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4 June 1985

Turkey

TRAINING AND SUPPORT SERVICES FOR REPAIR  
AND MAINTENANCE OF BIOMEDICAL EQUIPMENT

TURKEY  
DP/TUR/84/003/A/01/37

Project Findings and Recommendations

Technical Report Prepared for  
the Government of Turkey

by

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expert of the United Nations Industrial Development  
Organization  
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the United Nations Development Programme

This report has not been cleared with the United Nations  
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therefore necessarily share the views presented ./n/

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/n/ To be omitted after clearance by UNIDO

Table of Contents

		<u>Page</u>
1.	Summary	11
2.	Introduction	2
2.1	Project, background	2
2.2	Objectives of the report	3
3.	Findings	3
3.1	Activity	3
3.2	Findings	3
3.2.1	Assessment of data of biomedical equipment	3
3.2.2	Assessment of the required manpower	3
3.2.3	Assessment of the required training	4
3.2.4	Survey of the employment of technicians	4
3.2.5	Future curriculum of EBOEM-Gebze	4
3.2.6	Expansion of EBOEM-Gebze centre	5
3.2.7	Mobile service unit	5
3.2.8	Cooperation of Middle East Technical University and THY hospital	5
3.2.9	Health related technical activities at Boğaziçi University	6
4.	Recommendations	7
4.1	EBOEM-Gebze vocational training centre	7
4.2	Centre for Medical Instrumentation and Logistics	7
4.3	Finalization of the protocol between Ministry of Health and Boğaziçi University	8
4.4	MEU and THY cooperation	8
	<u>Annexes</u>	
1.	Job description	9
2.	Persons and places visited	10
3.	Number of hospitals and hospital beds	11
4.	List of repair and maintenance centres of Ministry of Health	12
5.	Immediate objectives of project DP/TUR/80/012	13
6.	Outputs of project DP/TUR/80/012	14
7.	Work programme for 1985 budget of DP/TUR/80/012	15
8.	Draft project document of DP/TUR/84/003	16
	References	29

1. Summary

- 1.1 The government decided to handle the health institutions from the management perspective to increase service productivity. This includes the steps which has to be taken to prevent wastage of medical equipment, improve the maintenance and repair services and training of the necessary personnel.
- 1.2 The total growth rate of hospital beds in the last ten years is 19%, and the number of medical equipment in the Ministry of Health (MH) amounts to a minimum of 19 thousands pieces. This indicates a significant growth in the number of equipment.
- 1.3 Around 750 technicians are required for repair and maintenance in MH alone, but presently only 20% of this is available.
- 1.4 With its present capacity the EBOEM-Gebze training centre appears to have enough requirement for new courses at least for a decade to come. With its expanded capacity by addition of important range of equipment additional demand for training will be created.
- 1.5 Mobile service unit is recommended for on the job training activities.
- 1.6 The expansion of the training centre should be in Gebze within the present institutional framework. New training centre in Haydarpaşa is not required.
- 1.7 Ministry of Education and Ministry of Health shall renew their present protocol in a way that it should refer to the activities related to the Instrument and Logistics Centre as well.
- 1.8 Boğaziçi University's biomedical engineering project in its extended form does not overlap with the present draft project document. (Annex 8.)
- 1.9 The protocol between Ministry of Health and Boğaziçi University in its final form should take into consideration the goals and activities proposed in the draft project document, and be a frame agreement. The objectives shall be described in two protocols. The second protocol should be based at a later stage on the achieved results in the manpower development and hospital inventory system activities.
- 1.10 Middle East Technical University and THY hospital cooperation in establishing and running a clinical engineering department in the hospital shall be supported.

The rate of exchange, as of 30 May 1985:

1 USD = 537,85,-fl

## 2. Introduction

2.1 **Project background.** The health care has been in Turkey a major concern for long time to the government. The "Five Year Development Plan 1985 - 1989" (ref 1.) emphasises that health institutions will be handled from the management perspective to increase service productivity. This includes the steps which has to be taken to prevent wastage of medical equipment and apparatus, improve the maintenance and repair services and to train the necessary personnel. It is planned to provide new guidelines and develop those services which relate to the selection, procurement, conservation, maintenance, repair and calibration of medical equipment and instruments.

The government already in 1975 asked UNDP assistance to make survey and recommendations for maintenance facilities of biomedical equipment in major centres in Turkey. Based on this a UNDP/UNIDO report was prepared. (ref. 2.) The recommendations set out in this report are in line with those stressed by the Five Year Development Plan.

As a first step to implement some of the recommendations the government with UNDP/UNIDO assistance (project DP/TUR/76/048) established a vocational type training centre (EBOEM) for repair and maintenance of biomedical equipment. After the first phase of its development had been achieved this centre started to operate in Kocaeli-Gebze.

As a second step to implement certain recommendations the government with UNDP/UNESCO assistance (project DP/TUR/80/012) rendered assistance to Boğaziçi University Biomedical Engineering Institute to support its activities and strengthen its capacity.

Both above mentioned projects had been completed. Based on the experiences the Boğaziçi project (TUR/80/012) has been revised and extended into a second phase.

To continue the expansion of the EBOEM centre into the vital field of i.e. x-ray equipment service, and to initiate the introduction or strengthening of certain elements of the cost conscious equipment management system in the MH (Ministry of Health and Social Assistance) a new project document proposal was prepared under the title: Training And Support Services For Repair And Maintenance Of Biomedical Equipment (D2/TUR/84/003).

From the late 1983 onward the Turkish Advanced Specialization Hospital (TYIH) in Ankara (which is one of the most advanced hospitals of MH) and the Department of Electrical Engineering of Middle East Technical University (METU) signed a contract to administer, manage and control the Medical Equipment and Maintenance Unit (TABOM) located in the hospital. According to the information received METU prepared a project proposal: Assistance To Electrical Engineering Department of METU in Establishing A Medical Equipment Repair And Maintenance Unit. This planned UNDP project could serve to build up the first clinical engineering department in Turkey, and according to our best knowledge the first one in the whole region.

