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Industrial Research and Development News

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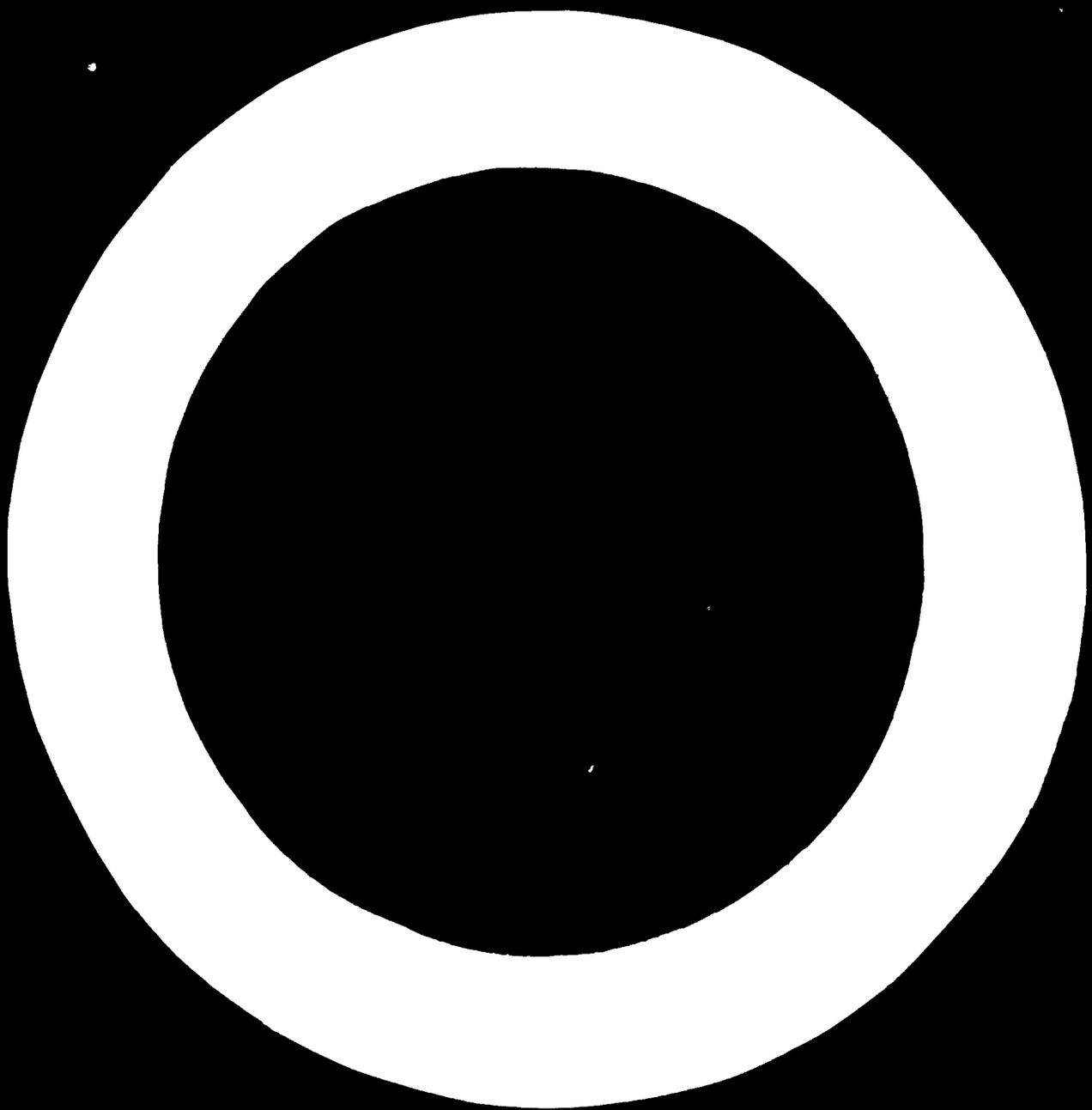

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Summaries of Feature Articles

Japan Information Center Uses Unique Computer System

by Hiroshi Fuwa

The Japan Information Center of Science and Technology has put into operation a computerized information storage and retrieval system which utilizes two forms of Japanese writing. This system aids the Center in such activities as preparation of abstracts, maintenance of a growing file of source documents and the preparation of publications.

