engineering

Name	Educational institute	Specialization	Date of return
	Imperial College (U.K.)	Structures	1981
	Washington S.U. (USA)	Environm. engr.	1981
	Univ. Ill. Champ. (USA)	Surveying/geodesy	1981/1982
	Salford (U.K.)	Hydraulics	1981/1982
	Univ. Cal. Berkeley (USA)	Struct. mech.	1982
	Univ. Ill. Champ. (USA)	Concrete design	1981/1982
	McGill (Canada)	Steel design	1984
	Davis, Ca. (USA)	Graphic engr.	1982

Electrical Engineering

	USA	Computers	1983
	USA	Communication (optical)	1983

Mechanical Engineering

5 B.Sc. abroad, details unknown.

Chemical Engineering

F. Sweiss	U.M.L.S.T. (U.K.)	Loss prevention	Sept. 1981
R. Bishtawi	A.I.W.A. (USA)	Reaction engr.	Sept. 1982
D.A. Abu Fara	McGill (Canada)	Control, process dynamics	Sept. 1982
S. Said	A.I.W.A. (USA)	Thermodynamics	Sept. 1981
N. Haymour	Santa Barbara (USA)	Computer aided design	Sept. 1982

Architecture

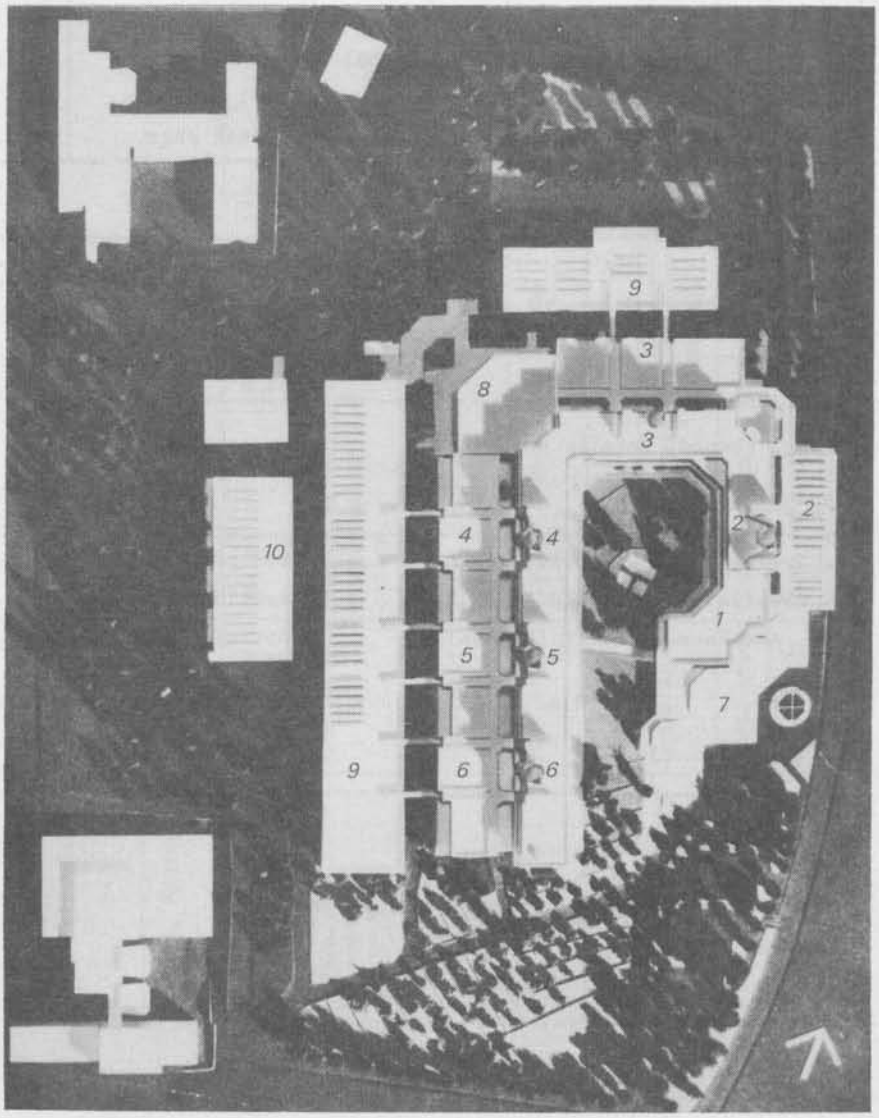
5 B.Sc. abroad, details unknown.

Appendix 4.VI

Faculty of Engineering and Technology
Site Plan

scale 1:1500

1. Administration
2. Architecture
3. Civil Engineering
4. Mechanical Eng.
5. Chemical Eng.
6. Electrical Eng.
7. Auditorium
8. Reading Room
9. Heavy Laboratories
10. Central Workshops



CHAPTER 5 REQUEST FET AND PROJECT PROPOSAL EEC

5 REQUEST FET AND PROJECT PROPOSAL EEC

5.1 Introduction

The FET submitted requests for aid to the European Economic Community (EEC) in May 1979 and to the Federal Republic of Germany (FRG) in September 1979.
The requests have been the subject of a detailed study by a consultant appointed by the Commission. With only a few exceptions the requests are supplementary and both of them have been incorporated in the Commission's proposal for the project. A decision taken in March 1980 allocated the funds to alternative projects in Jordan. This necessitated a reallocation of funds among the projects proposed under the EEC/Jordan Protocol (Universities of Amman and Yarmouk).

5.2 Concept of the project proposal

The project will provide funds for the supply of equipment required for the laboratories and workshops of the Faculty of Engineering and Technology in Jordan University. In addition provision is included for technical assistance to the faculty in the form of fellowships and expert advice through associated universities, and by formulating the programmes of study. The first stage of the buildings will be available in January 1981 and equipment will be required by June 1981.
The realization of the full development of the faculty will take place in two stages. The present project fully implements stage 1, which is to develop the required facilities and programmes for graduate studies compatible with good international practice. In stage 2, consideration will be given to increasing the scope of the Reference Library and developing more comprehensive programmes and facilities for post-graduate studies.

The implementation of the present project - stage 1 - will take place over a period of 4 years and the programme for each sector has been analysed in terms of the facilities required and the associated expenditure.

The grant to the Faculty of Engineering and Technology amounts to a total of 2,771,700 JD (6,680,000 EUA)*.

* EUA = European Unit of Account

The allocation to each sector of the project is set out below.

Allocation of costs (stage 1)
Faculty of Engineering and Technology

Item	Total [JD]	Amended total [JD]
1 Faculty building Furniture and equipment	160,000	160,000
2 Equipment and material	1,753,700	1,670,500
3 Audio-visual aids	5,900	5,900
4 Technical references	15,000	15,000
5 Foreign senior academic staff visits	430,000	376,000
6 Foreign senior technicians' visits	324,000	298,800
7 Training Jordanian technicians abroad	89,600	64,700
8 Industrial and academic visits of Jordanian academic staff	96,000	83,100
9 Joint research programme	56,000	47,700
10 Graduate study scholarships	50,000	50,000
Total	2,980,200	2,771,700

Grand total 2,771,700 JD.
Total cost of equipment and material (1, 2, 3 and 4) 1,851,400 JD
Total cost of technical asistance 920,300 JD

The balance between the equipment being supplied (hardware) and the technical assistance (software) is in the ratio 65 : 35, which ensures that in the formative years of the new faculty there will be a considerable investment in the transfer of know-how from the European experience to Jordan University.

The expenditure will be incurred over a period of 4 years covering

the full establishment of stage 1 of the project. The incidence of expenditure over the period is estimated as set out below.

