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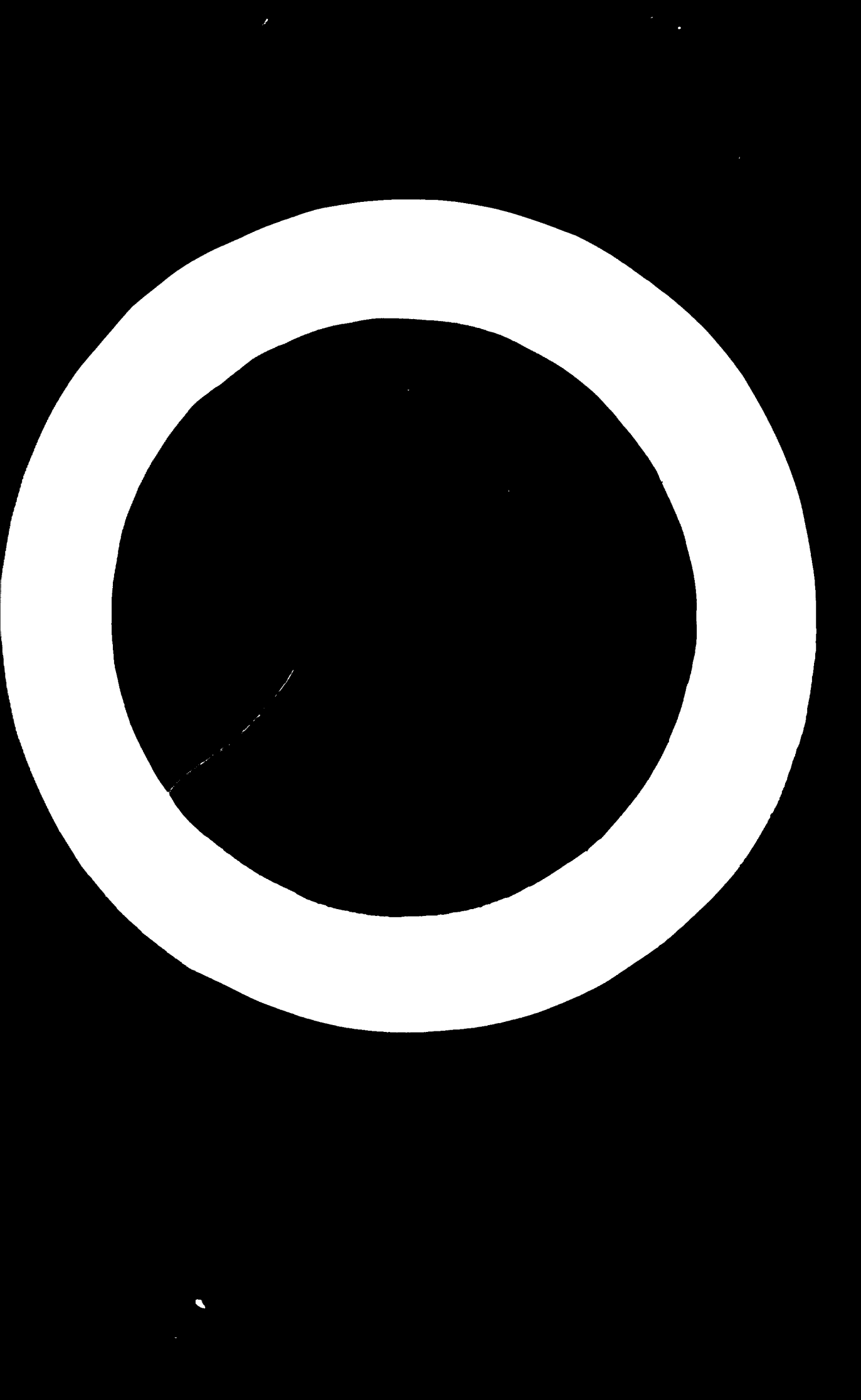

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Contents

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Summaries of Feature Articles

Advisory Committee on Application of Science and Technology Holds 10th Session

During a two-week session the Advisory Committee on the Application of Science and Technology to Development (ACAST) reviewed the activities of UNIDO and discussed problems that UNIDO suggested should be included in the World Plan of ACAST. Among other items on the agenda were a document on the better understanding of population problems, studies on the natural resources of developing countries and an examination of activities in marine science and technology.

Dixième session du Comité consultatif sur l'application de la science et de la technique au développement

Au cours de sa dixième session, qui a duré deux semaines, le Comité consultatif sur l'application de la science et de la technique au développement (UNACAST) a passé en revue les activités de l'ONUDI et examiné les problèmes que cette organisation voudrait voir inscrire dans le Plan mondial de l'UNACAST. L'ordre du jour prévoyait en outre l'étude d'un document consacré à une meilleure compréhension des problèmes de la population, celle des ressources naturelles des pays en voie de développement et l'examen des activités actuelles dans le domaine des sciences et des techniques de la mer.

El Comité Asesor sobre la Aplicación de la Ciencia y la Tecnología al Desarrollo celebra su 10° periodo de sesiones

Durante dos semanas, el Comité Asesor sobre la Aplicación de la Ciencia y la Tecnología al Desarrollo examinó las actividades de la ONUDI y estudió los problemas que, por sugerencia de esta Organización, debían incluirse en el Plan Mundial de dicho Comité. Entre otros temas del programa figuraron un documento sobre la mejor comprensión de los problemas demográficos, estudios acerca de los recursos naturales de los países en desarrollo y un examen de las actividades en materia de ciencia y tecnología marinas.

Trends in the Textile Industry in Developing Countries

by J. C. W. Buxton

Synthetics are the textiles of the future, but few developing countries have the resources or the markets necessary to establish or expand their textile industries on the basis of anything except cotton. The author believes that cotton and blends fill many of the needs of these countries and that they must develop their cotton agriculturally and adopt the best new technology for processing it.

Tendances de l'industrie textile dans les pays en voie de développement

par J. C. W. Buxton

Les fibres synthétiques sont les textiles de l'avenir, mais peu des pays en voie de développement disposent des ressources ou des marchés nécessaires pour créer des industries textiles nouvelles, ou de donner un plus grand essor aux industries existantes en utilisant des matières premières autres que le coton. L'auteur est d'avis que le coton et les mélanges de coton peuvent satisfaire la plupart des besoins de ces pays et que ceux-ci doivent donc s'efforcer de développer la culture du coton et d'adopter les techniques les plus modernes de traitement de cette libre.

Tendencias de la industria textil en los países en desarrollo

por J. C. W. Buxton

Las fibras sintéticas son los textiles del futuro, pero son pocos los países en desarrollo que cuentan con los recursos o mercados necesarios para implantar o ampliar sus industrias textiles salvo en el caso del algodón. El autor cree que el algodón y sus mezclas satisfacen muchas de las necesidades de estos países y que por ello deben desarrollar su cultivo e implantar las mejores técnicas modernas para elaborarlo.

Operations and Policies of the Commonwealth Development Corporation

by Sir William Rendell

On 30 June 1968, the Commonwealth Development Corporation had 74 direct investments in commercial and industrial projects in addition to infrastructure loans and investments in agricultural projects. In its twenty years of experience, the Corporation has developed its own pattern of operation, particularly in relation to the management of industrial projects in which it is involved.

La Commonwealth Development Corporation, son œuvre et ses objectifs

par Sir William Rendell

Le 30 juin 1968, la *Commonwealth Development Corporation* (Organisation du Commonwealth pour le développement) avait, outre un certain nombre de prêts pour des travaux d'infrastructure et de placements intéressant des projets agricoles, procédé à des investissements directs de capitaux dans 74 projets différents tant commerciaux qu'industriels. En 20 ans d'existence, cet organisme a mis au point son propre mode d'opération, notamment en ce qui concerne la gestion des projets industriels dans lesquels elle a des intérêts.

Actividades y principios básicos de la Corporación de Desarrollo de la Commonwealth

por Sir William Rendell

El 30 de junio de 1968, la Corporación de Desarrollo de la Commonwealth tenía 74 inversiones directas en proyectos comerciales e industriales además de préstamos para infraestructura e inversiones en proyectos agrícolas. En sus veinte años de experiencia, la Corporación ha desarrollado su propio sistema de funcionamiento, sobre todo en lo referente a la gestión de proyectos industriales en los que interviene.

A Pilot Plant Geared to Small-scale Production

Recognizing that the problems of a large factory in an industrialized country and those of a small factory in a developing country differ greatly and

Usine pilote à faible débit de production

Reconnaissant que les problèmes d'une grosse usine dans un pays industrialisé diffèrent fortement de ceux auxquels se heurte une petite entreprise dans un

Fábrica experimental para la producción en pequeña escala

Reconociendo que los problemas de una gran factoría en un país industrializado y los de una fábrica pequeña en un país en desarrollo difieren mucho y requieren

require different approaches, a company based in the Netherlands has set up a Pilot Plant that simulates conditions in developing countries. The Pilot Plant makes electrical components and is a self-contained unit that evolves both administrative and technical procedures according to its needs and resources. Staff members from subsidiary companies from all parts of the world come to the Pilot Plant for training.

pays en voie de développement et que ces problèmes ne sauraient donc être résolus par les mêmes méthodes, une société dont le siège se trouve aux Pays-Bas a créé une usine pilote où sont reproduites les conditions existant dans les pays en voie de développement. Cette usine pilote, qui fabrique des pièces d'appareillage électrique, est conçue comme une unité autonome et adapte ses procédés de gestion et ses techniques suivant ses besoins et ses ressources. Le personnel de filiales situées dans le monde entier vient y suivre des cours de formation professionnelle.

enfoques diferentes, una compañía radicada en los Países Bajos ha creado una fábrica experimental en la que se reproducen condiciones similares a las de los países en desarrollo.
La planta experimental fabrica piezas para aparatos eléctricos y funciona como unidad autónoma en la que se crean procedimientos administrativos y técnicos de acuerdo con sus necesidades y recursos. A esta fábrica experimental concurren para recibir capacitación empleados de las compañías filiales en todo el mundo.

Research Workers' Organization Promotes Action, Co-operation

by P. Nicolau

The International Institution for Production Engineering Research is an international group of research workers who have contributed to the scientific study of the processing of materials. The main purposes of the organization, of which the author was one of the founders, are to promote by scientific research the study of the mechanical processing of solid materials; establish permanent contact between research workers; and convene conferences of research workers in order to consolidate the results of research and ensure their publication. The members use the initials CIRP, which stand for College International Research Production, to indicate the structure, make-up, and essential tasks and fields of activity.

Une organisation de chercheurs scientifiques s'efforce de promouvoir l'action et la coopération internationales

par P. Nicolau

Le Collège international pour la recherche scientifique sur les techniques de production mécanique (CIRP) est un groupe des chercheurs de tous les pays qui ont contribué à l'étude scientifique du traitement des matériaux. Cette organisation, dont l'auteur est membre fondateur, vise essentiellement à promouvoir, par le moyen de la recherche scientifique, l'étude des techniques de traitement mécanique des matériaux solides, à établir des contacts permanents entre les chercheurs et à organiser des conférences qui donnent aux chercheurs l'occasion de mettre en commun les résultats de leurs recherches et d'en assurer la publication. Le sigle utilisé pour désigner cette organisation reflète à la fois la structure, la composition et la vocation essentielle.

Técnicas de producción mecánica (Una organización de investigadores fomenta la acción y la cooperación)

por P. Nicolau

El Colegio Internacional para el Estudio Científico de las Técnicas de Producción Mecánica es un grupo internacional de investigadores que han contribuido al estudio científico de la elaboración de materiales. Las principales finalidades de la organización, de la que el autor es miembro fundador, son fomentar el estudio de la elaboración mecánica de materiales sólidos mediante la investigación científica, establecer contactos permanentes entre los investigadores y convocar conferencias de investigadores con vistas a combinar los resultados de sus investigaciones y facilitar su publicación. Los miembros utilizan las iniciales CIRP que corresponden a las palabras inglesas siguientes: *College, International, Research y Production* (colegio, internacional, investigación y producción), para indicar la estructura, carácter, tareas esenciales y campos de actividad.

Biodeterioration Information Centre Provides World-wide Service

by H. O. W. Eggins

Biodeterioration renders materials unsuitable for their intended use, reduces their economic value or increases their processing costs. A world-wide problem, biodeterioration is particularly prevalent and hard to combat in developing countries because of climatic and economic conditions. The Biodeterioration Information Centre, Birmingham, England, collects information on all aspects of the problem from specialists throughout the world and makes it available through regular publications and a free question-answering service.

Le Biodeterioration Information Centre (Centre d'information sur les détériorations causées par des agents biologiques), service mondial de renseignements

par H. O. W. Eggins

Les agents biologiques rendent fréquemment certains matériaux inutilisables, en réduisent la valeur marchande ou augmentent le coût de leur transformation industrielle. Problème d'envergure mondiale, la détérioration des matériaux par les agents biologiques sévit tout particulièrement dans les pays en voie de développement par suite des conditions climatiques et économiques locales. C'est également dans ces pays qu'elle est le plus difficile à combattre. Le *Biodeterioration Information Centre*, dont le siège est à Birmingham (Royaume-Uni), centralise les renseignements que lui envoient des spécialistes du monde entier sur tous les aspects de ce problème et en assure la diffusion par le moyen de publications régulières et d'un service consultatif gratuit.

El Centro de Información sobre Biodeterioración presta servicios a escala mundial

por H. O. W. Eggins

La biodeterioración hace que los materiales sean inservibles para el uso a que se los destina, reduce su valor económico o aumenta los costos de su elaboración. Si bien es un problema que se plantea a escala mundial, la biodeterioración es sobre todo frecuente y difícil de combatir en los países en desarrollo a causa de las condiciones climáticas y económicas. El Centro de Información sobre Biodeterioración radicado en Birmingham, Inglaterra, recopila información de especialistas del mundo entero sobre todos los aspectos del problema, y la difunde a través de sus publicaciones periódicas y de su servicio gratuito de preguntas y respuestas.

Industrial Research Institute, Khartoum

by Abdalla Abdel Wahab

The Industrial Research Institute, Khartoum, began operating in 1965 and its work is now being conducted by a team of United Nations experts working with 50 Sudanese counterparts. Its servicing divisions are Technical Documentation, Management Services, Standards, Engineering and Chemical Technology.

Institut de recherche industrielle de Khartoum

par Abdalla Abdel Wahab

L'institut de recherche industrielle de Khartoum a commencé ses travaux en 1965; il est actuellement dirigé par une équipe d'experts des Nations Unies travaillant en collaboration avec 50 fonctionnaires soudanais de contrepartie. Cet institut est subdivisé en quatre sections: Documentation technique, Services de gestion, Normes, Ingénierie et techniques chimiques.

Instituto de Investigaciones Industriales, Jartum

por Abdalla Abdel Wahab

El Instituto de Investigaciones Industriales de Jartum comenzó a funcionar en 1965 y actualmente dirige sus trabajos un grupo de expertos de las Naciones Unidas, que colabora con 50 colegas sudaneses. El Instituto cuenta con dependencias de documentación técnica, servicios de gestión, normas, ingeniería y tecnología química.

Research Development Corporation of Japan

by Hisashi Harada

The Research Development Corporation of Japan was established in 1961 to develop and exploit scientific research in Japan on an industrial level. A major part of the Corporation's work is bringing promising research projects to the attention of industry. The author gives examples of projects successfully completed and of those now in progress.

Research Development Corporation of Japan (Société japonaise pour le développement de la recherche)

par Hisashi Harada

La *Research Development Corporation* a été créée en 1961 pour développer et exploiter la recherche scientifique au Japon, au niveau industriel. L'une des principales tâches de cette société consiste à attirer l'attention des industriels sur les projets de recherche qui semblent promis à un avenir particulièrement intéressant. L'auteur donne des exemples de projets qui ont pu être menés à bien avec succès, ainsi que d'autres dont la réalisation se poursuit encore.

Corporación de Desarrollo de la Investigación del Japón

por Hisashi Harada

La Corporación de Desarrollo de la Investigación del Japón fue creada en 1961 para desarrollar y explotar en el Japón, en el plano industrial, la investigación científica. Una parte importante de la labor de la Corporación consiste en señalar a la atención de las empresas industriales proyectos de investigación prometedores. El autor presenta ejemplos de proyectos realizados con éxito y de otros en vías de ejecución.

Co-ordinating Government Incentives to Industry in Brazil

by Alberto Eusebio do Carmo Tangari

With a total industrial working force of more than 2 million, Brazil has already entered the industrial phase of development. The body for co-ordinating its industrial efforts and making policy decisions is the Industrial Development Commission, comprising nine executive groups. The groups help to circumvent bureaucratic formalities and ensure that projects fill special technical requirements.

Le Gouvernement brésilien encourage la coordination des industries au Brésil

par Alberto Eusebio do Carmo Tangari

Disposant d'un effectif total de plus de deux millions de travailleurs dans l'industrie, le Brésil est maintenant entré dans la phase industrielle du développement. L'organisme chargé de coordonner ses efforts sur le plan industriel et de prendre des décisions de principe est la Commission du développement industriel, qui comprend neuf groupes exécutifs. Ces groupes s'occupent de toutes les questions d'administration et veillent à ce que les projets remplissent certaines conditions techniques.

Coordinación de incentivos del sector público a la industria del Brasil

por Alberto Eusebio do Carmo Tangari

Brasil, que cuenta con más de dos millones de trabajadores empleados en el sector industrial, ha entrado ya en la fase industrial del desarrollo. El organismo que se encarga de coordinar las iniciativas en el campo industrial y que decide la política en esa esfera es la Comisión de Desarrollo Industrial constituida por nueve grupos ejecutivos. Los grupos prestan su colaboración para obviar formalidades burocráticas y asegurar que los proyectos cumplan con determinados requisitos técnicos.

National Centre for Industrial Studies Established at Tunis

The National Centre for Industrial Studies, Tunis, has been established in order to: advise on matters connected with industrial development and evaluate the nation's industrialization plan; undertake detailed technical and economic studies for specific industrial projects; advise on the establishment of new industries and on technical and economic problems of existing enterprises; train personnel and disseminate information.

Création à Tunis d'un Centre national d'études industrielles

Le Centre national d'études industrielles de Tunis a pour tâches de donner des avis sur toutes les questions intéressant le développement industriel et d'évaluer le plan d'industrialisation du pays; d'entreprendre des études techniques et économiques détaillées sur certains projets industriels déterminés; de servir de conseiller pour tout ce qui concerne la création de nouvelles industries et les problèmes techniques et économiques des entreprises existantes; de former du personnel, et de diffuser des informations.

Creación de un Centro Nacional de Estudios Industriales en Túnez

El Centro Nacional de Estudios Industriales de Túnez se ha creado para cumplir las siguientes funciones: asesorar en materias relacionadas con el desarrollo industrial y evaluar el plan de industrialización del país; realizar estudios detallados de índole técnica y económica para determinados proyectos industriales; asesorar en el establecimiento de nuevas industrias y en los problemas técnicos y económicos con que se enfrentan las empresas existentes; formar personal; y difundir información.

Advisory Committee on Application of Science and Technology Holds 10th Session

The United Nations Advisory Committee on the Application of Science and Technology to Development met in Vienna from 25 November to 6 December 1968. It discussed the World Plan of Action for the Application of Science and Technology to Development, the outflow of trained personnel from developing countries, natural resources of developing countries, marine science and technology, and population problems. The Committee, a subsidiary body of the Economic and Social Council (ECOSOC), held its tenth session at the headquarters of the International Atomic Energy Agency (IAEA) under the chairmanship of Carlos Chagas (Brazil). Vice-chairmen were Jermen Mikhailovich Gvishiani (USSR) and Ronald Walker (Australia).

