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Sri Lanka.

ESTABLISHMENT OF A CERAMIC RESEARCH AND DEVELOPMENT LABORATORY

US/SRL/78/207

SRI LANKA

Report of the Federal Republic of Germany/UNIDO Evaluation Mission*

Bundesministerium für wirtschaftliche Zusammenarbeit
(Federal Ministry for Economic Co-operation)
Bonn

United Nations Industrial Development Organization
Vienna

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SUMMARY OF FINDINGS AND RECOMMENDATIONS

Findings

The project has made good progress in building up the capability of the Ceramic Research Laboratory (CRL) which is already, only 16 months after its official inauguration, providing services to the national ceramic industry and contributing towards the improvement of product quality and the increase of production efficiency. Solid initial contact and relationships have been established with industrial end-users (primarily with the 22 members and subsidiaries of the Ceylon Ceramics Corporation - CCC, but others as well) and related national institutions. CCC has made a considerable effort in promoting the CRL and has secured appropriate funds for its establishment and initial operation. There is a strong committment on the part of CCC for further support of the Laboratory.

The evaluation mission has confirmed that there is a definite and substantial need in the industry for the type of services which the Laboratory is either offering or will soon be in a position to offer. There is a growing awareness among the industrial end-users about the benefits which could result from using the Laboratory's capabilities. Several very positive results have been achieved in assisting the ceramic industry, particularly in testing and analysis of raw materials and trouble-shooting related to energy conservation and optimization of kiln operations. The Laboratory is already charging customers for a good number of its services.

The location of the Laboratory in Piliyandala, its facilities and working conditions are fully adequate. The Laboratory has managed to attract a national staff of competent and enthusiastic scientists and engineers; the selection of staff -- a total of 17 including 12 technical professionals -- has been made in a careful and independent manner, securing a solid basis and positive outlook for the future. The same positive assessment is applicable to international experts, particularly with respect to their technical expertise, adaptability, flexibility and committment to the project. From the onset of the project, attention was devoted to integrating the national staff in project activities, initiating team work and promoting mutual awareness of responsibilities among the national staff. The fellowship programme, which focused on gaining knowledge about equipment and basic laboratory operations, was used effectively. The equipment installed was well selected with respect to the current requirements of the end-users. The evaluation mission appreciated the good interaction of the project with on-going UNIDO projects in the fields of energy conservation and standardization and quality control.

The focus of the Laboratory's activities has thus far been on testing and quality control services, while the activities in trouble-shooting or consultancy services (e.g., body mixture testing and development, process modifications, product design, energy conservation, kiln regime investigations) -- where the industry demand is strong and where the Laboratory could make a name for itself in a relatively short time -- have not yet been fully developed. (The mission fully recognizes that it is more difficult to develop capabilities in this area.) The absence of a full-time national team leader has hampered the development and fuller utilization of the resources made available. The staff are relatively young and not yet sufficiently experienced for the range of services which the Laboratory is expected to provide.

It is clear that further international assistance is necessary to strengthen the CRL and make it self-sufficient and fully capable of providing the services required by the Sri Lankan ceramic industry. Considering the good progress of the current two-year project, further technical assistance is fully deserved by the CRL.

Recommendations

The mission recommends the continuation of international technical asssistance through UNIDO for a period of two years, to focus on the reinforcement of the testing and quality control capabilities and significant strengthening of capabilities in providing trouble-shooting services by the CRL. An outline of the future assistance requirements -- with international expertise, training and additional equipment components -- is given in the report. The budget is estimated at US $615,000. The continued assistance should be clearly formulated in a revised Project Document which will define the desired capability of the CRL at the end of the total duration of assistance.

In order that the project fully achieves the desired objective of establishing a capable and self-sufficient Laboratory which would serve both the CCC and other end-users, several measures -- elaborated in detail in Section IV.2 of this report -- are recommended to the CCC. They include the appointment of a full-time national head of the Laboratory, introduction of a staff and career development scheme, gradual expansion of the number of CRL personnel, setting up of a CRL advisory and planning board (which would include representatives of major end-users), increased sensitization of all potential clients and closer co-operation with several related national institutions.

The long-term availability of adequate domestic raw materials for the expanding national ceramic industry can be secured only through extensive and systematic studies of the quantity and quality of available minerals. These studies are currently lacking. The Government should be approached about supporting the CRL by a grant which would cover a multi-year project of raw material deposits investigation, in co-operation with the Geological Survey. In this way the very strong potential of the Laboratory in analytical and testing services would be put to a very important use.

LIST OF ABBREVIATIONS USED

BMZ	-	Bundesministerium für wirtschaftliche Zusammenarbeit (Federal Ministry for Economic Co-operation), Bonn
CCC	-	Ceylon Ceremics Corporation, Colombo
CRL	-	Ceramic Research Laboratory, Piliyandala
CSSR	-	Czechoslovakia
CTA	-	Chief Technical Adviser
DTA	-	Differential thermal analysis
FRG	-	Federal Republic of Germany
GDP	-	Gross Domestic Product
ILO	-	International Labour Organization, Geneva
SIDFA	-	Senior Industrial Development Field Adviser
SLSI	-	Sri Lanka Standards Institution, Colombo
SRL	-	U.N. abbreviation for identifying projects in Sri Lanka
Rs	-	rupees (exchange rate in December 1985: US$ = 26 Rs)
TA	-	Thermal analysis
UK	-	United Kingdom
UNDP	-	United Nations Development Programme
UNIDF	-	United Nations Industrial Development Fund
UNIDO	-	United Nations Industrial Development Organization, Vienna
US	-	United States

INTRODUCTION

The first nucleus of ceramic industry was established in Sri Lanka as early as 1939. Since then, and particularly after the creation of the Ceylon Ceramics Corporation(CCC) in 1955, the industry has grown and diversified into an important range of ceramics and heavy clay manufactures. Today the ceramic industry occupies a significant place on the Sri Lankan industrial scene.

In order to pursue the necessary support for this development, the Ceylon Ceramics Corporation, which presently includes 22 companies and subsidiaries, conceived in 1968 a plan for the establishment of a ceramic research institute and from the beginning UNIDO was involved in informal negotiations in this matter. A formal Government request for UNIDO assistance was received in September 1978, and a preparatory assistance project carrying the present number (US/SRL/78/207) was approved in 1979. This led to a three-week project formulation mission in July/August 1979; the resulting Project Document was submitted to the authorities of the Federal Republic of Germany in January 1980 with a request for financing. Following several years of investigations and negotiations, the financing was approved on 27 December 1982.

The project, with a total budget of US$1,136,554 (including UNIDO overhead costs), is primarily oriented towards the establishment and "running in" of the Ceramic Research Laboratory (CRL) attached to the CCC. The concept of the institution is that of an analytical laboratory (covering a wide range of non-metallic minerals used in the ceramic, as well as other industries) with the potential to perform technological development work and trouble-shooting related more specifically to the needs of the ceramic industry.

Analytical and pilot plant equipment worth around US$580,000 was purchased and shipped to Sri Lanka during 1983/1984, and the field activities began with its installation in early 1984. The laboratory was officially inaugurated in September 1984 and has since then, with a local staff of 16 and a range of short- and intermediate-term UNIDO experts, carried out its functions as outlined above, serving both the CCC and outside users.

The in-depth evaluation of the project was carried out in compliance with the agreement of the Federal Republic of Germany and UNIDO concerning the implementation and monitoring of projects financed by the Federal Republic of Germany through its special purpose contribution to the United Nations Industrial Development Fund (UNIDF). The purpose of the mission was to assess project progress to date and make recommendations for future assistance or follow-up. The terms-of-reference for the evaluation are attached as Annex I. The project, as foreseen in the original project document, was to have a duration of two years. The original project was to end in the first half of 1986 with the last visits by international experts.

The members of the evaluation team were:

Mrs. Blanca L. RAU-MENTZEN	-	Senior Officer Federal Ministry for Economic Co-operation - BMZ (Team Leader)
Dr. Karl Wolfgang MENCK	-	Economist Independent consultant selected by BMZ
Dr. Anton FORSTER	-	Mineralogist/Geologist Independent consultant selected by BMZ
Mr. Niels BIERING	-	Industrial Development Officer Chemical Industries Branch, UNIDO
Dr. Nikola CATIPOVIC	-	Industrial Development Officer Evaluation Unit, UNIDO

The Government of Sri Lanka was invited to associate itself with the mission's work and to nominate its representative in the team. Since it chose not to nominate a representative, the mission was essentially a joint Government of Federal Republic of Germany/UNIDO in-depth evaluation of the project.

The mission took place from 1 to 12 December 1985. In addition to activities in and around Colombo, field visits were made to Negombo, Dankotuwa and Balangoda. Members of the team contacted numerous government organizations, industrial end-users of project's services and project staff. The schedule of meetings held and visits made is given in Annex II. The list of persons met is attached as Annex III. The reports and documents examined by the mission are listed in Annex IV.

The mission presented its preliminary findings and recommendations and discussed them with the UNDP, Embassy of the Federal Republic of Germany and the Ceylon Ceramics Corporation on 10 December 1985. The mission wishes to thank the Hon. Denzil Fernando, Minister of Industry and Scientific Affairs, for his interest in the project. The evaluation team is grateful to the UNDP Office and the German Embassy in Colombo for the co-operation and assistance provided in carrying out its assignment and appreciates the advice given by Mr. C.J. Kamp, UNDP Resident Representative, and Dr. G. Pfeiffer, Ambassador of the Federal Republic of Germany. The excellent co-operation of the mission with the Ceylon Ceramics Corporation is acknowledged, in particular with Ms. R. Beligammana, Chairperson, and Dr. C.T.S.B. Perera, General Manager. Special thanks go to Mr. T. Schroll, UNIDO Senior Industrial Development Field Adviser, and Dr. F.A. von Metzsch, UNIDO Expert, for their significant support to the mission.

I. ECONOMIC AND DEVELOPMENT POLICY CONDITIONS FOR THE PROJECT

I.1. Overall Economic Performance

Sri Lanka is a small, socially segmented and complex nation of 15.4 million people. Ethnicity, religion, regionalism, caste, class and political affiliation determine the structure of the society and are significant for social and economic policies as well as for national politics.

The Gross Domestic Product (GDP) in 1984 was about US $5 billion or US $320 per capita. The rate of increase of GDP between 1978 and 1984 was 5.7 % annually. The country ranks in the upper zone of the low-income developing countries (according to the definition of the World Bank). The country's social indicators (such as life expectancy, infant mortality and primary school enrollment) outline the progress achieved (see Annex V). The recovery of the Sri Lankan economy can be explained partly by the recent world wide economic upswing which increased export sales, especially of tea and rubber. Also, the liberalisation and market-orientation policy of the Government since 1977 initated economic growth. However, financial imbalances in the budget, deficit in the balance of payments and a low rate of industrial and export growth have not been overcome yet.

In February 1984 the Government decided on a shift in investment priorities to remove the bottlenecks outlined above. Main concern is shown for adequate support of on-going projects. In the course of liberalisation of economic policy, public investment is to be retained in sectors and activities which represent genuine governmental activities. Furthermore, investments should reduce the balance of payments gap, improve the infrastructure (power, irrigation, transport and communication) and meet urgent health, education and housing needs. All these measures are supposed to supplement the policy which up to now consisted of removing price controls. Import regulations and the application of a unified and floating exchange rate, as well as promotion of foreign investment, are further measures to strengthen economic progress.

I.2. State-Owned Enterprises

Since 1977 the economy and the budget have to provide assistance for the modernisation and adjustment of the state-owned enterprises which provide 60% of the industrial output and 40 % of the industrial value added. A recent study of many state-owned enterprises by UNDP/ILO (project DP/SRL/84/038, see reference in Annex IV) identified shortcomings in the areas of finance and accounting, marketing, production, materials management and personnel. These shortcomings are summarized in Annex VI. Capacity utilization is in some cases below 50%, capital input per employee is twice as much as in the private industry, and the productivity of labour is about half of that in private enterprises. Government interferences have not been conducive to a profit-oriented business organization. Only recently, as exceptional cases, some factories have been closed due to inadequate management. The introduction of new production and management techniques is needed to initiate a process of internal efficiency improvement and to regain profitability. Some economic experts have proposed to the Government to secure a high standard of local production and to apply import restrictions which would be valid for a limited period during the process of modernisation and reconstruction of public enterprises.

I.3. Economic Policy

The shortcomings in many state-owned companies have been made evident by import liberalisation. The quality of foreign products is better and the prices are more competitive. In order to keep the local markets and to absorb a larger share of the purchasing power abroad, an improvement in the quality of production and the strengthening of export management capabilities are required. The Government has introduced export promotion policies and mechanisms, which have to be made even more attractive in order to give results.

Recently, economic experts in Sri Lanka have recommended that the producers turn their attention to the domestic market and increase production in a period of violatile world trade. This policy, in order to succeed, requires a technical upgrading of the Sri Lankan industry.

I.4. Industrialization Process and Policy

The economic development of Sri Lanka is not -- as that of other developing countries -- based on a transformation from an agrarian to an industrializing pattern. A comparison of figures for 1965 and 1984 shows that the share of the manufacturing sector in the GDP has declined slighly from 16% to 15%. However, this share has not been stable in the twenty-year period: the percentage was 23.1 in 1977 and 16.1 in 1983. Tobacco processing is the most important branch, textile industry ranks second, while the non-metallic minerals industries recorded a large increase in production. For the years 1985 and 1986 a considerable growth of the manufacturing sector is expected.

The Sri Lankan industry (including construction) employs 18.3% of the local labour force (approximately 5.6 million inhabitants). Sri Lanka's industry is characterized to a large extent by the progress and deficiencies of state-owned enterprises which constitute its major portion. The private sector in industry has not yet been able to increase its contribution to the GDP and employment although the management has made considerable progress and is flexible enough to meet the challenges raised by the market at home.

Most of the state-owned and private companies depend on imported machinery, equipment and materials. High energy costs and power cuts, as well as lack of technical skills and inappropriate product design and quality, often hamper competitiveness in national and international markets. Since the Ministry of Finance adjusted tariff rates in a piecemeal manner, disparities in effective protection have not been removed. Recent adjustments in the structure of tariffs have not altered the situation. The Sri Lankan industry faces many problems in keeping its markets as a result of management and technical inefficiencies. The Government has already taken steps to promote industrial production through measures by:

- Ministry of Industry and Scientific Affairs
- Industry Development Board
- Ministry of Textile Industries
- Ministry of Rural Industrial Development.

All these institutions and agencies offer services such as management assistance, financial support, apprenticeship training and technical upgrading at regional and sectoral levels. Special consideration is given to credit facilities. This policy should produce troubleshooting services to state-owned enterprises and investment capital for efficient enterprises. Measures towards private enterprises have not yet gained the same momentum as those in favour of state-owned enterprises from the standpoint of policy-makers. As a special service to free enterprises, the Government attracts foreign investment through liberalisation of controls, tax reliefs or similar measures and locations in special "free trade zones". The technical upgrading of state-owned enterprises and of the private business skill has to be intensified.

Special attention is given to measures which support the application of new technologies. It is furthermore important to strengthen the development of skills and technologies according to the conditions in each sector. A vocational training system has been set up and is functioning in the country. The promotion of science and technology receives priority in the decisions of the Ministry of Industry and Scientific Affairs.

I.5. Role of CRL in the Economic Policy

Taking into consideration Sections I.1 - I.4, it can be stated that the Ceramic Research Laboratory (CRL), which the project US/SRL/78/207 deals with, fits well into the current requirements of the Sri Lankan economy. Positive conditions are provided by the economic policy to make the Laboratory successful and efficient. On the one hand, the Laboratory is an input to the effort of upgrading the Sri Lankan ceramic industry (both in quantitative and qualitative terms); on the other hand, the economic and development policy initiates and stimulates technical upgrading as part of the improvement of the profitability of the Sri Lankan industry, of which the ceramic industry is an important part.

II. CERAMIC INDUSTRY IN SRI LANKA

II.1. Outputs of the Non-Metallic Minerals Sector

The non-metallic minerals sector, witnessing a long tradition in the development of the country, is of major importance. In 1983, this sector produced 7,936 tons of kaolin, 8,000 tons of graphite, 6,000 tons of zirconite, and 2,609 tons of feldspar. The total clay output (ball clay, kaolin, brick and tile clay, clay for cement manufacture) was 131,887 tons; the value of gem stones was US$39 million. The output of mica (scraps) was 171,000 tons, phosphate rock 16,000 tons, salt 129,222 tons, quartz (massive) 764,000 tons, ilmenite 81,778 tons and rutil 8,093 tons. The share of the non-metallic minerals industry in the total industrial production was 5.2% in 1984, slightly lower than in 1979 (6.6%), while the contribution to the value added in 1980 was 6.8% (calculation at current prices) or 13.2% (calculation at constant 1975 prices). The share in the total industrial employment in the same year was 9.5%. The share of mineral exports - mainly to Japan, Australia, United Kingdom and Singapore - in total exports has decreased (see Table II.1.1).

Table II.1.1. Changes in the composition of exports 1974/1984

Mineral Exports	Rs Million		% of total	
	1974	1984	1974	1984
Total	135	832	4	2
Gems	109	617	3	2
Other	26	215	1	-

Within the non-metallic minerals sector, those activities which offer opportunities for increased employment and value added deserve special attention. The processing of local materials in the manufacturing industry therefore constitutes the most promising area of technical and economic development in this sector. A range of these industries in the non-metallic minerals sector has been developed in Sri Lanka, and the ceramic industry is of prime importance. The availability of raw materials -- ball-clays, China clay, feldspar and quartz -- of satisfactory quality, adequate cost and sufficient quantity in Sri Lanka is a necessary condition for the development of the ceramic industry. Other requirements are access to domestic and export markets, including the ability to adapt products to the requirements of customers, and access to technology and know-how which reduce production costs and increase production output and quality.

II.2. Main Characteristics of the Ceramic Industry

Today the ceramic industry in Sri Lanka may be divided into three groups:

a. State-owned ceramic industry which operates a number of medium-sized mechanized factories producing a full range of fine and technical ceramics including tableware (porcelain as well as earthenware), glazed floor and wall tiles, sanitary ware, ornamental and gift articles, electrical insulators and refractories. In this group distinction has to be made between 22 fully state-owned plants and several factories in which the Government has well over 50% of the shares.

b. Small private ceramic industries, which have an average turnover of 6 - 7 million Rs/year, producing mostly earthenware articles including household articles and giftware. The technology is predominantly manual and firing is typically carried out in wood fired kilns.

c. Brick and tile factories, most of which are private, producing mainly building bricks and roofing tiles although some have also introduced other minor production lines (pressed tiles, pots, cooking stoves, etc.).

The most important group of ceramic industries comprising inter alia all fully state-owned enterprises is the Ceylon Ceramics Corporation (CCC) which, together with its subsidiaries, accounts for the overwhelming majority of ceramic manufacture in the country. Information on members of CCC and their installed capacities (as well as on subsidiaries) is given in Annex VII. Capacity utilization is relatively high, around 80% (counting Dankotuwa Porcelain which is currently operating at low capacity as a result of export marketing problems).

All enterprises of the Sri Lankan ceramic industry (Annex VIII e shows their locations) succeeded in gaining a consolidated position in their respective markets. During their expansion they had to cope with problems falling mainly in the following three categories:

- raw materials provision;
- marketing, including design and quality certification;
- technology development.

II.3. Raw Materials Situation with Respect to the Ceramic Industry

The Ceylon Island, according to the mineral resources map of 1983 (see Annex VIII a - sketch map scaled 1:2,000,000, according to J.H. Herath), is geologically comprised of three large sections. The major and central part of the island consists of an old archaean, highly metamorphosed basement complex with several rock types but always with hard rock materials. The adjacent western and northwestern part is built up of medium aged/jurassic blackshales interrupted by pleystone gravels. In the southwestern, southern and partly northeastern and eastern coastal areas, young diluvial and recent soft rock sediments -- like mineral sands, China clay and ball clays -- are predominant.

Ceramic industries are fundamentally based on two types of materials:

a. Non-plastic raw materials such as crystalline quartz, feldspar, limestone, dolomite, flourspar and -- for special ceramics -- graphites. These materials can be obtained from the central zone. Working mines, producing high-quality non-plastic ceramic raw materials, are situated around Ratnapura (close to Lanka Walltiles Ltd.), as well as southeast and northwest of Kandy (particularly in the Rattoto Mountains near Matale, close to Lanka Porcelain Ltd.), the most important deposit being Owela. Details are shown in Annex VIII b.

b. Plastic raw materials are more important. These deposits are distributed mainly in the southwestern coastal zone approximately 100 km long and 15 km wide. The main mines are (from north to south): Kochikade ball clay deposits near the Negombo Ceramic Factory, Kelaniya ball clay deposits near Colombo, Boralesgamuwa China clay deposits near the Piliyandala Ceramic Factory, Dediyavala ball clay deposits near the Kalutara Ceramic Factory (approximately 30 km south of Piliyandala) and the newly explored Meetiyagoda China clay deposit near Ambalangoda (aproximately 50 km south of Piliyandala Factory). Other raw materials like quartz sand and other mineral sands are found as beach sediments along the southwest coast. The most important are the Hendala deposits near Colombo and Beruwala, Kaikawala, Galle, Matara and Hambantota quartz and poly mineral sands. Maps in Annex VIII c and d show the relevant details.

