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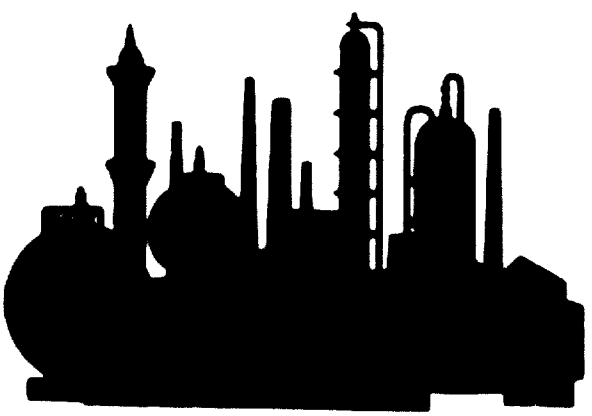
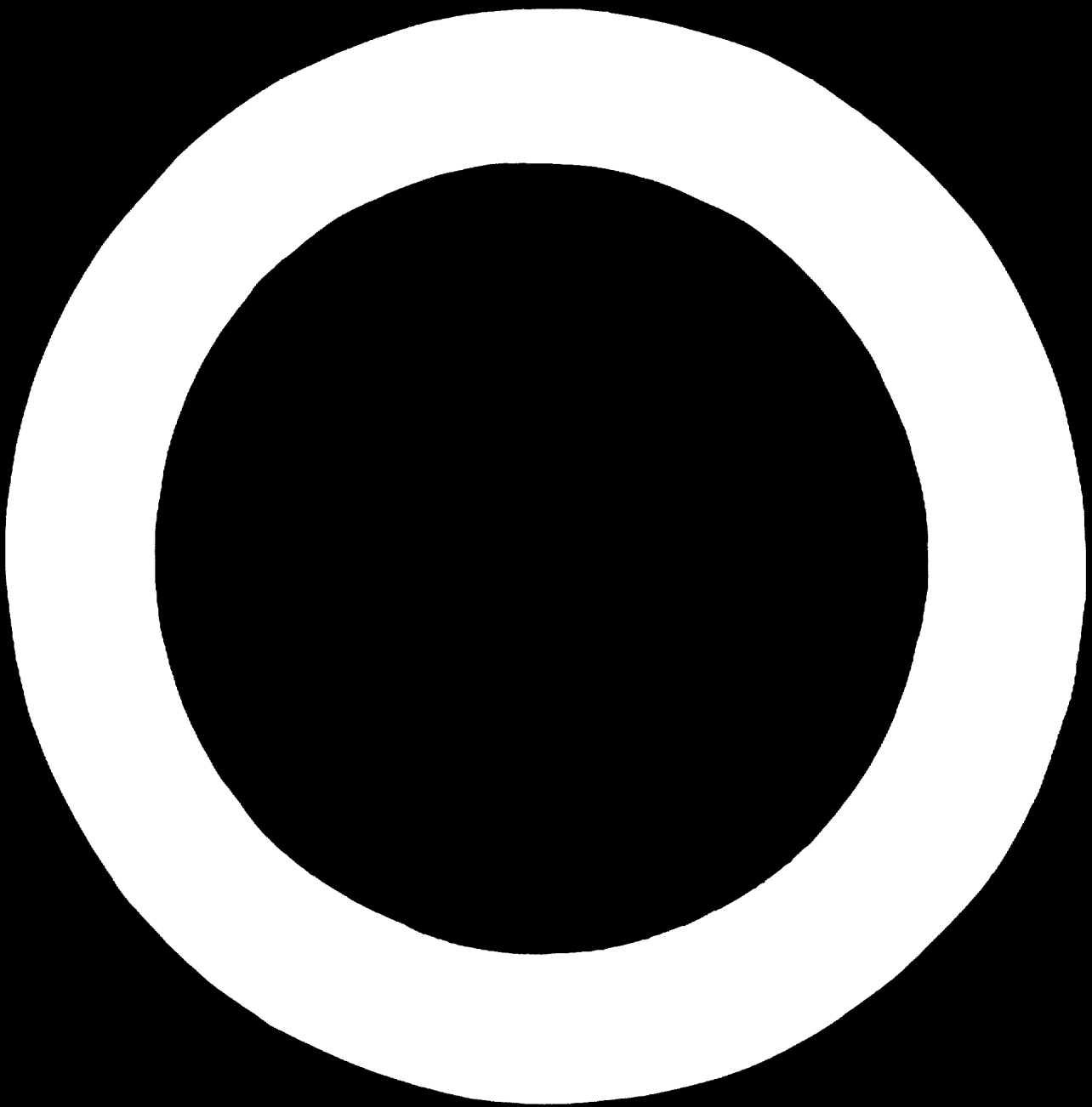
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

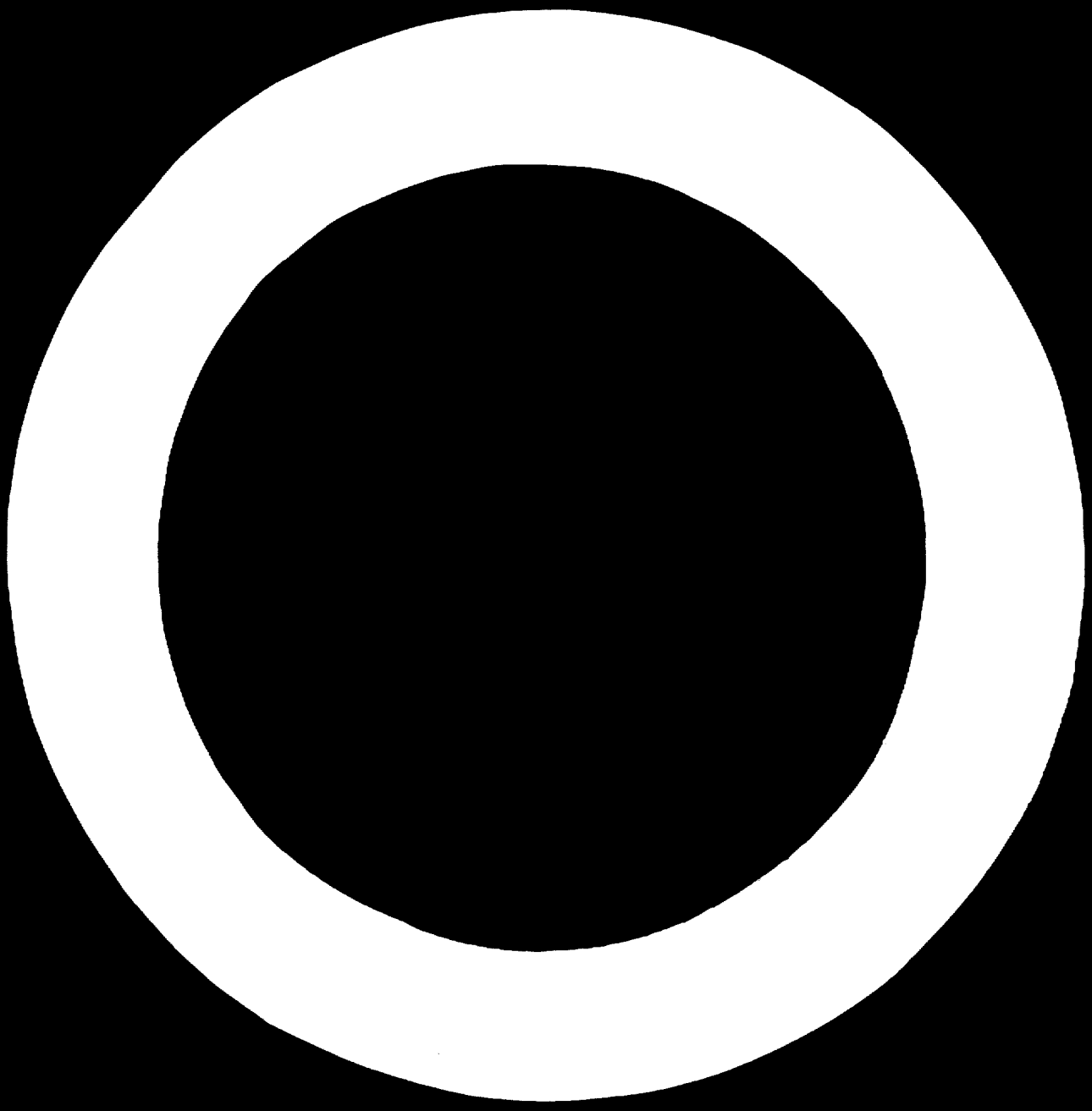
INDUSTRIAL RESEARCH NEWS

• Vol. I, No. 1



CENTRE FOR INDUSTRIAL DEVELOPMENT
UNITED NATIONS





CENTRE FOR INDUSTRIAL DEVELOPMENT

INDUSTRIAL RESEARCH NEWS

• Vol. I, No. 1

UNITED NATIONS
NEW YORK, JANUARY 1966

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FOREWORD

For many years there has been a need for a medium through which information relative to industrial research institutes would be exchanged between countries. It has been felt that such an exchange would assist in the process of establishing new institutes and in improving existing ones by way of providing guidelines on organizational structure, management of research programmes, financial matters and other related questions. Such a medium would promote the application of technical and scientific knowledge acquired by one institute, in solving a particular research problem, by others engaged in a similar type of research. It would help avoid the duplication of efforts in research areas explored already. In general such an exchange of information would promote interinstitute co-operation by acquainting institutes with mutual problems, by publicizing the results of their research, and by establishing intellectual ties between them.

A recommendation of the United Nations Interregional Seminar on Industrial Research and Development Institutes in Developing Countries which was held in Beirut, Lebanon, in December 1964, called upon the United Nations to disseminate information on the organization, functioning and programmes of industrial research institutes and similar organizations "with the view to facilitating the interchange of such information between different countries". To implement it, the Centre for Industrial Development sent out a questionnaire to some 200 institutes throughout the world to ascertain the appropriate way to promote this exchange. Returns showed that institutes generally favoured the idea of exchanging information; that they thought the exchange could be effectively carried out via a central clearing house of information to be established at the Centre for Industrial Development of the United Nations and by a periodical published by the United Nations. The responding institutes expressed their willingness to co-operate by providing material pertaining to their establishments toward this end.

The Committee for Industrial Development, a subsidiary body of

the Economic and Social Council of the United Nations, at its fifth session in May 1965, took note of the steps taken by the Centre for Industrial Development and expressed its support and approval of the project. On the basis of this approval the Centre for Industrial Development began planning for the first issue of a new publication to be known as *Industrial Research News*.

A follow-up to the initial questionnaire was subsequently mailed to institutes requesting specific details concerning the organizational aspects, functioning and programmes, and asking for co-operation and general support. The response to this second questionnaire has made it possible to compile material for this, the first issue. Subsequent issues will be based on the responses from industrial research institutes in various countries.

Industrial Research News intends to pursue the following goals: to disseminate information on the aims, organization, research programmes, needs, problems and achievements of industrial research institutes throughout the world; to keep institutes informed about current status and progress of industrial research projects; to acquaint Governments, industry, and other interested institutions with the scope of services rendered by institutes and the benefits that can be derived therefrom; to publicize the results of research; and to promote inter-institute co-operation by advising institutes of offers of, or requests for, technical assistance in industrial research problem-solving, the exchange of services or material and equipment, the interchange of personnel and other matters of mutual interest.

The Centre for Industrial Development would appreciate all comments or observations from authorities responsible for industrial development both in the industrialized and the developing countries that may lead to improvement in the effectiveness of subsequent issues of this periodical.

I. H. ABDEL-RAHMAN
Commissioner for Industrial Development

05223

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CALENDAR OF MEETINGS

African Symposium on Industrial Development

Cairo, 27 January–10 February 1966. United Nations, Economic Commission for Africa, Addis Ababa

International Organization for Standardization

Paris, January 31–February 2, 1966. For further information apply to the standards organization of your country

International Fair for Mechanical Handling

Basel, February 8–17, 1966. Genossenschaft Schweizer Mustermesse, 4000 Basel 21, Switzerland

Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy

Pittsburgh, February 21–25, 1966. Dr. Richard E. Hein, Programme Chairman, c/o Mellon Institute, 4400 Fifth Ave., Pittsburgh, Pa. 15213

Industrial Fastening and Assembly Exhibition and Conference

London, February 22–25, 1966. c/o Business Publications (Conferences & Exhibitions) Ltd., Mercury House, 103–119 Waterloo Rd, London, S.E. 1, England

Conference on Industrial Development in the Arab Countries

Kuwait, 1–10 March 1966. Mr. Abdul Wahab Al-Tammar, Secretary General of the Industrial Symposium of the Arab Countries, Ministry of Foreign Affairs, State of Kuwait, Kuwait

Symposium on Industrial Development in Latin America

Santiago, Chile, 14–25 March 1966. United Nations, Economic Commission for Latin America, av. Providencia 871, Casilla 179-D, Santiago, Chile

International Trade Fair for Food-stuffs and Beverages

Utrecht, April 25–29, 1966. Royal Netherlands Industries Fair, Utrecht, Netherlands

International Association of Fish Meal Manufacturers

Cape Town, April 26–29, 1966. National Fisheries Institute, 1614 20th St., NW, Washington, D.C. 20009

International Organization for Standardization

Madrid, May 2–5, 1966. For further information apply to the standards organization of your country

International Materials Handling Conference

London, May 13–15, 1966. Conference Secretariat, Institute of Materials Handling, 43–45 Dorset St., London, W 1, England

Seminar Industrial Architecture

Montreux, Switzerland, May 15–21, 1966. Section Suisse de l'I.L.A., c/o S.I.A., Beethovenstr. 1, Zurich 2, Switzerland

European Plastics and Rubber Conference

Paris, May 20–27, 1966. 98, rue Saint-Dominique, Paris 7e, France

International Association of Microbiological Societies

Philadelphia, May, 1966. Dr. L. Hayflick, Secretary, c/o Wister Institute, Third and Spruce Sts., Philadelphia, Pa. 10106

European Federation of Chemical Engineering

London, June 15–24, 1966. c/o Institution of Chemical Engineers, 16 Belgrave Square, London, S.W.1, England

International Clay Conference

Jerusalem, Israel, June 20–24, 1966. Dr. P. Graff Petersen, Secretary, c/o Institute of Mineralogy and Geology, University of Copenhagen, Copenhagen, Denmark

International Organization for Standardization

Paris, July 4–7, 1966. For further information apply to the standards organization of your country

International Conference on Operational Research

Cambridge, Mass., September 14–18, 1966. Dr. Philip M. Morse, Room 6-107, Massachusetts Institute of Technology, Cambridge, Mass. 02139

The Formulation of Research Policies

Santa Barbara, California, Biltmore Hotel, January 30–February 4, 1966. Dr. Lawrence W. Bass, Chairman, Arthur D. Little, Inc., 630 Fifth Avenue, New York, N.Y. 10020

Action on industrial research

The Asian Conference on Industrialization, 6–20 December 1965, Manila, Philippines

In 1963, General Assembly resolution 1940 (XVIII) called for the convening of an international symposium on industrial development to be preceded by regional and subregional symposia relating to the problems of the industrialization of developing countries. As a result, a series of regional symposia have been planned by the three regional economic commissions in the developing areas in co-operation with the United Nations Centre for Industrial Development. These meetings are to examine the status, prospects and problems of industrial development in developing countries in order to accelerate their industrialization.

The promotion of industrial research in the developing countries is recognized as essential for the acceleration of their industrial development. The Interregional Seminar on Industrial Research and Development Institutes in Developing Countries which was held in Beirut, Lebanon, in December 1964 recommended as a matter of urgency that the developing countries should take the necessary steps to establish appropriate industrial research and development facilities or to strengthen existing ones. Consequently this topic has been included for discussion in the meeting in the ECAFE region in December 1965 and for that in Africa in January/February 1966.

In preparation for the Asian Conference on Industrialization, an Expert Group met in Bangkok in August 1965 to prepare a document which would review and advise on the appropriate action which should be taken in the countries of the region to promote industrial research and design.

The Expert Group, under the Chairmanship of Dr. Canuto G. Manuel, Commissioner, National Institute of Science and Technology, Manila, Philippines, found that most countries in the region "face serious problems in regard to scientific and technical personnel, financial and foreign exchange resources, instruments and equipment, documentation services and other facilities" The following are some of the findings and recommendations of the Expert Group on Industrial Research:

"For industrial research and development, the most important requirement is competent scientific and technical personnel;

"To enable scientists to make their maximum contribution to research and development they must be assured a high social status, adequate emoluments and promotion opportunities and congenial atmosphere and conditions for work;

"In the absence of the willingness by industrial firms to undertake and support industrial research, the major responsibility for initiating and supporting it devolves on the governments;

"Since most of the countries have meagre financial resources and limited technical personnel, it is essential that research effort be productive of results capable of industrial application. The research projects should be directly related to programmes and plans of industrial development of the country;

"The results of research should be available at a level where they can be utilized by industrial firms. They should include pilot plant data, design and engineering data and market assessment and economic feasibility studies. Arrangements should also be made to encourage financial participation by industrial firms in pilot plant studies;

"In most developing countries, industrial firms prefer to import foreign know-how and technology, particularly since it has the advantage of assured performance and often includes supply of equipment, training of personnel and financial participations. Special incentives will have to be offered to industrial firms to compensate for possible loss in utilization of the results of indigenous research, or in undertaking their own research and development;

"It is recommended that the governments should give special incentives by way of liberal exemptions, risk capital and subsidies to industrial firms who may utilize indigenous know-how or take steps to develop their own industrial research efforts.

"Co-operative Research Associations for industry have proved a particularly useful tool in developing industrial research by small and medium scale industrial firms. They receive financial and organizational support from the government and undertake research for use by the entire industry;

"It is recommended that particular research encouragement be provided to firms willing to form co-operative research associations and undertake research;

"In most of the developing countries, there are no consulting engineering firms for design and engineering, market feasibility studies, etc. Industry also does not have competent technical personnel to advise them on process development and trouble-shooting within the factories.

"It is recommended that to further industrial development, institutes for industrial research and development and the scientists should provide consultancy services to industrial firms

"It is recommended that urgent steps be taken by ECAFE to set up a 'Regional Council for Industrial Research and Technology' under its aegis;

"International assistance has been of great benefit to the countries of the region. Several agencies of the United Nations have helped developing countries with library and documentation facilities, technical literature, machinery, equipment and instruments provision of the services of experts and fellowships to scientists for specialised training and high education in the advanced countries. Assistance has also been provided through regional plans and bilateral agreements between the advanced countries and the developing countries."

Acting upon the findings and recommendations of the Expert Group on Industrial Research, the Asian Conference on Industrialization recommended, on development of industries, inter alia:

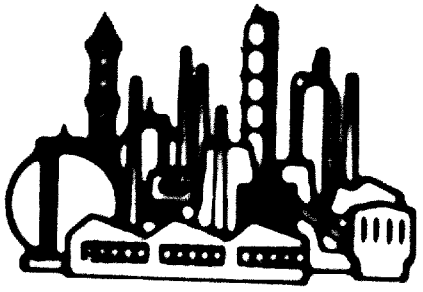
That, in order to attract and keep scientists in research institutions, suitable measures must be taken to assure the status emoluments and service conditions of scientists.

While scientific and industrial research institutes should function as autonomous organizations, the closest possible association and participation by user departments, industries and planning authorities in the research programmes of industrial research and development institutes should be assured.

The closest possible association in teaching and research and the use of equipment should be encouraged by the research institutes and the universities, and industrial research institutes should be provided with adequate arrangements for efficient documentation and library services for the scientific personnel.

The Conference further recommended that as a matter for regional and international co-operation, and in order to avoid waste of scarce resources on redundant research in different institutions and to stimulate exchanges of information and co-ordinate research activities, an Asian Council for Industrial Research and Technology be established as an organ of the ECAFE, to be composed of heads of important research institutions in the countries of the region.

To enable the Council to act as a catalyst and to promote the most effective co-operation between the institutes, a new Industrial Research Office should be established within the Industries Division of the ECAFE secretariat which should service the periodic meetings of the Council and stimulate the direct exchange of research programmes and projects between the co-operating institutes of the region.



United Nations Organization for Industrial Development

The General Assembly of the United Nations, at its twentieth session in December 1965, adopted unanimously a resolution establishing an autonomous organization within the United Nations to be known as the "United Nations Organization for Industrial Development". The new Organization is expected to take over the functions and responsibilities of the present United Nations Centre for Industrial Development.

The resolution includes, inter alia, the following operative paragraphs:

"Taking note of the widespread desire for a comprehensive organization for industrial development,

"1. Decides to establish within the United Nations an autonomous organization for the promotion of industrial development to be known as the United Nations Organization for Industrial Development;

"2. Decides that the administrative and research activities of this organization shall be financed from the United Nations regular budget, and its operational activities shall be financed from voluntary contributions to it by Governments of the Member States of the United Nations, of the specialized agencies and of the International Atomic Energy Agency, as well as through participation in the United Nations Development Programme on the same basis as other participating organizations;

"3. Decides that the principal organ of the organization shall be the Industrial Development Board;

"4. Requests the Secretary-General to make arrangements, in accordance with Article 101 of the Charter of the United Nations, for the immediate establishment of an adequate, permanent and full-time secretariat, as a part of the organization, which will avail itself of the other appropriate facilities of the Secretariat of the United Nations;

"5. Decides that the secretariat shall be headed by an Executive Director for Industrial Development, who shall be appointed by the Secretary-General of the United Nations and confirmed by the General Assembly;

"6. Decides to set up a special ad hoc committee composed of thirty-six Member States of the United Nations, of the specialized agencies and of the International Atomic Energy Agency, in accordance with the principle of equitable geographical representation, to prepare the necessary operating procedures and administrative arrangements of the organization established under paragraphs 1 to 5 above, taking into account the reports of the Secretary-General submitted to the General Assembly, document A/C.2/L.794, the reports of the Committee for Industrial Development and the relevant views expressed in that committee, in the Economic and Social Council, at the United Nations Conference on Trade and Development and in the General Assembly, and to report thereon to the Committee for Industrial Development at its sixth session, to the Economic and Social Council at its forty-first session and to the General Assembly at its twenty-first session".

The United Nations Interregional Seminar on Industrial Research and Development Institutes in Developing Countries

Beirut, Lebanon, 30 November – 11 December 1964

The Centre for Industrial Development of the United Nations organized the Seminar with the purpose of providing a representative group of industrial research administrators, managers, workers and policy-makers from various geographical areas with the opportunity to discuss and examine the various aspects and problems connected with the establishment and operation of industrial research institutes.

The Seminar dealt with three broad subjects, namely Objectives and Functions of Industrial Research Institutes, Industrial Extension Services, and Organizational Concepts and Problems. The following specific areas, among others, were examined:

(i) Research, development and promotion activities to strengthen manufacturing industries in the developing countries;

(ii) Types of technological and socio-economic studies to serve industrial development;

(iii) Procedure and information necessary to carry out feasibility studies on the economic and technological soundness of industrial projects;

(iv) Organization and establishment of facilities for laboratory testing and formulating of standards of identity and quality;

(v) Responsibility of the industrial research institute for the application of results of scientific and technological progress;

(vi) Establishment and development of industrial extension programmes and methods best adapted to conditions in developing countries;

(vii) Over-all organizational problems of industrial research institutes.

The consensus from the discussion at the Seminar was that:

Industrial research is fundamental in laying the foundation of a sound industrial base, and investment in industrial research should be recognized as, in fact, an investment in industry and even in the future of the nation.

The broad spectrum of industrial research should be given attention and the developing countries should emphasize applied research although fundamental research should not be neglected. Research should also provide assistance to all types of industry regardless of size.

There is a need to graft indigenous research into imported technology and to nurture such graft to full fruition to achieve increasing self-dependence.

The activities of the institutes should include, inter alia, utilization of raw materials; development, improvement or adaptation of production methods; processes and equipment; pilot plant trials; quality control; feasibility studies; design and productivity studies; marketing research; operational research; consultancy and trouble-shooting; and advisory services.

Whereas the integration of industrial research and development functions within the same institute was emphasized, it was recognized that under certain conditions some functions can be carried out by other organizations. However, the idea of team-work should be preserved.

The selection of industrial research projects should be governed by national needs; at the same time the institute should also respond to specific requests from industry.

With a view to its speedy application, industrial research should be conducted in relation to the practical needs and requirements of industrial development. An important function of industrial extension services is therefore to provide close contact between the problems of commercial production and the conduct of industrial research, and to promote the closest co-operation and association between research groups and those responsible for industrial production. To do this most effectively, it is necessary to get to know the needs of industry and, second, to stimulate interest and generate confidence in research and development on the part of industry.

Despite the great value of international and bilateral technical aid, it cannot serve as a substitute for the development of local staff. Thus training of researchers and research administrators was emphasized.

In choosing a pattern of organization, factors to be taken into consideration will include the level of economic development of the country concerned, type and scale of operation of existing industries, administrative set-up, needs of any predominant raw materials and financial as well as other resources.

Multi-purpose institutes, as opposed to specialized ones, offer obvious advantages in countries where resources are limited. As regards regional or subregional institutes, these require, for their success, an unusual homogeneity of the peoples concerned.

Industrial research institutes should co-operate fully with the economic planning authorities but should retain a measure of freedom to pursue promising self-initiated projects, placing major emphasis on applied research. Co-operation should exist also with other organizations connected with research or with related fields.

Methods of financing industrial research in developing countries include government grants, taxes or levies imposed on the commodities produced and fees or contract income. The research institute should charge a fee for the work it performs rather than offer it to industry or other users free of charge. Primary responsibility for the financial support of industrial research institutes in developing countries rests with the governments.

Editor's Note: The Proceedings of the Seminar will be published in February 1966. The Report of the Seminar and approximately sixty Papers will be included in the publication.

H.E. Najib Salha, Minister of Planning of Lebanon and Chairman of the Seminar, delivers the welcoming address. On his right, Dr. Azmi A. Afifi, Director of the Seminar; on his left, Mr. Assad K. Sadry, Resident Representative of the United Nations Technical Assistance Board in Lebanon. Foreground: some country representatives attending the Seminar

Management of industrial research institutes

Meeting of Experts – United Nations, 27 September to 7 October 1965

The need for guidance on managerial practice of industrial research institutes became apparent during the deliberations of the United Nations Interregional Seminar on Industrial Research and Development Institutes in Developing Countries held in Beirut, Lebanon. Institute directors present at the meeting felt that the problems connected with the management situation were of the greatest importance, and that the main difficulty stems from the fact that technical men with high administrative ability needed for such positions are hard to find anywhere, especially so in the developing countries where the requisite training and experience is not common.

Mindful of the urgency and importance of the problem, the Committee for Industrial Development, a subsidiary body of the Economic and Social Council of the United Nations, at its fifth session in May, 1965, stressed the need for a manual to be used as an aid in the training of managers and as a help in the improvement of current managerial practice of such institutes.

A background report for the proposed manual entitled Managerial Practices for Industrial Research Institutes in Developing Countries was prepared by the United Nations Centre for Industrial Development. This was circulated initially to six experts and forty-five honorary correspondents with broad experience in the field of industrial research management for suggestions, comments and criticisms.