Le Centre d'information du Japon utilise un système d'ordinateurs électroniques unique en son genre

par Hiroshi Fuwa

Le Centre japonais d'information scientifique et technique a adopté un système électronique d'emmagasinage et de récupération des données qui utilise deux sortes d'écritures japonaises. Il s'en sert notamment pour préparer des résumés, tenir des dossiers de documents de référence, dont le nombre va croissant, et préparer des publications.

El Centro de Información japonés utiliza un sistema de computadoras único en su género

por Hiroshi Fuwa

El Centro japonés de informaciones científicas y tecnológicas ha adoptado un sistema electrónico de memorización y extracción de datos que utiliza dos modalidades de la escritura japonesa. El Centro emplea este sistema para preparar resúmenes y publicaciones, mantener al día un archivo cada vez más nutrido de documentos básicos y otras actividades análogas.

The Building Research Station, United Kingdom

by James B. Dick

The oldest institute of its kind, the Building Research Station not only conducts research for government and central organizations, contractors, manufacturers and designers in the United Kingdom, but also provides services for countries throughout the world.

La Building Research Station du Royaume-Uni

par James B. Dick

La Building Research Station, qui est l'institut le plus ancien de ce genre, ne se borne pas à effectuer des recherches à l'intention du Gouvernement et des administrations centrales, des entrepreneurs, des industriels et des inventeurs du Royaume-Uni; elle prodigue ses services à de nombreux pays dans le monde entier.

Centro de Estudios de la Construcción, del Reino Unido

por James B. Dick

El Centro de Estudios de la Construcción, que es la entidad más antigua en su género, no sólo realiza investigaciones para organismos oficiales y centrales, contratistas, fabricantes y proyectistas del Reino Unido, sino que además proporciona servicios a países de todo el mundo.

The Chemical Industry of Pakistan: Development, Orientation, Current Trends

by Kamal Mohammad Habib

Since Pakistan became independent in 1947, its chemical industry has grown rapidly, particularly in the agricultural, petrochemical and pharmaceutical subsectors. Plans for expansion indicate that growth trends will continue.

L'industrie chimique au Pakistan: développement, orientation, tendances actuelles

par Kamal Mohammad Habib

Le Pakistan ayant accédé à l'indépendance en 1947, son industrie chimique s'est développée rapidement, en particulier dans les sous-secteurs de l'agriculture, de la pétrochimie et des produits pharmaceutiques. Les plans d'expansion indiquent que le pays se maintiendra dans la voie du progrès.

La industria química del Paquistán: desarrollo, orientación y tendencias actuales

por Kamal Mohammad Habib

La industria de productos químicos del Paquistán se ha desarrollado rápidamente desde 1947, año de la independencia, sobre todo en los subsectores agrícola, petroquímico y farmacéutico. Los planes de ampliación indican que proseguirá esta tendencia al crecimiento.

Making the Best Use of Management Consultants

by Lubor Karlik

The hiring of a consultant can be compared with seeking the service of a doctor. If the system of organization in a firm is able to develop sufficient capacity in time to thwart any breakdown of the functioning, its natural ability should not be made dependent upon outside help. Only when the circumstances are such that the organization cannot respond with proper and timely action should the appropriate help be administered. The function of a firm of consultants is to organize its staff and resources into a business entity, yet this function plays only a supporting role to the quality of the professionals who represent it. The consultant's ability should be the first concern. This is, by and large, determined by his academic training, experience, creative capacity and personality. The qualifications of the individual consultants are, therefore, of prime importance and should never be overshadowed by other considerations.

Comment utiliser au mieux les services de consultants en matière de gestion d'entreprises

par Lubor Karlik

On fait appel à un consultant comme on a recours aux soins d'un médecin. Si une firme est organisée et équipée pour pouvoir éviter à temps toute perturbation dans le fonctionnement de ses services, il ne faut pas l'habituer à compter sur une aide extérieure. C'est uniquement lorsque l'entreprise n'est pas en mesure, par suite des circonstances, de prendre elle-même en temps voulu les dispositions nécessaires, qu'il faut lui fournir l'aide dont elle a besoin. Un bureau de consultants organise son personnel et les ressources dont il dispose comme une entreprise de caractère commercial; cependant cette organisation n'a pas d'autre but que de permettre le recrutement de collaborateurs d'une haute qualité. Ce qui doit passer au premier plan, ce sont les compétences du consultant, qui dépendent, en fin de compte, de sa formation universitaire, de son expérience, de son esprit créateur et de sa personnalité. La valeur professionnelle de chaque consultant est donc un élément primordial qu'aucune autre considération ne doit jamais faire perdre de vue.

