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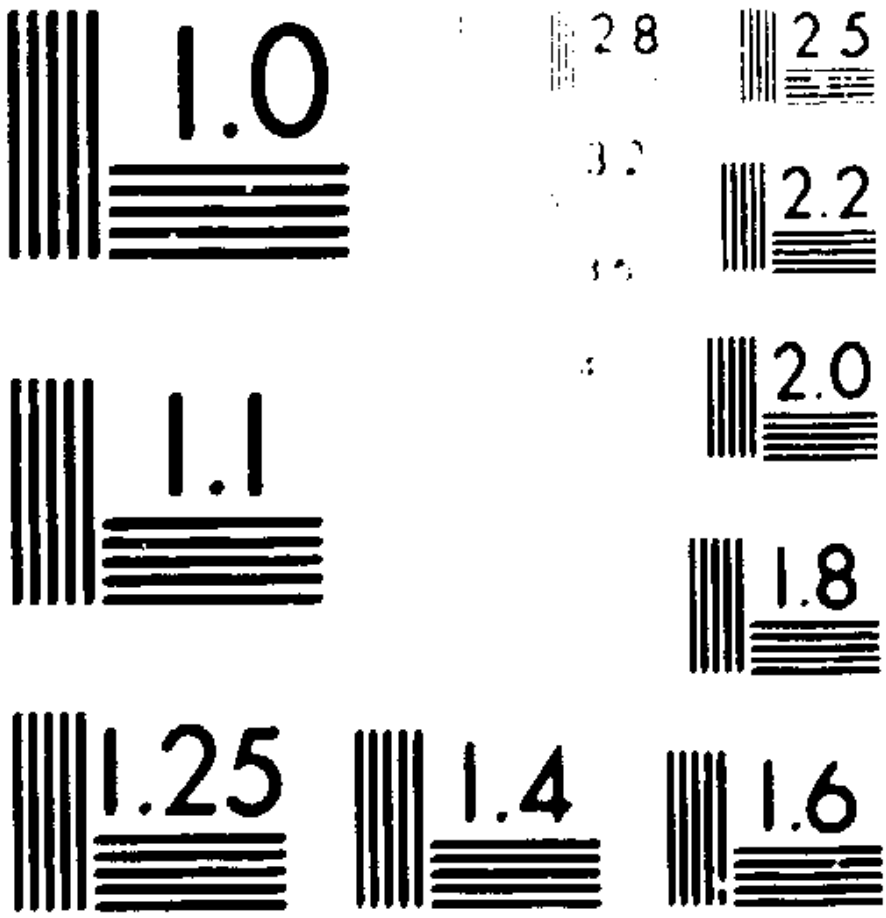
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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

HIGH-LEVEL MEETING ON CO-OPERATION AMONG DEVELOPING COUNTRIES IN THE FIELD OF CEMENT, LIME AND RELATED INDUSTRIES.

Ankara, Turkey, 14 – 18 December 1981

REPORT

Explanatory notes

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

References to tons are to metric tons.

The following abbreviations are used in this report:

ECDC	Economic co-operation among developing countries
TCDC	Technical co-operation among developing countries
UNDP	United Nations Development Programme
CHDC	Cement Research and Development Centre (Turkey)
CRI	Cement Research Institute (India)

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INTRODUCTION

The High-Level Meeting on Co-operation Among Developing Countries in the Field of Cement, Lime and Related Industries, organized by the United Nations Industrial Development Organization (UNIDO) in co-operation with the Government of Turkey and the Turkish Cement Manufacturers' Association, was held at Ankara from 14 to 18 December 1981.

It was the first meeting of its kind organized to promote closer co-operation among developing countries to facilitate the short- and long-term development of the cement, lime and related industries in the developing countries. The objective of the Meeting was to find new means of expanding UNIDO assistance under its programme of technical co-operation among developing countries.

I. ORGANIZATION OF THE MEETING

The Meeting was attended by 26 participants from the following 20 countries: Bangladesh, China, Democratic Yemen, Honduras, India, Iraq, Jordan, Malaysia, Mali, Nepal, Niger, Philippines, Somalia, Sri Lanka, Thailand, Turkey, Uganda, United Republic of Tanzania, Upper Volta and Yemen.

The Arab Union for Cement and Building Materials was also represented at the Meeting.

Carl Rydeng, UNIDO, served as Director of the Meeting in co-operation with Faruk Yagiz of the Turkish Cement Manufacturers' Association.

Opening addresses

The Meeting was opened by Sedat Yildiz, President of the Cement Manufacturers' Association of Turkey.

In his welcoming address Mr. Yildiz pointed out that participants had assembled to discuss how developing countries could co-operate to promote the growth of their cement, lime and related industries -- vital industries. He emphasized that the progress of developing countries depended primarily on their own efforts. The people of the developing countries should not remain inactive and wait for external help; they should instead take determined steps to accomplish the tasks they had set for themselves. In their endeavours, time was vital and should be utilized effectively to the maximum extent.