The raw material situation for the Sri Lankan ceramic and related industry is a favourable one in terms of variety. All raw materials needed for ceramic production are present in the country and the factories are located close to the main deposits of ball clay and China clay (see Annex VIII d and e). However, deposits of this type are inhomogenious in quality and extensions. China clay deposit of Boralesgamuwa is expected to run out of reserves in approximately 5 years. It will be replaced by the Meetiyagoda deposit. The Ceramic Research Laboratory, in co-operation with the Geological Survey, is now investigating this big deposit, estimated at 350,000 tons of refined kaolin. Based on an annual consumption of 6,000 to 8,000 tons/year, reserves are expected to last for another 50 years. The essential raw materials needed in the future can thus be provided.

Most of the knowledge about the wide range of Sri Lanka raw materials, rock and mineral resources -- particularly as related to the ceramic industry -- comes from the publications of I.W. Herath (see references in Annex IV). These publications include some results of mineralogical, physical and chemical tests on samples of raw materials. However, the samples came mostly from open-pit mining localities (from 1963 - 1971) and were not taken systematically. Since the Ceramic Research Division of the Geological Survey of Sri Lanka was closed in 1971, a comprehensive and systematic investigation of all important ceramic raw materials -- which would give a picture of the available quantity and quality -- is still pending. The role of the Ceramic Research Laboratory in identifying mineral reserves for the Sri Lankan ceramic industry could therefore be a very important one.

II.4. Marketing by the Ceramic Industry

The Sri Lankan ceramic industry has proven its ability to enter the local market and to penetrate export markets with considerable success. Two recent examples illustrate this point: the expansion of the sanitary ware line in the Piliyandala Ceramic Factory goes hand in hand with access to markets which have formerly been supplied with imports; Lanka Walltiles Ltd. (a subsidiary of CCC) started production mainly for export and is today exceeding the originally planned production capacity while exporting 85% of its output.

Similarly to the lack of reliable information on the raw materials availability, a complete overview of the domestic demand for ceramics does not exist. The market for sanitary ware, bricks and tiles appears to be increasing as the national housing programme of the Sri Lankan Government gains further momentum. Within the Prime Minister's "Million Houses Programme", 140,000 units have been constructed. The electrification programmes are increasing the demand for ceramic insulators; the market for tableware and porcelain, especially for cheaper categories, appears to be expanding.

The export market in the Asian region will be increasingly accessible in the future provided the Sri Lankan ceramic industry makes an effort to improve the design of articles and decorations. These are often specified by the importing agencies; however, the actual printing of transfers is part of the regular manufacturing programme in Sri Lanka. Possibilities to gain a more solid position in the U.S. and Canadian markets are being explored. Sri Lankan ceramic industry's representatives feel that they have a good chance to succeed abroad because of their comparative advantages for ceramic production with respect to countries which were formerly main exporters to North America. The success of additional marketing efforts related to these demanding markets will, however, depend on the industry's ability to follow new trends in product design and decoration. The chances for success would be enhanced by an easier procedure for obtaining quality certificates demonstrating the products' fullfillment of relevant standards of the importing country.

II.5. Technology Development in the Ceramic Industry

Seen as a whole, the ceramic industry has developed a considerable level of technology which enables it to use the available raw materials relatively efficiently and to expand markets at home and abroad. In the older factories -- mostly earthenware and sanitary ware, pottery, bricks and tiles -- conservative adequate technologies are applied. Production for the local market has met the demand.

Markets are now gradually changing and there is an increasing need for technical upgrading. More attention should be focused on technology upgrading to increase productivity, reduce costs and diversify production. Special attention has to be given to energy conservation and better energy management which has, in some cases, proved to be an effective instrument for reducing production costs. There is a lack of trained manpower in the ceramic as well as in other technical fields. The heavy overstaffing of untrained and clerical personnel reduces competitiveness.

In the last decade, new factories, incorporating modern technology from industrialized countries, have been established. Although these companies have started production in the mainstream of current technology, they have to undertake activities to maintain a continuous process of product and technology development. Neither for this nor for the testing of high-quality products are capacities available in the factories themselves; thus far they depend on expensive hard currency services from abroad.

II.6. Role of Project US/SRL/78/207 in the Process of Development of the Sri Lankan Ceramic Industry

The technical co-operation project US/SRL/78/207 - Establishment of a Ceramic Research and Development Laboratory - is financed and implemented in co-operation with the CCC. The Ceramic Research Laboratory is attached to the CCC. This organizational set-up is advantageous because it enables the project to support the CCC with the required services. Since the CCC has to play a central role in the development of Sri Lankan ceramic industry, the project and the CRL are in a position to render services to the ceramic industry as a whole. In this sense, the establishment and development of the laboratory with the CCC contributes to an improved efficiency of state-owned enterprises and -- if potential end-users in all Sri Lankan ceramic enterprises are sensitized -- to increased productivity of the non-governmental ceramic factories as well. Both outputs are required to strengthen the profitability of the ceramic industry sector in line with the objectives of the development and economic policy of Sri Lanka.

III. ANALYSIS OF THE PROJECT

III.1. Description and Analysis of Objectives, Outputs and Activities

It is important to note that the project proposal for US/SRL/78/022 was drafted in August 1979 as a result of a preparatory assistance mission. It was submitted to the authorities of the Federal Republic of Germany with a request for financing in January 1980. Negotiations took practically three full years before the financing was finally approved. The main project design elements (development objective, immediate objective, outputs and activities) remained essentially unchanged from 1979. The project was therefore designed before particular attention and care started to be focussed in UNIDO on how projects are formulated. It will be seen from the following paragraphs that the original design left a lot to be desired with respect to clarity, project function and project planning.

III.1.1. Development objective

In the section "Development Objective" of the Project Document, it is stated that:

"The project will

- strengthen the economy of the country by enabling it to make more efficient use of its natural and human resources;
- broaden the basis of employment through adequate training and specialization;
- create more jobs;
- enhance earning of foreign exchange while reducing imports of goods and energy."

This statement is too broad and directed toward a high-level target, significantly above the subsector of industry which the project is concerned with. A more realistic target for the development objective is found in the section "Background and Justification" and deals with:

- the development of the Sri Lanka ceramic industry;
- increase of its self reliance and reduction of its dependence on imported technologies;
- more efficient use of the mineral resources in Sri Lanka;
- reduction of import of ceramic materials and maximization of exports of ceramic products.

III.1.2. Immediate objective

The title of the project is "Establishment of a Ceramic Research and Development Laboratory" and the primary function of the project as indicated on the face sheet of the Project Document is institution-building. However, the immediate objectives given in the project document tend to give a somewhat different orientation of the project. They are listed as:

"- identify and characterize local ceramic raw materials in order to make more efficient use of them;

- develop, wherever necessary, suitable treatments for the available raw materials to make them more amenable for use;

- develop new products or improve presently manufactured ones;

- investigate and develop alternate technologies with the aim of either improving the quality of the presently manufactured products or in order to reduce costs;

- qualify the technical staff necessary to carry on the work of the Laboratory after termination of the project;

- develop alternate sources of energy."

This statement of immediate objectives brings in an element of confusion since it is not clear whether the above functions are to be performed by the project itself or by the R & D Laboratory which is to be established by the project. As it stands, the statement seems to describe -- in very broad terms -- the tasks of the Laboratory which it will be capable of performing when fully established.

The exact immediate objective of the project comes out in a clearer way from the text on "Background and Justification". In a summarized version, the objective of the proposed two-year project was:

> "to establish a Ceramic Research and Development Laboratory which will be capable of providing two major types of services to the Sri Lankan ceramic industry (primarily companies and subsidiaries of the Ceylon Ceramic Corporation) -- testing services and trouble-shooting services".

The project was clearly to be of an institution-building type. It is fortunate -- as will be seen in later text -- that all international experts, as well as the management of the Ceylon Ceramics Corporation, approached the project in this manner and that the development of institutional capability was their primary concern.

III.1.3. Outputs and activities

According to the original Project Document, the project was expected to produce the following outputs:

"1. A roster of domestic raw material resources with concrete data regarding their abundance and uses.

2. A body of procedures to treat and dress local materials to make them suitable for use in the ceramic industry.

3. Specifications of improved and appropriate methods for the use of the local ceramic industry.

4. Manufacturing specifications for new or improved products for the use of the local ceramic industry.

5. Designs and ultimate working drawings of improved tools and equipment for the local ceramic industry.

6. A formulary of standard frits, glazes and colours for the use of the local art potteries.

7. Alternate sources of energy based on agricultural wastes, and solar energy.

8. A body of technically trained ceramic specialists of all levels of technical hierachy.

9. A more efficient ceramic industry capable of manufacturing better products more economically.

10. Technical feasibility studies for new ceramic industries to be established in the future."

The problem with these outputs is similar to the problem described with respect to the immediate objective. In addition to being very broad, over-optimistic and in most cases not specific enough, the outputs are more of a direct-support type. They do not define in specific terms the elements of national capability which is to be built up.

UNIDO and UNDP introduced in 1982 a method of defining outputs for projects with an institution-building function (Programme Advisory Note on Technical Co-operation for Industrial Research and Service Institutes, UNDP/PPM/TL/29, 29 November 1982). An output should describe -- to the extent possible -- the corresponding organizational unit (module) of the institution. The output then defines the capability of the module in terms of: (a) functions or tasks to be performed; (b) staff composition and skills; (c) work procedures, routines, methodologies or guidelines to be used; (d) premises and facilities; and (e) equipment. Some of the outputs in the original project document only touch upon some of these elements (outputs 1 - 6 and 8).

The activities listed in the project document suffer from similar shortcomings. They are practically a rephrasing of the output statements. It is not clear which activity was to be done by which of the participants and how the international and national staff should work together. The job descriptions for international experts are considerably clearer in this aspect.

III.1.4. Resumé of the adequacy of project design

The original project design suffered from inconsistencies in describing what is to be expected at the end of the two years of international assistance. On the basis of the immediate (project) objective and outputs, as defined in the project document, the project would appear to have a direct support function, with the international team (in conjunction with national counterparts) producing the following results: a roster of domestic raw materials, a body of procedures, manufacturing specifications, etc.. However, the whole background and justification of the project, as well as its title, indicate that this is a pure institution-building project. The institution-building approach was fortunately adopted by all international experts who, from the onset of the project, devoted particular attention to integrating the national staff in project activities, initiating team work and promoting mutual awareness of responsibilities among the national staff. Both Chief Technical Adviser's reports (of 2 January 1985 and 15 August 1985) are focused on the organizational set-up of the Laboratory and the provision of initial consultancy (trouble-shooting) and testing and research services by the Laboratory for the industry.

In view of the above, the evaluation mission assessed project progress primarily by analyzing the development of instutional capabilities of the laboratory in providing selected services to industrial end-users. The terms-of-reference for the in-depth evaluation (Annex I) were very specific in placing particular emphasis on such measurement of project progress. The mission took the relevant immediate (project) objective to be the one underlined in Section III.1.2. The institutional capacity of the Laboratory was analyzed in terms of: (a) functions which are being performed, (b) staff skills and capabilities, (c) work procedures and methodologies which have been developed, (d) premises and facilities, (e) equipment, and (f) relationship with end-users.

On the basis of previous experiences in UNIDO institution-building projects, it would appear unrealistic to expect that the project could fully establish a laboratory capable of operating by itself (without further international assistance) in two years. The matter of project function and clear (quantified) project expectations is therefore of extreme importance.

It will be seen from the findings of the evaluation mission (Section III.3) that further international assistance to the Laboratory is considered both necessary and fully deserved. Because of ambiguities in the original project design, the continued international assistance should be clearly formulated in a revised project proposal (document) which would define the desired capability of the Ceramic Research Laboratory at the end of the total duration of the assistance.

III.2. Implementation of the Project

III.2.1. UNIDO inputs

The project budget as originally approved in December 1982, provided for a UNIDO contribution of US$1,005,800 which, with overhead costs of US$130,754 added, reached a total of US$1,136,554.

A series of successive budget revisions never altered the total amount and even the latest revision dated 22 April 1985 showed only very minor differences under the sub-totals of the various project components compared with the original budget.

Both of the budgets are reproduced in Annex IX a - c for easy reference and comparison. An overview of the chronology of implementation in terms of provision of UNIDO inputs is provided in Annex X in bar chart form. The specific inputs, as well as the reasons for their deviation from the originally foreseen inputs, are presented and commented upon in sub-paragraphs on each of the project components.

a. International experts

The original Project Document listed the following international experts and consultants (number of post, name of post and duration of assignment are listed):

11-01	Expert in Organization and Planning of R&D Work	18 m/m
11-02	Expert in Installation, Use and Maintenance of Laboratory Equipment	6 m/m
11-51	Consultant in Sanitary Ware	3 m/m
11-52	" " Plaster Mould Making	3 m/m
11-53	" " Kiln Design and Fuel Engineering	3 m/m
11-54	" " High-tension Electrical Porcelain	3 m/m
11-55	" " Refractories	3 m/m
11-56	" " Glazes and Colours	3 m/m
11-57	" " Structural Clay Products	3 m/m
	Total	45 m/m

The list of experts and consultants, having actually served under the project or under recruitment at the time of the evaluation, is given below with the names and nationalities of the incumbents indicated in brackets:

11-01	Expert in Ceramic Research and Development (Mr. Y. Kato, Japan)	15.0 m/m
11-02	Expert in Installation, Use and Maintenance of Laboratory Equipment (Mr. F. von Metzsch, FRG)	11.4 m/m
11-52	Consultant in Plaster Mould Making (Mr. F.A. El-Sobky, Egypt)	3.0 m/m
11-53	Consultant in Kiln Design and Fuel Engineering (Mr. M. Novy, CSSR)	3.0 m/m
11-55	Consultant in Refractories (Mr. W. Biehler, FRG)	1.0 m/m
11-56	Consultant in Glazes and Colours (Mr. I. Knizek, Mexico)	3.0 m/m
11-59	Consultant in Mineralogy and Microscopy (Mrs. I. Sacher, Austria)	6.0 m/m
11-60	Consultant in Ceramic Research Management (Mr. Z. Engelthaler, CSSR)	1.0 m/m
	Total	43.4 m/m

Mr. Kato (11-01) was intended to serve as a Chief Technical Adviser but at an early stage of his assignment, he was forced to take sich leave for about one month due to a heart problem and subsequently was requested to "take it easy". When he resigned after only one year in the field, this overall co-ordinating rersponsibility was shared with Mr. F. von Metsch (11-02). This team approach to the management of the project proved to be effective and Dr. von Metzsch had his first 6 m/m mission extended by 1.4 m/m due to these additional responsibilities. Subsequent missions of the two experts, 3 months for Mr. Kato and 3 months plus, later, 1 month for Mr. von Metzsch, primarily served the purpose of project co-ordination and management and were found to be a satisfactory alternative to the continuous presence of a full-time CTA. This was especially so since (a) the extended period of project implementation did not, for reasons of budgetary restraints, allow a full-time CTA assignment and (b) neither Mr. Kato nor Mr. von Metzsch would have been available for such an assignment. If the Government counterpart agency had been in a position to assign a full-time National Project Director (as foreseen in the Project Document), the lack of a full-time CTA would not in any way have been felt as a hampering factor.

The assistance provided by Mr. von Metzsch (11-02) in respect of installation, use and maintenance of the laboratory equipment occupied a large majority of his time -- at least during the first 7.4 m/m assignment -- and ensured a high degree of equipment utilization from the outset of the active phase of the project. The arrival of Mr. von Metzsch in March 1984 was (as the fielding of Mr. Kato at the end of December 1983) co-ordinated with the arrival of the bulk of the UNIDO equipment. In addition to his work in the field, the expert also provided valuable services to the project by establishing and maintaining contacts to equipment suppliers and training institutions, especially in the Federal Republic of Germany, even during the periods between his assignments.

The original list of consultants was revised soon after the arrival in the field of Mr. von Metzsch and the two consultant posts for high-tension insulators (11-53) and structural clay products (11-57) were cancelled by cable on 17/04/84 since the services in these two fields were no longer required at this stage of development of the CCC and the ceramic industry sector in general. In October 1984, the post of consultant in sanitary ware (11-51) was cancelled since a highly qualified national expert, Mr. T. Sivanadian, was identified.

Considering the importance of mineralogical identification in the work of the Laboratory, the post of consultant in mineralogy and microscopy (11-59) was introduced in June 1984. The last addition to the consultant list was 11-60, consultant in ceramic research management, a post which was introduced to allow the recruitment for a brief period of the Chief Executive of the UNIDO/CSSR Joint Programme in Ceramics and Non-Metallic Minerals, who is also the Director of the CSSR Institute for Ceramics, Refractories and Raw Materials.

The various consultants advised the national staff of the Laboratory on how most effectively to contribute towards the solution of problems in the industry related to their individual fields of specialization. In doing so, they contributed towards strengthening the links between the Laboratory and the manufacturing sector.

It should be mentioned that, from January 1986, the project will be benefitting from the presence of an Associate Expert, specialized in the geological evaluation of non-metallic minerals, financed by the Italian Government. He is expected to remain with the project for at least two years and will thus provide continuity.

b. National expert

As mentioned above, the project management identified a highly qualified national expert in sanitary ware technology who served the project for 6 months and provided competent services not only in the field of sanitary ware but also in a more general sense in product development, especially related to improvement of various ceramic body compositions.

c. Training

In the original version of the project, 4 fellowships of one year each were foreseen in the fields of:

- instrumentation (acedemic level);
- instrumentation (technical level);
- X-ray methodology; and
- petrographic microscopy.

This programme was, obviously, conceived at a time when neither the future incumbents of the national posts in the Laboratory (and their qualifications) nor the needs for training of these individuals, as a function of the Laboratory's areas of activity, were known.

When in mid-1984 the posts in the Laboratory were filled with national staff, most of whom were relatively young university graduates, it was felt that all of them would benefit greatly from the exposure to ceramic research and development activities elsewhere, as well as from specific training in the operation of the equipment for which they were made responsible. Consequently it was decided jointly by the counterpart organization and the international experts that a certain amount of training should be offered to all local staff. This would also further a feeling of equality among the staff, considered indispensable for the future team work.

As for the timing of the fellowships, it was recommended to postpone them until after the completion of all (or most) of the consultant assignments. Details on the training programme are given in Annex XI. An effort has been made to provide a broad range of training experiences to the trainees, focusing on the practical use of the equipment assigned to their respective units.

In addition to the altogether 14 fellowships awared, 2 study tours have been carried out under the project. The first one which was carried out in September 1983 by the part-time National Project Director, Mr. Perera, and the Chairman of the Ceylon Ceramics Corporation, Mr. Sebastian, covered visits to major equipment suppliers in the FRG and UK. This proved to be of great importance as a means of defining the exact specifications of equipment to be purchased and of selecting the types most suitable for the project's requirements. In addition to these visits, the team spent several days in Czechoslovakia, familiarizing itself with the potential services provided by

the UNIDO/CCSR Joint Programme, and 4 days at UNIDO Headquarters for consultations with various officers. The second study tour, carried out in April 1985, permitted Mr. Perera and the Deputy General Manager of the CCC, Mr. Kularatne, to participate in the World Congress on Non-metallic Minerals in Belgrade and the subsequent Technical Workshop organized by the UNIDO/CCSR Joint Programme on Complex Utilization of Non-metallic Minerals.

d. Equipment

A major part of the UNIDO input to the project -- a total of US$580,360 -- has been assigned to the procurement of equipment for research and development. A complete list of the equipment purchased is attached as Annex XII.

The bulk of the equipment was purchased in 1983 and shipped to the project in advance of the arrival of the expert in equipment installation, use and maintenance. Minor items were purchased at a later date at the recommendation of the various experts and consultants.

Installation and running in of major items were carried out with the assistance of service technicians from the supplier companies; certain defects or malfunctioning parts were replaced by the suppliers at their expense, thus ensuring the optimum functioning of practically all items.

III.2.2. Government inputs

The Government contribution as budgeted (see Annex IXc) totals 1,848,850 Rs for the period July 1983 to June 1985. This amount is equivalent to about US$72,000. In addition to the amount stated in the budget, the most important single contribution by the Government has been the Laboratory building located at the premises of the CCC in Piliyandala, some 20 km south of Colombo. The building, a plan of which is shown in Annex XIII, has 13 rooms distributed over two floors and covers a total floorspace of about 520 m^2. It is a building in good condition and with a pleasant and appropriate layout and is, from a technical point of view, more than adequate for the needs of the Laboratory. The project was most fortunate to have this building at its disposal from the start of the field activities, thus ensuring immediate installation of the equipment. The costs connected to the installation of the equipment and to the necessary services were borne by the Government as well. The Laboratory is conveniently located in the vicinity of the Piliyandala Ceramic Factory.