All these activities are very significant in reaching the goals set down in the Development Plan. However since these activities are running independently from each other it is almost inevitable that certain overlapping could occur. It is of particular importance that the coordination should be carried out from as early stage as possible. UNDP/UNIDO by preparing the present report would like to act in this line.

- 2.2 The objectives of the present report are: to assess the usefulness in the future of the planned activities, ensure complementarity between the various activities in Ankara and Istanbul, to finalize the Draft Project Document. (Annex 1.)

### 3. Findings

- 3.1 **Activity.** During the first period of my mission I visited persons and places involved or related to the above activities: Ministry of Education, Ministry of Health, State Planning Office, Boğaziçi University, Middle East Technical University, EBOEM-Gebze, the Bakırköy Centre of MH in ISTANBUL and the hospital where the III. grade repair and maintenance on the job training course was conducted by EBOEM. (Annex 2)

#### 3.2 Findings.

- 3.2.1 **Assessment of available data of biomedical equipment in Turkey.** The present number of hospitals and hospital beds in the country are 630 resp. 119.770 (Annex 3.). This represents an average 1.3 % annual growth-rate in the number of beds in the last ten years. The total growth rate of hospital beds is +19 % while the same figure in MH corresponds to +13 % slightly lower than the average. At the same time the increase of the number of beds/hospital was +62 % in MH while the average was +56 %. This indicates that the tendency of concentrating the capacity in the bigger hospitals is an ongoing tendency.

According to the available statistics in the MH the minimum number of presently available medical equipment in MH is 19.505 pieces. This figure is almost three times of the one available eight years ago. The actual growth in reality is certainly less. The great difference in figures indicates that in elapsed time the data collecting activity has been improved, too. The present system can not offer high reliability in data collection.

- 3.2.2 **Assessment of the required manpower.** Based on capacity calculation similar to one applied in the app. 3 of ref. 2. approximately 750 technicians would be needed to repair and maintain the almost twenty thousand equipment. The MH employs 30 engineers and 123 technicians. Thus in the best case 20 % of the required capacity is available. (Which is significant change to the situation seven years ago, when only 7 % was available.)

3.2.3 Assessment of the required training. In the EBOEM vocational training centre in Gebze currently there are three courses and a fourth is planned. Each course lasts three months, and due to the capacity of the laboratory the attendance can be a maximum of 20 students. If one assumes that all of the required 750 technicians would take part in the four courses this would require 38 courses. Since with its present capacity only 3 courses/year can be organized this would take 12.5 years to complete. (So far 9 courses were organized.) The number of students should actually be calculated to be more than 750, due to the natural manpower fluctuation. Thus we find the real training need to be rather much higher.

The calculation was based on the MH figures but in the future other organizations will also and certainly participate and send their technicians to these courses. This may balance the fact that most probably the MH will not reach very soon the indicated 750 technician level.

Beside the regular three months lasting courses special short term courses will surely be organized in the future as well. This would add to the load of the centre.

3.2.4 Short survey of the present employment of the technicians trained under the previous period. According to statistics in EBOEM so far 183 students attended the first (basic) course and 168 passed the test. The second and third grade courses were attended by 80 resp. 30 students. The higher courses were attended mainly by those who, passed the tests of the basic course. Therefore one can assume around 200 the total number of the different individuals who attended the course. (I did not have time to check every name in the EBOEM main book to find out the exact number of different individuals.)

According to MH statistics so far 10 electronics technicians have quitted their job at the ministry: four of them joined the Turkish Electricity Authority, and six work as freelancers. All who left MH went for considerably higher salary. The figures indicate that only 5 % of the trained people have left MH after the training, which is not an alarming figure. The other technicians work in different workshops of the MH.

It seems that the present courses conducted in EBOEM meet real need. Basic and advanced courses in electronics and electromedical equipment are really needed.

It is obvious that a relatively young teaching institution like EBOEM can not be expected to cope with the variety of needs and expand its activities suddenly. Bearing in mind that being the first vocational centre for medical equipment in Turkey it became, definitely, a course setting institution.

3.2.5 Future curriculum of EBOEM. As far as the curriculum is concerned EBOEM centre in Gebze should continue its teaching activity aiming at the technicians' vocational training in the various fields of medical equipment. It should consolidate the courses in electromedical equipment, establish x-ray equipment related courses, and start to plan and prepare the optical, thermal and mechanical instruments laboratories as well.



- 3.2.6 Expansion of the EBOEM-Gebze centre. The present and planned activities described above should be, carried out to the extent of possibility, in Gebze in the location and within the organization of the existing centre. Ministry of Education and Ministry of Health signed an agreement on 5.1.1985 for cooperation on arrangement and implementation of the training courses (ref. 3.). In this protocol Ministry of Education committed itself to assist in the provision of board and lodgings for the trainees attending EBOEM courses. As a result of this I had the opportunity to visit the new building on the campus which will serve as the dormitory for 30 students. The two level building has space for a library, a club room and facilities for cooking, etc. The expansion of the centre should continue in Gebze. The space for x-ray laboratory is ready for installation of equipment. The proposed new activities should be planned as well to stay in Gebze. The Vocational High School in Haydarpaşa or any other institution should only be considered in case when Gebze could not provide the necessary place. The best solution is to keep the whole training centre in one place under one organization.
- 3.2.7 In the draft project document provision is made for a mobile service unit. This is planned to be a lorry equipped with simple machines, instruments and tools to enable service and maintenance in remote places as well. The idea of this is supported by two arguments. The students in their on the job training course shall be engaged in repairing broken down equipment directly in the hospitals. By having a mobile unit the team can visit even small and remote hospitals thus rendering assistance to these places as well and giving a wider chance to select the most appropriate place for the training.
- 3.2.8 In par. 2.1 reference was made to various health related technical activities such as the UNDP/UNESCO, DP/TUR/80/012 project at the Boğaziçi University in Istanbul and the clinical engineering activity of the METU university in the THİY hospital in Ankara. METU groups activity is carried out under the acronym TABOM. During my visit in the THİY hospital I saw the laboratory, workshop and offices supplied to the technical staff of the university by the hospital administration. The place is ideal for the work being done. The activity is within the frame of clinical engineering: assistance to the hospital in running the sophisticated diagnostical and therapeutical equipment. Daily safety and preventive check of the equipment is carried out. The defective equipment are repaired. Service is given to the hospital in the selection, specification and purchasing of new equipment. The engineers and the technicians are doing practical and useful work. In a program with the computer of the hospital a patient file system is under preparation and some applied biomedical research work is done too.
- This centre (TABOM) could be developed into the first advanced clinical engineering centre of Turkey if they could continue with their activities in this field, and concentrate their efforts to furthering the technical support to the hospital. The size of this centre and the activity they render could serve as a model for similar clinical engineering centres to be set up in the future in sophisticated hospitals of the country

