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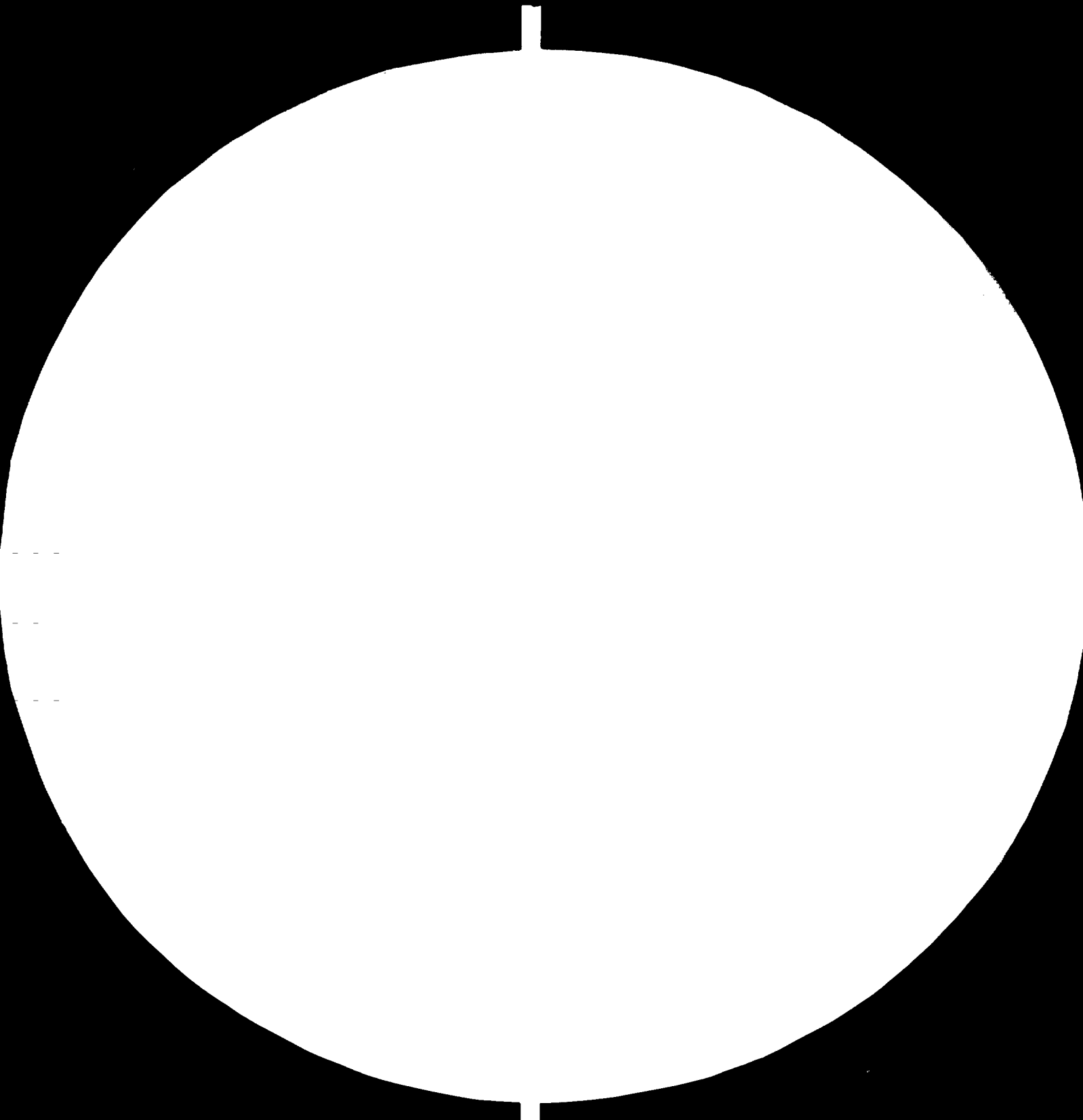

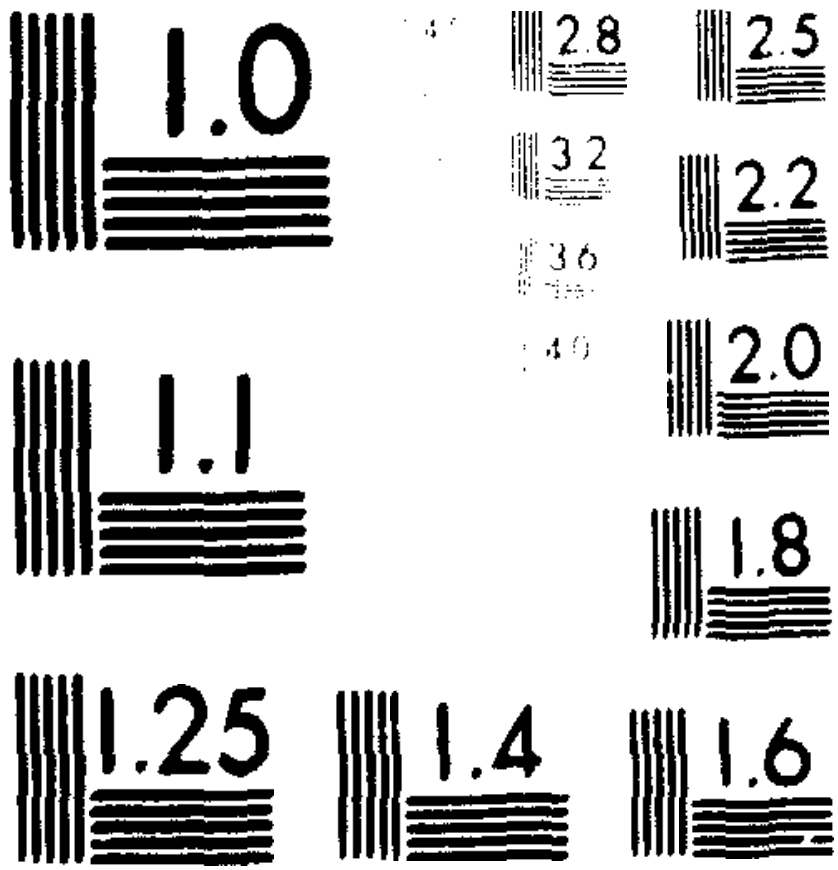

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CEMENT RESEARCH AND DEVELOPMENT CENTRE

DP/TUR/72/034

TURKEY

Terminal report

Prepared for the Government of Turkey
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Sigmund Attila Abaffy, project manager

United Nations Industrial Development Organization
Vienna

80-46133

Explanatory notes

References to dollars ($) are to United States dollars, unless otherwise stated.

A full stop (.) is used to indicate decimals.

A comma (,) is used to distinguish thousands and millions.

A "tonne" is a metric ton, or 1,000 kilogrammes.