A meeting of the six experts was convened at the United Nations Headquarters by the Centre for Industrial Development to study the comments made by the honorary correspondents, make additional suggestions and advise on the final draft of the manual. The meeting was attended by Dr. Lawrence W. Bass, Consultant; Ing. S. M. A. del Curril, President, Instituto Nacional de Tecnología Industrial, Buenos Aires, Argentina; Dr. Francis Godwin, Project Manager, Sudan Industrial Research Institute, Khartoum, Sudan; Mr. E. S. Hiscocks, Director, Tropical Products Institute, London, United Kingdom; Dr. C. G. Manuel, Commissioner, National Institute of Science and Technology, Manila, Philippines; and Dr. P. C. Trussell, Director, British Columbia Research Council, Vancouver, Canada, as well as the following staff members of the Centre for Industrial Development: Dr. Azmi A. Afifi, Chief, Industrial Institutions Section; Mr. P. B. W. Gollong; Dr. Mostafa Hamdy; Mr. Martyn N. Eggough and Mrs. G. Faridi.

The Commissioner for Industrial Development, Dr. I. H. Abdel-Rahman, welcomed the experts and thanked them for their comments on the background report. He suggested that considering the uneven stage of development of the various countries, the final draft of the manual should contain guidelines applicable to the greater number of them and that the goal of the proposed manual should be to guide the manager in his choice, control and judgement of staff, projects and programmes. He hoped that the meeting would produce a document that would contribute to the improvement of future programmes of research institutes.

SUMMARY OF THE DELIBERATIONS

The institute

The experts recognized the important role played by industrial research institutes in the industrialization of a country by way of providing certain basic and technical investigative services to investors, industry associations and government agencies, and felt that the definition of an institute should include these elements as well as an indication relative to the financing of the cost of services. The historical evolution of the industrial research institute from the simple laboratory set up for the purpose of testing raw materials and products to the complex institute such as can be found in some of the developed countries, may be useful to the developing countries as a guide in the process of establishing new institutes and a brief sketch of it would be included in the manual. The institute offers cer-

tain advantages that are not usually found when research is carried out by individual units or by scientists working separately. By having in one place a collection of technologists, engineers, economists, etc., working together on a given problem, the institute has a better chance of finding solutions to research problems. Such an arrangement is economical in the use of manpower and other resources. Other advantages are the sharing of laboratory facilities, equipment and library which permits assembling of a larger collection at a lower unit cost than if such facilities were procured for only one scientist or a small unit. Flexibility and diversity of services are ensured by the diversified talent gathered at one place and the training of young scientists is facilitated by the variety of assignments at the institute as well as by the personal contact with other more experienced members of the staff. Industry can also be kept informed on current developments through an institute programme of collecting and disseminating industrial technological information. Finally, the institute can serve as a channel for utilizing foreign technical skills by engaging foreign contractors and consultants to help accelerate the application of external technology to the national economy.

Scope of services

The experts agreed that no matter what pattern of activities the institute selects its primary purpose is that of assisting the industrial sector in a consultative or advisory capacity in the pursuit of industrial development. They made a distinction between routine services, such as information and laboratory analysis and testing; techno-economic services; general technical services; and research and development. On the latter, care was taken to differentiate between basic research, or long-range oriented research, which is mostly carried out in large industrial institutes in advanced countries, and applied research, or "product directed" which is concerned with the development of new or improved products and processes, reduction of costs, preservation of materials, etc.

Institutional patterns and organization

Great importance was placed on the qualities of character, technical training and leadership of the man who would head an institute, and on the administrative body empowered to appoint and dismiss him. The experts recognized the need for an administrative system appropriate to the peculiar requirements of industrial research institutes. They felt that in many instances the institute does not seem to fit into government administrative systems, and that a system whereby the government appoints a Board of Management to be responsible for the financial, technical and administrative operation of the institute has been known to be quite successful. The Board would be composed of representatives of industry, management, labour, etc. with a total membership somewhere in the neighbourhood of ten to fifteen.

The Board would meet periodically to transact its business and would report to the appropriate minister and give a full account of its management; the most important function of the Board would be to receive, discuss and approve the budget and to give consideration to the work programme.

The director has a key role to play and his qualifications are of utmost importance to the successful operation of the institute. He should have a sound technical or scientific background, be able to judge technical qualifications and capabilities, possess business and administrative skill, be co-operative and able to inspire his staff to action, should be prepared to make unpleasant decisions when necessary, be able to delegate authority, be morally courageous and although a technical man be able to write in a language the layman can understand. Once the director is appointed, his first chore will be to select an able staff to assist him.

The experts recognized that it is difficult to set down rules on what should be emphasized in matters of staff requirements because each situation is different, but they agreed that the staff appointed should have suitable technical abilities oriented toward the industrial work in mind; they will have academic training, the higher the better, but a sound record of achievement should be preferred.

A simple organizational structure is considered more advantageous during the early days of the institute: the staff works together under the direct supervision of the director, with no labels attached to the members. As the work develops and the staff grows, the need for a more formal organizational scheme will arise.

Planning and control of research programmes

Success in the operation of an institute is achieved through careful planning and control of its research programmes. These are classified into two broad types: sponsored pro-

grammes, initiated mainly by a client, and in-house programmes initiated by the institute itself.

Feasibility is a main consideration in both types of programmes and the institute is justified in rejecting unsound projects and in terminating work on those in progress if the results look too discouraging.

One expert suggested that since in-house programmes are usually undertaken to help in the economic development of the country they should be financed out of the institute budget and charged to overhead. He advised cautioning institutes against having too many projects of this type. Another expert disagreed with this thesis and expressed the opinion that in-house programmes have led to areas where most of today's research is based.

The various stages of a research project outlined in the draft from the original concept to commercialization were considered by the experts. They stressed that the list was offered as a sample only, and that institutes could undertake one, a combination of some, or all of them according to their particular situation and needs.

Effective control over the research programmes as a whole was considered of the utmost importance for the success of operations and several procedures that have proven useful toward this end were included.

Financing the institute

Financial support may originate from various sources such as government or its agencies, industrial associations, dues from sponsored research, endowments, and in some instances from a small percentage of the loans extended by development banks. In some developing countries, however, the main source of funds is government: in such cases, the experts suggested, the government should assure its financial support until the institute is able to secure other sources of revenue.

The director needs to prepare an annual budget to forecast financial requirements and control expenditure; the budget is presented to the Board of Management for consideration and approval. The meeting discussed the budget for routine operation, or operating budget, and the budget for major expenditures, or capital budget. A great deal of thought was devoted to the percentages allotted the various activities. Operating budgets of institutes in developed countries were used to illustrate the calculation of such percentages. It was observed that institute budgets in developed countries allot a high percentage to salaries, and that institutes in developing countries, especially those under government salary regulations, might lack a flexibility of action in this respect.

The most important asset of an institute, the experts felt, is the technical skill of its personnel and it is vital to measure and control it. To this end, several procedures used by well-managed technical organizations were studied and suggestions were added.

Personnel administration

On the premise that the success, reputation and acceptance of the institute depends primarily on the quality and ability of its staff, the experts set down basic principles for the recruitment, evaluation, training motivation and remuneration of the staff. They emphasized the need for a professional technical staff with a sound technical background and high standards of ethical behaviour. Such staff should be personable in appearance and manner and able to get along with others; they should be alert, adaptable and flexible, and be prepared to grapple with any type of problem within their professional competence.

Similar high standards may be applied to other grades and types of staff such as technical assistants, secretaries, etc.

There was a lively discussion on the number of supporting staff adequate for the effective running of the institute. The usual ratio, it was agreed, varied between one and three non-professional staff to one professional. The tendency to engage an excess of supporting staff should be discouraged in the interest of operational economy.

A procedure for staff evaluation is required in order to ensure fair promotion and recognition of merit. A system of promotion based on merit is preferred to one based on some other considerations such as nepotism, favouritism, or length of service alone.

Due to a lack of comparability of salary scales among different countries, the experts refrained from making recommendations on specific salary scales; they did emphasize, however, that salaries of institute staff should be related to those of other professionals in the area. The stability of the staff, they stressed, depended to a great extent on the adequacy of remuneration.

Relationship between the institute and its clients

The success of the institute is contingent on the ability of its staff to "sell" its services,

The Expert Group on Management of Industrial Research Institutes concluded deliberations on 7 October 1965. Left to right (front row): Dr. C. G. Manuel, Ing. S. M. A. del Carril, Dr. L. W. Bass, Dr. A. A. Afifi, Dr. I. H. Abdel-Rahman, Mr. N. K. Grigoriev, Dr. P. C. Trussell, Dr. F. Godwin, Mr. E. S. Hiscocks and Mr. P. B. Gollong. Left to right (back row): Mr. M. N. Eggough, Mrs. G. Faridi, Miss G. Picard and Dr. M. Hamdy

providing that it is able to offer returns for the investment. It is not enough that the institute is there to help government, local enterprises and industrial development agencies, but that it does so. In other words, the institute must have real competence and demonstrate it by bringing substantial gains to the user.

Techniques for developing sponsorship are many and varied and the experts did not hold a unified opinion as to the best manner to accomplish it. One of the early steps of the institute is to decide what field of endeavour it will cover, and what types of clients are likely to be interested in its services. Once this is established, it will be feasible for the institute staff to arrange personal contacts with prospective clients. If the senior officials of the institute are well known in the field of applied science, they may be able to have access to the inner circles where managerial decisions are made and thus be in a position to acquaint industry with the services the institute is prepared to offer. The good offices of the Board of Management can be used effectively in putting the institute in contact with potential client organizations. Other suggested media were: publication of promotional literature such as a brochure describing the objectives, areas of operation, outline or provisions for contracts, facilities and a summary of qualifications of the professional staff. It was emphasized that care should be taken to produce a first-rate publication since it will reflect upon the accuracy and competence of the establishment and that speeches and attendance at meetings by institute staff would help to promote public relations if conducted in a dignified and proper manner. Other points raised included the organization of special meetings, at which papers on important subjects may be presented by institute staff, as a means of expanding personal contacts as well as the development of a good public image. The director and his staff, it was pointed out, should always strive for excellence in every aspect of the institute's operation. Finally, the publication of a periodical was cited as another way of maintaining contact with potential clients and insuring that the name and activities of the institute are not forgotten.

Before the institute undertakes a particular project for a client an agreement must be signed by both parties; the contract or agreement contains information concerning the conditions of the specific project as well as the obligations of both the institute and the client. A specimen contract used in a developed country was thought to be useful to developing countries when in need of guidance in the matter.

The final subject discussed by the experts was the basic principles and consideration in institute-client relationship. They considered that the institute staff has a responsibility to demonstrate how technical resources can best be expanded for the solution of industrial problems.

Adjournment

The meeting adjourned on 7 October after having held nine plenary and nine drafting committee meetings. The result of their efforts was an initial draft of the Manual on the Management of Industrial Research Institutes in Developing Countries.

Manual on the management of industrial research institutes in developing countries

Introduction

Industrial research has probably always been carried out either by the university as a part of its research programme or as special projects by individual technicians or small units. The industrial research institute with its pool of technical talent as it appears today is of recent vintage, having its beginning about the start of the 20th century. Industrial research management, therefore, is a new science and it is not surprising to find that there are not many technical men available possessing the administrative skill needed to plan, pursue and carry out an industrial research programme.

To help those in need of guidance on the subject of industrial research management, the Centre for Industrial Development of the United Nations has prepared a Manual on the management of industrial research institutes in developing countries. The Manual is expected to be off the press in March 1966.

Purpose

Although the primary objective of the Manual, as stated in its preface, is the raising of managerial efficiency of industrial research institutes, in point of fact it is addressed to all those engaged in the conduct of industrial research. In addition to the main objective and its related ones, such as training of personnel, including managers, the Manual will be found useful by executives and policy-makers in government and industry who are in one way or another connected with industrial research activities. Economic planners and administrators, chambers of commerce and industry and technical assistance experts will find in it useful information relative to industrial research management.

The Manual can be used most effectively by those in the process of planning or establishing an industrial research institute. As a matter of fact, the title of the Manual addresses it expressly to the developing countries, where the process of industrialization, as well as the idea of the research institute, is comparatively new.

Scope

The Manual covers the major aspects of industrial research involving managerial decision and action. Its seven chapters deal with subjects ranging from the historic evolution of the concept of the industrial research institute to the practical issues involved in the everyday institute-client relationship. The chapters are well balanced and not unduly long.

The industrial research institute as a national technical resource is examined in the first chapter which also traces some of the historic developments in the field of industrial research and delineates the advantages which a community may derive from such an institute. A definition of an industrial research institute is included as well as the various services it may offer. The types of research that may be undertaken, whether initiated by the institute or sponsored research and possible financing of the services offered are outlined.

The above-mentioned services are discussed in chapter two. They are divided into four categories: routine services; techno-economic services; general technical services and research and development. Under the last-named, "basic research" and "applied research" are discussed. Distinction between the two types of research is important when deciding upon the scope of services the institute is prepared to offer. Basic research is generally undertaken not with a view to an immediate economic return whereas applied research is usually expected to yield such a return.

Institutional patterns and organization forms are discussed in chapter three. The writers stress the need for freedom of action for the

institute within the government structure and national policy. They suggest "a device which has been used very successfully" whereby the government appoints a Council or Board of Management as the policy-making body of the institute. Among the important functions of the Board is the appointment of the Director. The Director's functions and responsibilities are outlined here and are again referred to later in a discussion of personnel administration. On the question of organization, simplicity is recommended, especially at the beginning of the institute's life. The Manual distinguishes three forms of organization: a simple form; a more complex form for institutes with various specialized areas; and a multi-project team form suitable for institutes that use this type of approach in dealing with research problems.

Chapter four discusses the planning and control of research projects. It includes outlines for proposed studies for both client-sponsored and in-house programmes. The core of the chapter is an examination of the major stages involved in a research project, from planning to conversion of laboratory information to commercialization. The procedure for effective control of research projects as a whole is illustrated by a series of logical steps leading to the evaluation of the results.

Financial administration is dealt with in chapter five. After discussing the initial steps in organizing the institute, sources of funds are examined. Both operating and capital budgets are studied, and a brief description of working capital is included. Neither definitions nor specific instructions on the preparation of budgets are given; the Manual limits itself to explaining what types of expenses are included in each type of budget and leaves it at that. One interesting aspect of the chapter is the attempt to provide guidance relative to cost percentages that may be allotted to each activity, including salaries, without losing sight of the fact that cost conditions in the various countries will differ. This is done through the use of illustrative charts, one showing a breakdown of expenses by major categories, and another showing proportionate expenditures on salaries and wages of research organizations in a developed country. One criticism that may be voiced about the charts is that one of them, the one on salaries and wages, is rather out of date, covering the years 1951/52 and 1952/53, and conditions have changed since.

Costing of projects is discussed fully and methods for estimating project costs are described. The chapter ends with a discussion of the procedures used by many well-managed technical organizations to measure and control the technical skills of institute staff.

Personnel administration in its various aspects is the subject of chapter six. It covers procedures for recruitment, handling of separations, methods to encourage co-operation among the technical staff, remuneration and superannuation, evaluation of staff performance, training and motivation.

The importance of staff motivation is stressed most forcefully. For once, the suggestive tone observed throughout the Manual is abandoned and imperative words that have been avoided thus far are introduced here. The following personnel policies are recommended: satisfactory conditions of employment with opportunities for creativity and the development of personal capability; salaries and other benefits comparable to those of other professional men in the area; the formulation of policies for the cultivation of self-respect and the encouragement of a feeling of being a vital part of the organization and not just a piece of the administrative machinery; the establishment of administrative channels defining individual relationships to responsibility and authority in the chain of command; guidance and assistance in personal development; the provision of opportunities for the use of individual technical abilities and the recognition of personal achievement.

The seventh chapter sets forth principles to facilitate relations between the institute and its clients. It describes the role of the Board, the Director and the senior members of the staff in clientele development; it stresses the need for the staff to undertake certain outside activities in order to establish personal contacts with prospective clients and prescribes patterns of behaviour to help in creating and preserving an inviting public image of the institute. In discussing the media for external relations it suggests the type of publications the institute may use to disseminate information relative to institute activities and achievements. In all staff activities, in the publications and in all other institute matters, a quality of excellence must be striven for, the writers recommend.

The chapter closes with a discussion of contractual relationships and of the basic principles and considerations in institute-client relations.

Bibliography

An extensive select bibliography is appended to the Manual. It includes material on the administration of industrial research programmes and institutions as well as general works on administration, personnel, financing, office management, patents, public relations and report writing. Obviously, the expected world-wide circulation of the Manual was kept in mind by the compiler and books in languages other than English are also listed. It seems that possible difficulties in obtaining certain titles were foreseen and a wide choice of publishers in the various countries is offered. There is no pretence of comprehensiveness. It is offered as a guide in the search for material on various institute activities.

Style

The consensus of comments and suggestions received from different parts of the world was that the proposed manual should be simple and should deal with the various subjects in a clear and practical manner. This objective has been achieved. The Manual is written in clear and simple language, easy to read and understand. The style is suggestive rather than mandatory, and words and phrases that may imply preference for a given system of management or criticisms of existing managerial practices have been avoided. The Manual recognises the necessary variety in types of institutes in existence and respects variations in managerial practices that suit local conditions.

There is a certain amount of repetitiveness in the Manual. For instance, the qualifications of the Director are discussed in the chapter on "Organization" and again under "Personnel Administration"; finances are discussed under "Financial Administration" and also under "Planning and Control of Research Projects", and so on. This has been done purposefully in the hope that it will enhance the didactic value of the Manual.

The Mellon Institute of Industrial Research. The Mellon Institute was founded in 1913 by Andrew W. Mellon and Richard B. Mellon and is an outstanding research institute of the United States. Its first emphasis was on pure research; subsequently its field of activity was broadened to include practical problems in many phases of technology. The Institute is an endowed non-profit corporate body with an annual budget in excess of $7,000,000, a staff of more than 500 and a library containing more than 40,000 volumes

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Reflections on visits to industrial research institutes

EMMANUEL LARTEY, GHANA

Sponsored by a United Nations Fellowship, I have recently completed a tour of Industrial Research Institutes and other technological institutions in the United States of America, Mexico, and Argentina. This tour enabled me to see giant research organizations with staff over 2,000 each working in highly sophisticated and very specialised fields of scientific and technological research, as well as young and small research institutions seeking to find solutions to the more mundane industrial problems of developing countries.

On the one hand one was filled with respect for the intelligence behind the highly electronic and computerized approach to the fine areas of scientific research; on the other hand one was impressed with the genuine efforts being made with limited resources to apply technology to improve man's living conditions in the less developed areas.

The United States of America is a highly industrialized country in which there is now not so much need for the study of basic natural resources with a view to their economic utilization in industry. This stage has long been passed. Industrial research, therefore, seeks to break into new areas of technology, to discover new horizons, to evolve improved techniques for an already high level of industrial production.

Among the institutes visited in the United States, the Mellon Institute of Industrial Research stands out in my mind because certain aspects of its system of operation could be successfully applied in small institutes.

The Mellon is a private, non-profit institution, the first of its kind to be established in the United States; it was set up by a trust fund endowed by the Mellon family. Initially it was engaged wholly in industry-oriented applied research; later on fundamental and basic research were included in its programme. An interesting point of difference between this institute and the others is the fact that it provides laboratory facilities to research personnel to work on industry-sponsored projects. Upon completion of the project the researcher joins the staff of the sponsoring industry. Thus research workers are trained within the institute for industry.

This system is worthy of mention because it appears suitable for the conditions of industry in the developing countries. In Ghana, for instance, industry is young and cannot afford to undertake by itself the training of research staff. Government plays an active role in industry though, and it would be appropriate for a government-sponsored institute to train research workers for government-sponsored industry.

In a developing country the principal function of an industrial research institution is to help in the industrial development of the country through applied research predominantly oriented towards the study of natural resources. This leads to the development of technologies making possible the economic utilisation of these resources in industry, and the teaching of subjects that will help in the process of formulating an industrial problem and in finding a practical solution to it.

This principle underlines research work in the institutes I visited in Latin America, namely, Instituto Nacional de Tecnología Industrial (INTI) in Buenos Aires, and Instituto Mexicano de Investigaciones Tecnológicas (IMIT) in Mexico City.

The Instituto Nacional de Tecnología Industrial (INTI) is a national institution which works mainly on research for industry. It is equipped with mineralogy and metallurgy,

Mr. Emmanuel Lartey is an engineer educated in Ghana, the United Kingdom and the United States; at present he is Co-ordinator of Industrial Research of the Ghana Academy of Sciences and Director of the Building Research Institute in Accra.

chemistry, physics, materials, textiles and electronics laboratories as well as with pilot plants installations well suited to the projects they handle.

An interesting aspect of the Institute's programme is the lectures course given on Saturdays, for a period of six weeks. The participants, drawn mainly from industry bring their industrial problems to the classroom to be discussed and possible solutions are explored. The list of courses changes from year to year to allow the incorporation of subjects of current interest.

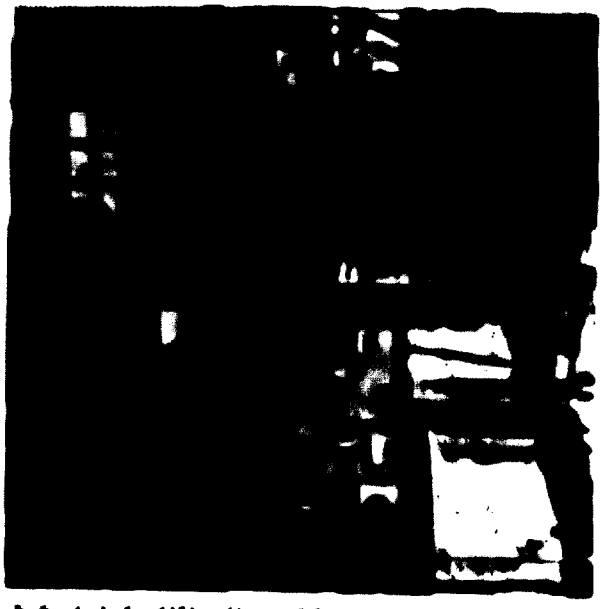
Another good example, the Mexican Institute developed a process for producing maize flour, maize being a basic staple food in Mexico. Pilot scale investigations conducted at the Institute resulted in the establishment of Maiz Industrializado, S. A. (MINSA) a factory which has at present a production of about 140 tons of maize flour per day. The flour is packed in 1 kilo bags which are in turn packed in 10 and 20 kilo bags, and then transported to the market. Improvements in plant and techniques are in hand to increase the daily production.

In addition to the direct industrial benefit to the country, this process provides a good opportunity for the introduction into the flour of additives to raise the low amino acid content of the maize and thus improve the diet level of the population.

Again in Mexico, a visit was made to a pulp and paper factory. This is a factory that produces pulp from sugar cane bagasse. It sells some of this in the form of wet pulp to other paper factories and uses the remainder either 100 per cent or blended with other wood pulps to produce various types of paper.

The corn flour factory (MINSA) and the sugar cane bagasse pulp factory were of particular interest to me, a citizen of Ghana. Corn is a basic staple food item in Ghana as it is in Mexico. Ghana also grows a considerable amount of sugar cane, and could, with advantage consider a sugar cane bagasse pulp process.

The tour, following so closely on a separate visit I had made earlier to the National Research Centre in Cairo, U.A.R., has been an eye-opener to the need for the developing countries to come together more closely in the field of industrial research. The United Nations Centre for Industrial Development, following up the recommendations of the Inter-regional Seminar on Industrial Research and Development Institutes in Developing Countries held in Beirut in December 1964, has introduced this bulletin, *Industrial Research News*. This first step is gratifying, and it is hoped that the bulletin will be the beginning of more active co-operation between Industrial Research Institutes and Centres in the developing countries. The success of the bulletin will depend largely on the response of Industrial Research Institutes to its call for supply of data and information. It is expected that this response will be enthusiastic.



Industrial utilization of bagasse. Separation of juice and refuse at sugar mill. The resulting bagasse mixture can be used for the manufacture of paper or as fuel

The United Nations Fellowship Programme in Industrialization for developing countries is a very useful means of assistance for industrial research and development in those countries. It is recommended that this programme continue on an annual basis. In future programmes use should be made of Industrial Research Institutes in both developed as well as developing countries. It would, however, be more advantageous if more time on detailed study is spent in the institutes in developing countries, as there are several areas of similarity in basic natural resources and conditions, the scale and nature of operations are similar, and experience gained from such institutes would be more directly applicable in the Fellow's own developing country. The major institutes in the developed and highly industrialized countries would provide useful experience in research management on brief visits by Fellows.

Research projects being developed

This feature of **Industrial Research News** *lists projects undertaken by Institutes in various countries throughout the world. Its purpose is to disseminate information so that Institutes may know what problems are under study and with what measure of success. By listing the research project undertaken it is expected that Institutes engaged in similar types of research will be able to contact each other directly or through the* **News** *if preferred, to exchange further information on the matter.*

Material for this feature has been provided by the co-operating Institutes. Its value will be enhanced if Institutes keep the **News** *informed on the current status of their projects.*

BRITISH COLUMBIA RESEARCH COUNCIL, VANCOUVER, B.C., CANADA

Operations research in mining

The British Columbia Research Council in Vancouver, B.C. is currently engaged in applying operations research techniques to ore reserve calculations and open-pit planning for two large mining properties. One is the Falconbridge Nickel Mines deposit at Tasu, Queen Charlotte Islands; the other prefers to remain anonymous. The Council has developed a number of computer programmes for use in such studies. For example, a "Drill Hole Programme" calculates weighted ore grades for benches of any given height; a "Pit Limits Programme" determines the optimum economic configuration for the pit. Given costs and recovery factors for underground mining, Council men can establish which sections of an ore body can be most economically recovered by underground methods. All programmes can be rapidly and economically run with a variety of costs and values so that "worst possible, best estimate and optimistic" versions are readily developed with a minimum of hand calculation.

INSTITUTO DE INVESTIGACIONES TECNOLOGICAS, BOGOTA, COLOMBIA

Improvements in the leather industry

The leather industry in Colombia is an important factor in the economic development of the country. Two million hides are processed each year, with an approximate value of two hundred and fifty million pesos; the industry employs fifteen thousand workers. Progress in this industry since the Institute started research in the subject has been remarkable and has had far-reaching repercussions in other industrial sectors.

As a result of the Institute's work, a Leather Research Centre supported by suppliers, tanners and producers of vegetable tanning chemicals has been established. The Centre is a model for industry research which may be extended to other industries such as plastics, foundries, metal-working and pulp and paper. The following are some of the improvements brought about by the research project: better hides, due to improved methods of slaughtering; better curing processes resulting from the development of a special salt and the establishment of a plant to distribute the new salt to hide suppliers; better tanning resulting from direct advice provided by the Institute personnel visiting tanning establishments; search for new vegetable tanning media; and the regular quality control of raw materials for the industry.

CENTRAL AMERICAN INSTITUTE OF INDUSTRIAL RESEARCH, GUATEMALA

Food preservation by irradiation

The Central American Institute of Industrial Research (ICAITI) has undertaken a food preservation project by means of irradiation. The effects of the radio-active doses on the pH of tropical fruits and the content of ascorbic acid and sugars in relation to the length of

ICAITI's Cobalt-60 Unit. Workers install the Cobalt-60 Unit; the equipment consists of a stainless steel tank, ten feet deep and six feet in diameter, seated in a hole in the ground. The Unit, which is expected to be fully operational early in 1966, will be permanently housed in a special building now under construction. Cobalt-60 sources available have a nominal activity of 4,000 curies distributed between 5 sources of 400 curies each and 2 of 1,000 curies each

time the irradiated fruits may be stored have been studied. In addition, bacteria counts were made of the fruits. A Cobalt-60 Unit, the first of its kind to be installed in Central America, was used as the source of radiation.

The Institute plans to use the Unit not only for food preservation purposes, but also in projects concerning entomology, grain and other staples, steriiization, exhibition of sprouting, etc.