Year	Expenditure [JD]
1981/82	869,300
1982/83	1,078,000
1983/84	532,400
1984/85	292,000
Total	2,771,700

As the project progresses each phase will be reviewed jointly by the dean of the faculty, a consulting professor and the delegation of the Commission so that an optimum utilization of the available resources will be obtained at each stage.

In particular the programme for implementation of the different sectors of the project will be reviewed in light of the previous progress and the available finance for each sector.

The estimated cost for stage 2 is 307,000 JD (740,000 EUA).

5.3 Brief description of the hardware and software components

Hardware

1. Furniture and equipment.
   This item covers furniture and equipment necessary for the lecture halls and associated student facilities.

2. Equipment and material.
   In the layout proposed for the new faculty buildings provision is made for workshops, heavy test laboratories and machine rooms, as well as laboratories for bench-type demonstration equipment.
   The project provides for equipping most of these facilities with all the necessary teaching equipment. Some equipment is also being provided which will allow post-graduate work to be undertaken to a limited extent.
   The request for equipment has been reviewed by consultants appointed

by the Commission who are satisfied that the list is comprised of essentially normal teaching equipment in reasonable quantities. A cost summary for the five departments is given below.

Department	EEC [JD]	FRD [JD]	Total [JD]
Civil	146,090	115,000	261,090
Electrical	100,000	325,000	425,000
Mechanical	199,000	342,000	541,000
Chemical	131,500	334,185	465,185
Architecture	12,200	48,744	61,244
Total	588,790	1,164,929	1,753,719

The various laboratories of the departments with details about recent condition, adequacy and requested funds are given in Appendix 5.I.

Some of the equipment of the laboratories and workshops have already been acquired, but the bulk of them has yet to be provided for.

Priority should be given to the Chemical Engineering Department as it has been the latest addition of the FET and setting up laboratories in this department requires starting from scratch.

3. Audio-visual aids.

   Ultimately only the request of the Chemical Engineering Department has been incorporated in the project proposal. It is expected that this department will serve as an audio-visual centre.

4. Technical references.

   This item covers books and magazines as a first step to improve the poor situation of the library.

Detailed lists of most of the hardware needed by the departments has been given in the EEC and FRG requests.

Software

Provision is included in the technical assistance to foster a close

relationship with well-established faculties of engineering of European universities. These will provide the necessary advice in the critical initial phase of the project. The cooperation will be effected through visiting professors, secondment of technical support staff, fellowships and joint research programmes.
Details of needs in this area of each department, e.g. rank, specialization, qualification and suggested starting date are outlined in Appendix 5.II.
The following is a summary.

5. Foreign senior academic staff visits.
   The estimate of requirements takes into account the comments of the Wagner report and also the requirements stated by the faculty. In practical terms it is unlikely that any greater number of senior academic staff members could be absorbed by the various departments in the initial stages.

   A summary of the numbers needed is given below.

Department	Year				
	81	82	83	84	85
Civil	1	2	2	-	-
Electrical	1	1	1	1	1
Mechanical	1	2	2	1	1
Chemical	2	1	2	1	1
Architecture	1	1	1	1	1
Total/year	6	7	8	4	4

   In view of the expected duration of the visits (approximately one academic year) and the consulting fees indebted to the Delft University of Technology, the estimate of cost of 430,000 JD for these 29 academic staff visits seems a bit low.

6. Foreign senior technicians' visits.
   These technicians are needed to help in a number of areas, including setting up laboratory equipment, establishing maintenance schedules,

running typical tests and writing and reviewing lab sheets. In addition, one will be needed to set up inventory and storage routines for each department.

A summary of the number of technicians needed is given below.

Department	Year				
	81	82	83	84	85
Civil	-	2	2	1	-
Electrical	1	1	1	1	1
Mechanical	3	1	2	1	1
Chemical	1	3	1	-	-
Architecture	-	-	-	-	-
Total/year	5	7	6	3	2

The estimated cost for a visit of 1 year amounts to 14,000 JD. For 23 technicians this totals 322,000 JD.

A discrepancy may be noticed in the provision for academic staff and technicians' visits.

7. Training Jordanian technicians abroad.

Faculty technicians will usually stay for a couple of months in relevant European universities or industries where they will receive training on some equipment and instrumentation or in laboratory management.

A summary of the number of technicians to be trained is given below.

Department	Year				
	81	82	83	84	85
Civil	1	2	3	3	-
Electrical	1	2	1	1	1
Mechanical	1	4	3	1	1
Chemical	-	2	2	1	1
Architecture	-	1	-	-	-
Total/year	3	11	9	6	3

The cost per visit (3-4 month training course) is estimated at 2,800 JD.

The total cost for 32 technicians amounts to 89,600 JD.

8. Industrial and academic visits of Jordanian staff.

This item will cover visits of Jordanian academic staff to European universities and industries. It is a part of the contined interaction of Jordanian staff with such institutes in the highly industrialized European countries.

A summary of the number of these visits is given below.

Department	Year				
	81	82	83	84	85
Civil	1	3	3	2	-
Electrical	1	2	2	1	1
Mechanical	1	1	2	2	-
Chemical	1	1	2	2	-
Architecture	-	1	2	1	-
Total/year	4	8	11	8	1

The cost per visit is approximately 3,000 JD, the total cost 96,000 JD.

9. Joint research programme.

These programmes will be set up by mutual agreement among the departments of the faculty and comparable departments in the European countries. A time schedule for each research project will be agreed upon.

The following are areas of research suggested by each department. Other areas, particularly those of interest in the development of Jordan, may also be considered.

Department	Areas of research
Civil	Analysis of linear and non-linear structures.
	Geophysical investigation of foundation problems.
Electrical	Electrocardiographic signal analysis.
	Semiconductor radiation of detectors and their application in medicine.
Mechanical	Non-conventional energy systems.
	Noise and vibration control.
Chemical	Modelling of mixing and thermal effects in un-premixed multifeed, multi-output chemical reactors.
	Separation of oil pollutants from sea water using fibrous beds coalescers.

A standard research programme will last from two to three years.

Total estimated cost of this item is 56,000 JD.

10. Graduate study scholarships.

The Faculty of Engineering and Technoloy has been building its academic staff since 1974. One item of this process is to seek graduate study scholarships for promising young engineers who gave been appointed in the faculty as teaching and research assistants.

The faculty is seeking scholarships for four candidates. The specialization areas will be made known at a later stage.

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Appendix 5.Ia

Civil Engineering laboratories

Laboratory or facility	Condition	Adequacy for instruction	Instructional area (m^2)	Total support (JD)
Structural lab.	good	adequate		{ 40,000
Materials of construction	good	adequate		
Fluid mechanic (hydraulic)	planned; some of the equipment is tendered; future expansion planned			100,000
Soil mechanics	good	adequate		25,060
Sanitary lab.	planned	not ready yet		15,000
Surveying & photogrammetry	good	adequate for surveying; elementary for photogrammetry		15,850 60,000
Highways				5,180

Total invested amount 65,000 JD

Appendix 5.Ib

Electrical Engineering laboratories

Laboratory or facility	Condition	Adequacy for instruction	Instructional area (m^2)	ready	Total support (JD)
Electronics	very good	adequate	250	'81	
Communication	very good	adequate	240	'81	120,000
Microwaves	very good	adequate	120	'81	
Digital systems	very good	adequate	90	'81	35,000
Acoustics/anechoic chamber	very good	adequate	130	'81	30,000
Machines	very good	adequate	430	'82	{ 100,000
Power	very good	adequate	300	'82	
Installation & maintenance	very good	adequate	250	'82	
Circuits & measurement	very good	adequate	150	'81	
Other labs control illumination	very good	not adequate	360 105	'81 '82	40,000 15,000
Printed circuits lasers electrical workshop	very good	not adequate	130 170 250	'81 '81 '82	35,000 20,000 60,000
Computer section	very good	not present	500	'82	
Semiconductors		not present	90	'81	30,000