The following abbreviations of organizations are used in this report:

CMA	Cement Manufacturers' Association
CRDC	Cement Research and Development Centre
TCDC	Technical Co-operation among Developing Countries
TCIC	Turkish Cement Industries Corporation, or Türkiye Çimento Sanayii T.A.S. (ÇISAN)
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization

ABSTRACT

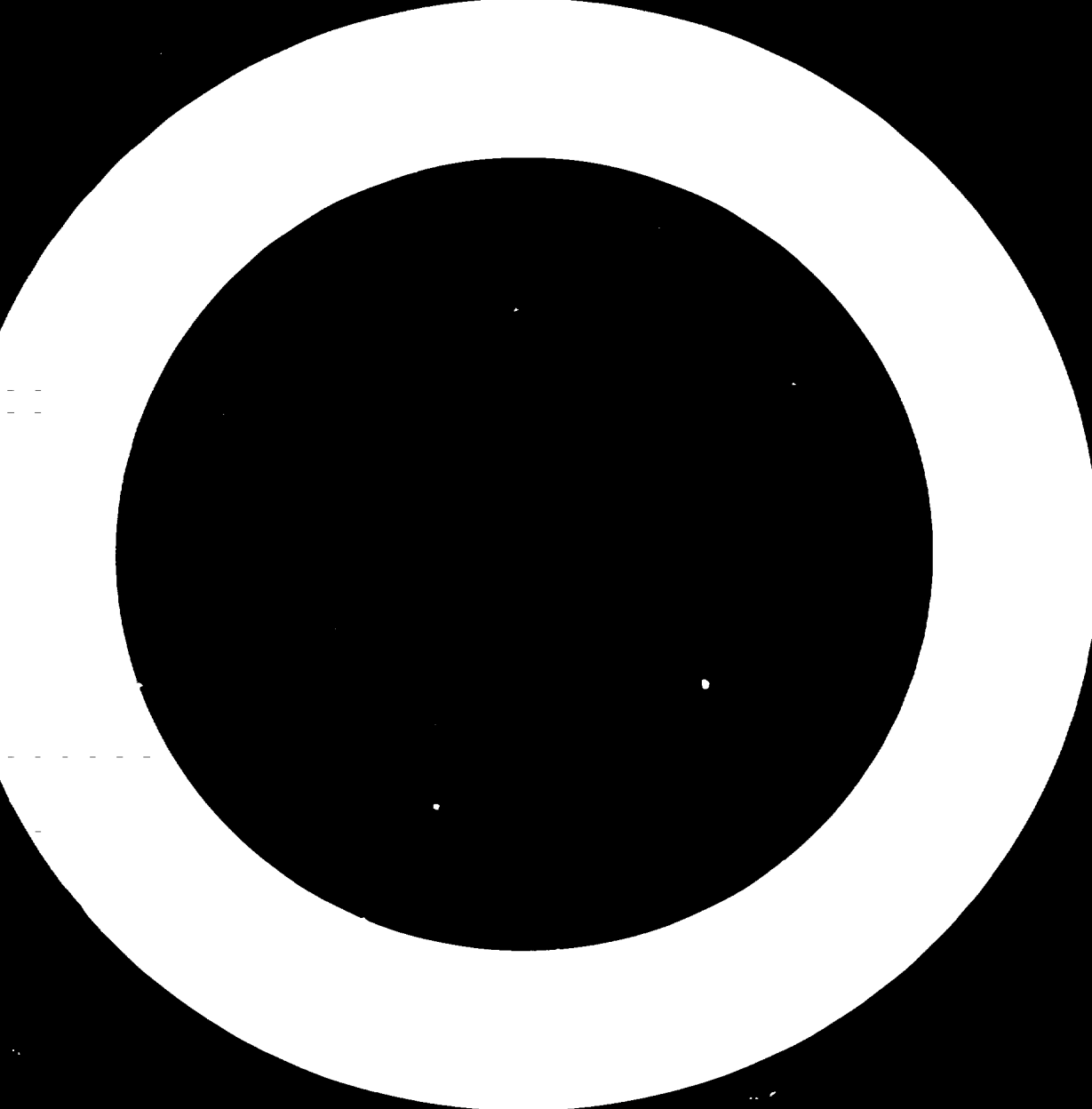
This project, "Cement Research and Development Centre" (DP/TUR/72/034) has been carried out for the Government of Turkey by the United Nations Industrial Development Organization (UNIDO) acting as executing agency for the United Nations Development Programme (UNDP).

This project was designed to give assistance to the Turkish cement industry both with its immediate problems and with its longer-term development needs. The first phase of the project has mainly dealt with the setting up of a cement research and development centre in Ankara.

After a preparatory mission in September 1973, the project began in January 1974 and this first phase of the project finished at the end of 1980.

The present report reviews the project as a whole up to September 1980 and is based on the work of Mr. Sigmund Abaffy who arrived in January 1974 for a 12-month mission as an expert in process-control equipment and who stayed on to become project manager. His mission finally ended on 9 January 1981.

The report describes the background of development in the Turkish cement industry which gave rise to the project, the preparation of the project document and the planning of the CRDC. The steps by which the project was implemented and the main achievements of the project so far are set out, and recommendations are made for phase two of the project for the consolidation and further development of the Centre.



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INTRODUCTION

This project, "Cement Research and Development Centre" (DP/TUR/72/034), has been carried out for the Government of Turkey by the United Nations Industrial Development Organization (UNIDO) acting as executing agency for the United Nations Development Programme (UNDP).

This project was designed with both long-term and short-term objectives. It was aimed, in the long run, at enabling the Turkish cement industry to become independent of the need for foreign expertise in the routine operations of cement production and utilization. The short-term objectives aimed to try and help solve the immediate problems encountered by the Turkish cement industry through the setting up of a cement research and development centre in Ankara.

The project started in January 1974, following a preparatory mission in September 1973, during which the project was designed and the project document drafted. A number of experts in various fields have been involved in this project and their reports on their missions are issued separately under the same project number (see annex I). The present report reviews the project as a whole up to September 1980 and is based on the work of Mr. Sigmund Abaffy who arrived in January 1974 on a 12-month mission as an expert in process-control equipment and who stayed on to become project manager. His appointment was successively extended, his mission finally ending on 9 January 1981.

This project was originally intended to last until 1977 but was revised and extended to July 1979 and then to the end of 1980 to allow for preparation of phase two of the project.

The project was jointly funded by UNIDO/UNDP, by the Turkish Cement Manufacturers' Association and by bilateral aid (see table 3 for the amount of contributions). This project has been a good example of the role the United Nations system can play in the procurement of investment assistance in that the UNIDO/UNDP input has generated a large bilateral contribution, amounting to several million dollars, for the development of the Centre.

RECOMMENDATIONS

Projects such as this one are "living" projects and will always need technical and financial support of various kinds and quantity as they continue to grow and develop. The initial objectives of such institutions as CRDC are subject to modification as they pass through different phases and new strategies have to be developed to meet new and additional targets.

1. Therefore, a new project document has to be prepared for the new phase of the CRDC, taking into account all the shortcomings and successes of the present project based on experience gathered during its implementation.

2. It was previously planned to set up an advisory council and this should now be done immediately. This council must review and evaluate the project as a whole and prepare a list of recommendations for the CRDC upon which the new project document can be based.

3. The support of UNDP/UNIDO and of other contributing countries must continue without interruption.

4. The present funding system of CRDC must be reviewed and modified and a kind of "floating capital" system adopted so that the Centre becomes more financially independent.