The eighteen members of the Committee are appointed on the basis of their personal qualifications to review progress in the application of science and technology and to propose to ECOSOC practical measures for such applications for the benefit of the developing countries. Members serve as individuals rather than as representatives of governments.

Sigvard Eklund, Director General of the IAEA, and Ibrahim Helmi Abdel-Rahman, Executive Director of UNIDO, welcomed the Committee to Vienna and introduced the presentation of the programmes of their respective organizations that are relevant to the application of science and technology.

The Director General of the IAEA, referring to the substantial contributions that the Agency was able to make to the development of atomic energy programmes in developing countries despite its limited resources, emphasized the need for greater assistance to these countries.

The Executive Director of UNIDO underlined the interrelation between science and technology and industrialization, and called for intensive co-operation between the Committee and UNIDO. The Committee decided to include in the agenda for the eleventh session an item dealing with science and technology in relation to industrial development. The session was convened in New York on 31 March.

Main topics of discussion

As the principal task of the Committee is the preparation of the World Plan of Action for the Application of Science and Technology to Development, its members asked that a preliminary document be prepared by members of the United Nations family for the twelfth session of the Committee, to be held in Addis Ababa from 24 November to 5 December. The document will cover the following subjects: research and development activities; education and training of personnel; scientific and technical information; institution building; extension services; and other appropriate

elements involving the application of science and technology. If adopted by the Committee, this document would form the basis of its contribution to the Second Development Decade. UNIDO is responsible for the section on "accelerating industrial development".

The Committee also examined the problem of regional approaches to science and technology and reviewed the meetings of its regional groups for Africa, Asia and Latin America which were held in July and August 1968. The question of establishing a regional group for Europe was raised.

Discussing the drain of trained personnel from developing countries, the Committee decided that there was a need to distinguish between the flow as it affects university personnel as well as professionals such as engineers, doctors and nurses. The Committee drew attention to the scheme of associateships that it had discussed previously and was of the opinion that a large part of the responsibility for the exodus lay with the developing countries themselves. The Committee emphasized the need for building facilities for high-quality training and for the provision of working conditions to attract back to their home countries those who had left. It was noted that some of the advanced countries have also experienced this exodus and are taking measures to stem it.

The Committee adopted and decided to submit to ECOSOC a report on "Natural Resources of Developing Countries: Investigation, Development and Rational Utilization". Having outlined certain criteria that should determine the scope and the particular branches of industry a developing country wants to foster, the report proposes that intensified promotion should be given to the following: technological research and development institutes; testing laboratories; planning and designing bureaux; industrial extension and advisory services; and training for industry.

The Committee invited the United Nations Secretariat, WHO, UNESCO, FAO, ILO and other agencies concerned, to prepare a joint report on problems of population, outlining the possibilities for greatly expanded and intensified activities in the following areas of research and application: population statistics and demographic analysis; knowledge of social, economic, cultural and population dynamics relevant to population policies; knowledge relevant to biological and health aspects of reproduction and fertility control; motivation, communication, educational aspects and related studies; and studies on organizational and logistic aspects of family planning programmes in specific countries.

The Committee examined and highly commended a report from the Secretary-General of the United Nations entitled "Marine Science and Technology: Survey and Proposals". The Committee agreed that it would like to see more emphasis given to the participation of developing countries in the programmes related to the study, research and exploitation of the resources of the sea. Not only should the number of training sources be increased and more scientists from the developing countries be included in the expeditions organized by international organizations and developed countries, but also ways and means should be found to further the establishment of the infrastructure and programmes of oceanographic interest in the developing countries.

The Committee examined a report from the Secretary-General entitled "The Protein Problem" and stressed that the paramount purpose of programmes for increased production and reduced waste of protein should provide, as a matter of priority, an adequate protein diet for the vulnerable population group, such as expectant and nursing mothers, infants and young children. The Committee expressed its deep interest and concern about this problem and its intention to continue periodic reviews of progress. The Committee noted with special interest the programme of the Joint FAO IAEA Division of Atomic Energy in Food and Agriculture and its work on the application of irradiation techniques to develop high-protein strains and varieties of plants. The Committee believes that this work warrants greatly increased support and urged the Directors-General of FAO and IAEA to reconsider the scale of resources now devoted to this subject.

Issues suggested by UNIDO

In a meeting with the United Nations Director for Science and Technology in June 1968, the Executive Director of UNIDO agreed that UNIDO would submit to the tenth session of the Committee an introductory document suggesting important issues for deliberation, consultation and further work to be undertaken by UNIDO and the Committee with a view to focusing the attention of legislative bodies, the United Nations agencies, the scientific community and industry in both the developing and the advanced countries on these problems. Although science and technology affect many aspects of industrialization, UNIDO selected five particularly pressing problems to present to the Committee for consideration as part of the World Plan of Action. These five are: the development of an optimum technology adapted to the conditions prevalent in developing countries; substantive and institutional questions related to industrial research within and for the benefit of developing countries; the design of products adapted to the special needs of developing countries; the repair and maintenance of industrial equipment; and the flow of scientific and technical information and the transfer of technology. The paper presented by UNIDO also outlined one specific project, an integrated desalination and chemical plant.

Optimum technology. While the adoption of an advanced technology will, in general terms, provide the necessary base for industrial expansion, it is evident that techniques employed in industrialized countries are not necessarily appropriate to the conditions and needs of all developing countries. For the maximum benefit

to be derived from the utilization of advanced techniques in developing areas, due allowance must be made for such local factors as investment potential, location of raw materials, size of the markets and the available labour force.

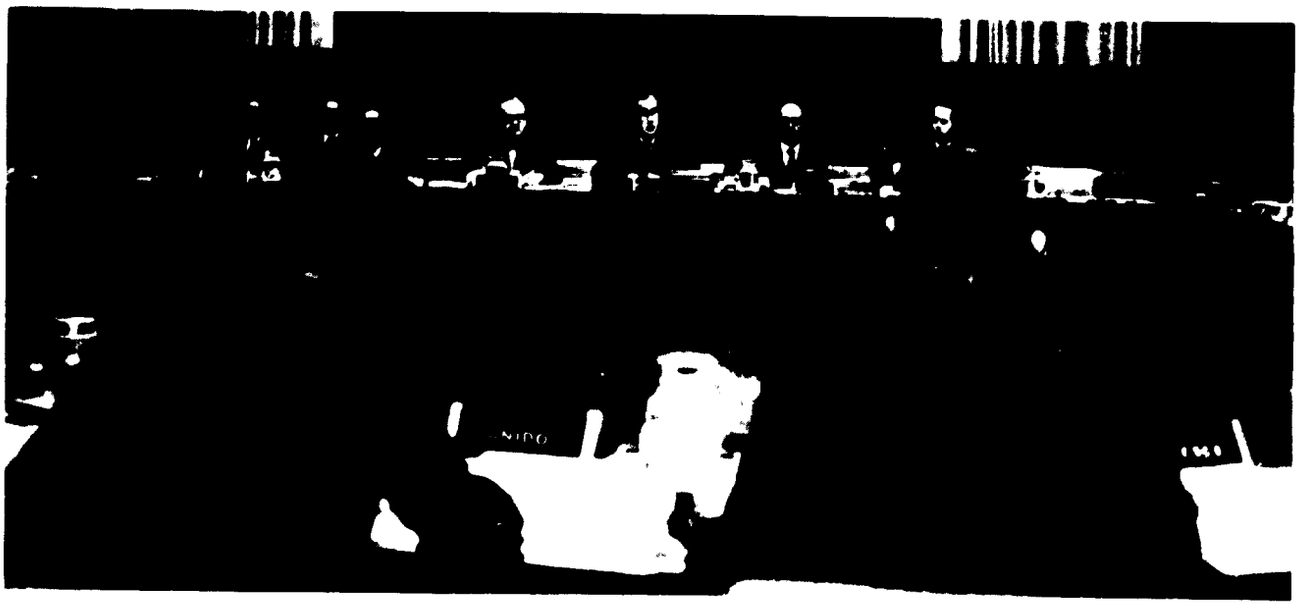
The most appropriate or "optimum" technologies in respect of any given industry or country are, therefore, those in which advanced techniques are best adapted to meet the particular political, social and environmental conditions of the area in question. Thus, to the extent that the requirements and resources of developing areas vary from one country to another, the evolution of optimum technologies necessarily calls for an industry-by-industry approach either within a given country or, where feasible, on a regional basis.

There are, nevertheless, certain general prerequisites to be considered as regards the over-all promotion and development of optimum technologies. It is clearly of prime importance that maximum co-operation is achieved between the developing and the developed countries. In the case of the developing countries, it is necessarily the local government which must be regarded as furnishing the initial impetus; in the industrialized nations, both the private and the public sectors are in a position to make an effective contribution.

Industrial Research. Industrial research is the basis for generating new and adapting known technology. Up to now most applied industrial research has been carried out by industry, governments, and industrial or scientific research institutions in the industrially advanced countries. If ways and means could be devised for developing countries to benefit fully from the research and the technical and organizational know-how of this vast network of industrialized research facilities, industrialization could be speeded up tremendously. There is also a great need to establish or strengthen local research institutions in developing countries.

Product Design. The implementation of the results of industrial research often requires the redesigning of established products or a design for new products. The organization of product design varies considerably in the industrialized countries, ranging from independent firms or individuals specializing in certain activities, to design departments in industrial research institutions or big enterprises. These firms or departments may be elaborate, comprising such services as drawing, testing, inspection, process planning and cost accounting. In the "affluent society", product design often remains the only weapon of firms in a highly competitive industry, such as the automobile industry in the United States.

The situation in the developing countries is generally quite different. The emphasis is not on style but on function, durability and price. Product design is markedly similar to that in the industrialized countries for export products only, which must compete on the



Pictured at the opening session are (from left to right) R. C. Desai, Assistant Director of the UN Office for Science and Technology; Azmi A. Afifi, Deputy Director of the Industrial Services and Institutions Division of UNIDO; I. H. Abdel-Rahman, Executive Director of UNIDO; Sigvard Eklund, Director General of IAEA; Carlos Chagas (Brazil), Chairman; G. Gresford, Director of the UN Office for Science and Technology and Secretary of the Committee; and A. Korn, UN Secretariat.

basis of appearance as well as function. Product design as a special branch of industrial engineering is still in its infancy. Usually foreign designs are bought or utilized under licensing agreements.

It is necessary to introduce product design capabilities into developing countries in order to ensure that they are able to produce original designs for simple products, industrial equipment and household articles. The main problem is to teach local personnel or young engineers to design products that meet established standards. This can be done by UNESCO if it concerns university level, or by UNIDO if it concerns in-plant training or extension courses for university graduates in the field of mechanical engineering. The problem would be alleviated by the preparation and publication of a number of textbooks that contain principles of design and the basic standards existing in different countries. Many of these manuals are already in existence but need to be adapted or translated.

Repair and Maintenance. Industrial research, in-plant or product design activities (with a view to adapting or finding new techniques to suit the particular needs of developing countries) will produce little effect and may result in waste of capital and human effort unless utmost care is taken in the repair and maintenance of industrial facilities that have been, or will be, installed in the developing countries.

Shortcomings in the developing countries have been clearly set out in the Report by the Group of Experts on Maintenance and Repair of Industrial Equipment in Developing Countries (UNIDO document ID/1 of 21 April 1967). These are: insufficient realization of the problem by both industry and government; lack of adequately trained personnel; poor utilization of industrial equipment; excess capital investment and high production cost; inappropriate local attitudes towards repair and maintenance; neglect of preventive maintenance; and problems of quality in terms of engineering technology, quality control and the supply of raw materials of correct specifications in the local manufacture of spare parts.

Flow of information and technology. Industrialization is, to a great extent, dependent upon the unimpeded flow of information in all fields of industrial knowledge and experience. No new technology could be generated, no old technology could be adapted for use in developing countries, no industrial research could be carried out successfully, and no plant or product design could be developed in or for the developing countries without the knowledge of the most recent advances made by scientists, engineers and technicians.

Most of this information originates in the industrialized countries. For gathering, sharing and evaluating scientific and technological knowledge, the industrialized countries have established effective procedures and institutions. There is, therefore, an urgent need to establish an adequate system of communication between, on the one hand, governments, industry, industrial research institutions, scientists and technicians in the developing countries, and on the other hand, the technological information sources in the advanced countries.

Integrated Desalination and Chemical Product Plant. Usable water is one of the scarcest natural resources in many parts of the world, particularly in the developing countries that are in arid or tropical zones. In view of this need, research projects for the efficient and economic production of desalinated water should be undertaken by all interested and competent organizations, institutions and industries.

One promising approach to the problem is the commercial use of by-products from the distillation process, such as sodium, magnesium and potassium salts and bromine, obtained from the effluent of a desalination plant. Investigation is needed to find the most economical methods of evaporation of and extraction from the effluent.

Use of these by-products commercially would require building a large chemical complex based on sodium chloride and producing, among other products, sodium carbonate, caustic soda and chlorine. Detailed technical studies, cost analyses and market research for both the desalinated water and the by-products would be needed to determine whether such a complex scheme would be economically feasible and, if so, which developing country should launch it.

Interregional Seminar on Incentive Policies for Industrial Development Held

As an integral part of its programme to help developing countries in the formulation and implementation of appropriate industrial policies, UNIDO has planned a new series of training seminars. The first of these was held at UNIDO Headquarters in Vienna from 10–21 March 1969 to consider incentive policies and measures to encourage industrial development.

Senior officials from developing countries engaged in the formulation of this type of industrial policy were invited to participate. Countries at different stages of industrialization in Africa, Asia and Latin America were represented.

The programme recognizes that countries at different stages of industrialization face different kinds of policy problems. Some countries may be interested in formulating a comprehensive set of policies for the first time; other countries may wish to adapt their existing policies to changing circumstances and objectives.

Expert Group on Plastics Makes Recommendations and Draws Up Agenda for Petrochemical Conference in 1969

AT THE INVITATION of UNIDO, eleven experts from both developed and developing countries met in Vienna 11–15 November to recommend measures to be taken by developing countries that wish to set up or expand their plastics industry and to draw up a provisional agenda for the Interregional Conference on Petrochemicals to be convened by UNIDO in 1969. A representative of the United Nations Economic Commission for Europe (ECE) joined the expert group for the discussions on the Conference.

Plastics have already been established as one of the world's leading building materials and their volume may be equal to that of steel by the 1980s. One reason for this is that plastics industries can be established at lower relative capital costs and at lower levels of production than those required for steel.

The Expert Group felt that developing countries could achieve significant economies by expanding the use of plastics, thereby also making available more domestic materials. It recommended, for example, that countries interested in such industries as furniture, jute, and surgical instruments should follow developments in the field of synthetic fibres in order to develop competitive local materials and facilities. It warned, however, that developing countries should concentrate on a limited number of plastics for domestic production and should attempt to make the fullest possible use of these materials.

The Expert Group recommended that UNIDO assist the developing countries in a number of ways, including helping in the standardization of terms used in the petrochemical industry and carrying out feasibility studies for countries planning to initiate petrochemical projects. Such studies should also deal with the selection of traditional plastics which should be manufactured first in newly developing countries.

The Expert Group recommended that UNIDO set up a basic documentation centre which would act as a clearing-house for information on petrochemical technology and the experience already acquired by developing countries. The Expert Group also suggested that UNIDO should maintain a list of experts in the field.

Other ways in which UNIDO might be of assistance to the developing countries, in the view of the expert group, included the following:

- Organizing a touring exhibition to visit the developing countries to demonstrate new techniques;
- Making available experts to advise on production and processing techniques and designs;
- Extending training facilities;
- In co-operation with the International Atomic Energy Agency (IAEA), keeping the developing countries informed of advances in the use of radiation processing of plastics (for example, plastics-wood, polyethylene and polyformaldehyde) and studying further possibilities for the use of these processes in developing countries.

After the conclusion of its discussions on the development of the plastics industry, held under the chairmanship of Ahmad Shah Nawaz of Pakistan, the Expert Group turned to a consideration of plans for the Interregional Conference on the Development of the Petrochemical Industry, which will be organized by UNIDO in October 1969 and for which the USSR has agreed to act as host. For this part of the discussion the chairman was Lovraj Kumar of India.

The Group felt that the purpose of the Conference would be best served by concentrating discussions on specific areas of technological development and economics that would be of use to developing countries in providing substitutes for imports, increasing their trade, co-operating on the interregional and intraregional levels, and extending the use of local raw materials. It recommended that the scope of the Conference should be limited to four main areas – plastics, synthetic fibres, synthetic rubber and petrochemical products and raw materials – where there have been major developments since the first Interregional Petrochemical Conference was held in Teheran in 1964.

Some 40 developing countries are expected to attend the Conference, and participants will include representatives at both the policy-making and the technical levels, in addition to individual experts and representatives of private industry.

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By J. C. W. Buxton

Trends in the Textile Industry

In most African and many other developing countries, the textile industry is based on cotton. As a basic agricultural product that can be grown relatively easily and economically, it can be used to provide work and wealth for a large sector of the population. For every person working in a cotton mill, ten families spend 25 per cent of their time growing cotton. The raw material can be made into numerous cloths suitable for many different climates.

The cotton-system plants, however, should be able to use rayon and blends of rayon and cotton and should require only the minimum modification to handle blends with synthetic materials.

Fibres of the future

One of the major problems of the textile industry in developing countries is that synthetic fibres, such as nylon 6 and nylon 66, polyesters and acrylics, are the fibres of the future because of their superior properties whereas cotton is now static or declining. However, the successful production of synthetic fibres requires much capital, know-how and marketing, so it seems likely that the advanced countries will tend to monopolize this industry. It is virtually out of the question for any developing country to set up its own synthetic industry unless it is relatively rich and has a large population. The capital requirements are so great that even an industrialized country such as the United Kingdom is not in a position to maintain the plants of the future, which require a population and a market of European proportions to be successful and competitive. The nylon and polyester patents have run out, however, so the cost of setting up plants to produce these synthetics will be reduced.

The following figures show how large the market is:

	Fibre Consumption			
	Total (in million pounds)		Per Capita (in pounds)	
	1965	1971 (estimate)	1965	1971 (estimate)
Western Europe	7,000	10,000	25	31
United States of America	8,000	9,000	41	45

Today the share of cotton in the Western Europe market is 42 per cent and of the American market, 53 per cent. Projections indicate that these percentages will fall to 35 and 44 per cent in 1971 and by 1975 may be 30 and 39 per cent respectively.

Even more striking are the figures for synthetics, which are expected to increase their share of the market from 16 to 20 per cent in 1965 to 28 to 31 per cent in 1971 and 35 per cent in 1975 in Western Europe.

These figures make no allowance for an important technological breakthrough, such as a new or refined and improved fibre. The tendency appears to be for new or improved synthetics to replace existing ones.

It should also be noted that if wool or cotton is replaced, the poundage of synthetics need not be increased greatly, as 100 units of natural fibre can be replaced by some 70 units of synthetic fibre or even, in the case of polypropylene replacing sisal for baler twine, by only 50 units. This is because synthetics are intrinsically strong.

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In Developing Countries

The adoption of a new synthetic for a given end use, for example polyester filament for rainwear or nylon filament for shirts, can shut down scores of cotton mills and give great prosperity to filament weavers overnight. Filament comes from the fibre maker and requires no conventional spinning, hence it has great impact, especially on the combed cotton poplin trade which only recently was thought to be a growth area.

The greatest growth areas for machinery makers have been in texturizing, that is imparting twist or false twist into continuous filament and heat-setting it; this is also a bulking process.

One effect on the design of machinery is the creation of spindles that turn at up to a million revolutions per minute as compared with, for example, 10,000 to 15,000 revolutions per minute for normal spinning and twisting. It is possible that this method of bulking will become obsolete; the Linen Industry Research Association (LINRA), Northern Ireland, invented the ATOZ system of differential shrinkage, and there are other new methods that result in stretch fabrics.