Developing countries having similar economies and facing similar problems should find new ways for broader and more effective co-operation and means of exchanging experience among themselves. Meetings such as the present one provided an excellent opportunity to promote such co-operation and should therefore take place more frequently.

On behalf of the Executive Director of UNIDO, Mr. Rydeng thanked the Turkish authorities and the Cement Manufacturers' Association for their support in organizing the first high-level meeting for cement and related industries. This new type of meeting should help UNIDO to find new ways of accelerating the development of specific industries.

The purpose of the Meeting was to analyse the situation of the cement, lime and related industries in different countries and use the best ideas and experience for international development activities.

As a starting point for the meeting, Mr. Rydeng made a quick review of the technical development of the cement industry.

The industry apparently had always been difficult to establish and operate. Progress in the early days of the cement industry was made by sharing experience. Today UNIDO was a focal point for sharing experience in policy making and in operating plants. UNIDO followed the development of the cement industry in all developing countries and was ready to advise and assist whenever called upon.

Special attention should be given to technical co-operation among developing countries as a possible supplementary technical assistance programme because it was an economic approach to transferring available know-how among developing countries. A good example of this approach was the training programme organized by the Turkish cement industry for other developing countries.

Election of officers

The following participants were elected officers of the Meeting:

Chairman:	F. Yagiz, Head of the Planning Department, Turkish Cement Manufacturers' Association
Vice-Chairman:	S. Al-Kassab, General Secretary of Arab Union for Cement and Building Materials
Vice-Chairman:	R.K. Tikku, Joint Secretary, Department of Industrial Development, Ministry of Industry, Government of India
Rapporteur:	A.A. Awil, Manager of Cement Factory Project, Ministry of Industry, Government of Somalia

Adoption of the agenda

The Meeting adopted the following agenda:

Opening of the Meeting

The development of the Turkish cement industry

The establishment and operations of the Turkish Cement Research and Development Centre, with major emphasis on:

- Training programme
- Services to the cement industry

The development of the cement industry in the developing countries
Country presentations by participants from selected countries
Proposals for technical co-operation among developing countries
Discussions and recommendations for a programme for future co-operation
Adoption of findings and recommendations

The participants visited the Cement Research and Development Centre, a cement factory and a factory manufacturing machinery and equipment for the cement industry.

The participants also had the opportunity to attend the closing ceremony of the two in-plant group training programmes for 34 senior technicians and engineers from 17 other developing countries organized jointly by UNIDO and the Turkish Cement Manufacturers' Association.

II. FINDINGS AND RECOMMENDATIONS

Co-operation in training

1. TCDC-organized training for engineers should be continued and extended and a new activity, in-plant training at home, should be promoted as a follow-up to training received abroad.

2. Short TCDC study tours for senior technical and managerial personnel should be initiated so that these technicians and managers can discuss common problems and techniques with counterparts in other countries to supplement their own experience.

3. Existing training facilities should broaden their scope of activities to include programmes and projects of interest to several countries in an area. Multinational training centres should be created, particularly those that would serve a group of countries having a common language and similar socio-economic conditions.

4. Regional training facilities should be developed. Here experience already available in developing countries could be utilized if appropriate.

Specific technical areas of co-operation

5. Energy conservation should be promoted through the use of industrial wastes and natural pozzolanic materials.

6. Testing methods for pozzolanic materials should be developed as well as the necessary standard specifications for low-grade and mixed cement.

7. Practice and methodology regarding pollution control should be reviewed.

Systematic exchange of information

8. A TCDC information system, including the distribution of a TCDC periodical giving information about on-going activities and documentation available in the developing countries should be established. Such a system of information exchange would function through national, subregional and regional centres and could be co-ordinated by an international information centre. The Meeting took note of the offer made by the host country to act as the co-ordinating centre.

III. SUMMARY OF STATEMENTS

The development of the Turkish cement industry

F. Yagiz

The economic and social importance of the cement industry has been recognized in Turkey, and the Government and the State Planning Office have taken measures to promote it. As a result, the cement industry is one of the well-established and developed industries in Turkey today.

During the past 15 years, cement consumption in Turkey has increased at a rate of about 11.5 per cent annually, and to meet this demand, cement production capacity has also increased steadily. The production capacity, which was scarcely a million tons per year early in the 1950s, has increased to about 20 million tons per year. At present, 35 cement plants are in operation and 7 new cement plants are under construction and due to go into operation by 1983.

The ever-mounting energy crisis has had its effect on the Turkish cement sector. Since the late 1970s the rate of growth has decreased by a few per cent. However, the figures of cement production and consumption for 1981 show that a slight recovery in the cement market has taken place. Nevertheless, the world cement industry may have to deal with a furtner aggravation of the energy situation, which will cause serious problems for cement producers, particularly those in third world countries lacking oil. Therefore, as many others have done, the Turkish cement sector has now started an immense programme for conversion from oil to coal.