As foreseen in the Project Document, the CCC has so far covered all personnel and running expenses of the Laboratory. This has now reached about 665,000 Rs per year but when the Laboraroty reaches full operation with all staff on board, the total cost is estimated to rise above 2,000,000 Rs per year. As explained in Section III.3.4., a steadily increasing portion of these costs will be offset by charging clients for the services provided. This practice has already started.

The present national staff consisting of 12 technical professionals and 5 non-technical staff (administration, driver, workers) has been carefully selected by the project management and has, since being hired in mid-1984, worked to the full satisfaction of the project. The staff represents the optimum team one can put together in Sri Lanka considering the relative modesty of the salaries which an organization like the CCC is in a position to offer. At present, the total personnel cost is 37,950 Rs per month or 420,000 Rs per year. At the time of reporting, three technical professional posts are still vacant and under recruitment. The most serious problem is, however, the difficulty to fill the post of the Director of the Laboratory with a full-time staff member. Mr. Perera, the General Manager of the CCC, has been filling this function on a part-time basis but assurances from the CCC that he would be released from his other duties to take full-time charge of the Laboratory have not been fulfilled. A qualified candidate for the post is now being identified. It has been decided, as a temporary measure (initially for one year), to finance the post as that of a national expert.

Other contributions from the CCC in 1985 include:

Minor purchases and services	Rs	95,000
Energy	Rs	150,000
	Rs	245,000

which, together with the personnel costs, brings the yearly contribution to 665,000 Rs.

III.2.3. Modalities of implementation

The project was approved in December 1982 and actions to identify candidates for the two expert posts and to obtain quotations for the large amount of equipment required were immediately initiated. 1983 was a year of preparatory work in close co-operation between UNIDO Headquarters and the management of the CCC. Great care was taken to select equipment suitable for the actual requirements; all quotations were pouched to Colombo for final evaluation by the project management which made a thorough comparison of all equipment offered and presented its recommendations in June. Further negotiations with the suppliers, including the visit of Mr. Sebastian and Mr. Perera, were carried out before taking a final decision on some of the larger items including X-ray equipment and thermo-gravimetric equipment.

Equal care was taken to select the two experts among several qualified candidates. Their arrival dates in the field were selected as a function of the schedule of equipment delivery. Mr. Kato (CTA) started his assignment at the beginning of January 1984 which, thus, signifies the start of project activities in the field. It was at his advice that the building in Piliyandala was selected as the project site and equipment was transferred there for installation. This part of the work started with the arrival of Mr. von Metzsch in March 1984. Parallel to the completion of the building (especially in respect of electricity supply) and the installation of the equipment, work went ahead to fill the posts of national research officers. In January 1984, 3 were already on board and, following interviews of about 100 candidates in April and May, another 11 persons (including an administrative secretary) were hired and assigned appropriate posts in the Laboratory. These interviews were carried out by the international experts and the CCC management. The same team also evaluated several candidates submitted for the consultant posts and gradually made a selection.

In September 1984 most of the equipment was installed and working, national personnel were in their posts, working procedures and even a price list for external clients were established and the Laboratory was ready to present itself to the "outside world". This occurred with a ceremonious official opening of the Laboratory on 18 September by the Hon. Minister of Industry and Scientific Affairs in the presence of inter alia the UNDP Resident Representative and the Ambassador of the Federal Republic of Germany. Among the guests were also all managers of the CCC factories and subsidiaries, as well as chairmen of most state corporations and representatives of universities and research institutes of relevance to the Laboratory.

Assisted by the UNIDO experts and consultants, the project then entered its third and most important phase, engaging itself actively in the practical work of testing, quality control, trouble shooting etc., for which the Laboratory had been designed. During the remainder of 1984, 574 orders for laboratory work were received, 85 of which came from clients outside the CCC, and the flow of orders continued into 1985. By the end of 1985, a total of over 1,300 had been received.

As explained elsewhere in the report (Section III.3), the remaining period of the project was one of practice, training and consolidation. National staff worked closely with international personnel in the execution of laboratory work and in the assistance to manufacturing plants and institutes. A major concern at this stage was to bring the Laboratory staff to appreciate the importance of carrying out the work of the Laboratory in a spirit of team work and to relate the work and the conclusions and recommendations emanating from testing and analysis of samples to the needs and requirements of the end-users.

The fellowship training programme was initiated in mid-1985 when the majority of the consultants had finished their assignments (thus avoiding absence of staff during the presence of consultants); the staff had by then already gained a certain practical experience allowing them to benefit more from the training and the exposure to a practical work situation.

In order to maximize the impact of the project, it was, through the co-operation of the UNIDO Senior Industrial Development Field Adviser, attempted to establish links to other on-going UNIDO projects. Particular reference should be made to projects DP/SRL/82/007 - Industrial Energy Conservation Programme and DP/SRL/83/012 - Establishment of an Industrial Energy Management Unit of the National Engineering Research and Development Centre, which have an important component related to the ceramic industry and which, through the recruitment of Mr. Novy, who served for 3 months under the present project as Consultant in Kiln Design and Fuel Engineering in 1984 and already then made significant proposals on energy saving, permitted an extended support of the activities of the Laboratory in this field. A recent four month mission of Mr. Novy under the energy conservation projects was carried out in close co-operation with the staff of the Laboratory, with its kiln unit as a base. Another project to which the laboratory has already contributed and with which an even closer collaboration is expected in 1986 is DP/SRL/82/003 - Development of Standardization and Quality Control. According to the Sri Lanka Standards Institution, which is the counterpart agency for this project, it is highly probable that the CRL will be accepted as a certified Laboratory authorized to issue quality certificates in the field of ceramics.

III.3. Evaluation of the Project - Findings

III.3.1. Achievements of the project

Since the immediate objective of the project is essentially to establish a ceramic research and development laboratory capable of providing testing and trouble-shooting services to the Sri Lankan ceramic industry, it is important to assess to what extent an institutional capability has been set up in the past two years.

In the area of testing services, as well as quality control, the following units have been set up and are operational:

- x-ray and thermo-analysis unit (with 2 technical professionals or research officers);
- mineralogical unit (with 1 research officer currently; 1 more to be added);
- chemical laboratory (with 2 research officers);
- physical laboratory (with 2 research officers).

In the area of trouble-shooting services (body mixture testing and development, process modifications, product design, energy conservation, kiln regime investigations), the following two units exist:

- pilot plant (with 1 research officer for design and 2 for preparation and forming);
- kiln and firing unit (with 2 research officers; however, one has recently left the Laboratory and Sri Lanka -- his post is to be filled).

The current organizational structure of CRL is shown in Annex XIV.

The part of CRL which is involved in testing and quality control analyses has reached a very solid level of capability. The fact that this part of the Laboratory has handled over 1,000 orders from customers in less than two years and charged for a good number of its services is a sig ·ant indicator of achievement. The services were initially performed wi ernational staff present, but they continued in 1985 even when no intern al experts were in the field. The equipment delivered by the project is very satisfactory; in fact, the Laboratory is equipped as well as a comparable ceramic testing laboratory in Europe. Its capabilities are therefore substantial and well suited for the current requirements of the industrial end-users. The national staff in this part of CRL is well educated, enthousiastic and motivated. The fellowship programme, which was focused on gaining knowledge about equipment and basic laboratory operation, was used effectively. The documentation and methodologies for testing and quality control are adequately developed and well organized. In addition to services for customers, the research officers work on research projects assigned to them (one day per week is set aside for this), the purpose being to broaden their knowledge and experience. Regular colloquia are held among all staff members where experience from research projects is shared.

There is a substantial need in industry for testing and quality control services which CRL is either offering or will soon be in position to offer. This is clearly indicated by the number of orders received by CRL since its inauguration. Of 1,308 orders received from September 1984 until December 1985, 1,087 (or 83%) have been from CCC factories and 221 (or 17%) from CCC subsidiaries and customers outside the CCC. Most of the orders dealt with testing and quality control services.

In 1985 (including December), a total of 1,121 orders (mostly for testing/quality control) were received and processed by the Laboratory. The following table shows the distribution of orders among different units, as well as the relationship between internal and external orders:

	X-ray and TA unit	Mineral. unit	Chemical lab.	Physical lab.	Pilot plant	Kiln unit	Total
a)	55	13	120	437	254	63	942
b)	42	10	34	67	5	21	179
c)	97	23	154	504	259	84	1,121

a) = internal orders, b) = external orders, c) = total orders.

During this period, the type of analyses performed by different units included the following (NOTE: the majority of orders for the pilot plant and kiln unit involved simpler testing services rather than assignments of a trouble-shooting nature.):

X-ray and TA unit	Mineral compounds and chemical elements (in mineral sands and tiles) and internal orders involving mostly X-ray diffractometry -- clay mineral and ceramic mineral phase determination.
Mineral lab	Internal orders involving the scanning microscope.
Chemical lab	Water absorption, % of sod.-silic. % of CaO, MgO, Fe_2O_3, % of free SiO_2-content, determination of impurities in feldspar, soluble salt-content, % Mg CO_3, % Al_2O_3, SiO_2 and Fe_2O_3, % of Co-sulf. and full chemical analysis.
Physical lab	Whiteness and brightness, particle size, bending strength, shrinkage, suitablility of plaster of Paris, sieve analysis, centrifuge size analysis and yellowness.
Pilot plant	Extruding tests, free moisture content, body mixing.
Kiln unit	Clay firing, firing in small Naber Kiln, firing floortiles at 900, 1200 and 2700°C, firing mosaic tiles in gradient kiln at 1180°C.

Several tests and analyses performed by CRL deserve to be mentioned because of implications which the results obtained had. They are an indication of the usefulness and importance of such a laboratory for the ceramic industry in Sri Lanka. Also, before the establishment of CRL such tests and analyses were essentially not possible in the country. These illustrative examples are:

- testing, analysis and return of a large shipment of imported plaster of Paris to Great Britain because of non-compliance with international standards;

- detailed testing and anslysis of domestic China clay from the Meetiyagoda deposit (in co-operation with the Geological Survey) and its first introduction into domestic ceramic production (in place of imported China clay);

- issuance of certificates for lead content to facilitate export of porcelain tableware from Dankotuwa.

It should be pointed out that, although the initial use of the testing capabilities of CRL by end-users is impressive, the capacity of CRL in testing and quality control is even bigger and its utilization should gradually rise. The capacity of the rather sophisticated equipment exceeds its current use but the capability of the national staff has to be developed gradually. It is important to note that a good number of services described above was performed with a significant part of the staff being on fellowship training abroad.

Most of the testing services performed in 1985 involved analyses of raw materials and products in a conservative manner, without extensive use of the sophisticated and expensive equipment available. Nonetheless, the results delivered to customers were satisfactory and reliable. The value of the 97 orders performed by the X-ray and thermoanalysis unit exceeds significantly the value of all other (simpler) orders. This part of the Laboratory should be used much more in the future for full chemical analyses, complete determination of mineral composition of materials tested, analyses of thermophysical properties and determination of other parameters. However, more extensive and reliable utilization of the X-ray and thermoanalysis unit and the mineralogical unit will require completion of the equipment with a number of accessory pieces of equipment and calibration instruments.

Solid steps were taken toward establishing the capability of CRL to perform trouble-shooting or consultancy services for the ceramic industry. However, capability development in this area is more difficult as experienced people are required for such services. The evaluation mission has established the significant need in the ceramic industry for trouble-shooting services. The current situation is such that CRL could make a solid reputation for itself in a relatively short time if it were to satisfy these needs. As most of the national staff in the pilot plant and the kiln and firing unit are relatively young and not yet sufficiently experienced, most of the services provided in the past year-and-a-half have been by international experts. However, they have always included the national staff in their work as a method of on-the-job training.

The equipment with which the pilot plant and the kiln and firing lab are equipped enables the provision of a rather wide range of services: body mixture testing and development, process modifications, product design, energy conservation, kiln regime investigations. It is estimated that about 30 interventions in industry related to trouble-shooting were performed in the past 16 months. In addition to the equipment listed in Annex XII, the kiln and firing unit has at its disposal a very practical portable set of equipment for energy audits in the ceramic industry, obtained through the project DP/SRL/82/007 -- Industrial Energy Conservation Programme. In fact, some of the most significant results from trouble-shooting services have been in the areas of energy conservation and kiln regime optimization. They have contributed significantly to establishing a certain reputation for the CRL in the industry. The work of Mr. M. Novy, international consultant in kiln design and fuel engineering, who worked with CRL staff on both US/SRL/78/207 and DP/SRL/82/007, deserves to be mentioned. The following services have had very significant effects in the industry:

- optimization of kiln design in the Lanka Refractory Ltd. in Meepe, setting the srage for an energy saving of 30% for the kiln;

- optimization of kiln operation by modifications of fuel oil burners in the Negombo Ceramic Factory, resulting in energy savings of 5 - 15% or 600 Rs per day (i.e., 180,000 Rs per year) on one bisquit kiln only;

- improvements in a sanitary ware kiln operation regime in the Piliyandala Ceramic Factory, based on diagnostic measurements, resulting in a decrease of kiln energy consumption by over 30%;

- optimization of kiln firing in the Lanka Walltiles Ltd. in Balangoda and introduction of better instrumentation techniques for kiln process control, resulting in very significant savings: 20% savings in energy cost or 5% savings in production cost per tile. The magnitude of these savings can be seen from the very impressive figure of around 130 million rupies of turnover for the Balangdoda factory in 1985.

In summary, it can be stated that project achievements after a relatively short time of CRL operations are significant. The Laboratory is offering services which are very appropriate to the needs of the Sri Lankan ceramic and related industry. The effectiveness of the Laboratory -- in terms of manpower, methodologies and techniques available, equipment, facilities, etc. -- in providing testing and quality control, as well as trouble-shooting services, can be considered as satisfactory, particularly since two years is a very short period in institution-building projects of this kind. It is very difficult to consider the cost efficiency of an institution-building project especially at an early stage, but some of the very positive examples described above are indicators that this project has gotten off to a very good start.

III.3.2. Suitability of the Laboratory for its intended purpose

The CRL was established essentially as a single-branch industrial research and service institution -- serving primarily the ceramic industry of Sri Lanka. The Laboratory focuses on two main functions: testing and analysis (including quality control) and trouble-shooting. The approach to the number of staff and the growth of CRL has been cautious. Only a core national staff has been hired at first, with plans for gradual expansion later as the Laboratory becomes established and its services more demanded. If the purpose of the Laboratory is examined in this light, then the Laboratory is very suitable and fits the most urgent needs of the national ceramic industry. The issue of the use of Laboratory services by the industry has already been touched upon in Section III.3.1.; it is further elaborated in Section III.3.4. The evaluation mission considers the initial use of these services by the end-users and, therefore, the acceptance of the Laboratory by the industry, as satisfactory. The question of the capacity of CRL to satisfy industry needs, already touched upon in Section III.3.1., is further discussed in Section III.3.5. which deals with the need for further international technical assistance. The industry need for testing and quality control services is close to being satisfied in the very near future; however, the very strong need for trouble-shooting services currently exceeds the capacity and capability of CRL.

III.3.3. Level of expertise of the national staff

Considering the relatively short period since the inauguration of CRL, the level of expertise of the national staff can be considered as very good, although more remains to be done. The selection of the national staff has been made in a careful and independent manner, as already described in Section III.2. Young people with a very solid academic background were attracted by the prospects of working in a well equipped laboratory on topics and problems which appeal to them. The qualifications of the national staff contacted by the evaluation mission are given in Annex XV. The enthusiasm and dedication of staff has impressed the evaluation mission. Their current level of expertise -- already satisfactory because of good background, some previous experience by a number of staff, and effective fellowship training -- has been raised by special efforts of the international experts on the project. The technical expertise, adaptability, flexibility and commitment of the international experts to the project have been impressive. From the onset of project activities, their attention was devoted to integrating national staff in project activities, initiating team work and promoting mutual awareness of responsibilities among national staff. This kind of orientation by international experts is essential for the success of an institution-building project.

On this subject of the increasing level of expertise of the national staff, it is important to mention the programme of applied research projects (already touched upon in Section III.3.1). Each research officer has been assigned a research project to work on (approximately one day per week). Topics for projects were selected by the international experts having in mind the need for research officers to specialize on the equipment assigned to them, but also the need to work on subjects which could be important for solving some specific problems in the ceramic industry. The research projects -- details of which are given in Annex XVI -- are therefore application-oriented. Regular colloquia are held among national staff, where experience from these projects is shared and possible team work initiated. Results from these projects should be of interest for the industrial end-users and should contribute to their increased awareness about the capabilities of CRL.

In Section III.3.4., the evaluation mission gives a positive assessment of the current degree of technical self-sufficiency of the Laboratory, considering only two years of international technical assistance. The Laboratory's outlook in the near future appears quite bright, although some further international assistance is essential, as well as some measures on the domestic scene. Several important positive elements (some of which are further elaborated in sections which follow) have contributed to the current satisfactory status of the project: good national and international staff, their effective way of working together, high technical level and adequacy of equipment delivered through the project, good initial relationship of CRL with the industrial end-users and a strong commitment of CCC in promoting the Laboratory.

III.3.4. Strategy of the Laboratory and its position in the industrial environment

On the basis of Chapters I and II, it can be concluded that the Sri Lankan ceramic industry -- based largely on domestic raw materials -- has already reached a relatively satisfactory level in terms of the numbers of plants, product range and capacity utilization. However, further improvement in its performance will require -- as in other mostly state-owned industries -- significant efforts in the fields of technical upgrading, management and marketing. The Ceramic Research Laboratory can make a contribution in the first field -- technical upgrading or ceramic technology development -- and that is its primary focus. Management and marketing problems will have to be solved in parallel to CRL's efforts.

The CRL is part of the Ceylon Ceramics Corporation. In the current organizational structure, the Laboratory is directly under the General Manager of the Corporation and reports to him. In the absence of a full-time national team leader (Head of the Laboratory) who has not been apppointed yet, the General Manager has devoted a part of his time to managing the Laboratory. This has been a difficult task considering his other numerous duties in the Corporation. The national staff of the Laboratory numbered 17 at the time of the evaluation, including 12 technical professionals (research officers).

The financing of the Laboratory in its initial period has been secured by the CCC. In 1985 the cost of the Laboratory amounted to an estimated 665,000 Rs (420,000 for salaries of personnel, 150,000 for energy and 95,000 for purchases and services).

CCC has made a considerable effort in promoting the Laboratory. There is a strong commitment on the part of the CCC for continued solid support of the CRL. Awareness about the Laboratory in its surroundings is quite satisfactory. Good initial contacts and relationship have been established with industrial end-users (primarily with CCC members and subsidiaries, but others as well) and related institutions in the country (Sri Lanka Standards Institution, Ceylon Institute of Scientific and Industrial Research, Geological Survey, National Engineering Research and Development Centre, Moratuwa University). There is a growing awareness among the industrial end-users about the benefits which could result from using the Laboratory's capabilities. Several very positive results which have been achieved by the project in assisting the ceramic industry (described in detail in Section III.3.1.) have positively contributed to this awareness and the standing of the Laboratory in the industrial community. The fact that the Laboratory has already started charging for some of its services is an indicator of the initial success achieved. Between June and October 1985 the Laboratory received orders from clients in the value of about 250,000 Rs. The value of orders from CCC-factories (184,000 Rs) is taken into account by the CCC in its internal financial calculations, while services to outside customers are charged directly through billing (the money earned going to CCC).

It is important to mention that in the view of the evaluation mission, the Laboratory passes a very sensitive test even after only slightly over a year of its official existence: if the international assistance were to terminate in the beginning of 1986, the Laboratory would survive and continue functioning (although it would not have been fully established and could not fully satisfy the existing need for technical services by the ceramic industry). Based on UNIDO experience with institution-building projects in other developing countries, this is a remarkable achievement.

The orientation chosen by CCC for the Laboratory up to the present has been a correct one. The Laboratory is essentially a single-branch industrial research and service institution (serving the ceramic industry). As far as its functions are concerned, the Laboratory has initially focused primarily on testing services. Quality control services are also being provided. Consultancy services (trouble-shooting, energy conservation, process and product development) are slowly expanding, with simple ones first and more complex ones later as the national staff develops. The national staff has been carefully selected, in a very independent manner. The CCC approach has been cautious -- to hire only a core staff at first and to expand later as the Laboratory becomes established and its services more demanded.

The CCC has a very realistic orientation and plans for the Laboratory in the future and is aware that building up a significant research and development capability is a long process which requires continous backing. Its financial commitment to the Laboratory appears very strong, particularly since the Corporation has begun a stabilization process in 1985 after several financially difficult years. In the next several years, the plans are to fortify the services which are now being offered and to slowly add a number of staff. The budget for the Laboratory in 1986 is an integral part of the CCC budget.