Cómo aprovechar mejor los servicios de los consultores de gestión

por Lubor Karlik

Recurrir a los servicios de un consultor es como recurrir a un médico. Si el sistema de organización de una empresa le ha permitido desarrollar la capacidad de impedir a tiempo problemas más graves de funcionamiento, no hay que acostumbrarse a depender de la ayuda externa. Sólo cuando las circunstancias sean tales que la organización no pueda reaccionar con medidas aceleradas y oportunas, se deberá buscar la ayuda necesaria. Una empresa de consultores debe, ante todo, organizar su personal y sus recursos de modo que formen una buena entidad comercial; pero ese aspecto de la empresa es sólo una base para el trabajo del personal profesional que la representa. La capacidad del consultor debe ser el elemento al que se acuerda mayor importancia, y estará determinada en general por la formación académica, la experiencia, las facultades creadoras y la personalidad. Las condiciones del consultor son de importancia primordial y no deben subordinarse nunca a otras consideraciones.

Research and Design for the Hungarian Aluminium Industry

by Erwin Maetz

The author describes the organization and functions of two supporting units of the Hungarian aluminium industry: the Research Institute for Non-ferrous Metals and the Design Centre of the Hungarian Aluminium industry.

Les services de la recherche et des projets de l'industrie hongroise de l'aluminium

par Erwin Maetz

L'auteur décrit l'organisation et les fonctions de deux services qui sont à la base de l'industrie hongroise de l'aluminium: l'Institut de recherche sur les métaux non ferreux et le Bureau des projets de l'industrie hongroise de l'aluminium.

Investigaciones y diseños en la industria húngara del aluminio

por Erwin Maetz

El autor describe la organización y las funciones de dos dependencias auxiliares de la industria húngara del aluminio: el Instituto de investigaciones sobre metales no ferrosos y el Centro de proyectos de la industria húngara del aluminio.

ISO, UN Bodies Offer Assistance in Standardization

The International Organization for Standardization (ISO) is an international non-governmental organization. It is working with UNIDO and other United Nations bodies in providing technical assistance to developing countries in setting up and supporting their national and regional machinery for standards activities.

L'ISO et les Nations Unies offrent une aide en matière de normalisation

L'Organisation internationale de normalisation (ISO) est une organisation internationale non gouvernementale. En collaboration avec l'ONUDI et avec d'autres organismes des Nations Unies, elle s'efforce de fournir une assistance technique aux pays en voie de développement, afin de les aider à mettre sur pied et à entretenir un mécanisme national ou régional, touchant les activités de normalisation.

La ISO, y las Naciones Unidas ofrecen asistencia en materia de normalización

La Organización Internacional de Normalización (ISO), organización internacional no gubernamental, está colaborando con la ONUDI y otros órganos de las Naciones Unidas en la prestación de asistencia técnica a países en desarrollo para ayudarles a establecer y poner en funcionamiento sus mecanismos nacionales y regionales destinados a las actividades de normalización.

TEMPO and the Broad Systems Approach

TEMPO, the Center for Advanced Studies of the General Electric Company, United States of America, is a unique long-range

Le TEMPO et la «méthode d'étude globale» (*Broad Systems Approach*)

Le Centre d'études supérieures (TEMPO) de la General Electric Company aux Etats-Unis, est une organisation unique en son

TEMPO y el "método de estudio global" (*Broad Systems Approach*)

El Centro de Estudios Avanzados (TEMPO) de la Compañía General Electric, de los Estados Unidos de América, es una organi-

planning and interdisciplinary study organization. It carries out studies not only for General Electric but for clients throughout the world.

genre qui se consacre à la planification à long terme et à des études interdisciplinaires. Il effectue des recherches, non seulement pour le compte de la General Electric, mais aussi pour des clients du monde entier.

zación única en su género, que se ocupa de la planificación a largo plazo y de estudios interdisciplinarios. Realiza estudios no sólo para la General Electric, sino también para clientes de todo el mundo.

Oceanic Research Institute Seeks To Master Paper Tide

by William C. Farmer

The ocean, which covers more than 70 per cent of the earth's surface, contains many resources that may be useful to industry, but much research is needed to utilize this potential. The new Oceanic Research Institute, La Jolla, California, seeks to gather all research and development information related to oceanography.