(i.e. in the 22 hospitals of the University Faculties of Medicine). This clinical engineering department could serve as one of the on the job training place for the teachers of the EBOEM in Gebze, and as a training place for other clinical engineers as well.

3.2.9 **Activities related to Boğaziçi University.** The project UNDP/UNESCO, DP/TUR/80/012/D/Gi/13 "Biomedical Engineering at Boğaziçi University" aims at supporting the activities of their Biomedical Institute and strengthening its capacity. The immediate objectives of the project (annex 5.) are to serve the education programmes of the Institute and render assistance to hospital personnel by providing seminars in management, use and maintenance of medical equipment.

Although the immediate objectives are of educational nature the outputs described in the project document (annex 6.) ,however, are directed somewhat less on the basic teaching and research activities of the university. Out of the 10 outputs 4 deal with services and assistance rendered to MH (points 4,6,8,9).

From the project document one can not clearly identify a parallelism or overlappings with the activities foreseen in the Gebze project DP/TUR/84/003. Beside the teaching and research activities the university commits itself to a) consultation services, b) certain assistance in establishing three "biomedical engineering centres" for MH, (point 8 in annex 6). From the project document and its work programme for 1985 (annex 7.) it is not clear that what tasks will be assigned to the proposed three biomedical engineering centres.

Comparing the revised project document of Boğaziçi University with the project document proposal of Gebze the two papers describe complementary activities. The Gebze project, in a parallel activity with the training development would in cooperation with the MH build up a) the national inventory system for medical equipment, b) develop a logistics and support centre to serve as a technical institute for the management of instrumentation problems of the Ministry of Health.

A protocol - which is not ratified-was prepared around the end of 1984 by MH and Boğaziçi University. It describes an intention of cooperation between the two institutions(ref. 4.). This document and the revised UNDP project document seem to be, from legal point of view, independent from each other. however the activities foreseen in this protocol rely heavily on expert and consultant capacity on the ongoing project.

In this programme wide range of activities are foreseen: establishment and putting into operation the complete technical support system of MH. This would include management system, technical centres (1 main centre and 5 subsidiary centres) for evaluation and repair of equipment, training of biomedical engineers, management staff and leading physicians.

It seems that these, very ambitiously proposed activities, which are in line with ref. 2., include and even supersede the decisive majority

of development objectives described in the Gebze project DP/TUR/84/003. Therefore one should carefully analyze whether the necessary number of technical experts for the planned five "biomedical centres" and the "main centre" will be available in due time and in required qualification. According to the protocol this staff, with recently acquired MS degree in biomedical engineering, will face a great variety of serious managerial and professional problems to tackle. This is another important fact that should be scrutinized.

The authorities before making their final decision should have the option to evaluate various alternatives within the scope of this large scale proposal : should they start with a modest version or enter immediately within the whole activity. Careful analysis of the alternatives is recommended.

#### 4. Recommendations

##### 4.1 **Gebze - EBOEM vocational training centre:** (see draft project document in Annex 8.)

4.1.1 Shall continue its training activity. Training course shall be updated as appropriate.

4.1.2 Establishment of x-ray laboratory for training purposes shall be started and completed.

4.1.3 Planning of laboratories and training activities in the field of optical, thermal and mechanical instruments shall be carried out.

4.1.4 One mobile repair and maintenance unit shall be provided to serve the trainees training, support the maintenance in remote hospitals, and serve as model for this type of future operations.

4.1.5 The expansion of the vocational training centre shall be within the existing organization and premises in Gebze. Separate training centre in Haydarpaşa not recommended.

##### 4.2 **Centre for Medical Instrumentation and Logistics:** (see draft project document in Annex 8.)

4.2.1 Define the objectives and organizational structure of the Centre with the view that it should be focusing its activity to support the Ministry of Health in developing its equipment system, logistics and maintenance as well as purchase planning system.

4.2.2 The Instrument and Logistics Centre should work as a technical and scientific organ of the Ministry of Health in the health oriented technical fields. Its activity does not include the direct orientation or daily management of the repair and maintenance centres of MH, although through its consultative status may be influential on it.

- 4.2 The existing agreement between the Ministry of Education and Ministry of Health, which deals in its present form with the training activities in Gebze, and expires at the end of 1985 shall be renewed and extended in a way that it should refer to the activities related to the Instrument and Logistics Centre as well.
- 4.3 The protocol between Ministry of Health and Boğaziçi University in its final form should take into consideration the goals and activities proposed in the draft project document (Annex 8.). A frame agreement may formulate the overall goals, but the objectives should be described in two protocols. The first protocol should cover the manpower development of the technical staff and the hospital related inventory system. After the completion of the objectives and the evaluation of the achievements the second protocol could be signed. This way the final objectives would be based on the effective achievements of the first phase.
- 4.4 The activity of METU university in the THY hospital in Ankara should be supported in a way that a well functioning clinical engineering department shall be established in the hospital. The department shall serve as model for similar units to be established in advanced hospitals.