In the project, the Head of the Technological Research Division had the collaboration of the College of Chemical Sciences and Pharmacy of the Universidad San Carlos de Guatemala. In the calibration of the Cobalt-60 Unit and in the matter of technical assistance in general, the Institute had the collaboration of the Scientific Director of "Atoms in Action", a United States Atomic Energy Commission scientific exhibit at the time in Guatemala City and that of a specialized technician of the Nuclear Centre of Puerto Rico.

Editor's Note:

The Central American Institute of Industrial Research (ICAITI) is situated in Guatemala. It was established in 1956 as a regional institute under the joint auspices of the Governments of the five Central American republics, Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua, and the Economic Commission for Latin America. Its functions are to advise and assist in the programming of the economic integration of the isthmus through technical advisory services to industry and investigation of the best utilization of the natural resources and raw materials of the region. The United Nations interest in the Institute dates from the outset. In 1956, a number of experts, including the Director of the Institute, were provided under the United Nations Expanded Programme of Technical Assistance to help build up the Institute.

Heavy requests for services from industry and governments and the lack of adequate Institute resources to cope with the increasing demand caused the approval of the United Nations Special Fund assistance programme in the form of a five-year project granted at the request of the Governments concerned, with the United Nations as the executing agency. After the completion of the first phase of the programme the Fund extended it for a further three-year period.

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY, PHILIPPINES

Conversion of coconut shell into marketable products

The aim of the project is to develop optimum processing methods for the conversion of coconut shell into marketable products.

Coconut shell, coir dust and short fibres were compressed in a mould to a pressure of 25,000 psi and carbonized for one half hour in an air-tight retort provided with a condenser. The carbonized mixture (briquette) produced was very porous and light. It can be used for metallurgical and industrial purposes.

Fermentation of cacao beans

The project aims to develop a microbial process for fermenting cacao beans in order to impart the qualities of flavour, aroma and colour desirable for the manufacture of cocoa, chocolate and other products.

Experiments showed that certain isolates of Saccharomyces were suitable for fermenting fresh cacao beans. A combination of oven-drying and sun-drying of fermented beans resulted in a desirable aroma. Standardization of the process will be conducted.

Uses of ozone in the Philippines

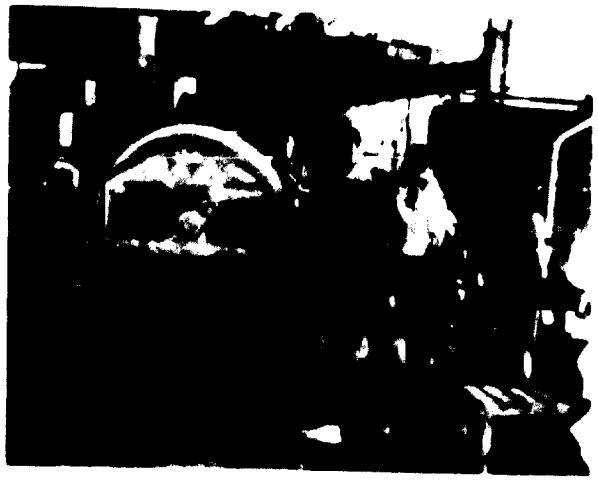
The Institute has undertaken an investigation of possible uses of ozone in the Philippines. The ozonolysis of locally available unsaturated oils (rice bran, lumbang and castor) have been studied. High yields of good quality azelaic acid were obtained from lumbang oil and optimum conditions were established for subsequent large-scale production. Azelaic acid was likewise prepared from rice bran oil and castor oil. Optimum conditions for its production are under investigation.

TECHNOLOGICAL RESEARCH INSTITUTE, BANGKOK, THAILAND

Production, processing and utilization of kenaf

Kenaf is now recognized as a valuable substitute for jute for most purposes, and must compete with it in the world's markets. However, the market price of Thai grade "A" jute is quoted below that of its counterpart, Pakistani true jute, due to, no doubt, differences in quality.

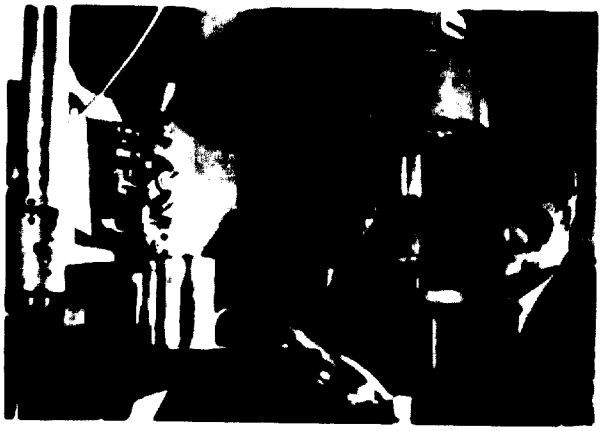
The purpose of the project is to improve existing techniques and develop new methods in the kenaf industry with the view to obtaining higher yields of better quality fibre and more efficient spinning, weaving and utilization of the kenaf fibre within the country.



Integrated coconut process pilot plant in Candelaria, Quezon, Philippines

The project includes the following: microscopic study of fibre development in the growing kenaf plant; measurement of fineness and strength, the results of which may be used as a basis for fibre grading and for comparison of fibre obtained in the various cultivation and processing experiments; study of the chemical properties of fibre and their relative significance; introduction of a standardized method of sampling, extracting and evaluating the fibre to measure the effect of plant variety, growing conditions and agronomic factors on the yield and quality of the fibre; an assessment of the rate at which rotting may be arrested to ensure high quality fibre; study of the effect of handling methods from farm to factory and storage conditions on the physical and chemical properties of the fibre; a survey of spinning and weaving operations at mills to be used as the basis for the development of spinning and weaving investigations; an examination of the various problems involving the testing and utilization of yarns and fabrics manufactured from kenaf, including quality control procedures for the spinning and weaving industries, a decay resistance investigation and methods of rot-proofing; and the economic evaluation of such improved techniques as may be developed in the course of work on kenaf fabric.

It is expected that as a result of the research project a stronger and finer fabric will be produced, and that improved rotting, handling and storage methods will ensure the preservation of that quality. The over-all result will be, it is hoped, a more profitable product for Thailand's export market.



Institute for Technological Research (Colombia) studies the production of fruit preserves. Robert Richardson (right), Chief of the United Nations Special Fund project, examines the results obtained from a filling machine used in this work

SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH, NEW DELHI, INDIA

Anticrease and related finishes

Three finishes in this field have been developed to the production scale operation while improvement particularly with respect to treatment of white fabrics and improvement in wet crease recovery are being undertaken.

Application of co-current and counter-current solid gas contacting system in textile processing

This project is part of the fluid bed studies in textiles. The preliminary trials in the counter-current gas solid system with 20 per cent solids hold-up were quite encouraging. A pilot plant unit to run a 16 in. wide cloth was designed, fabricated and erected. Data have been collected on drying of textiles in this unit to test its efficiency as a heat transfer medium.

Cross linked cellulose

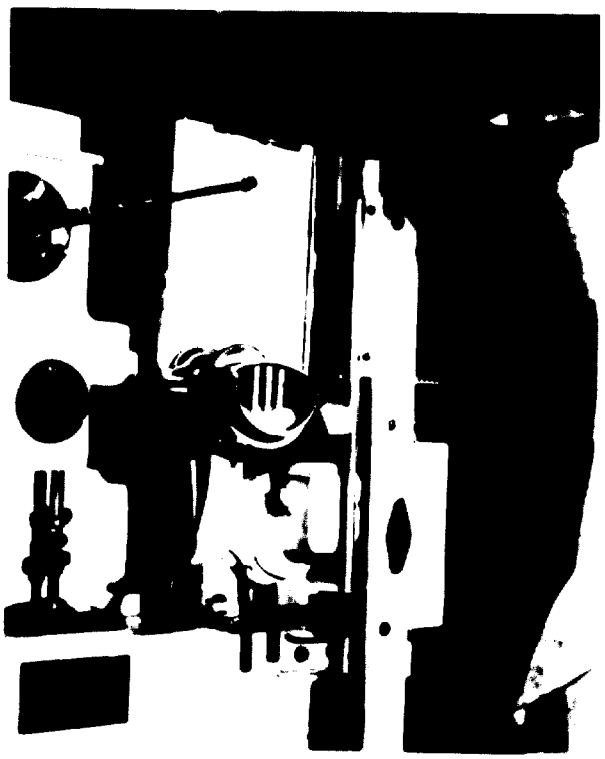
This work has progressed further into an important development particularly in respect of tensile properties of resin finished fabrics. It has been found that resin treated fabrics show high abrasion resistance if treated by the new process. This is a significant observation which is being covered by appropriate indian and foreign patent applications.

Graft polymerization of vinyl monomer on to cellulose

The objective of this scheme is to modify the cellulose by graft polymerization with vinyl monomers. Vinyl monomers, particularly methyl methacrylate, acrylonitrile and styrene, when graft polymerized on to cellulose; then the mechanical and other properties of cellulose, like wet and dry strength, dimensional stability, stiffness, resistance to abrasion, microbial attack and wetting are increased. The drying properties are also improved. Preliminary studies were carried out to find a suitable initiator system for the graft polymerization. it has been found that vanadium is quite an effective initiator for graft polymerization for methacryiate. But the same has been found ineffective to graft styrene on to cellulose. Other initiators are being investigated.

Manufacture of surkhi-puzzolana

The objective of this scheme is to study the manufacturing conditions of surkhi-puzzolana by fluidized bed method and collect operating and design data for its manufacture from Indian clays. A fluid bed calciner made of special fire clay material with fins protruding from the inner walls of the column has been designed to collect pilot plant data on the problem. A counter-current gas solid contact system will be the principle of operation. A geometrically similar model of the unit has been fabricated to study the flow pattern of the clay in the finned bed column.



Institute for Technological Research bread improvement study. Testing elasticity of bread dough made from locally grown wheat

Men in research

"Men in research" is the first of a series of brief biographic sketches of men prominent in industrial research in various countries. We are looking forward to continuing the series so as to further the acquaintance of research men with each other.

Ing. Salvador M. A.del Carril,
President, Instituto Nacional de Tecnología Industrial, Buenos Aires, Argentina

Salvador María Ambrosio del Carril is an Argentinian engineer, researcher, lecturer, writer and professor. He has been serving his country since the age of 21 when he joined the Sanitation Works Organization of Argentina. He rose to prominence quickly and at 28 he was appointed Chief of the Laboratory for Testing Materials of his Department. Later he became the first Director of Metallurgical Industries of the Ministry of Commerce and Industry; in 1948 he moved on to the post of Technical Adviser of Private Industries and of the Department of National Industries of Argentina where he carried out research work on cement and concrete. His work in this area resulted in his appointment as Director of a study for the establishment of a cement factory in San Luís, Argentina.

His professional career has been distinguished and honours have been bestowed upon him. At present, in addition to being the Director of Instituto Nacional de Tecnología Industrial (INTI), he is also Director of the Argentine Iron and Steel Organization (SOMISA), Secretary of the Argentinian Committee of the International Association for the Exchange of Students for Technical Experience (IAESTE); and Representative of the Secretary of State for Industry and Mining to the Argentinian Productivity Centre.

His teaching career started in 1935 at the National and Industrial College where he taught for eight years; then he lectured on materials testing at the Faculty of Engineering, first as Assistant Professor and later on as Associate Professor. He resigned in 1959 in order to devote more of his time to his work at the Institute.

Ing. del Carril has taken an active part in the activities of the various national technical institutions. He has participated in the work of the Standards Institute of Argentina (IRAM) and was a member of the Governing Council from 1945 to 1948; he is a founding member of the Argentinian Society for Testing Materials. In 1957, by a resolution of the Ministry of Commerce and Industry, he was commissioned to reorganize the Institute of which he became President in 1958.

He has represented his country with distinction in various international meetings and symposia, among them the XIe Conférence Générale des Poids et Mesures held in Paris in 1960; the Conference "Resources for Tomorrow" held in Montreal, Canada, in 1961; and the United Nations Interregional Seminar on Industrial Research and Development Institutes in Developing Countries, held in Beirut, Lebanon, in 1964.

Ing. del Carril has written many articles on metallurgy and cement technology.

Dr. Norton Young,
Director, Instituto de Investigaciones Tecnológicas, Bogotá, Colombia

Norton Young graduated in chemistry at Colombia National University in 1945. He travelled to the United States to undertake further professional training, first, nutrition

and biochemistry at Yale University, New Haven, Connecticut, then food nutrition at the Massachusetts Institute of Technology, Cambridge, Massachusetts.

He spent eight years at the National Institute of Nutrition of Colombia, where he collaborated with other researchers in the study of the chemical composition of food-stuffs. The results of this project led to the publication of a manual on the nutritional value of Colombian food. A new method of iodizing salt was developed under his direction, more adequate than the rather primitive system of production then in use.

The rapid advancement of his career bears witness to his technical and administrative capabilities. During his ten years of service at the institute, he has held in succession the posts of Chief of Section, New Products Development; Assistant Director and Director.

While at the institute, he has participated in the direction of research projects relating to the improvement of existing processes and the development of new uses for raw materials. Among his most important research projects are: the production and utilization of potato flour; the development of "dividivi" tannins: the potential utilization of coffee as an industrial raw material and the development of protein-enriched food-stuff.

Mr. E. Stanley Hiscocks,
Director, Tropical Products Institute,
London, England

Mr. Edward Stanley Hiscocks earned both a B.Sc. and a M.Sc. with honours at the University of Wales. In 1926 he joined the government service in the Department of Chemistry and then in 1939 was appointed Head of the Technical Branch, Raw Materials Department. In 1944 he was appointed Executive Secretary of the National Physical Laboratory, a post he held until 1957 when he became the Director of the United Kingdom Scientific Mission (North America). While in the Mission he was Scientific Attaché to the British Embassy in Washington, D.C., USA and Scientific Adviser to the United Kingdom High Commissioner in Ottawa, Canada. He returned to London in 1960 to take over the duties of Director of the Tropical Products Institute, Ministry of Overseas Development of the United Kingdom, a non-profit organization which carries out scientific and economic research to improve the production and utilization of the vegetable and animal products of developing countries.

Mr. Hiscocks has had a distinguished career as a diplomat, scientist and administrator; he has travelled extensively in the service of the Institute as well as to attend technical meetings and symposia; he has written many scientific papers and articles on various aspects of the organization and management of scientific research and his book, Laboratory Administration, which was published in both the United Kingdom and the United States is a well-known work in both countries; he has been a Fellow of the Royal Institute of Chemistry since 1935.

In the 1963 Honours List, Mr. E. Stanley Hiscocks was appointed Commander of the Order of the British Empire, a signal honour he very much deserves.

Dr. Canuto G. Manuel,
Commissioner, National Institute of Science and Technology,
Manila, Philippines

Canuto G. Manuel began his collegiate training in science at the University of the Philippines. In 1924 he earned his Bachelor degree in Agriculture. For his graduate degrees he turned to the University of Michigan. His Master of Science degree was awarded in 1929 and the Doctorate in 1932, both degrees in zoology.

The record of positions held testifies to his steadily growing administrative ability. Among these were: Assistant Curator, University of Michigan; Research Assistant, Institute of Fisheries Research, State of Michigan; Technical Assistant, Division of Fisheries, Department of Agriculture and Commerce, Manila; Chief, Division of Zoology, National Museum, Manila; Supervising Scientist, Institute of Science and Technology, Manila. The successful service in these positions has brought him to his present eminence as Commissioner, National Institute of Science and Technology for the Philippines. Dr. Manuel serves also as Chairman, Board of Grants to Inventors; Member of the National Science Development Board;

member UNESCO National Commission of the Philippines and in other science capacities.

The breadth of Dr. Manuel's interests is indicated in his awards list; the President's Gold Star Merit Medal as Outstanding Philippine Scientist; the Gold Medal for Distinguished Service to Philippine Boy Scouts and the Plaque for Outstanding Civic Leadership.

He has kept in touch with world-wide science developments by attendance at many international conferences, such as the American Association for the Advancement of Science, the XIIth UNESCO General Conference in Paris, the United Nations Interregional Seminar on Industrial Research and Development Institutes in Developing Countries in Beirut, the ECAFE-Asian Conference on Industrialization at Bangkok, Thailand.

Dr. Manuel holds membership in many different scientific and civic organizations, thus making his scientific knowledge and executive ability available in many phases of national and international activity.

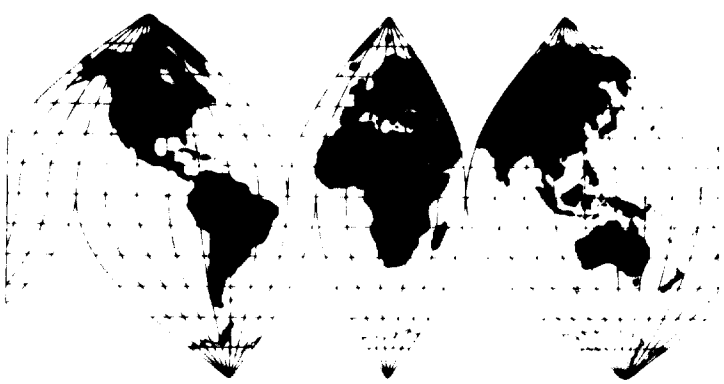
Dr. G. A. Webb,
Director of Administration and Research,
Mellon Institute,
Pittsburgh, USA

Dr. G. A. Webb received his chemical engineering education at the University of Pittsburgh where he earned a B.Sc. in 1934 and a Ph.D. in 1940. In 1934 he served as chemical engineer at the Clairton By-Product Coke Plant of the U.S. Steel Corporation, and then in 1937 he joined Mellon Institute on a Fellowship relating to chlorinated rubber. He next spent 1940-41 with the Firestone Tire and Rubber Company, in charge of basic work on chlorinated and synthetic rubber.

In 1941 Dr. Webb returned to Mellon Institute on a two-year Koppers Company Fellowship that was concerned with the development of a process for making styrene and with other catalytic researches. Transferred to Koppers research organization in 1943 he served in various important capacities in engineering research and development. The wide experience gained in those posts, specially in coordination, and budget preparation and planning, qualified him for the post of manager, planning section, Chemical Division of Koppers Company.

Dr. Webb joined the research directorate of Mellon Institute in February 1956 as Director of Engineering and in August 1957 was appointed Director of Administration, one of the three management divisions of the institute, the other two being scientific research and finance.

Dr. Webb has had a successful career as a researcher and executive in the development of chemical engineering processes in the synthetic organic chemical industry, particularly catalytic operations involving dehydrogenation, chlorination and polymerization, and has had fifteen United States and foreign patents issued to him. He is a specialist in chemical engineering economics. He has published papers on those domains and on counter-current liquid-liquid extractions. He is also a professional engineer in the State of Pennsylvania and a member of the American Chemical Society, American Institute of Chemical Engineers, American Society of Mechanical Engineers, American Society for Engineering Education, Engineering Society of Western Pennsylvania, Pittsburgh Chemists Club, Society of Chemical Industry, American Association for the Advancement of Science, Phi Lambda Upsilon, Sigma Tau, Tau Beta Pi, and Sigma Xi.



Scientific and technological information in the USSR

I. Fundamental considerations

The USSR recognizes that scientific and technical information forms a most important aspect of scientific research, design and production processes. The fundamentals and the major tasks of information agencies have been formulated in a number of State Acts. There exists a basically united, comprehensive and national structure of scientific and technological information whose agencies complement each other. The system is secured by the State Committee for Science and Technology of the Council of Ministers of the USSR.

The basic structural principles of this State-operated system includes: specialization of the agencies based on functional division and increased responsibilities; division of labour at various levels—the national, branch and Republican agencies prepare, publish and disseminate information; the subordinate agencies deal with the utilization of them in scientific research, design and production processes; centralized processing of documental data and publication of bibliography and reference literature on the following subjects: science and technology and their advancement; co-operation between agencies; the role of subordinate agencies; differentiate forms of information; establishment of a system of reference and information service based on a network of co-ordinated reference and information stocks and the availability of a uniform classification system; use of machinery and equipment on information practice; enlistment of scientific and technical personnel and the promotion of a close co-operation between them and other information agencies as well as the various social organizations; the advantages of international co-operation, etc.

A centralized system of scientific and technological information service can best meet the demands that modern science and technology make today.

II. The agencies of scientific and technological information service

The control of the system is vested on the State Committee for Science and Technology with the Council of Ministers of the USSR which incorporates the Department of Scientific and Technological Information and Popularization. Jointly with the Scientific Council on the Problems of Scientific and Technological Information, under the Committee, the Department works out policies and long-range plans for advancement of the system, which includes all-national agencies, branch information agencies, information agencies of the Union Republics and information agencies of research and design institutes and offices and industrial enterprises.

An important part of the agencies of scientific and technological information is the libraries that collect literature on science and technology and which co-operate with the information agencies in the establishment and utilization of reference and information stocks.

Some information agencies are State supported, others meet their expenses by payment for services rendered.

III. General trends and policies

The national institutes of scientific and technological information under centralized control examine the literature, compile and publish bibliographies, abstract periodicals and reviews. The All-Union Institute for Scientific and Technical Information (VINITI), which is the largest information centre, in 1965 published 160 series of abstract periodicals, including abstracts, annotations and bibliography of articles from 17,000 periodicals, on books and paterts from 102 countries in 71 languages. About 700,000 publications are reviewed yearly. Series of abstract periodicals are reviewed yearly. Series of abstract periodicals are regularly provided with indices. Publica-

tions reviewed in the Soviet Union exceed one million a year. Seventy series of weeklies entitled "Express information bulletins" carry up-to-date information on the advancements of science and technology.

The Central Institute of Patent Information publishes descriptions of patents certificates awarded in the USSR; the Bulletin of inventions and trade marks carries brief formulas of inventions. In addition, a great number of translated foreign patents and their abstracts are published and microfilmed from the All-Union Technological and Patent Library stock.

Branch Institutes of Scientific and Technological Information collect, evaluate, classify and disseminate information on the progress of science, technology and manufactures in their respective branch organization and enterprises.

The basic functions of the Institutes of Scientific and Technological Information in the Union Republics are: to evaluate and popularize scientific and technology progress and inventions in manufacturing and technology in the leading branches of the national economy; the practical utilization of these developments; and the supervision of procedures for their application as discussed in all agencies' publications.

Some Republican information institutes are sometimes given "branch information centre status" in regard to their best developed industry. For example, the Information Institute of the Uzbek Republic deals with the problems of raising cotton and sericulture; the Republican Information Institute in Georgia does the same for tea.

The Departments of Scientific and Technological Information perform the following major tasks: participate in research work and design and provide assistance to other departments and laboratories; secure, evaluate and interpret information relevant to their problems; publish and disseminate information; organize the practical utilization of technological advancements; co-ordinate the exchange of experience among the Institute and other related institutions; and popularize the results of research to branch information institutes.

Large and middle-size industrial enterprises have established bureaux of technological information of their own aimed at bringing information materials to specialists and others within the enterprise. Smaller enterprises have part-time information officers assigned to them.

To sum up, all information material prepared and published by all-union and branch information institutes is disseminated by local information agencies established in enterprises and offices.

IV. Agencies for popularizing scientific and technological achievements

The following agencies work closely with the information agencies towards this end: Exhibition of the Achievements of Soviet National Economy is the largest, permanent centre. Nearly 100,000 exhibits are displayed in its 72 pavilions. It features articles manufactured in the country, equipment, etc. It includes seminars, advanced training and related activities; Houses of Popularization of Scientific and Technological Achievement and Technology Rooms carry out activities to popularize scientific and technological advancements, production techniques, inventions, etc. They feature conferences, seminars, consultations, public displays, films, etc.

V. Reference and information servicing

Information agencies assisted by science and technological libraries are setting up reference and information stocks. Reference and information centres are established under all-national and branch information centres to help in the provision of needed information. To avoid duplication, each branch information institute is assigned a topical problem; they provide microfilms, patents descriptions and reports.

Translations are co-ordinated: organizations and enterprises do not start a translation unless the translation co-ordinating centre advises them that the piece has not been translated before or is not being translated. The State Public Library of Science and Technology has a central national stock of translations which are supplied upon request.

All publications and information materials are classified according to the Universal Decimal Classification system (UDC). Co-ordination and methodological guidance on expansion and application of it is provided by the State Science and Technology Committee. Branch information institutes translate and publish branch UDC tables. The Soviet agencies are co-operating with the International Federation of Documentation towards the improvement of the classification system.

VI. Mechanization and automation in the preparation and search for information

The International Federation of Documentation (FID) has set up a special committee to deal with the problems of mechanization and automation in searching for information based on UDC.

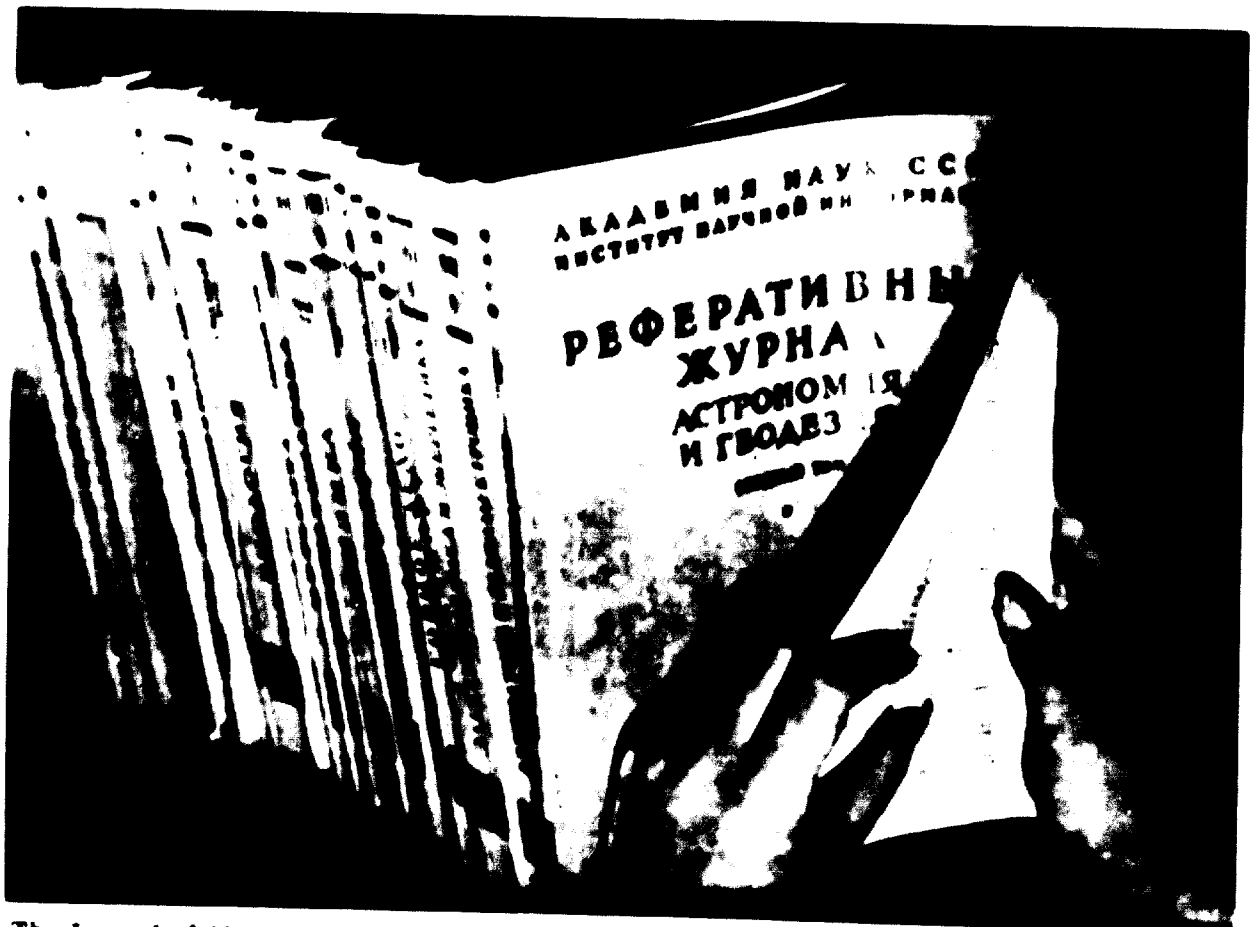
Several Soviet agencies are developing a uniform classification system, index and code system for documental material. They place great importance on problems of mechanization in search as well as on the use of modern communication equipment to speed up its transmission.