For the Turkish cement sector, energy, though very important, is not the only problem to be dealt with. Like other fast-growing industries, the cement industry in Turkey also encountered during its growth numerous technical troubles at all stages, from planning to operating cement plants. All these problems caused losses in investment, in production, in marketing etc. Thus a cement research and development centre was needed, so that solutions to the problems of the sector could be found and a scientific basis for the development of the sector could be established. The Turkish Cement Manufacturers' Association, with the assistance of the United Nations Development Programme (UNDP) and UNIDO, therefore initiated a project to establish such a centre.

The Cement Research and Development Centre provides services to both the public and private sectors. Now, a few years after starting operations, the activities and services of the Centre are being extended to offer developing countries various kinds of technical assistance. The services could be further expanded to interested countries within the framework of UNIDO/TCDC programmes.

In addition to ensuring the proper operation of the existing production lines, developing countries have to improve their industrial design and engineering capabilities and apply new technologies efficiently. In this respect economic and technological co-operation between developing countries has not been as effective as it could be. The Turkish cement industry would like to strengthen this co-operation by sharing its engineering and manufacturing capabilities with other developing countries.

The establishment and operation of the Cement Research and Development Centre

M. Soylu

The two main technical divisions of the Cement Research and Development Centre are the Raw Materials and Cement Division and the Process Research and Control Division. They are at present operating fully with all the installed facilities.

The Raw Materials and Cement Division carries out (a) routine analysis and (b) research studies.

Routine analysis involves testing raw materials and cement samples for their chemical composition and physical properties. The Centre has undertaken to analyse samples from potential raw material deposits for the several new factories to be put in operation by the end of 1984. Testing of cement samples is carried out as quality control work on behalf of the Ministry of Science and Technology. Periodically, through unannounced visits, cement samples are collected from every cement plant by the staff of the Centre and tested to ensure that they conform with existing Turkish standards; moreover, representative samples from every export batch are also tested for conformance in the laboratories of the Centre.

Research studies can be divided into short-term studies, the aim of which is to find solutions to specific plant problems, and long-term studies, whereby research is carried out not for the sake of science but for the sake of industry and is expected to be directly applicable.

The Process Control Division takes care of the maintenance of all the electronic and electric equipment. The work involves calibrating and repairing such devices, which are vital for controlling the process, and making technicians who are currently working in cement plants or are about to be employed familiar with the facilities available in the Centre.

Training programmes of the Cement Research and Development Centre

B. Bertan

In line with the Lima and New Delhi declarations, the Government of Turkey is organizing in-plant training programmes jointly with UNIDO for the cement industry, small-scale foundry operations and the sugar industry. At the Cement Research and Development Centre a training section has been established that is responsible for organizing national and international training programmes, seminars and meetings. Information, public relations, publication activities of the Centre are carried out by this section as well.

The Centre is carrying out the following national training programmes:

Statistical quality control course for the chief engineers of the laboratories of the cement factories

Process control course for future technicians of the cement industry

Electrical control and measuring devices course

Automatic weigher course for electrical engineers

As regards international training programmes, the first in-plant group training was organized in 1979 and is being repeated annually. Ninety-five participants have so far participated in three interregional programmes and one regional programme. The principal objective of these programmes is to bring together a group of technical personnel for a concentrated programme the benefits of which could otherwise be obtained only through a long period of training and research and development. Two such training programmes, consisting of theoretical and laboratory training, specialized in-plant training, study visits and an evaluation session, are now being conducted. In the session concerned with theory the following subjects are dealt with:

Role of cement industry in industrial and economic development
Prefeasibility studies
Raw material and quarrying
Cement chemistry
Production technology and plant operation
Process control
Quality control and standards
Measures to conserve energy
Environmental and pollution control
Management and marketing aspects of cement industry

Study visits are made to plants engaged in manufacturing the machinery components of a complete cement plant, the Research and Exploration Institute of Natural Resources and universities and other educational institutions. Practical training is conducted in various cement plants in Turkey according to the fields of interest of the participants.

The cement industry in the developing countries

UNIDO secretariat

Cement is the most versatile low-cost building material available. Developing countries should develop the cement industry as a pace-maker for development itself. Since the industry is both investment and energy intensive, it is important to promote also alternative technologies. First, the cement quantities produced should be extended with the use of natural or artificial pozzolanic materials. Secondly, also the lime industry should be developed because lime is a binder and a starting point for production of appropriate cements, and it is an important input for agriculture and industry.

The lime industry has the further advantage that small production units are economically and technically feasible. While cement plants are seldom built with an annual capacity below 120,000 tons, lime plants can be built at a reasonable cost with capacities as small as 5,000 tons per year.

UNIDO has in the past assisted in establishing both the cement and lime industries and will also in the future support development of these industries. Support from both developing and developed countries is also needed, and technical co-operation among developing countries will be an important means of providing this support.

IV. SUMMARY OF COUNTRY PRESENTATIONS

Before proposals for promoting future TCDC activities were discussed, some delegations described briefly the present situation of cement and related industries in their countries.