L'Oceanic Research Institute s'efforce d'endiguer une «marée de papier»

par William C. Farmer

L'océan, qui couvre plus de 70 p. 100 de la surface du globe terrestre, recèle beaucoup de richesses qui peuvent être utiles à l'industrie, mais il faudra encore procéder à des recherches approfondies avant de pouvoir utiliser ce potentiel. L'Oceanic Research Institute, récemment créé à La Jolla, en Californie, s'efforce de recueillir le plus de renseignements possible concernant la recherche océanographique et les progrès accomplis en la matière.

El Instituto de Investigaciones Oceánicas procura organizar la avalancha de documentación

por William C. Farmer

Los océanos, que cubren más del 70% de la superficie del globo, contienen muchos recursos que la industria podría utilizar; pero para aprovechar esa riqueza latente se necesitan muchas investigaciones. El nuevo Instituto de Investigaciones Oceánicas de La Jolla (California) procura recopilar toda la información sobre lo que se está haciendo en materia de oceanografía, incluso en la esfera de la investigación.

USSR Institutes Preparing Sectoral Surveys

UNIDO and the Union of Soviet Socialist Republics (USSR) have signed an agreement on the use of funds from the voluntary contribution of the USSR in the preparation of surveys on the iron and steel, non-ferrous metals and engineering industries. These surveys are intended to help UNIDO and developing countries in identifying suitable areas for technical assistance and to improve the efficiency of UNIDO's current operational activities through *(a)* the selection, review and accurate presentation of up-to-date information on the development of the industry sector and *(b)* the collection and elaboration of information on plans, projects and estimates related to the future prospects of the sectors during the 1970s, particularly in the developing countries.

The survey on each sector is expected to cover the following subjects:

- Consumption of products (statistical data, forecasts, factors influencing consumption, competition with other products and so on);
- Production and production capacities (utilization of existing capacities, data on production, current and future economic or organizational problems in the production, modernization and expansion of capacities);
- Raw materials (factors influencing their supply as well as activities within the sector);
- Man-power needs, problems and solutions;
- Costs, prices and efficiency (national and international comparisons, based mostly on reports);
- Technological developments (new processes, new applications, new trends, reports on experiments, etc.);
- International trade, data on trade trends, factors influencing the position of the developing countries in international regional trade;
- Investment (based on reported data on cost, cost structure, cost per production unit, trends in investment, financial solutions and so forth);
- Organization of the sector (size of private or state-owned firms, common ventures, integrations);
- Research and development institutions; and
- Review and elaboration of information on trends and prospects in the 1970s.

The surveys are not to be handbooks or encyclopedias, but well organized information papers based on facts, new knowledge, new applications, experience, statistical data, forecasts and estimates reported or made available during 1967 and 1968. Much of the content will be based on information reported through professional communication media, such as journals, news agencies, reports of experts, reports prepared by national and international organizations, feasibility studies and books.

One USSR institute will assume responsibility for the preparation of each survey; the Institute of Information of the Steel Industry for iron and steel, the Institute of Information of the Non-ferrous Metals Ministry for non-ferrous metals and the Konyunkturny Institute of the Ministry of Foreign Trade for metalworking and engineering. The three institutes will organize the necessary co-operation with other institutions.

UNIDO will co-operate with institutions involved in the survey, consulting continuously with them on technical problems of mutual interest, the selection of experts and, if necessary, changes in the study programme. There will be a regular exchange of information and, when it is considered useful, joint participation in meetings.

DO1192

The Author: *Hiroshi Fuwa, Chief of the Computer Center of the Japan Information Center of Science and Technology (JICST), has been with JICST since 1958. From 1945 to 1957 he worked for the Electrotechnical Laboratory, Tokyo. He is a graduate of the Tokyo Institute of Technology.*

Japan Information Center Uses Unique Computer System

By Hiroshi Fuwa

THE JAPAN INFORMATION CENTER of Science and Technology (JICST), a non-profit institution financed by the Government and industry, has begun to put into operation a computerized processing system for scientific and technical information. This system is unique in that it uses Kanji, a type of Japanese writing using Chinese-derived characters, and Kana, the Japanese syllabic script.

Through this new system, the Center can more efficiently carry out its activities, which are: collecting comprehensive scientific information from all over the world and processing it systematically; disseminating information rapidly to organizations and individuals, regularly or upon request; encouraging and assisting other organizations in their information programmes.

Shortly before the Center was founded in 1957, Western Reserve University of Cleveland, Ohio demonstrated the feasibility of using a computer system for scientific information and documentation work. The Center took this into consideration from the outset and made long-range plans for adopting a computerized system suited to its needs. For two years, 1959 and 1960, the Center used a punch card system. In 1960, as an intermediate step, the Center installed a medium-sized electronic computer operated on magnetic tapes. This was used for storing and retrieving information on metals. It also served as a useful device for training personnel, testing other systems and providing the staff with basic knowledge of the techniques of handling scientific and technological information.