VII. Personnel training

Adequate training of information agencies personnel is highly important. The All-Union Institute of Scientific and Technological Information operates permanent training since 1962. About 500 information workers take these courses each year. Those who graduate are invited to lecture at local courses. Short courses are also offered and several higher education establishments train engineers in design and maintenance of machinery for technological and scientific information service as well as those for branch industrial scientific and technological information services.

VIII. Co-operation among the members of the Council of Mutual Economic Assistance (CEMEA)

Co-operation in the exchange of information becomes closer each year. The Permanent Working Group on the problems of scientific and technological information has functioned since 1962. The Group holds meetings twice a year to discuss problems and issue recommendations. A great success was the INFORGA—'65 International Exhibition organized by the Members of CEMEA in May-June 1965 which displayed equipment for mechanization and automation in the preparation and search for information as well as improved engineer and administrative techniques.



The Journal of Abstracts, *a bi-weekly publication of the USSR Institute of Scientific and Technological Information in Moscow, carries in each issue 32,000 annotations on books and articles published all over the world*

Interinstitute co-operation

Interinstitute co-operation may take many forms: it may be accomplished by the exchange of personnel, services, technical advice or materials; by the granting of fellowships to other institutes personnel; by providing institute staff for certain periods of time to other institutes to assist them in setting up a laboratory or a service in a laboratory, to train local technical personnel or to advise on the best way to carry out a particular research project; by accepting visits of other institutes personnel; or by doing a specific piece of problem-solving for an institute unable to do it. Whatever form it takes, such a co-operation would certainly benefit all concerned.

Visits from institute Directors accepted

Dr. P. C. Trussell, Director of the British Columbia Research Council, Vancouver 8, B.C., is prepared to have directors of industrial research institutes, or men intended to hold such posts, from developing countries visit the offices and laboratories for the purpose of becoming acquainted with the routines and practices in handling technical information, contract research and "in-house" research programmes. The Director is prepared to reveal methods of organization of staff and of programmes and to provide information on budgeting, accounting, reporting, contacts with clients, publicity media and all operations involved in the effective functioning of an industrial research institute at the level of about 100 people. It is suggested that visits be from two to three weeks.

The Council will not charge for these visits, but it assumes no obligation for the provision of transportation and living expenses for the visitors.

Editor's Note: This project can be a part of a fellowship programme sponsored by the governments concerned or the United Nations. For further information, contact the Industrial Institutions Section, Centre for Industrial Development, United Nations.

Laboratory equipment and apparatus needed

The Animal Products Section (APS) and the Animal By-Product Utilization Institute of the Bureau of Animal Industry Department of Agriculture and Natural Resources in Manila, Philippines find it difficult at times to pursue or complete within a reasonable time some of the phases of the projects due to lack of some laboratory equipment and apparatus. The time involved in seeking the aid of other research centres causes delay in the performance of the research activities, thus the necessity for equipping the laboratory with apparatus and equipment such as power meat saw; large vertical retort; silent cutter; laboratory size sausage stuffer-linker; furnace for high temperature; analytical balance; torsion balance; incubator; electric range, laboratory size spray drier; pH meter; spectrophotometer and grinding mill.

The institutes also express their earnest desire to obtain fellowships for training abroad.

Fellowships

The Instituto Nacional de Tecnología Industrial in Buenos Aires grants fellowships in Argentina as well as in foreign countries for studies in subjects of potential importance to the technical development of the country. The fellowships which usually last twelve months are granted by the Board of Directors upon the recommendation of the Advisory Committee.

In addition the Institute as a representative in Argentina of the International Association for the Exchange of Students for Technical Experience, IAESTE, helps in obtaining work-study fellowships for foreign technical men to study in Argentina, as well as for Argentinians to acquire technical training in other countries.

To obtain a fellowship the following is done: a request is made to the local IAESTE Committee to study in a specific country; the request is transmitted to the country's Committee which in turn proposes it to a particular enterprise. If the enterprise accepts,

the "fellow" works for that enterprise from a minimum of eight weeks to a maximum of a year. The "fellow" gets a salary according to his capabilities and enough for his living expenses.

At present the Institute is trying to interest a wider sector of the Argentinian industry in taking part in the work-study fellowships programme in an effort to help a greater number of foreign technical men to acquire further training in Argentina.

Requests for information should be addressed to:

The Director
Instituto Nacional de Tecnología Industrial
Libertad 1235
Buenos Aires
Argentina

Provision of experts

The Tropical Products Institute in London receives from time to time requests for the provision of experts for special duties overseas and for help in the improvement of renewable resources, principally tropical plant and animal products.

Some of the requests for provision of experts deal with the following matters: to conduct a particular "on the spot" inquiry into ways of improving processing techniques, to set up a laboratory or an operation in a laboratory, to train local personnel in techniques; and to fill a vacancy in an overseas scientific establishment with one of the Institute's officers.

In addition to the visits on special projects, senior members of the Institute's staff make frequent tours abroad with the object of identifying problems in the developing countries with which the Institute might help; of making the facilities of the Institute more widely known, and of attending meetings in their particular fields of interest.

Research service for government organizations in the developing countries which can be carried out within the Institute's normal work programme is usually undertaken without charge. In cases where a charge has to be made the inquirer is advised accordingly.

Requests should be addressed to:

The Director
Tropical Products Institute
56-62 Gray's Inn Road
London, W.C.1
England

Exchange of information

The Rubber Research Institute of Malaya invites inquiries from rubber producers in Malaysia, Brunei and Nigeria who may require more detailed information applicable to their own special problems. Where it is considered necessary, visits will be made to estates in Malaya when convenient. Visits to estates in other territories are by special arrangement. The only visits for which charges are normally made are those of clone identification inspectors. Interviews should be arranged by letter as members of the senior research and advisory staff are frequently absent on visits to plantations.

Requests should be addressed to:

The Director
Rubber Research Institute of Malaya
Post Office Box 150
Kuala Lumpur
Cable address: Searching, Kuala Lumpur

Exchange of clones

In 1954 an agreement was reached between five rubber research institutes in South-East Asia to exchange promising new clones. Each institute provided each of the others with 20 clones so that each institute received 80 clones.

Under the terms of the original exchange, each institute acted for the others as agent in its own territory, with respect to agreements restricting disposal of these clones to third parties. A new reciprocal arrangement to have immediate effect has now been reached between the following institutes: Institut des Recherches sur le Caoutchouc au Cambodge, Institut au Vietnam (previously known as the I.R.C. Indochine), Rubber Research Institute of Ceylon and Rubber Research Institute of Malaya. The new arrangement provides that the clones shall become "free" clones, i.e., free of restrictions on disposal to third parties irrespective of agreements previously signed, within the territories of Cambodia, Ceylon, Malaysia and Viet-Nam. The original proprietors will reserve the right to dispose of these clones to other countries. When circumstances permit, this new arrangement may be extended to include the other participants in the original exchange.

Research service

The TNO (Applied Scientific Research Organization in the Netherlands), through the appropriate National authorities, has expres-

sed its willingness to co-operate with the United Nations Centre for Industrial Development in the search for possible ways and means to utilize the services of TNO as an aid in solving some of the techno-economic problems facing industry in the developing countries.

Provision of documentation

The National Committee for Science and Technology of the USSR has expressed its readiness to co-operate with the Centre for Industrial Development in supplying reports and other documentation on recent scientific and technical developments pertaining to some technological problems of industry in developing countries: The All-Union Institute for Scientific and Technical Information (VINITI) will take a leading part in this co-operative effort.

Specific needs

The Viet-Nam Rubber Research Institute is in need of personnel and equipment as follows: supporting staff is needed to carry out routine work so that the chiefs of the various services may have freedom to devote all their time to research work; equipment is needed to replace the greater part of present equipment which is at least ten years old. It is contemplated to acquire the following: 1 dynamometer; 1 granulator; 1 laboratory dryer; and divers and sundry instruments for technological testing, e.g. Relaxometer, Curometer, etc.

Industrial Research News requests institutes to participate in the project to promote co-operation by providing information relative to their needs as well as their offers to help other institutes. Please address correspondence to:

Industrial Institutions Section
Technological Division
Centre for Industrial Development
United Nations
New York, N.Y. 10017

NATIONAL CONFERENCE ON INDUSTRIAL RESEARCH

Corporate research and profitability was the theme of the first National Conference on Industrial Research at Purdue University in Lafayette, Indiana, on January 10-11, 1966. The Conference was a joint project of Purdue's Krannert Graduate School of Industrial Administration and Industrial Research. Focal point of the Conference was an examination of the role, growth and management of R and D at four major companies: Westinghouse Electric Corp., B. F. Goodrich Co., Beckman Instruments, Inc. and the Xerox Corp.

Three executives—a representative of top management, the financial officer, and the research director—from each of the companies discussed the contribution of R and D and answered questions posed by special panels and conference attendees.

MALAYSIA CONTEMPLATES THE ESTABLISHMENT OF AN INDUSTRIAL RESEARCH INSTITUTE

The Malaysian Government is at the moment contemplating the recruitment of an Expert Consultant to advise the Ministry of Commerce and Industry on the feasibility of establishing a national institute for industrial and scientific research in Malaysia.

INDUSTRIAL RESEARCH AND DEVELOPMENT ORGANIZATION FOR GHANA

The Government of Ghana is studying the possibility of establishing an industrial research and development organization through which the Ghana Academy of Sciences, the Ministry of Industry, the Ministry of Commerce and the Ghana National Chamber of Commerce will co-operate and co-ordinate their resources to serve the industrial sector.

The role of industrial patents in the transfer of technology to developing countries

"Access to patented and unpatented technological and managerial know-how is essential to economic development and the industrialization of developing countries." This position, which is at the basis of the interest of the United Nations in the field of industrial property, was reaffirmed by the General Assembly in its resolution 2091 (XX) on "Transfer of technology", adopted unanimously at its recent 20th session. That resolution is designed to put the combined efforts of all United Nations bodies concerned behind the important task of making advanced, patented and unpatented, technology available for building up modern enterprises in developing countries.

The General Assembly had become concerned with this problem at its 16th session in 1961. At that session a number of delegations, led by Brazil which also spearheaded this year's resolution, expressed their concern over what they feared were excessive financial burdens involved in securing patent licences from companies in the economically advanced countries. As a result of the discussions at that session, the Assembly adopted resolution 1713 (XVI), on "The role of patents in the transfer of technology to developing countries", in which it requested the Secretary-General to study the issues involved, including specifically (i) the effects of patents on the economy of under-developed countries; (ii) patent legislation in selected developed and under-developed countries; (iii) the characteristics of the patent legislation of under-developed countries in the light of economic development objectives.

In his report on the role of patents in the transfer of technology to developing countries,[1/] the Secretary-General found that the patent system was on balance likely to be beneficial to the advancement of industry in developing countries, provided effective administrative and legislative measures exist to prevent monopoly abuses. On this basis, and in accordance with the results of an inquiry among Member Governments, the Secretary-General found no basis for holding an international conference in order to review the existing international patent structure, a question which had been specifically put to him by the Assembly.

The Secretary-General's report also indicated, however, that the problems arising in connexion with the transfer of advanced technology to developing countries went much beyond the question of patents. In modern industry patents cover only a part of the total technology needed for the industrialization of less developed countries. He therefore urged the development of more effective national and international arrangements for the transfer of the complete package of patented and unpatented technological and managerial know-how which is needed by modern industrial enterprises.

In its conclusions, the Secretary-General's report stated as follows:

> "The analysis presented in this report covers the economic, legal and technical implications of the patent system for the economies of under-developed countries. The basic position from which the problem has been approached was that of the United Nations, i.e. that the economic progress of the under-developed countries is a matter of concern not only to themselves, but also to the world community at large, and that—as stated in General Assembly resolution 1713 (XVI)—'access to knowledge and experience in the field of applied science and technology is essential to accelerate the economic development of under-developed countries and to enlarge the over-all productivity of their economies'.

1/ United Nations, Dept. of Economic and Social Affairs, The Role of Patents in the Transfer of Technology to Developing Countries; report of the Secretary-General. New York, 1964. Doc. E/3861/Rev.1. 95 p. (Sales No.: 65.II.B.1.)

"The issues of patents to nationals and residents is one—though not the only—method at the disposal of Governments of under-developed countries for encouraging and rewarding invention and technical progress. The establishment of patent systems in under-developed countries for nationals and residents, moreover, raises no specific problems, subject to the possible need for technical assistance or pooling arrangements in administering such systems, and the general importance of conserving the scarce scientific manpower for directly productive tasks. In this direction, non-examination systems of patent issue may recommend themselves especially to under-developed countries. The possibility of utilizing international resources for the purpose of examination of patent applications from under-developed countries also clearly suggests itself.

"The real issues revolve around the position of the foreign patentee—and it is with these that resolution 1713 (XVI) on the role of patents in the transfer of technology to under-developed countries is concerned. Where a patent granted to a foreign national is not worked in the under-developed country, there may result artificially high prices of the patented article when imported into the under-developed country, but such high prices may be the result of other factors than the exclusionary monopoly given the patentee. The patent system may thus be an element in the over-all picture of adverse terms of trade for under-developed countries, but its impact is not separably measurable. In this context, it has nothing to do with the balance of payments burden of royalties since no royalties are paid where the patented product is not locally produced. The situation may be eased from the point of view of under-developed countries if the more developed countries operate—as some often do—the patent system in a context of general (especially anti-trust) legislation which serves to reduce or counteract possible misuses of the system for restrictive or price-raising purposes, not only at home but also on operations abroad. The under-developed countries are also in a position to adopt, and many have in fact adopted, measures to control unreasonable prices and other abuses of the patent system.

"Where the patented product or process should be advantageously introduced into the economy of under-developed countries, a number of issues arise. The case where this can be done without the technical co-operation or other resources is the foreign patentee or any other source outside the under-developed country is in practice exceptional; where such a case exists, provisions for compulsory working or licensing will deal with the situation if fairly and effectively administered. This will also be the case where the patent can be worked with such additional foreign know-how and resources as can be acquired from third parties or in the open market. The best course of action by the under-developed country will depend on whether it prefers the patentee to come and work his invention himself (possibly in a joint venture with local enterprise)—provided he is willing to do so on acceptable conditions—or whether it prefers the invention to be worked wholly by nationals. There may be sound economic reasons for either preference in given cases. In spheres of production vital to the national interest and the development of special resources, or to public health, limitations on patentability, or provision for limiting the scope of the patent grant by special working or compulsory licensing in the public interest are natural, as is evidenced by the inclusion of such limitations on the legislation of many countries.

"Where the technical services, management experience and perhaps capital resources as well as other connexions of the foreign patentee himself are essential for the introduction of the patented process in the under-developed country, and cannot be procured elsewhere, his minimum terms and conditions will have to be met in one form or other if it is decided to bring the innovation to the under-developed country. In so far as this can be described as a one-sided relationship and may express itself in undue balance of payments burdens on the under-developed country (or else in undue delays in introducing the new technology), such results are not attributable to the patent system as such, nor is the resulting burden properly measured by the patent royalties.

"The Governments of the developing countries have a legitimate interest in preventing excessive exploitation of their one-sided technological and financial dependence. One such possible method is the screening and control of licence agreements, and avoidance of unduly restrictive features. The world community and the Governments of more developed countries can assist by inducing patentees not to be unduly restrictive in the conditions and terms on which they are

willing to spread technology into underdeveloped countries; a variety of policy measures ranging from domestic compensation of patentees, provision of international funds for this purpose, equivalent investment guarantees and legislation against restrictive practices applying to business operations abroad, could be used for this purpose.

"In its final paragraph, resolution 1713 (XVI) raises the question of the 'advisability of holding an international conference in order to examine the problems regarding the granting, protection and use of patents'. No views on this question have been expressed by any Governments in their replies to the Secretary-General's inquiry. In fact, as pointed out in the report, the problems arising in connexion with the transfer of technology to developing countries go much beyond the operation of national patent systems or the conduct of international patent relations, so that a Conference such as that contemplated in the resolution could only deal with part of the issues. More could be done through the adoption at the national level of appropriate legislative and administrative measures along the lines discussed in the report.

"In the final analysis, the question of patents can be best seen in the broader context of facilitating the transfer of technology, patented and unpatented, to the developing countries, and enhancing the ability of the latter to adapt and use such foreign technology in the implementation of their development programmes. This may be considered as falling within the scope of inquiry of the Advisory Committee on the Application of Science and Technology to Development, established by Economic and Social Council resolution 980 A (XXXVI), to whose attention the analysis presented in this report may usefully be drawn."

The findings of the Secretary-General's study were widely endorsed in the relevant discussions of the Committee for Industrial Development, the United Nations Conference on Trade and Development, the Economic and Social Council and in the recent 20th session of the General Assembly. The Economic and Social Council, in the summer of 1964, adopted resolution 1013 (XXXVII) which followed largely the recommendation of the United Nations Conference on Trade and Development (Recommendation A.IV.26), requesting the Secretary-General "to explore possibilities for adaptation of legislation concerning the transfer of industrial technology to developing countries, generally and in co-operation with the competent international bodies, including United Nations bodies and the Bureau of the International Union for the Protection of Industrial Property .. "

Accordingly, the representatives of the Secretary-General attended as observers the meeting of a Committee of Experts which was convoked in Geneva in October 1964 by the United International Bureaux for the Protection of Intellectual Property (BIRPI) to consider the Bureaux' Draft Model Law for Developing Countries on Inventions. In a note submitted to the meeting by the Secretary-General,[2] special emphasis was placed on the desirability of including in a Model Law alternative provisions to implement different policy objectives, specifically concerning such major issues as compulsory licensing and working of patents, government review of international licence agreements, and the strengthening of the administration of industrial property legislation. Moreover, it has been understood that the Model Law was "intended to serve as a guide or framework, rather than as a text to be adopted uniformly in all countries which would be difficult to devise in view of the wide range of policies and conditions prevailing in different developing countries throughout the world".

The final text of the Model Law[3] incorporates most of the Secretary-General's recommendations which, as stated above, dealt primarily with the following problem areas:

"Working provisions

"Foremost among these provisions may be those serving to assure that inventions protected by patents are actually worked in the country itself whenever this is economically possible and desirable. Patents can serve the aim of advancing the development of national industries and the utilization of the natural resources of developing countries only in so far as they are actually worked in the country.

"There is a variety of mechanisms which governments may use in order to induce actual working: the grant of patents may be conditioned upon a present commitment of production of the invention in the country; a patent which remains unworked for a stated period may be either revoked; or

[2] Ibid.

[3] United International Bureaux for the Protection of Intellectual Property, Model Law for Developing Countries on Inventions, Geneva, 1965. 124 p. BIRPI publication No. 801 (E).

(subject to fair royalty payments) it may be opened to compulsory licensing to others offering to manufacture the product in the country; or it may be opened to public use by the government or private producers; or it may be made subject to automatic lapse upon failure to prove production within a specified period. In those cases where the invention is considered affecting major public interests, e.g., because it affects public health or because it relates to vital sectors of the economy, the law may exclude patentability altogether, as is done in a number of countries.

"The precise policy towards this issue of the working of patents and the choice of mechanisms for the implementation of such policy will be matters for consideration by individual governments when they come to formulate their patent legislation.

"Government review of international licence agreements

"Where patents of foreign nationals are to be licensed for domestic production in the country, governments may—and frequently do—reserve the power to screen the financial terms and other conditions of the licensing agreements. Such a review is chiefly designed to make sure that the contribution to economic development to be derived from patented technology is not outweighed by the costs of securing it—chiefly in terms of royalty payments abroad, high prices to domestic consumers, and restrictive provisions unduly limiting the production and marketing of the domestically produced products. Government review can therefore not be limited to a verification, whether the patentee has exceeded the scope of the rights conferred by the patent, but must extend over the entire context of the licensing agreement.

"It may be noted that in this connexion the Secretary-General's report also points to the measures by which the governments of industrialized countries can contribute to making advanced technological know-how available to developing countries on acceptable terms.

"Administration of industrial property laws

"Whatever substantive provisions may be included in a patent law, their effectiveness will depend in large measure on the provision made for their administration. This involved in the first place the establishment of a Patent Office and the determination of its functions. Perhaps the principal issue raised in this connexion is whether there should be a preliminary examination of patent applications. While such examination would require the availability of extensive technical expertise—which is in limited supply in most developing countries—the grant of patents without examination may impose upon the economy of these countries a substantial burden in the form of higher prices protected by unjustified patent monopolies. This would be the case especially since it is more difficult to uproot invalid patents—e.g., through violations followed by infringement proceedings—than to avoid their registration by a properly administered system of preliminary examination."

Patents as part of over-all technology

Going beyond the question of the role of patents, the Secretary-General's report pointed out in its conclusions that the problems arising in connexion with the transfer of technology to developing countries went much beyond the operation of national patent systems or the conduct of international patent relations, because under existing conditions patents covered only a part of the total technology needed for the industrialization of developing countries. As stated in the report, "In the final analysis, the question of patents can best be seen in the broader context of facilitating the transfer of technology, patented and unpatented, to the developing countries, and enhancing the ability of the latter to adapt and use such foreign technology in the implementation of their development programmes".

Accordingly, the consideration of this subject by United Nations organs, mainly the Advisory Committee on the Application of Science and Technology to Development and the General Assembly no longer centres on patents but extends to the full range of patented and unpatented technological know-how. At its recent fourth session, the Advisory Committee requested the Secretary-General to initiate selected industry and country case studies on the actual experience in the transfer of technology to developing countries, especially through enterprise-to-enterprise arrangements, [4] along the lines recommended in the Secretary-General's report entitled "The role of enterprise-to-enterprise arrangements in the supply of financial, technological and managerial needs of developing countries". [5] This

[4] Advisory Committee on the Application of Science and Technology to Development, record of the fourth session (E/AC.52/R.3/Rev.1), paras. 69-75.

[5] United Nations document E/4035 of 15 June 1965.

report provided a conceptual framework for a systematic evaluation of the enterprise-to-enterprise channel by which much of patented and unpatented technology flows to developing countries. It recommended that further inquiry in this field would comprise (a) empirical study of actual experience of technological growth in selected industries in developing countries; and (b) an attempt to devise principles and criteria for new forms of enterprise-to-enterprise arrangements and relationships which would be appropriate under different circumstances depending especially on the complexity of the technology involved and the level of economic development and entrepreneurship prevailing in a given recipient country.6/

In that connexion, the Advisory Committee also recommended that the Secretary-General examine, in consultation with the United International Bureaux for the Protection of Intellectual Property (BIRPI) and other bodies concerned, "existing and possible measures for reducing the cost to developing countries of securing access to foreign patented and non-patented industrial know-how".7/

Finally, at its 1965 session the General Assembly in its above-mentioned resolution 2091 (XX) on "Transfer of technology", specifically requested the Secretary-General to continue his studies of:

"(a) The adequacy of existing national and international practices for the transfer of patented and unpatented technology to developing countries and the possible development of improved practices, including model clauses;

"(b) National and international action and institutional arrangements, including the systematic collection and dissemination of scientific and technological data and materials, so as to promote the expeditious and effective transfer of technology, especially from private and public industrial enterprises in the developed countries to industrial enterprises in the developing countries;

"(c) The problems encountered, especially by developing countries, in obtaining technical know-how;

"(d) Other measures for specific technical and financial assistance to developing countries in their efforts to secure an increased flow of technological and managerial know-how and to adapt it to their individual needs."

The resolution further requested that the competent international bodies, including United Nations bodies and the Bureau of the International Union for the Protection of Industrial Property, give particular attention to requests from Governments of developing countries for technical assistance in the field of industrial property legislation and administration. In fact, the Director of the United Nations Bureau of Technical Assistance Operations has informed its Resident Representatives that this is another field in which technical assistance in the form of experts and fellowships may be provided.

6/ Ibid., p. 8.

7/ Op. cit., para. 74 (n) (b).

RECENT DIRECTORIES

European research index; a guide to scientific and industrial research in Western Europe. [London] Francis Hodgson [1965] 2 v. It contains the first comprehensive list of research establishments in many countries and covers the research facilities of European industrial firms for the first time. This is the first reference work of its kind to be published in any language. The arrangement is alphabetical by country, within each country, universities, including technical universities, have been separated from the research establishments: research establishments are listed first, in alphabetical order according to the language of the country. In all cases, except for industrial firms which are marked by an asterisk, the title is given in English. Geographical names are also given in English. A comprehensive index is included in volume 2.

Research centre directory 2nd edition, ed. by Archie M. Palmer and A. T. Kruzas. Detroit, Gale Research Co., 1965. $38.00. It lists about 3,000 research units sponsored by about 300 universities and private non-profit organizations in the U.S. and Canada. It includes a subject index, and four other indexes based upon the name of sponsoring institution, geographical area, research unit and research director.

05225

Iron ore: today and tomorrow

JACK R. MILLER

Senior Technical Adviser for the Centre for Industrial Development, United Nations

Five years ago, the United Nations published a series of steel consumption and production forecasts for 1972-1975. An estimated increase in the world ingot steel output from 275 million tons to 630 million between 1955 and 1975 anticipated operating levels in the iron and steel industry that were previously unknown. Many knowledgeable and experienced steel men expressed sincere doubts about the projections. Today we have actual production tonnages for seven years from 1958 to 1964, which may be checked against the estimates of 1959. So far, the forecasts stand up well. Predictions that 1975 ingot production will reach 630 million tons and pig iron 384 million tons are no longer considered outlandish, and the output of 436 million tons of raw steel and 313 million tons of iron attained in 1964, fall close to the predicted growth curves. In fact, new evaluations indicate that it is likely that the 630-million-ton-estimate for steel in 1975, may be low.

The revised figure developed for this article for steel ingots hardly differs from the earlier projection of 630 million tons.[1/] The pig iron estimate, however, has risen from 384 million tons to 486 million and, contrary to what might therefore be expected, there is a downward revision in the required iron ore tonnage from 825 million tons to 780 million. The higher pig iron figure develops mainly because the lower scrap utilisation capability of the oxygen converter has introduced a larger pig iron to steel ingot ratio.[2/] The large over-all difference in iron ore tonnage lies in an increase in average iron content from 47 per cent to 52.2 per cent, due to increased use of pre-treatment techniques, especially pelletizing, that is already established in the industry. Notwithstanding the greater quantity of contained iron in the ores now anticipated for iron-making in 1975, there will be a significant reduction in the bulk of the ore to be handled. This increase in what may be called iron-bearing density in usable ores is one of the dominant consequences of recent events affecting the industry. A direct effect will be a broad reduction in the number and location of suitable high grade ore sources in the future. In 1963 the origins of iron ore, concentrates and agglomerates, were distributed among forty-five countries. Only six of these countries; Liberia, Mauritania and Sierra Leone in Africa and three in Latin America, shipped more than a million tons of ore of 62 per cent grade or better. Exclusive of the USSR, which is a somewhat special case, we may add four more if we lower the Fe level to 60 per cent. The total number of important "high grade" ore producing countries that may be inferred from the 1963 list is thus ten; Brazil, Chile, Peru and Venezuela in Latin America, three in West Africa, Norway and Sweden in Europe, and India.