5. Close co-operation should be developed between CRDC and similar institutions both in developed and in developing countries. Close contacts with international technical organizations must also be established.

6. CRDC should be involved in regional and interregional activities in the field of cement technology in general and should provide engineering services to other developing countries.

I. BACKGROUND OF THE PROJECT

The development of the Turkish cement industry began in the early 1950s and increased significantly after 1963 when the first of the five-year development plans began to be put into effect.

The first cement plant in Turkey was erected in 1911 in Istanbul with a capacity of 20,000 tonnes per year. The capacity was expanded to 40,000 tonnes per year in 1923. Up to 1950, only four further cement plants were set up, increasing the total production capacity to 400,000 tonnes per year.

In order to meet the increasing demand for cement, new cement plants had to be erected and, in 1953, the Turkish Cement Industries Corporation (TCIC) was established as a government enterprise to deal with new investments in the field of cement production.

By 1960, six new cement lines had been added by the TCIC and meanwhile the private sector had also erected two new cement plants. Thus the total cement production capacity of the country in 1960 had reached about 2 million tonnes per year.

As mentioned above, developments in the cement sector accelerated from 1963 onwards and table 1 shows how the total installed capacity of the cement industry in Turkey increased about 10-fold in the 15 years covered by the first three five-year plan periods. The first five-year plan period ended in 1968, the second in 1973 and the third in 1979.

Table 1. Development in the cement sector, 1963-1979

Year	Number of plants	Total installed clinker capacity (thousands of tonnes)
1968	19	5 095
1973	27	10 025
1979	35	18 730

Turkey not only has a very high rate of population growth (on average around 2.35%), but the per capita consumption of cement has also been increasing rapidly, jumping from about 90 kilogrammes per year in 1963 to 350 kilogrammes in 1978, more than a three-fold increase within 15 years.

Briefly, the rates of increase of both production and consumption of cement have never been under 10% annually for the past 15 years, varying between 11-12% and 10-11% respectively. This high increase in production has also created the possibility of exporting the surplus and, from 1972 onwards, Turkey became a net exporter of cement exporting around 1-1.5 million tonnes of cement annually since then.

This fast development in the cement sector made necessary the setting up of a cement research centre and, in 1972, preparatory work started with the aim of establishing a research institute within the body of the Cement Manufacturers' Association (CMA). This Association was set up early in the 1960s with the aim of dealing with all sorts of problems in the Turkish cement sector. The Association was formed by companies producing hydraulic binders belonging to both private and government enterprises and, in time, it acquired great power and influence and now acts as the only authority dealing with all technical, managerial and economic questions in the cement sector, acting on behalf of the Ministry of Industry and Technology in certain areas such as quality control of the cement produced by the sector. The Association may be regarded as a unique organization since it brings together companies who are in competition with one another. However, as the Association provides invaluable benefits to the whole industry, cement producers prefer to belong to it and, in Turkey, the balance between production of and demand for cement still does not necessitate much real competition between producers.

The Association is financed from several sources including membership fees, charges for quality control, payments made by member companies in accordance with the quantity of cement they produce and also from a special fund created by collecting certain premiums from producers.

The management of the Association is conducted by an Executive Board composed of ten members, five representatives of the Government sector and five representatives of the private sector. As a rule, the chairman of the Board is the Director General of the Turkish Cement Industries Corporation.

Table 2 shows the distribution of the cement plants between state and private ownership.

Table 2. Ownership of cement plants

Sector	Number of plants	Total production capacity of clinker (thousands of tonnes)	Share in total production (percentage)
State	16	5 425	28.96
Private	14	8 820	47.09
Mixed	5	4 485	23.95
Total	35	18 730	100.00

Parallel to its rapid development, the cement industry was facing several problems, technical, economic and commercial, for which solutions based on scientific data had to be found and thus the establishment of a research institute became an urgent need.

During the preparatory studies for the establishment of a research centre, the need for technical expertise appeared to be the most urgent problem and, in order to solve this problem, it was decided to bring UNIDO into the picture. After consultation with the Resident Representative of UNDP in Ankara, UNIDO provided two short-term experts to come to Ankara to participate in the preparation of the project document.

II. PREPARATION OF THE PROJECT

The project document was approved by the Turkish Planning Office in late 1973. The main problems it set out to tackle were these:

(a) Most of the cement plants operating in Turkey were equipped with automatic control instruments, devices and recorders. These were intended to ensure safety, keeping the products up to specification, efficient operation throughout the manufacturing process and a reduction in energy consumption. However, due to lack of skilled personnel and inadequate technical know-how, the process-control equipment was not functioning properly and consequently the above-mentioned objectives were not achieved. A complete rehabilitation of the whole process-control system was essential;

(b) The Turkish Cement Manufacturers' Association (CMA) was carrying out quality-control services with its limited facilities. This was not as efficient as it should be and the need for a more effective and adequate control system was obvious;

(c) Alongside fast development in the cement sector, the need for new types of cements and particularly for blended cements also developed which necessitated research work to determine the appropriate formulations;

(d) The proper use of cement and the most appropriate way of producing concrete were not always followed by the concrete manufacturers and certain measures, including training, needed to be taken. The provision of a well-equipped concrete laboratory was essential.

In addition to the requirements outlined above, there was an evident need for efficient training facilities, for an information and dissemination centre and for advisory and consultation services.

Once the main objectives and needs were defined, it was decided that the Cement Research and Development Centre should be set up and must include the following main sections:

(a) An automation and measurement technique unit to deal with the process-control problems;

(b) A complete cement laboratory to carry out the quality-control work more efficiently and to conduct the research work necessary to solve the urgent problems of the sector;

(c) A well-equipped raw-material laboratory to conduct the necessary laboratory-scale research on raw materials and additives for the proper formulation of all types of cement, especially blended cements;

(d) A complete concrete laboratory to provide full services to the concrete manufacturers.

During the execution of the project, further needs for the establishment of additional units and complementary services were considered in a more detailed way and work programmes were reviewed to include the provision of an information and documentation unit, a language laboratory, a workshop, a small photo and film studio, a glass studio, a fuel laboratory, a photocopy and mimeography unit, training facilities, and advisory and consultation services.

In the project document, certain paragraphs were included dealing with UNDP's previous and future assistance, the institutional framework of the organization, provision for government follow-up, and other related activities with particular reference to seeking bilateral supports for the project. A detailed work plan describing project activities, UNDP inputs, bar charts, and project budgets covering UNDP and government counterpart contributions, were also included in the document.

The project document was published by the Government in the official gazette T.C. Resmî Gazete, dated 14 May 1975, number 15236, reference 7/9192, and thus came into force.

III. IMPLEMENTATION OF THE PROJECT

The Executive Committee of the Turkish Cement Manufacturers' Association decided to start the construction of the Cement Research and Development Centre at a meeting which was held on 29 April 1975. The civil work was contracted to a Turkish construction company on 8 August 1975 after evaluation of tenders submitted by a number of local firms and construction work began late in 1975.