With the development of computer technology and the rapidly growing requirements of the Center, a large-scale, faster and more versatile device soon became both practicable and justifiable. In 1967, the Center began to install a system

Abstracts Published by JICST in Fiscal Years of 1966 and 1967

	1966	1967
Mechanical engineering	66,897	67,146
Electrical engineering	39,339	35,043
Chemistry and chemical industry	98,397	92,460
Metallurgy, mining, earth sciences	28,264	35,978
Civil engineering and architecture	21,257	27,788
Physics	34,917	41,992
Atomic energy	14,712	14,854
Management science	18,789	19,368
Japanese chemistry	30,411	31,301
Total	352,983	366,930

with a large memory capacity that can be used in time-sharing operations. Alpha-numeric as well as Kanji-Kana characters can be used for storing, editing and retrieving scientific and technological information that is prepared and published in Japanese in the Center's major publication, *Current Bibliography on Science and Technology*.

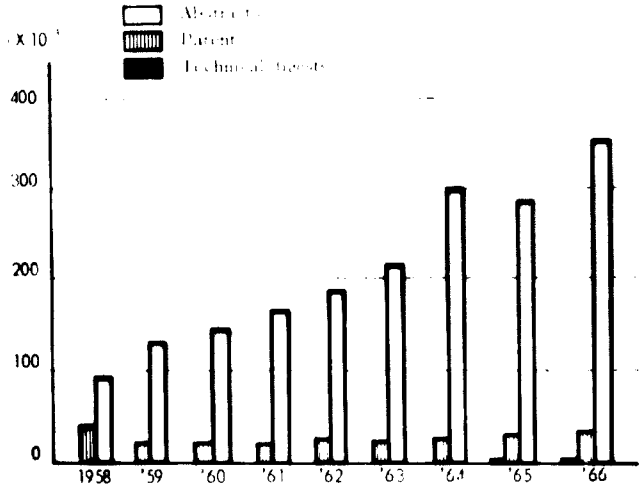
Since each symbol of Kanji has three or more pronunciations, the number of homophonic combinations, particularly when transcribed in Kana, presented a major challenge to the Center in developing its system. This challenge has been met, and the system is now in use.

Preparation of Current Bibliography

About 100 information officers with scientific or technological backgrounds are continually at work analysing, abstracting and classifying journal articles. In addition, about 3,000 scientists and engineers who are actively engaged in scientific and industrial research are registered as abstracters for JICST.

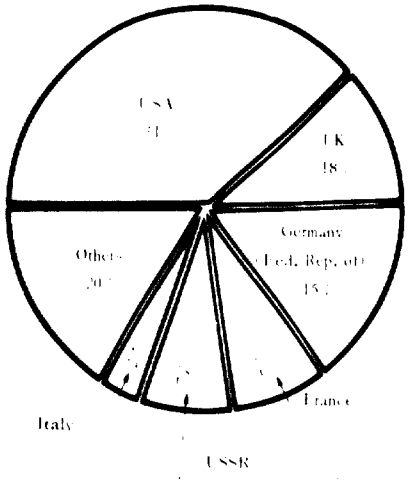
Previously, the abstracts prepared for the *Current Bibliography on Science and Technology* by the information officers and outside experts were processed manually. This required the following procedures: typing, on 4 · 6 inch cards, each abstract with its original title, Universal Decimal Classification Number, author and complete identification of the publication in which it appeared; bringing together the nine sections and arranging the abstract cards in the predetermined order; sending the material to a commercial offset printer. This procedure required approximately three months.

Information Processed by JICST



Under the mechanized system, the procedures are: punching abstracts onto paper and making them machine-readable with Kanji teletypewriters; arranging abstracts that have previously been tagged; printing on film with a special Kanji printer. The mechanized process takes approximately half the time that the manual process requires.