Bangladesh

Owing to insufficient mineable deposits of limestone, the cement industry in Bangladesh has not developed, and the country has to meet its demand for cement mainly from imports. The Government has estimated demand for cement for the current year at 1 million tons and for 1984/85 at about 1.5 million tons. The demand for cement in the country comes mainly from the public sector, which accounts for 60-70 per cent of total consumption.

The country has only one complete cement plant, established in 1941, with a capacity of 125,000 tons per year at present. After a thorough revamping, which is expected to be completed by 1982, the plant will produce 175,000 tons annually. The limestone for this factory is largely imported from India, with only a small quantity coming from domestic sources. The largest mineable deposit in Bangladesh - about 500 metres below ground level - amounts to 100 million tons, on the basis of which a plant with 1 million tons capacity per year can be installed. According to a detailed geological study of another mineable project - at a depth of 0-200 metres - undertaken by UNDP, underground mining is not possible. Further investigation is necessary to ascertain the possibility of developing the deposit as an open quarry. Provided that they are found technically feasible, two cement plants with a capacity of 1.3 million tons per year may be installed. If development is not delayed, cement production capacity could be increased to about 1.5 million tons per year by 1985/86. It appears, therefore, that the country will continue to depend on imports until 1985/86, when self-sufficiency could be attained for a few years. Thereafter, with increased development activity in the country, the demand will gradually increase, and the country will have no alternative but to revert to importing. A few more grinding plants based on imported clinker may be installed, however. Alternatively, bulk cement terminals could be installed to reduce the cost of imported cement.

Co-operation among developing countries can play a vital role in the development of the cement and related industries in Bangladesh. Bangladesh has already started to enjoy the benefits of such co-operation; however, a systematic approach to solve the country's problems is necessary. A specific need is to have a team of Bangladesh experts trained to execute a project right from the planning stage up to marketing:

Bangladesh would request UNIDO to provide (a) guidance to Bangladesh experts in evaluating their resources and in planning and executing projects and (b) assistance in utilization of phospho-gypsum.

Bangladesh personnel from the cement industry have been participating in the training programme at CRDC. Training should continue for plant operators and selected experts to enable them to keep abreast of technical developments in the cement and related industries.

China

The development of the cement industry in China has a long history. As early as 1889 the first vertical cement kiln was built; and, in 1906, the first rotary kiln with a capacity of 4,000 tons per year was set up. In 1980, the production of cement was 80 million tons: 50 large and medium-sized plants produced 25 million tons while 4,000 mini plants produced 55 million tons.

Since China is a developing country with a vast territory and a long communication and transportation line, cement is badly needed for local industry in the vast rural areas and small towns and especially for the construction of reservoirs. In view of this situation, mini cement plants equipped with shaft kilns have been put up all over the country to satisfy local demand.

These mini cement plants have certain advantages. Little investment is required; the construction period is short; production is used locally, which saves on transportation costs; and the product is suitable for construction of housing for agricultural workers. But simultaneously they have some disadvantages. Production costs are high; the quality of clinker is low; and they consume slightly more energy than larger plants. Therefore, during the readjustment of the economy, attempts are being made to limit the development of plants that are too small, especially those equipped with manually operated shaft kilns.

China has developed more than 60 types of cement, but more than 90 per cent of production consists of ordinary Portland cement and blast-furnace slag Portland cement. The remaining 10 per cent consists of pozzolanic cement, fly-ash cement, oil well cement, rapid hardening cement, slag dam cement and white cement etc. As far as the manufacturing process is concerned, the wet process predominates at present, about 60 per cent; the remaining 40 per cent are semi-dry and dry processes. Most dry-process plants in China use waste heat boils. The average heat consumption of clinker is about 1,500 kcal/kg clinker. The suspension preheater kiln is not yet widely used in China.

The fuel of China's cement industry is mainly coal (89 per cent). Of the raw materials production, limestone is the most important calcareous material. Limestone is abundant and widely dispersed. At present more than 500 deposits with an estimated reserve of about 20 billion tons have been exploited.

To develop the cement industry, a cement development centre is now under construction with UNIDO assistance. After the completion of this centre in the near future, China will be able to offer training courses.

Several institutes deal with cement research: the Cement Research Institute in Beijing, which is a division of the Research Institute of Building Material; and the Design Institute of the Cement Industry in Tianjin (both in the north); and the Research Institute of the Cement Industry in Hefei in the south.

In recent years much research has been undertake energy saving, resource utilization and improving properties of cement and .

Democratic Yemen

The cement industry in Democratic Yemen is yet to be established. A project to erect a cement plant with a capacity of 850 tons per day is being implemented.

A feasibility study indicated that the high costs of production were mainly due to the cost of fuel and of electric power. A recent marketing survey estimated that consumption by 1986 would be below 250,000 tons a year; this means that either the surplus could be exported or the plant run at a lower capacity.

The country is also studying the possibility of starting with clinker grinding, i.e., importing clinker instead of cement and in future supplying local clinker after a plant has been erected.