It is estimated that, when the Laboratory is fully operational (after all of the staff have been trained and industry has been fully sensitized), the budget necessary will rise to about 2,500,000 Rs. Since the service arrangements and spare parts for the sophisticated and expensive equipment delivered in the course of the project, as well as the depreciation of equipment, could amount to almost 1,500,000 Rs, special attention must be given to this issue after the international assistance is over. The management of the CCC appears fully committed to appropriating up to 1% of the CCC turnover (without subsidiaries) for Laboratory operations in future years. The above turnover is expected to reach 250,000,000 Rs in 1985. The CCC management also expects that the Laboratory will be earning over 600,000 Rs already in 1986 by charging for its services. Testing and quality control services are expected to be provided to ceramic as well as allied industries, while trouble-shooting services should be offered only to the ceramic industry.

On the more critical side concerning the position of the Laboratory in its industrial environment, the evaluation mission notes that a wider range of clients are not fully sensitized about the Laboratory and that its connection and relations with the smaller private industry are only at an initial stage. The focus of the Laboratory's activities has thus far been on testing and quality control services, while the activities in trouble-shooting or consultancy services (e.g., body mixture testing and development, process modifications, product design, energy conservation, kiln regime investigations) -- where the industry demand is strong and where the Laboratory could make a name for itself in a relatively short time -- have not yet been fully developed. (The mission fully recognizes that it is more difficult to develop capabilities in this area.) The absence of a full-time national team leader has hampered the development and fuller utilization of the resources made available. The staff are relatively young and not yet sufficiently experienced for the range of services which the Laboratory is expected to provide. There is also a lack of technician-level personnel.

Although the project progess in building the Laboratory's capabilities after two years can be considered as good, it is clear that further international assistance is necessary to strengthen the CRL and make it fully capable of providing testing and quality control services and trouble-shooting or consultancy services as required by the development of the Sri Lankan ceramic industry.

In order to achieve the above desired objective, the measures listed below should be considered. They have already been thoroughly discussed by the evaluation mission with CCC management, and several of the measures are about to be implemented. They are:

- selection and appointment of a full-time CRL head whose engagement should be secured on a long-term basis;

- in addition to the already established commitment of the CCC to the further development of the Laboratory, serious consideration should be given to the possibility of introducing a staff and career development scheme which would reflect the unique role of CRL in the framework of the development of the ceramic industry and the accompanying challenges to the desired qualified staff (for example, if the Laboratory's income from charging for services is increasing, the staff should receive financial incentives);

- expansion of CRL national personnel by a number of technical professionals and several technician-level staff;

- setting up of a CRL board which will have advisory and planning functions, consist of major end-users and related institutions, and meet periodically according to the needs of the CRL;

- in order to make the CRL more acceptable to a wider range of end-users and related institutions and to better reflect its activities, consideration should be given to the issue of renaming the Laboratory to a "Ceramic Technology Development Centre" (there is currently a misconception by some end-users that the Laboratory is involved only in fundamental research and analytical studies);

- intensification of efforts in the sensitization of all potential clients and the strengthening of contacts with them -- for instance, by advertisement, brochures, seminars and regular dissemination of information concerning activities and outputs of the Centre and the possible application of results by end-users and related institutions;

- setting up of a separate CRL account as a second logical step in the process of charging end-users for services; and

- closer contact with the Industrial Development Board and the Ministry of Rural Industrial Development which have initiated programmes to strengthen small-scale ceramic enterprises, mostly private; the Laboratory could act as a catalyst in these programmes by conveying its know-how to these institutions which might then serve as a channel between the Laboratory and those small enterprises which have developed the capacity to absorb technical upgrading.

The securement of a long-term availability of adequate domestic raw materials for the expanding Sri Lankan ceramic industry is a very important task in which the CRL can play a significant role. The current situation related to this issue is described in Section II.3. The Government should be approached about supporting the CRL by a grant which would cover a multi-year project of raw material deposits investigation, in co-operation with the Geological Survey. In this way the very strong potential of the Laboratory in analytical and testing services would be put to a very important use and the Laboratory would have additiona financial support.

III.3.5. Need for further international technical assistance

Project progress after two years can be considered as very good. In many ways, compared to similar U.N. institution-building projects, it can be assessed as remarkable. Some of the strong points of the project have been elaborated in Sections III.3.1 and III.3.4. However, it is clear that further international assistance is necessary to strengthen the CRL and make it fully capable of providing testing and quality control services and trouble-shooting services as required by the development of the Sri Lankan ceramic industry. Two years is a very short period for establishing an institutional capability in a developing country. Considering the good progress of the project in the past two years, it can be said that further international assistance is fully deserved by the CRL.

The evaluation mission recommends the continuation of international technical assistance through UNIDO for a period of two years with the objective of developing a viable centre capable of meeting the needs of the Sri Lankan ceramic industry. The assistance should focus on the reinforcement of the testing and quality control capabilities and significant strengthening of the capabilities in providing trouble-shooting or consultancy services. In the additional two years of technical assistance, the strong points of the project and CRL (capable and enthousiastic staff, good equipment, good initial acceptance by the industry) should be further reinforced, while some of the weaker points mentioned at the end of Section III.3.4 should be overcome through measures recommended in the same Section. The mission is of the opinion that five years of international assistance (1983 - mid-1986 and two additional years starting in the second half of 1986) should be sufficient for making the CRL self-reliable and fully capable of serving the Sri Lankan ceramic and allied industries. After that period, further development of CRL should be solely the responsibility of CCC and the Government.

The budget recommended for the two-year continuation is estimated at US$615,000 (including UNIDO overhead costs). The breakdown of this budget by components is as follows:

- additional equipment plus maintenance and servicing of existing equipment	$ 180,000
- Chief Technical Adviser	$ 160,000
- short-term experts	$ 130,000
- fellowships/training	$ 50,000
- miscellaneous	$ 25,000
- UNIDO overheads	$ 70,000
TOTAL	$ 615,000

The explanation for each of these components is given below.

Equipment: The x-ray and mineralogical sections of the Laboratory are equipped with rather sophisticated equipment worth close to $500,000. In order to make this equipment fully usable for a wide range of analytical and testing services, 15-20% of the above value needs to be spent on accessories, additional parts and calibrating instruments (max. $100,000). Another $20,000 is needed for expanding the pilot plant and kiln units of CRL. During the next two years of international assistance, it is estimated that $30,000 per year will have to be spent on the servicing and maintenance of the sophisticated equipment which is at the disposal of CRL. The equipment component therefore amounts to $180,000.

CTA: The mission is of the strong opinion that a Chief Technical Adviser should now be present at the CRL on a longer term basis. He should be an energetic, industrially-oriented ceramic engineer with a strong consulting experience. He should play a key role in assisting the CRL in fully establishing itself among the industrial end-users. He should be experienced in both the testing and quality control services and -- especially -- trouble-shooting activities. His presence is recommended for a total of 24 m/m.

Short-term experts: A total of around 18 m/m of short-term expertise would be required to strengthen the CRL in its activities. The specifications of this short-term expertise will be given in the project proposal (a portion will have to remain unspecified, to be used when urgent needs in specific technical fields arise). A quality control expert would certainly be needed for a period of 2-3 months in order to speed up the process of having CRL accepted as a certified Laboratory in the quality control network now being established by the Sri Lanka Standards Institution. He would thus contribute to the co-operation which has already started between CRL and the UNIDO-executed project DP/SRL/82/003 - Development of Standardization and Quality Control. Short-term experts in a number of specialized areas related to testing and trouble-shooting services would also be required.

Fellowship/training: Most of the national staff have undergone initial training abroad; however, additional specialization will be required in several areas (for example, advanced instrumental analysis). At this stage of the project, an efficient way of providing the training (or part of the training) would be a twinning arrangement with a foreign institution of a similar profile. The national staff could be trained in that Institution, but also the experts from the Institution could come to Sri Lanka for additional on-the-job training and co-operation.

Miscellaneous: This component would cover the strengthening of the CRL library with technical literature, possibly the ordering of some special chemicals, as well as unforeseen expenses.

The exact specifications of the international assistance requirements should be made in a detailed project proposal to be prepared by the Chemical Industries Branch of UNIDO as soon as possible after this evaluation report is made available. The mission recommends that the continued assistance be clearly formulated in the form of a revised project document which will define the desired capability of the CRL at the end of the total duration of assistance. In this manner, the project document would cover both the period 1983-1986 and the forthcoming two years. Thus, some of the shortcomings of the original project design (discussed in Section III.1.) would be overcome.

In accordance with the current practices of project formulation being used by UNIDO, the outputs of the project should describe the main organizational groups of CRL in terms of their capabilities/capacities which are planned at the end of the project. The two main groups (departments) are:

- department for testing and quality control services (including the x-ray and DTA unit, mineralogical unit, chemical laboratory and physical laboratory), and

- department for trouble-shooting or consultancy services (including the pilot plant and the kiln and firing unit).

Each of them should be described in terms of:

- functional services to be performed (type, as well as estimate of magnitude and quality), including clients or end-users;

- staff composition and skills acquired;

- methodologies, guidelines, work routines developed;

- premises, facilities, equipment; and

- marketing and financing of services.

It would be desirable to have a portion of the project extension financed by the UNDP. This could include a certain number of months of the CTA or the training component. This financing could help bridge the gap between the end of the current phase (April - May 1986) and the beginning of continued assistance through the special purpose contribution of Federal Republic of Germany to UNIDF (as the approval is expected to take some time). The mission recommends that $55,000 of the budget required be provided by UNDP, with the remaining $560,000 coming from UNIDF.

The mission is also of the opinion that reporting on project progress could be improved in the future if practices which are established in UNDP-financed projects are used (semi-annual progress reports together with internal evaluation reports). A field review meeting with representation from BMZ, UNDP, UNIDO and the Government of Sri Lanka should be held approximately one year after the additional technical assistance gets under way.

III.4. Monitoring and Backstopping

In Section III.2, "Implementation of the Project", reference was made at various points to matters pertaining to the monitoring and backstopping of the project. It was particularly stressed that the national project management was closely involved in the specification and selection of UNIDO inputs, particularly experts, consultants and equipment, and that excellent co-operation was also received from the international staff of the project in this respect, including the finalization of fellowship training. It is felt that the high quality of the inputs and their close relevance to the needs of the project and, in the final analysis, to the requirements of the Sri Lankan ceramic and non-metallic-mineral-based industries is due to the careful work, involving all interested parties, which went into the delivery of the various inputs.

The monitoring per se is carried out at a number of different levels from project management, via the CCC, UNDP office and UNIDO Headquarters, to BMZ. Its importance and effectiveness is closely related to the volume and accuracy of available information.

III.4.1. Government

At the level of the project and the Government implementation agency, CCC, the project has been followed practically on a day-to-day basis. Although the monitoring at this level has been somewhat hampered by the absence of a full-time National Project Director (it is recalled that Mr. Perera was only able to devote a minor part of his time to the task) the delay in bringing information on project progress and related problems to the attention of the responsible decision-makers has been negligible.

On the other hand, it has been noted that certain actions requiring endorsement or direct intervention from the Chairman of the CCC or his office have been delayed in the past to the detriment of the optimum progress of the project. This seemed to be the case in the recruitment of national staff for the still vacant posts and in general follow-up administrative decisions taken at the project level. It should be noted that the presence of international personnel has counteracted most of the negative effects of the sluggish response mechanism of the CCC (initially even in such minor cases as purchase of necessary supplies for the completion of the Laboratory building) and, by and large, the project has not suffered any significant delays on this account.

Whatever problems might have existed in the past in this respect, it is the firm impression of the evaluation team that the recent appointment (in September 1985) of Mrs. Rukmini Beligammana as Chairperson of the CCC has contributed markedly to their elimination. It is obvious that the CCC now is committed to a policy of strong support to the project and effective response to its needs. Recent examples are the initiation of the recruitment of a national Chief of Laboratory, an agreement to increase the number of national staff as required, and plans for launching a public relations campaign aimed at improving the awareness among end-users about the services of the Laboratory. It may be said that the laboratory has now been fully accepted as a member of the CCC group with all the privileges and responsibilities which such a position entails.

III.4.2 UNIDO

The monitoring by UNIDO Headquarters of project activities and progress towards achieving the objectives laid out in the Project Document has been based on personal observations by the backstopping officer, oral reports by experts and consultants, debriefing at UNIDO Hqs., personal leters by experts/consultants and technical and progress reports from the project. Each of these sources of information is briefly discussed in the following text.

a. Monitoring visit

In September 1984 the backstopping officer carried out a 10-day mission to Colombo in order to gain a first-hand impression of the progress of the project and to establish personal contacts with the project personnel and the representatives of the Government, the Embassy of the Federal Republic of Germany and UNDP. The visit was planned to coincide with the official opening of the laboratory on 18 September, thus allowing Mr. Biering to represent UNIDO at this event.

Besides all the official contacts made on this occasion which subsequently facilitied communication, the backstopping officer also met with all national staff of the project and familiarized himself with their background and current work situation. Of particular importance were long discussions with the CCC management and with representatives of certain end-users inside and outside the CCC. These meetings allowed an exchange of ideas on the scope of the future project development, particularly in the sense of building-up an efficient service institution capable of responding to the needs of the national ceramic industry.

In the following months it was found that the first-hand experience gained by the backstopping officer enhanced his understanding of the overall situation on the project and the environment in which it operates, and with this his ability to provide it with backstopping support.

b. Oral reporting and personal letters from experts/consultants

It is characteristic of this project that its international staff, without exception, took a deep personal interest in the project and in several cases went far beyond their formal terms-of-reference in an effort to speed up implementation, especially selection and repair of equipment and identification of training institutions (and stimulation of their interest) for the fellowship programme.

Through personal letters to the backstopping officer (or copies sent to him of letters addressed to equipment suppliers and others), UNIDO Hqs was kept continously informed about progress in delivery of inputs and planning of future activities and was given a chance to take parallel action.

Debriefing discussions with the experts and consultants in Vienna also provided a wealth of information on the progress of the project and the various problems it had to cope with from time to time. The face-to-face discussion of such matters provided more insight into the life of the project than is normally possible to convey by means of formal written reports.

c. Progress and internal evaluation reports

In addition to the technical reports which, particularly in the case of the two long-term experts, Mr. Kato and Mr. von Metzsch, have provided updated summaries of the status of project implementation, the progress has been reported in the form of (i) a project internal evaluation report elaborated in November 1984, and (ii) quarterly progress reports by the SIDFA elaborated since the beginning of 1985. The progress reports, which focused primarily on the delivery of inputs and other administrative matters, have only to a limited extent provided information not available elsewhere. It was already mentioned in Section III.3.5 that the application of the UNDP/UNIDO format of six-monthly progress reports would bring about a definite improvement.

d. Technical reports

Technical reports have been prepared by all experts and consultants employed by the project. The report of the two long-term experts were in a way progress reports; those prepared by Mr. von Metzsch provide very explicit information on progress of activities and on the practical measures taken to strengthen the position of the Laboratory. The reports of the sectoral consultants typically deal with technological matters within their respective fields of competence and often provide practical advice on how the Laboratory could improve its services to industry in these fields. As a tool for monitoring they are only of marginal importance. All reports examined by the evaluation mission are listed in Annex IV.

III.4.3 Resumé

The general picture which emerges from the above information is strongly influenced by the deficiencies in the project management structure, i.e., the absence of a full time National Project Director and the lack of continuity of the Chief Technical Adviser function which, for all practical purposes, was shared by two international experts, Mr. Kato and Mr. von Metzsch.

Although much information about the progress of the project reached the CCC and UNIDO, there was a lack of formal reporting aimed at identifying and exposing specific areas of problems or delays (on one hand) and positive features (on the other). It was, therefore, not quite clear from the official files to which extent project personnel (national and international) was co-operating in an effort to build up an integrated team nor was the extent of contacts with the industrial end-users elaborated to any significant extent. This may, at least partly, be due to a lack of understanding at the project level of the importance of this type of information at the backstopping level.

A result of the lack of exchange of information and views related to institution-building activities of the project may be that the objectives and their achievement have had less of a consideration than the provision of physical and infrastructural inputs. This is not unusual in the early stages of a project which only "takes off" after the major inputs have been delivered. However, the in-depth evaluation has shown that efforts towards the achievement of the immediate objective have been significantly more important than demonstrated through the reporting system.

To sum up, it may be stated that although deficiencies in the management and reporting of the project are obvious, informal contacts between, as well as supporting action from, all parties involved have largely made up for the shortcomings. In the future it would, nevertheless, be advisable to strengthen the monitoring and backstopping of the project as it enters an increasingly complex and demanding phase.

III.5. Suitability of the Project as a Pilot Measure

For Sri Lanka itself, the project already represents a model approach to the strengthening of a state corporation whose recent development has been overly dependent on foreign sources of know-how, technology and even testing and quality control facilities. If, as expected, the financial situation of the CCC improves over the next few years, it may be possible to demonstrate that part of the credit for this goes to the Ceramic Research Laboratory. However, of greater relevance in the context of the present report is the fact that for the executing agency (UNIDO) and the financial donor (Government of the Federal Republic of Germany), the project may be referred to as a model case of establishing an industrial research and service institution (institution-building).

The appreciation of the project as a pilot measure would be strengthened by an extended and in-depth reporting according to UNDP guidelines. The recommended measures of sensitization of clients through advertisement and public information and through the establishment of an advisory and planning board of the Laboratory are necessary to increase the relevance and application of the Laboratory as a pilot project for the industrial promotion in Sri Lanka (and, later, possibly in other developing countries). Donor agencies and UNIDO should further support the appreciation of the Laboratory as a pilot measure by continuous information about the results and capabilities of the Laboratory. At a later stage, when the CRL is fully established in the country itself, UNIDO and other parties involved could consider whether the Laboratory would be able to perform tasks at a regional level and thereby also serve as a regional pilot project.

IV. FINDINGS AND RECOMMENDATIONS

IV.1. Findings

1. Overall Government orientation and efforts in industrialization -- both in the required improvement of the public sector and the development of the private -- represent a favourable framework for the project US/SRL/78/207. The project has a pilot character in these long-term efforts. Domestic raw materials of relatively good quality -- although still insufficiently identified and mapped in a systematic manner -- form a solid base for the Sri Lankan ceramic industry which has already reached a satisfactory level in terms of the number of plants, product range and capacity utilization. Further improvement in the performance of the ceramic industry will require support in the fields of management and marketing (which are, in general, weaker points of state-owned companies), as well as ceramic technology development which is the actual scope of this project.

2. Since its approval in December 1982, the project -- financed by a special purpose contribution of the Federal Republic of Germany to the United Nations Industrial Development Fund (in the amount of US$1,136,554) and executed by UNIDO -- has led to the establishment of a centre for testing and technology development in the ceramics industry within the Ceylon Ceramic Corporation (CCC), which was inaugurated on 18 September 1984 under the name Ceramic Research Laboratory (CRL). Since then, good progress has been made in building up the capability of the Laboratory which is already providing services to the national industry and contributing towards the improvement of product quality and the increase of production efficiency. Solid initial contact and relationships have been established with industrial end-users (primarily with the 22 CCC member companies and subsidiaries, but others as well) and related national institutions, as well as some international centres in the same field.

3. CCC has made a considerable effort in promoting the CRL and has secured appropriate funds for its establishment and initial operation. There is a strong commitment on the part of CCC for further support of the Laboratory. CCC has a realistic orientation and plans for the Laboratory in the near future, in response to the requirements of the ceramic and non-metallic mineral-based industry, and is aware that building up a significant research and development capability is a long process which requires continuous backing.

4. The evaluation mission has confirmed that there is a definite and substantial need in the industry for the type of services which the Laboratory is either offering or will soon be in a position to offer. There is a growing awareness among the industrial end-users about the benefits which could result from using the Laboratory's capabilities. Several very positive results have already been achieved in assisting the ceramic industry, paraticularly in testing and analysis of raw materials and trouble-shooting services related to energy conservation and optimization of kiln operations. The Laboratory is already charging customers for a good number of its services.

5. The location of the Laboratory in Piliyandala, its facilities and working conditions are fully adequate. The Laboratory has managed to attract a national staff of competent and enthusiastic scientists and engineers; the selection of staff - a total of 17 including 12 technical professionals -- has been made in a careful and independent manner, securing a solid basis and positive outlook for the future. The same positive assessment is applicable to international experts, particularly with respect to their technical expertise, adaptability, flexibility and committment to the project. From the onset of the project, attention was devoted to integrating the national staff in project activities, initiating team work and promoting mutual awareness of responsibilities among the national staff. The fellowship programme, which focused on gaining knowledge about equipment and basic laboratory operations, was used effectively. The equipment installed was well selected with respect to the current requirements of the end-users. The evaluation mission appreciated the good interaction of the project with on-going UNIDO projects in the fields of energy conservation (DP/SRL/82/007 and DP/SRL/83/012) and standardization and quality control (DP/SRL/82/003).