Of the three predominant synthetics, nylon got off to a headstart, and at present its production equals the combined production of polyesters and acrylics. The acrylics had the fastest growth from 1958 to 1965 and were very important in knitwear and carpets. Polyesters should experience the fastest growth of all synthetic fibres from 1965 to 1971 because of superior versatility.

Fabrics such as polypropylene, chlorofibres and elastomers will probably grow slightly faster than other synthetics, but they are much less in use at present.

Today Western Europe has enough nylon manufacturing plants to satisfy the demand expected in the next seven years, even though these plants are working at only 60 per cent capacity. The polyester plants can satisfy demands for two and a half years ahead, and the acrylics are in a similar position on a slightly lesser scale. Obviously developing countries have little chance to break into this market.

In making textile feasibility studies, one should start from what the market requires or appears to require. This testing of the needs of the market is by far the most important and most difficult task in the whole study. The first estimate is never completely accurate and must be adjusted before the mill is established and continually afterwards.

If any one of the links in the chain, which begins with the bale of raw cotton and ends with the bolt of finished cloth, is weak, the entire industry suffers. By modern thinking, the chain should be lengthened to include garment making through packaging to marketing, particularly because the basic manufacturing costs are a small part of the final retail price.

Choosing equipment

In establishing textile plants in developing countries, one of the most important and most difficult decisions is the choice of equipment. Contrary to general opinion the textile industry has been automated for many years; it is in the course of becoming highly automated and requiring even more capital. £6,000 per worker, although in Zambia the amount is £3,000 because a nascent industry requires twice as many workers as one that is established. In my opinion, developing countries should follow this trend and install labour-saving, up-to-date machinery in their new plants, even if they have a surplus of cheap labour. In ten years the most modern installations will be obsolete, if they

are not obsolete already compared with the most costly available processes.

The modern high production card and drawing frame, for example, has at least four times the output of old conventional models and consequently occupies 25 per cent of the floorspace. By simple economic value, it would be wrong to use low-production, uneconomic machinery where a better choice is available at an economic price.

Similarly, if the capital cost is unavoidably high, treble or even quadruple shift work imposes itself; mills should be planned for three work shifts a day.

Using a treble work shift does not depend only on the availability of workers, or the will of the management. The location, buildings, layout and machinery must be tailor-made for intensive work. The mill of today should be dustless, equipped with air changing, cleaning and cooling, in addition to dust extraction. It should be scientifically illuminated with adequate distribution and intensity of light. It should be on one floor and in one building. Finishing of cloth requires a different type of building and is usually located nearby for convenience of handling.

In spite of being as efficient as possible, vertical integrated textile plants suffer from limitations; one of them is size. It is usually impractical to start with more than a 500- or 600-loom plant, the minimum economic unit for finishing. Such a plant is not large enough to achieve the lowest possible cost, but it should be designed to double within five years its capacity and thus be competitive by world standards.

Another limitation is the shortage of capital. Most new plants are started on loans that must be paid off within five to ten years; the repayment and the high interest inflate costs during the initial period. Even up-to-date machinery depreciates substantially, but this fact is accounted for with the basic cost. Another financial consideration is the cost of expert management, which is expensive but imperative for many years.

Future of natural fibres

An increasingly important limitation for many developing countries is that cotton is their chief raw material at a time when synthetic fibres are having great impact on the world textile industries. Synthetics and blends are the growth areas, but it is not practical for relatively small African countries to produce synthetics, or to start with blends such as polyester cotton. Local cotton must be used and it is unreasonable to think of importing polyester or synthetics until a later stage.

The best policy appears to be to develop the cultivation of cotton so that it can compete in price, and to adopt the new technology for producing finishes, such as resin finishes for crease resistance and easy care.

The same policy can be adopted for other natural fibres such as jute, kenaf and sisal. Money and effort must be spent on all natural fibres, including wool and linen, to equip them with properties such as permanent press for shape retention and controlled shrinkage.

This is the blend age. Synthetic fibres are seldom ideal by themselves. By the use of blends that have been carefully evolved with natural fibres they can be given character, comfort and dimensional stability. There will always be a place for natural fibres when they are developed to suit new conditions.

Experts Examine Problems of the Wool Industry

Problems facing the wool and worsted industry in developing countries were discussed at a meeting of an Expert Group in Bursa, Turkey, from 1 - 9 November. Convened by UNIDO in co-operation with the Turkish Sümerbank General Directorate, the meeting took place in the local Sümerbank worsted mill.

The discussions, which centred on a working paper and the practical experience of members of the group, covered various aspects related to spinning, weaving and knitting, and fabric dyeing and finishing. At the end of each session, the observers were given an opportunity to intervene, addressing individual participants on topics that had been discussed during that session.

Members of the group also visited three local mills, and, at the request of the host organization, gave a critical appraisal of the conditions they had found there. At the conclusion of the meeting in Bursa, several members of the group visited woollen and worsted mills in Istanbul.

Participating in the meeting were twelve experts selected by UNIDO from among representatives of the wool industry, members of the teaching profession, and textile consultants from Belgium, Denmark, the Federal Republic of Germany, France, Hungary, India, Switzerland, Turkey, the United Kingdom and the United States of America. They attended the meeting in their individual capacity and not as representatives of their governments or organizations. In addition, the Sümerbank General Directorate had invited some 35 technicians from Turkish woollen and worsted mills to attend the meeting as observers.

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By William Rendell

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Operations and Policies of the Commonwealth Development Corporation

In 1948 THE PARLIAMENT of the United Kingdom set up the Colonial Development Corporation (CDC), an independent statutory body, to promote and support economic development in those Commonwealth territories that were still dependent. From 1957 until 1963 countries that became independent were ineligible for new CDC investment, but in 1963, Parliament restored the original area of operations and the Corporation received its present name, Commonwealth Development Corporation.

By its constitution, CDC is an independent entity entitled to borrow capital, within limits fixed by statute, from the United Kingdom Treasury and other sources at current market rates and conditions. The Government appoints the chairman and members of the Board, who are part-time and non-executive; members of the CDC management, including the General Manager, are appointed by and responsible to the CDC Board. The amount of money that the Corporation may borrow has been increased periodically and now stands at £160 million (including short-term finance), of which a maximum of £130 million may be drawn from the Treasury at any time. As of 30 June 1968, the total outstanding withdrawals from the Treasury were £112 million. CDC has no equity capital. Loan capital drawn from the Treasury is repayable over a long period (normally between fifteen and 30 years, with a maximum of 40 years) and usually carries interest at a rate equivalent to that paid by the British Government for equivalent borrowings at the date of drawing. Typical interest rates paid by CDC during 1968 ranged between $7\frac{3}{8}$ per cent and $7\frac{3}{4}$ per cent. Under new arrangements introduced in 1966, each year the Government makes available a limited amount of Treasury drawings on which interest is waived for an initial period of up to seven years; interest is, thereafter, payable at the full rate. Loans raised by CDC from market sources bear full commercial rates. As CDC has to pay its way, the cost of its capital is an important element in determining which projects can be justified as CDC investments.

Projects undertaken

The Corporation is authorized to undertake any economic development that is consistent with its charter and that will show the necessary financial return. Consequently its portfolio includes infrastructure loans in addition to investments in agricultural, commercial and industrial projects. On 30 June 1968 just over half (52.4 per cent) of the commitments amounting to £152 million were in infrastructure projects (power and water, housing, finance and transport) compared with £41 million (27 per cent)

in commerce and industry and £31 million (20.6 per cent) in agriculture and primary production. CDC has many more investments in industrial and commercial projects than in infrastructure projects, which tend to be large, or agricultural projects. In fact, on 30 June 1968, there were 74 direct investments in commercial and industrial projects, including thirteen investments in local development companies which, in turn, had made a number of industrial sub-investments. On 30 June 1968, nine industrial development companies to which CDC had supplied £7.75 million on the £19 million total capital resources and for which CDC bears management responsibility, had investment commitments in some 130 projects to a total value of £19 million. The other four CDC investments in local development companies comprise minority holdings in four public companies, each of which has a number of its own industrial investments.

The area of operation of CDC consists largely of the less developed of the developing countries; 70 per cent of the total CDC investment is in African countries in the belt between the Sahara and the Republic of South Africa. The main emphasis in these countries is on the processing of primary commodities, such as foodstuffs and raw materials. CDC often invests in industrial projects where the factory process is linked with an agricultural forestry project in which CDC has an investment. The nineteen investments of this type involve capital commitments totalling £16 million, or some 40 per cent of the total industrial commercial investment.

In the case of other projects, industrial investments tend to be directed to such basic operations as cement manufacture and textile production, which account for another 10 per cent of total industrial investment. Textiles also appear frequently on the development companies' list of investments, particularly in the case of Northern Nigeria Investments Ltd. where 66 per cent of the total £5.5 million investment lies in textile companies. CDC has evolved, in addition, a successful and profitable line in the development of industrial estates with factories for purchase or hire by entrepreneurs of light industries. The main CDC agencies for this type of project are in South East Asia, as for example the Singapore Factory Development Co. and the Borneo Development Co., both jointly owned with the respective Governments and disposing of capital resources of £2 million and £1.7 million, respectively. Other instances are a Hong Kong company (jointly owned with private developers) that rents out workshops in a building constructed to provide separate industrial premises on each floor and a Jamaican company that develops industrial sites adjacent to the new port installations at Kingston, Jamaica.

Management policy

The success of an economic operation depends on good management, and a financial development agency is usually dependent on finding competent and honest entrepreneurs to establish and manage the projects in which it invests. International development agencies will not take responsibility for management, and most national agencies of donor countries follow the same policy. At its inception CDC was operating exclusively in British dependent territories, a number of which lacked an indigenous entrepreneur class, and launched many self-managed projects. The results were so disappointing that in the mid 1950s the CDC Board gave instructions to eschew new projects where competent outside management was not forthcoming. After a time it became evident that adherence to such a ruling would mean little or no CDC-financed development in a number of countries.

Meanwhile CDC management had been gaining experience through carrying on the original projects that held out some prospect of success. On the basis of this experience, in 1951, Lord Reith, CDC chairman, took the lead in decentralizing the administration and setting up regional offices in Jamaica, Lagos, Nairobi, Salisbury and Singapore. Experience had shown that, even with the facilities of modern communications, commercial operations in Africa, the Caribbean, or the Far East cannot be adequately managed from London. CDC was thus organized to operate in the management business and, unlike other development agencies, has continued to do so.

The Corporation moved into management with caution, recognizing that industrial projects present particular management difficulties because of the specialized techniques involved in different industries and that these techniques can change radically in a short time. CDC has sought to avoid management responsibilities for industrial operations other than those concerned with the simple conversion of foodstuffs or raw materials with the production of which CDC is itself associated. There are exceptions, such as the Chilanga Cement Ltd. in Zambia, but for industrial projects CDC usually seeks an experienced partner from private enterprise to take responsibility for management. Even then, results are unlikely to be satisfactory to the investors unless the manager has a direct interest in the success of the project. The best method of ensuring this is to require him to subscribe a substantial amount of equity. Managers should not only stand to gain by the success of the project which they manage, but also should be penalized financially if it turns out to be a failure: management fees, however shrewdly devised, do not adequately encompass the latter contingency.

Experienced entrepreneurs in Africa are primarily expatriates, Asians in East Africa and traders of Syrian and Eastern Mediterranean extraction in West Africa. Indigenous entrepreneurs with the industrial experience and financial backing sufficient for a large industrial project are just emerging. In the Far East, the Chinese industrialist certainly lacks nothing in business acumen, but often does not easily adapt to Western ideas of financing and commercial organization. In the Caribbean, CDC has been particularly

successful in association with local entrepreneurs in Jamaica, but these successes have not been duplicated elsewhere in the area.

Investment arrangements

The most desirable arrangements involving substantial amounts of local capital frequently are made when the capital comes from government sources. CDC is associated in projects with industrial companies from several Western European countries and Japan, but language and custom limitations tip the balance heavily in favour of industrial partners from Commonwealth countries, the United States and, most of all, the United Kingdom. There is no exclusivity in favour of United Kingdom companies, nor are investments of the CDC tied to the procurement of plant and machinery from the United Kingdom, although normally evidence is required that British manufacturers have been given the opportunity of quoting for large contracts involving overseas procurement. The general requirement when CDC makes an industrial investment is that the over-all return should enable the Corporation to pay its way; this means that individual investments should show a margin over the cost to CDC of the money invested.

Industrial investments have been made exclusively in companies established under the local company code, approximating United Kingdom company legislation, and are in the form of shares, a loan, or both. One reason for this is that the capital of CDC is entirely loan for the redemption of which provision must be made in favour of a CDC equity investment; in the event of project failure most of the investment will be lost. Since the Corporation must risk losses, it should share in the capital gain if the project is a success.

In individual cases considerations of balance between the holdings of the various parties associated in the venture and within the portfolio of CDC will also be important. The split between share and loan capital in the subsidiary companies of CDC may have little significance. As of June 1968, shares formed 57 per cent and loans 43 per cent of the direct investments of the Corporation. In the case of the local development companies, shares made up 38 per cent and loans 62 per cent, but the latter figures conceal considerable variation in the figures for individual companies.

CDC normally demands that a project should not require external guarantees except from a government if it directly controls important aspects of the trade, such as the price of the product, or in some cases where the company in which CDC is investing has a (commercial) controlling shareholder. The Corporation obtains from governments advance assurances of project eligibility for such common features as concessions for a pioneer industry and investment protection.

Regional development agencies, such as the African Development Bank and the Asian Development Bank, have projects in most developing countries. Because of the charter and financial structure of CDC, it has been reluctant to invest in other generalized development agencies, whether sponsored by governments or private enterprise, unless the Corporation can exercise some control over the destination of the capital it provides. Nevertheless, CDC has small minority holdings in four local development companies: those in Jamaica and Rhodesia are controlled by private enterprise, and those in the Federal Republic of Nigeria and Malaysia are government controlled after expansion under the auspices of the International Bank for Reconstruction and Development and the International Finance Corporation. In addition to these investments, CDC has sponsored nine local industrial development companies. In the eastern and northern states of Nigeria, Sierra Leone, the Republic of Singapore, Sabah and Sarawak, the companies are joint ventures between CDC and the government concerned. In three instances, CDC and the respective governments have been joined by the development agencies of other governments, of the Federal Republic of Germany and the Netherlands in Kenya and Tanzania and of the former's agency in Uganda. CDC is the sole owner of the Fiji Development Company.

In every case CDC ensures that the manager and each of the associates has the right to veto individual proposals for new projects. These nine local industrial development companies have achieved sufficient success to enable CDC to channel investments into industrial projects, as opposed to agricultural projects and infrastructure loans, rather than to make direct investments. The advantages offered by this type of agency include: the participation of local governments in development projects in respect of finance and the making of decisions by their Board representatives, who thus acquire experience in the fields of project and company promotion; co-operation between donor government agencies; local decision-making, giving the local entrepreneur an opportunity to establish the soundness of his credit; easier handling of applications for finance for smaller projects.

These nine companies have been successful both as development agencies and as profitable ventures. All except one, that was forced by unusual circumstances to suspend operations, have made a profit.

What, then, are the lessons of general application that CDC has learned from its experience of promoting, investing in, and sometimes managing, industrial development projects? Perhaps the basic lesson is that any industrial operation that is set up in a developing country and run as an appendage of an expatriate concern in an industrialized country will normally run into trouble fairly quickly. For a successful venture, the operation should be integrated into the local economy both in regard to part ownership and participation at every level, from the factory floor through to the boardroom. Training will be required, the extent depending on the level of education and the industrial and commercial experience of the local inhabitants. If the effort is made with patience and sympathy it will pay off, even on the bare criterion of cost efficiency.

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A Pilot Plant Geared to Small-scale Production

THE USE OF AUTOMATIC techniques in production processes is increasing constantly in industrialized countries. This trend is associated with extensive series production that results partly from general economic expansion and partly from the emergence of fewer but bigger specialized production centres serving large areas. These centres will probably increase in number in Western Europe with the gradual reduction of tariff barriers by organizations such as the European Common Market.

The word automation conjures up a picture of unattended machines producing an enormous volume of identical articles. This is true of factories in Western Europe and North America where industrial expansion has brought about an acute shortage of skilled labour. To operate with a minimum of supervision, machines are usually complex and consequently expensive. Their maintenance and repair requires highly skilled mechanics.

Highly skilled workers are also engaged in the design of the end-products and the machines that make them. Even where a considerable labour force is required in a manufacturing process such as an assembly line for the

Left: In the Pilot Plant several operations are carried out in one large room.

component parts made by an automatic machine, conveyor belts, pneumatically operated tools and a variety of electrical and electronic equipment are necessary.

Behind these purely technical activities are the other trappings of great industrial enterprise: the production control and accounting sections with their punched cards and computers, the quality control and inspection departments, the personnel department, the medical services and all the other offices that have become necessary for the running of a large factory. Every person working in such a factory is a specialist in some field.

But what is the situation in those countries that have a shorter history of industrial and economic independence? Where a large factory in an industrialized country is producing in terms of hundreds of thousands or even millions, a less developed country produces only tens of thousands or less. What are the possibilities of a developing country obtaining this relatively small requirement? First, the country may purchase the goods from the large factory that can easily satisfy a small additional demand. But the products may not be exactly what the country wants, or there may be no currency to pay for them, or certain governmental pressures may deter import. The second possibility is for the products to be made locally and this, of course, is much preferred in the majority of cases.

The second possibility usually cannot be realized without some outside assistance, and it is natural to turn to the big factory for technical know-how. But how far is this know-how likely to be of real value? Obviously drawings and manufacturing instructions geared to a production run of half a million are of no use if the total requirement is only 5,000. Of course the engineers in the base factory can modify their designs so that production with more limited means is a possibility, but the great drawback is that those modifications need to be made with big factory mentality and with the aid of the resources of a big factory. What may appear to be a logical solution in a factory employing 5,000 people may encounter severe difficulties in, for instance, West Africa in a factory employing 100. How, then, can the large, sophisticated factory in an industrialized country offer valuable assistance in setting up small-scale production facilities in a country in the early stages of industrialization?

This problem exercised the minds of the Philips Radio, Gramophone and Television management for many years and in 1961 led to the decision to set up a model factory to study the specific problems associated with small series production and all aspects of small plant management within a worldwide organization.

Pilot Plant operations

This special factory is the Pilot Plant at Utrecht. It is small, and so that it will remain small the company chose a site where local conditions and bylaws will permit only limited expansion. Philips located this plant away from its main factories in order that personal contact with other engineers on the staff would be restricted; wherever possible communication must be by letter rather than by telephone. The Pilot Plant is a self-contained unit looking after its own personnel affairs, its own accounts and its own purchasing; above all, it runs on its own technical resources.

When the factory was built, a skeleton staff set about recruiting the labour needed to begin operations. This staff tailored arrangements to suit the needs of a small factory.

The staff of the Pilot Plant did not accept administrative procedures followed in the large parent factory as being unquestionably correct for small plant management, but carefully studied and modified procedures wherever desirable. Such organization generally means that one man will deal with a greater variety of activities than his more specialized counterpart in the large organization. Typical arrangements that have resulted from this re-organization is that the secretary of the manager is also the receptionist and the accountant looks after personnel matters. Also, paper work has been considerably reduced and a higher concentration of information is presented on fewer forms.

Production tools and equipment, administrative procedures, documentation methods, stores organization and stock control systems were studied and simplified. The assembly line itself was thoroughly examined and analysed, since the standard system (which was taken directly from the large factory) was found to be unsuitable in small series production. The staff created an entirely new system that has already proved to be extremely flexible. It is equally suitable for small or fairly large-scale production and does not become obsolete as a small plant grows bigger.