Foreign Journal Titles by Country



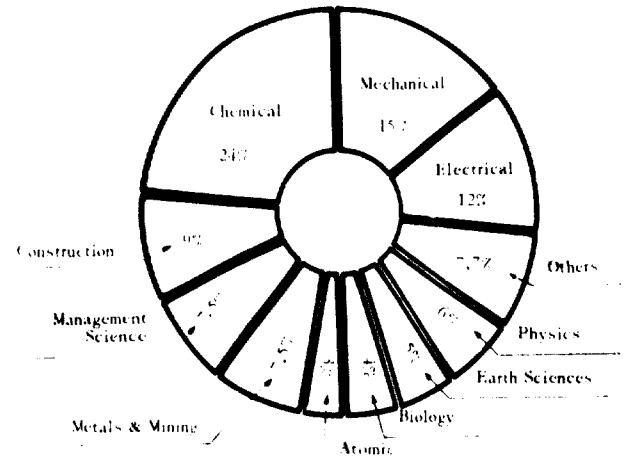
The computers used are FACOM 230-50 and 270-20 models that are connected up with Kanji teletypewriters or Kanji lineprinters. Available in this system are 1,861 Kanji characters, 718 Kana symbols, numerals, symbols and 492 characters from other alphabets, including Greek and Russian. The computer selects the letters needed and projects them on a cathode-ray tube. A synchronized built-in camera takes photos at a rate of five lines per second with 40 letters per line. The film is processed and sent to an offset printer.

In addition, an electrostatic device takes up the images on the cathode-ray tube and produces proof sheets.

Preparation of indexes and retrieval of information

With the aid of the computer, the Center can utilize the magnetic tapes used in preparing the *Current Bibliography* to compile author and subject indexes. The manual pro-

Foreign Journal Titles by Subject



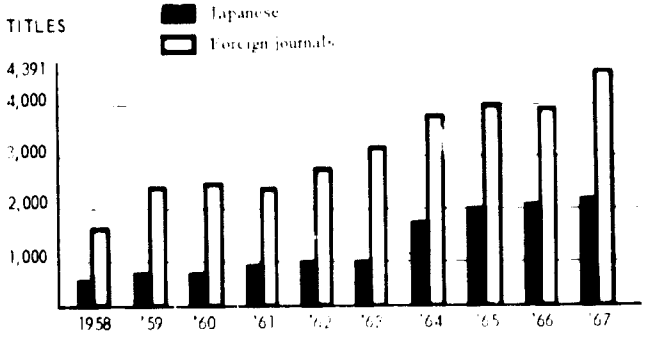
cedure for index-making requires a large supply of manpower working for eight months, but the new process makes it possible to prepare indexes as soon as a volume is completed. Moreover, a series of new indexes are available automatically if the programmes have been worked out before the volume is put on tape.

When the Center has a three-year supply of processed tapes, an information retrieval service will be available to the public upon request.

Source document file

JICST's working collection now contains more than 7,000 journals and 40,000 technical reports. Each year the total increases by about 10 per cent. The acquisitio ı policy for journals is based on the following considerations: number of titles which the Center has the capacity to process; comprehensive coverage of science and technology,

Foreign Journals Processed



with the exception that journals on life sciences are limited to those directly connected to the physical sciences and engineering; unbiased country distribution. (See accompanying diagrams.)

To control library procedures e.g. acquisition, checking out material, storage—and to facilitate identification and location of the ever-growing collection, the Center must apply the computer system. The use of the computer system in the library is still being developed, and eventually will include the compilation of a national catalogue of periodicals.

Utilization of international magnetic tapes

Even with mechanization, abstracting and classifying remain difficult. To prevent duplication of effort, the Center will use processed magnetic tapes available from overseas, such as the MEDLARS tapes prepared by the National Library of Medicine, United States of America.

Research and development on information retrieval

When the search for information is done by machine, studies on keywords or thesaurus (structured glossary) become necessary. As keywords form the basis for retrieval, their frequency distribution and association factors should be made clear. Such clarification can be done only through intensive use of a computer system. The computer therefore, will constitute a powerful means not only for the retrieval of such information as structural formulas of chemical compounds, but also for the study of information work itself.