Total invested amount 120,000 JD

Appendix 5.Ic

Mechanical Engineering laboratories

Laboratory or facility	Condition	Adequacy for instruction	Instructional area (m^2)	Total support (JD)
Metallurgy	planned to ordered	not operational yet	5974	30,000
Metropoly	planned to be ordered	not operational yet	5328	38,000
Vibration	some equip-ment on order	not operational yet	1076	11,000
Machine design	planned to be ordered	not operational yet	1292	10,000
Electro-mechanical control	planned to be ordered	not operational yet	1292	-
Auto engineering	-	-	-	4,000
Solar energy	-	-	-	12,000
Tribology	-	-	-	40,000
Workshop	some equipment available; more on order	adequate	20334	166,000
Fluid mechanics	most equip-ment available	adequate	4650	40,000
Thermodynamics	some equipment available; more on order	adequate	4133	20,000
Heat transfer	equipment on order	not operational yet	4650	60,000
Internal combustion	equipment on order	not operational yet	1292	30,000
Strength of materials	most equip-ment available	adequate	5328	-
General mechanics	some equipment available; more on order	adequate	861	-
Metal treatment	-	-	-	40,000
Compressed air	-	-	-	30,000

Appendix 5.Id

Chemical Engineering laboratories

Laboratory or facility	Condition	Adequacy for instruction	Instructional area (m^2) (planned)	Total support (JD)
Unit operations	equipment on order	not operational yet	6690	91,650
Heat and mass transfer	equipment on order	not operational yet	1300	14,600
Materials handling	equipment on order	not operational yet	1160	13,775
Fluid/particle mechanics	equipment on order	not operational yet	580	13,660
Crystallization	equipment on order	not operational yet	390	25,850
High temp. & pyrometry	equipment on order	not operational yet	580	29,550
Thermodynamics & combustion	equipment on order	not operational yet	870	13,850
Chem. reaction engr.	equipment on order	not operational yet	870	17,150
Biochemical engr.	equipment on order	not operational yet	390	22,050
Industrial processes	equipment on order	not operational yet	870	19,200
Process design	equipment on order	not operational yet	580	6,200
Instrumental analysis	equipment on order	not operational yet	1010	54,700
Constant environment	equipment on order	not operational yet	390	9,650
Cold room	equipment on order	not operational yet	390	-
Photography	plans for future equipment	not operational yet	300	-
Research	equipment on order	not operational yet	1010	38,400
General laboratory equipment				119,300

Total invested amount 60,000

Appendix 5.Ie

Architecture laboratories

Laboratory or facility	Condition	Adequacy for instruction	Instructional area (m^2)	Total support (JD)
Studio model workshop photo lab.				61,250

Appendix 5.IIa

Technical assistance

Department: Civil Engineering

Foreign senior academic staff visits

	Level and number	Area of specialization and duties	Period	Suggested starting date
EEC	2 Prof.	Structures materials (to be discussed in due time)	9 months (81/82) (82/83)	
FRG	1 Prof.	To teach construction and management	1 academic year 1980/1981	Oct. 1,1980
	1 Prof.	To teach concrete	1 academic year 1981/1982	Oct. 1,1981
	1 Prof.	To teach sanitary engineering	1 academic year 1982/1983	Oct. 1,1982

In addition to teaching the stated courses the visiting professor will advise the department on the available laboratories and will conduct seminars for faculty members and other interested Jordanians.

Foreign senior technicians' visits

	Number	Qualification	Job description/ area of specialization	Period
EEC	3	Diploma with 10 years experience	Material, soil and highways	4 months each 81/82 82/83 83/84
FRG	1	Diploma with 10 years experience	Setting up the sanitary laboratory and helping the local technician	1 year (81/82)
	1	Diploma with 10 years experience	Setting up the hydraulic laboratory and helping the local technician	1 year (82/83)

Training of Jordanian technicians abroad

	Level and number	Location	Training areas	Period	Suggested starting date
EEC	1	Concrete laboratory	Material	6 months 81/82	
	2	Soil mechanics laboratory	Soil	6 months 82/83	
	2	Highway laboratory	Highways	6 months 83/84	
FRG	1 Tech.	Concrete laboratory	Concrete	1 year 1980/1981	Oct. 1,1980
	1 Tech.	Highway and transportation laboratory	Highways	1 year 1981/1982	Oct. 1,1981
	1 Tech.	Soil mechanics laboratory	Soil	1 year 1982/1983	Oct. 1,1982
	1 Tech.	Sanitary and water supply laboratory	Sanitary	1 year 1983/1984	Oct. 1,1983

Industrial and academic visits of Jordanian academic staff

	Level and number	Area of research	Period	Suggested starting date
EEC	3 Ph.D.	Structures	3 months (80/81) (81/82) (82/83)	
	2 Ph.D.	Soil	3 months (81/82) (82/83)	
	1 Ph.D.	Highways	3 months (81/83)	
FRG	2 Ph.D.	Structures	Spring and summer	Feb. 1981
	1 Ph.D.	Soil mechanics	Spring and summer	Feb. 1982
	1 Ph.D.	Highway engineering	Spring and summer	Feb. 1983

Appendix 5.IIb

Technical assistance

Department: Electrical Engineering

Foreign senior academic staff visits

	Level and number	Area of specialization and duties	Period	Suggested starting date
EEC	1 Prof.	Control engineering teaching and establishing research programme	1 academic year 1980/1981 Sept. 1980	
FRG	1 Prof.	Telephony teaching and establishing M.Sc. programme	1 academic year	1981/1982 Sept. 1981
	1 Prof.	Electronic instrumentation & measurements teaching and establishing research programme	1 academic year	1982/1983 Sept. 1982
	1 Prof.	Digital systems teaching and establishing research programme	1 academic year	1983/1984 Sept. 1983
	1 Prof.	Electrical machines teaching and establishing research programme	1 academic year	1984/1985 Sept. 1984

Foreign senior technicians' visits

	Number	Qualification	Job description/ area of specialization	Period
EEC	1	Technician's degree plus 10 years experience or equivalent	Senior technician (communication and electronics)	4 months Sept. 1980-Jan. 1981
FRG	1	Technician's degree plus 10 years experience or equivalent	Senior technician (communication and electronics)	2 years 1981 to 1983
	1	Technician's degree plus 10 years experience or equivalent	Senior technician (electrical machines and electrical power)	2 years 1983 to 1985

Training of Jordanian technicians abroad

	Level and number	Location	Training areas	Period
EEC	1 Tech.	Electronics laboratory and printed circuits laboratory	General electronics	6 months 1980/1981
	1 Tech.	Digital systems laboratory	Microprocessors and computers	6 months 1981/1982
FRG	1 Tech.	Electronics laboratory and printed circuits laboratory	General electronics	1 year 1981/1982
	1 Tech.	Communication laboratory and microwaves laboratory	Communication engineering	1 year 1982/1983
	1 Tech.	Digital systems laboratory	Microprocessors and computers	1 year 1983/1984
	1 Tech.	Electrical machines laboratory	Electrical machines and electrical power	1 year 1984/1985