Striking examples of this approach can be found in tooling. One of these is the use of a domestic smoothing iron as a hot plate in certain coil and other assembly processes. The use of this iron is not an interim measure to be replaced by a specially built apparatus at a later date; it is a permanent feature. A smoothing iron is obtainable anywhere where radio sets are sold, but the manufacturing facilities for making a special tool may not exist.

As the activity got under way, the Pilot Plant staff members successively solved all the problems. They detected missing or incomplete instructions from the parent plants and modified components to suit hand assembly methods. They increased their understanding of the problems surrounding long distance communication and developed ways and means of improvising. The training of unskilled labour received special attention and training systems have been devised which

are divorced from the big factory personnel selection and training school methods.

Services offered

The Utrecht Pilot Plant is now able to offer its cumulative experience of small factory organization and manufacturing techniques to affiliated factories in countries overseas. It provides ready-made assembly lines (stressing simplicity so that local maintenance is easy), undertakes the training of staff, and disseminates information and advice in various publications and reports. The training and pilot plant programme are meant only to serve staff members in Philips factories in developing countries and technicians from third parties with whom the company has technical assistance agreements. Selection is made by local representatives of the firm or from the centre.

There are considerable advantages in training personnel, whether from Europe or elsewhere, in Utrecht rather than sending instructors abroad. Often engineers and foremen occupy a social position which makes it difficult for them to undergo training in their home country without appearing something of an anomaly; this difficulty can be overcome in the environment of Utrecht. People from all over the world have been trained at Utrecht. Some come for training in a special field, such as accounting or the manufacture of loudspeakers. Such training can be given in a few weeks or months, but for those who wish more broadly based training as, for instance, that of production managers, a stay of a year or more is necessary.

An important element in all training programmes is practical experience. The trainees receive ample opportunity to carry out the work for which they are being trained; classroom instruction is minimal or even non-existent.

In most cases the training is rounded off by each trainee carrying out a case study. The trainees receive the subjects and suggestions on whom to consult, and the literature and other information sources available. The outcome usually gives a good indication of the abilities of the trainee and whether the aim of the training course has been achieved.

In providing written information, the Pilot Plant has found it more valuable to communicate ideas than details. In many cases factories in developing countries require more information than their counterparts in industrialized countries but unnecessary detail often confuses. If Utrecht uses a base plate five millimetres thick for a jig, it is often better to provide a sketch showing roughly what is required than to have someone 3,000 miles away wonder if ¼ inch is acceptable. The Pilot Plant presents information in an illustrated eye-catching form with a minimum of text. This reduces the task of translating into several languages, and technicians are able to make a quick judgement on the importance of the information and whether the ideas can be applied to their local circumstances.

Three basic divisions are made in the degree of production integration:

A trainee receives instructions at the Pilot Plant.

- Set assembly using components made elsewhere and supplied ready for mounting in the sets;
- Assembly based on components made elsewhere but with processing or sub-assembly to be done locally;
- Fully integrated manufacture, starting from basic materials.

Within these basic divisions, new production methods have made it possible to produce standard Philips products and their components efficiently in small series. There is no reduction in quality and the equipment used is simple and inexpensive.

The Utrecht Pilot Plant has prepared many production units for the manufacture of radio and television sets overseas. This preparation includes:

- An estimate of requirements for personnel, equipment and floor space;
- Making and purchasing such items as furniture, tools and other equipment;
- Trial run;
- Compiling extensive illustrated documentation;
- Packing and forwarding of the complete set-up;
- Training the person who will be responsible for a particular production run.

Many staff members of the Pilot Plant have travelled abroad to solve problems of material supply, to begin new production runs and even to start new plants.

Future activities

In speaking of the future of any industrial activity, it is normal to stress the expectation of expansion. This is true of the Pilot Plant, but in a particular way. The emphasis for expansion will be on the factories it assists rather than on itself. Any other policy would be inconsistent with the aims of the plant. If growth for growth's sake became part of the Pilot Plant's own ambitions, it could no longer serve its intended purpose.

Many authorities and institutions active in the field of industrial development in developing countries are showing their interest in the work being done at the Pilot Plant. Immediate continuity is assured, since full technical independence of all factories outside the home country cannot be accomplished overnight. Foreseeable changes are bound to come in the range of products handled, the trend will be toward more complicated and sophisticated products as markets develop, and some planned expansion will probably take place under the conditions mentioned above. Longer term forecasts cannot be made except to say that the Pilot Plant will remain for as long as it is needed. If vigour, imagination and a willingness to adapt are important, it will be needed for a very long time to come.

This article was prepared by staff members of the Pilot Plant.

Industrial Development Board To Meet 24 April—15 May

The Industrial Development Board, the governing body of UNIDO, will hold its third session from 24 April to 15 May in Vienna.

A subsidiary organ of the Board, the Working Group on Programme and Co-ordination, will meet from 8 to 22 April to consider the documentation prepared for the session with a view to: examining the report on past activities, the current programme and the proposed work programme; assessing the financial implications thereof; identifying and commenting on problems of co-ordination in the industrial development field. The meetings of the Working Group are open to representatives of the 45 countries that are members of the Board.

The Board will adopt the agenda for the third session on the basis of the provisional agenda approved at the second session, which met in Vienna 17 April to 14 May 1968. Important items on the provisional agenda include the activities of UNIDO, financial and organizational matters, the co-ordination of the United Nations system in the field of industrial development, and questions relating to intergovernmental and non-governmental organizations.

Items under the activities of UNIDO are those for 1968, the 1969 work programme, the programme of work for 1970, a summary forecast of UNIDO activities in 1971 and an outline of a long-term programme.

Under financial and organizational matters, the provisional agenda contains the following items: the budget estimates for 1970 as approved by the Secretary-General; the forecast for 1971; Regular Programmes for 1970 and 1971; voluntary contributions; organizational matters, including institutional arrangements.

The two items under co-ordination of industrial development activities are the central role of UNIDO and the consolidated and analytical reports and related documents.

Since the second session of the Board, five international non-governmental organizations, the Pan-American Federation of Engineering Societies, the World Federation of Engineering Organizations, the Union des Industries de la Communauté Européenne, the Union Internationale des Architectes, and the International Federation of Automatic Control, have applied for consultative status with UNIDO; two intergovernmental organizations, the Asian Productivity Organization and the Banque européenne d'investissement have requested to be associated with UNIDO.

The Board will elect a president, three vice-presidents and a rapporteur. As the election is based on the principle of equitable geographical distribution and the offices are subject to rotation among the groups referred to in the annex to General Assembly resolution 2152 (XXI), this year the president will be elected from Group C (Latin America); the three vice-presidents from Group D (countries of Eastern Europe with centrally planned economies), the African states in Group A, and the Asian states plus Yugoslavia in Group A; and the Rapporteur from Group B (Western Group).

By P. Nicolau

Research Workers' Organization

When the Société Française des Mécaniciens held discussions on metal cutting for several days in Paris in 1948, some members agreed that existing empirical methods were delaying production engineering techniques, and recognized the magnitude and importance of the work necessary to break away from this empiricism. As a result, Messieurs E. Bickel (Switzerland), D. F. Galloway (Great Britain), P. Nicolau (France) and O. Peters (Belgium) arranged to bring together a number of special research workers who were dealing with the problem of applying scientific methods to production techniques.

The tasks given to these workers under the slogan "Scientific execution of work" was appropriate because the manufacturing cost and the functional value of all work in all centres of industrial activity depends mainly upon mechanical production techniques. For instance, in industrial countries 5 per cent of the national production is wasted in chips. Moreover, problems that ought to be investigated in this field are so complex that only international co-operation can make it possible to solve them satisfactorily.

Principal aims

When the International Institution for Production Engineering Research (in French *Collège International pour l'Etude Scientifique des Techniques de Production Mécanique* and in German *Internationale Forschungsgemeinschaft für Mechanische Produktionstechnik*) was founded in Paris in 1951, members decided to use the initials CIRP — C, College; I, International; R, Recherche or Research; P, Production — to indicate the structure, the make-up, the essential tasks and the fields of activity.

In accordance with the statutes, the following are its principal aims:

- To promote by scientific research the study of the mechanical processing of all solid materials, including checks on efficiency and quality of work;
- To establish permanent contact between research workers by comparing their research programmes and by the exchange of their experimental results;
- To convene conferences of research workers in order to consolidate the research results and to ensure their publication.

CIRP carries out its activities in a purely scientific manner, providing an open forum for all useful aspects of the subject but firmly excluding advertising or commercial propaganda. It is a group of research wor-

The Author: *A founder member and ex-president of the International Institution for Production Engineering Research, P. Nicolau now serves as Secretary-General of the organization. He spent most of his military career at the Central Laboratory for Armaments in France, becoming its Director. He was also Director of Schools for Armament and assisted in the creation, for the French Ministry of Education, of the Higher Institute for Materials and Mechanical Construction, of which he is Director. Mr. Nicolau is a member of the Royal Academy for Science and Literature of Göteborg, Sweden, an honorary member of the French and Belgian Society of Engineers and ex-president of the French Society for Metallurgy.*

Promotes Action, Co-operation

bers and not one of the national professional organizations; members are chosen "by co-option from individuals who have contributed to the scientific study of the processing of materials, and especially those who direct or have directed a Research Laboratory".

Through such a membership, CIRP serves not only as an international forum for mechanical production techniques, but also as an organism of co-operation and action that perfects, by scientific means, the operations in mechanical workshops.

Within CIRP research workers of all countries can gather together in order to study the processes used for treating materials in the solid state (machining by mechanical, physical or chemical means; forming; cutting; assembly and fitting) and the corresponding means of operation (machine tools, metrology). They examine such processes mainly from the following points of view:

- Basic principles;
- Effect of material properties;
- State of surfaces;
- Geometric shapes that can be obtained;
- Interchangeability;
- Automation;
- Adaptation of the work to the man; and
- Efficiency and economic aspects.

At the present time the CIRP has about 100 active members from 24 countries, who represent almost all the research laboratories that carry out continuous work in their fields of activity.

These countries are Australia, Austria, Belgium, Canada, Chile, Czechoslovakia, Denmark, Finland, France, the Federal Republic of Germany, Hungary, India, Israel, Italy, Japan, the Netherlands, Norway, Poland, Sweden, Switzerland, the United Kingdom, the Union of Soviet Socialist Republics, the United States of America and Yugoslavia. The members are equitably distributed among educational establishments and private or public organizations of the mechanical engineering industries. A qualified person from any country may become a member.

Each year CIRP members and interested observers meet at a General Assembly to present and discuss the most important results of research from each country. From time to time specially selected reporters stress the principal current problems. The meeting also features round-table discussions on topical questions of importance to orientation and efficiency of research. Recent topics have been Research and Industry, 1964; Guidance and Orientation of Research, 1965; Adaptive Control, 1966; Research and Standardization, 1967.

The number of papers and their scientific value and practical interest has increased steadily each year. In 1966 members presented approximately 80 papers, more than ten of them surveys. Since 1951 the papers, together with the discussions to which they have given rise, have been published regularly in the Annals of CIRP in one of its three official languages (English, French, German).

Working groups

CIRP has created working groups whose main tasks are developing research projects in their specific fields and ensuring permanent liaison between the members who are prepared to co-operate in specific research work. At present eight working groups are in operation: cutting, physical and chemical machining processes, forming, grinding, machine tools, metrology interchangeability, surfaces, and optimization.

The fields of activity of these working groups are as follows:

● *Cutting* — The whole range of processes in which the shape of a component is conferred by removing material, that is the processes of cutting (turning, milling, etc.); the work of the group will be mainly concerned with fundamental problems of chip formation, physical laws concerning the wear of cutting tools and factors governing the production of surface finish.

● *Physical and Chemical Machining* — Research into material removal processes in which the material removal is not effected through the mechanical action of a tool but is of a physical, physico-chemical or chemical nature; in particular the electro-erosion process or electro-discharge machining (EDM), the electro-chemical process or electro chemical machining (ECM), material removal by beams of highly concentrated energy, *viz.* electron, ion and light beam machining.

● *Forming* – All those processes in which the final shape is conferred by plastic deformation of material (in the form of bars, plates, cast or sintered slugs), including pressure joining and the separation processes; the field includes the application of the theory of plasticity to industrial forming processes.

● *Abrasive Process* – Research into all material removal processes, such as grinding and finishing, in which the material removal is done with the aid of abrasive grains; the work of the group will be concerned mainly with fundamental problems of abrasive grains, basic characteristics of grinding wheels, fundamental mechanics of grinding process, economics of abrasion and so on.

● *Machine Tools* – Problems of the design, manufacture and use of machine tools; these problems are connected with specific qualities, such as accuracy, static and dynamic behaviour, efficiency, automation, and resistance to wear, which describe the performance of machine tools; the group also deals with the performance of individual structures and units, such as drives, bearings, guideways and control systems.

● *Metrology Interchangeability* – Development and application of measuring techniques to the analysis and control of quality in production; the scope covers measurement of size, shape and positional relation.

● *Optimization* – Planning and conducting co-operative international research to develop new knowledge and new techniques for technical, economic and human optimization of the over-all design and manufacturing system; the subjects dealt with include design for production, group technology, factory equipment selection and layout, numerical control, adaptive control, application of computers to manufacturing, manufacturing systems, information technology and human factors in production engineering. This group also makes recommendations to the other CIRP working groups concerning research which they might undertake to assist the process of economic optimization of the various elements (production equipment and processes) of the manufacturing system.

● *Surface Roughness* – Study of the geometrical, physical and chemical properties of the surfaces of workpieces; investigation of production processes in relation to these characteristics with the object of establishing a typology; effect of these characteristics upon the desired function.

Intended to be an aid to industry, in recent years the groups have performed the following tasks:

● Provision of selected bibliographies;

● Organization of colloquia;

● Co-operative research projects;

● Co-operation in specialized sub-groups;

● Exchange of research programmes;

● Standardization of terms and symbols;

● Annual presentation of laboratory reports and the discussion of work taking place in the various laboratories.

Co-operation with other organizations

A ninth group has undertaken the preparation of "Dictionaries of Production Engineering" in liaison with national professional bodies. The following volumes of the CIRP Dictionary have been published:

● Volume 1, *Forging and Drop Forging* (German-English-French);

● Volume 1.R, *Forging and Drop Forging* (German-Spanish-Italian-Portuguese);

● Volume 2, *Grinding, Surface roughness* (German-English-French);

● Volume 3, *Sheet Metal Forming* (German-English-French).

The following are in preparation:

● Volume 1.N, *Forging and Drop Forging* (Nordic langnages);

● Volume 4, *Cold Extrusion and Upsetting* (German-English-French);

● Volume 5, *Machining* (German-English-French);

● Volume 6, *Turning, Broaching, Shaping, Planing, Slotting* (German-English-French).

A Liaison Committee composed of the chairmen of the different groups keeps the general scientific and technical programme up to date, guides the execution of the programme in liaison with interested industries, co-ordinates the work of the groups and investigates interrelated problems.

As a member of the Union of International Technical Associations, CIRP has received from the United Nations Educational, Scientific and Cultural Organization (UNESCO) financial aid that has enabled it to produce its technical dictionaries.

In recognition of the general interest in and significance of the work carried out by CIRP, the Organisation for Economic Co-operation and Development (OECD) has sponsored and given material aid to proposed co-operative research work in three fields: metal cutting, cold forming and surface roughness. Moreover, a financial contribution from OECD made it possible for CIRP to undertake a census of laboratories engaged in research into production engineering (World Register) and to distribute it widely. This work would have been in vain if it had not been carried out in close collaboration with the industries that will eventually benefit from it.

In addition, CIRP has studied the problems of liaison between university and industry or, perhaps more precisely, research and industry. These problems arise more in the field of mechanical production techniques than in any other, because it is here that the greatest gap exists between the laboratory and the workshop. A report of the round-table discussion on this subject at Stresa, Italy, in 1964 is being published in German, English and French.

To assist in establishing liaison between research and industry in the field of mechanical production it is most important to establish close links between CIRP on the one hand and the industries interested in its work and the national institutions directing such research on the other. The members of CIRP have been asked to undertake the setting up of permanent liaison between the relevant industries and organizations in their respective countries.

In each country CIRP has invited those industries that are interested in its work to associate themselves with CIRP by becoming "benefactors". CIRP expects from its "benefactors": a continuous supply of information concerning the actual needs of industry; provision of the necessary means to enable the most qualified laboratories to participate in the co-operative research projects under CIRP; moral support; a relatively modest material contribution for the operation of the Secretariat of CIRP.

In return, CIRP offers: free documentation on all research work undertaken and published in CIRP Annals; through its national members, continuous information concerning the co-operative research work of CIRP and its working groups; participation in the annual discussions.

CIRP is endeavouring to develop better media for the interchange of information on production engineering research. Developing countries could profit from this activity by taking part in some of the public sessions or by obtaining information from qualified members on specific subjects.

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43 Governments Pledge Contributions to UNIDO

At the first annual Pledging Conference for UNIDO, held at United Nations headquarters in New York on 4 December, 43 Governments pledged a total of US$ 2,656,108 for the 1969 operations of the Organization.

Of this total, $1 million was a contribution announced by the Federal Republic of Germany to the Special Industrial Services programme (SIS).

In addition to the countries that announced contributions, representatives of 34 countries made statements. Some said that their Governments would announce their contributions at a later stage, while others expressed the view that funds for UNIDO operational activities should come from the resources of the United Nations Development Programme (UNDP).

In an opening statement to the Conference, United Nations Secretary-General U Thant referred to the conviction expressed by the Industrial Development Board that the autonomy and effectiveness of UNIDO could be better ensured if it had independent financial resources. He stated that vast resources would be required to finance the industrialization of the developing countries and that while most of the efforts to achieve a meaningful level of industrialization would have to come from the countries themselves, international machinery had a role to play in promoting concerted efforts and in acting as a catalyst for the provision of specialized assistance in key areas of industrial development.

U Thant concluded with an appeal for a large number of contributions and pointed out that the success of this Conference would serve to further the aims envisaged by the General Assembly when it decided to create special United Nations machinery for industrial development.

In his statement to the Conference, the Executive Director of UNIDO, Ibrahim Helmi Abdel-Rahman, recalled the high hopes that the creation of UNIDO has inspired. The ultimate success of the organization in coping with the problems of industrialization depended on the existence of an adequate framework for international co-operation, he added, for though significant strides forward had been made, the challenge of the task that lay ahead still loomed large. He concluded that it was the response of the member Governments to this challenge and their support in providing the means necessary to carry out the practical aspects of the work that would ultimately determine whether UNIDO would be able to live up to the high hopes inspired by its creation.

The Conference unanimously elected Heinrich Haymerle (Austria) as President, and Eduardo Bradley (Argentina) and Petre Tanasie (Romania) as Vice-Presidents.