Also there is an interest in studying the possibility of producing mixed cement by eddition of pozzolanic or other similar materials.

Such ideas will be evaluated in the future.

India

In April 1980, when the current five-year plan began, the installed capacity for cement manufacture in India was 24 million tons. India plans to double this capacity to 46 million tons by 1984/85. Of this additional 22 million capacity, 4 million has materialized during 1980/81 and another 4 million tons is likely to materialize during the current year. Considering the present trend of development in the cement industry and the country's extensive experience, coupled with the availability of expertise for cement machinery manufacture, the above-mentioned target is likely to be fully achieved. Plants of the size of 400,000-600,000 tons per year are fully manufactured in the country, and even for plants of 1 million tons capacity the import content is not more than 25 per cent. Consultancy in cement manufacture is also well developed.

The Cement Research Institute of India works closely with the industry. The Institute has undertaken extensive work in developing vertical shaft kiln technology for mini cement plants and precalcination technology and is carrying out raw material and quality control studies. Besides the Cement Research Institute, the government-owned Cement Corporation and the Associated Cement Company have set up institutes that provide trained workers for the cement industry.

Setting up mini cement plants is being encouraged in remote areas where scattered limestone deposits are available. Since the cost of production of such plants is higher, financial and other incentives are provided to make them economically viable.

As far as promoting TCDC is concerned, high-level meetings could be made more effective by creating some machinery for follow-up.

India can help other developing countries in:

(a) Setting up training facilities or providing training in India;

(b) Preparing project reports and feasibility studies and undertaking turnkey jobs for cement plants;

(c) Setting up facilities for manufacturing cement machinery:

(d) Setting up an information centre. The Cement Research Institute would collaborate in this project with the Arab Union for Cement and Building Materials. CRI can also provide technological information on vertical shaft kilns, precalcination, and the manufacture of rice-husk ash cement and mixed cements.

Areas where India seeks assistance include:

(a) Collaboration with the Turkish Cement Research and Development Centre;

(b) Collaboration with China in the field of mini cement plants.

Jordan

The establishment of the cement industry in Jordan dates from the early 1950s. In 1951, the Jordan Cement Factories Company Limited was formed as a public shareholding company, with a special government concession giving the company a monopoly of the locally produced and imported cement with a sale price to be set by the Government. The Government held 49.5 per cent of the Company's capital. The company started manufacturing cement in 1954 in its Fuhais works, located 20 kilometres north-west of Amman, using a semi-dry process and with a production of 200 tons of clinker per day.

In parallel with the increase in the demand for cement in Jordan, the company has expanded its Fuhais plant by adding larger production units as shown below.

Year commissioned	Process	Production (tons clinker/d)
1954	Semi-dry	200
1960	Semi-dry	300
1963	Semi-dry	300
1967	Dry	700
1979	Dry	2 000

At present the company is building a new dry-process production unit, equipped with a precalciner to produce 3,000 tons of clinker per day. The commissioning of this unit is scheduled for the beginning of 1983. The company is carrying out a feasibility study for an additional dry-process production unit, with commissioning envisaged in 1986 and that of the line under consideration is anticipated in 1986.

With those additional production units, the country's cement demand should be completely covered by locally produced cement. However, in fact, the demand for cement up to has always been much greater than the most optimistic forecast, and the company has been forced to import cement to fill the gap between its planned production and the sky-rocketing cement demand.

To promote further the cement industry, the Government is sponsoring the Reshediya cement project to set up, midway between Amman and Aqaba, two dry-process production units each producing 3,000 tons of clinker per day for export. This project is being implemented by a Japanese company on a turnkey basis. The plant, which will be linked by rail to Aqaba, is scheduled for commissioning in mid-1984. A white cement plant with an annual production of 300,000 tons is also under implementation. This plant, owned by a Syrian-Jordanian industrial company, is expected to be operational in mid-1984.

The main problems of the cement industry can be summarized as follows:

Loss of skilled personnel to neighbouring countries

Environmental pollution from the Fuhais, which is located near a residential area

Malaysia

Demand for cement in Malaysia is mainly met by local production, with only 10 per cent covered by imports when demand is at a peak. Imports to Peninsular Malaysia come mainly from Singapore and to Sabah and Sarawak from the Philippines. Because of the close proximity of a plant to southern Thailand, Malaysia exports 0.2 per cent of its production there.

Demand for cement was about 3 million tons in 1981. It is expected to increase at the rate of 15 per cent per annum in the 1980s owing to the massive efforts to improve infrastructure (highways, ports and airports) and to construct commercial buildings. Based on this growth rate, demand is expected to increase to 10.5 million tons by 1990.

At present five companies produce cement, with a total capacity of 3 million tons per annum, three of these will be expanded, thereby increasing the capacity by 3.7 million tons per annum. Projects for five new cement companies have been approved but not yet implemented. Total capacity of these projects is 4.6 million tons per annum. All together, the total approved capacity is 11.3 million tons per annum.