6. In the view of the evaluation mission, the Ceramic Research Laboratory passes a very sensitive test even after only a year and a half of its existence: if the international assistance were to terminate in the beginning of 1986, the Laboratory would survive and continue functioning on its own (although it would not have been fully established and could not fully satisfy the existing need for technical services by the ceramic industry). From UNIDO experience with institution-building projects in developing countries, this is a remarkable achievement. To sum up paragraphs 1 - 5, this achievement, which vouches for a continued growth of the Labaratory in terms of competence and impact, has been made possible by the following positive features of the project:

   - The project resulted from a persistent request by the Government of Sri Lanka which, as early as 1969, recognized the need for a national research and quality control laboratory in the ceramic industry field;

   - The physical infrastructure for the Laboratory (the building, in particular) was available and almost ready for effective occupancy and operation at the start of the project;

   - Great care was taken in the selection of national staff, giving priority to recent graduates with a sound academic background;

   - The Laboratory was provided with a comparatively large quantity of analytical and physical investigation equipment including several sophisticated items (X-ray diffractometer, X-ray spectrometer, thermogravimetric equipment and electron scanning microscope); in return, this equipment raises considerably the capability of the Laboratory in the field of raw material/mineral investigations and, in the eyes of some important end-users, signifies excellence at the international level;

- From the very start of its operational phase (inauguration of the CRL), the project focused on laboratory work and other investigations related directly to the needs of the end-users; the links with industry were, therefore, established at the earliest possible point in time;

- The training of the national staff -- on-the-job training by international experts and consultants, as well as fellowship training abroad -- was aimed at enhancing their appreciation of the imperative of satisfying end-users' needs and at increasing their capacity to solve industry-related problems, both individually and as a team;

- The project has thus far avoided wide spreading of the scope of its activities, maintaining as its main technological field the ceramic industry (with other mineral-based industries being of secondary priority) and limiting its activities to testing, quality control and trouble-shooting, giving lower priority to basic research and postponing training activities (for outsiders) and information services for the future.

7. On the more critical side concerning the position of the Laboratory in its industrial environment, the evaluation mission notes that a wider range of clients are not fully sensitized about the Laboratory and that its connection and relations with the smaller private industry are only at an initial stage. The focus of the Laboratory's activities has thus far been on testing and quality control services, while the activities in trouble-shooting or consultancy services (e.g., body mixture testing and development, process modifications, product design, energy conservation, kiln regime investigations) -- where the industry demand is strong and where the Laboratory could make a name for itself in a relatively short time -- have not yet been fully developed. (The mission fully recognizes that it is more difficult to develop capabilities in this area.) The absence of a full-time national team leader has hampered the development and fuller utilization of the resources made available. The staff are relatively young and not yet sufficiently experienced for the range of services which the Laboratory is expected to provide. There is also a lack of technician-level personnel.

8. The original Project Document suffered from inconsistencies in describing what was to be expected at the end of the two years of international assistance; the project was originally designed more as a direct-support type rather than institution building. It is fortunate that international experts, as well as the management of CCC, approached the project in such a manner that the development of institutional capacity was their primary concern.

9. Although the project progress after essentially two years can be considered as good, it is clear that further international assistance is necessary to strengthen the CRL and make it fully capable of providing testing and quality control services and trouble-shooting or consultancy services as required by the development of the Sri Lankan ceramic industry. Two years is a very short period for establishing an industrially-oriented institutional capacity in a developing country. Considering the progress of the project up to now, it can be stated that further international assistance is also fully deserved by the CRL.

IV.2. Recommendations

1. The mission recommends the continuation of international technical assistance through UNIDO for a period of two years with the objective of developing a viable, self-sufficient industrial research and service institution capable of meeting the needs of the Sri Lankan ceramic industry. The assistance should focus on the reinforcement of the testing and quality control capabilities and significant strengthening of the capabilities in providing trouble-shooting services by the CRL. The mission is of the opinion that five years of international assistance (1983 - mid-1986 and two additional years starting in the second half of 1986) should be sufficient for making the CRL fully established and self-reliable in serving the Sri Lankan ceramic and allied industries. After that period, further development of CRL should be solely the responsibility of CCC and the Government.

2. The exact specifications of the international assistance requirements should be made in a detailed project proposal to be prepared by the Chemical Industries Branch of UNIDO as soon as possible after this evaluation report is made available. The mission recommends that the continued assistance be clearly formulated in the form of a revised Project Document which will define the desired capability of the CRL at the end of the total duration of assistance. In this manner, the project document would cover both the period 1983 - 1986 and the forthcoming two years. Thus, some of the shortcomings of the original project design would be overcome.

   The immediate (project) objective should be:

   "To establish a Ceramic Research and Development Laboratory, within the Ceylon Ceramic Corporation, which will be capable of and self-sufficient in providing two major types of services to the Sri Lankan ceramic industry (primarily companies and subsidiaries of CCC, but other end-users as well):

- testing and quality control services (raw material testing, product testing, issuance of quality control certificates), including extensive systematic studies of the quantity and quality of ceramic raw materials available in the country; and

- trouble shooting or consultancy services (body mixture testing and development, process modifications, product design, application of glazes, energy conservation, kiln regime investigations).

It is estimated that by the end of the project, the Laboratory will, on a regular basis, be providing testing and quality control services to about 30 end-users in the ceramic and a number of users in allied industries, and trouble-shooting services to about 15 end-users in the ceramic industry".

The institutional capacity to be built up by the project (in terms of functional services; staff composition and skills acquired; methodologies and guidelines developed; premises, equipment and facilities; and marketing and financing of services) is to be quantified, to the extent possible, in the section of the Project Document dealing with "Outputs".

3. The future assistance to CRL should include:

- an international expert component, including a longer-term Chief Technical Adviser and short-term expertise;

- a training component, partly including a twinning arrangement with a foreign institution of a similar profile; and

- an additional equipment component (mostly accesories and calibrating instruments).

An outline of international assistance requirements is given in Section III.3.5. The budget recommended for the two-year continuation is estimated at $615,000 (including overhead costs). It would be desirable to have a portion of this budget (approximately $55,000) financed by UNDP in the form of a short "bridging" phase, with the bulk of the project extension ($560,000) being financed through UNIDF. The reporting on project progress to all parties concerned (including the donor country) should be improved in the future through the application of practices established for UNDP-financed projects (semi-annual progress reports together with internal evaluation reports). A review meeting with representation from the Federal Republic of Germany, UNDP, UNIDO and the Government of Sri Lanka should be held approximately one year after the bulk of the additional technical assistance gets underway.

4. In order to achieve the desired objective of the project, the following measures are recommended to the CCC:

   - selection and appointment of a full-time CRL head whose engagement should be secured on a long-term basis; he should possess a wide experience in material testing and ceramic industry development and should already have a solid reputation among the industrial end-users;

   - in addition to the already established committment of the CCC to the further development of the Laboratory, serious consideration should be given to the possibility of introducing a staff and career development scheme which would reflect the unique role of CRL in the framework of the development of the ceramic industry and the accompanying challenges to the desired qualified staff;

   - expansion of CRL national personnel by a number of technical professionals and several technician-level staff (the latter, particularly for the Laboratory workshop, should be recruited in co-operation with the national vocational training facilities);

   - setting up of a CRL board which will have advisory and planning functions and consist of representatives of major end-users and related institutions; the board should meet regularly and have an influence on decision-making according to the needs of the end-users;

   - in order to make the CRL more acceptable to a wider range of end-users and related institutions and to better reflect its activities, consideration should be given to the issue of renaming the Laboratory to a "Ceramic Technology Development Centre" (there is currently a misconception by some end-users that the Laboratory is involved only in fundamental research and analytical studies);

   - intensification of efforts in the sensitization of all potential clients and the strengthening of contacts with them -- for instance, by advertisement, brochures, seminars and regular dissemination of information concerning activities and outputs of the Centre and the possible application of results by end-users and related institutions;

   - closer co-operation with the Sri Lanka Standards Institution (SLSI) in order to speed up the process of having the CRL accepted as a certified laboratory in the quality control network currently being established by SLSI;

   - closer contact with the Industrial Development Board and the Ministry of Rural Industrial Development which have initiated programmes to strengthen small-scale ceramic enterprises, mostly priavate; the Laboratory could act as a catylyst in these programmes by conveying its know-how to these institutions which might then serve as a channel between the Laboratory and those small enterprises which have developed the capacity to absorb technical upgrading.

/...

5. The long term availability of adequate domestic raw materials for the expanding national ceramic industry can be secured only through extensive and systematic studies of the quantity and quality of available minerals. These studies are currently lacking. The Government should be approached about supporting the CRL by a grant which would cover a multi-year project of raw material deposits investigation, in co-operation with the Geological Survey. In this way the very strong potential of the Laboratory in analytical and testing services would be put to a very important use and the Laboratory would have additional financial support.

6. When the Laboratory is fully self-sufficient, it is estimated that its operational budget will rise to about 2,500,000 Rs. Since the service arrangements and spare parts for the sophisticated and expensive equipment delivered in the course of the project, as well as the depreciation of equipment, could amount to almost 1,500,000 Rs, special attention must be given to this issue after the international assistance is over. Although the management of the CCC appears fully committed to appropriating up to 1% of the CCC turnover (without subsidiaries) for Laboratory operation in future years, it is recommended to CCC to make a medium-term financial plan with respect to securing the necessary funding. The Ministry of Industry and Scientific Affairs should be closely consulted. The necessary funding should be obtained, to the maximum extent possible, from the following sources:

   - charging end-users for services, as already started; most of the services could be charged according to a price list, but a number of specific services could be charged according to special agreements (for example, consulting services for energy conservation could be related to a percentage of costs saved by the Laboratory's intervention); and

   - Government-financed projects related to raw material deposits investigation and mapping, as outlined in recommendation No. 5.

   CRL's commendable efforts in charging for its services in 1985 should be reinforced by the setting up of a separate Laboratory account within CCC, as a second logical step in the process of assessing fees to end-users. If possible, the Government should encourage the development of CCC by granting tax deductions for payments made to the Laboratory, recognizing its research and development status and the possible impact it may have on the ceramic industry.

7. Both in the next two years and beyond, CRL should concentrate on developing contacts and co-operation with similar international institutions. For a laboratory of this type, participation in international seminars and conferences and integration into the international network of similar organizations is important. At a later stage, when CRL is fully established in Sri Lanka, UNIDO and other parties could consider whether the Laboratory would be able to perform tasks at a regional level.

8. The Government should be aware that a research and development Laboratory such as the CRL can significantly contribute to the ceramic technology upgrading in the country. However, for the ceramic industry to be fully upgraded, efforts parallel to those by the CRL have to be initiated to solve management and marketing (especially export promotion) problems which are, in general, weaker points of the mostly state-owned industry in Sri Lanka.

9. The evaluation mission would appreciate if the Ceylon Ceramics Corporation could report to UNIDO on the follow-up to recommendations Nos. 4 - 6 by the end of 1986.

Annexes

Annex I

Terms of reference for the joint Government of Federal Republic of Germany/UNIDO in-depth evaluation

I. Background

A. Short history of the project

The first nucleus of ceramic industry was established in Sri Lanka as early as 1939. Since then, and particularly after the creation of the Ceylon Ceramics Corporation in 1955, the industry has grown and diversified into an important range of ceramics and heavy clay manufactures.

In order to pursue the necessary support for this development, Ceylon Ceramic Corporation, which comprises a total of 24 companies and subsidiaries, conceived in 1968 a plan for the establisment of a Ceramic Research Institute and from the beginning UNIDO was involved in informal negotiations in this sense. A formal Government request for UNIDO assistance was received in September 1978, and a preparatory assistance project carrying the present project number (US/SRL/78/2o7) was approved in 1979. This lead to a three week mission in July/August 1979 of Mr. Knizek, who drafted the Project Document, which was sumitted to the authorities of the Federal Republic of Germany of January 198o with a request for financing. Following years of investigations and negotiations, the finance was finally approved on 27 December 1982. The Project Document remained in essence unchanged for the re-phasing of the project.

B. Main characteristics of the project

The project, which has a total UNIDO contribution of US-$ 1,oo5,8oo, is primarily oriented towards the establishment

and "running in" of a Ceramic Research Laboratory attached to the CCC. The concept of the institution is that of an analytical laboratory (covering a wide range of non-metallic minerals used in the ceramic, as well as other industries) with the potential to perform technological development work and trouble-shooting related more specifically to the needs of the ceramic industry.

Analytical and pilot plant equipment worth some US-$ 575,000 was purchased and shipped to Sri Lanka during 1983/84, and the field activities began with its installation in early 1984. The laboratory was officially inaugurated in September 1984 and has since then, with a local staff of 12 and a range of short and intermediate-term UNIDO experts, carried out its functions as outlined above, serving both the CCC and outside users.

Following a presently on-going programme of fellowship training abroad of the national staff and a number of further consultants' missions scheduled for the coming months (including the first quarter of 1986), the project, as presently budgeted, will reach its completion during the first half of 1986.

C. Reasons for evaluation

The present evaluation is being carried out in compliance with the agreement between the Government of the Federal Republic of Germany and UNIDO concerning the implementation and monitoring of projects financed by the Federal Republic of Germany special purpose contribution to UNIDF.

II. Scope and Purpose of the Evaluation

The primary purpose of the evaluation mission is:

1. Measure and assess the outputs or results of project activities in developing institutional capability in selected areas and compare with original expectations;
2. Within this context, identify accomplishments and shortfalls and the reasons thereof;
3. Examine the external factors which have facilitated or impeded project progress;
4. Make an assessment of actual and/or potential project effectiveness, i.e., progress in achieving the project objective and in providing relevant services to the intended clients. This will include a re-examination of the adequacy of project design (formulation);
5. Make recommendations for future action or follow-up.

As part of the above tasks, the mission will specifically review if the approach utilized on the project has led to optimum results, and why the project has or has not been efficient and effective in achieving the results. The evaluation will in particular study:

(a) Effectiveness and efficiency of the Laboratory - in terms of skilled manpower, methodologies and techniques available, facilities, equipment, etc. - in providing services which are appropriate to the present and future needs and capabilities of the Sri Lankan ceramic and related industry in the following areas:

(i) consultancy services;
(ii) testing services.

(b) Suitability of the Laboratory for its intended purpose; use of Laboratory services by the industry (end-users); capacity of Laboratory to satisfy industry needs;

(c) Level of expertise of national staff; outlook for attaining Laboratory's technical self-sufficiency in the near-term;

(d) How does the Laboratory develop its medium-term plan and strategy? How does it plan its own growth? Is there a managing board or other supervisory organ? Who is participating in this superversion?How is the future operational financing assured?

(e) Based on overall achievements to date, specify areas of the Laboratory's activities which need further strengthening and, if any, the pre-conditions and parameters for additional technical assistance.

III. Composition of the Mission

The mission will be composed of the following:

- One economist, independent consultant
- One ceramic expert, independent consultant
- Ms. Rau-Mentzen, Senior Officer representing BMZ
- One evaluation officer representing UNIDO
- Mr. Niels Biering, Backstopping Officer, representing UNIDO

The Government of Sri Lanka is invited to associate itself with the mission's work and to nominate a representative.

IV. Consultations in the Field

The mission will maintain close liaison with the German Embassy, the UNDP Resident Representative and the Senior Industrial Development Field Advisor in Sri Lanka, the concerned Government organizations and the project's national and international staff.

The mission is expected to visit several end-users of the Laboratory's services, members of the Ceramic Corporation, as well as others.

Although the mission shuld feel free to discuss with the authorities concerned all matters relevant to its assignment, it is not authorized to make any commitments on behalf of BMZ or UNIDO.

V. Time-table and Report of the Mission

The mission members will receive a briefing at UNIDO headquarters. Upon arrival in Colombo, the mission will be briefed by the UNDP Resident Representative and the UNIDO SIDFA, who will also provide the necessary substantive and administrative support. The mission will attempt to complete its work within ten days, starting in Colombo on 2 December 1985. At the end of the mission, a meeting should take place where the mission will present its initial findings, conclusions and recommendations, and be ready to discuss these with senior Government officials, UN officials, as well as with the German Embassy.

The mission will complete a preliminary draft of its report in Sri Lanka and will leave behind a copy of initial findings, conclusions and recommendations with the German Embassy and the Resident Representative.

The final version of the report will be submitted simultaneously to BMZ and UNIDO headquarters, within one month of completion of field work. After clearance by the two organizations, the report will be submitted to the Government of Sri Lanka.

Annex II

Schedule of meetings held and visits made

December 1	- Discussion with SIDFA and international expert
" 2	- Briefing at UNDP office - Briefing at Embassy of F.R. Germany - Meeting with General Manager of the Ceylon Ceramics Corporation (CCC) - Visit to the Ceramics Research Laboratory in Piliyandala
" 3	- Meeting with Chairperson of the Ceylon Ceramics Corporation - Meeting with Finance Manager of CCC - Visit to the Geological Survey - Meeting with national project staff in Piliyandala - Meeting at the Ministry of Industry and Scientific Affairs
" 4	- Visit to the Negombo Ceramic Factory - Visit to Dankotuwa Porcelain (Pvt.) Ltd. - Visit to Sumagi Tile Industries in Dankotuwa
" 5	- Visit to Piliyandala Ceramic Factory - Visit to Ceylon Institute of Scientific and Industrial Research - Meeting with Director-General, Sri Lanka Standards Institution - Meeting with Industrial Development Board
" 6	- Visit to Lanka Walltiles (Pvt.) in Balangoda
" 8	- Drafting of preliminary findings and recommendations
" 9	- Meeting with representative of World Bank - Meeting with national project staff in Piliyandala
" 1o	- Presentation of preliminary findings and recommendations at UNDP - Presentation of preliminary findings and recommendations at the Embassy of the F.R. Germany - Presentation of preliminary findings and recommendations at the Ceylon Ceramics Corporation headquarters in Colombo - Meeting with national project staff at Piliyandala

December	1o	- Visit to Ceylon Transport Board
"	11	- Visit to Sri Lanka Export Development Board - Visit to the Department of Small Industries Goverment Handicraft Ceramic Center in Waragoda - Visit to Boralesgamuwa Kaolin Refinery Salpiti Corale
"	12	- Visit to Ceylon-German Technical Training Institute - Visit to Apprenticeship Training Institute

Annex III

List of persons met

Ministry of Industry and Scientific Affairs - Colombo

- Hon. Denzil Fernando	- Minister of Industry
- Mr. H.P. da Silva	- Additional Secretary
- Mr. P. Kasunasiri	- Senior Assistant Secretary

United Nations Devleopment Programme - Colombo

- Mr. C.J. Kamp	- Resident Representative

United Nations Industrial Development Organization - Colombo

- Mr. T. Schroll	- Senior Industrial Development Field Adviser
- Mr. S. Ericson	- Junior Professional Officer
- Dr. F.A. von Metzsch	- International Expert, project US/SRL/78/2o7
- Mr. W. Luetkenhorst	- Division of Industrial Studies, UNIDO headquarters
- Mr. J. Müller	- Expert, UNIDO-Czechoslovakia Joint Programme for International Co-operation in Ceramics

Embassy of the Federal Republic of Germany - Colombo

- Dr. G. Pfeiffer	- Ambassador
- Mr. H. Sasse	- Economic Counsellor
- Mr. E. Taenzer-Westphal	- Attache

World Bank - Colombo

- Mr. E.K. Hawkins	- Resident Representative

Ceylon Institute of Scientific and Industrial Research - Colombo

- Mr. E.R. Jansz	- Director
- Mr. D.R.K. Lokuliyana	- Minerals Technology Section

Geological Survey - Colombo

- Mr. D.E. de S. Jayawardena	- Technical Director

Industrial Development Board

- Mr. P. Gunawardena	- Chief Engineer
- Mr. T.B. Weerasekera	- Director, Regional Development

Sri Lanka Expo Development Board

- Dr. S. Wickramaratna	- Deputy Director Projects Division
- Mrs. I. Yayasekera	- Assistant Director/ Marketing
- Dr. S. Wickramaratua	- Projects Division

Sri Lanka Standards Institutions - Colombo

- Dr. N.R. de Silva	- Director General

Ceylon Ceramics Corporation

Headquarters - Colombo

- Mme. R. Beligammana	- Chairman
- Dr. C.T.S.B. Perera	- General Manager, Head of CRL Piliyandala (part-time)
- Mr. E.A.N. Weerasinghe	- Finance Manager

Ceramic Research Laboratory - Piliyandala

- Mr. B.D.S. R. Silva	- Senior Research Officer
- Mr. C.L. Ranatunga	- Research Officer
- Mr. P. Mithraratne	- Research Officer
- Mr. C.E. Alles	- Research Officer
- Mr. G.M.A.G.B. Gaspe	- Research Officer
- Miss M.L.C. Pigera	- Research Officer
- Mrs. N. Perera	- Administrative Secretary
- Dr. M.M.J.W. Herath	- Consultant

Dankotuwa Porcelain (Pvt.) Ltd.