The forty-five countries which made up the list of iron ore suppliers do not include the development of the reserves of West Australia which has moved ahead during the past few years with unusual speed and scope. The 1963 suppliers also do not reflect possible ore movements from impressive new sources in Africa and South America. In each of these cases, the known inventory of usable iron ore has been increased by additions that may be measured in thousands of millions of tons. Characteristically, the grade of the new ores is around 65 per cent Fe. In one particular instance where this is not the case, enrichment techniques on a large scale will maintain and extend the utility of the huge ore reserves of Canada and the United States. The main iron ore producing centres of the future may thus

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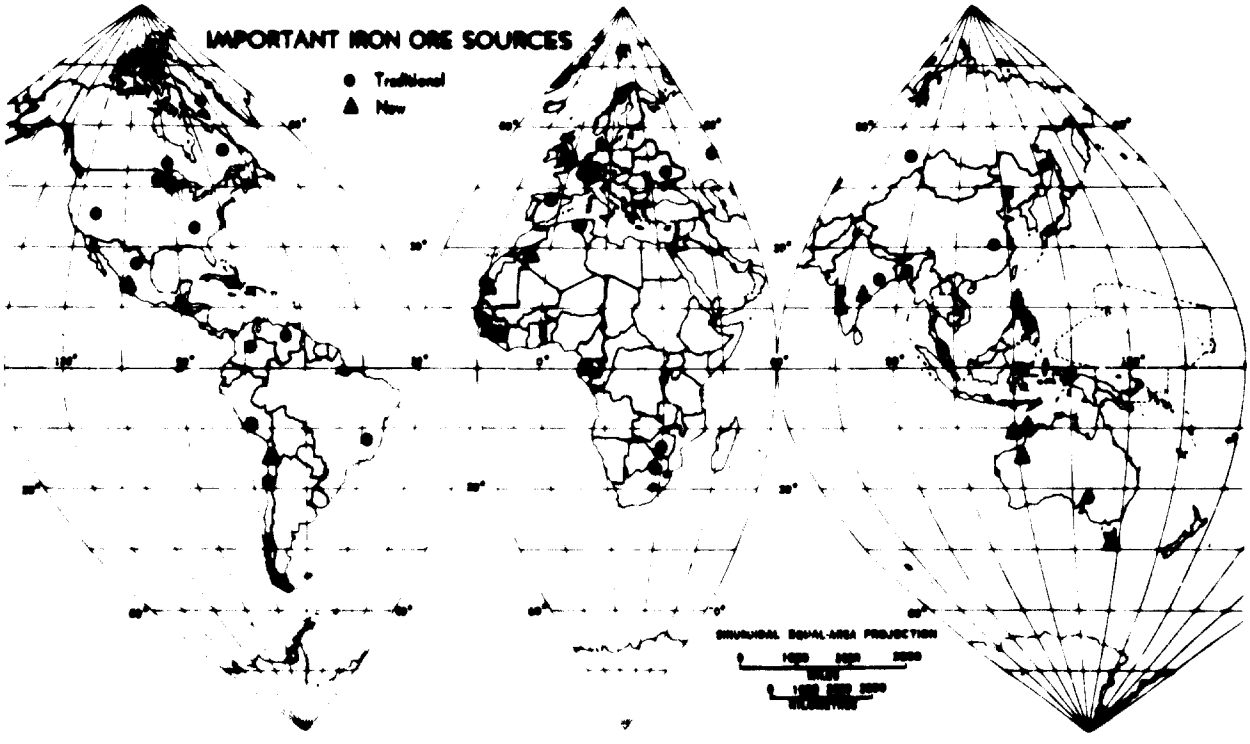
1/ The average of 622 million ingot tons shown in table 2 does not include provision for Mainland China. In the 1959 study there were allowances for this 32 million tons, a quantity which has since been reduced to about 13 million tons.

2/ A pig iron to steel ratio of 0.795 has been used in the calculations for this article.



be expected to be found in Australia, the ten nations already mentioned, and the Soviet Union. They may be conveniently gathered into six groups: Australia, West Africa, South America, the USSR, North-west Europe and North America.

So far as concerns the individual iron ore producers, the bottom is fast falling, if it has not already dropped out of the market for natural run-of-mine ores, because of the more stringent requirements of the major consumers. By 1970, practically all ore consumed by the industrialized countries will be beneficiated. Improved conventional separation practices and flotation methods will be combined to make higher grade products, while commercial applications of novel modifications of electrostatic and magnetic differentiation will be applied widely during the coming decade. Although the use of sinter will continue, the preference for pellets as the most effective form of agglomerated iron ore is already established among all large consumers, and as pelletizing practices advance the use of partial reduction will increase. With these techniques clearly in view and with a steadily rising flow of quality ore into a highly competitive market, the appeal of ordinary grades of unimproved run-of-mine ore has deteriorated rapidly, and will continue to do so. Notwithstanding an increase in the volume of iron ore trade, the present intensive competition may be expected to continue undiminished.

Upgrading of natural ores, even those of moderately rich content, will, therefore, increasingly become common practice for the ore suppliers themselves. Today's blast furnace ores are available in any of four different types: natural run-of-mine material; coarse "improved" run-of-mine grade; sinter or pellets. Tomorrow's burdens will use the same types of ore, but the emphasis will be placed on ever higher degrees of improvement in the form of sinter and pellets, especially the latter. One year ago there was 43 million tons of pelletizing capacity in the world; a year from now this figure will reach 66 million tons, and by 1970 the global pellet plant potential will be close to 100 million tons, and practically all of this pellet production will be directly associated with some ore mining operation. This is even now a fact at most large iron mines in the United States and Canada, in Sweden and at places as far apart as Marcona's San Juan in Peru and Goa in India. New iron ore mining and shipping complexes now under construction in West Australia and in Bailadilla, India, and some recently put into operation, as at Algorrobo in Chile, in Liberia by LAMCO, Brazil by Vale Rio Doce and in the Philippines, are adding pre-treatment facilities and pelletizing units.

Ore preparation activities by iron ore suppliers are being extended beyond the production of regular pellets. For the iron ore purchaser

there is the stimulus of cheaper iron costs. In the production of one million tons of iron annually there may be a total hot metal cost of $1.50 per ton less for a pellet burden than for one with coarse ore; with fluxed pellets the savings may increase to $1.80 per ton; and given pre-reduced pellets, the total difference may be nearly $4.50 per ton of hot metal. For the iron ore supplier, there are the advantages of greater capability to produce and sell higher quality types of iron ore, which represent more than assurance of a competitive position in the market; apparently it is good business also. An investment of $11 million to enable a $41 million regular pellet plant to produce pre-reduced pellets for 1 million tons of liquid iron, may yield an additional earned profit of 8 per cent after taxes, in the United States.

Along such lines of progression, we soon come to the ultimate level of iron ore enrichment by the ore producer, where he becomes a manufacturer of pig iron and later, of steel. The idea is already part of the plans for the new Australian ore deposits; a fully integrated plant at Goa has been one of the important candidates for India's next "big" plant, after Bokaro; a steel operation at Victoria in Brazil, based on Minas Gerais ores, is being urged with striking regularity. Even more decisive than any of these are the steps taken last August by some sixteen neighbouring African countries to establish a West African Iron and Steel Authority. A 700,000 ingot ton integrated iron and steel producing establishment is to be planned, built and managed by the Authority. The plant will be the hub of a subregional complex of iron and steel operations. It will burden a modern blast-furnace plant with high quality ores from Liberia's Nimba deposits which are pre-treated and shipped from Buchanan where, quite naturally, the new plant will be located on a deep water site.

These developments, and others like them, derive from changing technical factors. Increasing requirements for iron and steel impelled the geologist's search for new deposits of iron ore and the metallurgist's inquiry into new and modified procedures for the oxide's conversion to metal. The first provided an abundance of the higher quality ores that were essential for the second's more effective processes. Together, they tend to reduce the usefulness of many traditional iron ore sites. These are being challenged by new sources of great magnitude and unusual richness, and the bearings between iron ore producers and iron ore consumers are being altered. Thus, the impact of changing locational relationships is added to the new technical parameters of the industry.

The new ores are only just now beginning to reach the blast-furnace, and as little as two years ago they had not yet come into the market. The additions to the world's iron ore potential includes the thousand million tons of 58 per cent ore in Tindouf, Algeria; the same quantity in the 65 per cent to 68 per cent deposits of Nimba-Simandou of Guinea; 3 billion tons of ore in Bailadilla, India; huge new deposits located in Northern Chile that may place the iron ore potential of the west side of South America on a par with Brazil's Minas Gerais and Venezuela's Cerro Bolivar. These are only some of the new iron sources that need to be mentioned with the better-known 15 billion tons of West Australia and the equal tonnage in Tasmania. They signal the advent of a modified geography of iron ore that will have to be taken into account for at least the rest of this century.

A preliminary picture of what that new geography can mean may be drawn from table I. The figures for 1975 are estimates of tonnages "available for export" that recognize the considerable commitments of technical skill, investment and time that must be expended in bringing the production of a new deposit to the iron ore consumer. The 1975 export estimates relate closely to projections of steel ingot production for the next decade and, equally so, to known plans for the world's mining and ore treatment capabilities, including current facilities in operation or under construction and new ones still in the planning stage.

Australia is, of course, the new entrant in the field, moving from a zero start to more than 20 million tons in 1975. Africa's potential rise of some 30 million tons originates mainly in the resources of the West African group, especially Liberia and Mauritania. A 12-million-ton increase in Asia may involve a drop in Malaysian shipments and a 16-million-ton lift in India. West Europe remains relatively unchanged, a 10-million-ton advance by Sweden being offset by a like reduction among the Coal and Steel Community countries. The USSR's increased movement of 10 million tons will, as in the past, go almost exclusively to the East European nations.

A striking point which comes out of table I is the magnitude of the increased iron ore supply potential indicated for North and South America. The developments of Australia and

Table I. World exports of iron ore
(In millions of metric tons)

	Recorded exports			Estimated available for export
	1950	1955	1963	1975
	MT-%	MT-%	MT-%	MT-%
North America	4.61-15.4	17.81-26.4	31.28-25.6	60.0-22.8
Incl:				
USA	(2.59- 8.7)	(4.59- 6.7)	(6.95- 5.7)	(7.5- 2.6)
South America	3.71-12.4	13.14-19.5	33.58-27.6	78.1-29.8
Incl:				
Brazil	(.89- 0.3)	(2.57- 3.8)	(8.30- 6.8)	(25.5- 9.7)
Chile	(2.60- 8.7)	(1.24- 1.8)	(7.12- 5.8)	(16.1- 6.1)
Peru	(0)	(1.70- 2.5)	(5.76- 4.8)	(13.0- 5.0)
Venezuela	(0)	(7.24-10.8)	(12.40-10.2)	(23.5- 9.0)
Europe (West)	22.43-49.0 e/	34.82-30.2 e/	45.95-19.7 e/	51.0- 9.9 e/
Incl:				
CECA a/	(7.77- —)	(14.49- —)	(21.85- —)	(25.0- —)
Sweden	(12.94-43.2)	(15.65-25.3)	(20.34-16.7)	(30.0-11.4)
Europe (East)	3.23- 0 e/	8.94- .2 e/	21.09- .2 e/	31.6- .2 e/
Incl:				
USSR b/	(3.23- —)	(8.82- —)	(20.87- —)	(31.0- —)
Africa	5.60-18.6	9.82-14.7	15.60-12.8	47.5-18.1
Incl:				
West Africa	(1.16- 3.9)	(3.77- 5.6)	(10.20- 8.4)	(38.5-14.7)
North Africa	(4.44-14.7)	(5.05- 7.5)	(3.84- 3.2)	(5.0- 1.9)
Asia c/	1.39- 4.6	6.01- 9.0	16.84-13.9	29.4-11.2
Incl:				
India	(.13- 0.4)	(2.84- 4.2)	(7.95- 6.5)	(24.0- 9.2)
Malaysia	(.53- 1.7)	(1.62- 2.4)	(6.71- 5.5)	(2.8- 1.1)
Philippines	(.56- 1.9)	(1.42- 2.1)	(1.47- 1.2)	(1.5- .6)
Oceania	0	0	.30- .2	21.0- 8.0
Incl:				
Australia	(0)	(0)	(0)	(21.0- 8.0)
WORLD TOTAL d/	29.97-100	67.23-100	121.92-100	262.6-100

a/ Mainly internal — i.e., France to Belgium, Luxembourg and West Germany.

b/ Mainly internal — i.e., USSR to East European countries.

c/ Mainland China not included.

d/ Mainland China and "internal" not included.

e/ "Internal" tonnage not included.

West Africa notwithstanding, the possible additions of 45 million tons for South America and 30 million tons for North America could be even more significant.

The problems that the altered iron ore geography may impose on the industry's ore producer are somewhat simplified by the fact that his main customers generally will not have changed. Table II shows them still to be the United States, the Community countries and Great Britain in Europe, and Japan in the Far East. United States production of 150 million ingot tons of steel in 1975 will absorb practically all the country's ore production, and still need some 50 million tons, mostly from Canada and South America. In Western Europe, one third the ores used to produce 130 million tons of steel will come from West Africa. At least half the remaining needs will be filled from the low grade resources of Great Britain and France, with an appreciable drop in the quantity originating in the latter; the balance will be made up by increased deliveries from Sweden, Canada and South America. In the East, Japan's ore imports

Table H. Projections for 1975 ingot steel and pig iron production and iron ore total and import requirements

(In millions of metric tons)

	Ingot production		Estimates for 1975				
			Ingot production	Pig iron production		Iron ore consumption	Iron ore imports
	1965	1964	Range	For steel	Total		
North America	112.5	123.4	153-170	113	124	200	51
Incl:							
USA	(106.4)	(115.1)	(141-155)	(104)	(113)	(182)	(61)
South America	3.5	7.9	18.7-23.5	15	17.5	28	TIS
Europe (West)	79.7	123.9	161-187	123	138	222	123
Incl:							
CECA	(40.4)	(62.8)	(103-115)	(77)	(87)	(139)	(91)
UK	(20.1)	(26.7)	(39- 47)	(30)	(34)	(55)	(32)
Europe (East)	80.5	112.1	115-172	101	121	194	TIS
Incl:							
USSR	(45.3)	(65.0)	(117-130)	(87)	(104)	(167)	TIS
Middle East	.1	.3	2.3- 2.5	1.7	2.0	3	1
Africa	1.7	3.2	7.5-11.5	6.7	8.9	14.5	TIS
Asia	11.2	46.9	72-85	55	65	104	48
Incl:							
Japan	(9.4)	(39.8)	(40-57)	(38)	(42)	(67)	(48)
India	(1.7)	(5.9)	(19.5-23)	(15)	(18.6)	(30)	TIS
Oceania	2.3	5.1	9.5-12.5	7.6	9.6	15.5	TIS
TOTAL 1/	269.5	422.8	579-664	423	486	781	223

TIS = Totally internal supply.

1/ Mainland China not included.

2/ Average 62.2% Fe and providing for 97% utilization factor.

will come increasingly from Australia which will cut sharply, but not completely, into the tonnages shipped from India, Malaysia and South America.

The forecasts of raw steel production in table II change only moderately the anticipations of nearly 10 years ago. We may still, and with a greater sense of assurance, expect a total world ingot output in 1975 of 600 million to 700 million metric tons. The pig iron estimate, pin-pointed a little more closely, has been raised about 20 per cent to 486 million tons of iron. Almost 70 per cent of the nearly 800 million tons of ore consumed in producing that amount of iron will come from indigenous ore sources. The remaining 30 per cent—223 million tons of iron ore grade above 62 per cent Fe—represents a market that is 38 per cent greater than 1964 in terms of tonnage, and 45 per cent larger when expressed in iron values. To meet the demands of that market in 1975, there will be available a total of 262 million tons of ore.

The locational patterns of this supply defines important concentrations in the western parts of Australia and Africa. These will tend to replace lines of iron ore trade that have generally extended east and west, to a flow that is essentially south and north. United States ore consumers already receive the bulk of their imports down from Canada, and up from South America, this will continue and expand. To Europe, ores will move down from Sweden and up from West Africa, the first will be an established activity on an increased scale, while the second is a "new" trend. Similarly, in Japan the main movement of ore imports, tending more and more to come northwardly from Australia, will be "new".

The results of an altered iron ore geography will not come about automatically nor will they necessarily remain fixed. The 40-million-ton excess of available ores will produce and perhaps intensify present competitive relationships of iron ore trade. Such pres-

sures will keep prices of imported iron ores relatively unchanged at best but more likely they will impart a tendency for ore prices to move slightly downward. These same competitive factors will expose opportunities for intermittent reappearances of secondary iron ore movements along traditional paths, east-west from South America, Canada, Sweden and, it must be noted, from Australia, Africa and the United States as well.

"Traditional" iron ore source: mines in the Mesabi Range, USA

"New" iron ore source: Mt. Nimba (Liberia, West Africa)

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Men needed for Special Fund Projects

SPECIAL FUND PROJECT IN COLOMBIA

Institute for Technological Research (IIT) in Bogotá

JOB DESCRIPTION COL-10-SF

Post title: Metallurgical Engineer (Heat Treatment)

Duration: One year

Date required: As soon as possible

Duty station: Bogotá, with travel within the country as required

Duties: Under the over-all guidance of the Chief of Mission, and in co-operation with the staff of the Institute for Technological Research (Instituto de Investigaciones Tecnológicas — IIT), the expert will be expected to

Promote heat treatment of metals by training Colombian counterparts and by participation in industrial seminars.

Study the needs of Colombia and instruct operators at existing facilities on the proper use of heat treatment,

Recommend practices for modifying properties of available metals and foundry castings of ferrous and non-ferrous types, and establish specification for heat-treatment of metals required for manufactured products, tools and dies;

Relate physical properties and metallographic analyses to plant practices, and

Advise and make plans for the possible establishment of a modern metallographic and heat treatment laboratory within the framework of the Institute.

Qualifications: Metallurgical engineer with academic qualifications and extensive practical industrial experience dealing with the various problems concerned in the heat-treatment of metals.

Language: Working knowledge of Spanish desirable, otherwise English essential. French or Italian an asset.

Background information: The IIT was organized in Bogotá in 1955. The Institute is autonomous under the sponsorship of the National Reserve Bank, the National Petroleum Company, the National Federation of Coffee Growers, the Agricultural Loan Bank and the Institute for Industrial Development. It presently has a staff of over 100 of whom half are university graduates and the other half have been trained abroad.

To expand facilities at the IIT for more effective assistance to the country's small and medium-sized industries, the United Nations Special Fund has a four-year Project to provide seventeen man-years of expert service, as well as fellowships and equipment. The food, metallurgical, mechanical, chemical and agricultural processing industries will be aided.

During the first two years of this Project, effective assistance has been given by the Institute's activities to foundries and metal-working industries. Direct in-plant process consultation, as well as plant lay-out and product development, have been combined with general educational seminars. The United Nations Special Fund will provide through this Project the services of a mechanical engineer, a metallurgical engineer and a tool engineer within the next two years.

The Institute has a metallographic equipment and chemical analysis equipment. The expert will be provided with a counterpart who, in addition to academic studies, has been trained for one year at the British Cast Iron Research Association and the British Non-Ferrous Metals Research Association.

SPECIAL FUND PROJECT IN SAUDI ARABIA

Industrial Studies and Development Centre

JOB DESCRIPTION SAU-29-SF

Post title: Industrial Information and Documentation Expert

Duration: One year

Date required: 1 October 1966

Duty station: Riyadh

Duties: The expert will be a member of an international team of experts under the leadership of the project manager and will assist in the establishment of an industrial studies and development centre in Saudi Arabia. Specifically, the expert will be concerned with the setting up of an industrial documentation and information service. In particular, he will be required to assist in

Selecting suitable publications and documents as basic reference material for the library;

Ascertaining the relevant data and information needed by industry and the means through which such information should be channelled;

Devising suitable mechanisms for liaison with, and dissemination of information to industry.

Organizing and operating the service, including the library.

Training counterpart staff in the above duties.

Qualifications: University degree in science, technology or engineering, and wide experience in industrial documentation and dissemination of information.

Language: English essential, Arabic desirable.

Background information: The petroleum industry forms the basis of the economy in Saudi-Arabia and accounts for about 60% of the total Government revenue. However the Government has been intensifying its effort towards greater diversification and increased industrialisation. For the period 1959—1963, the total of earmarkings and expenditures in development projects has risen from $12 million to $134 million. The number of industrial enterprises not related to petroleum and mining now stands at about 500, the average investment in each being about $70,000.

For these reasons the Government intends to establish a Centre capable of formulating a national plan for industrialisation and advising on appropriate policies and programmes and on the implementation of industrial project.

Included in the project will be the planning and construction of a model industrial estate for which the Special Fund will provide the necessary equipment for a small general service workshop. The establishment of this industrial estate will serve as a focal point for future industrial activity, particularly for establishing industries under the most desirable conditions.

SPECIAL FUND PROJECT IN SAUDI ARABIA

Industrial Studies and Development Centre

JOB DESCRIPTION SAU-29-SD

Post title: Chemical Engineer or Industrial Chemist

Duration: One year initially, with possible extension to two years

Date required: 1 July 1966

Duty station: Riyadh

Duties: The expert will be a member of a team of international experts under the leadership of the project manager and will assist him in establishing and initially operating the Industrial Studies and Development Centre, for the purpose of advising the Ministry of Commerce and Industry in the formulation of industrial development plans for the country and their implementation and advising the Central Planning Organization on all matters relating to policies and programmes of industrialization. To this end the expert will be required to

Study the resources, trends of demand and other relevant factors and indicate the specific industries which have development possibilities in the chemical field.

Conduct feasibility studies or, when necessary, prepare terms of reference for such studies to be made by consulting firms on contract, and advise on the assessment and evaluation of projects and their implementation.

Draft specific industrial projects.

Provide general technological council for formulating plans and policies for industrial development.

Advise industry on technological problems.

Train counterpart staff in the above duties.

Qualifications: A university degree in chemical engineering or industrial chemistry and broad experience in conducting surveys and feasibility studies and in the implementation and operation of projects. Knowledge of industrial development problems in developing countries desirable.

Language: English essential, Arabic desirable.

Background information: The petroleum industry forms the basis of the economy in Saudi Arabia and accounts for about 80% of the total Government revenue. However, the Government has been intensifying its effort towards greater diversification and increased industrialization.

For these reasons the Government intends to establish a Centre capable of formulating a national plan for industrialization and advising on appropriate policies and programmes and on the implementation of industrial project.

Included in the project will be the planning and construction of a model industrial estate for which the Special Fund will provide the necessary equipment for a small general service workshop. The establishment of this industrial estate will serve as a focal point for future industrial activity, particularly for establishing industries under the most desirable conditions.

SPECIAL FUND PROJECT IN COLOMBIA

Institute for Technological Research (IIT) in Bogotá

JOB DESCRIPTION COL-10-SE (TARS-10)

Post title: Mechanical Engineer (Tools)

Duration: One year

Date required: As soon as possible after 31 January 1966

Duty station: Bogotá, with travel within the country as required

Duties: Under the over-all guidance of the Project Manager and as a part of a team co-operating with the staff of the Institute for Technological Research (Instituto de Investigaciones Tecnológicas – IIT), the expert is expected to:

Promote tool engineering by training Colombian counterparts and by participation in seminars,

Propose ideas for the use of tools (jigs, fixtures, dies, cutting-tools, gauges, etc.), aiming at lessening the skill requirements from production operator in the production process and, at the same time, increasing the productivity and improving and maintaining the quality of the products,

Adapt these proposals to the production processes in Colombian factories and justify their feasibility by favourable cost estimates,

Assist in the application of these proposals through design, fabrication and try-out of the tools, and

Work out suggestions for the creation and adoption of a unified system of standards for jigs, fixtures, dies, cutting tools, etc., taking local conditions into account.

Qualifications: Tool engineer, preferably with academic training in mechanical engineering or production engineering and substantial industrial experience or with practical industrial experience and responsibility equivalent to such academic training.

Language: Working knowledge of Spanish desirable, otherwise English essential. French or Italian an asset.

Background information: The IIT was organized in Bogotá in 1965. The Institute is autonomous under the sponsorship of the National Reserve Bank, the National Petroleum Company, the National Federation of Coffee Growers, the Agricultural Loan Bank and the Institute of Industrial Development. It presently has a staff of over 100 of whom half are university graduates and the other half have been trained abroad.

To expand facilities at the IIT for more effective assistance to the country's small and medium-sized industries, the United Nations Special Fund has a four-year project to provide seventeen man-years of expert service, as well as fellowships and equipment. The food, metallurgical, mechanical, chemical and agricultural processing industries will be aided.

Industrial research institutes and their activities

Progress through industrial research

Industrial research is helping to quicken the pace of industrial development in many developing countries throughout the world. More developing countries than ever before have established facilities of one kind or another to provide the applied research support that their economies, now undergoing a steady industrial transformation, demand. If the present trend continues, the next several years should witness a manifold increase in industrial research activity in these countries as the reversible relationship of stimulation and counter-stimulation between industry and industrial research gathers momentum.

The bulk of industrial research in developing countries is carried out by industrial research institutes and industry associations. These organizations frequently offer a wide range of services which may be divided into four major classifications as follows:

Research and development, mainly of an applied nature, represents the major activity of most industrial research institutes. Thus the institutes aim at the development of new products or processes, and/or the improvement of existing ones, with a view to commercial exploitation within a reasonable period of time. Basic or exploratory research, when undertaken, is generally on a marginal scale.

Techno-economic services include such activities as feasibility and marketing studies, raw material survey, management and production engineering, productivity improvement and general techno-economic analyses and projections.

General technical services are of particular importance in developing countries since in many of them the average level of industrial experience is relatively low. Research institutes have therefore had to fill the need for technical trouble-shooting, particularly for the benefit of small-scale and medium-scale industries. Other services in this category include quality control, equipment valuation and assistance in the administration of production standards and specifications.

Routine services generally include a programme of industrial information and documentation. Under such a programme many research establishments offer technical inquiry services on a variety of topics as well as general industrial information, technical digest services, training manuals, analyses and testing, assistance in patent development and licensing and in establishing contact with foreign technology.

Following are three reports on industrial research institutes located in India, Israel and the Republic of Viet-Nam which are typical of the role of such institutes in the industrial development programmes of developing countries.

ISRAEL

The Paint Research Association, Haifa

Organization

The Paint Research Association was founded towards the end of 1960, jointly by the Scientific Council of Israel, The Ministry of Commerce and Industry, the TECHNION – Hebrew Institute of Technology – and the paint industry. Its special field is paint research and its activities cover the whole country. Its laboratory is located on one of the TECHNION buildings. Direct contact with TECHNION is ensured by physical as well as intellectual proximity and with other similar organizations at home and abroad by occasional communications and visits.

Research management

The Association is staffed with two chemists, two laboratory assistants and two technical assistants. A recently approved research programme made it possible to add a third chemist to the staff. Generally speaking, there is no demarcation of responsibilities and the staff, working as a group, carry out research and provide services according to their capabilities.

The research programme is proposed by the director of research and is approved by the management before submitting it to the Scientific Council and the Ministry of Commerce and Industry for final consideration and approval. Financial support is provided by grants from one or both agencies, and is conditional upon the scientific survey of the proposed programme and the economic interest in the research planned.

The management is composed of representatives of the paint industry, the Scientific Council and the Ministry of Commerce and Industry. Only management's approval is required for research projects proposed and paid for by industry of other agencies. Research is limited to the field of applied science, with expected short-term results, and problems related to local conditions are preferred.