A. Financing

Sources of funding

In broad terms, the establishment of the Cement Research and Development Centre was to be financed through local and foreign contributions, the former for local expenditures including the land, buildings, and locally available equipment and the latter for foreign expertise, scholarships and modern laboratory equipment which had to be imported. The proportion of local and foreign funds needed was estimated to be more or less equal and at the end of the project this estimate proved to be correct, as will be seen later.

The Cement Manufacturers' Association purchased 63,250 square metres of land as a site for the centre. The cost of construction was also completely met by the Association. However, a temporary difficulty in financing slowed down construction activities for a while and this eventually caused a delay of about nine months beyond the projected date of completion.

The specific clause which was included in the text of the project document relating to bilateral assistances proved invaluable since, during the execution of the project, enormous contributions were secured through this particular clause. Naturally, the contributions and assistance of all the parties involved were considerably increased and encouraged by certain aspects of the project such as the priority given to it by the Turkish Government, the efficient co-operation and co-ordination between the UNDP and UNIDO representatives and the Turkish counterparts and the fact that the project proceeded according to plan and ran smoothly.

Sources and quantities of contributions so far secured are shown below.

Table 3. Sources of financial contributions up to 1 September 1980
(Thousands of $)

Year	UNIDO/UNDP	Federal Republic of Germany	Turkish Cement Manufacturers Association	Others
1973	5	-	1 800	
1974	34	-	300	
1975	108	-	500	
1976	62	525	1 500	41
1977	270	110	1 500	22
1978	200	125	200	
1979	105	1 450	200	
1980	295	105	200	—
Total	1 079	2 315	6 200	63

Grand total 9 657

Distribution of expenditure

As mentioned above, contributions secured through UNDP and through bilateral assistance were used mainly for experts, scholarships and study tours, laboratory and workshop equipment, training material, certain office machines and vehicles. Local contributions were used mainly for the construction of buildings and to meet local expenditure.

Table 4, below, shows the distribution of expenditure according to the main cost items.

Table 4. Distribution of expenditure
(Thousands of $)

Item	Amount
Land	1 800
Construction of buildings	3 800
Experts[a/]	681
Scholarship and study tours[b/]	168
Equipment[c/]	2 908
Other	300
Total	9 657

a/ Names and duration of mission of short- and long-term experts are given in annex I.

b/ Number of scholars, fields and places of training and information on study tours are given in annex II.

c/ Extensive deliveries of equipment from the Federal Republic of Germany have supported UNIDO in supplying several departments of the Centre with essential apparatus, spare parts and support systems.

B. Main project activities

The progress of the implementation of the project may be summarized in terms of its main activities.

Buildings

The construction of buildings, including the administration section, laboratories, cafeteria, conference hall and other auxiliary units, covering a construction area of about 6,250 square metres, was started late in 1975 and completed in mid-summer 1978.

The entire civil work cost $3.8 million against the bidding price of $2.6 million due to the high rate of inflation during this period.

All architectural and engineering services, including technical control of the construction, were provided by the Turkish Cement Industries Corporation. Certain modifications were made to the architectural projects after consultation with the experts F. Le Bel and G.M. Idorn who visited Turkey for a short while in October 1977 at the invitation of the Cement Manufacturers' Association. The expenses of this visit were met by the Association.

A group of engineers, including the architect of the project, representatives of the civil-work contractor, the construction supervisor and a chemical engineer working for the Association, visited various leading cement research laboratories in Europe in order to see the most up-to-date systems and on their return submitted a report on their impressions including a number of suggestions which were incorporated into the project. The expenses of this visit were met by the Association.

Experts

As will be seen in annex I, various experts visited Turkey up to 1 September 1980 and most of them provided invaluable inputs and assistance to the project. Excluding very short consultation visits, the results obtained from the missions of experts are summarized below.

Francois Le Bel dealt mainly with the following topics which have great importance for the sector:

Energy savings in the cement industry
New techniques in the production of blended cements
Important aspects of the operation of cement plants

Furthermore, Mr. Le Bel gave several lectures to selected audiences on the above-mentioned subjects, followed by technical discussions.

Mr. Le Bel's missions yielded extremely fruitful results especially in the production of blended cement. As table 5 shows, production of blended cements increased very rapidly during the last five years and now represents more than 75% of total cement production, which has resulted in important savings of fuel. Indeed, it is estimated that, in 1980 alone, savings of fuel oil in the cement sector in Turkey will be around 120,000 tonnes.

Table 5. Development of the production of blended cement in Turkey

Year	Quantity of cement produced (thousands of tonnes)				BC share of total production (percentage)
	NPC[a]	BC[b]	Others[c]	Total	
1973	8 506	246	194	8 946	2.7
1974	7 813	871	247	8 931	9.8
1975	8 634	2 113	103	10 850	19.5
1976	9 630	2 688	74	12 392	21.7
1977	9 186	4 570	76	13 832	33.0
1978	6 870	8 390	84	15 344	54.7
1979	4 001	9 735	76	13 812	70.5
1980[d]	3 042	9 880	78	13 000	76.0

a/ Normal Portland cements.

b/ Blended cements including trass and slag cements.

c/ Other special cements produced on request including white cements.

d/ Projected figures.

Mr. Le Bel particularly underlined the importance of blast-furnace slags as valuable additives. He visited steel mills such as Karabük and İskenderun and, taking his advice into account, extensive studies were afterwards performed by experts of the Turkish Cement Industries Corporation. It was concluded that the extension of the Bartin Cement Plant, located on the Black Sea coast near the Karabük Steel Mill, would be a feasible project, particularly given the possibility of using blast-furnace slag produced by the Karabük Steel Mill in large quantities. The extension of the Bartin Cement Plant has now been included in the annual investment programme of TCIC by the State Planning Office and serious studies are being made for the realization of this project. The World Bank has also recently become involved in the project and has shown an interest in meeting the foreign currency needs connected with it.

Similarly in İskenderun, where TCIC has a clinker-grinding plant, a similar project based on Mr. Le Bel's suggestions is under consideration.

Mr. Le Bel's advice in regard to the utilization of Elbistan lignites, Turkey's largest brown-coal deposits in the south-east of the country, is also being studied. However, very comprehensive research would be necessary to prepare a sound project for this region. A huge power station in Elbistan is under consideration and,according to laboratory test results, the ash produced by this power station as waste material will have a chemical composition which might make its use as raw material for cement production possible. However, it is too early to prepare a precise project now.

Gunnar M. Idorn, who is one of the world's leading experts in concrete technology and was the director of a famous concrete research station in Denmark, has provided considerable assistance. He was asked to make recommendations on the policies to be followed by the CRDC for the cement and concrete industry. His recommendations also included arrangements for the concrete laboratory of the CRDC, the services to be offered, and preparation of national and international training courses in concrete technology. Mr. Idorn's recommendations were fully taken into account during the preparation of an organization chart for the structure of the CRDC and of the document defining its aims and status. The organization chart and a summary of the document are given as annexes III and IV at the end of this report.

His suggestion for setting up a Turkish concrete institute which would co-ordinate the activities of universities, research laboratories, concrete manufacturers and other related bodies is also under consideration and such an institute will be established in the near future. The aim of the institute will be to make all essential knowledge on concrete technology available for improvements in practice.