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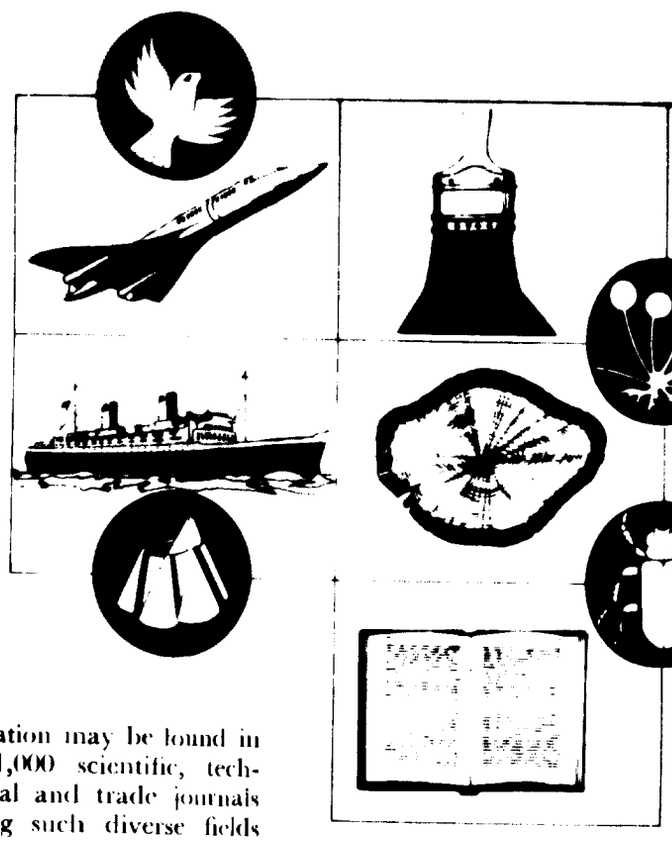
The Author: *At the University of Aston, Birmingham, England, H. O. W. Eggins is in charge of the Biodeterioration Information Centre, which is closely associated with practical research on the ecology of deteriogenic fungi. He is a member of the International Biodeterioration Research Group and was Chairman of the Organising Committee for the first International Biodeterioration Symposium held at Southampton University in September 1968. After receiving his Ph.D. at the University of Nottingham, Mr. Eggins attended Ibadan University, Nigeria, where he studied cellulolytic fungi and the biodeterioration of palm oil.*

Biodeterioration I

Provides Worl

BIODETERIORATION IS OF CONSIDERABLE importance to many industries, particularly in the developing countries where biodeterioration hazards can drastically reduce the availability of foodstuffs and the life of equipment.

The term biodeterioration is used to describe the microbiological deterioration of materials so that they are rendered unsuitable for their intended use, reduced in economic value or more costly to process. It applies to a wide range of commodities and structures that are liable to be affected by a variety of micro-organisms. Some examples are the attack on wood, paper, textiles and grain by fungi and insects; the blocking and corrosion of pipelines by bacteria; the growth of fungi and algae on concrete and painted surfaces; the fouling of ships and marine structures by barnacles and molluscs; the destruction of products in storage by rodents and the hazards caused to aircraft by birds. The aim of the Biodeterioration Information Centre at the University of Aston in Birmingham, England, is to assist in solving these problems.



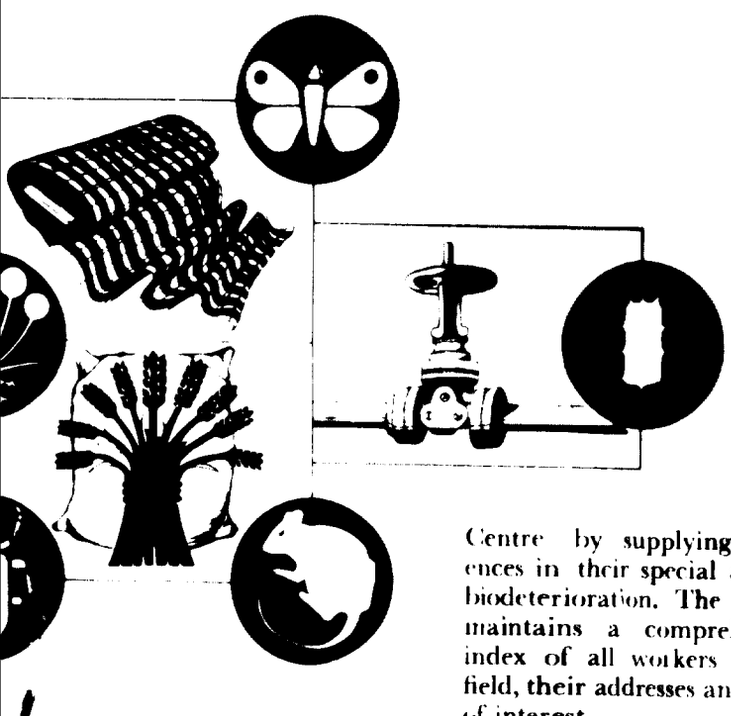
Collecting material

The University, aided by a grant from the Office for Scientific and Technical Information, United Kingdom Department of Education and Science, established the Centre in 1965. Linked closely with the University's practical research on problems concerned with the biodeterioration caused by fungi, the Centre collects literature on the deterioration of economically important materials by living organisms. Important information may be found in some 1,000 scientific, technological and trade journals covering such diverse fields as mycology and the aeronautical industry and in test specifications, patents and commercial preservative and curative literature. More than 100 biodeterioration experts from all over the world assist the

By H. O. W. Eggins

Information Centre

ld-wide Service



Centre by supplying references in their special area of biodeterioration. The Centre maintains a comprehensive index of all workers in the field, their addresses and fields of interest.

The information collected from all sources forms the basis of a system for a free question-answering service, a specialized bibliographical service, and a loan and photocopy service. The Centre also publishes a semi-annual journal, the *International Biodeterioration Bulletin*, containing primarily original and review articles and notes on new techniques, and a quarterly journal, ***International Biodeterioration Bulletin Reference Index Supplement*** (**IBBRIS**), containing references to published literature on all aspects of biodeterioration. Charges are made only for the photocopy service and the journals, and special arrangements may be made with recipients in developing countries when currency difficulties are encountered.

After establishing the information collection service, the Centre developed a small research team for short-term experimentation on specialized projects arising from the frequent literature surveys undertaken. Completed projects include the development of test techniques to encompass a number of biodegradable materials, several culturing systems to enable the rapid growth of biodeteriogens and the elucidation of detoxification pathways. Current research includes an assessment of plastics decay, an appraisal of the potential uses of silicones for water-repellent preservatives, a mycological evaluation of the deterioration of pure cellulosic substrates and beechwood timber, and the determination of factors involved in the tolerance of certain bacteria and fungi to withstand the presence of pentachlorophenol based biocides.

It is hoped that a growing realization of the importance of biodeterioration will lead to a greater sponsorship for advancing research techniques and thereby result in the elaboration of industrial processes and curtailment of material deterioration.

The need for information on biodeterioration is world-wide, but it is of special importance to developing countries as many of them are in the tropics, where temperature and other environmental conditions are highly conducive to this form of deterioration. The

Research Projects

Brazilian Company Produces Animal Feed from By-product

The Sociedad Algodoeira do Nordeste do Brasil (SANBRA), Recife has developed a process to use the protein-rich by-product, castor cake, as animal feed. The castor seed cake competes in price and quality with other proteinic products, such as cotton cake, soya and coconut. Two products have been produced by the company: Lex Proteico, which contains 36–38 per cent protein, 35 per cent carbohydrate, and is 51 per cent soluble; and Proteico Ration, a blend of Lex Proteico, Cotton Lex, molasses and salt.

The table below shows the amino acids contained in castor seed cake in comparison with other products.

Since the shortage of protein is one of the most important problems facing developing countries and the shortage for human consumption cannot be separated from the shortage for animals, the United Nations has been active in assisting developing countries in their attempt to solve this problem. Because of the importance of the utilization of castor seed cake as animal feed, UNIDO is preparing a document, to be published later this year, giving a complete description of methods, equipment, investment, process and other economic and technological aspects.

A comparison of the principal amino-acids contained in cakes of certain oleaginous seeds in percentages

Amino-acids[a]	Castor seed[b]	Cotton seed[c]	Peanut[c]	Coconut[c]	Soy bean[c]
Glycine	—	5.3	5.6	—	—
Valine	6.6	3.7	8.0	2.4	4.2
Leucine	7.2	5.0	7.0	11.3	6.6
Isoleucine	5.3	3.4	3.0	0	4.7
Phenyl-alanine	4.2	6.8	5.4	5.2	5.7
Threonine	3.6	3.0	1.5	0	4.0
Tryptophane	0.6	1.3	1.0	1.6	1.2
Cystine[d]	3.5	2.0	1.6	1.8	1.9
Methionine	1.5	2.1	1.2	0	2.0
Arginine	11.0	7.4	9.9	7.1	7.0
Histidine	2.5	2.6	2.1	0	2.3
Lysine	3.1	2.7	3.0	0	5.0
Tyrosine[d]	1.0	3.2	4.4	0	4.1
Glutamic Acid[e]	18.0	17.7	—	—	—

Source: [a] Amino-acids, considered on the basis of 16 per cent of nitrogen in the cakes; [b] *The Journal of the American Oil Chemists' Society*, August 1958; [c] The magazine *Oléagineux*, January 1959; [d] *The Journal of the American Oil Chemists' Society*, July 1944; [e] Cotton seed: Bailey.

Determining Relative Flammability of Polymers

A highly sensitive and easily reproducible analytical technique for determining the relative flammability of polymers has been developed recently by General Electric Research and Development Center, Schenectady, New York, United States of America.

The new technique, performed with a simple and compact apparatus, consists of burning small strips of solid or woven samples in a candle-like manner in combinations of selected gases. Because of the accuracy and precision of this testing method, it is expected to

be valuable to plastics and textile manufacturers, chemists, chemical engineers and others who must evaluate the flammability of products.

The technique and accompanying apparatus were the results of a search for a simple, reproducible, and informative test that could be used to differentiate degrees of polymer flammability. Such an accurate measure was needed for research on the nature of combustion.

Unlike most traditional measures of flammability the new technique depends upon a variable that can

Scientists test the new technique they developed for determining the relative flammability of polymers.

be measured precisely, the minimum volume concentration of oxygen required to support the burning of the sample. This minimum value, which is described as the critical or limiting oxygen index, can be determined to an accuracy of 1 per cent.

In the technique, a solid polymer stick eight centimetres long is clamped in an upright position inside a tall, vertical, glass chimney. The sample is ignited at the top and allowed to burn down in a candle-like manner. At the same time, the technician introduces air enriched with nitrogen or oxygen at the bottom of the vertical chimney and allows it to rise slowly, at a controlled rate, past the flame.

A strip of woven fabric can be burned in a similar manner if supported by a single filament of quartz or hard glass woven loosely through the sample.

The flammability of a sample is determined by adjusting the concentration of gases rising past the burning material. The critical oxygen index is defined as the minimum oxygen concentration that permits the entire length of the sample to burn.

Each gas used in the technique is metered by its own critical flow orifice. Test atmospheres are prepared by metering air and either nitrogen or oxygen, mixing the gases, and feeding them into the glass chimney. The gases are passed through a bed of glass beads to smooth their flow and then up through the chimney and out of the open top.

The technique is not limited to gaseous atmospheres of nitrogen and oxygen. To study the effects of different flame kinetics, nitrous oxide can be substituted for oxygen and various inert gases (such as helium, argon, and carbon dioxide) can be used in place of nitrogen.

The Flammability Tester (Oxygen Index Apparatus) consists of a highly accurate gas metering unit and a flame holder assembly. The metering unit, a small compact cabinet, contains flow regulators, calibrated critical flow orifices, Bourdon test gauges, valves, and gas connexions. The flame holder assembly, which connects to the metering unit, consists of a stand, Pyrex chimney, sample holder, and a bed of glass beads.

According to its developers, the Flammability Tester can be used as a laboratory tool to provide insight into the complex chemistry and physics of burning and should be valuable in determining the true chemical effects of new flame retardant materials on the burning of natural and synthetic fabrics and structural materials. Such knowledge may also provide greater insight into the selection and use of these flame retardant materials in the manufacture of plastic products.

The new oxygen index technique differs in several important respects from other methods for measuring polymer flammability. The use of the candle-like flame to evaluate flammability results in negligible convective heating of the sample; that is, the flame burns down along a surface which has not been pre-heated by hot gases released by the combustion process.

The measurable critical oxygen index affords a sensitivity and reproducibility not possible in other techniques. The small size and compactness of the Flammability Tester and its ease of operation indicate that it will be useful in research and production laboratories. The technique could be used to form the basis of new standards for the evaluation of fabric flammability.

Meeting on the Establishment of Pharmaceutical Industries

An Expert Working Group on the Establishment of Pharmaceutical Industries in developing countries will meet in Budapest 4 - 10 May. Sponsored by UNIDO, the Group will consist of some twenty participants from both developing and developed countries.

Developing countries need basic drugs for use in the treatment of infections, nutritional deficiencies, children's diseases, and vascular, urinary and dermatological problems. Many of these countries could produce pharmaceutical substances from animal and vegetable minerals, which would improve the health of the population and provide economic benefits from the industries that would be established.

The principal points the Group will consider include:

- Types of pharmaceutical preparations used particularly in developing countries, and their sources;
- Facilities available in developing countries for the production, testing and quality control of pharmaceutical preparations;
- Facilities available in developing countries to support a pharmaceutical industry;
- A recommendation on the pharmaceuticals considered essential to developing countries;
- The establishment of a list of useful drugs or pharmaceutical preparations;
- The preparation of a list of therapeutical materials from both animal and plant sources that could be used to prepare basic pharmaceutical products.

Answers to Industrial Inquiries

Reprocessing of Used Refractory Materials

Each month the UNIDO Industrial Inquiry Service receives a number of requests for possible solutions to a wide variety of industrial problems. (For a full description of this free service, see Industrial Research and Development News, ***Vol. III, No. 1, pp. 22–23.) Beginning in this issue, the*** News ***will publish a selection of subjects about which information has been requested, so that readers with similar problems may also use the Service. The column will publish, in addition, replies to questions representing problems of wide interest. The name of the organization is given in each case.***

The development of standardization for industry in Nepal (107)

Nepal Industrial Development Corporation, Kathmandu, Nepal

The establishment of a steel rolling mill in a developing country (108)

Private Inquirer, Trinidad, W. Indies

Copper production and copper processing industries throughout the world (111)

Operations and Market Research Bureau, The Chamber of Economic Affairs, Ljubljana, Yugoslavia

The long-range economic development and industrialization of a city (112)

College of Business Administration, University of the Philippines, Diliman, Rizal

The utilization of intermediate technology in India (115)

Khadi and Village Industries Commission, Bombay, India

The planning and organization of industrial estates (116)

Ministry of Commerce and Industry, Seoul, Korea

Literature on methods of industrial promotion (119)

Capital Investments Board, Accra, Ghana

A bibliography for an industrial development corporation library (121)

Industrial Development Corporation of Zambia, Ltd., Lusaka, Zambia

Technological forecasting for the metallurgical industries (123)

Industries Development Corporation Ltd., Haifa, Israel

The development of a packing materials industry (124)

Haile Selassie I Printing Press, Addis Ababa, Ethiopia

Recent industrial planning in India, Japan, Malaysia, the Netherlands, Pakistan and Sweden (128)

Ministry of Commerce and Industry and Foreign Trade, Lusaka, Zambia

Mathematical and statistical analysis in industry (129)

Director General of Statistics, Ministry of Economy, Tehran, Iran

The development of a cassava processing industry (130)

Instituto Nacional de Technologia y Normalizacion, Asuncion, Paraguay

Possibilities regarding the manufacture of polyvinyl chloride (PVC) self-sealing bags for the packing of glucose and blood plasma (131)

Chemical Consultants of Pakistan Ltd., Lahore, West Pakistan

The processing of agricultural products in Algeria, Mali, Niger and Tunisia (139)

Institute of Tropical and Subtropical Agriculture and Forestry, Prague, Czechoslovakia

Published material on technical information services (144)

Centre for Industrial Research, Haifa, Israel

Industrial planning, project evaluation and profiles (147)

Institut Panafricain pour le Développement, Douala, Cameroun

Regulations concerning multinational enterprises, both public and private, that serve the public interest (149)

Organization of American States, Buenos Aires, Argentina

Cold storage and canning (150)

National Productivity Center, Ankara, Turkey

The effect of legislation on the development of the minerals industry in various countries (151)

Federation of Pakistan Chambers of Commerce and Industry, Karachi, West Pakistan

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We quote below from a query received from the Ghana Industrial Holding Corporation on the **reprocessing of used refractory materials.**

"Our Steelworks Division, which has a capacity of 30,000 tons of steel per year, uses considerable quantities of refractories (of the order of US$100,000 to 200,000 annually). When these refractories become worn, they are removed and discarded. From time to time we receive inquiries from other industrial establishments in need of refractories, as to whether we could supply such to them.

"It has occurred to us that in many applications, where the refractories are to be used as high-temperature insulants rather than in direct contact with fire, reprocessed refractories might be satisfactory. We imagine that such reprocessing could consist of breaking up the used refractories into smaller pieces (by means of a crushing machine), and subsequent consolidation of the pieces into larger blocks by use of a heat-resistant binder, such as a special clay.

"If this were possible, we could help other industries in Ghana, could save valuable foreign exchange for the country, and recuperate some of the investment made by our Steelworks in refractory material."

The answer was provided by a letter from a United Nations expert, a letter from the Inter-Group Laboratories of the British Steel Corporation (formerly BISRA, the British Iron and Steel Research Association) and an article on "Furnace Maintenance with Reprocessed Refractories, a Panel Discussion", *Journal of Metals*, August 1967. Part of the answer from the United Nations expert is given below.

"Discarded refractories from many industrial applications are reclaimed in most industrial countries for re-use as grog in compounding refractory bricks. This is usually done with clay refractories, less frequently with basic refractories. If the Steel-works Division in Ghana is a well integrated operation, they might have both, that is fireclay and basic (magnesite, chrome-magnesite) refractory waste. I would not recommend that the basic waste refractories be reused. That leaves only clay-based refractories to be dealt with.

"To make best use of the waste materials, one would normally start with their classification according to quality. Clay refractories used in steel plants vary widely in their properties and above all, refractoriness. While a low quality brick might be used in certain parts of the soaking pits, nothing but the best is suitable for the most exposed parts of a blast furnace. The classification should be started at the steelworks, where their place of use is well known. Next comes cleaning. This is a particularly difficult operation as much of the steel plant waste refractories is contaminated with slag and iron which must be eliminated before any use of the waste can be made. The cleaning can be done only by hand, which might be expensive. Badly contaminated refractory wastes are not worth cleaning, especially in countries where labour is expensive.

"Further up-grading of the waste refractories requires a manufacturing plant with a degree of sophistication and mechanization relative to the desired manufacturing capacity and the funds available. The simplest manufacturing plant would, therefore, have a crusher (of the jaw or gyratory type) and a dry-pan for grinding the grog together with the required bonding clay. A bucket elevator would elevate the ground grog-and-clay mixture to a vibrating screen, where it would be screened to the required size and deposited in a bin or silo.

"The bulk of the production of the refractories plant would be bricks of standard size and shape, probably 9" × 4½" × 3". These are best shaped mechanically. A sizable portion of the output would be in so-called special shapes that are best moulded by hand into wooden moulds.

"The screened grog-on-clay mixture would then be taken from the bin and tempered with water in a pug-mill for shaping by extrusion. In this case the pugged grog-and-clay mixture is fed directly into an auger extrusion machine, from which a continuous column is extruded. This column is cut by means of a

wire cutter and the blanks obtained are re-pressed on a suitable press. Some small plants still prefer to pre-dry the blanks and repress them in a suitable hand-operated toggle press.

"Today, the simplest and least expensive way to work the ground grog-clay mix into bricks is by dry-pressing. The presses used here may vary from a US $100,000 dry press to a simple hand-operated screw press equipped with a fly-wheel. In any case the clay-grog mixture is tempered only with from 8 to 10 per cent water in a wet-pan or a mixer. Tempering with water for dry pressing may be done, however, directly in the dry pan, by adding the required amount of water at the time of grinding. In this manner one operation is saved and the whole process simplified. The humidified clay-grog mixture is usually deposited in a bin from which it is taken as required for pressing.

"Up to a certain output, the bricks may be dried on the floor under a shed. Drying should present no problem in Ghana except, perhaps, during the rainy season. A plant with an output of over 30 tons per day should be equipped with an artificial drier, using waste heat from the kilns.

"Firing would be done in periodic round, down-draft kilns. For outputs of over 5,000 9" bricks per day a tunnel kiln would probably be more economical in the long run, even though its initial cost would be higher. The firing degree would probably be to cone 13 - 14, that is approximately 1,370° C.