Industrial and academic visits of Jordanian academic staff

	Level and number	Area of research	Period	Suggested starting date
EEC	1 Ph.D.	Medical signal processing	June-Feb. June 1980	
	1 Ph.D.	Nuclear electronics	June-Feb. June 1981	
	1 Ph.D.	Digital telephony	June-Feb. June 1982	
FRG	1 Ph.D.	Medical signal processing	Spring and summer 1982	Feb. 1982
	1 Ph.D.	Nuclear electronics	Spring and summer 1983	Feb. 1983
	1 Ph.D.	Digital telephony	Spring and summer 1984	Feb. 1984
	1 Ph.D.	Medical electronics	Spring and summer 1985	Feb. 1985

Appendix 5.IIc

Technical assistance

Department: Mechanical Engineering

Foreign senior academic staff visits

	Level and number	Area of specialization and duties	Period	Suggested starting date
EEC	1 Prof.	Materials sciences metallurgy	9 months 81/82	
	1 Prof.	Computer aided design	9 months 82/83	
FRG	1 Prof.	Metrology	1 semester	1980/1981
	1 Prof.	Computer aided design	1 semester	1981/1982
	1 Prof.	Internal combustion engines	1 year	1982/1983
	1 Prof.	Heat transfer	1 year	1982/1983
	1 Prof.	Non-Newtonian fluid dynamics	1 year	1983/1984
	1 Prof.	EHD lubrication	1 year	1984/1985

Foreign senior technicians' visits

	Number	Qualification	Job description/ area of specialization	Period
EEC	1	Diploma or equivalent, minimum of 5 years experience in university or polytechnic laboratory	Materials science/ metallurgy	4 months 81/82
	1	= =	Metrology	4 months 82/83
	1	= =	Thermodynamics/ solid mechanics/ fluid mechanics	4 months 81/82
FRG	1 Tech.	Strength of materials	Setting up of equipment and experiments for stress analysis techniques	1 year 1980/1981
	1 Tech.	Fluids	Installation & laboratory organization	1 year 1981/1982
	1 Tech.	Metrology	= = =	1 year 1982/1983
	1 Tech.	Metallurgy/ materials science	= = =	1 year 1983/1984
	1 Tech.	Thermal systems	Internal combustion engines and other thermodynamic systems and heat transfer	1 year 1984/1985

Training of Jordanian technicians abroad

Level and number		Location	Training areas	Period	Suggested starting date
EEC	1	Materials science/ metallurgy	Instruments materials	6 months 82/83	
	1	Thermodynamics, heat transfer/ fluids	Instruments and machines	6 months 81/82	
	1	Mechanics of solids/ stress analysis	Instruments techniques	6 months 82/83	
	1	Workshops: metal	Maintenance and stock control	6 months 81/82	
	1	Workshops: wood	Maintenance and stock control	6 months 81/82	
FRG	1 Tech.	Workshops	Pattern making	1 year 1980/1981	Oct. 1,1980
	1 Tech.	Metallurgy laboratory	Heat treatment, welding and forging	1 year 1981/1982	Oct. 1,1981
	1 Tech.	Internal combustion engine	Maintenance and operation of various types of I.C.engines	1 year 1982/1983	Oct. 1,1982
	1 Tech.	Refrigeration and air conditioning	Operation and maintenance of equipment and running of tests	1 year 1983/1984	Oct. 1,1983
	1 Tech.	Metrology	Fine measurement techniques	1 year 1984/1985	Oct. 1,1984

Industrial and academic visits of Jordanian academic staff

	Level and number	Area of research	Period	Suggested starting date
EEC	1 Ph.D.	Materials science/ metallurgy	3 months 81/82	
	1 Ph.D.	Computer-aided design	3 months 82/83	
FRG	1 Ph.D.	Lubrication	Spring and summer	July 1981
	1 Ph.D.	Heat-pipe applications	Spring and summer	July 1982
	1 Ph.D.	Metal forming	Spring and summer	July 1983
	1 Ph.D.	Non-Newtonian fluid dynamics	Spring and summer	July 1984

Appendix 5.IId

Technical assistance

Department: Chemical Engineering

Foreign senior academic staff visits

	Level and number	Area of specialization and duties	Period	Suggested starting date
EEC	1	Process dynamics and control. To start research in this area and teach 1 course in control and 1 seminar to faculty members.	1 academic year 1980/1981	
	1	Plant design and economics. To start research in computer-aided design area and to teach relevant undergraduate courses.	1 academic year 1982/1983	
FRG	1 Prof.	Process dynamics and control. To start research in this area and teach 1 course in control and 1 seminar to faculty members.	1 academic year 1980/1981	Oct. 1,1980
	1 Prof.	Separation processes. (e.g. petroleum refining, crystallization, etc.). To start research in these areas and to teach relevant undergraduate courses and to give seminars.	1 academic year 1981/1982	Oct. 1,1981
	1 Prof.	Plant design and economics. To start research in computer-aided design area, and to teach relevant undergraduate courses and give continuing education courses.	1 academic year 1982/1983	Oct. 1, 1982
	1 Prof.	Same as per item 2	1 academic year 1983/1984	Oct. 1,1983

Foreign senior technicians' visits

	Number	Qualification	Job description/ area of specialization	Period
EEC	1	Higher national diploma or equivalent and minimum of 5 years experience in a Chemical Engineering department.	Operation and maintenance of equipment normally available in Chemical Engineering departments at university level.	Sept. 1981- Feb. 1982
FRG	1	Higher national diploma or equivalent with 10 years experience.	To participate in installation and commissioning of unit operation equipments.	1 year 1980/1981
	1	Higher national diploma or equivalent with 5 years experience in Chemical Engineering education establishments.	To lead the operational team responsible for the operation of unit operation equipments.	1 year 1981/1982
	1	Higher national diploma or equivalent with 10 years experience in instrumental chemical analysis.	To participate in installation commissioning and operation of the instrumental analysis laboratory equipments.	1 year 1982/1983

Training of Jordanian technicians abroad

Level and number		Location	Training areas	Period
EEC	1	Unit operations lab.	Operation and maintenance of teaching equipment in Chemical Engineering laboratories at educational institutions.	Sept. 1981-March 1982
	1	Chemical instrumental analysis lab.	Operation and routine maintenance of chemical instrumental analysis lab.	Sept. 1982-March 1983
FRG	1 Senior tech.	Unit operation laboratory	Operation and maintenance of teaching equipment.	1 year 1981/1982
	1 Senior tech.	Instrumental analysis lab.	Operation and routine maintenance of chemical analysis instruments.	1 year 1982/1983
	1 Tech.	Unit operation laboratory	Maintenance of electronic and mechanical equipments.	1 year 1983/1984
	1 Tech.	General lab. areas	Operation and maintenance of optical instruments.	1 year 1984/1985

Industrial and academic visits of Jordanian academic staff

Level and number		Area of research	Period	Suggested starting date
EEC	1 Ph.D.	Biochemical engineering single cell protein	4 months June 1981	
	1 Ph.D.	Computer-aided design	4 months June 1982	
FRG	1 Ph.D.	Separation operations	Spring and summer	Feb. 1981
	1 Ph.D.	Mixing effects in chemical reactors	Spring and summer	Feb. 1982
	1 Ph.D.	Powder technology	Spring and summer	Feb. 1983
	1 Ph.D.	Computer-aided design	Spring and summer	Feb. 1984

Appendix 5.IIe

Technical assistance

Department: Architecture

Foreign senior academic staff visits

	Level and number	Area of specialization and duties	Period	Suggested starting date
FRG	1 Prof.	Architectural design and construction	1 year (80/81)	Oct. 1,1980
	1 Prof.	Architectural design and landscape	1 year (81/82)	Oct. 1,1981
	1 Prof.	Architectural design and urban planning	1 year (82/83)	Oct. 1,1982
	1 Prof.	Architectural design and construction	1 year (83/84)	Oct. 1,1983
	1 Prof.	Architectural design and landscape	1 year (84/85	Oct. 1,1984

Training of Jordanian technicians abroad

	Level and number	Location	Training areas	Period
FRG	1 Tech.	Model workshop	Architectural model making	1 semester (1981)
	1 Tech.	Photo lab.	Architectural photo lab.	1 semester (1982)

Industrial and academic visits of Jordanian academic staff

	Level and number	Area of research	Period	Suggested starting date
FRG	1 Ph.D.	Architectural design and construction	Spring and summer	Feb. 1983
	1 Ph.D.	Architectural design and landscape	Spring and summer	Feb. 1984

CHAPTER 6 CONCLUSIONS

6.1 Organizational aspects of the cooperative relation.

The level of the academic staff members of the F.E.T., the realization of the buildings in phases II and III within the given time of the project, the available equipment and that to be bought with E.E.C. funds, together with the accurately projected development concerning quality and quantity of the Jordanian teaching staff--these things could make the F.E.T. an interesting and eminent partner for the T.H.D.