Harold Boeck dealt primarily with manufacturing technology in the cement industry, the engineering aspects of cement plants, new systems, capacity and site selection and he has given very effective assistance to the sector. As a result, a group dealing with the preparation of feasibility studies is now well established. Up to now, it has been housed within the TCIC. This group carries out very competent feasibility studies and has recently started to offer this service to the private sector of the cement industry as well. Furthermore, the group is able to provide this service to neighbouring countries and, in fact, following an agreement with the Islamic Development Bank, this

group will soon be extending its services to the member countries of the Islamic Development Bank, most of whom are developing countries in need of foreign expertise in the field of engineering. The work of this feasibility group is in conformity with the stated objectives of the Lima Declaration and Plan of Action on Industrial Development and Co-operation and has thus a special importance.

In addition, this group has recently started a study aimed at computerizing considerable parts of the theoretical work of industrial feasibility studies. Computer programs are being developed with the help of two engineers who have previously been trained abroad through the UNIDO fellowship programme.[1/] When the preparation of this computer program is completed, both the existing AEG computer at the CRDC and the new PDP 1-11 computers which will be delivered to the Centre soon, will be used for carrying out the programs.

Jean-Claude Antoine, who has been in Ankara twice as a UNIDO expert, was also involved in the preparation of feasibility studies, but, being an economist, he dealt exclusively with the economical aspects. He made a valuable contribution to the project and had an important role in creating and developing the above-mentioned group. On one occasion, he was in Ankara at the same time as Mr. Boeck and they trained the feasibility group together.

Gerhard Grieshammer visited Ankara twice and prepared very comprehensive reports which formed the basis for the Federal Republic of Germany's assistance to the project. These reports dealt with all aspects relating to the establishment of a raw material laboratory from the planning to the operational stage, even down to the correct way of installing the equipment to be delivered and the schedule of the training programme to be followed. As a consequence of these well-prepared reports, very considerable assistance from the Federal Republic of Germany was obtained.

Uwe Zimmer, a German concrete expert, who visited Ankara both for UNIDO and for the Federal Republic of Germany, and K. Yokoyama, a Japanese concrete expert, separately and at different times both prepared rather similar reports on the equipment for the concrete laboratory. The agreement between their reports establishes the adequacy of their conclusions and provides a good basis for possible future contributors. Mr. Zimmer also included in his report detailed descriptions and work diagrams for the concrete laboratory and flow-charts for the preparation and testing of concrete mixes. With the help and

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1/ One of them, Mr. O. Karadoğan, an electronic engineer, is now in the army as a reserve officer, but he still participates in this study as a part-timer. The other engineer, Mrs. A. Özdamar, is a full-time employee of the group mentioned above.

advice of Mr. Idorn, the experts' reports for the concrete laboratory were finalized and are ready for implementation.

Felix Sobek, an expert from the Federal Republic of Germany in the field of firing systems and specially in the use of natural gas as a fuel for cement plants, visited Turkey as a short-term expert. His advice, both at the headquarter of TCIC and at the Pınarhisar Cement Plant, in the neighbourhood of which natural gas was discovered, gave extremely fruitful results and the Pınarhisar Cement Plant has been using natural gas since 1977 without any difficulty. In addition, the problem of environmental pollution has decreased considerably. The same technology is expected to be used in both the Adana and Mardin Cement Plants, in the neighbourhood of both of which natural gas was found in adequate quantities.

Alfred Madsen provided assistance to the cement plants of Çorum and Ünye. His contribution covered expertise in the field of regular and preventive maintenance work in cement plants.

Nicola Schicci was another short-term expert, specializing in diesel generators, who gave direct assistance to the Van Cement Plant where a number of diesel generators had become rather obsolete due to the lack of expertise. Mr. Schicci stayed in this cement plant, examined all existing generator groups and prepared a detailed report including technical advice on re-activating the generators, the spare parts to be imported and other measures to be taken. Due to lack of foreign currency, however, his recommendations have not been completely carried out.

Fellowships

The number of fellowships and study tours undertaken during these seven years represented a total of around 60 man/months.

Out of the 42 persons who have been awarded fellowships, 29 are still working in the cement sector, 17 of them employed by the CRDC as full-time personnel. Of the scholars who have left the cement industry, two have temporarily joined the army as reserve officers (O. Karadoğan and C. Özdenfedekar), one (H. Erkan) joined the DESİYAB (State Industry and Employer Investment Bank) looking after the cement project,[2] one (A. Baydar) joined TEK (Turkish Electricity

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[2] H. Erkan has prepared the following reports as a DESİYAB staff member: Sector analysis of the Turkish cement industry; feasibility study for setting up a granulation unit at the Ereğli Steel Plant; feasibility study for setting up a grinding and packing plant for the production of blast-furnace slag at the Ereğli Steel Plant; feasibility study for a coal mill for the Batı Anadolu Cement Plant in İzmir; feasibility study for a trass-drying unit for the Yozgat Cement Plant.

Board) where she deals exclusively with the utilization of fly ash obtained as waste material from the power plants operated by TEK.[3/]

The remaining few who had training through the fellowship programme of the project and who have totally left the cement sector have mainly done so because of better payment conditions in other sectors. In order to correct this, the appointment regulations of the CRDC, including a scale of wages and salaries and a bonus plan, were set up in such a way that CRDC is now able to pay its employees about 15% higher than employees in the government service, though its rates are not yet comparable with those paid in private industry. It is expected that comparability with the private sector will soon be achieved.

Since the statute of CRDC and the present organizational structure came into force, all appointments have been made, or corrected, in accordance with the appointment regulations.

At present, the number of personnel working for the CRDC is 27.

Study tours

As will be seen in annex II, 19 man/months of study tours were undertaken up to 1 September 1980. Through these study tours, top people had the opportunity of visiting various countries with fruitful results.

Visits made to Japan provided an opportunity to become acquainted with the cement technology of that country, as a result of which the precalcination systems which were invented and improved in Japan are now being considered for use by the Turkish cement sector. The first precalciner kilns will most probably be installed in the extension of the Bolu and Bartın cement plants. Feasibility studies for these extensions are now being prepared. Visits to cement research stations in Japan also provided very useful ideas in terms of the establishment, organization and operation of research institutes.

Visits made to the Union of Soviet Socialist Republics provided invaluable experience, particularly in the field of winter concreting. A full report was prepared on this subject and distributed to the relevant authorities and lectures were given. In Turkey, particularly in central and eastern Anatolia where winters are long and severe, construction seasons are rather short. As a result, the demand for cement reaches its maximum for a few months of the year.

3/ A. Baydar has been involved in the preparation of a book, Possible Fields of Utilization of Fly Ash in Turkey, which is due to be printed soon.

This siuation causes difficulties in meeting the seasonal demand, although the annual production of these regions has always been more than the annual consumption of cement. The technology of winter concreting will be of great help in solving this problem, but it can only be introduced after the concrete section of the CRDC becomes operative.[4/] Visits to the Union of Soviet Socialist Republics, which included a tour of Siberia, provided experience in operating cement plants at extremely low temperatures.