ANNEX 1

JOB DESCRIPTION

DP/TUR/84/003/11-51/31.5

Post title Industrial Training Expert - Biomedical Equipment

- Duties
- a) To assess available data on biomedical equipment presently used in Turkey and estimate manpower and training needs requirements;
  - b) To assess the capabilities and capacities of the existing biomedical centres in Istanbul and Ankara with a view to ensure complementarity with the proposed centres;
  - c) To carry out a short survey of the present employment of the repair and maintenance technicians trained under the previous project to determine the appropriateness of the training received. On this basis, to suggest the curriculum to be designed and developed;
  - d) To determine the desirability of a pilot mobile unit, and to assess the justification for having two technician training centres;
  - e) To finalize the Draft Project Document in the light of his findings ensuring that the appropriate institutional linkages between the different ministries involved are clearly articulated.

Background information

Under a previous project, DP/TUR/76/048, UNDP/UNIDO provided technical assistance to establish the Gebze Training Centre for Repair and Maintenance of Biomedical Electrical and Electronic Instruments. In 1984, the Government of Turkey proposed a follow-up project to increase the utilization of biomedical instrumentation in the Country's health facilities by expanding the stock of properly trained and qualified repair and maintenance technicians and by establishing a centralized instrument management system.

On the basis of the Government's proposal, UNIDO has prepared a Draft Project Document. The complexity of the project, however, calls for the fielding of a short-term expert for five weeks.

ANNEX 2

Persons And Places Visited

1. Dr. Adnan Kahveci, Chief Adviser to the Prime Minister
2. Prof. Dr. Yusuf Müftü, Undersecretary of Ministry of Health
3. Mr. Ruhan Sümbül, President, Office for Administrative and Financial Affairs
4. Mr. Abdulgani Sınık, Director, Planning, Research and Coordination, Ministry of Health
5. Mr. Ahmet Sözmen, Head of Repair Centres, Ministry of Health
6. Dr. İlhan Sezgin, Undersecretary for Technical Education, Ministry of Education
7. Mr. Mehmet İyigün, Director General of Technical Education, Ministry of Education
8. Mrs. Meral Orgun, State Planning Office
9. Prof. Dr. Adnan Sokollu, National Project Coordinator
10. Prof. Dr. Necmi Tanyolaç, Director, Biomedical Engineering Institute, Boğaziçi University
11. Dr. Kemal Bayazıt, Director and Chief Physician, Advanced Specialization Hospital (THIY), Ankara
12. Dr. Hayrettin Köymen, METU, Department of Electrical and Electronic Engineering
13. Dr. Ziya İder, METU, Department of Electrical and Electronic Engineering
14. EBOEM Training Centre in Gebze
15. Bakırköy Centre
16. M.E.T.U. (Middle East Technical University)
17. Boğaziçi University

ANNEX 3

Number of Hospitals And Hospital Beds In Turkey  
(as of 1985)

Institution	No of hospitals	No of beds	% of beds	bed/hosp.
Min. of Health	412	60.000	50	146
Social Security	78	20.000	17	256
Faculties of Medicine	22	16.000	13	727
Private	87	2.564	2	30
Others	91	21.206	18	233
<b>TOTAL</b>	<b>690</b>	<b>119.770</b>	<b>100</b>	<b>174</b>

Source: SPO

Number of Hospitals and Hospital Beds in Turkey  
(as of 1975)

Institution	No of hospitals	No of beds	% of beds	bed/hosp.
Min. of Health	593	53.310	53	90
<b>TOTAL</b>	<b>904</b>	<b>100.480</b>	<b>100</b>	<b>111</b>

Source: reference 2.

Growth: 1985/1975	no of hospitals	-24 %
	no of beds	+19 %
	beds/hospital	+56 %
	beds/hospital in MH	+62 %

ANNEX 4

List of Repair And Maintenance Centres of  
Ministry of Health

Ankara	Bursa
İzmir	Antalya
İstanbul	Sivas
Adana	Kayseri
Diyarbakır	Trabzon
Van	Elazığ
Erzurum	Kars
Konya	Muş
Samsun	Urfa
Malatya	



ANNEX 5

Immediate Objectives of  
Project DP/TUR/80/012/D/01/13

- a) To assist in the establishment and updating of a documentation centre for biomedical engineers, medical doctors and other professionals concerned with biomedical research, equipment and instrumentation.
- b) To support the biomedical engineering education programme through the provision of training facilities.
- c) To assist in providing seminars and other training activities for medical personnel and administrators of hospitals on the management, use and maintenance of medical equipment.
- d) To provide additional research and calibration equipment for training the graduate students and for consultancy services to the hospitals.

ANNEX 6

Outputs of

Project DP/TUR/807012/D/01/13

1. A documentation centre, established and kept up-to-date, serving biomedical engineers, medical doctors and other professionals concerned with biomedical research, equipment and instrumentation.
2. During the first two years, one Ph.D. and 10 M.Sc. students will be trained. Subsequently, the annual intake will raise to 30 M.Sc. and 5 Ph.D. students.
3. Scientific publications and other technical reports by Graduate Programme staff in the biomedical engineering research field will be issued.
4. A workshop enabling repair, maintenance and servicing of medical equipment and instrumentation will be established in 1985.
5. Design and construction of Prototype equipment for research and specific clinical use will be made.
6. Consultation services to government and hospitals on selection and proper use of medical equipment will be provided.
7. Training of medical personnel on capabilities and limitations of new medical equipment will be carried out.
8. Assistance will be provided to the Ministry of Health in establishing three biomedical engineering centres, and continuous training programmes will be made available to the staff of these centres, both at the institute and at the centres.
9. Calibration and preventive maintenance programmes and services will be provided to the hospitals in the Marmara Region.
10. Upon request, consultancy services on biomedical engineering training will be provided to the developing countries around Turkey.