The five existing companies operate at an average of 85 per cent capacity. Three of these are privately owned and two have government participation. The four companies in Peninsular Malaysia produce clinker and the one in Sarawak imports clinker from Japan and the Republic of Korea, although it has plans to produce clinker in the near future.

Malaysia is still developing the cement industry. Delays and failures in project implementation are most likely due to the high costs of machinery and energy. Further, companies have to operate under government-set prices; the ex-factory price is now about $71 per ton in Peninsular Malaysia. There are also problems of transporting cement from the west coast of Peninsular Malaysia to the east coast, which has no factory. This problem has been temporarily solved by adding extra coaches to the railway to meet demand when it is at a peak.

The cement industry in Malaysia is fairly young. Since new plants will be set up and existing plants will be expanding, additional workers will be needed. In training them UNIDO can be of assistance.

Malaysia wishes to continue to improve the efficiency of its cement production and can benefit from the co-operation of other developing countries.

Mali

The first cement plant in Mali was built in 1968 with assistance from the Union of Soviet Socialist Republics. It has a capacity of 50,000 tons per year and uses the wet process.

The factory is situated at Diamou, 420 kilometres from the capital and 700 kilometres from the nearest port (Dakar, Senegal). The railway from Dakar to Bamako is the main transport facility available for the necessary supplies of equipment and utilities.

The production of the plant does not at present cover the demand in the country; imports amounted to 144,000 tons in 1980. The Government has therefore decided to establish a second cement plant with a capacity of 260,000 tons per year. The plant is expected to go into production in 1985 or soon after. Lime is also produced in Mali. A first kiln with a capacity of 5,000 tons per year was set up at Diamou in 1978, and a second kiln with a capacity of 2,000 tons per year is under construction at Bamako.

Niger

Since 1966, Niger has been active in cement production based on its own natural resources.

In the early 1970s UNIDO technical assistance was used to consolidate the operation of the Malbaza cement plant; the annual capacity was increased from 30,000 to 40,000 tons. Owing to the increasing demand for cement, Niger is now planning to expand cement production capacity. A new factory is to be built, and under a programme of technical co-operation with UNDP/UNIDO, all possibilities for expansion will be evaluated to secure adequate development of national resources, including training.

As a part of TCDC, Niger proposes that the Malbaza cement factory be developed as a regional training factory in co-operation with UNIDO.

Philippines

The first cement plant in the Philippines was built in 1914, followed by a second in 1920. In the 1950s, when economic development plans took definite shape, two more plants were set up, followed by an additional eight plants in the 1960s and six more plants in the early 1970s. This brought a total of 18 plants in the country with a total rated capacity of

7.37 million tons. The largest cement plant has an annual rated capacity of 767,400 tons and the smallest, 127,910 tons. Of the industry's total rated capacity 69 per cent is concentrated in Luzon.

Since some of the older plants had been allowed to deteriorate, the Government, anticipating a stronger demand for cement in line with its accelerated industrialization programme, prodded the Association of Cement Manufacturers and the Philippine Cement Manufacturers Corporation to undertake a rerating of the productive capacity of the country's cement plants.

A rationalization plan for the cement industry was approved in 1979 by the President. The long-term goal of the plan is to rehabilitate the industry, convert to coal firing of the kilns, and to expand the industry to meet growing demand. The total capacity approved for rehabilitation is 1.5 million tons. The Ministry of Energy has undertaken to ensure availability of coal of adequate quality; and the Government has, through the National Coal Authority, guaranteed coal of minimum quality at a price not greater than 70 per cent of the equivalent oil price.

Coal conversion projects are granted a pioneer status, and incentives are extended to those undertaking; rehabilitation projects are given a non-pioneer status. The cement plants are to be converted to coal within 18 months from the date the contract for the supply of the equipment becomes effective. The rehabilitation programme, on the other hand, is expected to be completed within four years.

The Philippine Cement Industry Authority has formulated guidelines for expanding the cement industry rationally. The Authority has specified that all new plants will be established henceforth only at sites that offer adequate raw material reserves and good harbour facilities. In the same manner, all new plants will be required to be at least of a million tons capacity and coal-fired and to undertake to export 70 per cent of their production. To assure realization of these export commitments, joint ventures with qualified foreign partners are to be encouraged.

The Authority has also adapted procedures that would ensure a careful review by the Authority of important aspects of projects such as raw material reserves and analysis, process and plant design, plant layout,

equipment specifications, performance guarantees, infrastructure requirements and capital cost estimates for plant and infrastructure. In collaboration with the Development Bank it has acquired the services of engineering consultants to assist companies in supervising contractors to ensure that equipment, plant design and specifications shall be adhered to and training programmes formulated and implemented; that a complete set of the vendors' and contractors' drawings shall be obtained to permit the plant to order spare parts direct from the original equipment manufacturer and not through the turnkey contractor at additional cost, as has hitherto been the case.