Visits to the United States of America certainly provided good experience since these trips included visiting a number of research and development institutes and cement plants. Participation in an international conference in the United States, where cement and concrete specialists discussed a number of topics relevant to cement production and use, also provided fruitful inputs for the Turkish cement sector. The CRDC now plans to use methods very similar to those of the National Bureau of Standards in the United States in checking the performance of the control laboratories in cement plants in terms of the accuracy of the tests they carry out.

The visits to India were particularly useful since India has had a similar path of development in the cement sector to that which Turkey is now following Possessing well-equipped and effective cement research laboratories, India is an advanced country in cement technology and the Indian cement industry has long become self-reliant and is exporting engineering know-how to other developing countries. From this point of view, CRDC wishes to co-operate with similar institutions in India. This co-operation could start by an exchange of experts within the framework of the Technical Co-operation among Developing Countries (TCDC) programme and could provide mutual benefit.

The visit to China provided the possibility of becoming acquainted with Chinese experience in the field of cement technology. Although participants could not visit cement plants in this country,[5/] a meeting held between Turkish and Chinese experts and a short visit to a building research station near Beijing (Peking) provided interesting insights into the development of this sector in China.

4/ Another similar practice which would help the even distribution of cement demand throughout the year is the manufacture and use of prefabricated construction elements. This industry is still very limited in Turkey.

5/ It is expected that full information about cement technology in China, with special reference to energy conservation in the cement sector and the use of different processes and techniques, including mini-cement plants, will be gathered through Turkish participation in the Interregional Seminar on Cement Technology to be held in China from 9-22 October 1980.

The visit to the Federal Republic of Germany enabled Turkish representatives to discuss the possible volume and coverage of the contribution which this country was intending to make. Turkish experts also visited the institutions where a group of engineers from the Turkish cement sector were being trained and had an opportunity to discuss the programme with experts of the Federal Republic of Germany. During this trip to the Federal Republic of Germany, Turkish officials also had a chance to visit the cement research laboratories at the University of Aachen where they met with top experts in the field of cement research. Prof. Dr. G. Ludvig afterwards visited Ankara within the framework of the technical assistance provided by the Federal Republic of Germany and made an important contribution to the project. In the near future, CRDC will co-operate with the cement research section of the University of Aachen.

The visit to Brazil was in connection with an international seminar held in that country in the field of low-cost housing. The Turkish participant contributed a report to the seminar.

IV. ACHIEVEMENTS OF THE PROJECT

The project as a whole, with all its shortcomings and successes, has itself made a great contribution to the Turkish cement industry and the CRDC has already started providing productive services to the sector.

In the near future, the CRDC will be fully operational along the lines of the objectives set out in the project document. The only sections remaining to be completed are the concrete laboratory, which is not equipped so far, and the partially-equipped raw materials section. All the remaining equipment of the raw materials section is being shipped and is expected to arrive and be installed by mid-October 1980. This means that all the main sections of the CRDC, with the sole exception of the concrete laboratory,[6/] will be fully operational by the end of 1980, which, is in fact, the terminal date of the present project.

As part of the successful setting-up of the CRDC, and particularly due to the input of technical expertise, certain specific objectives have been achieved which may be summarized as follows.

1. A cement school has been opened within the CRDC in order to provide a complete basic training for non-skilled personnel to be employed by the cement industry and more advanced training for personnel of different categories already employed by the sector. The first course of this school started in August 1980 and 30 graduates of technical schools, from different disciplines, are being trained. These technicians will have theoretical courses for the first two months after which they will have on-the-job training in cement plants for a further four months. After this six-month training, these technicians will be appointed to various plants. Every year, two such courses will be conducted at different levels and for different disciplines. In the near future, similar courses will be organized regularly for participants from other Near and Middle-East countries and also from some African countries. At present, the only regular course being conducted for participants from foreign countries is the In-Plant Group Training Programme in the field of cement technology which is organized by UNIDO in co-operation with the Turkish Cement Manufacturers' Association. The first In-Plant Training Programme of this nature was held late

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6/ CRDC has made an agreement with the concrete section of the Middle East Technical University in Ankara to use their facilities, both academic staff and laboratory equipment, whenever needed. The first full co-operation in this matter started in 1979 during the In-Plant Group Training Programme and the university has provided a full training course for the participants both in CRDC and at the university.

in 1979 and was attended by 19 participants from 17 countries. The same Group Training Seminar will take place this year from 3 November to 20 December 1980 in Turkey. Twenty participants are expected to attend this seminar.

2. A good dialogue between the CRDC and cement plants has been started. In this connection, a small team from CRDC are visiting plants and meeting plant managers and section heads in order to discuss the problems of each particular plant, the way the plant management has tried to solve these problems, the results they have achieved and the possibility of CRDC assistance. CRDC has developed a questionnaire relating to this activity, through which CRDC staff can become familiar with the problems of each plant, local resources available for solving the problems and local experience in dealing with such questions. In the course of time, through proper evaluation and interpretation of the data collected, which eventually will build up a complete data bank, CRDC will be able to provide more efficient assistance to the sector.

3. The concept of the production of blended cements has been significantly promoted and, as shown in table 5 above, production of such cements has increased rapidly, providing invaluable economic benefits to the sector and to the country. In this context, the extension of the Bartın and İskenderun cement plants is being seriously considered. In both cases it is planned to utilize the blast-furnace slag from the nearby steel plants in large quantities. A similar situation exists in the Elbistan district in south-east Anatolia, where the largest power station in Turkey is under construction with the aim of using the immense deposits of brown coal existing in the area. A project for a cement plant is being considered in which the ashes of the Elbistan power station will be used, providing great advantage to the national economy.

4. The use of precalciner kilns, both for the new cement plants and for the extensions to existing plants, is planned. This system will result in a reduction in the total cost of investment and will also permit the use of raw materials with higher amounts of impurities. The use of low-grade fuels will also be possible. The first precalciner kiln will be installed in the extension of the Bartın Cement Plant.

5. The use of natural gas as a fuel in cement plants has been started at the Pınarhisar Cement Plant. Similar applications are being considered for the Adana and Mardin Cement Plants where natural gas deposits have been discovered.

6. The raw-materials section of the CRDC is about to start an important project in making an inventory of the raw materials available in Turkey which are suitable for the production of cement. This survey, when completed, will provide invaluable information for the preparation of accurate feasibility studies. It will be especially helpful in the selection of sites for future cement plants which will be of considerable advantage both to the cement sector and the national economy in general.