ANNEX 7

BOĞAZIÇI UNIVERSITY  
BIOMEDICAL ENGINEERING INSTITUTE

Work Program For 1985 Budget

Proj. TUR/80/012/D/01/13

10. PROJECT PERSONEL

10.11-Consultants (4 m/m)

- a) ECRI, Dr. Nobel agreed to provide for 3 months, one of their expert BME, M. Bruley beginning May first ending August first 1985. Total fee including transportation, ECRI for Mark Bruley service will be \$ 18.000

I suggest the following tasks should be specified for ECRI specialist in the contract.

" Main tasks of BME, M. Bruley will be to train laboratory instructors of B.U. Biomedical Engineering Institute on calibration and preventive maintenance technique on the following Medical Equipments-Anesthesia units, Vaporizers, Aspirators, Cardiac resucitators, ECG, External pacemakers, Heard-Lung bypas units, Hemodialysis units, Infant incubators, Temperature monitors."

- b) One or two short term lecturer from Universities or Research organizations will be requested for 15 days lecture sometime in September or November.

30. TRAINING

30.31-Fellowships

Associate Prof. Y. Istefanopulos will be send to U.S.A. for 3 months beginning July 1985.

30.32-Group Training

Two persones each for one month will be sent to U.S.A. July to August. The names and details for arrangement will be given after graduation ceremony in June.

40. EQUIPMENT

After Mr. Mark Bruley's arrival around June the list of equipment will be submitted.

Prof Dr. Necmi Tanyolaç  
(NPC)  
Project TUR/80/012/D/01/13

ANNEX 8.

UNITED NATIONS DEVELOPMENT PROGRAMME

Project of the Government of Turkey

PROJECT DOCUMENT

Title: Training and Support Services for Repair and Maintenance of  
Biomedical Equipment

Number: DP/TUR/84/003

Duration: 3 years

Primary Function: Direct Training

Secondary Function: Institution Building

Sector: (Govt. Class.)

(UNDP class. and code):

Sub-Sector: (Govt. Class)

(UNDP class. and code):

Government Implementing Agency: Ministry of National Education

Executing Agency: United Nations Industrial Development Organization (UNIDO)

Estimated Starting Date: January 1986

Government Inputs: TL 703,200,000 (in kind)  
(local currency)

UNDP Inputs: \$ 366,840  
(US Dollars)

TL 622,285,000 (in cash)  
(local currency)

Government Cost-Sharing \$ 509,510  
(US Dollars or other freely  
convertible currency)

Signed: \_\_\_\_\_  
(on behalf of the Government)

Date: \_\_\_\_\_

\_\_\_\_\_  
(on behalf of the Executing  
Agency)

Date: \_\_\_\_\_

\_\_\_\_\_  
(on behalf of the United  
Nations Development Programme)

Date: \_\_\_\_\_

## PART I - Legal Context

This Project Document shall be implemented within the legal framework of inter alia the Revised Standard Agreement concerning Technical Assistance between the Government of Turkey and the United Nations Development Programme signed by the Parties on 21 October 1965 of which UNIDO has been made a party in August 29th 1969.

In particular, the provision of article V, paragraph 1, obligating the Government to apply the provision of the Convention on Privileges and Immunities shall be deemed to apply mutatis mutandis to technical assistance carried out in accordance with this project document.

## PART II - The Project

### A. Objectives

1. The development objective of the project is to increase the utilization of biomedical instrumentation in the country's health facilities by expanding the stock of properly trained and qualified repair and maintenance technicians and by establishing a centralized instrument management system.
2. The immediate objectives of the project are two-folds
  - a) Consolidation and expansion of the Gebze Training Centre for Repair and Maintenance of Biomedical Electric and Electronic Instruments.
  - b) Establishment of a Centre for Medical Instrumentation Logistics and Support (Bakırköy).

### B. Special Considerations

This project represents a much needed - complimentary and supplemental-follow-on to an earlier, successful UNDP project (DP/TUR/76/048) under which the Gebze Training Centre for Repair and Maintenance of Biomedical Electrical and Electronic Instruments was established. To our knowledge, the total effort (the earlier project plus this one) represents a unique approach to a highly urgent problem which many developing countries are facing. Thus, at a later stage, Turkey could be in a very good position to assist other developing countries (through example/training) in improving their capabilities in repair and maintenance of medical instrumentation.

### C. Background and Justification

WHO, at the world conference in Alma Ata, set a goal of "Health for All by the Year 2000," and the Government has determined to make every effort to achieve that goal with respect to Turkey. To do so, however, requires inter alia a major effort to (1) significantly increase the utilization of existing biomedical instruments in the country's hospitals and health care centres, and (2) develop a continuing supply of paramedical/technical personnel in the hospitals and health care centres trained and qualified in the proper use of such equipment, and (3) develop a continuing supply of engineers/technicians trained and qualified in the repair and maintenance of electric, electronic, optical, thermal and mechanical biomedical instruments.

Hard figures are difficult - it not impossible - to come by, but the following may serve to suggest the rough dimensions of the problem.

1. A subcommission of Turkey's fourth five-year development programme special commission reported that, in 1973, Turkish hospitals/health care centres had electronic equipment valued at US \$ 286 million - of which 70-80 % was either inoperable or not in proper condition.
2. A UNIDO investigation (DP/TUR/76/048) reported that, in 1976, the Ministry of Health hospitals alone possessed biomedical equipment worth at least US \$ 53 million - about 95 % of which did not receive the prescribed/required repair and maintenance services.
3. A study by the TUBITAK Marmara Research Institute estimated that, in 1978, Turkey required almost 2000 engineers and technicians to meet the need for repair and maintenance of electronic equipment.

The situation has not significantly improved since these studies were conducted - although one small step has been taken to address the problem: The establishment of the Gebze Training Centre for Repair and Maintenance of Biomedical Electrical and Electronic Equipment (DP/TUR/76/048). This project successfully met its very limited objectives - the Centre has been established and partially equipped, trainers have been trained, and training programmes designed and implemented. One of the major objectives of the present project is to consolidate the achievements realized under that project and to expand the Centre (by extending its capacity to include training in the repair and maintenance of X-Ray equipment, to take in more trainees, and to take its services (on-the-job training of the trainees) to its client institutions).