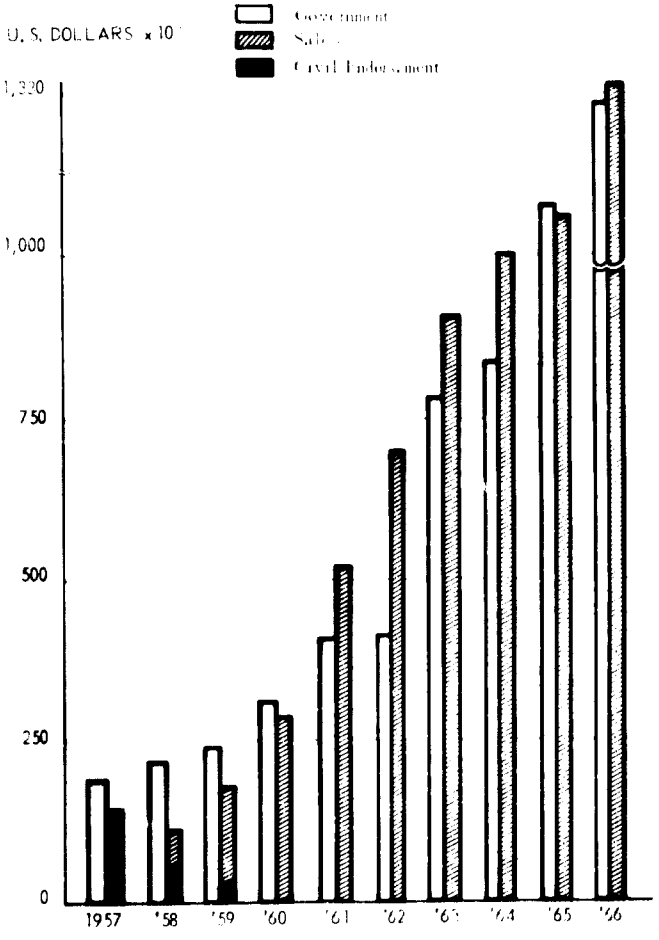
Office automation

Computerization can also take over many facets of routine, time-consuming office jobs, such as control of copying jobs, receiving of orders for publications, shipping and maintenance of payroll.

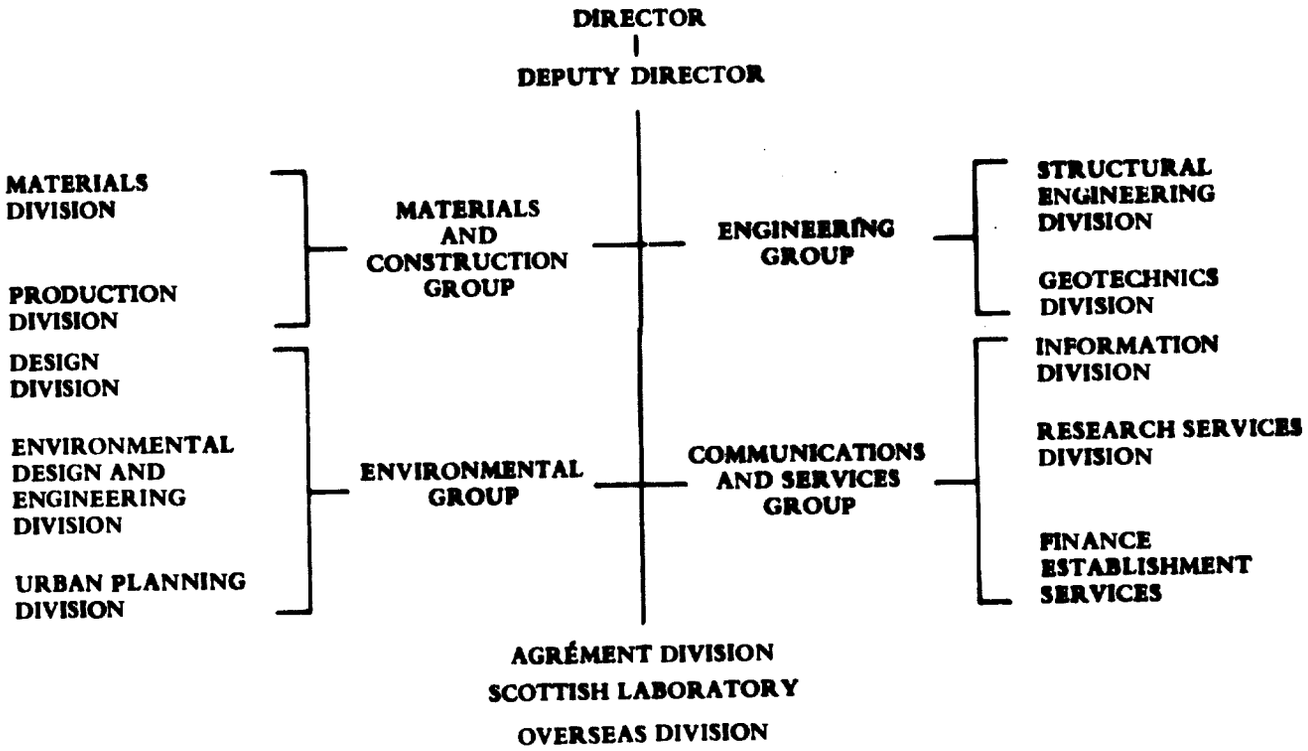
Publications

Computerization will greatly facilitate the preparation of all of the Center's publications. Five of the nine sections of *Current Bibliography on Science and Technology* those on Mechanical Engineering; Electrical Engineering; Earth Sciences, Mining and Metallurgy; Civil Engineering and Architecture; Pure and Applied Physics are issued bi-monthly. Three sections Atomic Energy (Isotopes and Radiation Chemistry Series), Management Science, and Complete Chemical Abstracts of Japan appear monthly.