- Mr. G.P. Haththotuwa	- Chairman
- Mr. S. Waduge	- General Manager

Lanka Refractories Ltd. Meepe

- Mr. T. Kularatne	- Deputy General Manager

Lanka Walltiles (Pvt.) Ltd. - Balangoda

- Mr. R. Munamalpe	- Factory Manager
- Mr. K. Nanayakkara	- Production Executive

Negombo Ceramics Factory

- Mr. W.D. Weerasinghe	- Deputy General Manager (Technical) of CCC
- Mr. Wijesekera	- Plant Manager
- Mr. T. Sivanadian	- former national expert for sanitary ware (project US/SRL/78.2o7), now ceramic consultant Waikkal/Colombo
- Mr. D. Nihal	- Factory manager

Piliyandala Ceramics Factory

- Mr. S.R. Kuruppu	- Factory Manager
- Mr. N. Wijesiriwardena	- Energy Manager

Boralesgamuwa Kaolin Refinery Salpiti Korale

- Mr. R.D. Padmaviri	- Factory Manager

Sumagi Tile Industries - Dankotuwa

- Mr. W.S. Peiris	- Managing Director
- Mr. T. Sivanadian	- Advisor

Ceylon-German Technical Training Institute

- Mr. V.L.C. Perera	- Principal Director
- Mr. S. Ilukkumbure	- Senior Training Engineer (Programmes & Planning)

Apprenticeship Training Institute

- Mr. G.C. Simonsen	- Project Manager

Others

- Mr. M. Behnsen	- Project Manager, German Agency for Technical Cooperation, Colombo
- Mr. D. Leupholz	- Senior Consultant for Bus Design and Construction
- Mr. U.G. Tompkowitz	- Senior Production Consultant, Project Advisor

Annex IV

List of publications and documents examined

L. Fernando
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Sri Lanka, The Impact of PL 48o Title I Food
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Annual Supplement 1985

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ters, Colombo

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3. US/SRL/78/2o7 Technical Report by Y. Kato, 2 January 1985

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Annex V

Sri Lanka - economic and other indicators

Item	Quantity		Value
Population and term 1983	millions		15,4
GNP per capita 1983	US-$		330
Average annual growth rate of GNP 1965-1983	per cent		2,9
Average annual rate of inflation 1973-1983	per cent		14,5
Distribution of gross domestic product 1983	per cent		
agriculture			27
industry			26
(manufacturing			14)
services			47
Exports 1983	millions of US-$		1066
Imports 1983	millions of US-$		1788
External public debt outstanding and disbursed 1983	millions of US-$		2205
Debt service as percentage of exports of goods and services 1983	per cent		11,9
Number enrolled as percentage of age group 1982			
primary school	per cent		100
secondary school	per cent		54
higher education	per cent		4
Central government expenditure per cent of GNP 1982	per cent		34,4
Overall deficit percent of GNP 1982	per cent		14,4
Life expectancy at birth 1983	years	male	67
		female	71
Infant mortality cases under 1 year (1983) per 1000 live births			37

Annex VI

Summary of shortcomings of public sector enterprises based on UNDP/ILO survey

Finance and Accounting

i. inadequate financial planning, e.g., lack of sufficient in-depth cash flow analysis;

ii. lack of effective integrated mangement information systems;

iii. orientation of reporting system toward supervisory agencies as against the needs of the corporation;

iv. shortage of qualified personnel.

Marketing

i. Poor sales/profit performance due to lack of marketing capability and deficiencies in marketing practice;

ii. inherited attitudes from the days of the centrally planned economy, in particular an allocation and administrative approach to sales and distribution;

iii. ignorance of and apparent insensitivity to customers' requirements;

iv. lack of qualified and experienced marketing personnel at policy level and within the function;

v. restrictions imposed by MISA on marketing practice, e.g., overseas travel, sales expenses and pricing.

Production

i. Lack of realistic standards, production norms and poor discipline;

ii. overmanning;

iii. poor direction and control of operations resulting in low output at excessive cost;

iv. poor product specifications for materials and lack of quality control, combined with low utilisation of plant equipment and materials;

v. poor maintenance of plant and bad energy utilisation leading to inflated product costs;

vi. lack of adequate qualified manpower.

Materials management

i. Lack of coordination of the supply function as an integrated whole;

ii. time consuming purchasing procedures leading to additional costs in stock-holding;

iii. too much reliance placed on lowly paid and low grade manpower;

iv. poor storekeeping practice;

v. lack of sufficient monitoring of yields in material usage.

Personnel

i. Disturbing levels of turnover, absenteeism, overtime and overmanning;

ii. inadequate manpower planning, recruitment, selection and training procedures;

iii. failure to prescribe a period of probation working for new employees and to employ satisfactory performance appraisal techniques;

iv. lack of training for suvervision and technical staff;

v. poor salary structure.

Source: UNDP/ILO, project DP/SRL/84/033, A management Survey of Industrial Enterprises to Provide a Basis for a Management Development Programme, July 1985.

Annex VII

Ceylon Ceramics Corporation

a. Member Companies of the Ceylon Ceramics Corporation

b. Installed capacity of major units on a single shift basis

c. Subsidiaries (with per cent of CCC shares)

Annex VII a

Member Companies of the Ceylon Ceramics Corporation

Ceramic Factory - Piliyandala
(manufacturing crockery, sanitaryware + mosaic tiles)

Ceramic Factory - Negombo
(manufacturing crokery, low-tension insulators + printing ceramic transfers)

Clay Refinery - Boralesgamuwa

Clay Refinery - Meetiyagoda

Ball Clay Plant - Dediyawola, Kalutara

Graphite Crucibles Factory - Gampola

Noorani Tiles - Waikkal
(manufacturing roofing tiles and wire cut bricks)

Vijaya Tiles - Bollegala, Kelaniya

Shaw Industries - Angoda

Brick + Tile Factory - Bangadeniya

Brick + Tile Factory - Elayapattuwa, Anuradhapura

Brick + Tile Factory - Mullaitivu

Brick + Tile Factory - Weuda, Kurunegala

Brick + Tile Factory - Mahiyangana

Brick + Tile Factory - Amparai

Brick + Tile Factory - Yatiyana, Matara

Brick + Tile Factory - Bingiriya

Lime Plant - Hungama

Annex VII b

Installed capacity of major units on a single shift basis

Production Unit		Installed Capacity M Tons
Crockery	(Piliyandala)	2400
Crockery	(Negombo)	1560
Sanitaryware	(Piliyandala)	780
Mosaic Tile	(Piliyandala)	3000
Insulators	(Negombo)	300
Kaolin	(Borelesgamuwa)	2040
Kaolin	(Meetiyagoda)	6180
Refined Ball Clay	(Waskaduwa)	1500
Hydrated Lime	(Hungama)	1800

(Brick and Tile Factories)	(QTY. In '000 NOS.)
Bangadeniya	3216
Yatiyana	3252
Weuda	3180
Anuradhapura	3036
Odduch ıddan	2136
Irrakkaman	3168
Mahiyangana	4212
Bingiriya	1224
Uswewa	4464
Total	27,888

Subsidiaries

General Manager's Office, Ceylon Ceramics Corp., Colpetty

Organisation	Type of Product	% of Ceylon Ceramics Shares (on the paid-up capital)
Lanka Porcelain Limited	Porcelain Table-Ware	75
Dankotuwa Porcelain Limited	Porcelain Table-Ware	54
Lanka Wall Tiles Limited	Glazed Wall Tiles	80
Lanka Refractory Limited	Refractories for Steel, Ceramic and other allied industries	100

05th December, 1985

Annex VIII

Deposits of raw materials and location of ceramic factories - maps

a. Geological map

b. Occurences of feldspar, vein quartz, silica sands and garnet

c. Clay mineral provinces

d. Location of industrial units and mines

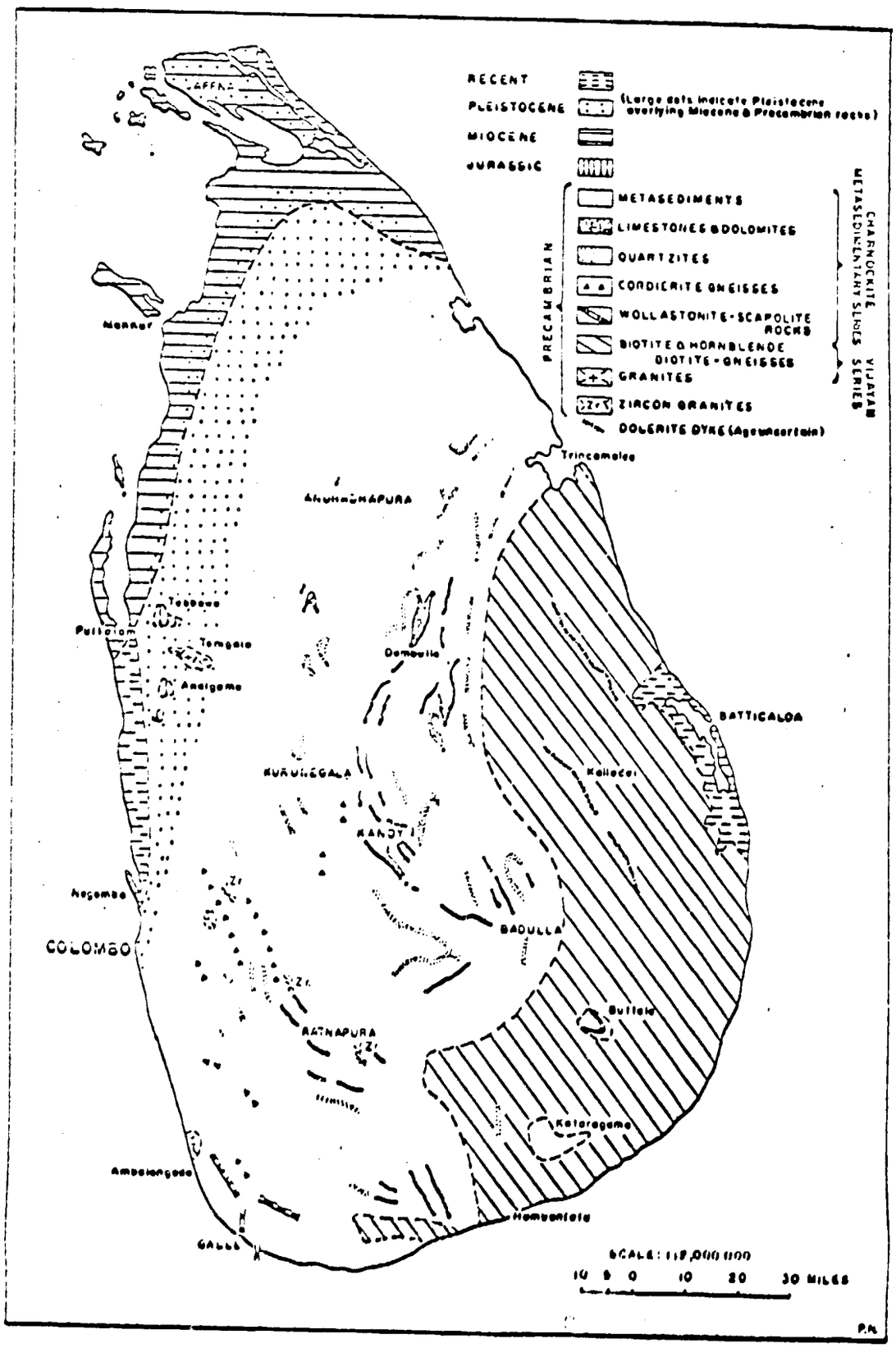
e. Location of ceramic factories

d. Location of ceramic factories

Source: J.W. Herath, 1980 (see Annex IV for references)