Membership is limited to industries which have their own laboratories and carry out their own development work. Competition is strong, so that the Association is restrained in its project development and limits itself to those tasks that cannot be undertaken by the members themselves. Within these limits, the research programme has been delineated as follows:

(a) Most important imported raw materials and the correlation between quality and performance of paints made therefrom, e.g. linseed oil,

(b) Local specific conditions in the maintenance of paint coatings, e.g. atmospheric corrosivity in various parts of the country, corrosivity and fouling of sea water in Mediterranean and Red Sea ports, duration of road sign paints;

(c) Adaptation of local chemical products to paint formulation, e.g. Chromefluor complexes;

(d) Research in tropical paint conditions;

All these projects were initially proposed by the Association, later on some of them were taken up by government agencies.

When a research project is proposed a feasibility study is conducted to determine if the laboratory can undertake it, if additional equipment is needed, and if scientific and technical personnel is available. Time allocation is then checked.

The proposal, which is submitted by the research director, states time allocation for each worker and financial requirements. The research director is assisted by a subcommittee of chemists of the member firms, its functions are to screen research projects, to suggest new programmes and to control and assist in the performance of those under way.

Finances

The budget of the Association is composed of:

(a) Annual dues of member industries about 1% from the paint industry turnover, other industries' contribution is determined by the management,

(b) Government agencies research grants,

(c) Government agencies special grants – for laboratory equipment,

(d) Government agencies subsidies – for the first time in 1965-66;

(e) Non-members research fees.

About 85-90% of the budget is earmarked for operating expenses, the remaining 10% is spent on capital expenses. The Association does not own a building.

The budget is submitted to management for approval. Bi-monthly reports are submitted to the Ministry of Commerce and Industry concerning income and expenditure, the Con-

Laboratory for preparation of experimental paints

Weathering properties of paint are evaluated at Paint Exposure Test Station

troller of State audits it from time to time. No cost analysis has been prepared the organization is too small to make it necessary.

Industrial extension services

The Association offers the following industrial extension services:

(a) Research results are communicated to all members. Members' paints are tested along with Association's research projects whenever feasible.

(b) Free consulting service is provided to all members: it is often required for control of failures in application or work of foreign specifications and requirements, of test methods and analysis control, etc.

(c) Quality controls have been set up in different fields—general industrial paints, ship's paints, and others. Quality and composition control is followed up specially for exports of paints and shelfgoods. Checking of raw materials of local and foreign origin is often asked for;

(d) No pilot plant has been set up;

(e) Technical information is disseminated by way of meetings and occasional reports.

Projects being handled

The type of research the Association is conducting has been described under Research Management. Occasionally new products are tested. Feasibility of new processes have been explored. Literature research and laboratory tests are undertaken before advising on the subject.

No economic advisory service is provided, be it on plant location, pilot plants, manufacturing or marketing studies and development of new industries.

Staff training

There are no facilities for educational training of technical staff, and only one apprentice is undergoing training in laboratory work at the moment. The staff is encouraged to read and carry out experiments on their own, under supervision of the chemists. The Association has helped in placing people in member firms, but care has been taken not to induce the staff to leave the Association for other establishments.

REPUBLIC OF VIET-NAM

Institut de recherches sur le caoutchouc au Viet-Nam (Viet-Nam Rubber Research Institute)

Organization

The IRCV specializes in rubber agronomy and technology. Its activities cover south Viet-Nam, where the Hevea brasiliensis grows.

Rubber research policies in the Republic of Viet-Nam can be defined according to their aims and means, taking into consideration the troubled circumstances of today's political situation. In general, it can be said that the results obtained by the larger institutes such as the Rubber Research Institute of Malaya are in the process of being adapted to the scale of conditions in the country's rubber regions.

In addition to activities in the field of agronomy, the Institute undertakes a varied programme in technological research. These activities include the automation of the manufacture of latex to insure the continuous production of rubber (the most important current effort related to the drying phase), the quality control programme affecting the collection, storage and manufacture of rubber, the formulation of standards and the search for new presentation formulas – size, packaging, etc., to fit the manufacturers' needs.

The Institute is composed of four sections: Research, Documentation and Dissemination Services, Management of Experimental Stations, and Administrative and Technical Services (shops).

The chiefs of research services are generally agricultural engineers or chemists. Each of them has a double responsibility: the functioning of a service, which serves all researchers, as far as equipment is concerned, and the carrying out of research in one or several specified subjects.

In the Republic of Viet-Nam, the Institute keeps in special contact with the Centre National de Recherche Scientifique, the Faculty of Science, the technical services of large plantation societies, and the managers of small and medium-sized plantations.

In the international scene, the Institute belongs to the Inter-Rubber Research and Development Board and collaborates closely with other member institutes such as the Rubber Research Institute of Malaya, the Rubber Research Institute of Ceylon, the Institut français du caoutchouc, the Institut de recherches sur le caoutchouc au Cambodge, the Institut de recherches sur le caoutchouc en Afrique, etc.

Financial aspects

The cost of research itself including services such as dissemination and administration, totals approximately 1× 000,000 Viet-Nam dollars 1/ and may be divided as follows:

	Per cent
Capital	10
Supplies	30
Supervisory staff	25
Operating personnel	25
Miscellaneous	10

Industrial extension service

Research results are communicated to technicians by the following manners:

(a) By organizing technical commissions which gather technicians of the various societies and the Institute; these commissions meet to discuss matters of common interest.

(b) By way of publications, such as annual reports, technical pamphlets describing original research results and archives or records listing partial results of research in progress to keep members informed concerning the evolution of research projects.

1/ The Viet-Nam dollar is equivalent to $ U.S. 0.08.

A NEW PROCESS FOR THE PREPARATION OF CRUMB RUBBER

A public meeting was held in the Dewan Bahasa dan Pustaka on 27 November 1964, to disclose the details of a new process for the preparation of crumb rubber. An audience of some 400 members of the plantation industry heard the Director, Dr C. C. Webster and the Head of the Chemical Division, Mr. B. C. Sekhar, introduce the process which stems from original work by Messrs. Sekhar and Chan Peng Sung. Mr. D. J. Graham, who led the development team consisting of Messrs. S. Sethu and Chan Peng Sung, described the present commercial process of mechano-chemical crumbing which reduces latex coagula, cup lumps or tree lace into fine granules, so facilitating rapid drying. The final product is expected to be a uniform, technically specified rubber. Cost of production is expected to compare favourably with sheet and even more favourably with crêpe.

Ore yard crane. Loading iron ore from storage pile for transfer to blast furnace bins in Poland

Ingot teeming. Pouring of molten steel into moulds at Huta Lenina Plant in Poland

INDIA

National Metallurgical Laboratory

Organization

The National Metallurgical Laboratory has specific roles to play in promoting basic and fundamental research in metallurgical subjects and more so in undertaking applied research and pilot plant industrial scale trials for the development of mineral, ferrous and non-ferrous metal industries of India. As such, the research and development themes at the NML are aligned to the industrial growth in mineral and metal fields projected during successive Five-Year Plans; these requirements place a high premium on ingenuity in metallurgical research and development so that it is accepted as an asset to the industrial potential of the country. In this planned and yet dynamic growth of the Indian mineral and metal industries, the active role of the NML has today not only been fully established but also adequately appreciated in an ever-increasing measure. The progress in these fields at the NML has been significant, steady and rewarding.

The National Metallurgical Laboratory was established in 1950 under the aegis of Council of Scientific and Industrial Research, Ministry of Education, Government of India; with the objective of fostering applied and fundamental metallurgical research in India on an organised basis and to serve as a central station for carrying out research and development work on indigenous ores, minerals, refractories, ferrous and non-ferrous metals and alloys etc., in relation to their potential applications in Indian mineral and metal industries, poised for dynamic growth and expansion under the successive Five-Year Plans.

Fundamental and applied research investigations are conducted in the following research divisions and integrated pilot plants set up during the last decade.

Research divisions

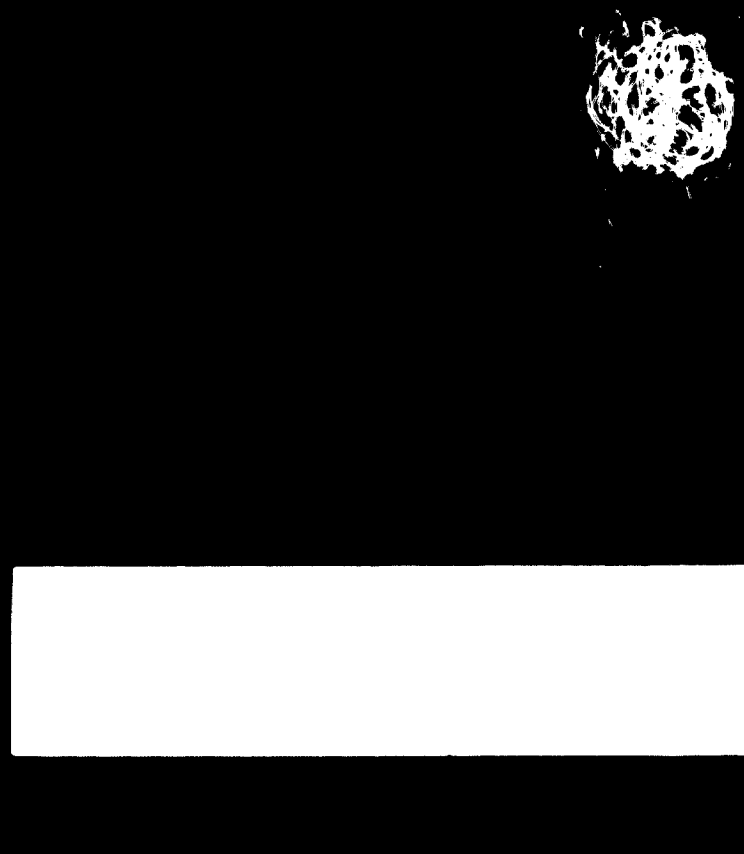
Ore-dressing and Mineral Beneficiation
Low-shaft Furnace Project
Extractive Metallurgy
General Metallurgy
Chemical
Refractories
Mechanical Metallurgy
Physical Metallurgy
Iron and Steel
Alloy Steel
Liaison and Operational Research
Engineering Design
Instrumentation
Electronics
Mechanical, Electrical and Civil Services
Library and Documentation
Statistics, Economics and Project Reports

General themes of research

During the last decade, the National Metallurgical Laboratory has undertaken pioneering research and development work in the various fields of metallurgy. With the changing pattern of the industrialization of the country covering an ever-widening spectrum under successive Five-Year Plans, the research and development programme of the National Metallurgical Laboratory has been "industrial application" oriented, designed to provide the solution to multifarious metallurgical problems in the execution of diverse projects both simple and complex, intriguing and straightforward arising in the wake of dynamic growth of India's mineral and metal industries. In pursuing these objectives, several integrated pilot plants have been designed, fabricated and commissioned at the National Metallurgical Laboratory. Pilot plants relating to the production of foundry grades of pig iron in low-shaft furnace, pneumatic steel-making, aluminising of steel wires and strips, production of indigeneous refractories, production of electrolytic manganese metal and manganese dioxide, beneficiation and sintering of iron ores, production of ferro-alloys in submerged arc electric smelting furnace, production of magnesium metal etc. are today in full-scale operation. In February 1963, an integrated mineral beneficiation pilot plant was commissioned, which is one of the largest anywhere. This pilot plant has a capacity of treating up to five tons of ore per hour depending on the metallurgical flowsheet developed at the National Metallurgical Laboratory. The entire planning layout and engineering of the pilot plant have been done by the staff of the National Metallurgical Laboratory, which since its commissioning has been yielding exceedingly useful results of potential value to mineral and metal industries. In recent years these industries have been increasingly appreciative and ready in accepting the immediate value and long-term benefits of research and development work in their economic pattern of exploitation of indigenous mineral wealth of our country.

Financial status

The entire budget of the laboratory is met from the funds provided by the Government of



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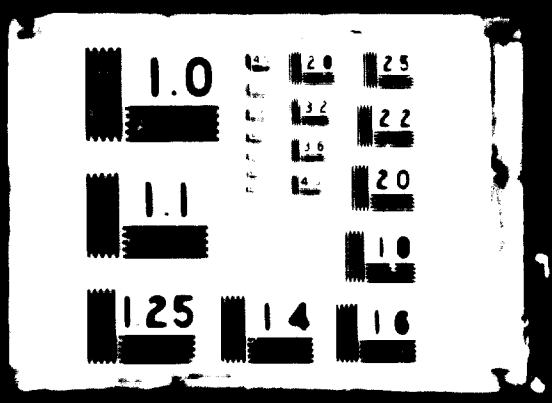


India through the Council of Scientific and Industrial Research. The budget figures of the laboratory for 1964-65 are given below:

(Figures in lakh of rupees a/— 1 lakh = 10^5)

Recurring	Rs.36.384
Capital	Rs. 3.861
Pilot plants	Rs.28.270
Defence project	Rs. 0.641
Staff quarters	Rs. 7.047
	Rs.76.203

a/ Equivalent to $US 0.2101.

Industrial extension services

As metallurgical industries are becoming increasingly conscious of the application of research results, numerous technical problems are being referred to this laboratory in ever-increasing number. These are being effectively handled to increase productivity consistent with quality output of the products made. Technical liaison is effectively maintained with the industry through personal contact and publications brought out by this laboratory such as NML Technical Journal, proceedings of the symposia, monographs embodying the results of long-term projects, preparation of preliminary project reports, Investigation project reports and special reports, periodical press releases on some of the major achievements, popular brochures and bulletins on the processes developed by the laboratory for commercial exploitation of patented processes have proved valuable, collection and dissemination of statistical data, through organizing international symposia on metallurgical subjects of topical value, through field investigations by technical staff of the laboratory at the request of the industries themselves and also at the initiative of the laboratory are important. Technical consultancy services have been enlarged to provide technical assistance on all possible technological problems posed by the industries as also the industrial research and extension work on the processes developed at the National Metallurgical Laboratory.

As a part of extension services, National Metallurgical Laboratory has established Regional Foundry Stations at different parts of the country to help and solve the problem of small and medium scale foundries on the spot. The laboratory has also set up a Marine Corrosion Research Station on the sea-coast of West Bengal to undertake scientific studies on multiple aspects of corrosion under marine conditions.

Projects being handled

During the last decade, the National Metallurgical Laboratory has undertaken pioneering research and development work on both fundamental and applied metallurgical problems relating to indigenous ores and minerals, refractories, ferrous and non-ferrous metals and alloys in relation to their application to India's metal industries. The range of such problems covers a wide field, e.g., development of rationalized ranges of alloy and special steels from indigenous sources; beneficiation of low-grade ores and minerals; development of techniques for the extraction of metals from their ores; production of substitutes for strategic and imported alloys; study on corrosion of metals and its prevention; development of electroplating and metal finishing techniques; production of different types of refractories from indigenous sources; and physics and structure of metals and alloys. Some of the integrated pilot plants installed by the National Metallurgical Laboratory are among the best anywhere, wherein considerable emphasis has been laid on continuous pilot plant investigations and semi-industrial prototype trials with the basic objective of Industrial scale implementation of important researches and processes developed at the National Metallurgical Laboratory based on indigenous techniques and mineral resources. A small sample of the achievements in this direction is discussed below.

Development of substitute alloys

NICKEL-FREE AUSTENITIC CHROMIUM-NITROGEN-MANGANESE-COPPER STAINLESS STEEL

Research and development work on nickel-free austenitic chromium-manganese-nitrogen stainless steel is of basic metallurgical interest and industrial significance. In India, several thousand tons of austenitic stainless steel chiefly in the form of sheets for fabrication into utensils and for chemical uses etc. are being imported at a heavy expenditure of foreign exchange.

Based on totally available indigenous raw materials, the substitute nickel-free stainless steel was successfully developed and produced on a tonnage scale. These steels possess excellent deep drawing properties consistent with high tensile strength and adequate ductility for different fabrications. Industrial trials were successfully made on the manufacture of household utensils by deep drawing and pressing methods. These steels can thus replace the standard 18/8 austentitic stainless steels in a large variety of applications.

MANGANESE-BEARING SUBSTITUTE BRASS

The low production of copper in India due to limited availability of workable deposits of the ore has resulted in import of huge tonnage of the metal to meet the country's requirement. To minimize the use of copper, the National Metallurgical Laboratory has developed substitute brass containing manganese, in which the copper content has been reduced appreciably. Utensils fabricated from this substitute brass have shown properties comparable to those of conventional brass utensils and can be utilized in their place.

Development of magnetic materials

Practically all of a country's requirements of permanent magnets are met largely by imports. The general compositions of the Alni, Alnico and Alcomax type of magnets are well known and can be industrially produced by casting or by powder metallurgical processes. Although the casting is relatively simple, the difficult part is the specialized heat treatment techniques required to confer the optimum magnetic properties. These techniques have been thoroughly studied in the National Metallurgical Laboratory. The laboratory has also developed the barium ferrite type of ceramic magnets. These magnets can be produced from indigenous raw materials and most of the machinery required is also available in India. A unit has been set up in the laboratory to manufacture Alnico, Alni and Alcomax types of permanent magnets so as to meet the requirements of the industries. The process for production of Alnico type permanent magnets developed at the National Metallurgical Laboratory has been released for commercial exploitation.

Mineral beneficiation

With a view to utilizing the low-grade ore deposits of the country to the maximum benefit, the National Metallurgical Laboratory, since its inception, has initiated long-term projects on the beneficiation of different types of low-grade ores and minerals to find their effective commercial utilization. Ores thus treated relate to low-grade iron ores, manganese ores, chromite, copper ore, fluorspar, limestone, graphite, etc. Some examples are given below.

Beneficiation and agglomeration of iron ores

In the mining of iron ores for smelting purposes, the utilization of the ore fines becomes complicated by the Indian weather conditions. It has been the experience of the steel plants that under Indian tropical weather conditions, the screening and handling system becomes completely blinded and choked due to the muddy conditions caused by the tropical rain on the admixture of iron ore fines. The high alumina content of the ore also affects the smelting operation in the blast-furnace. The problems of improving the quality of ores despatched from the mines and also to ensure regular supplies of properly blended and sized ores to steel plants for the production of quality sinter were successfully tackled at National Metallurgical Laboratory. Based on the investigations conducted at NML, the steel plants in public and private sectors are putting up their ore beneficiation and sintering plants.

Beneficiation and agglomeration of low-grade limestone

The quality of the Indian limestone used in steel-making vis-à-vis their silica contents is deteriorating and with these poor grades of limestone, production in the steel plants is adversely affected. It is therefore very essential to beneficiate the limestone so as to reduce its silica content. Comprehensive work on upgrading of limestone for steelmaking was successfully undertaken on pilot plant scale. The use of upgraded limestone in steelmaking promises considerable potential as shown by full-scale steel plant trials conducted in a country's steel plants.

Beneficiation of low-grade manganese ores

The National Metallurgical Laboratory has made a country-wide study on the amenability of low-grade manganese ores to beneficiation. Ore samples from Andhra Pradesh, Maharashtra, Madhya Pradesh, Mysore, Orissa and Rajasthan were investigated. The findings are that the majority of these ores can be upgraded to 48 per cent and above manganese content and can be utilized for ferro-manganese production. The NML also advised a number of State Governments and commercial enterprises in putting up large-scale plants.

Beneficiation of low-grade chromite

With a view to utilizing the country's low-grade chrome ore deposits, extensive work has been conducted on the beneficiation of the chromite ores by ore-dressing and thermal methods. It has, however, not been possible to upgrade the chromite ores to metallurgical grade by ore-dressing methods alone due to the intimate association of iron and chromium in the chrome spinel. However, the beneficiated product can be suitably used for refrac-

tory and chemical industries. By thermal beneficiation techniques, the low-grade chrome ores have been successfully beneficiated to metallurgical grade.

Iron and steel technology

Smelting of iron ore in low-shoft furnoce

In keeping with the policy of the Government to promote a regional distribution of basic industries, alternative methods of iron production utilizing non-coking fuel for reduction purposes are being investigated by the National Metallurgical Laboratory in its 15 tons/day low-shaft furnace pilot plant. Smelting trials conducted so far at the National Metallurgical Laboratory have shown that foundry grade pig iron can be successfully produced using low-shaft furnace smelting technique. On behalf of the State Governments of Andhra Pradesh, East Punjab, Maharashtra and Rajasthan, pilot plant investigations have been completed at the pilot low-shaft furnace, determining the suitabilities of the regional raw materials for the production of foundry grades of pig iron. On the basis of investigation project reports prepared by the National Metallurgical Laboratory, establishment of industrial plants for the production of foundry grades of pig iron is now well on its way in suitable locations. The National Metallurgical Laboratory is now currently engaged in the exhaustive investigation trials on injection of light naphtha in the low-shaft furnace to determine the optimum use of naphtha in relation to the production of iron.

Production of ferro-alloys

With the establishment of alloy, tool and special steel plants in public and private sectors during the Third and Fourth Five-Year-Plan Periods, there will be a great demand for different types of ferro-alloys which, unless produced in the country, have to be imported, thereby entailing an expenditure of a huge amount of foreign exchange. The National Metallurgical Laboratory has, therefore, embarked upon a major research project on the development and production of different types of ferro-alloys suitable under Indian raw-material conditions. The laboratory has developed techniques for alumino-thermic production of different types of ferro-alloys and a considerable quantity of carbon-free ferro-chrome conforming to rigid ordnance specification has been supplied to the Ministry of Defence to meet their requirement. Special ferro-alloys like ferro-titanium, nitrided chrome-manganese, a full range of iron-manganese-chrome alloys etc., have also been successfully produced by alumino-thermic process.

A pilot submerged arc smelting furnace for the production of ferro-alloys of 1-3 tons per day has been installed at the National Metallurgical Laboratory. The furnace is now operated round the clock and high-carbon ferro-chrome has been successfully produced on a tonnage scale for the first time in India. These pioneering studies now being taken up at the National Metallurgical Laboratory will be of basic importance not only for the development of special steels, but also for the setting up of ferro-alloy plants for their commercial production.

Production of steel by L-D process and by side-blown pneumatic process

Pioneering pilot plant studies have been conducted in the National Metallurgical Laboratory in basic lined oxygen and side-blown converters designed and fabricated in the laboratory. Extensive trials have been conducted with Indian pig iron and very useful data have been collected.

Non-ferrous technology

Production of electrolytic manganese metal

Electrolytic manganese metal finds considerable application in the production of nickel-free stainless steel, nickel-free coinage alloys, high and low expansion alloys, etc. There was no commercial production of this metal previously. Extensive laboratory scale investigations had formulated the development of a process for the successful production of metal of 99 per cent purity from low-grade ores and initially a semi-pilot plant of 32 lb/day capacity was set up and electrolytic manganese metal has been successfully produced. A pilot plant for producing 100 lb/day of electrolytic manganese has been installed and full-scale production is under way.

Production of magnesium metal

Magnesium, which is indispensable in the production of light alloys for aircraft and used in metallic form for strategic military requirements, has been produced successfully for the first time in India on laboratory scale in the National Metallurgical Laboratory. The present requirement of this metal is met by import. The National Metallurgical Laboratory has put up a pilot plant to produce magnesium metal (25 lb/day capacity) as well as magnesium powder to meet the requirement of the ordnance factories.

Development of light metal alloys

The National Metallurgical Laboratory has initiated a project in the development of aluminium-based alloys from indigenous raw materials including the use of rare earth group of metals. Binary aluminium-magnesium alloys containing high magnesium (7-10 per cent) do not usually lend themselves to hot-working. Work was done to improve the hot workability of these higher Al-Mg alloys by the addition of rare earth residues such as misch-metal and it was found that alloys containing 7-9 per cent Mg can be made hot working by the addition of 2-3 per cent misch-metal to the alloy melt. The wrought alloys have shown tensile strengths of the order of about 30 tons/sq. inch (47.25 kg/mm) which are comparable to mild steel.

Development of techniques for production of bimetals

With the development of electrical industries in India, the need for bimetal is increasingly felt but the entire requirement is still met by import as its production techniques are closely guarded secrets. Two general purpose bimetals for application up to 200°C have been successfully produced and the material can be manufactured in India with the technical know-how developed at the laboratory which has been released for commercial scale production.

Surface protection and metal finishing

Aluminizing of steel

Aluminized steel is a better corrosion-resistant than the galvanized material. Viewed in this context and also keeping in view that the country's entire requirement of zinc is met by import, the National Metallurgical Laboratory undertook a comprehensive research scheme on the development of suitable techniques for the production of aluminized steel. Extensive work conducted in the laboratory has resulted in the successful formulation of three processes of aluminizing which essentially differ in the types of flux used. To work out the economics of the process and to determine the feasibility of the methods for commercial production, a pilot plant was designed and built in the laboratory and highly successful pilot plant trials were conducted. Samples of aluminized wires produced at the pilot plant were sent to British Iron and Steel Research Association who has reported that the samples were exceptional in quality and set a very high standard. This process has been leased out to as many as twenty-nine firms for commercial production of aluminated steel articles.

Studies on corrosion of metals and alloys

The National Metallurgical Laboratory has, since its inception, been fully alive to the need of metallurgical research on corrosion of metals and alloys and has already done extensive work in the causes and effects of corrosion phenomena. It is also assisting metallurgical industries in defining their corrosion problems, suggesting remedial measures, etc. Long-range research work on the corrosion of metals and alloys under various atmospheric conditions is under way and interesting results have been obtained in certain cases.

The National Metallurgical Laboratory has set up a corrosion research station on the seacoast at Digha in West Bengal to study the various aspects of corrosion under marine atmosphere.

Development of plating techniques

A number of novel plating techniques like plating on aluminium, plating on non-metals, plating of brass from non-cyanide baths etc. have been developed and the technical know-how of the processes were demonstrated to small plating industries who evinced keen interest in the methods. The processes developed have been released free of royalty and premium for the benefit of the plating industries.

Development of refractories

With the steel ingot production reaching the higher targets as formulated under the successive Five-Year Plans, there will be a corresponding rise in the demand for refractories which form the backbone of iron and steel as well as metallurgical, glass and ceramic, cement and kiln brick industries. Refractories are used as lining materials for industrial furnaces and other high temperature operations. A large number of refractory products has been developed utilizing indigenous raw materials. Among the products developed which have considerable scope for industrial scale utilization are:

Magnesite Refractories
Chrome-Magnesite Refractories
Mullite Refractories
Zircon Refractories
Sillimanite Refractories
Forsterite Refractories
Carbon and Clay-bonded Graphite Crucibles

Carbon Refractories
Dense Carbon Aggregate
Submerged Arc Welding Flux

Staff training

Under the various Technical Co-operation Schemes like Colombo Plan, Unesco Fellowship, Indo-French Technical Co-operation Programme, etc., the research staff of the NML are periodically deputed abroad to undergo training on specialized field of metallurgical and allied technology. The services of the trained staff are fully utilized in the laboratory for metallurgical research and development work as well as for the benefit of the industrial complexes of the country.

Development of sponsors for research projects

Whenever a project has reached the stage of commercial exploitation, it is publicized through press and technical notes on the subjects and they are circulated to industries who may be interested in the process. Thereafter, contacts take place in the form of personal discussion, arrangement of practical demonstration furnishing full economics of the process and their utilities. In all such discussion and practical demonstrations, research and liaison staff are deployed. As a result of close contact and co-operation with industries, 22 out of 24 processes developed have been released to industries for commercial production.