- It is very possible to interpret the F.E.T.'s request for "software" (exchange of personnel) in the above terms and to estimate its value for the T.H.D.

- The difference in development of the departments of the F.E.T. requires a differentiated approach to the request.

The Department of Civil Engineering is in a fairly stable developmental phase. The choice by students for this department is by far the greatest. Experience has been gathered from all the academic years. The first class of students has been graduated (60 graduates with a BSc degree). The curriculum has been stabilized; the academic staff can handle the program. The primarily Jordanian staff guarantees a great degree of continuity.
The Department of Architecture employs part-time professors as well as professors from abroad (UK).

The Departments of Electrical Engineering, Chemical Engineering and Mechanical Engineering are much less in demand by students. Among those enrolled--just as in the Department of Architectural Engineering--are many girl students who will mostly not enter the labor market. The curricula are often still being developed; experience has not been gathered from all the academic years. The teaching staff is sometimes subjected to great changes (for example, in the Department of Mechanical Engineering).

- In light of the above, the requests of all the different departments are more or less in need of updating. However, this is almost exclusively with regard to the software component.

- It is therefore desirable to have a flexible solution to the request for the software component. This holds for the yearly ratio of software to hardware, the time-phasing, the length of the mission as well as for the filling-in of persons. A rule to go by should be that within the 4-year framework of the agreement and the general financial space which is bid by the E.E.C. funds allocated for these purposes, the partners involved (T.H.D. and F.E.T. academic staff members) should seek the most optimal solution considering the specific circumstances, possibilities, wishes, etc.

- If it becomes apparent--as expected--that the T.H.D. cannot comply with all the quantitative and qualitative wishes for the software package, then a cooperative relation will have to be established among a number of technological universities in the European Community. Already existing contacts held by the F.E.T. as well as by the T.H.D. can serve as a guide in the choice of possible partners. In the Netherlands the T.H.T. and the T.H.E. can be considered. Moreover, the existing cooperative relation with the Imperial College of Science and Technology in London can be called upon.
  If additional cooperative relations of the F.E.T. with English institutes should be included, then the main place of coordination should be in Amman. It is there that the most benefit is gained from a well-run fulfillment of the project. It is also there that all the lines come together.
  This kind of multiple cooperative relations gives the F.E.T. optimal possibilities to call on specific expertise. At the same time it raises the chances for realization of this extensive project. In the case of English institutes the language problem will play a lesser role, for example in the exchange of technicians.

- A broad management organization which takes the responsibility for execution of the project, coordination, etc. does not conform to the nature of the inter-university cooperative relations.

- For the yearly evaluation of the progress of the project, an external expert (consultant) who is acceptable to all parties should be called in.

- With the interpretation and filling-in of the software component, it should be taken into account that the Dutch system of scientific

scaling and professors' ranks is different from the Jordanian system based on the American model. A large number of scientific staff members would fill a professor's position if the Jordanian rules were followed (according to the number of years of scientific work and publication activities). For all the departments of the T.H. there must be considered--in conference with the Jordanian counterpart--whether a full professor or scientific staff member can best serve the needs of the F.E.T.

- With respect to the estimated software costs it should be pointed out that the figures mentioned in the "Financial Proposal" do not comply with the staff rates calculated by T.H.D. For 1980 these were: (personnel costs per working day)

technician	fl. 400,-
senior technician	fl. 500,-
chief technician	fl. 640,-
lecturer	fl. 765,-
assistant/associate professor	fl. 990,-

These figures include salary and overhead costs, but they do not comprise travel and D.S.A. expenses.

6.2 Problems concerning the educational situation.

Scaling and recruiting policies with regard to the academic staff.

An education which is adapted in content, form and presentation to the socio-economic situation in Jordan and the region, and particularly to the expected developments in these areas, bids optimal possibilities for:

- motivation of students during their study (resulting in better study results).
- preparation with regard to knowledge, skill and attitude of the graduates--to become a technical expert or engineer (good career perspective, high job satisfaction, creative contribution as an engineer) as well as to be a citizen and member of a social elite (taking technical-political decisions with respect to the developments in the country).
- approach to the problems which Jordan and the region will be facing in the near and more distant future.

- It was ascertained that the criteria for scaling of the teaching staff of the F.E.T. (based on scientific productivity and measured by articles which treat subjects not necessarily relevant for the socio-economic situation in Jordan) will lead (and have led) to the build-up of a teaching staff with a broad and deep scientific knowledge that is not necessarily arising from the relevant problems in Jordan and the region. (Degrees are primarily earned in Western, and often renowned, institutions.)

- Since the law discourages consulting, a natural inflow of Jordanian practical experience is not guaranteed. This inevitably will be reflected in the content, form and presentation of the curriculum. Moreover, the use of the mentioned criteria compel the professors (with their promotion in mind) to carry out regular scientific activities (mainly) in the West. This could contribute to less optimal educational situations in the F.E.T.

- Although the Syndicate (Association of Engineers, in many ways comparable with our K.I.V.I.) should control adherence to the rule discouraging consulting (and may give fines), it is apparent that in practice consulting occurs in varying degrees, but of course not

under a regime of rules for balanced distribution of time and benefit. Here, too, unfavorable situations can arise with respect to the training and thus affecting the students.

- There can be numerous improper solutions for the problems mentioned. A central issue in this connection should be the drafting of criteria for the scaling of academic staff members, which deviate from the criteria applied to the rest of the University of Amman. Practical experience and contacts in trade and industry should be given much greater emphasis in this regard.

- Existing plans for the establishment of a so-called Global Office together with the Yarmouk University, the Association of Engineers and the Royal Scientific Society (the latter being more or less comparable to the T.N.O. in the Netherlands), in order to regulate consulting by the teaching staff of the F.E.T. (and also of the polytechnic), should be carried out without delay.

- The rules concerning time investment and reimbursement to be prepared by the Global Office should be primarily directed toward the interests of education. At least a portion of the income from consulting should be used to the advantage of the F.E.T. These rules should receive a legal basis.

- Participation or involvement by students in such projects--within the scope of practical work (summer training of 8 weeks) or design projects--should be strongly encouraged wherever possible. Rules for the reimbursement of activities by students participating in consulting work should also be created.

- During the discussion periods which are amply provided in the curriculum, much thought should be given to the practical problems confronting the staff members (and possibly the students).