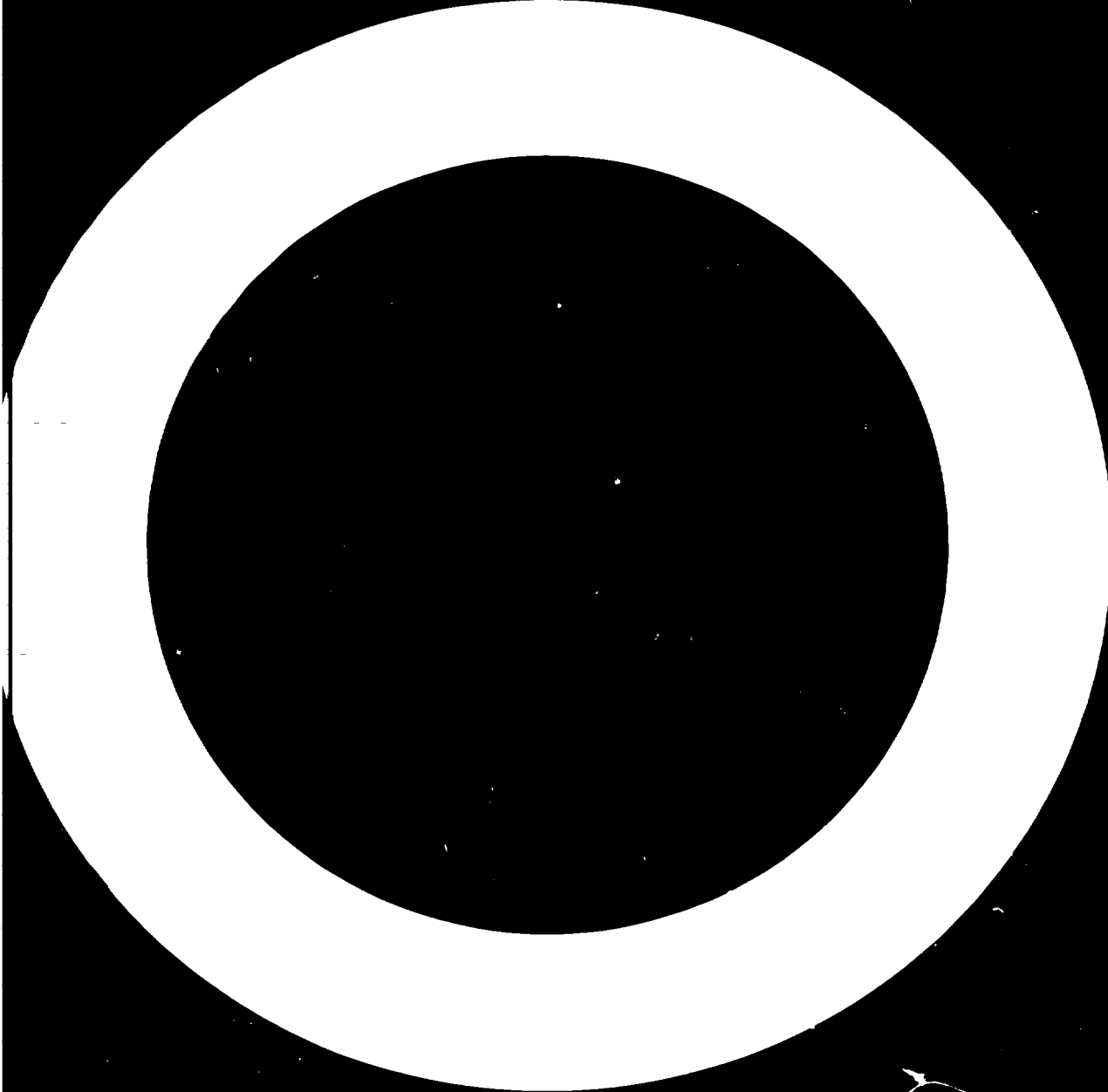
7. The feasibility group, already set up, now has the skill and experience required to provide services to the Turkish cement sector and is intending to export the same services to other developing countries within the framework of the TCDC programmes.

8. In order to use the computers in the CRDC in the fullest possible way, additional computer programs are being prepared. Thus, the computers will be used for theoretical and economic studies, including feasibility studies, in addition to their use by the CRDC for laboratory test and research work.

9. Quality control work is already being entirely conducted by the CRDC.

10. Information and advisory services will develop in due time.

11. Research activities, which are only being conducted to a limited extent, are expected to grow progressively and to gain significant momentum in the near future.



Annex I

INFORMATION ON PROJECT EXPERTS AND THE REPORTS PRODUCED[a/]

Process control equipment - Sigmund Abaffy, Sweden

The expert came for 12 months in January 1974 as a process-control expert. He became the project manager and his appointment has been consecutively extended until 9 January 1981.

Cement technology - Harold Boeck, Denmark

25 Nov. 1976 - 24 March 1977	(as feasibility expert)
29 Sept. 1978 - 13 May 1979 3 Nov. 1980 - 20 Nov. 1980	Three reports, all subtitled: "Applying (or Application of) new appropriate energy saving technologies in the Turkish cement industry" DP/ID/SER.A/109, 21 June 1977 DP/ID/SER.A/189, 15 January 1979 DP/ID/SER.A/216, 4 July 1979

Maintenance - Alfred Madsen, Denmark

28 Nov. 1976 - 29 Dec. 1976	"Preventive and general maintenance of cement-making equipment" DP/ID/SER.A/93, 8 February 1977

Feasibility studies - Jean-Claude Antoine, France

10 Dec. 1976 - 22 Jan. 1977	"Financial preparation of feasibility studies"
5 July 1978 - 12 July 1978	DP/ID/SER.A/151, 2 March 1978

Diesel Generators - Nicola Schicci, Italy

29 Sept. 1976 - 28 Oct. 1976	"Assistance to the diesel electric power station at the VAN cement plant" DP/ID/SER.A/88, 18 January 1977

Firing cement kilns - Felix Sobek, Federal Republic of Germany

27 Sept. 1976 - 25 Oct. 1976	"Conversion of firing system for use with natural gas" DP/ID/SER.A/70, 15 November 1976

Cement manufacturing - Francois Le Bel, France

18 Nov. 1976 - 10 Dec. 1976 2 Sept. 1977 - 6 Oct. 1977	Two reports subtitled: "Study on the optimization of cement kiln and mill productivity" DP/ID/SER.A/81, 18 January 1977 DP/ID/SER.A/119, 2 December 1977
1 Sept. 1978 - 15 Oct. 1978	"Starting up of the research laboratory for the cement industry" DP/ID/SER.A/189, 19 June 1980

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a/ All reports issued under this project have the same general title, "Cement Research and Development Centre". The subtitles and reference numbers of the experts' technical reports are listed here.

Testing cement and raw materials - Gunnar Idorn, Denmark

3 Dec. 1976 - 13 Dec. 1976	"Mission report on concrete technology" UNIDO/IOD.85, 4 March 1977
5 July 1978 - 13 July 1978	"Winter concreting" DP/ID/SER.A/171, 20 October 1978

Concrete technology - Uwe Zimmer, Federal Republic of Germany

2 Oct. 1977 - 17 Dec. 1977	"Study on the equipment and organization of the concrete technology laboratory" DP/ID/SER.A/147, 11 January 1978
2 June 1978 - 27 July 1978	

Raw material testing - Gerhard Grieshammer, Federal Republic of Germany

18 Sept. 1978 - 15 Oct. 1978	"Cement research equipment" DP/ID/SER.A/178, 3 November 1978

Mr. Grieshammer was in Turkey three times earlier as a bilateral expert from the Federal Republic of Germany.