The National Metallurgical Laboratory holds a symposium every year on topical metallurgical subjects where scientists, technologists and engineers from all over the world meet and exchange technical know-how on interrelated problems. All the discussions together with the contributed papers are published afterwards in the form of Proceedings which are circulated to scientists and technologists in the field of study.

Textiles. Laboratory technician testing tensile strength of yarn

An experiment in sponsored research in India

Shri Ram Institute for Industrial Research, Delhi, India

INTRODUCTION

Founded by the late Sir Shri Ram, a leading industrialist and philanthropist of the country in the year 1947, this Institute is a non-profit organization dedicated to the development of industrial growth in India through applied research. During the last fifteen years, the Institute has developed a number of products, processes and instruments from which twenty-five are in commercial production. The yearly sales turnover of five such major products alone is of the order of Rs. 90 lakhs.

Notable among these are carboxymethyl cellulose, polyesters, srifirset compounds, polystyrene emulsion paints, organdie, plasti-peel, pine-oil, ethyl ether and plasticizers based on castor oil.

ORGANIZATION

The Institute is managed by a governing body, under the chairmanship of Dr. C. D. Deshmukh, Vice-Chancellor of Delhi University, and is comprised of the Director-General of CSIR, representatives of the Government of India, the Federation of Indian Chambers of Commerce and Industry, and Lala Charat Ram, representing the Shri Ram Scientific and Industrial Research Foundation.

The High Polymer Division and the Textile Division, each headed by an assistant director, are the major units of this Institute. In addition, there is a Miscellaneous Industries Division, a Pilot Plant and Engineering Services Division and a Test House. Staffed on the CSIR pattern, there are over eighty professional scientists and technologists working in this Institute, besides the supporting services for maintenance, administration, accounts, etc.

FINANCES

A substantial part of the Institute's income is derived from sponsored projects. Considerable process/product development work has been entrusted to this Institute by a number of private companies and entrepreneurs. This Institute has also undertaken projects on behalf of various Ministries of the Government of India, PL480 authorities, NRDC and CSIR.

In addition to the Institute's royalty returns, funds are also derived from investment of trust funds (created by the late Sir Shri Ram).

PROJECT ORGANIZATION AND EXECUTION

There are many types of projects in the specified fields of textiles, high polymers and chemicals engaging the research scientists at the Institute. These projects have systematically originated, either as a project proposal from a client (industry, Government, CSIR etc.) or in the Institute itself as a related work to another working project, or as an entirely new research proposal by the research team. A research scheme is prepared, within which the probability of the success of the project is thoroughly examined, the costs are estimated, a research approach is planned, staff are assigned, the duration of the scheme is determined and previous experience of the Institute on similar work is studied. Particular care is taken to prevent clashing of interest with any other sponsor of the Institute.

All research schemes are then submitted to the Screening Committee of the Institute which consists of experts from within and without the Institute. The project is evaluated in all its aspects and modifications are made, if necessary. The scheme is then allotted to one of the divisions, and a research team is appointed with a senior officer as the Project Manager-in-charge and leader of the team. Sometimes there may be more than one officer associated with a single research scheme.

All the projects sponsored by private industry are carried out in strict confidence and the results are made available solely to the sponsors. In the case of self-sponsored, CSIR and NRDC sponsored research projects, all the research work carried out and the processes developed at the Institute are made available to industry for commercial exploitation through the National Research Develop-

ment Corporation of India, Mandi House, New Delhi. All the work carried out at the Institute as far as possible is protected through patents taken in this country and other industrially advanced countries like the UK, USA, France, etc. From time to time, the work is also published in important foreign and Indian journals. The Institute has to its credit about 113 patents and 140 publications to date.

TEXTILE INDUSTRIES DIVISION

The Textile Industries Division is conducting research on different aspects of textile technology. Typical projects are shown below.

(a) Textile processing research

(i) Development of newer sizing compositions and their evaluation.
(ii) Development of novel finishes.
(iii) Development of rot-proofing and water-repellent agents and their application.
(iv) Application of fluidized bed to textile processing.

(b) High tenacity viscose rayons

(i) High tenacity tyre cord yarn.
(ii) High wet modulus textile yarns.

(c) Cellulose research

(i) Moisture relationship in chemically modified cotton.
(ii) Newer cross-linking agents for cellulose.
(iii) Multipurpose finishes.
(iv) Cellulose derivatives.

(d) Dyes, intermediates and auxiliaries

(i) Naphthol AS and other naphthols.
(ii) H-acid and Gamma acid.
(iii) Benzidine.
(iv) Turkey Red Oil.

(e) Textile testing and instrumentation

(i) Impact tear tester.
(ii) Electronic Moisture Meter.
(iii) Electronic Yarn tension meter and recorder.

(f) Wool

(i) Development of anti-shrink processes.
(ii) Canary colouration in wool.

Typical among the products and processes developed are:

1. **Carboxymethyl cellulose**

The know-how to produce this important cellulose derivative has been developed and a (Rs. 10 lakh) plant to produce three to four tons a day has been designed and fabricated indigenously. It has been in continuous production for the last six years.

2. **Organdie finish**

For the first time in India this high quality textile finish was developed and leased out to M/s. Finlay Mills and is in commercial production since 1955.

3. **Srifirlan**

Anti-shrink and anti-felting process leased out to M/s. Universal Dyeing Works, Delhi, makes possible excellent shrinkage control and uniform treatment with a simple plant, and results in excellent knitwear and knitting wool.

4. A whole range of resins for wash and wear finish has been developed and is manufactured in an ever-increasing scale by M/s. Sardesai Bros., Bilimora.

5. **Srifircides**

A series of compounds of excellent antiseptic and rot-proofing efficiency called Srifircides have been developed for treating fabrics for defence and general use. Minimum actinic degradation and maintenance of the feel of the orlginal fabric are attractive features.

6. **Tire cord viscose rayon**

A pilot plant with 90 to 95% indigenous compounds at a remarkably low cost of Rs. 1 lakh has been built and successfully operated to produce tire cord yarn comparable to the best imported varieties.

7. New cross-linking agents for cellulose fabrics which raise the abrasion resistance and tear resistance of the fabrics have been developed to provide excellent base fabrics for wash and wear finishing.

This, when fully developed to a commercial scale, is likely to add a new dimension to existing know-how in this field.

HIGH POLYMER DIVISION

The division specializes in industrial polymers (for the plastics, paint and rubber industries) polymer auxiliaries like plasticizers, fillers, stabilizers, pigments, colours etc., polymer raw materials (monomers and chemi-

cal intermediates for plastics), and polymer applications.

(a) Polyesters

Another process which is successfully competing with foreign know-how is polyesters suitable for laminates and casting. The process developed at the Shri Ram Institute is being commercially exploited by M/s. Rawji Amarsi, Bombay. Polyesters from the basis ingredients for reinforced plastics are badly needed for the country, for the chemical industry, boat building industry, defence purposes, structural uses, and a number of consumer articles.

(b) Polystyrene emulsion paint

This process is under production since 1960 based on indigenous raw materials. This water-thinnable polystyrene emulsion paint is much better suited for Indian conditions and yields an excellent and durable finish. This process is being presently exploited by M/s. Keytuo Chemicals Ltd., Bombay.

(c) Plasticizers for P.V.C.

A series of primary, secondary and polymeric plasticizers have been developed from castor oil. The process has been licensed to M/s. Modern Chemicals, Bombay, and is in commercial production. These plasticizers are superior to conventional ones.

(d) Dibuthyl phthalate

The process for making dibuthyl phthalate was developed at the Shri Ram Institute and is presently being commercially exploited by M/s. N. Nandalal and Co., Bombay.

(e) Bisphenol

The process for making bisphenol, as important raw material for the plastics industry, developed at the Shri Ram Institute is under commercial operation for the last two and a half years. The process is being exploited by M/s. Raghunand Chemicals, Bombay.

(f) Octoic acid

Octoic acid, another important raw material for the plastics industry, has been developed at the Shri Ram Institute on behalf of M/s. General Pigments and Chemical Products, Bombay. The commercial plant has already been built and is going into production in 1965.

(g) Pentaerythritol

Work on this has been completed on a pilot plant scale. The commercial plant is being designed by the licensee M/s. Allied Resins and Chemicals, Calcutta.

(h) Toluene di-isocyanate

Development work on Toluene di-isocyanate was also undertaken by the Shri Ram Institute. This chemical which forms intermediates for rigid and flexible polyurethane foams will be quite interesting to defence. A pilot plant for making this chemical will be set up in collaboration with M/s. U. Foam Private Ltd., Hyderabad.

(i) Ethyl chloride

The process for making ethyl chloride which is yet another important chemical intermediate for making cellulosics has been developed at the Shri Ram Institute. A pilot plant has been set up by M/s. Lyka Labs., Bombay.

(j) ABS plastics

Work on ABS plastics, which are one of the cheapest plastics, has also been undertaken by the Shri Ram Institute. Laboratory work has been completed. The process is likely to be commercially exploited by 1965-66.

(k) Plastipeel

This is a rubbery protective coating for precision parts of machinery during storage and transit, widely used by machinery manufacturers and ordnance. It has been in increasing commercial production by M/s. Plastipeel Corporation, Bombay, for the last four years.

Work on Emulsion Polymerization of Vinyl Chlorlde and the synthesis of a new catalyst to reduce polymerization time has been undertaken.

MISCELLANEOUS INDUSTRIES SECTION

This section has been undertaking work of a miscellaneous nature to serve some of the regional Industries. Quite a few major important projects have been successfully worked out and have been adopted by industry. Mineral Wool or Rock Wool is one of the earliest successful projects. It is a very good insulation material and is used for insulating pipelines in industry, supply lines in cool regions like the hills, in refrigerators and on reaction vessels.

Pilot plant studies on the production of Pine-Oil from Indian Turpentine Oil were carried out at the Institute. The pilot plant turned into the first Pine-Oil factory of India which was inaugurated by Shri Manubhai Shah, Union Minister for Industries, in July 1960, at Hoshiarpur (Punjab).

A process has been developed for the production of glycerophosphates, an important pharmaceutical product, on behalf of M/s. Chowgule and Co. (Hind) Ltd., Bombay. Other successful processes leased out include a process for preparation of ethyl chloride and indelible cloth marking ink etc., dehydrogenation of carene to cymenes on a commercial scale; industrial utilization of trisodium phosphate, an important by-product from Indian Rare Earths.

A process for making puzzolona cement using fluidized bed techniques from different types of clays, is under active study. A prototype pilot plant has been built to standardize optimum processing particulars for different clays.

ENGINEERING SERVICES SECTION

The textile, high polymer and miscellaneous industries research work has been very much facilitated by engineering and other services rendered by this section. It undertakes designing of plants and equipment, supplying their drawings and blueprints, and also fabrication and maintenance of plants.

The Institute has helped the Central Fuel Research Institute in the designing of a semi-commercial production unit for phthalic anhydride, and the National Research Development Corporation of India for designing pilot plants for Pine-Oil, Copper Chlorophyll, refining of cotton seed oil etc.

Units required for the developmental work in connection with the Institute projects viz., Fluidized-Bed for Textile Processing, Viscose Tire Cord Spinning Units, Glycerophosphate, Carboxymethyl Cellulose, Srifirset Compounds, Salicylanilide, Sulphonation of Castor Oil etc., have been designed and built.

The Central Road Research Institute's personnel were assisted in carrying out pilot plant operations for burning special clays in a rotary kiln, at this Institute.

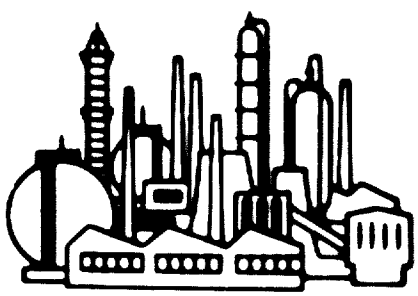
One of the fundamental principles on which the Institute's activities are based is the utilization to the maximum extent of the facilities available in the country for the manufacturing of equipment and the reliance on indigenous sources of materials.

PENTAERYTHRITOL

A pilot plant of 8 kg/day capacity has been constructed and operated successfully. A semi-commercial plant to produce one-half ton per day is now under construction for M/s. Allied Resins and Chemicals Ltd.

TEST HOUSE

This section has been rendering analytical and testing services to regional industries, business houses, insurance companies, Indian Railways, Indian Standards Institution etc. A modern analytical laboratory is being maintained and is used to analyse materials of a diversified nature. These include, to mention a few, food and drinks, water and sewage, minerals and ores, textiles and auxiliaries, paints and varnishes, chemicals and drugs, plastics and fuels, etc. In addition, it is also helping a number of industrial concerns, both small and large, to improve their fuel efficiency, maintenance and operation of water softening units, concentration of caustic liquor, manufacture of refined salts and maintenance of swimming pools by way of their water-analysis.



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Directories

Institutes of industrial research and technology in the Philippines

Compiled by Dr. Canuto G. Manuel, Commissioner,
National Institute of Science and Technology, Manila, Philippines

GOVERNMENT SECTOR

Name and address of research institute (1)	*Name and designation of head of the institute* (2)	*Source of funds* (3)	*Industries served* (4)	*Research programme, project and/or functions* (5)	*Publications on results, reports, etc.* (6)
Abaca Development Board, Manila	Mr. Teodoro de Vera, Chairman-General Manager	Government budget	Abaca, fibre and pulp; handicrafts	Improvement of abaca fibre processing; development of abaca by-products	Annual report
Bureau of Animal Industry, Department of Agriculture and Natural Resource (DANR), Manila	Dr. Anacleto B. Coronel, Director	-do-	Dairy, food processing and preservation; leather	The Animal Utilisation and Dairy Research Division undertakes research on the utilisation and processing food products of animal origin; improvement of animal strains; development of dairy animals; leather technology	*Journal of Animal Industry*; BAI recorder Annual reports
Bureau of Mines, DANR, Manila	Mr. Fermando B. Buenaga, Director	-do-	Mining	Assay laboratory for minerals and mineral products; geological surveys; utilisation and processing of mineral ores; assists in establishment of mineral industries	Mineral News Service Annual reports

Name and address of research institute (1)	*Name and designation of head of the institute (2)*	*Source of funds (3)*	*Industries served (4)*	*Research programme, project and/or functions (5)*	*Publications on results, reports, etc. (6)*
Bureau of Plant Industry; DANR, Manila	Mr. Eugenio Cruz, Director	Government budget	Food processing and preservation	Six Plant Utilisation and Research Units conduct researches on utilisation, processing and preservation of food products of plant origin; improvement of food crops yield; agricultural engineering	Philippine Journal of Agriculture; BPI Digest; Annual reports
Fisheries Commission, DANR, Quezon City	Atty. Arsenio N. Robles, Commissioner	-do-	Food processing and canning (aquatic products); deep-sea fishing	Fisheries technology; researches on utilisation, processing and canning of food products from marine sources; economic limnology	Philippine Fisheries Yearbook
Forest Products Research Institute, Los Banos, Laguna	Mr. Manuel R. Monsalud, Director	-do-	Wood and other forest products; pulp and paper	Research on better utilisation and processing of wood species; industrial utilisation of wood wastes, like pulp and paper, insulating boards, plywoods, etc.	Forest Products Technical Notes; Annual reports
National Development Company (NDC), Manila	Mr. Jose Pangalinan, General Manager	Gov't is major stockholder; small portion of capital stock owned by private investors	Variety of industries	Six technical departments conduct industrial research and product and process development on basecrements, industrial fuels, rice and corn oil extraction, food canning, fertilizers, pulp and paper, cassava flour products, cements and other non-metallic products, construction materials, etc. Development and survey results are bases of investments by private sectors	-do- Sectoral Techno-Economic Evaluation Reports

Name and address of research institute (1)	*Name and designation of head of the institute (2)*	*Source of funds (3)*	*Industries served (4)*	*Research programme, project and/or functions (5)*	*Publications on results, reports, etc. (6)*
National Institute of Science and Technology (NIST), Manila	Dr. Canuto G. Manuel, Commissioner	Government budget	All types of industries	Research and development activities aimed at establishment of new industries and improvement of existing ones (primary and secondary industries); product and process development using local raw materials and industrial wastes; tests and standardization of products and materials; scientific instruments repair, fabrication and calibration; design and operation of pilot plants; ceramics; plastics; coconut technology; physics and electronics; vegetable oils; food products; fermentation products; antibiotics; etc. Its technical operating units are: (a) Industrial Research Centre-Chemical and Engineering Laboratories; (b) Food and Nutrition Research Centre; (c) Medical Research Centre; (d) Biological Research Centre; (e) Agricultural Research Centre; (f) Tests and Standards Laboratories; (g) Scientific Instrumentation and Technical Services Division and (h) Scientific Documentation and Library Division for technical information and consultation	Philippine Journal of Science; Philippine Abstracts; NIST Newsletter; Annual reports

Name and address of research institute (1)	*Name and designation of head of the institute* (2)	*Source of funds* (3)	*Industries served* (4)	*Research programme, project and/or functions* (5)	*Publications on results, reports, etc.* (6)
National Cottage Industries Development Authority (NACIDA) Manila	Mr. Jovito Rivera, Administrator	Government budget	Cottage (handicraft) industries	Improvement and standardization of quality of products locally produced in regional cottage industry centres	Annual reports
Philippines Atomic Energy Commission (PAEC),[b] Manila	Mr. Pedro G. Afable, Acting Commissioner	-do-	Variety of industries (including agriculture and medicine)	Researches on the production and utilization of different kinds of radioisotopes for use in various industries, including agriculture and medicine, aimed at improvement or development of the social and economic status of the country; physics and electronics, etc.	-do-
Philippine Coconut Administration (PHILCOA), Quezon City	Mr. Bienvenido Marques, Chairman-General Manager	-do-	Coconut (copra) coir, etc.	Improvement and standardization of copra and coco coir through better processing; utilization of coconut by-products	Coco News Annual reports
Philippine Sugar Institute, Manila	Mr. Marciano A. Dizon, General Manager	Cess tax from sugar planters and producers	Sugar; pulp and paper	Researches on improvement of cane yield; sugar refining; utilization of sugar cane wastes for industrial products, etc.	Philsugin Quarterly; Annual reports
Philippine Tobacco Administration, Quezon City	Atty. José Abalos, General Manager	Government budget and cess tax from tobacco planters	Tobacco and by-products	Utilization and development of tobacco by-products and wastes; improvement and standardization of leaf quality and crop yield; cigar and cigarette blending	-do- Philippine Tobacco Review

[a] Implementing research agency on all non-nuclear sciences of the National Science Development Board.

[b] Implementing research agency on nuclear science of the National Science Development Board; PAEC operates the Philippine Atomic Research Centre and Reactor located in Quezon City.

Name and address of research institute (1)	*Name and designation of head of the institute* (2)	*Source of funds* (3)	*Industries served* (4)	*Research programme, project and/or functions* (5)	*Publications on results, reports, etc.* (6)
Atlas Consolidated Mining and Development Company, Manila and Cebu	Mr. José Soriano, President	Private funds	Mining; fertilizers	Product and process development in ore-dressing (copper and iron) and in fertilizer formulation, and utilization; quality control; Market Research and Development (MR and D)	*Note:* R and D results and technical reports of private industrial laboratories are not released to public but for their own use
A. T. Suaco and Company, Manila	Dr. Angel T. Suaco, President	-do-	Drugs and pharmaceutical	Products and process development in the manufacture of pharmaceuticals and use of local materials; quality control; MR and D	-do-
Cia Cellulosa de Filipinas, c/o Tabacalera, Manila	Mr. Ramon Barrata, President	-do-	Pulp and paper	Utilization and processing of pulp and paper from sugar cane bagasse; MR and D	-do-
Delta Manufacturing Corp., Pasig, Rizal	Mr. James Huange, General Manager	-do-	Meat processing and canning	New product and process development (pork and beef canning); utilization of animal by-products and waste of meat canning plant; product quality control; MR and D	-do-
Elizalde and Company, Manila	Mr. Manuel Elizalde, President	-do-	Paint, hemp rope; iron and steel; mining	Product and process development and improvement and quality control of company's product; MR and D	-do-
Esso Standard (Philippines) Manila	Mr. G. H. White, General Manager	-do-	Gasoline refining; petrochemicals; chemicals	Product and process development in the petroleum and fertilizer industries; quality control and analysis of products and by-products; MR and D	-do-

Name and address of research institute (1)	*Name and designation of head of the institute (2)*	*Source of funds (3)*	*Industries served (4)*	*Research programme, project and/or functions (5)*	*Publications on results, reports, etc. (6)*
Franklin Baker Co., San Pablo City, Laguna	Mr. Russell L. Miller, President and General Manager	Private funds	Coconut	Development of coconut by-products; improvement of quality of desiccated coconut and other coco food products; MR and D	-do-
Grassland Farms Incorporated, Sta. Maria, Bulacan	Mr. Vicenter Araneta, President	-do-	Dairy	Dairy cattle breeding development of cattle feeds; product quality control; milk bottling; MR and D	-do-
H. G. Henares and Sons, Inc. Pasay City	Mr. Hilarion Menares, Sr., President	-do-	Paint, office supplies	Product and process development and quality control in paints, pencils, crayons, carbon paper, etc.	-do-
International Chemical Industries, Guiguinto, Bulacan		-do-	Chemical	R and D activities in the processing and production of various industrial chemicals and derivatives, also for synthetic detergents; MR and D	-do-
Liberty Flour Mills, Inc. Mandaluyong, Rizal	Mr. Felix Maramba, President	-do-	Food processing; flour milling and baking	Development of new bakery food products; utilization of milling by-products; quality control; MR and D	-do-
Marcelo Enterprises, Northern Hills, Malabon, Rizal	Mr. José P. Marcelo, President	-do-	Fertilizer; iron and steel; rubber products; agricultural chemicals	New products and process development in all its lines of manufacture; product quality control; agricultural chemical and liquid fertilizer; MR and D	-do-
Peter Paul Philippines Corporation, Candelaria, Quezon Province	Mr. Virgil Murray, General Manager	-do-	Coconut	Industrial/commercial utilization and development of coconut by-products; MR and D	-do-

Name and address of research institute (1)	*Name and designation of head of the institute (2)*	*Source of funds (3)*	*Industries served (4)*	*Research programme, project and/or functions (5)*	*Publications on results, reports, etc. (6)*
Metro Laboratories Inc. Makati, Rizal	Mr. Juan Pla, General Manager	Private funds	Drugs and pharmaceuticals	Products and process development or improvement, especially on the use of local materials; quality control of drug products; MR and D	*Note:* R and D results and technical reports of private industrial laboratories are not released to public but for their own use
Philippine Electrical Manufacturing Co. (PEMCO) Makati, Rizal	Mr. Delbert Hamilton, Plant Manager	-do-	Electrical lighting and appliances	Product and process development; improvement and quality control	-do-
Philippine Packing Corp., Manila	Mr. Calvin Crawford, President	-do-	Food (fruit) processing and canning	Product and process development and improvement especially pineapple canning and by-products; quality control; MR and D	-do-
Philippine Refining Company, Manila	E. A. Griffiths, Vice-President and General Manager	-do-	Vegetable oil refining	Product and process development regarding coconut oil and by-products; quality control; MR and D	-do-
Philippine Standard Sanitary Ware Company, Pasig, Rizal	Mr. Ernesto Iagdameo, President	-do-	Ceramics	Product and process development in the manufacture of plumbing and other sanitary wares from local ceramic raw materials; MR and D	-do-
Procter and Gamble Philippines Co. Manila	Mr. Williams Petty, President	-do-	Vegetable oil refining	Product and process development and quality control especially in coconut oil and its by-products; MR and D	-do-
Republic Flour Mills Inc., Pasig, Rizal	Mr. José Concepcion, Jr., President	-do-	Wheat flour milling and baking	Development of new bakery products; utilization of milling by-products; MR and D	-do-

Name and address of research institute (1)	*Name and designation of head of the institute (2)*	*Source of funds (3)*	*Industries served (4)*	*Research programme, project and/or functions (5)*	*Publications on results, reports, etc. (6)*
San Miguel Corp., Manila	Mr. José Soriano, Chairman	Private funds	Glass, brewery, frozen dairy products, animal feeds	Products and process development, improvement and quality control in all its lines of production, MR and D	*Note:* R and D results and technical reports of private industrial laboratories are not released to public but for their own use
Shell Chemical Co., Manila	Mr. L. S. Dawson, General Manager	-do-	Agricultural and industrial chemical gasoline refining	Product and process development on petro-chemicals; quality control laboratories; MR and D	-do-
Superior Gas and Equipment Co., Mandaluyong, Rizal	Mr. Dominador Tiocijo, President	-do-	Gas fuel; industrial chemicals	Product and process development on industrial gases and chemicals like CO_2, O_2, HCl, H_2SO_4, Chlorine, etc. MR and D	-do-

Organizational patterns of industrial research institutes

The following organizational outlines show how two research institutes have developed to meet the widely different needs of their countries. We present them as a possible basis for institute planning.

REPUBLIC OF KOREA

Kyung Pook Provincial Industrial Testing Laboratory, Taegu

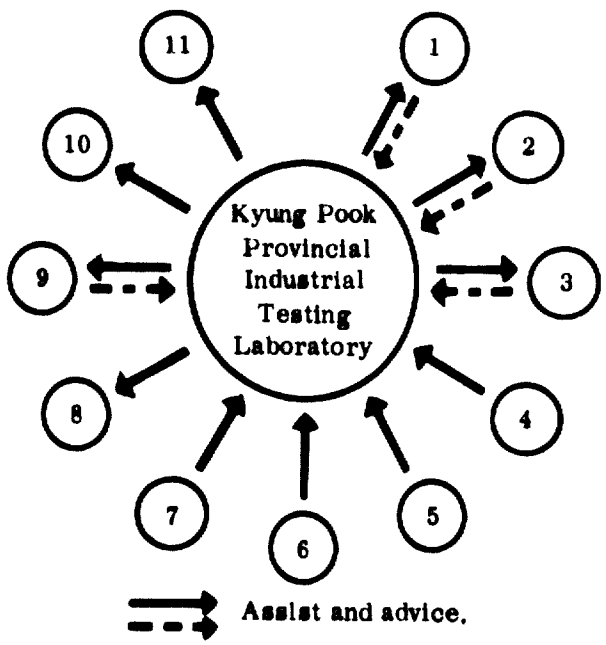
Organization

The Kyung Pook Provincial Industrial Testing Laboratory was established under the Kyung Sang Pook Do (Provincial Office) to provide the following services to Government and industry: analysis, improvement of products, technical advice, assistance on the development of industrial techniques, and testing of industrial products with the view to ensuring their compliance with Korean standards.

The main purpose is to develop a prosperous regional society and to help in the establishment of a self-supporting economy through the promotion of quality products.