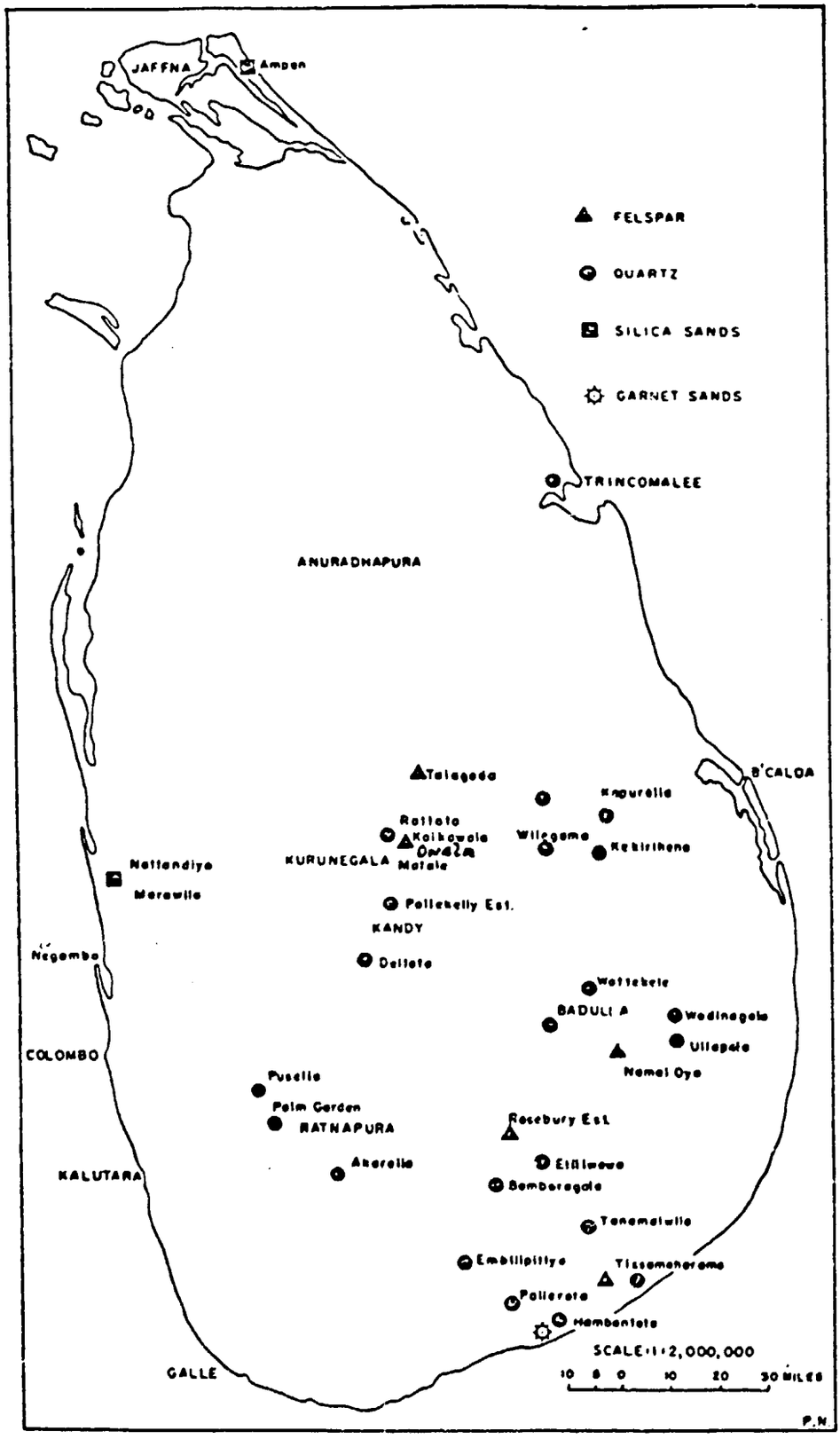
Annex VIII a

Geological map - Sri Lanka



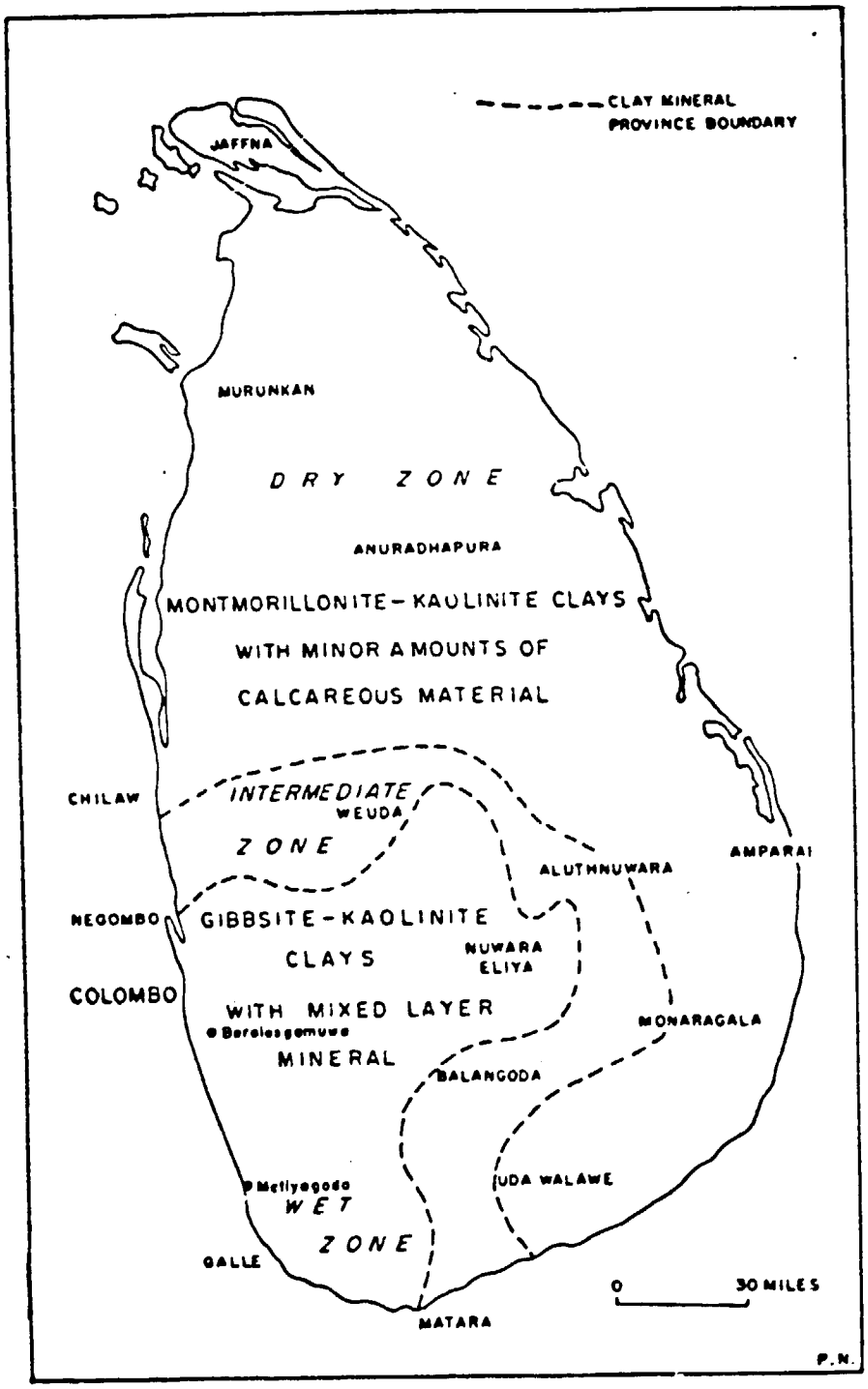
Annex VIII b

Occurrence of feldspar, vein quartz, silica sands and garnet - Sri Lanka



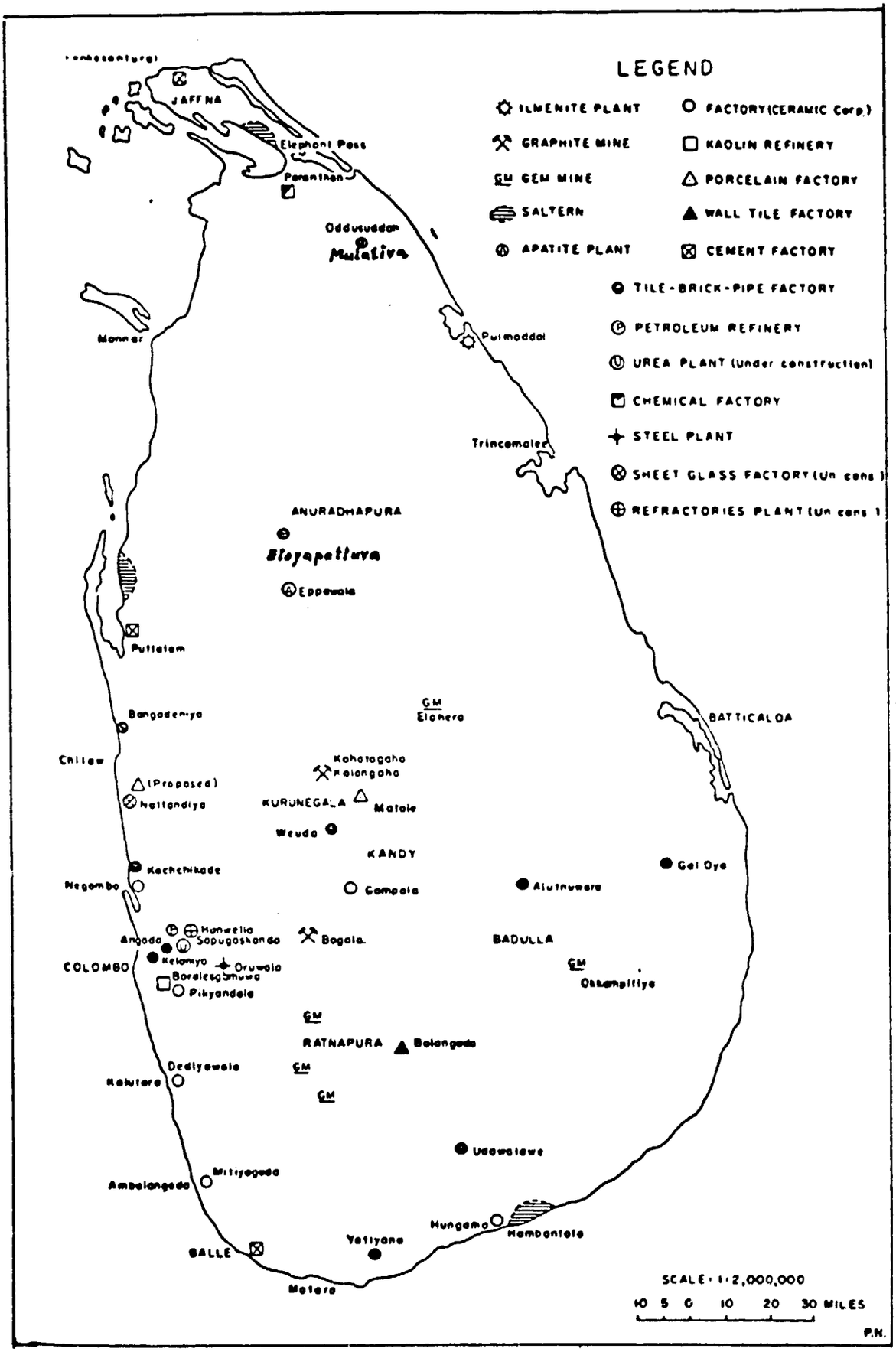
Annex VIII c

Clay mineral provinces - Sri Lanka



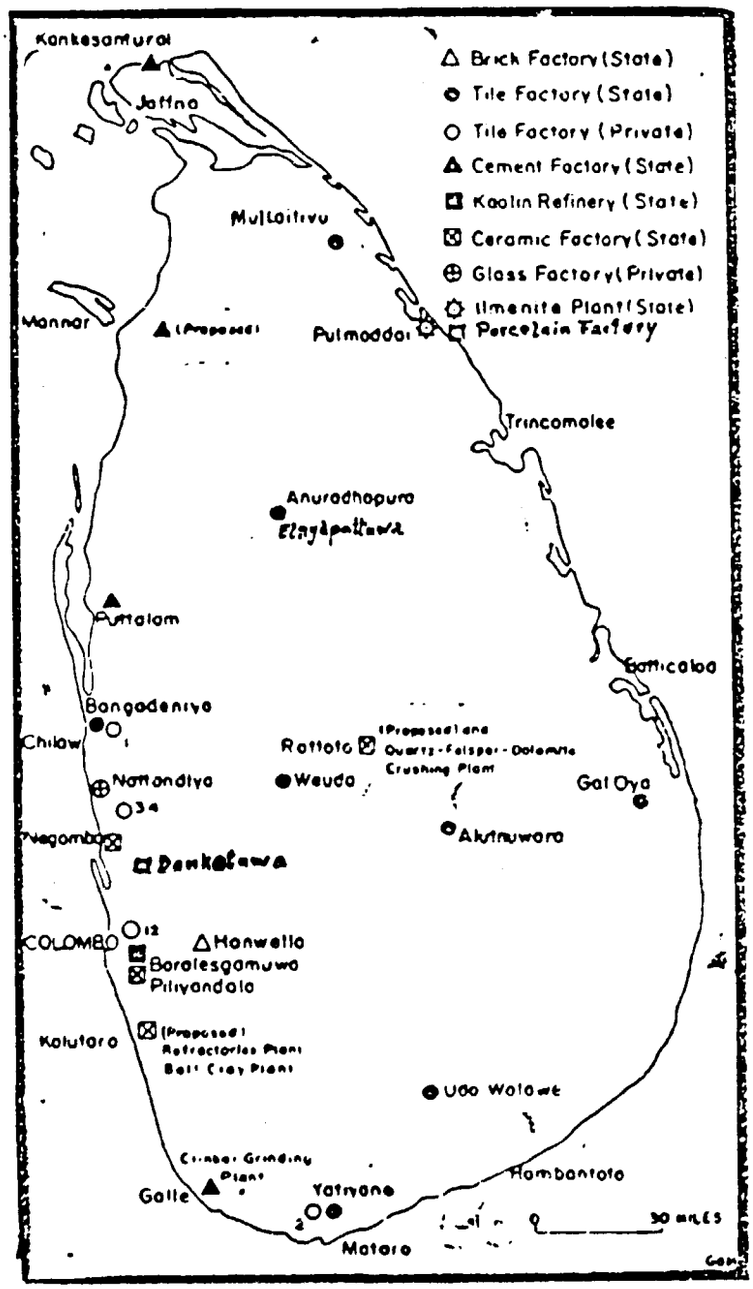
Annex VIII d

Location of industrial units and mines



Annex VIII e

Location of ceramic factories



Annex IX

Project budgets

a. Original project budget - UNIDO contribution

b. Revised project budget - UNIDO contribution

c. Project Budget - Government contribution

UNIDO

PROJECT BUDGET/REVISION

3 COUNTRY	4. PROJECT NUMBER AND AMEND.	5. SPECIFIC ACTIVITY
SRI LANKA	US/SRL/78/207	32.1.B

10 PROJECT TITLE
Establishment of a Ceramic Research and Development Laboratory

15. 10. 11 PROJECT PERSONNEL EXPERTS / Post title	16. TOTAL		17. 1982		18. 1983		19. 1984		20.	
	m/m	$	m/m	$	m/m	$	m/m	$	m/m	$
11-01 Expert in R and D Organization	18	119,700			6	38,400	12	81,300		
02 Expert in Equipment Installation	6	38,400			6	38,400				
03 Consultants	21	141,900			6	38,400	15	103,500		
04										
05										
06										
07										
08										
09										
10										
11										
12										
13										
14										
11-99 SUBTOTAL:	45	300,000			18	115,200	27	184,800		

21. REMARKS

Annex IX a

UNIDO

PROJECT BUDGET/REVISION

2. PAD NUMBER

4. PROJECT NUMBER UB/SRL/78/207 32.1.B	16. TOTAL		17. 1982		18. 1983		19. 1984		20.	
	m/m	$	m/m	$	m/m	$	m/m	$	m/m	$
12.01 OPAS Experts										
13.00 Support Personnel										
14.00 Volunteers										
15.00 Experts Travel		2,000				1,000		1,000		
16.00 Other Personnel Costs		4,000						4,000		
17.01 Locally hired Experts										
17.02 Locally hired Experts										
19.00 Total Personnel Component	45	306,000			18	116,200	27	189,800		
20. SUBCONTRACTS										
29.00 Total Subcontracts Component										
30. TRAINING										
31.00 Fellowships	48	76,800			36	57,600	12	19,200		
32.00 Study Tours, UNDP G. Training/Meetings										
33.00 In-service Training										
34.00 Group Training (non-UNDP)										
35.00 Meetings/Consultations (non-UNDP)										
39.00 Total Training Component	48	76,800			36	57,600	12	19,200		
40. EQUIPMENT										
49.00 Total Equipment Component		610,000		460,000		143,800		6,200		
50. MISCELLANEOUS										
51.00 Operations — Maintenance										
52.00 Reports		3,000						3,000		
53.00 Sundries		10,000				5,000		5,000		
55.00 Hospitality (non-UNDP)										
59.00 Total Miscellaneous Component		13,000				5,000		8,000		
99. GRAND TOTAL:		1,005,800		460,000		322,600		223,200		

UN[illegible]

[illegible]ECT BUDGET/REVISION

3. COUNTRY	4. PROJECT NUMBER AND AMENDMENT	5. SPECIFIC ACTIVITY
SRI LANKA	US/SRL/78/207	32.1.B

10. PROJECT TITLE
Establishment of a Ceramic Research and Development Laboratory

15. INTERNATIONAL EXPERTS (functional titles required except for line 11-50)	16. TOTAL m/m	16. TOTAL $	17. PY m/m	17. PY $	18. 1985 m/m	18. 1985 $	19. m/m	19. $	20. m/m	20. $
11-01 CTA	15.0	109,893	12.0	85,893	3.0	24,000				
02 Exp. in Equipment Installation	10.4	67,401	7.4	43,401	3.0	24,000				
03										
04										
05										
06										
07										
08										
09										
10										
11										
12										
13										
14										
15										
16										
11-50 Short term consultants	17.0	128,650	4.0	24,650	13.0	104,000				
11-99 Sub-total—International experts*	42.4	305,944	23.4	153,944	19.0	152,000				

21. REMARKS

* If more than 16 experts are required check here ☐ and attach continuation sheet 1A. This sub total *must* include all experts.

Form/FS 83/Rev 4 (2.83) Part 1

UNIDO

PROJECT BUDGET/REVISION

4. PROJECT NUMBER US/SRL/78/207 32.1.B	16. TOTAL m/m	16. TOTAL $	17. PY m/m	17. PY $	18. 1985 m/m	18. 1985 $	19. m/m	19. $	20. m/m	20. $
OPAS EXPERTS (functional titles required)										
12-01										
12-02										
12-03										
12-99 Sub-total–OPAS experts[b]										
ADMINISTRATIVE SUPPORT PERSONNEL										
13-00 Clerks, secretaries, drivers										
13-50 Freelance interpreters (non-UNDP projects)										
13-99 Sub-total–Administrative support personnel										
UN VOLUNTEERS (functional titles required)										
14-01										
14-02										
14-03										
14-04										
14-99 Sub-total–UN Volunteers[b]										
15-00 Project travel		5,038		1,038		4,000				
16-00 Other personnel costs (including UNIDO staff mission costs)		2,196		2,196						
NATIONAL EXPERTS (functional titles required)										
17-01 Sanitary Ware Expert	6.0	3,000			6.0	3,000				
17-02										
17-03										
17-04										
17-05 18-01		-114		-114						
17-99 Sub-total–National experts[b]		2,886								
19-99 TOTAL–PERSONNEL COMPONENT	48.4	316,064	23.4	157,064	25.0	159,000				

[b] If additional individual budget lines are required, check here ☐ and attach continuation sheet 1A. These sub-totals must include budget lines listed on page 1A.

Form/FB.83/Rev.4/Add.1 (2.83)

UNIDO

PROJECT BUDGET/REVISION

4. PROJECT NUMBER US/SRL/78/207 32.1.B	16. TOTAL		17. PY		18. 1985		19.		20.	
	m/m	$	m/m	$	m/m	$	m/m	$	m/m	$
SUBCONTRACTS										
21-00 Subcontracts										
TRAINING										
31-00 Individual fellowships		66,935				66,935				
32-00 Study tours; UNDP group training		10,065		10,065						
33-00 In-service training										
34-00 Non-UNDP group training										
[illegible] 38-02		- 482		- 482						
39-99 TOTAL–TRAINING COMPONENT		76,518		9,583		66,935				
EQUIPMENT										
41-00 Expendable equipment		15,112		8,531		6,581				
42-00 Non-expendable equipment		610,458		585,458		25,000				
48-02		-17,354		-17,354						
49-99 TOTAL–EQUIPMENT COMPONENT		608,216		576,635		31,581				
MISCELLANEOUS										
51-00 Sundries		5,002		2		5,000				
55-00 Hospitality (non-UNDP projects)										
56-00 Support costs (ICC and DC projects only)										
59-99 TOTAL–MISCELLANEOUS COMPONENT		5,002		2		5,000				
SURPLUS/DEFICIT										
81-00 Surplus/Deficit (ADM/FS use only)										
99-99 PROJECT TOTAL	48.4	1,[illegible]5,800	23.4	743,284	19.0	262,516				
[c] COST SHARING (UNDP/IPF projects only)										
[c] NET UNDP CONTRIBUTION										

[c] For information only – *not* for PAD input

Form/FS.83/Rev.4/Add.2 (2.83)

PROJECT BUDGET COVERING GOVERNMENT CONTRIBUTION IN KIND

COUNTRY :- SRI LANKA.
PROJECT NO:- US/SRL/78/207

TITLE:- ESTABLISHMENT OF A CERAMIC RESEARCH AND DEVELOPMENT LABORATORY

	TOTAL		1983		1984		1985	
PROJECT PERSONNEL	m/m.	Rs.	m/m.	Rs.	m/m.	Rs.	m/m.	Rs
Manager Research and Development	24	63,500	6	15,240	12	31,750	6	16,510
Research Officers	120	285,000	30	68,400	60	142,500	30	74,000
Experimental Officers	120	153,000	30	36,720	60	76,500	30	39,780
Mechanical Engineer	24	57,000	6	13,680	12	28,500	6	14,820
Lab Assistants	120	235,725	30	56,574	60	117,862.5	30	61,288,5
Lab/Field Assistants	24	21,525	6	5,166	12	10,762.5	6	5,596.5
Technical Assistants	24	19,050	6	4,572	12	9,525	6	4,953
Fitters	24	16,905	6	4,057.2	12	8,452.5	6	4,395.3
Librarian	24	25,650	6	6,156	12	12,825	6	6,669
Stenographer	24	34,395	6	8,254.8	12	17,197.5	6	8,942.7
Typist	24	19,075	6	3,978	12	10,787.5	6	4,309.5
Peon	24	15,750	6	3,780	12	7,875	6	4,095
COMPONENT TOTAL	576	946,575	144	226,570	288	474,537.5	144	245,459.5

PROJECT BUDGET COVERING GOVERNMENT CONTRIBUTION IN KIND

(IN LOCAL CURRENCY)

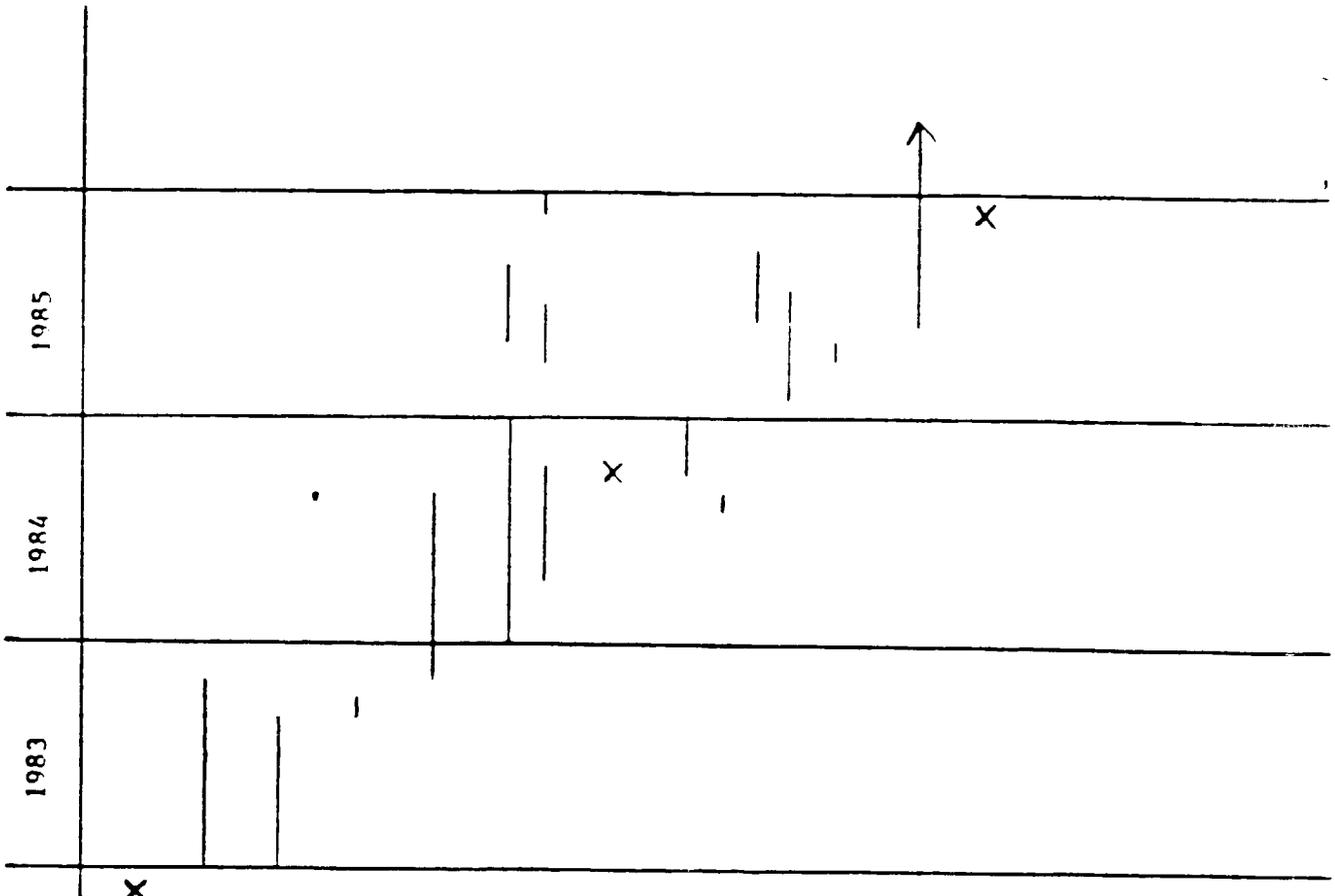
COUNTRY - SRI LANKA

PROJECT NO - US|SRL|78|207
TITLE - ESTABLISHMENT OF A CERAMIC RESEARCH AND DEVELOPMENT LABORATORY

	TOTAL		1983		1984		1985	
TRAINING:-	m|m	Rs	m|m	Rs	m|m	Rs	m|m	Rs
Experimental Officer (Maint)	36	49,673,25	9	12,042	27	37,631,25	-	-
Technical Assistant (")	12	9,652,50	3	2,340	9	7,312.50	-	-
COMPONENT TOTAL	48	99,325,75	12		36	44,943.75	-	-
EQUIPMENT:-								
Expendable Equipment		50,000		12,000		25,000		13,000
Non-Expendable Equipment		62,500		15,000		31,000		16,000
Premises		720,000		720,000		-		-
COMPONENT TOTAL		832,5000		747,000		56,250		29,250
MISCELLANEOUS								
Operation and Maintenance of Equipment		1,825		499		937.5		487.5
Sundry		8,625		2,070		4,312.5		2,242.2
COMPONENT TOTAL		10,450		2,470		5,250.0		2,242.5
GRAND TOTAL		1,848,850.75		990,430		580,981.25		277,439.5

Annex X

Chronology of project implementation



Annex XI

Details of national staff fellowship training programme

Name	Laboratory Section	Country of Training	Period of Training
Mr. HEWA WARAWITAGE, S.		CSSR	09/09/85-27/09/85
		FRG	28/09/85-19/10/85
		THE NETHERLANDS	20/10/85-02/11/85
		SPAIN	03/11/85-16/11/85
		FRG	17/11/85-06/12/85
Mr. RANATUNGA, C.L.	XRD/DTA	FRG	07/06/85-21/07/85
		THE NETHERLANDS	21/10/85-02/11/85
		SPAIN	03/11/85-16/11/85
		FRG	17/11/85-22/11/85
Ms. PIGERA, M.L.C.	Chemical Lab	JAPAN	2 m/m, 1986
Mr. DHARMASIRI, N.K.A.	Chemical Lab	JAPAN	31/10/85-28/12/85
Mr. KARUNASINGHE, N.	Microscopy	JAPAN	11/11/85-21/12/85
Mr. MITHRARATENE, P.	Kiln Room	CSSR	09/09/85-21/09/85
		FRG	22/09/85-01/11/85
Mr. JAYAKODY, K.P.A.	Physical Lab	FRG	28/04/86-31/05/86
Mr. SILVA, S.R.B.D.	Chief Research Officer	JAPAN	02/09/85-30/11/85
Mr. RANASINGHAGE D.		JAPAN	2 m/m, 1986
Mr. ALLES, E.C.	Pilot Plant	CSSR	09/09/85-21/09/85
		FRG	22/09/85-01/11/85
Mr. PANNILA, A.S.	Physical Lab	CSSR	09/09/85-22/09/85
		UK	23/09/85-20/10/85
		THE NETHERLANDS	21/10/85-02/11/85

Annex XII

Inventory of Equipment - CRL

Remarks: Y13 = Inventory Number
CCC = belongs to CCC
O = not inventarised, low value, or consumptive items