"Special consideration must be given to the source of the clay, which could either be local or imported and should be the best bonding clay available.

"The plant should have its own small laboratory where simple routine control tests, such as the determination of shrinkage, porosity and softening point (the so-called Pyrometric Cone Equivalent), could be carried out.

"This is a brief outline of the manufacturing process. There might be considerable variations and refinements depending on the capacity desired and the funds available.

"The next step would be to determine the amount of available refractory waste and to calculate the output of the plant. Subsequently an expert would have to decide the lay-out of the plant and prepare equipment specifications."

The answer from BISRA was as follows:

"An exhaustive search of the metallurgical literature has revealed only one reference on the use of recovered refractories and I enclose a copy for your attention; this non-availability of literature has also been confirmed by the British Ceramic Research Association who could only add two very old papers to the one enclosed. These are as follows. 'Used Refractories', by C. C. Hermann, *Pocco*, 1935, 79, 410; 533 and 'Utilising Waste Material in the Iron and Steel Industry', by E. A. Wraight, *Mining Journal*, 1940, 209, 266.

"They also suggested that the Lafarge Aluminous Company Ltd., 73 Brook Street, London, W.1., manufacturer of refractory concrete, may be able to offer some guidance on the use of recovered refractories as an aggregate in refractory concrete."

Copies of "YOUR QUESTIONS ANSWERED" describing the Industrial Inquiry Service and other sections of the Industrial Information Service of UNIDO will be sent free on request.

Group Training Programme on Industrial Estates

The Group Training Programme on Industrial Estates, organized by UNIDO in co-operation with the Government of India, was conducted at the Small Industry Extension Training Institute, Hyderabad, India.

The course for seventeen English-speaking trainees from developing countries began on 19 January with six weeks of classroom instruction. The next four weeks were devoted to visits and project work in industrial estates in India.

The main topics of the classroom part of the programme were: the role of industrial estates; the place of industrial estates in the promotion of small-scale industries; the economic and physical planning of industrial estates; organization, management and finance; services and facilities.

The importance of industrial estates as a tool for the development of small-scale industries has been gaining increasing recognition in developing countries in recent years. A number of estates are already in operation, others are under construction and many projects are at the planning stage.

Various United Nations Development Programme Special Fund projects include assistance for the establishment of industrial estates. Expert advice and assistance in this field has been provided under UNDP Technical Assistance and Special Industrial Services programmes to an appreciable number of countries.

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Practical problems are dealt with in the workshop of the Institute.

Industrial Research

INDUSTRY IN THE Sudan is in its early stages of development. Only 9,000 people were employed by industry in 1956, and the majority of them in workshops of less than thirty people; the economy of the country was based on agriculture. Realizing the hazards inherent in such an economy, the Government began to pursue a policy aimed at greater industrialization, so that by 1971 it is planned that industry will provide 16 per cent of the gross domestic product.

Naturally, such comparatively rapid development has brought a number of problems, among them that of finding skilled labour. There is, and will be for some time, a shortage of skilled manpower and personnel experienced in modern industrial technology. It was with the idea of assisting in bridging this gap that the Special Fund, now part of the United Nations Development Programme (UNDP), signed a five-year plan of operation with the Sudan Government in February 1965 to set up the Industrial Research Institute in Khartoum, with the United Nations Centre for Industrial Development, the predecessor of UNIDO, as the executing agency. The Industrial Research Institute at present occupies three buildings with a floor area of 1,000 square metres in grounds of approximately 9,000 square metres and is situated in Khartoum on the ring road connecting the three towns of Khartoum, North Khartoum, and Omdurman and within half a mile of the junction of the White and Blue Niles (the Mogren area).

Plans are being finalized for the design of a permanent headquarters, which will be located in Khartoum near the University and other research and government departments and within easy reach of the main centres of industry in the three towns.

These new premises will contain ten chemical research laboratories, two mechanical testing laboratories, a chemical engineering laboratory, a reference library, conference and lecture halls, and workshops, in addition to the management engineering offices and administration.

The Author: *Abdalla Abdel Wahab is Chairman of the Board of Directors of the Industrial Research Institute and Under-Secretary of the Ministry of Industry and Mining. He is also chairman of three boards, those of Petroleum, the Industrial Development Corporation and the Industrial Planning Corporation. Previously he has served as Under-Secretary of the Ministry of Finance and Economics and as Chairman of the Board of the Institute of Public Administration. Mr. Wahab has a Diploma from Khartoum University College, is an M.A. (Hons.), University of St. Andrews, Fife, Scotland, and a Fellow of the Economic Development Institute of the World Bank.*

By Abdalla Abdel Wahab

Institute, Khartoum

A staff member works in the laboratory of instrumental analysis.

The Institute, established as a corporate body on 20 February 1968, is controlled by a Board of Directors on which the private and public sectors of industry and the relevant Government Ministries are represented.

The objectives of the Institute are to promote industrial and economic development through the application of industrial research and technology adapted to conditions in the Sudan by making widely available at local centres information on assistance, professional advice on processes, standards and techniques of industrial production, costing, organization, and management technology.

At present a team of United Nations experts works with fifty Sudanese graduate counterparts. The counterparts, with few exceptions, joined the Institute without previous practical experience and, therefore, the training of such staff is one of the most important aspects of the work of the Institute.

Apart from training on the job and lectures, eleven fellowships have been awarded to counterparts by the United Nations, and several others by the Sudan Government and, with bilateral aid funds, for study overseas.

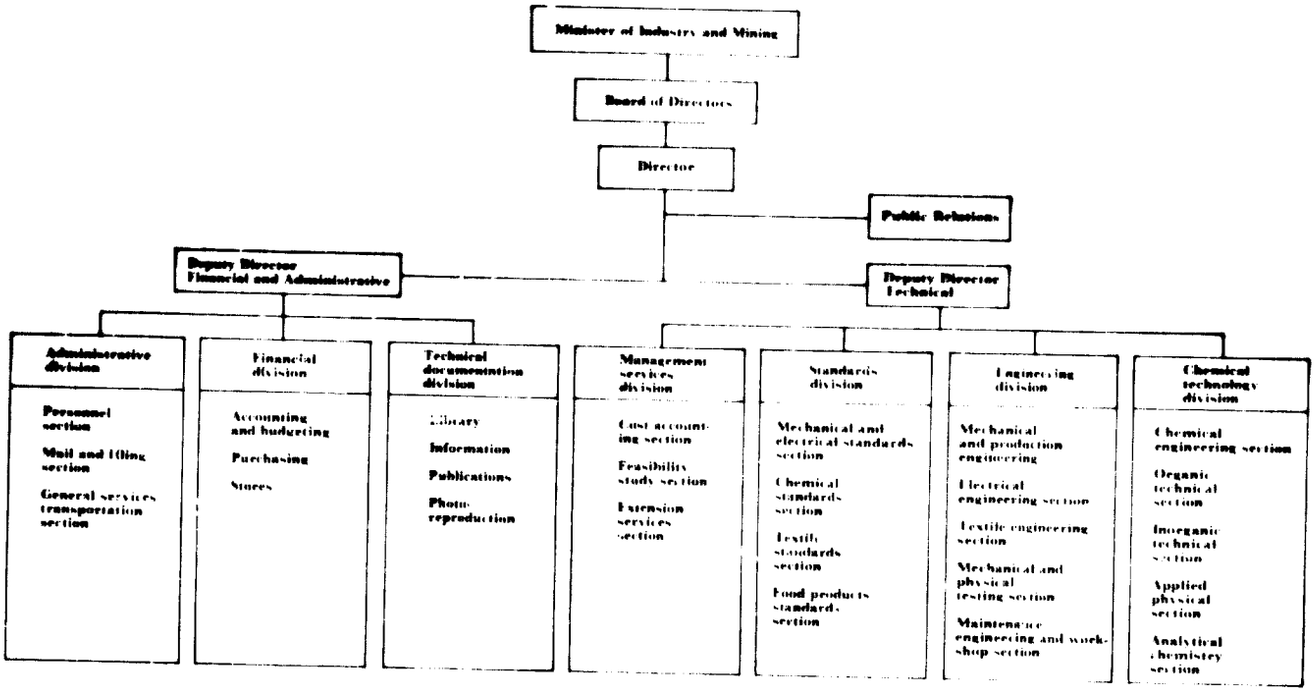
In a developing country such as the Sudan, new areas for investment are constantly arising and the Institute has carried out a number of feasibility studies, mainly for the public sector, for new projects such as, for example, a fertilizer plant for the production of urea and a tannery. At the same time, the Institute is engaged in research to discover projects suitable for private investment and to present technical and economic profiles of them.

It furnishes advice and provides consultancy services on problems of industrial planning, process engineering, production management, management accounting and costing and quality control to existing industries and to those that are being established. The Institute has also conducted specialized courses on subjects pertaining to industrial development and technology.

The Organization and Promotion of Industrial Investment Act 1967 was introduced under the aegis of the Ministry of Industry and Mining to further the development of industry and to promote a healthy climate of investment for private investors at home and overseas. One important consequence of this Act was the formation of the Sudan Organization for Standard Specifications. The Institute is represented on its Board and on all its technical committees. Standards on a number of local industrial products have been drawn up and will be submitted to the Organization for issue as standards.

In the chemical laboratories a wide variety of analyses of ores, raw materials and finished products are conducted and advice is given on the efficient utilization of local raw materials and on improvement in the quality of products.

INDUSTRIAL RESEARCH INSTITUTE, KHARTOUM, SUDAN



Another important aspect of the activities of the Institute is its library and information service. The public is encouraged to use the library, which contains books on most technical subjects and is increasing considerably; it also receives copies of more than forty technical periodicals.

The Institute has been financed by the Sudan Government and from UNDP funds. Under the formative act, the Institute is allowed to charge for its services and although only nominal charges have been made so far, it is hoped that receipts for services will eventually form a major part of its revenues. The Institute, though comparatively new, is emerging as a successful enterprise and an asset to industry.

UNIDO Information Course for Government Officials

In May 1968, the Government of Switzerland contributed one million Swiss francs to UNIDO to be used in organizing information courses for government officials and professionals from developing countries responsible for formulating and applying technical assistance programmes for industry. It is expected that the participants in the training programmes will assist their home countries in the development of industrial projects and facilitate a working relationship with UNIDO.

The first of these training programmes, organized for English-speaking participants from African and Middle Eastern countries, covered a period of six weeks in March and April 1969. UNIDO will hold similar programmes for English, French and Spanish speaking persons from Africa, Asia, Latin America, Europe and the Middle East.

The participants spent the first two weeks of the programme at UNIDO Headquarters in Vienna. Here they studied the functions and procedures of UNIDO, particularly those concerned with planning and executing technical assistance programmes. Following this, they began a three-week tour of European industries and related institutions. During the final week of the course, the participants returned to UNIDO headquarters for discussions on the activities of the programme and their relevance to industrial problems in their home countries.

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Research Development Corporation of Japan

By Hisashi Harada

THE RESEARCH DEVELOPMENT CORPORATION of Japan (JRDC) was established on 1 July 1961 under the Research Development Corporation Act. The purpose of this national corporation, which operates under the Science and Technology Agency, is to develop the results of scientific research in Japan on an industrial level and to promote its effective exploitation.

Many domestic research projects that are potentially applicable to industry are apt to be left at a stage at which they require further development before they can be fully exploited. This tendency is due partly to hesitation at undertaking projects in fields new to industry and partly to a lack of sufficient development capital within industry.

To meet this situation, the Government and interested groups in industry proposed the establishment of a national organization devoted solely to bringing promising research projects to the attention of industrial circles in order that these projects could be fully utilized, the cost of development being borne by the Government.

Thus was established JRDC, which plays a liaison role between research centres and industry.

The organization, capitalization and other matters relating to JRDC are set out in the articles of the Research Development Corporation Act of 1961.

The capital, which is provided by the Government, amounts at present to US$10 million with an expected annual increase of a few million dollars.

According to the Research Development Corporation Act, JRDC has the following functions:

- Development of new research projects of national importance whose industrial application entails difficulties (commissioned projects);
- Effective exploitation of these projects (exploitation);
- Liaison activities related to promising research projects which have industrial application (liaison).

The Author: *Hisashi Harada is vice-president of the Research Development Corporation of Japan. He has been Director of the Promotion Bureau of the Science and Technology Agency and Deputy Vice Minister for Administration and Judge-in-Chief of the Patent Office. He is a graduate, in engineering, of Tokyo University.*

Commissioned projects

Various research sources, such as public or private research laboratories, universities, companies and

individuals, submit research projects to the Corporation at their discretion.

After getting the assessment of the Development Council, which consists of ten men prominent in science, industry and finance, JRDC examines these projects closely to determine whether any should be classified as a commissioned project.

The Corporation then proceeds to tailor the selected projects to its requirements and takes the measures, such as obtaining licenses from researchers, necessary for its full development. A public announcement is made that the project is open for bids by interested firms. After receiving tenders, JRDC carefully examines the applicants' qualifications for commission on the basis of their technical competency, financial soundness and interest in carrying out the developmental work.

The Corporation and the firm selected sign a contract after both have studied such matters as:

- Details of the development project;
- Determination of the financial assistance to be advanced by JRDC and its method of payment;
- Licensing and other protective measures;
- Setting of standards to determine the success or failure of the development;
- Determination of royalties and method of payment.

The firm begins the commissioned project with the guidance of the research groups under the supervision of JRDC.

Upon completion of the developmental work, JRDC, on the advice of the Development Council, assesses the results to determine success or failure in accordance with the standards set in the initial agreement. Evaluation is based on whether or not the development has reached a stage at which it can be considered a success in terms of industrial application.

When a development has been judged successful, the commissioned firm begins its exploitation and repays the commissioned sum to JRDC in annual installments over a period not to exceed five years, it also pays JRDC the royalties. Approximately half of all royalties thus received will be forwarded by JRDC to the researchers who submitted their projects.

When the development is unsuccessful, the firm will cease its work and the repayment of the commissioned sum will not be required. The Corporation repossesses the remaining related material from the firm.

There are now more than 60 commissioned projects and the commissioned sum for them amounts to more than US$13 million. Half of them already have been developed successfully, and the rate of success is nearly 90 per cent.

Exploitation

The technological opportunities gained by a firm as the result of successful projects will usually be followed up by the same firm and incorporated into its regular operations. If the firm so wishes, it may retain the exclusive right of exploitation for a given period.

As such a period of monopoly control draws to an end, the Corporation invites other parties to undertake wider exploitation, subject to a specified license fee. Part of the fees thus obtained are forwarded to those who presented the original research results.

Some of the successfully developed projects already have been exploited by companies other than the commissioned ones. Many successfully developed projects are now drawing attention overseas too.

Liaison

In addition to commissioning developmental projects, JRDC performs the role of mediator between research circles and industrial firms for the exploitation of new techniques.

Upon request, JRDC attempts to find a suitable party to meet the requirements of the applicants and carries out the necessary mediation. If the mediation is successful, JRDC charges a pre-agreed fee to the parties concerned.

Overseas relationships

The techniques developed during the seven years of operation of JRDC are now being exploited by various firms in Japan, and some of the products have been exported.

Recently JRDC has been drawing world-wide attention because of its specific functions and activities and the attractiveness of the new techniques developed. Several of them are now under negotiation for overseas exploitation.

Projects successfully developed

The following brief descriptions of a few of the commissioned projects illustrate the importance of the work undertaken by JRDC.

Double focusing mass spectrometer for solids. The development of this double-focusing mass spectrometer was completed in 1963.

Although it is based on the Mattauch-Herzog double focusing arrangement which was presented in 1934, many improvements were made. The newly developed spectrometer has very high sensitivity and resolution and a very wide detectable mass-range. It can serve effectively not only for quantitative analysis of impurities and doping materials but also for the determination of the structures of organic compounds of high molecular weight. The new mass spectrometers have been marketed in Japan and other countries.

Wave-energy electric generator buoy. Many attempts have been made to find an efficient and reliable mechanism for converting wave-energy into electric power. The realization of large power generation on such a principle has encountered many difficulties, but in the case of a small power supply with a limited use, it is found sufficiently feasible, and this project is one such

case. A specially designed air turbine with a generator is mounted on a buoy, and the reciprocal motion of the air in the passage of the turbine chamber caused by the ups and downs of the sea's surface drives the turbine. Electricity thus produced is charged into a battery, which acts as the electrical source of a light and a horn of the buoy. The newly developed buoys are now being used in many ports of Japan and have been exported to Canada and England.

Amino acid rapid auto-analyzer. The purpose of the project was to shorten the time and cut the cost of analysis by an amino acid auto-analyzer. The new analyzer requires about two hours per sample rather than 24 and the cost is reduced almost 90 per cent. The construction of the analyzer is almost the same as the conventional one, but its column is shortened and reduced in diameter. The size of the particles of ion exchange resin has been reduced, and there is a column junction capable of flowing buffer fluid under high pressure, which was impossible in the conventional type.

Electrolytic heat treatment of metal band saw. Metal band saws are subjected to repeated twisting and bending during use. The teeth of a saw must be hard, but the body of a saw must have sufficient tenacity. Saws of this type have been tempered partially by means of a gas flame or heater. The newly developed technique uses electrolytic tempering. The teeth of a band saw are immersed in a potassium acetate bath, heated by electrolytic electrical discharge and quickly hardened by being passed through a cooling bath. It is possible to obtain teeth of a high degree of hardness and a tenacity that can hardly be obtained by the conventional method and to secure products of uniform quality in continuous stable processing. As the new method is twice as fast as the conventional one, it, along with the adoption of automatic control, doubles the productivity.

Expanded steel member. Trusses assembled with triangles as the basic form are widely used in the construction of buildings and other structures. The drawback of these trusses is the high cost of labour required for rivetting and welding in order to assemble steel members into trusses. By this new technique, trusses (expanded steel members) are produced continuously by passing the hoops through a few stages of cold rollers, and the production cost is reduced considerably. The products have been used as the semi-construction members of, for example, the highest building in Tokyo.

Projects under development

The following three projects are among those still under development.

Defluorinated tricalcium phosphate by fluidized calcination process. This new technique is aimed at producing high quality calcium phosphate used for nonpoisonous mixed feed (e.g. mixture of bean cake, methionine, and calcium phosphate) for livestock. In this new technique, conventionally used soda ash is replaced by cheaper silica sand, and a conventionally used rotary kiln for calcination is replaced by a newly designed fluidized calciner of high thermal efficiency. The production cost of calcium phosphate with very little residual fluorine is expected to be much reduced.

Isobutylene polymer. This new technique is aimed at producing isobutylene polymer (butyl rubber and polyisobutylene) from isobutylene at a reasonable cost by separation from B-B fraction which can be obtained in large quantities as a by-product during naphtha cracking. In the conventional manufacturing method, $AlCl_3$ is used as a catalyst in polymerization at a low reaction temperature; a high purity of solvent is also required. In comparison with the conventional method, this new technique has two advantages. Polymerization can be carried out at a temperature not as low as that previously used by utilizing a newly developed catalyst and the recovery process of solvent can be simplified as the degree of purity required for solvent is less. Isobutylene polymer of the same quality can, therefore, be produced at a reasonable cost.

Single flank gear rolling tester. Conventional precision tests for spur gears are carried out by the individual error measurement method in which each cog is measured and the amount of error calculated, or in the double flank gear rolling test method. In the former method the gear error is measured directly, but this takes time and errors frequently occur, while in the latter method the procedure is simple, but errors in working condition cannot be measured, and thus precise gear testing has been difficult to achieve. The newly developed single flank gear rolling tester can measure rolling error under working conditions and, as the error curve can be monitored on recording paper sheets or on oscillographs, high precision tests can be performed in a short time with a simple procedure, which makes it possible for this tester to be used to test production during manufacture.