Sri Lanka

The first cement plant in Sri Lanka was set up in the early 1950s under the Government Department of Industries. In the late 1960s the present Sri Lanka Cement Corporation (SLCC), a more independent institution, came into being. At present SLCC owns three cement plants, two of which produce clinker and also grind it into cement. One plant of a small capacity is only a grinding plant that depends on the excess clinker from the other two plants. The original installed capacities of the kilns and the grinding plant have been improved beyond the design specifications by local engineers. Through these modifications production has been increased by almost 15-20 per cent. At present Sri Lanka has an installed capacity of about 720,000 tons per year.

The projected local demand is around 1.4 million tons for 1981-1984. In 1980, only about 625,000 tons was produced. A gap of more than 250,000 tons has to be bridged annually by imports. To cut down the import bill, SLCC has launched an expansion project by which production is to be increased by another 500,000 tons annually. Tolerances are also left in the kiln capacities to double this amount by providing other facilities to the process line, which means that eventually production is to be 1 million tons on the new process lines. With the commissioning of this new process line, it is hoped that Sri Lanka will have an exportable surplus of cement.

The expansion project will become more independent as far as the management is concerned, since it will be operated by a public limited liability company with 60 per cent of the shares owned by SLCC and 40 per cent by the public.

Oil-fired kilns result in escalating costs in manufacture. As 40-45 per cent of the total costs is for furnace fuel, the kilns are now being fed with discarded tires. Another problem is the turnover of highly skilled workers, especially in the technical and engineering services. The Cement Corporation is a training ground for engineers, who leave the industry after two to three years of service. It is, however, hoped that with the commissioning of the new cement plant some of the present problems will be solved. One urgent question the new cement company faces is where its power will come from. Although the new plant will be ready for commissioning by the second half of 1982, the electricity board will not be in a position to provide power before the end of 1984. This means that a generator for producing 20 megawatts will be required.

Thailand

The first cement plant in Thailand was built in 1913 by the Siam Cement Co. Ltd., and its production was enough to meet domestic demand. The second plant, built by the Talaprathan Cement Company, was established in 1954. Since many large-scale construction projects were launched during the first 10 years of national development, which tripled domestic demand, a third company, the Siam City Cement Company, was founded in 1968. At present the total production capacity is 7.38 million tons per year.

Of the total 18 kilns, 9 wet-process and 4-dry process kilns belong to the Siam Cement Company, 3 dry-process kilns to the Talaprathan Cement Company, 1 dry-process kiln to the Siam Cement Company and 1 to the Universal Cement Company, which produces white cement only.

Ninety per cent of consumption is for construction purposes and 10 per cent for production of cement products such as asbestos cement sheet and cement tile. During the period 1973-1977, total production capacity was about 800,000 tons per year higher than domestic demand, and the surplus was exported. However, starting in 1974, domestic demand has been increasing sharply, and in 1978 Thailand had to import a substantial amount of cement. This situation continued up to 1981.

During this period the cement prices (c.f. Bangkok) of all Asian countries were higher than the Thai domestic price of about $35-$40 per ton. Thus the Government allowed the consumer price to double and agreed to let the cement manufacturers import cement instead of having independent importers. The increment of the imported price was evenly spread over every ton of cement in the country.

The Thai Government is encouraging the expansion of production capacity by offering investment incentives. Since a fourth cement company is now under construction and all three existing companies are expanding their capacity, it is estimated that during the period 1982-1987 Thailand will be able to meet total domestic demand.

Uganda

The annual installed cement capacity in Uganda is about 465,000 tons per annum divided between two factories - the Tororo cement works in the east (165,000 tons) and the Hima cement works in the west (300,000 tons). Both factories are controlled by the Uganda Cement Corporation, a quasi-governmental organization. At present only the Tororo factory is producing at about 10 per cent of the rated capacity. A third factory, the Kasese factory, has two production lines, but one has yet to be commissioned and the other repaired.

The Government considers the reactivation of the cement industry a priority, since without cement the rehabilitation of other sectors of the economy can hardly start. The Tororo works, which is the oldest factory, needs rehabilitation, which will require about USh 7.5 million, and the Government is looking for the necessary funds. The works consists of:

Plant	Rated capacity (t/a)
Lime	21,500
Asbestos sheets	20,000
Plastic pipes	180

As for the rehabilitation of the Hima works, it is hoped that the commissioning of production line II will start in 1982; funds are being sought for the repair of production line I.

The Government is also planning to set up another cement plant to meet local demand, as well as to export cement to the neighbouring countries of Burundi, Rwanda, Sudan and Zaire. The Turkish Cement Industries Corporation has already started work on the feasibility study financed by a loan to the Uganda Government by the Islamic Development Bank. This is a major project and may require multilateral financing and technical co-operation.

The Government is encouraging the use of local materials for putting up low-cost housing. Both local industrialists and international entrepreneurs are being encouraged to set up factories for making building materials such as bricks and tiles using local clays. This is an area where investment is welcome. Another major area of reconstruction in Uganda is road repair and construction, where vast amounts of lime will be required. Therefore, the Uganda Cement Corporation also envisages an expansion of lime production.