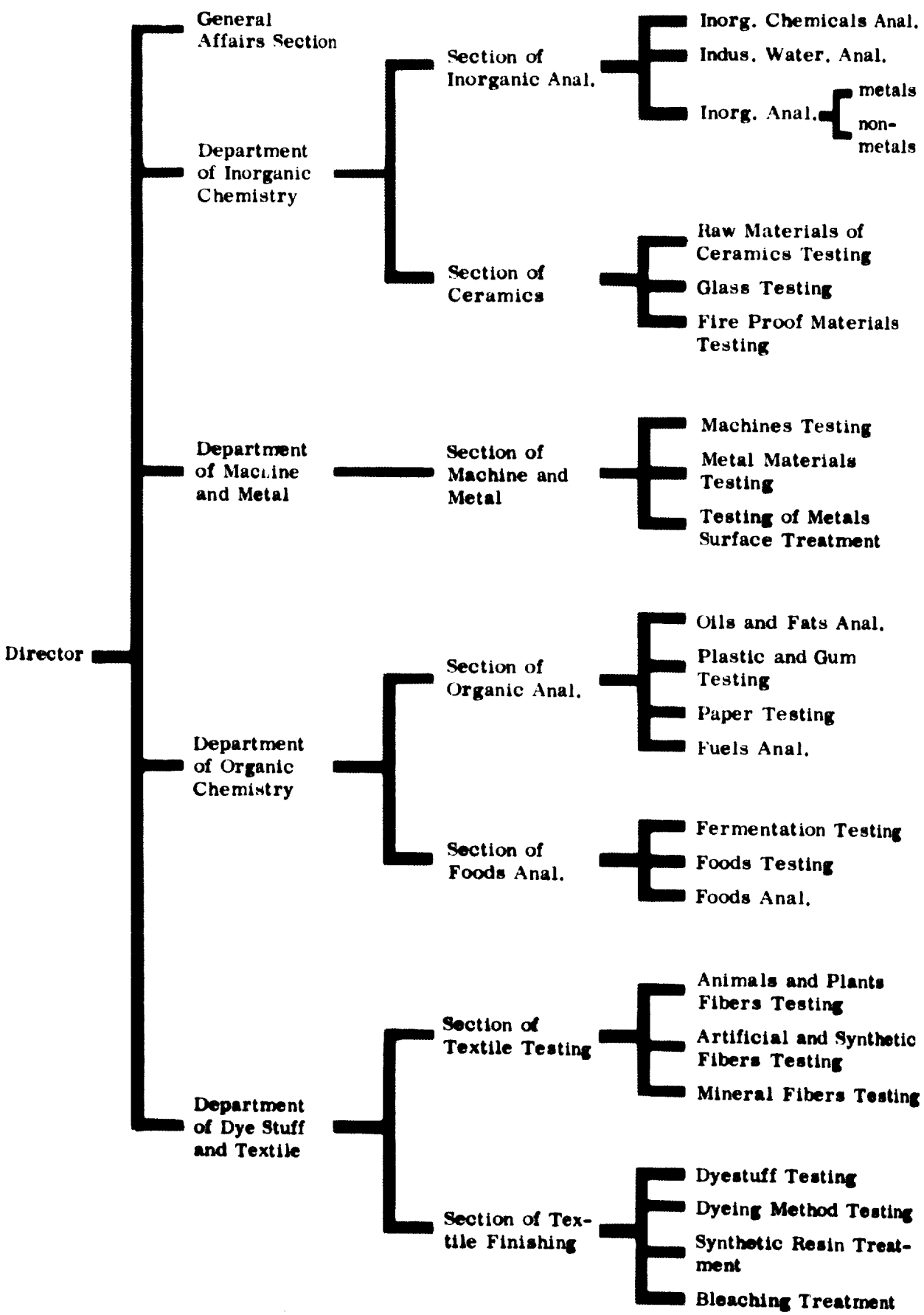
Co-operation with other institutions

The laboratory co-operates closely with universities, colleges, other research institutions, government-controlled companies and small and medium-size private industrial enterprises. The following diagram illustrates this co-operation:



(1) Kyung Pook National University
(2) Taegu College
(3) Chung Ku College
(4) Atomic Energy Research Institute
(5) National Industrial Research Institute
(6) Geological Survey of Korea
(7) Research Institute for Mining and Metallurgy
(8) Minor Enterprisers
(9) Air Materials Department Command
(10) Kyung Pook Engineering High School
(11) Taegu Engineering High School

Organization



Research management

Studies and surveys of water for industrial uses are carried out twice a month in order to improve the quality of the products. After the tests and analysis, advisory service is provided to the various industries utilizing such water.

Financial status

The laboratory is Government-sponsored. Its annual budget is 10,424,160 won.1/

Industrial extension services

In pursuit of the Government export promotion programme, the laboratory provides its personnel to manufacturing enterprises which manufacture goods for export. Seminars and meetings are held to disseminate the results of research projects among the staff, experts and professors. Laboratory facilities are open to students and technicians who wish to widen their technical knowledge at vacation time.

Staff training

Two staff members are sent each year, at Government expense, to specialized institutes to undertake special training.

THE NETHERLANDS

TNO—Applied Scientific Research

Under a Netherlands Act, which came into operation in 1932, the Central Organization for Applied Scientific Research started its activities. This organization became known as TNO, which is an abbreviation of Toegepast Natuurwetenschappelijk Onderzoek (Applied Scientific Research).

As the Netherlands Government wanted to stimulate applied scientific research throughout the Netherlands community, it gave TNO an independent position, although on the different TNO boards the Government is represented along with representatives from science and representatives of specific sectors of the community. The Government finances the capital costs of TNO and a part of the operating budget. TNO is a non-profit organization.

The Central Organization of TNO performs its functions for a considerable part through Branch Organizations, whose activities are co-ordinated by it.

The following Branch Organizations form part of TNO today:

The Organization for Industrial Research, TNO (since 1934);
The Organization for Nutrition and Food Research, TNO (since 1940);
The National Defence Research Organization, TNO (since 1946);
The Organization for Health Research, TNO (since 1949).

The Central Organization and the Branch Organizations carry out their research and directly related tasks through research institutes, departments, committees, etc., as indicated in the chart of the Organization, TNO below.

Over-all management and a number of administrative functions are concentrated in the Head Office of TNO, Koningskade 12, The Hague. The separate institutes or departments have, however, enough freedom of action to ensure that assigned tasks are carried out in the best possible way. The majority of the institutes are concentrated in The Hague area. The total number of TNO employees is about 3,500 at the moment. About 1,600 of these serve the institutes of the Organization for Industrial Research, TNO, listed in the chart below.

About 50 per cent of the operating budget of the Organization for Industrial Research TNO derives from industry as payment for contract research, analysis and testing of materials, contributions to co-operative research programmes carried out by TNO for industrial groups, etc. The other 50 per cent supplied by the Government serves to finance activities directed at giving information to industry regarding technological advances, to finance new research projects and to finance the TNO contribution to co-operative research projects.

In the case of contract research for Netherlands sponsors, the sponsors, as a rule, become the exclusive owners of all results of direct interest to them. Under certain conditions this also applies to non-Netherlands sponsors or a group of non-Netherlands and Netherlands sponsors.

Committees, institutes, etc., belonging to the Central Organization and the Organization for Industrial Research not included in the Condensed Chart on page 69

Central Organization, TNO

Committee for Hydrological Research, TNO
Committee for Fishery Research, TNO
Committee for Industrial Air Poliution, TNO

1/ The Korean won is equivalent to $US 0.0078.

Centre for Radiobiology and Radiation Protection, TNO

National Council for Agricultural Research, TNO [2/]

Organization for Industrial Research, TNO

Netherlands Ship Model Basin

Netherlands Research Centre, TNO, for Shipbuilding and Navigation

Metrological Institute, Bemetel-TNO

Committee for Agricultural Industries, TNO:
Experiment Station for the Utilization of Potatoes

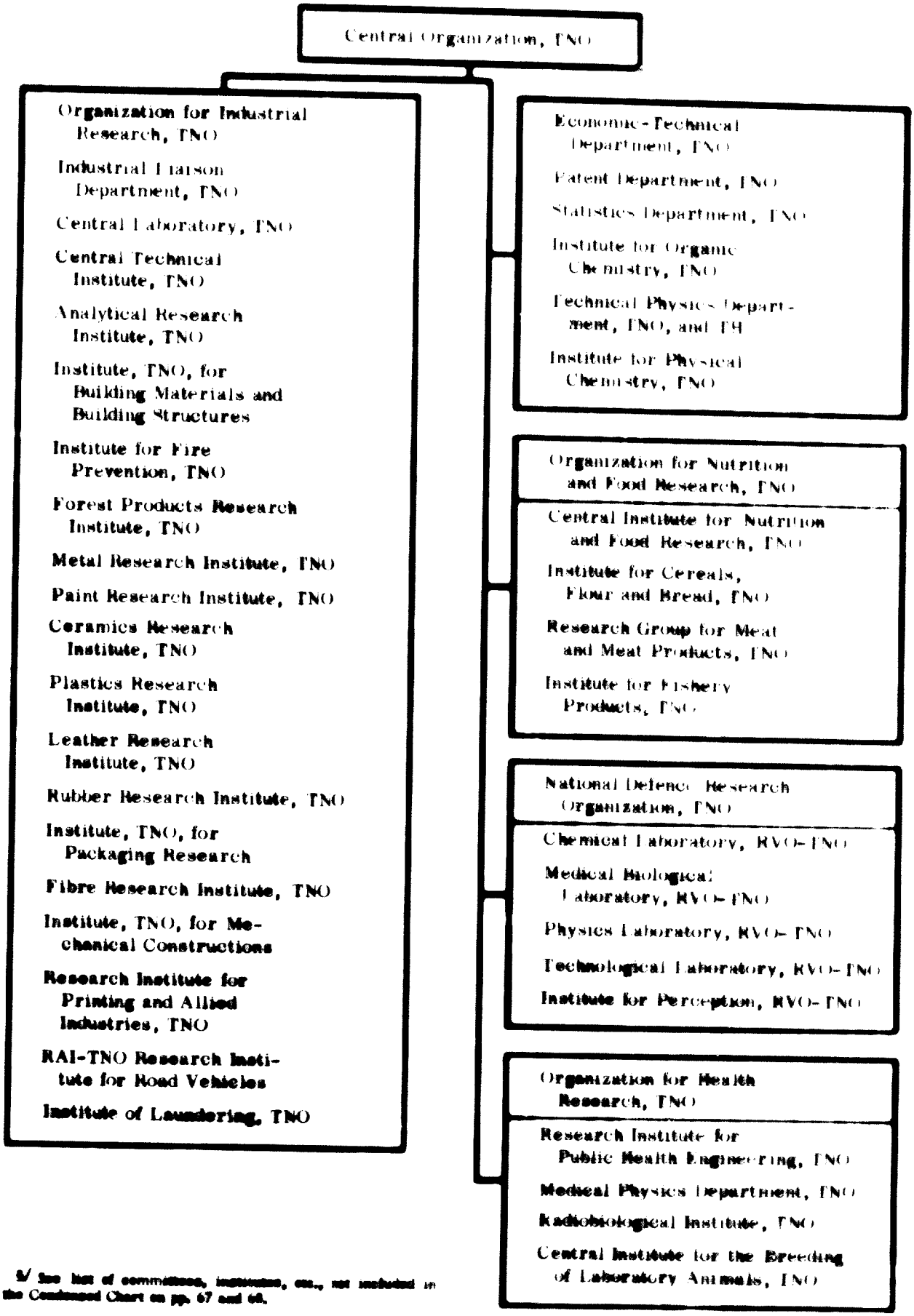
National Institute for Malting Barley, Malt and Beer, TNO

[2/] The Council co-ordinates the research activities of 34 agricultural research institutes which are not considered as TNO institutes proper.

Workers operating diamond-cutting machines at the Asscher Diamond Works in Amsterdam, the largest of its kind in Europe

Condensed Chart of the Organization TNO [a]

(January 1968)



[a] See list of committees, institutions, etc., not included in the Condensed Chart on pp. 67 and 68.

Services of industrial research institutes to government and industry

The institutes offer their technical and advisory services to governments, government agencies, industrial enterprises, chambers of commerce and industry and other interested parties in the following areas:

INSTITUTO DE INVESTIGACIONES TECNOLOGICAS, BOGOTA, COLOMBIA

Industrial consultation: Under this heading are included works requested from the Institute by persons or institutions which produce considerable revenue. The subjects have been those the Institute deals with in the course of its work, and the extent has been from small chemical or physical analysis to the development of entire chemical processes.

Laboratory analysis and testing: The most important projects include industrialization of agricultural products, especially foodstuffs; the study of industrial uses of raw materials; and the facts affecting agricultural and industrial production. Among them are: study of the quality of flour made from national wheats; research on enriching staple food; development of packaging for fresh fruit; study of technological properties of wood from the Magdalena River Valley; plant nutrition; effect of Bogotá River salt upon fauna and flora; insecticides used on cotton plantations; and the effect of pesticides on fresh food.

Technical and economic feasibility projects: Institute activities in this field are of considerable value. The following studies, briefly described, have been carried out: techno-economic study on the possibilities of production of piretro in Colombia; a feasibility study on site, investment, cost and lease possibilities of a system of silos for storing rice, wheat and beans; a study on the technical and economic aspects of installations for freezing, storage and quality control for fruit processing plants; a feasibility study on the establishment of a food manufacturing plant in Boyaca; several studies on market analysis, some of which were followed by a second step concerning manufacturing processes, investments and production costs.

Technical assistance to industry: Technical assistance to small and medium-sized industry is one of the important activities of the Institute. As a result of the evaluation study carried out by a Technical Assistance Programme expert in co-operation with the United Nations Special Fund, it was evident that there was a need to expand the programme to cover administrative matters as well as technology and to enlarge the area covered in order to serve other regions of the country. The Institute worked closely with the Agricultural Credit Bank and the Banco Popular in financing small and medium-sized industry. The Institute participated actively in training Agricultural Bank personnel assigned to the programme of technical assistance to small industry utilizing raw material originated in agriculture, animal husbandry and mining. Metallurgical and metal-mechanical industries and chemical industries were the most important industries receiving technical assistance.

Quality control of foodstuff: This was carried out by chemical and physical laboratories tests and visual and organoleptic inspection. The most important projects dealt with agricultural and animal husbandry as well as those products destined for human consumption. In a minor way, the following products were also evaluated: raw materials, industrial products, metals and alloys. In all, 1426 products were analysed; among them: concentrated feeding stock, insecticides and fertilizers.

KYUNG POOK INDUSTRIAL TESTING LABORATORY, TAEGU, KOREA

Tests of industrial products: Tests and analysis of industrial products and raw materials are carried out with the view to improving their quality.

Improvements of industrial products: Pro-

duction research and surveys of natural resources are undertaken in order to improve the quality of those products that have previously been tested.

Problem-solving: Analysis and examination of products to identify them are performed at the sponsors' request.

Technical assistance: Advice is provided to manufacturing plants to help in the improvement of the quality of products.

Industrial standardization and investigation of Korean Standards: Preliminary inspection of products to assess their standardization and a follow-up inspection to ensure their compliance with Korean Standards are carried out.

Consulting service: The Institute provides advice on various industrial techniques to Government, sponsors and small and medium-sized industrial enterprises.

Technical co-operation: The Institute co-operates with manufacturing plants that produce goods for export, as well as with other institutes and small and medium-sized industrial enterprises.

Technical training: Technical training is provided according to specific needs.

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY, MANILA, PHILIPPINES

Industrial research and development: It deals with product development, utilization of waste, ceramics, applied microbiology and drug research.

Pilot plant and engineering research: It includes process and equipment design and development, and studies of coconut technology.

Food and nutrition research: Food technology and nutrition evaluation of food products are studied.

Testing, analysis and standardization services: It offers quality control techniques and operations.

Technical consultancy and trouble-shooting services: It includes technical inquiries and plant operations research.

Techno-economic evaluation services: Project feasibility and pre-investment studies are carried out.

Scientific instruments repair, fabrication and calibration services: Among them are glass-blowing, optics, fine mechanics, and electronics instruments.

Scientific documentation services: The Institute offers the following services: its scientific library may be consulted; in addition, technical information is provided upon request.

On-the-job technical manpower training: The Institute is equipped to train personnel in technical laboratory and other skilled techniques.

ASSISTANCE PROVIDED BY THE UNITED NATIONS TO INDUSTRIAL RESEARCH INSTITUTES

The Centre for Industrial Development provides substantive support to nine Special Fund projects in the field of industrial research for which the United Nations is the executing agency.

These projects are:

(a) **The Central American Research Institute for Industry (ICAITI), located in Guatemala**

(b) **The Institute for Technological Research, Colombia**

(c) **Silicate Institute, Israel**

(d) **Industrial Research Centre, Israel**

(e) Technical Standards National Institute, Paraguay

(f) Industrial Research Institute, Sudan

(g) Technological Research Institute, Thailand

(h) Industrial Studies and Development Centre, Tanzania

(i) Industrial Studies and Development Institute, Saudi Arabia

Total expenditure by the Special Fund and the Governments of the countries concerned during the period of United Nations assistance amounts to $20,000,000.

Role of second-hand industrial equipment in developing countries

The experience in developing countries gives examples of both successful and unsuccessful utilization of imported second-hand industrial equipment. The advantages and disadvantages of the utilization of this category of equipment in furthering the process of industrialization of developing countries are consequently the subject of considerable controversy. This is well reflected in governmental policies concerning the importation of such equipment, which range from no restrictions at all to a complete prohibition of imports.

The quantities of second-hand equipment generated in industrialized countries are considerable. They can be expected to increase in the foreseeable future. No country can base its economic development on second-hand equipment. Still, if such equipment can be used to economic advantage in developing countries, it could make significant contributions towards the accelerated industrialization in these countries. The determination of the suitability of second-hand equipment for the needs of countries undergoing industrialization was the primary purpose of the deliberations of the Meeting of Experts on this subject organized by the Technological Division of the Centre for Industrial Development of the United Nations in New York in December, 1965.

The panel of experts recognized that the problems of utilization of second-hand equipment in developing countries were different, depending on their stages of development, which vary widely. In their discussions, the experts thoroughly examined all the relevant aspects of the main problems under consideration. The topics analysed were:

- Definition and classification of second-hand equipment
- Sources and generation of second-hand equipment
- Advantages and disadvantages of utilization of second-hand equipment
- Maintenance problems
- Cost considerations
- Implications of the use of second-hand equipment for the industrialization of developing nations
- Existing mechanism for the selection, inspection and testing, rebuilding, purchase and transfer of second-hand equipment
- Past experience of developing countries with the utilization of second-hand equipment
- Import restrictions
- Financing problems
- Complete second-hand plants

On the basis of their analysis the experts came to a number of conclusions and formulated recommendations for appropriate action.

The major conclusions reached were the following:

1. Considerable quantities of second-hand equipment with potentialities for use in developing countries are generated every year in advanced industrial countries. The supply of such equipment will almost certainly increase in the foreseeable future.

2. There is little knowledge in developing countries of the availability and sources of second-hand equipment; and quite often the entrepreneurs in developing countries are not aware of the areas in which second-hand equipment could be particularly useful.

3. The utilization of second-hand equipment is an economic and technological problem. The utilization of such equipment is usually only an alternative to the use of new equipment, and it is important that any decision to use second-hand equipment should be taken only after a careful scrutiny of costs and benefits.

4. Second-hand equipment which is uneconomical under a given set of conditions can still be used to economic advantage under a different set of conditions. There are several examples of this in both developed and developing countries.

5. The principal advantage of second-hand equipment over new is the lower capital cost; and the scope for using such equipment depends upon the extent to which second-hand equipment is cheaper than new equipment. In certain circumstances, immediate availability of second-hand equipment can be an additional advantage.

6. The well-known shortage of managers and technicians in developing countries makes it more difficult to tackle the problems involved in the selection and installation of second-hand equipment than in the case of new equipment.

7. In selecting second-hand equipment, particular care should be taken to ensure the availability of spare parts and of all the necessary information for the operation and maintenance of the equipment (e.g. manuals, spare parts lists, etc.)

8. Second-hand equipment for use in developing countries should be purchased only after thorough inspection and after satisfactory reconditioning, wherever necessary.

9. Major pieces of equipment, integrated units, and complete second-hand plants offer particular advantages under proper safeguards.

10. Equipment, whether new or second-hand, which is not capable of producing goods of acceptable quality at prices which are at least competitive on the domestic market, should not be acquired under any circumstances.

11. Second-hand equipment which is subject to rapid obsolescence should also not be considered for long-term investments.

12. On balance, it appears that the use of second-hand equipment for certain production programmes in developing countries can be advantageous, but great care is necessary in choosing the right technology and equipment in order to safeguard the interests of developing countries.

The recommendations made by the experts were for action to be taken by (a) developing countries, (b) industrially advanced countries, and (c) the United Nations system.

Actions by developing countries:

1. Development of expertise in location, transfer and utilization of second-hand equipment.

2. Elimination of discriminatory restrictions on the import of second-hand equipment.

3. Carrying out of periodic surveys to determine the possibilities of utilizing second-hand equipment in the implementation of industrialization programmes.

Actions by industrially advanced countries:

1. Collection and dissemination of information on availability of second-hand equipment.

2. A widening of the scope of aid programmes to include and increase the economic utilization of second-hand equipment.

3. Make governmental export credit insurance available for second-hand equipment.

4. Review existing tax arrangements to provide incentives for the transfer of complete second-hand plants to developing countries.

Actions by the United Nations system:

1. Circulation of Experts' Report to the appropriate legislative organs of the United Nations as well as to individual Governments and other interested organizations in developing and advanced countries, to obtain comments and views on same.

2. Preparation of additional studies on the suitability of second-hand equipment, by industry sectors and by type of equipment.

3. Increase technical assistance to developing countries, at their request, in the selection and purchase of second-hand equipment from the advanced countries.

4. Consider the convening of an intergovernmental working party to undertake the following tasks:

   (a) The adoption of a standard classification of second-hand equipment so that there is uniformity in nomenclature.

   (b) The organization of services in connexion with the evaluation and inspection of second-hand equipment, and

   (c) The establishment of a clearing house to facilitate the transfer of second-hand equipment.

An invitation to co-operate in the development of Industrial Research News

Editorial Office
Industrial Research News
Centre for Industrial Development
United Nations, New York

To Our Readers:

Dear Sirs,

Now that the first issue of *Industrial Research News* is in your hands we hope you will see its potential value in the dissemination of information in this field. Industrial research is the key activity in the forward march of progress of nations.

We who have prepared *Industrial Research News* are anxious to help with that forward progress. But in truth we can only work with the materials which you will give us. The reports of your plans, your activities and your problems will make future issues of *Industrial Research News* valuable.

So we turn to you again for help; we need your suggestions and welcome your criticisms.

To help you to help us we have printed a questionnaire on the opposite page. You will see that our questions fall naturally into four groups:

Staff of the Institutes
Services offered
Methods used to develop a following
Type of projects now under way.

Again let us emphasize the importance of your helpful response at an early date.

Sincerely yours,

EDITORIAL DIRECTOR
Industrial Research News

Readers' Questionnaire

Your thoughtful consideration of and prompt answers to the questions listed in this Questionnaire will be very greatly appreciated.

1. Name of your organization _____

_____

2. Address _____

_____

3. Name of Director _____

4. Staff of the organization: _____

How many staff members do you have? Total _____

Professionals _____ Supporting technical staff _____ Clerical staff _____

Have you fellowships open to additional workers? Yes ☐ No ☐

Field of specialization _____

Does expansion of your work indicate need for additional staff members? Yes ☐ No ☐

In what fields of work? _____

5. What services are you now offering? (Please check)

Basic research	☐	Pilot plant operation	☐	Market studies	☐
Raw material ut ilization	☐	Plant location and layout	☐	Testing	☐
Process development	☐	Plant management	☐	Personnel training	☐
Feasibility studies	☐	Productivity studies	☐	Trouble-shooting	☐

6. What services do you need from other research establishments? _____

_____

_____

_____

7. What methods are being used to attract a following among governmental and industrial people? (Please check)

Seminars and conferences	☐	Publication of bulletins	☐
Visits to plants	☐	Training of industrial personnel	☐
Industrial exhibits	☐	Technical inquiry services	☐

Others _____

_____

8. What type of projects are now under way in your Institute? (Please describe)

_____

_____

_____

_____

_____

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Industrial Research News starts its life at an auspicious moment when the developing countries of the world are taking definite steps toward the fulfilment of industrial development goals; the *News* will always be ready to encourage, help and report progress in this most important field of human endeavour.

The Central Clearing House of Information is at the service of anyone wishing to inquire about problems connected with industrial research, whether managerial, technical, or matters affecting technical personnel.

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Technological Division
Centre for Industrial Development
United Nations, New York, N.Y. 10017

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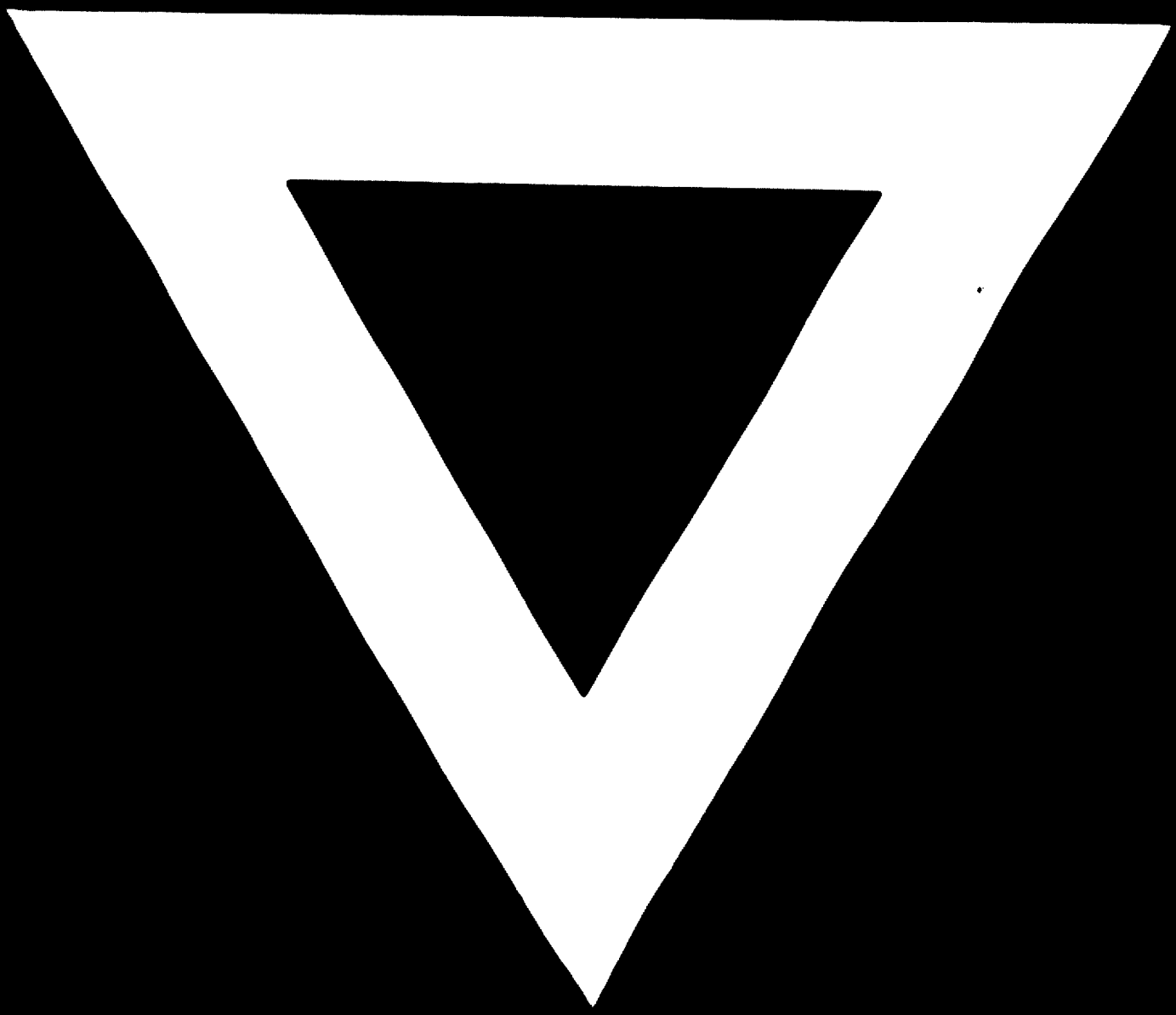

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