But even this addresses only part of the problem - in addition to electrical and electronic (including x-ray) equipment there are other kinds of equipment which also require regular and proper repair and maintenance - and properly trained personnel to do it. We refer here to optical, thermal and mechanical equipment. The groundwork for the expansion of Gebze Training Centre into the field of these equipment is to be made within the objectives of this project.

Finally, it is necessary - if Turkey is to ever get "on top" of the problem - to (1) know exactly what equipment is on hand; what equipment is operable and what is inoperable, (2) establish a system of keeping track of this information on, ultimately, a national basis, and (3) establish a system of ordering/reordering necessary equipment/spare parts. Thus the second objective of this project is to establish a "Centre for Medical Instrumentation and Logistics" which would inter alia involve a computerized inventory management system. Such a system, once installed and operational, would also provide information/guidance for developing appropriate training activities; a data bank dealing with design features, references of instructions for use, servicing instructions, etc., of equipment in the inventory; and could assist in eventually standardizing (to the extent possible) the supply of equipment used.

D. Outputs

1. The Gebze Training Centre for Repair and Maintenance of Biomedical Electric and Electronic Instruments will:
  - a) Be fully equipped and staffed to provide training of repair and maintenance technicians for all major electric and electronic biomedical equipment / instrumentation.
  - b) Provide training programmes geared to identified needs and develop its own internal programme of training and refresher activities.
  - c) Double its through-put of trained repair and maintenance technicians: By the end of the project, its through-put of trainees should have doubled to approximately 250 per year in all major types of electric, electronic and x-ray instrumentation.
  - d) Provide a mobile repair and maintenance capability so as to service equipment (and, at the same time, train the trainees) that cannot be transported to / from the Centre.
  
2. The Centre for Medical Instrumentation Logistics and Support will be established at Bakırköy (in Istanbul) and, concentrating initially on the hospitals and health care centres of the Ministry of Public Health, will:
  - e) Be organized (its mandate and its relationship to the other centres and the various hospitals / health care centres, etc., clearly articulated; an appropriate structure established; procedures worked out, etc.) and staffed with properly trained personnel.
  - f) Develop an information system which will be based on the functional requirements of Ministry of Health. Will include a data base which would serve the technical and the economy planner staff (availability of equipment, age group, depreciation factor, price, technical remarks, etc.). After having determined the requirements and the structure of the system it will be handled on a computer basis. The system will also include a standardized approach to gathering and reporting such information on a regular and periodic basis.
  - g) Establish a computerized system for the stocking/reordering of spare parts, etc.
  - h) Develop and implement an appropriate and comprehensive training programme for "counterpart personnel" in the hospitals / health care centres.

### E. Activities

To achieve the above outputs, the following activities will be undertaken:

#### General

1. An inter-ministerial committee (including inter alia representatives of the Ministries of Health and Education and Social Welfare) will be established at the beginning of the project to oversee and coordinate the various elements of the project and to facilitate cooperation between their hospitals/health care centres/institutions.
2. The necessary documentation (including appropriate by-laws) for the establishment of a "Centre for Medical Instrumentation Logistics and Support" will be prepared and submitted to the appropriate Government authorities within 18 months from commencement of project activities.

#### The Gebze Centre (Output 1.)

3. Necessary equipment/supplies to expand and complete the Gebze Centre will be obtained (some of which can come from hospitals in the area and some will be purchased under this project) and installed.
4. At least 6 additional trainers (to cover attrition and to provide training in repair and maintenance of X-Ray equipment) will be recruited and trained so that the Gebze Centre can expand the scope of its training as well as the number of technicians trained.
5. Present training courses will be updated (as appropriate) and conducted according to an officially published annual programme. New courses will be designed and implemented as needs are identified, equipment made available, and trainers trained. It is anticipated that, during the life of the project, at least 8 new courses will have been added to the Centre's curriculum and integrated into its programme.
6. An appropriately equipped mobile service unit will have to be secured and put into operation. The mobile service unit will be used to visit hospitals/health centres in the Gebze/Istanbul area to provide repair and maintenance service on that equipment that cannot be transported to/from the Gebze Centre. (With the mobile unit trainees will have an opportunity to see the significance of their learning and advanced trainees will be able to get guided on-the-job training.)
7. Training needs in the areas of thermal, optical and mechanical instrumentation will be exactly defined. Equipment required and sources of supply, costs, etc. will be indentified. Necessary budget projections will be prepared and submitted to the government authorities.

#### The Bakırköy Centre for Logistics and Support (Output 2.)

8. Objectives of the Centre will be clearly articulated and, accordingly, an appropriate organizational structure developed, including a description of the functions to be performed and job descriptions for key personnel



and a time table for implementation. Staff will be recruited and trained.

9. A computerized information system appropriate to the Turkish situation will be designed, tested in a selected sample of Public Health hospital/health care centres, and finalized. As part of this activity, available appropriate computer programme will be reviewed, the most appropriate selected and necessary adaptations/modifications introduced. The necessary computer hardware will be selected and installed. (The exact details of hard- and soft-ware will be defined by the end of the first year of the project; all that can be specified at this point is that the system must be (a) adapted to the realities of the Turkish situation and (b) planned for expansion as the Centre's services are extended and enlarged.)
10. Training courses will be organized and conducted for personnel of the hospitals/health care centres to acquaint them with the system and develop the necessary knowledge/skills to enable them to fully participate in its operations. It is anticipated that, after the initial course programmes have been conducted, they will have to be conducted on a continuous regular periodic schedule as the initial programme is extended to additional institutions, to reflect technological changes/new developments in biomedical instrumentation, and new hires/replacements are brought in.
11. Appropriate premises to house equipment and for office/training facilities will be secured and/or arranged for and equipped.