- Since a (possible) cooperative agreement between the F.E.T. and the T.H.D. (and other institutions) will bid good possibilities for gaining knowledge of current practices concerning consulting work in the Netherlands, a few facets should be pointed out here which could

conceivably hinder comparison. At the same time these facets serve as reasons to progress with caution in striving toward more freedom in consulting work in Jordan:

- the Dutch society cannot serve as an example for the yet scarcely industrialized, centrally governed Jordanian society.
- the elaborate academic staffs of departments and branches in the Netherlands can absorb discontinuities in time-allotment of staff members. Such discontinuities will present much greater problems in the case of the still-developing F.E.T.
- The T.H.D. has a long history of development, making it possible to have a balanced interplay between societal needs and educational offers. The more dynamic, unbalanced situation of the younger F.E.T. in the developing country of Jordan will demand disproportionately great attention by professors for the evaluation and adjustment of the educational curriculum.

- All of these arguments appear to be in favor of stricter rules with regard to consulting work in Jordan.

- Although the law provides for obligatory participation by Jordanian engineers in the realization of industrial establishments in Jordan by foreign enterprises, this apparently does not occur in all professional areas (for example, good participation in the area of civil engineering, but poor participation in the area of chemical engineering). More stringent governmental measures are apparently necessary. If the F.E.T. is to be made into a viable and outstanding institution, then the Jordanian professors should have had the opportunity to acquire the necessary expertise in their own country.

- A higher (and possibly more specialized) educational level of the graduates will be a better guarantee for gaining access to industrial know-how in the near future.

- In order to reach the desired level, support from foreign (among others, Dutch) institutions will often be required. In this situation of (temporary) vacancy-filling, allowance will have to be made for relatively long detachments in Jordan.

- Raising the level of the Amman graduate engineer has consequences for

the engineer trained elsewhere (in Jordan, or the larger group trained abroad). An improved coordination with the University of Yarmouk (and if ever possible with those of Nablus and Birzeit) could lead to a satisfactory situation within Jordan. The diversity in educational levels of the engineers trained abroad will be the source of increasingly critical problems. Besides the potentially more rigid requirements by the Association of Engineers for registration in Jordan, or the registration in two levels (linked to levels of responsibility with regard to professional practice), new courses as well as post-graduate courses should be offered. In addition to courses followed at or under the auspices of a scientific institution, television education is a possibility.

6.3 Recruiting and training problems with regard to the technical and administrative staffs.

Technical and administrative staffs of sufficient size and level are necessary for the development of the F.E.T.

- Although the technical training possibilities (vocational schools and polytechnics) are growing in size and level, it may be ascertained that this offers an insufficient basis for the projected qualitative and quantitative growth of the F.E.T.

- The relatively low salary of the technical staff is the most important cause for the lack of enthusiasm in seeking a position at the F.E.T. Trade and industry in Jordan, and even more so in the rich oil states of the Persian Gulf, absorb a major proportion of the manpower as a result of better salary offers.

- The low salaries, absolutely seen, (with regard to the standard-of-living level) provide the technicians with a very low status in the Jordanian society. This results in great social pressure on university education together with decreasing application for non-university technical training. Another result of this social pressure is that the vast majority of the technological university educations of Jordanian citizens are earned abroad. Particularly boys in the upper social levels are able to make use of this possibility. On the one

hand the extremely high selection threshold of the F.E.T. can be avoided; on the other hand a very high status can be gained through study at a well-known institute.

- Concerning the administrative staff it is also the (absolute) low salaries which lead to undesirable situations. In the first place it is primarily the women who are willing to accept these conditions; this means that the administrative staff (through marriage) is always subjected to change. In the second place the educational level is (too) low for the necessary efficiency in this mainly English-language education.

- It is needless to say that job satisfaction for both categories of employees is not always high. The incomes are scarcely adequate or even inadequate to support oneself, so that a second paid job (for example, taxi driver) is necessary.

- The solutions to these problems as they are managed by the F.E.T. are artificial but efficient. Graduates (BSc) with extremely high marks (for example the 5 best of their year) receive a contract offer. This provides them with a temporary appointment as technician for roughly one year, after which the opportunity is given for further study abroad in order to complete their education (MSc and PhD). In fact the vertical displacement of engineers, which Wagner has pointed out, is in practice here.
  Technicians are offered a higher education (for example at the R.S.S. and in the future at the F.E.T.) with the obligation to commit themselves to the F.E.T. for a number of years. After that their knowledge and skills can be diverted toward the aims of industry (...).

- Proper solutions, as we see them, can only be achieved through raising the status and the income linked with it. This holds for technical as well as administrative functions. Diminishing the salary differences of technicians and engineers on the one hand and of technicians employed at the F.E.T. and in industry on the other hand, could increase motivation for a job at the F.E.T.

- Particularly the polytechnic will have to keep pace with a very broad expansion of the technological university education in Jordan.

- Entrance in the F.E.T. should be made possible for a (tentatively) very limited category of graduates of the polytechnic. (At present a small percentage of the students are admitted to the F.E.T. who do not have to meet the requirements with regard to the Tawjihayi.)* These students could fill a part-time technical function at the F.E.T. during their study (a requirement which could perhaps be temporarily bound--on improper grounds--to admission to the F.E.T.).

- If the F.E.T. takes the continued education of technicians in its own hands, which is probable, a satisfactory (but improper) solution for the problems under consideration can be expected; training directed toward the needs of the F.E.T. is thus possible. The qualitative as well as the quantitative aspects can be planned.

- It is nevertheless recommended that the specific expertise and facilities present at the R.S.S. and the polytechnic of Amman be taken into consideration when setting up the courses mentioned.

- The training possibilities offered by industry from which apparatus is purchased should definitely be pointed out here. Knowledge gained in this training can be subsequently integrated in the F.E.T. courses.

- Concerning the spending of E.E.C. funds for the exchange of staff, emphasis should be placed on works "on location." The exchange of knowledge and experience should preferably occur in the relevant work situation (in Amman).

- Elaboration of educational television programs to include technical education should be considered. At present these are directed only at education through the high school level.

6.4 Upgrading/modernization of education.

In a developing society such as that of Jordan, in which industrialization to a large degree must still take form, the universities should take extra care in the continual anticipation of planned or otherwise expected developments.

- Engagement of the universities in the national long-term planning

* See page 13.

(5-year plans) is desirable.

- The lack of realistically coordinated long-term planning for the region makes anticipation of regional developments extremely speculative.

- With a definite attuning of the curriculum to the activities in the region, which is linked to the expectations of sort and number of labor positions during a period of at least one decade, greater caution should be taken than is apparently the case at present.

- A more realistic prognosis will acknowledge, moreover, that political stability in the area in question can hardly be expected. Intensification of multinational consultation among universities (periodical consultation among the deans of technological universities) can be useful (for coordination level, determination of main topics, etc.) but remains of limited relevance.

- Fear for political influence (real or unreal) by Jordanian engineers in neighboring countries (in view of their less feudal and more liberal-religious background) appears already to lead to the instigation of measures which could limit the regional labor market for the Jordanian engineer, e.g. recruiting Philippino and Korean laborers for work in the rich oil states of the Persian Gulf.

- A more realistic manpower planning and a less speculative upgrading of the education appear to be necessary in order to guard Jordan against great unemployment problems in the long run.

- In the education at the F.E.T. more use should be made of part-time teaching staff than is presently the case. Under the responsibility and supervision of a full professor, these special teaching staff members could promote particular parts of the curriculum, for example by assisting in design exercises or graduate projects, by serving on the examination committee, by participating in discussion groups (inasmuch as these are practically directed), by setting up an audio-visual data bank, etc. The earlier-recommended changed scaling criteria for professors would be applied here.

- Modernization and expansion of the branch libraries should receive

high priority (books as well as magazines).