The Government considers technical management of the industrial sector an integral part of the rehabilitation programme. For the cement sector engineers are needed to help local personnel in running the factories, which means in effect giving on-the-job training to the local personnel. UNIDO has been approached for this kind of assistance. The Government is grateful to the Turkish Cement Industries Corporation for its offer to train 10 Ugandan cement engineers.

Raw materials such as gypsum, fluorspar and asbestos used in the manufacture of cement have to be imported. However, there is evidence that these minerals exist in Uganda, and what is required is full exploration. Technical assistance is being sought in the form of provision of machinery and personnel for the exploration and mining of the reserves.

Furnace oil for cement production is obtained from the Mombasa oil refinery, which is located about 800 km from the Tororo factory and about 1,500 km from the Hima factory, which brings the cost for oil up to $0.50 per litre. For this reason, the management of the Uganda Cement Corporation is considering switching to the use of coal from the nearest and cheapest sources available.

Many possibilities exist for co-operation between Uganda and other countries. Uganda seeks financial and technical assistance, and it offers industrial enterprises from abroad the opportunity to set up new joint ventures, either with private Ugandan industrialists or with quasi-governmental organizations like the Uganda Cement Corporation.

Upper Volta

Upper Volta has raw materials for cement production at Tin Hrassan 375 km from Ougadougou. The first idea was to establish a railway from the capital to Tin Hrassan to exploit limestone for cement production and manganese for export. The project was, however, not found feasible because of the instability of manganese prices, and the Government has examined other alternatives.

The project at present being promoted is a clinker grinding plant to be established near the capital so that the cement market can be developed with the help of imported Portland clinker. Later when the market has been adequately developed a complete clinker factory can be built at Tin Hrassan.

Yemen

Cement production in Yemen is about 80,000 tons per annum. At present there is one factory in the country that meets only about 8 per cent of the demand. To meet the requirements of the country; it meets only 8 per cent of the demand. factory near San'a with an installed capacity of 500,000 tons per year. The new plant is expected to start production in early 1982. Moreover, the old factory will be expanded to produce an additional 200,000 tons per year, starting in December 1983. Thus the total capacity of cement production will be 800,000 tons per year by the end of 1983.

The Government has also included a third plant with a capacity of 500,000 tons per year in the five-year plan (1982-1986). The feasibility study for the project has started, and the plant is to be completed by 1986, when total cement production will amount to nearly 1.4 million tons per year, enough to meet the country's demand and perhaps enable export to neighbouring countries.

V. SUMMARY OF DISCUSSIONS

The Meeting discussed various proposals made by the delegates to strengthen technical co-operation among developing countries, to promote the short- and long-term development of cement and related industries in the developing countries. It was considered that co-operation under the TCDC formula (whereby co-operating countries would share the local costs for experts and trainees) would open up a new dimension of international co-operation that would increase substantially the scope of UNIDO technical assistance in this field.

A useful approach to promote closer co-operation and the exchange of experience would be to make the Meeting the first of a series of policy-oriented meetings to monitor the development of the industry and make recommendations for further UNIDO action.

The Meeting evaluated some ongoing training activities in Turkey. About 34 engineers from 17 developing countries were being trained in various Turkish cement factories. The Meeting felt that this training should be expanded as a continuing service to developing countries.

Similarly, other TCDC activities could be developed with support from developing countries. The following proposals for future high-level meetings to review specific developments were presented:

Arab States	Information systems
China	Small-scale cement technology
India	Blended cement and energy conservation
Philippines	Negotiation techniques and conversion of cement plants
Thailand	Operation of large modern precalziner plants
Turkey	Feasibility studies

Further, the participants expressed interest in preparing documentation before other such high-level meetings, e.g., country papers, reports on specific technical subjects and comprehensive proposals for future co-operation.

It was felt that the Meeting provided an opportunity to identify specific fields for co-operation, e.g., special production technologies available in

other developing countries or national training facilities that could be used internationally. Some of the possible TCDC activities proposed by the participants were, inter alia:

Exchange of information and organization of study tours to study utilization of red mud

Utilization of kiln dust

Development of machinery manufacture

Development of new and existing regional and national training facilities

Promotion of energy conservation

Development of testing methods and specifications for low-grade and mixed cement

Establishment of a TCDC information system, including the distribution of a TCDC periodical on on-going activities and giving information about documentation available in the developing countries

In general, UNIDO was requested to co-ordinate such TCDC activities and to facilitate the contacts between interested countries. However, it was felt that the countries themselves should take the lead and make an effort also to strengthen co-operation on a bilateral basis. The Meeting agreed that TCDC should be encouraged to start in the following areas:

Exchange of experience on successful projects, technologies and negotiation methods

Exchange of expert services under special TCDC financial arrangements

Expansion of training programmes for engineers offered by developing countries

Transfer of technical information among developing countries on a continuous and systematic basis

Annex

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