#### F. Inputs

##### 1. Government Inputs

- a) Financial. The Government will cost-share the project for a total of US \$ 509.510. Additional cost-sharing may be considered during the life of the project.
- b) Assignment of National Staff. Since a major part of the project deals with the planning and development of institutions, national manpower requirements can be identified and specified in detail only as the project is implemented, and the Government undertakes to provide these as required. Initial requirements can be identified and these will be provided as indicated:

National Project Coordinator*	January 1986
Director, Gebze Centre*	January 1986
3 Senior Trainers, Gebze Centre*	January 1986
5 Junior Trainers, Gebze Centre*	January 1986
6 Trainer trainees, Gebze Centre	January 1986 and continuing
Administrative Staff, Gebze Centre* *	January 1986
Support Staff, Drivers, etc., Gebze Centre* *	January 1986
Director, Bakırköy Center	June 1986
Professional, Technical and Administrative Training Staff, Bakırköy Centre	August 1986 and continuing

\* already in place

\* \* some of these are already in place, but additional personnel will be required

c) Training Provisions. The expenses of participants in the training courses organized and conducted at the Gebze Centre and other institutions will be covered by their respective institutions (through advanced transfer of funds to the project which then disburse/administer them.)

d) Land, Building, Equipment.

- Premises (Gebze, Bakırköy)
- Equipment (to be specified as project progresses)
- . to be provided from January 1986 and onwards
- . estimated value of ₺ 649.905.000.-

e) Miscellaneous

Operation Expenses:	1986.....₺	8.415.000.-
	1987.....₺	15.980.000.-
	1988.....₺	28.900.000.-

f) Cash Contribution

- Project Personnel Cost.....₺	70.584.000.-
- Training Costs.....₺	8.041.000.-
- Equipment and Premises.....₺	289.000.000.-
- Sub-contracts.....₺	221.000.000.-
- Miscellaneous.....₺	33.660.000.-

2. UNDP Inputs

a7 International Staff

- Industrial Training Advisor - CTA January 1986 36 m/m

Will be responsible for administering the project, specifying short-term expert/consultant needs, overseeing the work of the international experts, seeing to it that trainer-trainees are trained (abroad and locally), and providing advice and counsel to the National Project Coordinator.

Will have had substantial experience in the design and development of institutionalized training capabilities- preferably in a medically-related field.

- Trainer in Repair and Maintenance of X-Ray equipment March 1986 12 m/m

- Expert in Computerized Information Systems April 1986 12 m/m
- Short-term Expert/Consultant/Trainers in specific technical fields as required 23 m/m

b) Training

Provision is made for a total of 32 m/m of Fellowship and Study Tours

c) Equipment

Most of the equipment for the project is expected to come from local sources (either purchased locally or supplied by the hospitals/health care centres). Provision is made, however, for the purchase of a mobile repair and maintenance unit and two vehicles.)

d) Miscellaneous

Provision is made for Headquarters Reviews, Operating Expenses of vehicles, Reports and Sundries.

G. Preparation of the Work Plan

A detailed Work Plan for the implementation of the project will be prepared by the leader of the international staff assigned to the project, in consultation with the leader of the national staff. This will be done at the start of the project and brought forward periodically. The agreed upon Work Plan will be attached to the Project Document as Annex 1. and will be considered as part of that document.

H. Preparation of the Framework for Effective Participation of National and International Staff in the Project

The activities necessary to produce the indicated outputs and achieve the project's immediate objectives will be carried out jointly by the national and international staff assigned to the project. The respective roles of the national and international staff, will be determined by their leaders, by mutual discussion and agreement at the beginning of the project, and set out in a Framework for Effective Participation of National and International Staff in the Project. The Framework will be attached to the Project Document as an Annex and will be reviewed from time to time. The respective roles of the national and international staff shall be in accordance with the established concept and specific purposes of technical cooperation.

I. Development Support Communication

For Turkish health care and industry both in public and private sectors communication channels will be maintained through publications of pamphlets and through other media describing the activities of the Centres and the project. Contacts will be sought with similar institutions in developing countries and in industrially developed ones with the aim of exchanging experiences, establishing professional relations and seeking training places for mutual exchange of technical personnel.

#### J. Institutional Framework

The Government Counterpart Agency for the project is the Ministry of Public Education. However, it is recognized that the activities, outputs and Objectives of the project concern not only the above Ministry, but also the Ministries of Public Health and (to a lesser extent) the Ministry of Social Welfare. Therefore, a Project Advisory Board will be constituted with representatives of all the above Ministries and including SPO, the National Project Coordinator and UNDP/UNIDO, Ankara. The Advisory Board shall be responsible for effecting all necessary coordination in order to ensure timely and adequate provision of all counterpart inputs as also to advise on the detailed Work Plan.

As far as the counterpart payments are concerned, the Ministry of Public Education, as the designated counterpart, shall be responsible to UNDP. However, necessary internal arrangements shall be made as between the different Ministries to ensure that the other Ministries deposit their shares of the costs to the credit of the Ministry of Public Education. If necessary, the Advisory Board shall provide estimates of costs for different activities to assist in such apportionment.

#### K. Prior Obligations and Prerequisites

None

#### L. Future UNDP Assistance

Since one of the objectives of the project deal with the creation of a new institution it is likely that further UNDP assistance may be requested in consolidating and expanding the Bakırköy Centre. Details of such assistance, if required, can only be specified toward the close of the present project.

### PART III - Schedules of Monitoring, Evaluation and Repts

#### A. Tripartite Monitoring Reviews : Technical Review

1. The project will be subject to periodic review in accordance with the policies and procedures established by UNDP for monitoring project and programme implementation.
2. Two tripartite review missions should be undertaken, to take place 15 and 32 months after the start of the project.

#### B. Evaluation

The project will be subject to evaluation, in accordance with the policies and procedures established for this purpose by UNDP. The organization, terms of reference and timing of evaluation will be decided by consultations between the Government, UNDP and Executing Agency concerned.