- Outside the circuit of magazines directed toward the markets of the highly industrialized countries (both East and West), it would be desirable to publish a technological Arab magazine of international interest, directed primarily toward the domestic market. Execution of this plan could be carried out by Yarmouk, F.E.T. and R.S.S., for example. Market research should be able to indicate whether a division in professional areas (as is the case of the JASE) is possible. The great number of universities in the region would seem to be an adequate basis in order to offer such a magazine. Publication of at least a portion of the contents in the English language would make international recognition and appreciation possible.

- The use of English during lectures and not for instruction and discussion gatherings is commendable. Access to the international literature is thus guaranteed. Moreover, in this way it can be avoided that the question of a language barrier is raised when finding employment at one of the many foreign (European, American) enterprises which operate in the region.

- In order to compensate the declining level in the knowledge of English (as was noticed in the F.E.T.), setting up a language laboratory could offer a solution. In addition to complying with the compulsory part of the program (university requirement - English) there is the possibility of making the laboratory available to students and staff outside class time. Extramural use (e.g. in courses by, or in cooperation with the R.S.S.) is also possible.

- The contemplated plan of the F.E.T. for modernizing the audio-visual component of the educational package is praiseworthy. The availability of a central audio-visual service is important in this connection. Possibilities include (video) films of practice cases, of one-time events such as trial tests, of routine information, instruction films, etc. If no moving pictures are required, a slide series could serve the purpose. Besides use along with the program's courses and in the laboratory, this kind of information could also have a reference function through availability outside the class and laboratory time.

6.5 External democratization.

- Participation in Jordanian education is compulsory up to the age of 16 and is free of charge. After this elementary and preparatory education, varied possibilities for vocational and scientific training are offered.

- The Tawjihayi (General Secondary Education Certificate Examination) is a deciding factor for admission to a university. It is taken yearly by a relatively large number of students from various strata of the population (60% of the 15-17 year-olds participated in secondary education in 1979-80). Status and income considerations intensify social pressure on the universities.

- After creaming off the select top layer for medicine (with a Tawjihayi score of 95% or more) the second choice is for technological university education--still with a very high selection threshold of 93% or more for the Tawjihayi. In spite of these large admission limitations, 14.5% of the 18-23 year-olds in 1979-80 studied at a Jordanian institution for university education.

- Enthusiasm for education in civil engineering is by far the greatest. For this reason many must be content with a second choice. Many girls choose for education in the field of architecture, chemical engineering or electrical engineering (which compose 1/2 to 2/3 of the student population). Because these girls disappear from the labor market after marriage, the intake differences between these branches and that of civil engineering appear more pronounced in the number of available engineers on the labor market.

- The fact that 4702 of the 11757 students in Jordanian universities in 1979-80 were female means that in addition to preparation for professional practice, the university plays an important role as a general cultural institution. This can equally be seen as a source of diminishing returns for the university.

- The social top-layer often chooses famous foreign universities for their sons, sometimes also a "simpler" education, because the chance of success would then be greater (or because the Tawjihayi scores were

not sufficient for admission to the F.E.T.). The result is that many more Jordanian engineers are trained abroad rather than in their own country. (At present there are 8000, spread across universities in Eastern and Western Europe and in the Middle East, as opposed to 800 students in the F.E.T.) In addition, the final level of engineers entering the Jordanian market is widely divergent.

- A social middle layer, as far as the boys are concerned, makes up the student population of the F.E.T. The financial thresholds for attending school between the age of 16 and the second academic year form a barrier for an effective external democratization in the educational system. That is to say, these thresholds prevent that equal opportunity be given to all social strata in obtaining education which is attuned to the talents of the individual in question. It is particularly the expensive first academic year (tuition is for example 4 to 5 times the monthly salary of a school teacher), for which no interest-free loan is granted by the state, which puts pressure on the financial carrying-capacity of the family.

- The greater size and closeness of family ties probably act somewhat as a compensating factor.

- Scholarships are scarcely granted.

- It is recommended that the government extend the possibilities for receiving an interest-free loan to cover the first academic year.

- It is recommended that the government introduce a scholarship system which would permit the good students to keep their study debts to a minimum. On the one hand this forms an extra stimulus for academic success; on the other hand it places the graduate in a financially more similar position with respect to the engineer educated abroad.

- The raising of the license norms (carried out by the Association of Engineers for entry in the registers) implies that additional training facilities should be offered to the engineers who were trained abroad and who have a deficient education. In this way the study-debt differences would also be levelled.

- For a poor country such as Jordan study abroad implies an undesirable flow of currency toward foreign countries. Compensation measures to be carried out by the government are conceivable. These measures could help in the achievement of a more balanced distribution of students over technological educational institutes (because the choice for an academic education abroad would be made less attractive). At the same time all the graduates could be placed in a similar financial relationship with the government.

- In the event of declining employment perspectives in Jordan the government could manipulate the admissions norm of the engineers educated abroad and use this as a planning instrument. This could be effected through the Association of Engineers and would affect those engineers with an education that was not attuned to the needs of the country and region.

6.6 The technological university education.

It is the intention of the academic staff to make the F.E.T. into an outstanding and viable institution. The expertness of these staff members, the solid curriculum and the facilities which will be available (buildings and equipment) offer a sound basis. Moreover, substantial measures have been drawn for the expansion of the Jordanian body of professors. This is a bit less valid for the technical and administrative personnel.
Besides the earlier mentioned characteristics concerning weak and strong areas in the engineer's education at the F.E.T., a number of marginal notes can be made.

- The upgrading of the F.E.T. does not appear to be sufficiently integrated in the national planning of the entire technological education. No optimal contributions can be expected in the following areas: solutions to the socio-economic problems of Jordan and the surrounding region, promotion of economic development, and strengthening of the infrastructure in the Arab world.

- Horizontally seen, there is no (good) coordination between the educations of the various universities--Amman, Yarmouk and perhaps Birzeit and Nablus--which would be able to lead to a division of specialisms

and main topics and to a coordination of the educational levels.

- Vertically seen, the vocational (secondary) institutes, technical and engineering institutes (polytechnic) and the F.E.T. appear to offer educations which are not sufficiently coordinated with one another. Vertical transfer of students from the polytechnic to the F.E.T. is not possible, for example.
  An important amount of frustration appears to lurk behind the practically non-existent contact between the F.E.T. and the polytechnic. Rivalry has played a primarily negative role here. The Technical Engineering Institute of Amman (Polytechnic, established in 1975) appears to offer a sound education. Laboratory and workshop exercises are supported by an impressive arsenal of modern apparatus and high-level teaching staff. (The institute is financed by the Ministry of Education and has a current equipment budget of approximately ½ million guilders.) A smaller polytechnic will be ready in 1981 in Hussein City near Irbid (with other specialties). The government financing gives this same government (Ministry of Education) a grip on the graduates (among others, the laboratory technicians).
  Tripartite consultations among Ministry of Education - polytechnic - F.E.T. concerning a possible temporary employment of laboratory technicians at the F.E.T. (instead of at the Ministry of Education) could lead to attractive solutions for all members. Study facilities at the F.E.T. should be considered in this connection. It is possible that the status of this polytechnic training should be re-evaluated (such as occurred in the Netherlands, resulting in the granting of the ing. title). Extension of the study (for a portion of the student population) is perhaps necessary for achieving this purpose (from 3 to 4 years).

Reduction of the salary differences between graduates of the polytechnic and the F.E.T. (BSc) seems reasonable. Moreover, this would stimulate enthusiasm for the mentioned technical training. The resulting higher application should be made possible by elaboration of the facilities proportionate to those of the technological university education (which will be more than five times greater with the completion of the Yarmouk extension plans). At the same time the social pressure on the engineer's education could be lightened (the F.E.T. admitted a total of 160 students in 1979-80 from a total application of 9000). Moreover, more high-level technicians will become available for functions at the F.E.T. as a result.