Course on Industrial Planning

Approximately 30 participants from English-speaking African countries attended a subregional course on industrial planning in Nairobi. The one-month course began on 17 February and focussed attention on problems and prospects of industrial development, industrial planning, project planning, and industrial policies and organization in Africa.

The course was co-sponsored by UNIDO and the African Institute for Economic Development and Planning in co-operation with the Economic Commission for Africa and the World Bank.

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By Alberto Eusebio do Carmo Tangari

Co-ordinating Government Incentives to

ALTHOUGH BRAZIL has already entered the industrial phase of development, with more than 45,000 industrial enterprises and a total working force of more than 2 million, its rate of growth is still inferior to that of the industrially advanced countries. Further industrial progress in Brazil with a lessening of the economic breach between Brazil and industrialized countries depends on certain basic conditions. Progress can be seriously delayed if:

- The development of industrial production comes about with an obvious disproportion between the production of capital goods and the production of raw material and fuel;
- The capacity of the country to import does not follow the normal growth of its economy;
- Rural production does not increase sufficiently to parallel the increase of real revenue, plus the population expansion;
- Regional discrepancies are not corrected;
- The development of the industrial complex is effected without the simultaneous improvement of working skills at all levels.

Various government agencies deal with the different facets of these problems, but in the vital area of government incentives to industrial development, the body responsible for co-ordinating efforts and making policy decisions is the Industrial Development Commission (CDI) of the Ministry of Industry and Commerce.

INDUSTRIAL PROJECTS APPROVED BY THE MINISTRY OF

Executive Groups (Sectors)	1964 (July/Dec.)			1965		
	No. of projects	NCr$ 1,000	Equiv. in (*) US$ 1,000	No. of projects	NCr$ 1,000	Equiv. in (*) US$ 1,000
Engineering industry (GEIMEC)	15	15,795.9	13,163.2	40	143,866.2	119,888.5
Food industry (GEIPAL)	—	—	—	—	—	—
Chemical industry (GEIQUIM)	—	—	—	14	61,200.0	51,000.0
Leather industry (GEITEC)	—	—	—	4	1,839.3	1,532.7
Paper and printing industry (GEIPAG)	—	—	—	—	—	—
Spinning and weaving industry (GEITEX)	—	—	—	—	—	—
Electrical and electronic industries (GEINEE)	—	—	—	—	—	—
Civil engineering material (GEIMAC)	—	—	—	—	—	—
Metallurgical industry (GEIMET)	2	92.9	77.5	4	11,501.3	9,584.4
TOTALS	17	15,888.8	13,240.7	62	218,406.8	182,005.6

Source: MIC (CDI SECOP)
(*) Conversion tax NCr$ 1.20/US$ 1.00
(**) Conversion tax NCr$ 2.20/US$ 1.00
(***) Conversion tax NCr$ 2.715/US$ 1.00
(****) Conversion tax NCr$ 3.22/US$ 1.00

Industry in Brazil

The Author: *Alberto Eusebio do Carmo Tangari is the Acting Chief of Cabinet to the Minister of Industry and Commerce and Acting Secretary-General of the Industrial Development Commission of Brazil. He also is a representative of the Ministry of Industry and Commerce at the Latin American Free Trade Association (LAFTA). Mr. Tangari, who is now employed by the Bank of Brazil, is a former director of the Brazilian Company of Industrial Projects and was representative of the Ministry in the Executive Council of the National Superintendency for Supplies and special consultant to the Latin American Economic Commission.*

A member of the Ministry of Industry and Commerce presides over the Commission, and its members include the Ministers of Interior, Finance, Planning and Transport and representatives of banks and of the Chief of Staff of the Armed Forces. Nine Executive Groups, Mechanical Industries, Metallurgical Industries, Textile and Cloth Industries, Civil Construction Material Industries, Food Production Industry, Chemical Industry, Electric and Electronic Industry, Leather and Leather Products Industry and Paper and Printing Industries, work under the direction of the Commission. These groups use the following tools to stimulate industrial development:

- Duty and sales tax exemptions on the importation of manufactured goods that Brazil does not produce;
- Rapid depreciation, for tax purposes, in the value of manufactured goods purchased in the country;
- Priority in receiving financial grants or guarantees from official credit agencies;
- Priority in receiving registration of investments and or foreign financing from the Central Bank;
- Recommendation to the Customs Policy Council that it grant the customs tariff protection necessary for the rapid expansion of industry.

The Executive Groups help to prevent the bureaucratic formalities that sometimes plague government agencies, for each Group consists of representatives of all official bodies and selected large organizations interested or involved in a certain industrial sector. A

INDUSTRY AND COMMERCE OF BRAZIL, 1964/1968 (Jan./June)

1966			1967			1968 (Jan. to June)			Total value of investments (1964/68 — June)		
No. of projects	NCr$ 1,000	Equiv. in (**) US$ 1,000	No. of projects	NCr$ 1,000	Equiv. in (***) US$ 1,000	No. of projects	NCr$ 1,000	Equiv. in (****) US$ 1,000	No. of projects	NCr$ 1,000	US$ 1,000 (*****)
107	168,489.8	76,586.2	98	513,022.7	188,958.6	36	63,571.3	19,742.6	296	904,745.9	418,339.1
4	7,221.0	3,282.2	33	150,279.7	55,351.6	29	121,533.5	37,743.3	66	279,034.2	96,377.1
17	373,500.0	169,772.7	17	412,132.0	151,798.1	7	52,242.9	16,224.5	55	899,074.9	388,795.3
11	2,400.4	1,091.0	13	2,613.7	962.6	11	2,635.2	818.4	39	9,488.6	4,404.7
14	208.7	94.8	332 (I)	32,659.3	12,029.2	425(II)	63,979.7	19,869.5	771	96,847.7	31,993.5
—	—	—	76	119,316.4	43,947.1	67	52,335.9	16,253.4	143	171,652.3	60,200.5
—	—	—	13	5,701.7	2,100.0	14	51,073.7	15,861.4	27	56,775.4	17,961.4
—	—	—	14	25,943.1	9,555.4	16	27,557.4	8,558.2	30	53,500.5	18,113.6
19	232,510.6	105,686.6	11	44,975.4	16,565.4	9	27,292.7	8,476.0	45	316,372.7	140,389.9
172	784,330.5	356,513.5	607	1,306,643.8	481,268.0	614	462,222.3	143,547.3	1,472	2,787,492.2	1,176,575.1

(*****) Sum of values obtained in different years at prevailing rates
(I) Including 321 AE in GEIPAG
(II) Including 390 AE in GEIPAG
AE Applications for exemption with investments lower than 2,500 minimum salaries

Group can make the necessary decisions and the interested party is spared the task of approaching all the official organs. The presence of representatives of finance contributes to the efficiency of the system because it eliminates the need for obtaining individual approval of each item of the project by each official department involved.

Another advantage of these Groups is that projects that they approve are designed to fill special technical requirements that integrate them into the basic programme of each sector. In short, the Groups seek to promote rationalization, expansion and integration of industries in addition to encouraging the exportation of their products. As the accompanying chart shows, the number of projects handled by these Groups has increased consistently in the last few years.

Since industrial activities are an important part of the private initiative system in Brazil, the Government may not and cannot replace entrepreneurs. Any measures of control or incentives should be considered part of a permanent dialogue with leaders of industry. To ensure that such discussions are meaningful, the Government created the Consulting Commission of Industrial and Commercial Policy, a body composed of ten prominent leaders of industry.

With the help of the Executive Groups and the Consulting Commission, the Industrial Development Commission will be able to execute the economic policy of the Government by taking co-ordinated action in all sectors and by organized expansion in all areas.

General Assembly Takes Action on UNIDO

On 19 November, the United Nations General Assembly considered the report of its Second Committee on the work of UNIDO.

The General Assembly deferred action on a draft resolution recommended by the Second Committee until its financial implications had been considered in the Fifth Committee.

The Second Committee adopted the draft resolution (Doc. A/C.2/L.1009/Rev.1) on 15 November by 59 votes to none with 20 abstentions. Co-sponsored by 37 nations, the resolution, in its operative paragraphs,

1. *Takes note* of the report of the Industrial Development Board at its second session;

2. *Requests* the Industrial Development Board to include in its future reports a summary of the activities of the Organization for the past year;

3. *Invites* Governments to provide additional support to UNIDO by making available through voluntary contributions, in accordance with Section II, paragraph 23, of General Assembly resolution 2152 (XXI), adequate resources for an expanded programme for field activities under flexible procedures;

4. *Requests* UNIDO to accelerate the preparatory work within its competence for the next Development Decade and to co-operate actively in the concerted efforts being undertaken by the organizations in the United Nations system to elaborate the International Development Strategy for the 1970s;

5. *Endorses* Industrial Development Board resolution 11 (II), wherein the Board recommended the sum of $1.5 million as the planning level of the regular programme of technical assistance for industrial development in 1969 and 1970;

6. *Considers* that the United Nations Industrial Development Organization should be entrusted with the responsibility for executing a larger number of projects related to industrial development under the two components of the United Nations Development Programme, taking into consideration the increasing flow of requests for such projects.

In other action, the General Assembly approved without objection the admission of Mauritius, Southern Yemen, Equatorial Guinea and Swaziland as UNIDO members, and agreed to the inclusion of Cuba among the member states of the Industrial Development Board listed in Group D "Socialist Countries of Eastern Europe."

The General Assembly also endorsed the recommendation in the report of the Second Committee that the Industrial Development Board should consider, at its third session, in the light of the experience gained, the need for its Working Group on Programme and Co-ordination.

Finally, the Assembly elected delegates to the Industrial Development Board from the following fifteen countries, to serve a three-year term, ending 31 December 1971:

Group A: India, Iraq, Upper Volta, Kuwait, Sudan, Thailand;

Group B: Denmark, France, Japan, the Netherlands, the United States;

Group C: Brazil, Chile;

Group D: Cuba, Poland.

The following fifteen countries will serve until 31 December 1970: Austria, Belgium, Czechoslovakia, Guinea, Indonesia, Italy, Nigeria, Peru, Rwanda, Somalia, Sweden, Switzerland, Trinidad and Tobago, the Union of Soviet Socialist Republics and Zambia.

The following fifteen countries will serve until 31 December 1969: Argentina, Bulgaria, Cameroon, Canada, Colombia, Federal Republic of Germany, Ghana, Iran, Ivory Coast, Pakistan, the Philippines, Spain, Turkey, the United Kingdom and Uruguay.

The following article was written by the UNIDO expert who is responsible for planning and bringing into operation the industrial information service of the National Centre for Industrial Studies at Tunis.

National Centre for Industrial Studies Established at Tunis

On 8 August 1968 Ahmed Ben Salah, Secretary of State for Planning and National Economy in Tunisia, and Mir Khan, United Nations Resident Representative at Tunis, signed the operational plan of a Special Fund project for the establishment of a National Centre for Industrial Studies at Tunis. UNIDO is the executing agency for this project. The Centre will help to make Tunisia less dependent on foreign countries for industrial studies and will remedy the shortage of technical and economic studies, a problem facing practically all Tunisian industrial establishments.

Main tasks

According to the operational plan, the main tasks of the Centre will be to:

- Advise on matters related to industrial development and the evaluation of the industrialization plan;
- Undertake detailed technical and economic studies for specific industrial projects, including those under the development plan;
- Advise on the possibilities for establishing new industries and on their financing and operation;
- Advise existing industrial enterprises in both the public and private sectors on technical and economic matters;
- Provide professional training;
- Disseminate information and data assembled by the Centre, foreign studies and publications to those using these services.

Special attention will be given to the co-ordination of the activities of this project with those of other bilateral or multi-lateral technical assistance programmes of existing or future Tunisian industrial development agencies, and of the Centre of Industrial Studies for the Maghreb at Tripoli.

The National Centre for Industrial Studies is under the aegis of the Ministry for Planning and National Economy, the department responsible for co-operating with participating organizations and for executing the operational plan. An advisory committee on co-ordination will maintain liaison between Tunisian industries, agencies concerned with industrialization and the Centre.

Although under a government department, the Centre will have independent legal status.

In order to accomplish its tasks, the Centre will have the assistance of international experts who are to advise and train national personnel so that the Centre can continue its work when the UNIDO project ends. The United Nations Development Programme (UNDP) will provide assistance for five years, after which the Tunisian Government will be solely responsible for financing the work of the Centre.

Through UNIDO, the Special Fund will contribute to the Centre:

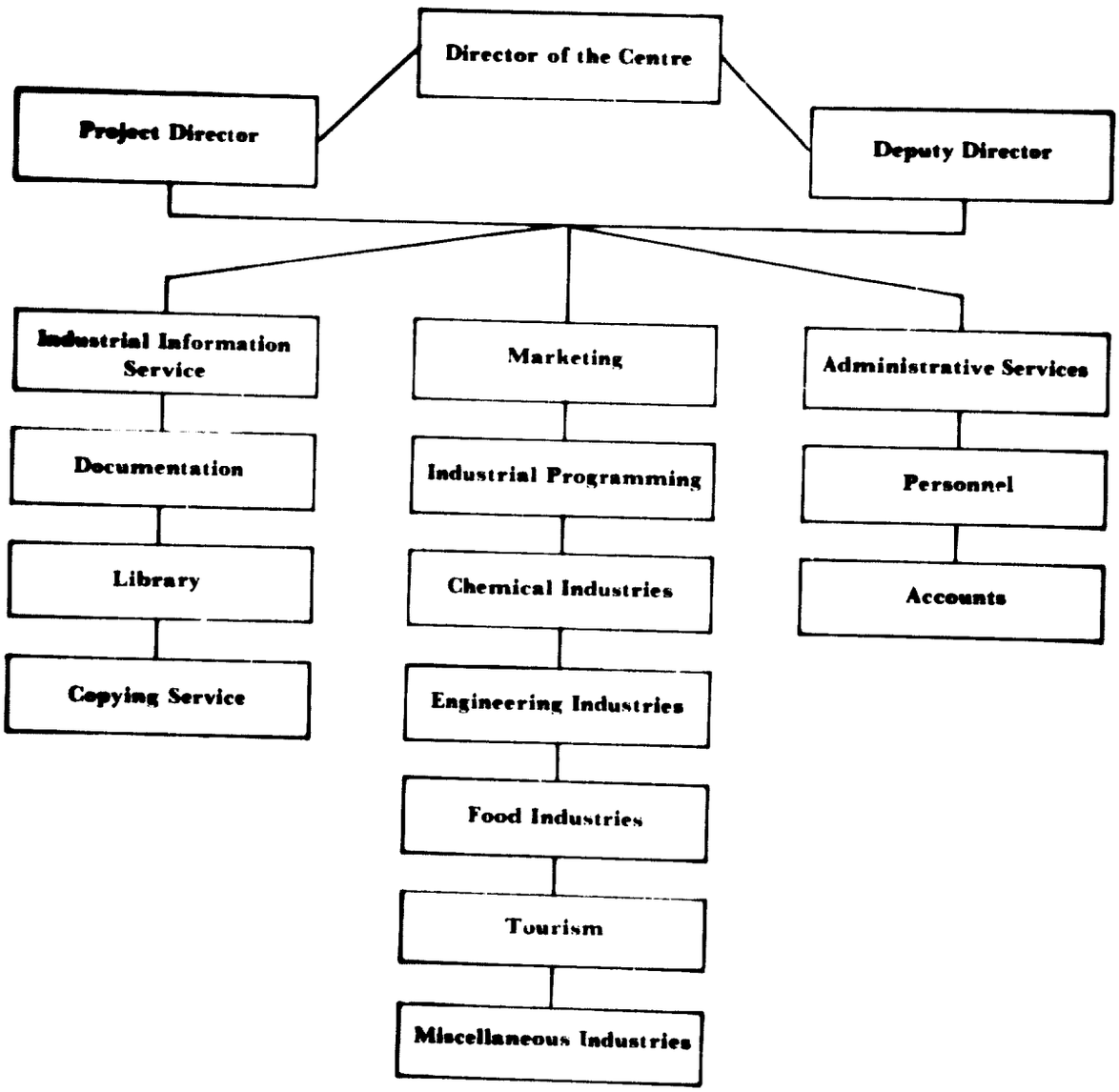
- 300 man-months of service by international experts;
- Fellowships for training Tunisian personnel at an estimated cost of US$50,000;
- Provision to buy US$30,000 worth of equipment;
- An estimated US$34,800 to local operating expenses.

As its matching contribution, the Tunisian Government will provide:

- 460 man-months of service by Tunisian specialists;
- Administrative staff up to 1,070 man-months;
- Remuneration, in local currency, to the recipients of fellowships at an estimated cost of US$62,000;
- Premises and furnishings at an estimated cost of US$140,000;
- Consultant services costing some US$50,000;
- A contribution of US$120,500 to local operating expenses.

These figures give an idea of the extent of the project and of the volume of work that it will encompass.

NATIONAL CENTRE FOR INDUSTRIAL STUDIES



The opening of the National Centre for Industrial Studies will coincide with the preparatory phase of the second four-year plan (1969 1972) which covers a number of industrial projects for the establishment of new units, the expansion of existing units and studies for forthcoming projects.

Priorities

As the Centre will not be able to undertake all the necessary studies, priority will be given to certain sectors, such as chemicals, mechanical engineering and metallurgy, food and tourist trade.

Experts in these four fields have been recruited and economists have been selected to help them to undertake technical and economic studies. The Centre can also call upon consultants specializing in other industrial fields.

Under the operational plan, the National Centre for Industrial Studies will be assisted by an Advisory Committee on Co-ordination made up of: five representatives of the Secretary of State for Planning and National Economy; one from each of the following boards, Mines and Power, Trade, General Planning and Agriculture Development; two representatives of the Secretary of State for Public Works and Housing; one from the Transport Board and one from the Highways and Bridges Board; one representative of the Tunisian Federation for Industry, Commerce and the Handicraft Trades (UTICA); one representative of the National Investment Corporation; one representative of the Tunisian Bank Corporation; the Director of the Centre; the Deputy Director of the Centre; the Resident Representative of UNDP in Tunisia or his deputy; the Director of the Project, and technical advisers.

In preparing a work programme, the Advisory Committee has proposed the following provisional list of studies:

Engineering and metallurgical sector

(a) Sahel Engineering Workshops: market study for hardware products;

(b) Market study for steel products;

(c) Re-utilization of the former arsenal at Menzel-Bourguiba.

Chemical sector

(a) Market study for phosphates;

(b) Effective commercial exploitation of Tunisian phosphates;

(c) Enrichment of Tunisian phosphates;

(d) Manufacture of sulphuric acid from pyrites or gypsum (combined with the manufacture of cement).

Power sector

(a) Utilization of natural gas from El Borma.

Tourism sector

(a) Profitability study of the tourist industry.

Miscellaneous

(a) Evaluation and analysis of the system of standardizing selling prices;

(b) Investment code;

(c) System of calculating net cost and profitability in various industrial sectors.

As one purpose of the Centre is to disseminate information and statistics and foreign publications or studies of interest to Tunisian industry, it will have an industrial information service. One function of this department will be to correlate scientific and technical with economic information. Most information services in Tunisia are attached to economic bodies such as banks and institutes.

In order to list available facilities and to promote collaboration in the use of existing information resources, the Centre has established contacts with important institutional services.