C. Progress and Terminal Reports

The National Project Coordinator will prepare the project progress report in accordance with the standard UNDP procedures and format.

The Executing Agency shall be responsible for the timely submission of the terminal report.

Tentative Work Plan/Bar Chart\*

Annex 1

Activity

	1986	1987	1988
Establishment of Interministerial Committee			
Preparation and processing of necessary documentation for establishment of a Medical Instrumentation Logistics and Support Centre			
Acquisition of additional equipment including mobile unit for Gebze Centre			
Recruitment and training of new trainers at the Gebze Centre			
Updating present courses, development of new courses, publication of annual training programme at Gebze			
Organization and set-up of Bakirköy Centre			
Development of Management Information System (Bakirköy)			

\* To be more fully elaborated by the CTA and National Project Coordinator as per Part II, G. of the project document.

ENTRY DP/TUR/84/003	4. PROJECT NUMBER AND AMEND. DP/TUR/84/003	5. SPECIFIC ACTIVITY 31.5 A
PROJECT TITLE: Training and Support Services for Repair and Maintenance of Biomedical Equipment		

A. PROJECT BUDGET COVERING UNOP CONTRIBUTION

INTERNATIONAL EXPERTS (functional titles required except for line 11-50)	16. TOTAL		17. 1986		18. 1987		19. 1988		20.	
	m/m	\$	m/m	\$	m/m	\$	m/m	\$	m/m	\$
1 Industrial Training Advisor - CTA	36	246,600	12	82,200	12	82,200	12	82,200		
2 Trainer - Rep of X-Ray Equipment	12	82,200	9	61,650	3	20,550				
3 Expert in Computerized Information System	12	82,200	9	61,650	3	20,550				
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17 Short term consultants	23	157,550	6	41,100	6	41,100	11	75,350		
18 Sub-total - International experts <sup>a/</sup>	83	568,550	36	246,600	24	164,400	23	157,550		

REMARKS

<sup>a/</sup> If more than 16 experts are required check here  and attach continuation sheet 1A. This sub-total must include all experts.

PROJECT NUMBER	DP/TUR/84/003	16 TOTAL		17 1986		18 1987		19 1988		20.	
		m/m	\$	m/m	\$	m/m	\$	m/m	\$	m/m	\$
EXPERTS (functional titles required)											
1											
2											
3											
4	Sub-total - OPAS experts <sup>b/</sup>										
ADMINISTRATIVE SUPPORT PERSONNEL											
1	Clerks, secretaries, drivers										
2	Freelance interpreters (non-UNDP PROJ)										
3	Sub-total - Admin support personnel										
VOLUNTEERS (functional titles required)											
1											
2											
3											
4	Sub-total - UN Volunteers <sup>b/</sup>										
1	Project travel		4,500		2,000		1,500		1,000		
2	Other personnel costs (including UNIDO staff mission costs)		6,000		2,000		2,000		2,000		
NATIONAL EXPERTS (functional titles required)											
1											
2											
3											
4	Sub-total - National experts <sup>b/</sup>										
TOTAL - PERSONNEL COMPONENT		83	579,050	36	250,600	24	167,900	23	160,550		

If additional individual budget lines are required, check here  and attach continuation sheet 1A.

These sub-totals must include budget lines listed on page 1A.

ACT NUMBER	DP/TUR/84/003	16. TOTAL		17. 1986		18. 1987		19. 1988		20.	
		m/m	\$	m/m	\$	m/m	\$	m/m	\$	m/m	\$
CONTRACTS											
1	Subcontracts										
TRAINING											
1	Individual fellowships	24	52,800	6	13,200	12	26,400	6	13,200		
1	Study tours; UNDP group training	7	17,500	2	5,000	4	10,000	1	2,500		
1	In-service training										
1	Non-UNDP group training										
1	Non-UNDP meetings										
1	TOTAL - TRAINING COMPONENT	31	70,300	8	18,200	16	36,400	7	15,700		
EQUIPMENT											
1	Expendable equipment		10,000		3,000		4,000		3,000		
1	Non-expendable equipment		190,000		97,000		68,000		27,000		
1	Premises										
1	TOTAL - EQUIPMENT COMPONENT		200,000		100,000		70,000		30,000		
MISCELLANEOUS											
1	Sundries		27,000		5,000		14,000		8,000		
1	Hospitality (non-UNDP projects)										
1	Support costs (CC and DC Proj. only)										
1	TOTAL MISCELLANEOUS COMPONENT		27,000		5,000		14,000		8,000		
SURPLUS/DEFICIT											
1	Surplus/Deficit (ADM/TS use only)										
1	PROJECT TOTAL	114	876,350	44	373,800	40	288,300	30	214,250		
	COST SHARING (UNDP/IFP projects only)		509,510								
	NET UNDP CONTRIBUTION		366,840								

c/ For information only - not for PAB input



### References

1. Fifth Five Year Development Plan 1985 - 1989, published by Devlet Planlama Teşkilatı, Yayın No: DPT:1987, paragraphs: 610,613,620,621, chapter: basic targets and strategy par. 60,67
2. Survey And Recommendations For Maintenance Facilities Of Biomedical Equipment Used In Major Centres In Turkey. UNDP/UNIDO report DP/TUR/75/048, May 1977 prepared by Nandor Richter
3. Protocol Between The Ministry Of National Education, Youth And Sport and the Ministry Of Health And Social Assistance For the Cooperation On Arrangements And Implementation Of The Training Courses At Kocaeli-Gebze Electronic Equipment Maintenance And Repair Centre (EBOEM). Signed: 5 January 1985
4. Protocol Between The Ministry Of Health And Social Assistance and the Bosphorous University For Extension Of Services For Biomedical Equipment Of The Ministry And For Establishment And Operation Of Biomedical Engineering Centres.  
(Signed but, not ratified no date of signature .)