- There is no clear national long-term planning for employment, which could give insight into the distribution by sort and number of functions that will become available during this period. Uncertain political developments make this kind of planning extremely difficult--and speculative. Perhaps the forthcoming 5-year plan (1980-1985) will throw some light on these developments (available in spring of 1981).

- Interaction with the practical situation does not function optimally. Even the officially available possibilities are not fully used, notwithstanding the good contacts which exist on a professional level between individual academic staff members and members of practically oriented organizations as the R.S.S. and the Syndicate. Moreover, expertise inherent to the T.N.O.-type of activities is not always recognized and is sometimes underestimated--therefore not used by the F.E.T. On the other hand, the bureaucracy is seen as an obstacle for more formalized cooperation. It is also clear here that rivalry has disadvantageous effects. The Dutch practice that T.H.D.-professors, through management functions, for example, are directly called into T.N.O. activities prevents such communication problems.
  At present the reproach is made that two of the most important industrial developments in Jordan (phosphate and potash production) are not sufficiently reflected in the curriculum.

- Perhaps seminars, if more frequently organized, could function as intermediary between the F.E.T. and the R.S.S.

- The possibilities for receiving continued training in industry, which exist in the higher industrialized countries, are (almost entirely) lacking in Jordan. This could mean that besides the category of graduates with a broad general education (leading to MSc or perhaps to BSc) directed toward small industry and government, another group of students will necessarily need early specialization in order to achieve the required level. For this reason specialization for at least this portion of the students in the present fifth year should be made possible by offering elective courses. It is for this group of students that a continued education (leading to a MSc and PhD) should be realized on short term. It is worth mentioning here that the plans of the F.E.T. (the projected staff development and the equipment requested) anticipate such a development.

6.7 Cultural aspects of the education.

The F.E.T. aims at fulfilling the needs of (the people of) Jordan and the region. It is clear that these needs are of a socio-economic, thus political nature.

Two dominant characteristics of the Jordanian society are important in this connection: Islam as the state religion and strong family ties. It is demographically interesting that the population is composed of two different groups, Bedouins and Palestinians. The creation of the state of Israel and the occupation of the West Bank by Israel in 1967, together with a high natural population increase led to a growth of 450% in 25 years. A large part is composed of the many Palestinians who arrived due to military actions. The somewhat higher average in training level of this population group has already led to considerable tensions in Jordan's short history.

Economically seen, the loss of the West Bank was quite important, for it meant the loss of the vegetable (80% reduction) and fruit garden (45% reduction) of Jordan. In addition, the income from the tourist industry declined drastically. Great efforts in the realization of irrigation works in the Jordan Valley have gradually been able to compensate this loss. The cultivatable part of the land, however, is only 5-6%; the rest is desert or rocky terrain.

In the Jordanian industry the service sector holds an extremely important place (two-thirds of the GNP in 1979). In the order of their contributions to the GNP, we find within this category the governmental services, wholesale and retail trade (including the restaurant and hotel branch), financial services and transportation and telecommunications. The tourist industry is stimulated by the decline of Beirut. Many Arabs come in the summer to the climatologically milder Jordan. Charter flights carry West Europeans to Aqaba, where the hotel accomodations are being greatly expanded.

The most dynamic sector is that of transportation and telecommunications. The re-opening of the Suez Canal has led to an increase in the harbor traffic (from 1974 to 1979 a tripling of freight and quadrupling of the number of ships), for which expansion of

the harbor was necessary several times. The installation of "free zones" near Aqaba has greatly stimulated transit traffic. A new national airport is being built near Amman. A second airport for domestic flights is situated near Aqaba.

Almost a quarter of the economically active population is presently employed in agriculture and horticulture. Production has suffered from a series of four droughts. It is hoped that a doubling of the irrigated land can be realized in the 'eighties. At present two-thirds of the consumption food in Jordan is imported.

Middle-sized and small businesses make by far the largest contributions to employment in industry; however, the most important contributions to the GNP come from a very limited number of large industries. The smaller companies are directed to a great extent toward food-processing and the clothing industry. They are primarily concentrated in the area around Amman-Zarka. Many companies have been transferred from Beirut to Amman (260 new companies were registered in 1979).

The three largest industries are phosphate extraction, cement manufacture and oil refinery. Three phosphate mines are producing at present with a total capacity of 4.5×10^6 tons in 1980 (mines in Rusaifa, Wadi Husa and Al-Hasa). A large phosphate fertilizer plant is under construction near Aqaba. The building of two sulphuric acid plants (1800 tons/day capacity) and a second fertilizer plant is foreseen for the coming period of five years. Transport of the ore takes place at present by rail to Aqaba. A new phosphate extraction area near Shadiya is in development.

The cement factory at Fuheis has recently been expanded and now has a yearly production of 1.1×10^6 tons, which will be expanded to 1.6×10^6 tons in 1981. A second factory is projected near Aqaba.

Petroleum refining takes place near Zarka. The present production level is 2.4×10^6 tons/year; this will be increased to 3.5×10^6 tons/year, covering domestic needs.

Glass and ceramics industries have developed on the basis of domestic raw materials. Further, copper and manganese ore deposits are known. Uranium and vanadium are apparently present in small amounts in the phosphate ore. A large potash plant will

be completed near the Dead Sea in 1981 (full production around 1984/85). In the last few years American, French and Japanese concerns have been active in oil exploration.

The building sector has undergone an important development, although stabilization seems recently to have been reached. This development is partially a result of real estate investments by Jordanians who were employed abroad. The transfer of companies from Lebanon has also been a stimulating factor. And finally the growth of the tourist industry should be mentioned.

Two important sources of earnings for the country are the remittances from Jordanians working abroad, and the gifts and loans from a great many countries (U.S.A., U.K., Saudi Arabia, Libya, Iraq and Kuwait). These latter contributions compose roughly half of the state income.

- The trained engineers will play an important role in building up the country and satisfying the needs of the inhabitants. In the first place, as engineers they will help in changing the environment and conditions for living. In the second place, as well-educated elite it can be expected that they will exercise political influence. In particular, political influence on society as a politician-with-technological-specialty is of great importance.

- It is thus very important, too, that as students they have learned to see what kind of influence technology has on society. Only when they have learned to recognize the social implications as an integral part of their work will they be able to carry out their tasks as socially responsible engineers.
  The F.E.T. must educate its engineers in this sense. Courses in the curriculum (such as philosophy of science and history of technology) having the above-mentioned purposes should thus never be electives.

- The Student Union can have an important function in this cultural forming. Discussions which are launched in classes can be continued outside class time. An extra-curricular program organized by the Union ("Studium Generale") can also be noted as an important feature. Ideas include the organization of lectures, expositions and discussions on topics which appeal to students and which illustrate the social

implications of their future activities as engineers.

- Thus a plea must be made for the founding of such a Student Union. On the other hand, a coordinating organization of the existing departmental student associations, once it has been set on the right track and is actively supported by the university, can also serve these purposes.

APPENDIX 6.I

List of Abbreviatins

E.E.C. - European Economic Community
F.E.T. - Faculty of Engineering and Technology, University of Jordan.
JASE - Journal of American Society of Engineers
K.I.V.I. - Koninklijk Instituut van Ingenieurs (Royal Institute of Engineers)
R.S.S. -The Royal Scientific Society, Amman
T.H.D. - Technische Hogeschool Delft(Delft University of Technology)
T.H.E. - Technische Hogeschool Eindhoven
T.H.T. - Technische Hogeschool Twente
TNO - Centraal orgaan voor Toegepast Natuurwetenschappelijk Onderzoek (Organization for Applied Scientific Research in the Netherlands)

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