Annex II

INFORMATION ON FELLOWSHIPS AND STUDY TOURS

Fellowships

The following fellowships were awarded:

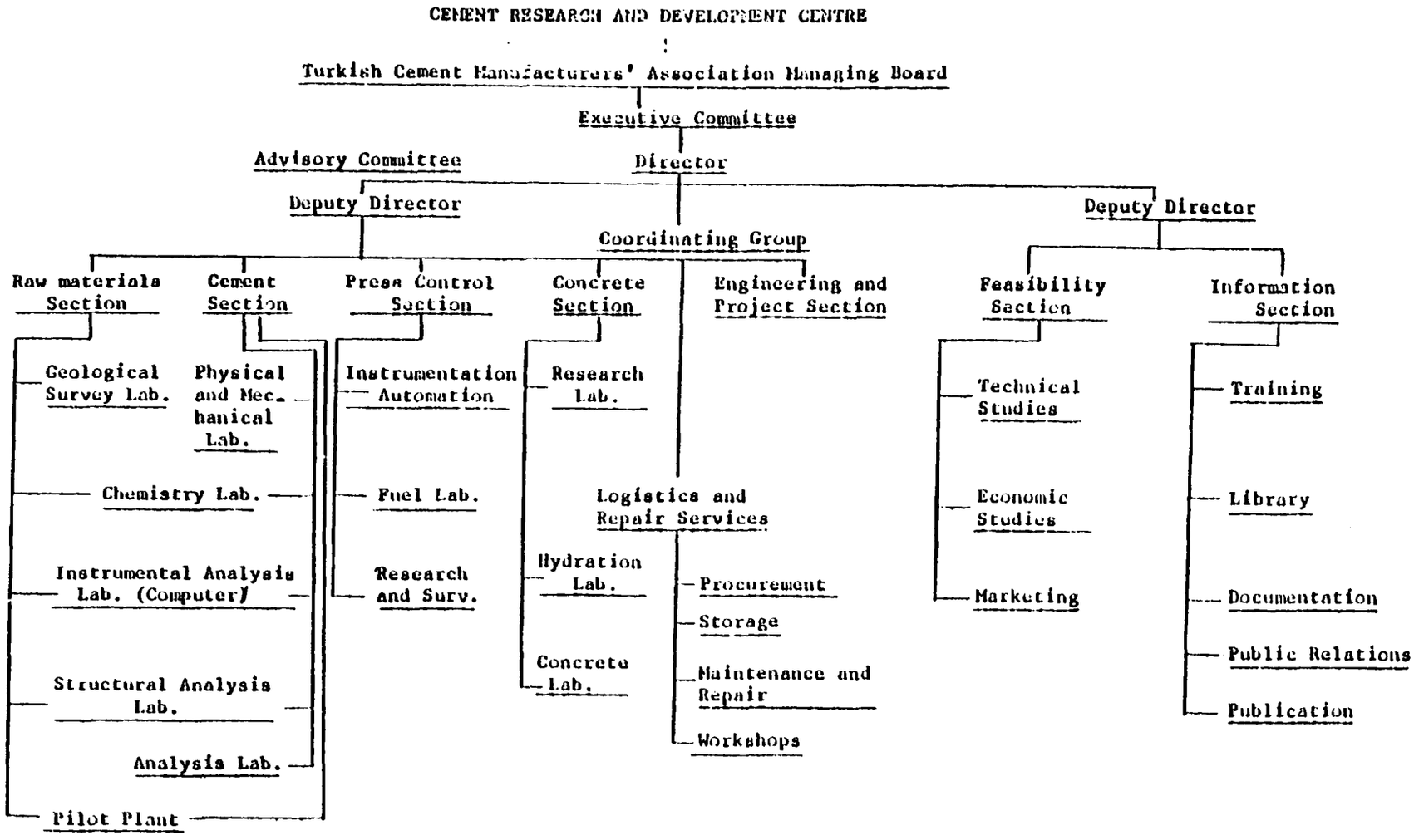
		Man/ months	Number of persons involved
Measurement and control of electrical systems in cement factories	France/Federal Republic of Germany	6	3
Process-control instruments	France	1	1
Electronic instruments	Federal Republic of Germany/ Switzerland	2	2
Schenk weigh-feeders	Federal Republic of Germany	10	9
Modern instruments in chemical analysis	Federal Republic of Germany	5	4
Modern instruments in chemical analysis	France	4	3
Electron microscopy	Japan	2	1
Analysis of computer data	Federal Republic of Germany/ Switzerland	7	2
Feasibility studies	France	4	5
Total		41	30

Study tours

A total of 21 study tours, representing about 19 man/months, have been made (some in groups) by 24 management personnel to the following countries: Brazil, Federal Republic of Germany, France, Hungary, India, Japan, Poland, Sweden, Union of Soviet Socialist Republics, United States of America.

Annex III

ORGANIZATION CHART OF THE CRDC



Annex IV

SUMMARY OF THE STATUTE OF CRDC

Aim

Article 1

CRDC's aim is to develop the present and planned cement and other hydraulic sectors in our country according to modern technologies, and to adapt the present technology to the conditions of the country.

Subjects of work

Article 2

The main functions of CRDC are:

(a) To obtain scientific, technical and economic data and to plan and implement short- and long-term research on these subjects;

(b) To conduct empirical and theoretical research, in co-ordination with research institutes and universities, to solve the problems of the sector and to meet the requests of foreign countries;

Article 3

(c) To act as advisor to the sector and its consumers and also to foreign countries;

(d) To inform the producers and consumers about the latest technology;

(e) To provide all kinds of training;

(f) To improve quality control in the Turkish cement plants and act as an arbitrator in disputes;

(g) To control cement and hydraulic binders in accordance with accepted standards on behalf of the Ministry of Industry.

Decision and executing organs

Board

The Board of CRDC determines the sphere of competence to be given to the Director of the Centre and the Executive Committee. It also determines the methods of management and control of CRDC.

Advisory Council

The Advisory Council is composed of representatives of the sector, universities and the State Planning Organization. It assists CRDC with its short- and long-term research and development programmes. The Advisory Council meets twice a year.

Organization

Director of CRDC

The Director is appointed by the board of the Cement Manufacturers' Association and he or she has the responsibility for financial, technical and administrative matters. The Director can attend the meetings of the Board and Executive Committee as an observer.

Technical Deputy Director

The Technical Deputy Director is responsible to the Director for the management and co-ordination of these units:

(a) Raw material and cement research section;

(b) Process control and research section;

(c) Concrete research section;

(d) Pilot plant;

(e) Supply and maintenance section.

Economic Deputy Director

The Economic Deputy Director is responsible to the Director for the co-ordination of the work of these units:

(a) Feasibility studies section;

(b) Training and information section;

(c) External relations section.

Co-ordination section

This section is linked directly to the Director and indirectly to the Technical and Administrative Deputy Directors. The personnel of this section assist CRDC with their knowledge and experience.

Revenues

Article 4

The revenues of CRDC are derived from:

(a) Funds available from the cement fund of the Ministry of Industry, royalties received by the Cement Manufacturers' Association, funds created by cement exports;

(b) Fees earned from the research, development, advice and arbitration services or CRDC on a contract basis;

(c) Revenues from publications;

(d) Technical assistance, grants etc.

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