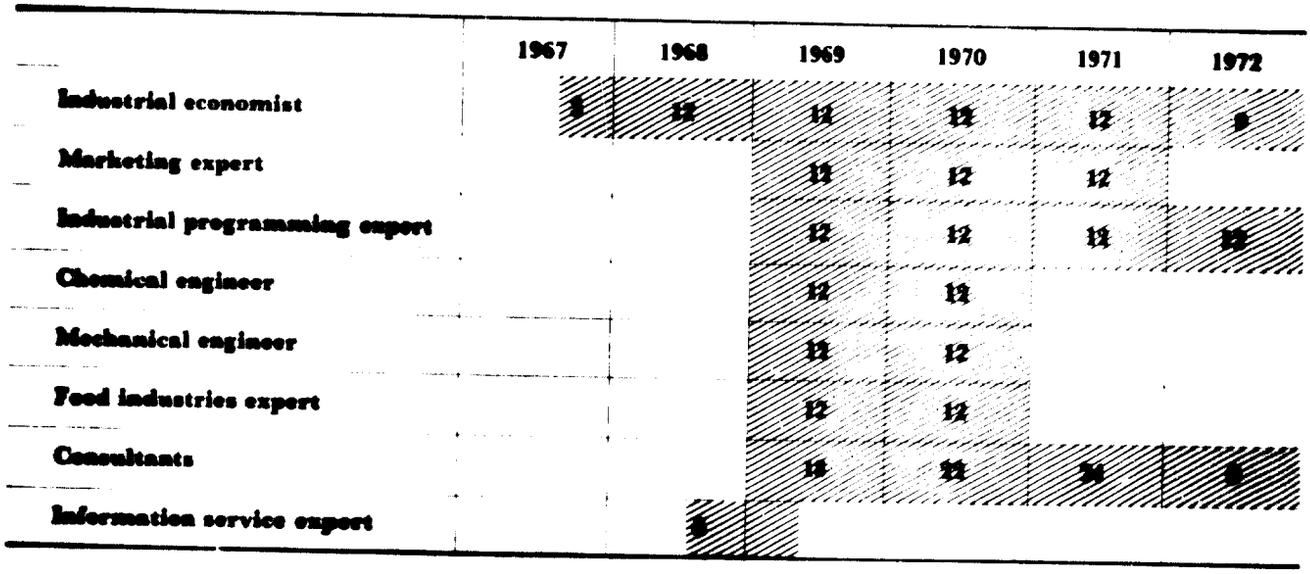
The Centre is already providing technical and economic documentation and other industrial information to the experts at the Centre and to Tunisian users. Some of this information is furnished in collaboration with the Maghreb Centre for Industrial Studies at Tripoli.

The discussion at the meeting of representatives of information services from African countries at Tunis, 11–13 November, made clear the urgent need to set up centres to supply developing countries with the information necessary to carry out effectively industrialization studies and projects. Information experts face difficult problems in the selection and publication of industrial information, particularly that dealing with recent and advanced techniques that can be assimilated and fully utilized by technicians.

In making provision for the industrial information service at the Centre, the Government of Tunisia and UNIDO have begun to close a wide gap, one that will disappear with the establishment of the National Scientific, Technical and Economic Information Service.

PLAN FOR THE EMPLOYMENT OF INTERNATIONAL EXPERTS

Months of Service



For Your Information . . .

The following publications may be purchased throughout the world from United Nations sales distributors, through local book dealers, or directly from: Sales Section, United Nations, New York or Geneva. Prices are given in U.S. dollars but payment may be made in other currencies.

Fertilizer Production, Technology and Use, 404 pages (Sales No.: E.68.II.B.1; US$5).

In view of the rapidly growing world population and the need to raise the nutritional level of much of the population, it is vital that the world food supply be increased. The use of fertilizers plays an essential role in this effort. The fertilizer industry also provides a solid base for industrialization in developing countries. The United Nations, therefore, organized the Interregional Seminar on the Production of Fertilizers, held in Kiev, Ukrainian Soviet Socialist Republic, from 24 August to 11 September 1965. The final report of the Seminar has been issued as a separate publication (ST/TAO/SER.C/78).

Fertilizer Production, Technology and Use contains papers presented at the Seminar. Part one consists of reports on fertilizer production in three regions (Africa, Asia, Latin America and the Far East) and in a number of countries (Argentina, Ceylon, Chile, Colombia, India, Iran, Israel, Japan, Mexico, Nigeria, Peru and Turkey). There are also papers on the production and use of chemical fertilizers in the Union of Soviet Socialist Republics and the Ukrainian Soviet Socialist Republic.

In part two, papers concerning technology, maintenance and safety measures are presented. Among these are: "Recent Trends in the Technology and Economics of Ammonia Production", "Experience in Construction and Operation of Nitric Acid and Ammonium Nitrate Plants in a Developing Country", "Development of the Urea Industry" and "Organization for Maintenance Work and Its Importance".

Part three deals with questions of planning, economics, marketing and the use of fertilizers in agriculture. The papers in this section include "Factors Relevant in Determining Location for Fertilizer Projects in Developing Countries", "Certain Aspects of Fertilizer Distribution in Developing Countries", "Fertilizer Marketing in a Developing Country" and "World Trade in Fertilizer Raw Materials".

Industrialization and Productivity Bulletin, No. 12, 96 pages (E.68.II.B.3; US$1.50).

Issue number twelve of this semi-annual publication includes articles on the promotion of small-scale industries through government purchasing, decentralization and project evaluation under economies of scale and indivisibilities, and skill requirements in manufacturing industries.

One of the most important undertakings of UNIDO in its relatively short period of existence was the convening of the first United Nations International Symposium on Industrial Development, held in Athens, Greece, from 29 November to 19 December 1967. The purposes of the Symposium were to focus attention on the obstacles to the acceleration of the industrialization of the developing countries and to promote discussion on the further action to be taken by both developed and developing countries.

In order to publicize the wide range of subjects discussed and the issues that were raised for consideration by the Symposium, issues Nos. 13 and 14 of the *Industrialization and Productivity Bulletin* are being devoted to a presentation of subject material and industrialization problems, examined by the Symposium. Approximately fifteen technical studies, specially prepared for discussion, will appear in these two issues.

Issue 13 of the *Bulletin* contains a selection of eight technical studies and papers. The introductory article is based on the "Industrial Development Survey", UNIDO's first effort to make a comprehensive assessment of the rate of industrial growth in the developing countries and to identify the factors influencing this growth.

Profiles of Manufacturing Establishments, Volume II, Industrial Planning and Programming Series, No. 5, 818 pages (Sales number: E.68.B.13; US$6.50).

UNIDO has published the second volume in its series *Profiles of Manufacturing Establishments*. (Volume I was reviewed in the *Industrial Research and Development News*, Vol. III, No. 1, page 45.)

The series has been developed by UNIDO as part of its data bank service to industrial economists and others concerned with industrial planning and programming in the developing countries. Each profile is designed to provide, in capsule form, summary data on the structure and performance of an existing industrial

establishment or enterprise over a given period. The data provided covers such aspects as equipment and other capital assets, production, employment, and the technical layout, capacity utilization, and marketing policies. Manufacturing industries in the study are selected from both developed and developing countries.

The second volume of *Profiles* covers the countries studied in Volume I: France, India, Israel, Japan and Yugoslavia. In addition to the sample establishments in the nineteen industry groups represented in Volume I, it provides data on establishments classified under other branches of industry such as knitmills, wearing apparel, wood manufacture, glass, concrete and structural clay products, leather tanneries, electrical machinery and appliances. Some 460 manufacturing enterprises in the five countries are now covered in the two volumes.

The *Profiles* offer a variety of potential uses, since they suggest raw materials for further study rather than a manual for industrial programming. They can be used as a standard of comparison: for the efficiency and viability of existing factories; in evaluating the recommendations of industrial consultants; as a cross-reference for economic feasibility studies; or in country by country comparisons of the performance of industrial plants.

Industrial Estates in Europe and the Middle East, 290 pages (E.68.II.B.11; $3).

The sixth in a series of studies and reports on industrial estates to be published by the United Nations, this volume contains the reports of two consultative groups, six discussion papers and one information paper submitted to the groups.

The reports of the two groups (Parts I and II) contain findings and recommendations on aspects of policy, economic and physical planning, organization and management, services and facilities, financing and regional and international co-operation in the development of industrial estates in various countries.

Part III, "Industrial Estate Plans and Projects in some European and Other Countries" consists of a general survey and country data on Belgium, Bulgaria, Cyprus, Denmark, Finland, France, Greece, Ireland, Israel, Italy, Malta, the Netherlands, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Conclusions and suggestions for developing countries are brought out in Part IV "The Role of Industrial Zones, Areas and Nuclei in Development Policies and Programmes, with Special Reference to the Promotion of Small-scale Industries: the Experience of Italy".

"The Role of Industrial Estates, Areas and Zones in Providing an Industrial Base in Urban and Regional Development Plans" (Part V) examines the role of industrial estates, areas and zones in urban and regional development planning and concludes that they can make a significant contribution in providing an industrial base for development and in guiding the choice of an industrial location. The paper contains an analysis and recommendations on the provision of industrial land and facilities under a comprehensive urban planning system.

In Part VI, a paper on "Pre-Project Planning for Industrial Estates" provides a frame of reference and a check list for the industrial estate planner, in addition to criteria, guidelines and planning ratios for the preparation of a project proposal. It also contains some considerations on the management and operation of an industrial estate and criteria for establishing port and airport estates.

The next section includes an analysis of sources of finance and methods of obtaining it with special reference to the experience of India.

This paper recommends a system of guarantees and insurance to facilitate private and institutional financing for industrial estate projects and to reduce the burden of government financing. The last two papers describe "United Nations Activities in the Field of Industrial Estates" and "Research Parks in the United States: A Case Study from Colorado".

A limited number of the following may be obtained free on request from: Industrial Documentation Unit, UNIDO, Vienna.

Alumina Production from Various Ores, 78 pages (ID/WG.11/10).

This is a report on the first of a series of expert meetings UNIDO has planned in order: to examine the present technological and economic status of aluminium production; to make recommendations for the development and improvement of the aluminium industry in developing countries; and to aid UNIDO's technical assistance activities.

The first section assesses the present state of alumina and aluminium production, particularly in developing countries. The second section examines the reserves of and requirements for bauxite and non-bauxite ores. Practically all aluminium is obtained from bauxite. The Union of Soviet Socialist Republics, however, has successfully produced aluminium from other aluminium-bearing ores on a commercial scale.

In the third and fourth sections the conventional production of alumina from bauxite by the Bayer process and recent improvements of the process are reviewed. In the next section special methods for producing alumina from low-grade bauxites and complex ores are examined.

The sixth section deals with experiences in the creation, expansion and improvement of the alumina industry in developing countries.

Modernization and Expansion of Plants in the Copper Industry, 51 pages (ID/WG.12/7).

UNIDO has planned a series of Expert Group Meetings on the copper industry and this is a report of the first one. The opening sections deals with the present state of copper production in developing and other countries, the production of copper-bearing ores and primary copper, smelting, refining and semi-fabricating capacities. Recent trends are evaluated.

Improvements in technology and new methods of copper production are examined in the second section of the report.

The third section examines the economic and engineering prerequisites for the modernization and expansion of copper plants and assesses the significance of economic factors, such as capital investments, market projections and production growth rate.

Technological and Economic Aspects of Establishing Textile Industries in Developing Countries, 176 pages (ID/ 7).

Based on a working paper submitted to the first United Nations Interregional Workshop on Textile Industries in Developing Countries, held in Lodz, Poland, in September 1966, this manual gives a comprehensive breakdown of the factors necessary for the successful development of textile industries in developing countries. It assesses the needs of developing countries and formulation of policies at national level by a consideration of: the ways in which Governments can help in promotion; financing and fiscal policies; the relative merits of domestic manufacture and the import of textiles in developing countries. The manual draws attention to the establishment and modernization of plants, their location, and the selection of appropriate markets and suitable machinery and equipment. Chapter III deals with raw materials: cotton, wool and man-made fibres and such aspects as criteria for selection, blending and processing. Both this chapter and Chapter IV, "Textile Processes and Products", that discusses spinning, weaving, dyeing and finishing, contain figures and tables. The size and structure of plants are dealt with in Chapter V. Mill administration, quality control, productivity, marketing, training needs and technological transfer are discussed in Chapter VI. The concluding chapter draws attention to recent technological developments and their application to developing countries. Various systems of cotton spinning and winding equipment and their costs are also compared.

Calendar of Meetings

April to November 1968

Inter-American Congress of Chemical Engineering
Buenos Aires, 21–26 April. W. J. M. Douglas, Vice-President, Inter-American Confederation of Chemical Engineering, c/o McGill University, Montreal 2, Quebec, Canada.

International Congress of the Precast Concrete Industry
Amsterdam, 17–23 May. International Bureau for Precast Concrete, 50 Rue Neuve, Brussels.

Rubber Technology Meeting
Tampere, Finland, 5–6 June. Swedish Institute of Rubber Technology, P.O.B. 7310, Stockholm 7. Finnish Institution of Rubber Technology.

Seventh International Congress on Food Distribution
Madrid, 1–4 July. José Ma. Llosent Marañon, Sindicato Nacional de Alimentación, Paseo del Prado, 20-Planta 11, Madrid-14.

International Conference on Soil Mechanics and Foundation Engineering
Mexico, 24–31 August. International Society of Soil Mechanics and Foundation Engineering, c/o Institution of Civil Engineers, Great George Street, London, S.W.1.

International Congress on Nutrition
Prague, 28 August–5 September. Dr. Josef Masek, c/o Institute of Human Nutrition, Budejovicka 800, Prague 4.

International Conference on Technical Progress in the Pulp and Paper Industry
Poznań, Poland, 2–5 September. Polish Technical Association of the Pulp and Paper Industry, Plac Komuny Paryskiej 5, Lodź, Poland.

International Commission on Glass, Annual Meeting
Toronto, Canada, 3–6 September. Mr. C. Thorpe, Secretary, British Glass Industry Research Association, Northumberland Road, Sheffield, S10 2UA, Yorkshire, United Kingdom.

International Foundry Congress
Belgrade, Yugoslavia, 7–12 September. Professor N. B. Pajevic, Savez Drustava Livaca SFRJ Kamegijeva 4, Belgrade.

International Congress on Metallic Corrosion
Amsterdam, 7–14 September. P.O.B. 52, Schoemakerstraat 97, Delft, Netherlands.

Sixth International Council of Societies of Industrial Design (ICSID) Congress
London 10–12 September. ICSID 69 Congress Secretariat, 12 Carlton House Terrace, London, S.W.1, United Kingdom.

International Industrial Conference
San Francisco, 15–19 September. (By invitation.) Frances O. Bohley, Executive Secretary, Stanford Research Institute, Menlo Park, California 94025.

International Congress of Chemical Engineers, Chemical Equipment and Automation (CHISA)
Mariánské Lázne, Czechoslovakia, 15–20 September. Czechoslovak Chemical Society, P.O.B. 857, Prague 1.

Fundamental Research Symposium on Papermaking Systems and Their Control
Oxford, United Kingdom, 21–26 September. Technical Section British Paper & Board Makers' Association, Inc., 3 Plough Place, Fetter Lane, London, E.C.4.

Fourth International Synthetic Rubber Symposium and Exhibition
London, 30 September–2 October. Mary Taylor, c/o Rubber & Technical Press Ltd., 25 Lloyd Baker Street, London, W.C.1.

World Federation of Engineering Organizations, Second General Assembly
Beirut, October. G. F. Gainsborough, Secretary-General, c/o Institution of Electrical Engineers, Savoy Place, London, W.C.2.

Engineering Inspection and Quality Control Exhibition and Conference
London, 1–13 November. Business Conferences and Exhibitions Ltd., Mercury House, Waterloo Road, London, S.E.1.

TO THE READER,

The Industrial Research and Development News, *which was formerly published biannually, commences quarterly publication with this issue.* IRDN *will continue to report on industrial research institutes and their work as well as other industrial development activities of value to developing countries.*

Readers are invited to participate in establishing the News *as a world-wide forum for the discussion of industrial research and development activities by contributing relevant material for review and publication. Views on questions related to research administration and policies, reports on research projects, profiles of research and industrial development institutions, news of industrial projects carried out by both the public and private sectors, and contributions on industrial problems in the field of research and development are welcomed for consideration by the Editorial Board.*

Contributions accepted by the Board will be printed with the usual due acknowledgement to the author.

Readers are also invited to comment on the topics discussed in the magazine and to suggest subjects they would like to see raised. A readers' column will be introduced for this purpose.

Contributions, suggestions and questions should be addressed to:

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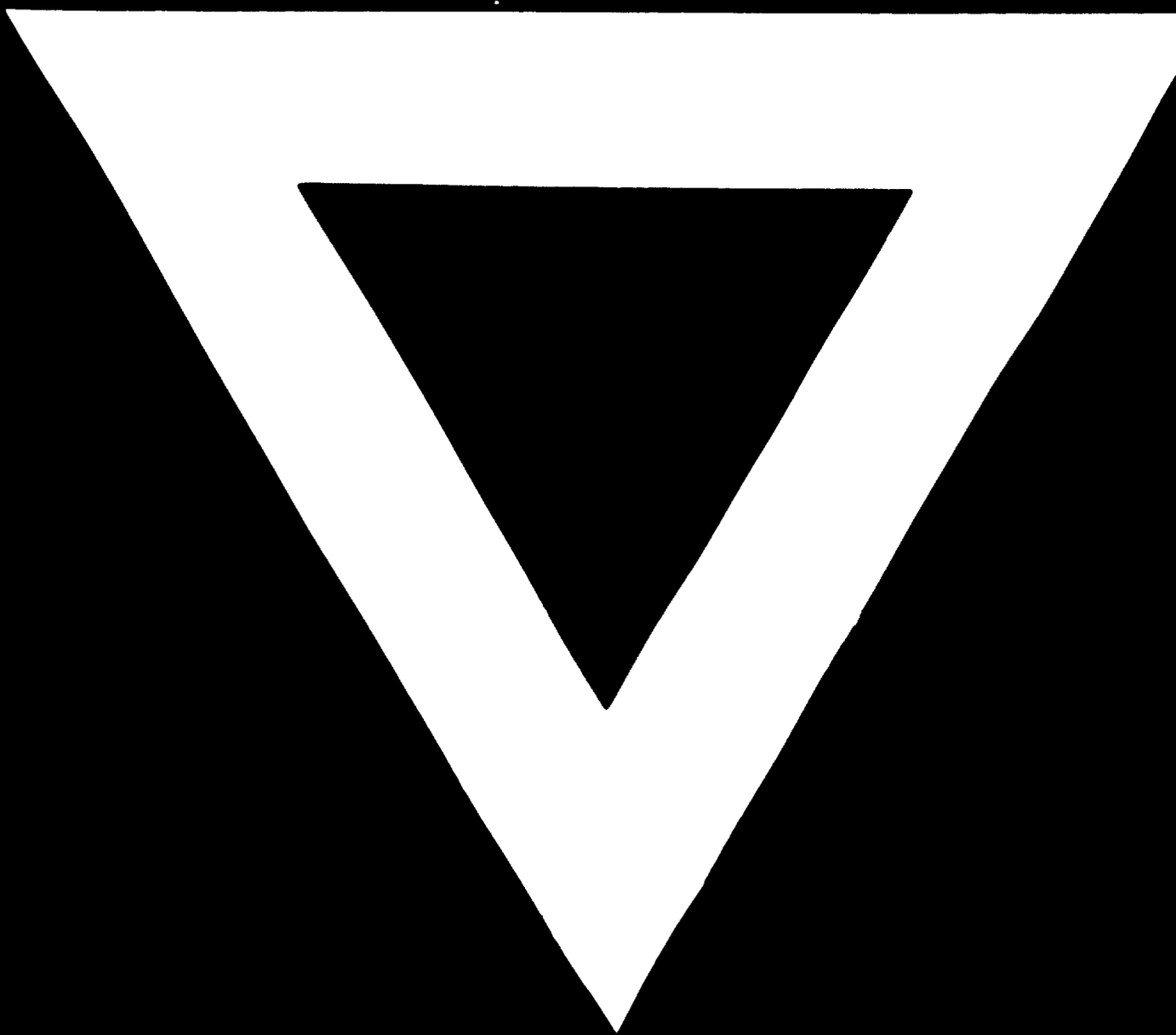

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