Room 1	Responsible RO: Mr. Siritunga
U 1	Air Conditioner
o	Dehumidifier
o	Humidity Control (Brit)
o	Humidity Control (Jap)
P1	Zephir Cooler (for P2 & P3)
P2	X-Ray Diffractometer PHILIPS
P5	On-Line-Recorder 8203 A
P9	Printer KSR 34
P3	X-ray Fluorescence Spectrometer PHILIPS
P4	Hewlett-Packard Computer HP 85
P6	Argon-Methane Cylinder 1
P7	Argon-Methane Cylinder 2
P8	Helium Gas Cylinder
N1	STA Unit (for Simultane Thermo Analysis) NETZCH
N2	Measuring Unit (Control Panel) for N1 & N3
N3	Differential Dilatometer NETZSCH
N4	Thermostat for STA
N5	Thermostat for Dilatometer
M3	Test Piece Extruder
S16	Sartorius Balance 1501 B MP8-1
S11	Vibratom Mill (located in room no 3)
03	Drying Oven
o	Dessicator
o	Small Agate Mortar
Room 2	Responsible RO: Mr. Karunasinghe
U2	Air Conditioner
J5	JEOL Scanning Electron Microscope (SEM)
J5	Photo Equipment for SEM
F3	Polarising Microscope (Through Light)
F4	Refractive Index Liquid Set
S4	Stereo Microscope
K2	Micrometer Dispensing Device
M18	MOHS Hardness Set (incomplete)
o	Dessicator
o	Microscopic Slides
O	Mineral Collection
Room 3	Responsible RO: Mr. Karunasinghe
B11	BOLEY Lathe with Chucks, Collars and Cutting Tools
N6	Stone Sawing Machine with Diamond Wheels 200 & 350 mm
S12	Grinding & Polishing Machine
14	Hand Throwing Machine (used for Grinding) (from room no 6)
o	Imbedding Resins
S11	Vibration Mill (from room no. 1

Room 5 Responsible RO: Mr. Alles

A1	AVERY Sliding Scale Platform Balance 150 kg
A3	Stirrer 0.12 kW
A4	Glaze Pump with Motor 0.56 kW (two parts) with 2 nozzles
A5	Mixer with 40 ltr. tub & Agitator
A6	7 Plastic Vessels with 2 metal Racks
1 1	Jaw Crusher
N14	Ball Mill 100 ltr. NETZSCH with Spare Lining in Store Room
CCC	Ball Mill 100 ltr. (from Negombo)
CCC	Rack - used for Shaking - used for Ball Milling
B2	Muller Mixer (Edge Runner)
B8	Jar Mill, Rack with 6 jars 9" (5 ltr.)
B9	Jar Mill, Rack with 6 Jars 11" (10 ltr.)
05	OSK Pot Mill, Rack with one 15 cm Jar (1.5 ltr.)
F1	Small NORTON Jar Mill, Rack with 400 ml Jar
F2	Small NORTON Jar Mill, Rack with 400 ml Jar
N7	High Spped Stirrer (Blunger)
N8	Filter Press with 16 Filter Plates & Clothes
S13	Hydrometer (0-60 g/ltr.
o	3 Aluminium Tubs
o	Various Plastic Tubs
o	2 kg Spring Balance

Room 6 Responsible RO: Mr. Alles

H1	HANDLE De-airing Extrusion Machine (Vacuum Extruder) with 14 Discs
1 3	Handthrowing Machine
1 4	Handthrowing Machine (lent to room 3)
1 5	Jigger Machine
1 6	Jigger Machine
S5	IR Quick Drier SARTORIUS with 480 g Balance (transferred to Negombo)
S17	Platform Balance 11,000 g SARTORIUS (from Room 9)
S18	Platform Balance 12,000 g (sent to SARTORIUS, Wien, for repair)
M9	Needle Penetrometer BATY for Testing non-plastic
B5	Clay Hardness Tester SE for Testing Pug Mill Clay
M4	Test Piece Extruder BRCA
M5	Test Piece Extruder BRCA (transferred to Negombo)
M6	Green Strength Tester
G1	GALLENKAMP Viskosimeter
M1	Large MEMMERT Drier with Fan Air Revolution
M2	Small MEMMERT Drier

Room 7 Responsible RO: Mr. N. Dharmasiri

Glaze Station:

N9	Spraying Box
A2	Compressor with Spray Gun with 6 nozzles
C4	OSK Drying Oven
	Stirrers and Vessels see room 5

Kiln Section

K1	Gradient Kiln 1400°
N10	Small NABER Super Kanthal Kiln 1400°
N11	Large NABER Kiln 1200°
1	Gas Kiln
1 8	Gas Kiln (transferred to Negombo)
B11	BICKLEY PCR Kiln 1800°

o	Oxygen Cylinder
o	Seger Cones
o	Thermochrome Crayons
B6	Buller's Ring Gauge
B7	Buller's Ring Gauge
C2	Filament Pyrometer
J1	6-channel Printing Recorder JUMO
07	Calibrator for Thermocouples
07	Potentiometer
R3	Microvoltmeter UDS
R4	System Voltmeter UDS
R5	High Voltage Tester UHP
B1	Autoclave
CCC	Chain Block for Autoclave
K3	Adiabatic Calorimeter with Beckmann Thermometer
o	Equipment for Thermoshock dry
M17	CANNON Statistic Calculator

Room 8 Responsible RO: Mr. Pannila

02	OSK Drying Oven
07	Humidity Chamber (Material Test Cabinet)
G8	Multi Test Tube Drier
R1	RETSCH Agate Mortar Motor Grinder
R2	Laboratory Sieving Machine RETSCH VIBRO with 20 sieves
G4	Stirrer Handilab Minor with 3 Rotors
S14	Hydrometer (0 - 60 g|ltr.)
S15	Hydrometer (0 - 60 g|ltr.)
K6	Andreasen Sedimentation Apparatus
K7	Andreasen Sedimentation Apparatus
S8	Sedimentograph (Centrifugal Particle Size Analyzer)
S9	Sedimentograph (Centrifugal Particle Size Analyzer)
M7	Permeability Meter GF with Sample Holder
M7	Green Strength Tester
M12	Glaze Thickness Tester
T1	Bend & Tensil Strength Tester TONI 6300
C6	Sample Splitter
K4	Thermostat (8 ltr|min)
B14	BROOKFIELD Viscometer
G2	GALLENKAMP Universal Viscosimeter
G6	Viscosimeter REDWOOD
F5	Vacuum Pump
B14	Digital Vacuum Meter
B15	Mercury Vacuum Torr Meter
L1	Colorimeter LF 90 LANGE with Measuring Head, Standards and 3 Filters
S6	IR Quick Drier SARTORIUS with 480 g Balance
S10	Platform Balance 11,000 g SARTORIUS 1501
M11	Needle Penetrometer BATY for Testing non-plastic Surfaces
M13	Thickness Tester
M14	Moisture Expansion Measuring Device with Standard Steel Block
M16	CANNON Statistic Calculator
K 3	Vernier Caliper 200 mm
K 9	Vernier Caliper 200 mm
o	Micrometer Screw
o	Micrometer Screw

Room 9 Responsible RO: Miss Pigeria

S1	Analytical Balance SARTORIUS 2024 MP 6
S17	Platform Balance 11,000 g SARTORIUS (lent to room 6)
CCC	METTLER Analytical Balance
C5	Centrifuge HETTICH ROTANTA
H2	6 Platinum Crucibles (48.99 g)
	2 Platinum-Gold Moulds (88 g)
	3 Platinum Dishes (66.25 g)
	6 Nickel Crucibles
K12	ORSAT Apparatus
T2	pH - Meter TPS
S7	IR Quick Drier SARTORIUS with Balance 480 g
M13	Ion sensitive Electrodes for Pb and F
	with AG|AgCI-Reference Electrode
B12	Magnetic Stirrer
CCC	Flame Photometer CORNING
CCC	Colorimeter CORNING

Room 10 Responsible RO: Miss Pigeria

C2	Crucible Furnace Simon Müller
C4	Crucible Furnace Simon Müller
O1	OSK Drying Oven
G5	Stirrer Handilab Minor with 3 Rotors
L2	Water Destillation Plant
G9	Multi Test Tube Drier
o	Sandbath
o	Heating Plate
o	Glassware
o	Chemicals

Room 11 + 12 Responsible: Mrs. Perera

U3	Split Type Air Conditioner
E1	Electric Typewriter OLYMPIA
H3	Vacuum Cleaner HOOVER
U5	U-BIX copier with stand
M15	Overhead Projector
o	Magic Board
o	Books according to separate List

N13 Jeep NISSAN Patrol

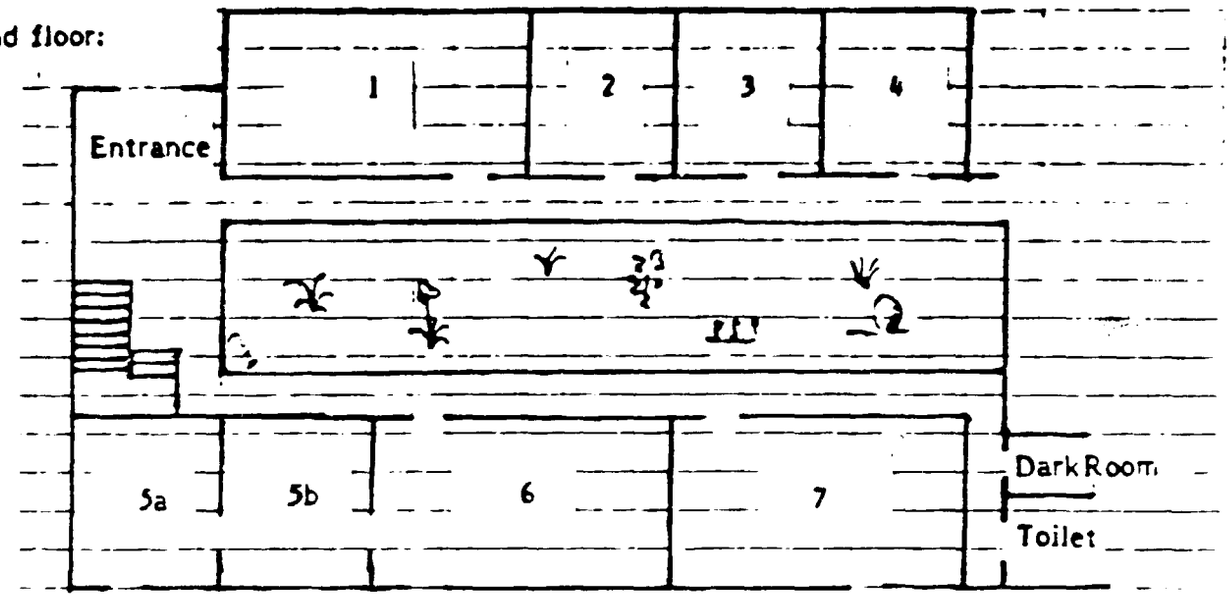
Dark Room Responsible RO: Mr.S.Silva

B3	Muller Mixer
o	Spare Heating Spirals for large NABER Kiln (N11)

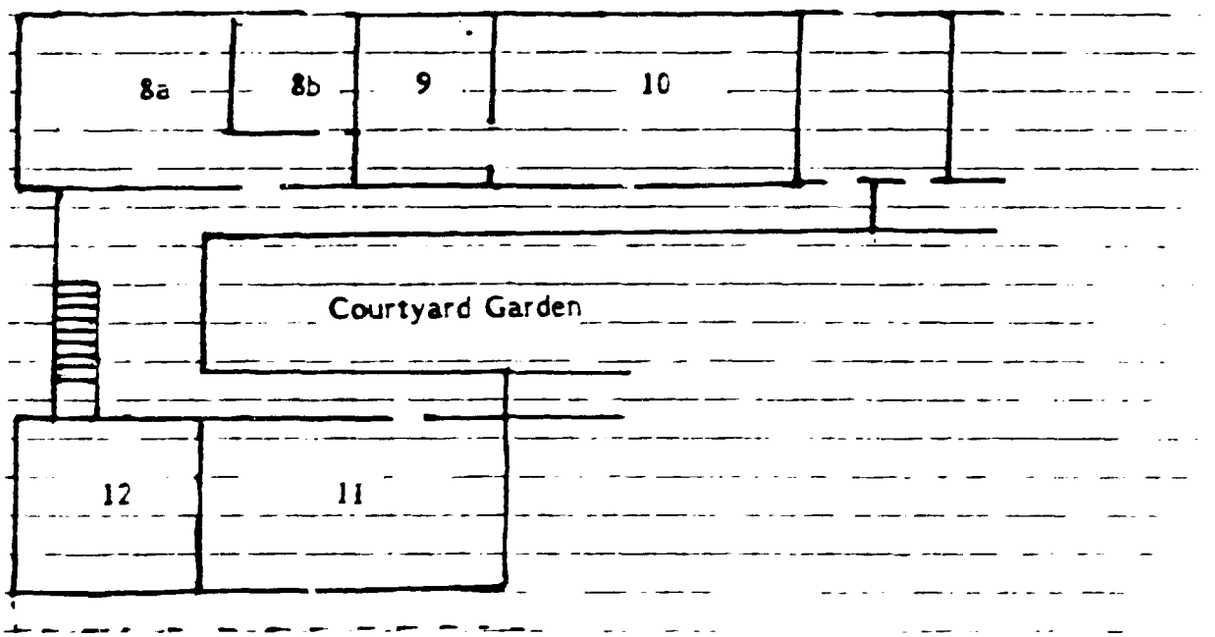
Annex XIII

Plan of Laboratory at Piliyandala

Ground floor:



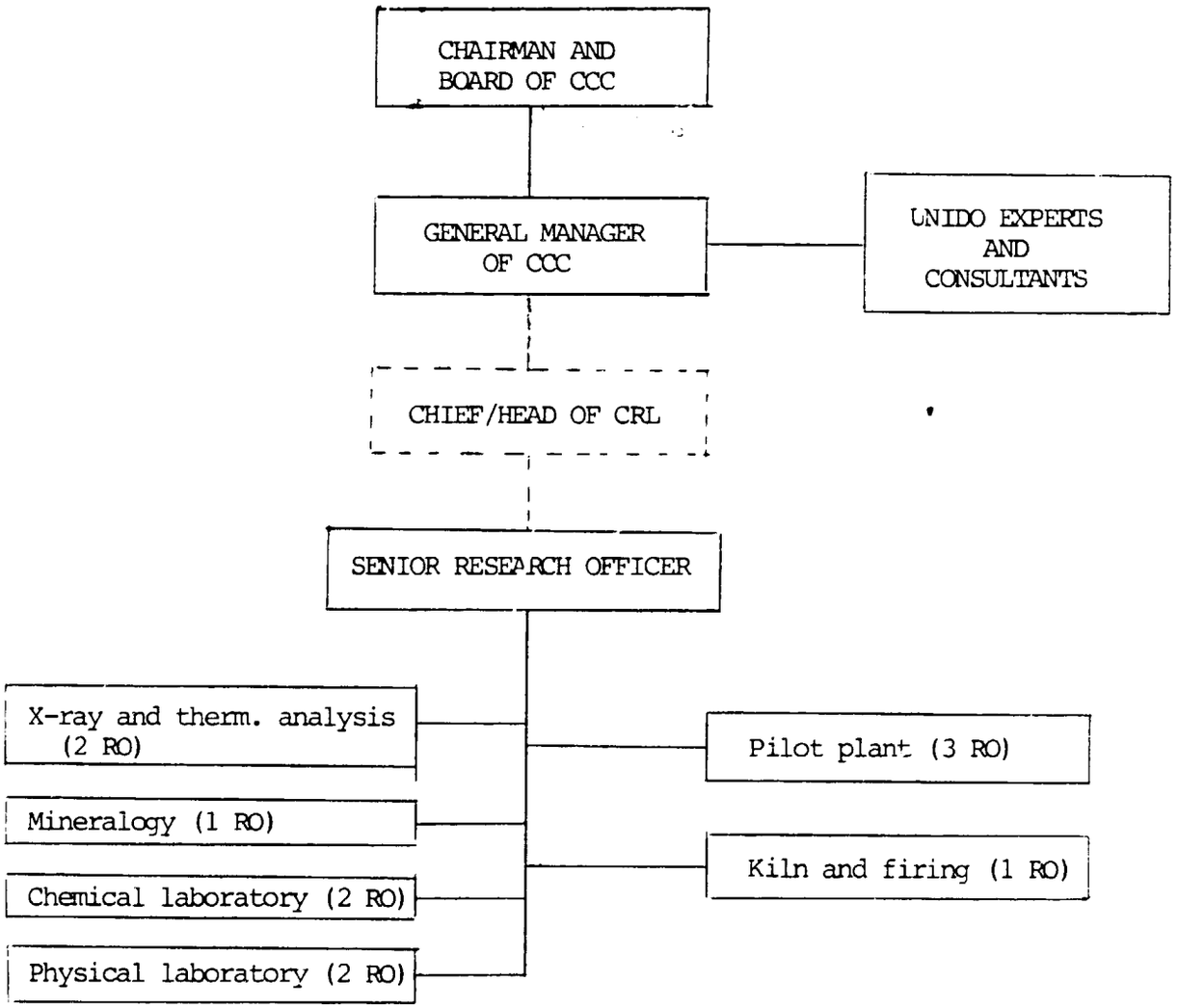
Upper floor:



Room no	Division	Research Officers
1	X-Ray and Thermoanalysis	H.W.S. Siritunga, C.L. Ranatunga
2	Electron Microscope	N. Karunasinghe, NN
3	Workshop (and sample preparation)	NN
4	Store Room (in future: sample preparation)	B.D.S.R. Silva, SRO
5	Pilot Plant, Body Preparation	C.E. Alles, G.M.A.G.E. Gaspe
6	Pilot Plant, Forming	- " - - " -, Mrs. R.D. Hemalatha
7	Kiln Room	P. Mithraratne, N. Dharmasiri
8	Physical Laboratory, Material Testing	A.S. Pannila, K.P.A. Jayakody
9	Chemical Laboratory, Balance Room	K.A.N. Dharmasiri
10	Chemical Laboratory, Experimental Room	Miss M.L.C. Pigera
11	Meeting (Conference, Lecture) Room	Mrs. C.M.N. Perera
12	Office	Mrs. D. Talwatte

Annex XIV

Current organizational chart of the Ceramic Research Laboratory



Annex XV

Qualifications of national staff contacted by the evaluation mission

CCC GM and part-time Chief of CRL Dr. C.T.S. Perera
Ph.D., B.Sc. (Hons) Ceram. Technol. - U.K.

Sen. Res. Officer Mr. B.D.S.R. Silva
B.Sc. (Hons) in Geology, Post grad. Dipl. Ceram. - U.K.

Research Officer Mr. H.W.S. Siritunga (met in FRG)
B.Sc. (Hons) in Physics, B.Sc. - U.K.

Research Officer Mr. C.L. Ranatunga
B.Sc. (Hons) in Physics, B.Sc. - U.K.

Research Officer Mr. Karunasinghe (absent)
B.Sc. U.K. (Mining and Mineralogy)

Research Officer Mr. E.C. Alles
G.C.E. (O.L.) Science subject

Research Officer Mr. R.C. Gaspe
B.Sc. Biol. Math. Chem. Phys.

Ind. Designer Mrs. R.D. Hemalatha
B.A. in fine arts

Research Officer Mr. P. Mithrarathne
B.Sc. Chemical Engineering

Research Officer Mr. A.S. Pannila
B.Sc. (Special) Physics

Research Officer Mr. K. Jayakody
B.Sc. Physics

Research Officer Mr. K.A. Dharmasiri
B.Sc. (Hons) Chemistry

Research Officer Mrs. M.L.C. Pigera
B.Sc. Engin. math.

Secret/administr. Mrs. C.M. Nimali Perera
B.Sc.

Proj. assist. Mrs. Damayanthie Talwatte
B.Sc.

Annex XVI

Applied research projects

Mr. Silva (SRO):	Fundamental studies of pigment preparation and application.
Mr. Panilla (Phys.lab.):	Regeneration of Plaster of Paris from used moulds. Investigations for suitable methods to regenerate Gypsum by recalcination as for instance by using succinic acid for faster recrystallisation.
Mr. Siritunga (XRD/DTA):	Determination of the composition of waste clay from Boralesgamuwa and Meetiyagoda China clay deposits. Evaluation of possible usage in the wide field of low quality ceramic products.
Mr. Ranatunga (XRD/DTA):	Effects of moisture, expansion and thermal expansion on gracing, peeling and spit-out of earthenware bodies made at Piliyandala and Negombo factories (x-ray, thermoanalysis, dilatometry and other methods).
Mr. Alles (pilot plant):	Development of soft and hard porcelain bodies and glazes.
Mr. Jayakody (phys.lab.):	Development of zirconium silicate sagger body to be used in the porcelain and tile industry.
Mr. Karunasinghe (miner.):	Usage of paddy husk as raw material for ceramics.
Mr. Dharmasiri (chem. lab.):	Study of lead release in ceramic and other tableware.
Miss Pigera (chem.lab.):	Cation exchange capacity and its effect on the rheology of local clays.
Miss Hemalatha (pilot plant):	A study of current market trends (design-wise), main and ornamental ware.
Mr. Gaspe (pilot plant):	Investigations of the plasticity of Sri Lankan clays and imported clays by Pfefferkorn method.
Mr. Mithraratne:	Calorimetric investigation - energy conservation programme with Petroleum Corporation.