Sources of Annual Income



ORGANIZATION OF THE BUILDING RESEARCH STATION



basic work is essentially long-term research, but it is usually desirable to define a series of projects, each with a clear objective, and to have formal reviews at specified dates.

The current research programme comprises about 100 projects. Over the last five or six years BRS has reduced considerably the number of research projects being undertaken at one time. Through a concentration of research resources, the Station can make a more effective contribution, not only ro current problems, but also to those that it may face in the immediate future. Also, the research process itself is generally more efficient when staff members work intensively on a single project, rather than attempt to undertake a number of studies at the same time.

Limiting the number of projects to be undertaken lends particular importance to the decision on where the emphasis in research should be placed. The director and the steering committee discuss the broad pattern of the work. The steering committee, which is under an independent chairman, is made up of representatives from government departments with major building responsibilities and also of representatives from various sectors of the building industry. Once decisions on the major allocation of the research resources have been made, the Station organizes the divisions that are considered appropriate, and the division heads, in consultation with their assistant directors, decide on the main areas to be tackled. Division and section heads then have detailed discussions of the specific projects to be undertaken.

One policy question discussed recently is whether it is more desirable for the research worker to formulate research proposals for the industry or for industry itself to define its own research needs. Experience at BRS has shown that, in nine cases out of ten, the final formulation of projects is best done by the research worker himself, but it is important that this is not done in isolation. It is vital that the research worker conduct his research in close contact with the industry and feel himself to be a member, rather than an appendage of the industry. To improve liaison between the research worker and the industry, the Station has been holding special research symposia in which current research in various fields is discussed.

Over the years, the Station has also supplemented its informal and individual links with different parts of the industry by setting up various advisory committees that include members from industry to deal either with the work of the Station as a whole or with certain specialized subjects. Currently the specialist committees are on Urban Planning, Management Studies, Econometrics, Engineering Services and Cranes for Low-Rise Housing. These committees usually function for six months or a year.

The major consideration in selecting the main areas for research and specific projects to be undertaken is the likely outcome of the research, in terms of results and future application. When the Station selects research projects, it identifies the potential clients who would be interested in the results of the research and considers the best ways of encouraging the implementation of these results. It is often desirable to bring the client into the research process, so that the progress of the research and the presentation of the final results can be tailored to meet his needs.

Another factor to be considered in planning is the research effort in the industry as a whole, both at home and abroad. It is not so much a problem of avoiding

overlapping, as of ensuring the maximum over-all benefit from the Station's work by taking into account work being done elsewhere. These considerations lead to an emphasis on particular research where BRS has a specific role arising either from a responsibility, such as that of meeting government requirements, or from its specialized resources.

Clients in the United Kingdom

In the United Kingdom, the potential users of the Station's research results fall into four main categories: government and central organizations, contractors, manufacturers and designers.

Government and central organizations

Since July 1967 the Station has been part of the Ministry of Public Building and Works. BRS also has considerable contact with other ministries particularly those of Housing and Local Government, Education and Science, Health, and the Scottish Development Department that have responsibilities in the building field. All these government departments have established development groups in relation to their building programmes, for example, public building, housing, schools and hospitals, all of which represent important clients for the work of the Station.

The Station provides various government departments with scientific and technical information that serves as a basis for legislation and recommendations in the building field.

Researchers work with an experimental press for making large concrete panels.

Other government agencies, such as the National Building Agency and the Agrément Board, also require research. The Station has an assessor on the Agrément Board and acts as technical agent for it, being responsible for advising on the performance of new materials or components, and for checking how far these requirements are met in particular applications submitted to the Board for certification. In this way, BRS not only helps the Board and the industry to have innovations applied, but also, more generally, develops yardsticks that can be used by manufacturers in the development of new products.

The Station may be required to submit evidence on such topics as housing research or noise, or to undertake some research specifically directed at providing information on topics being considered by various government bodies. Beyond this, the Station is responsible for providing policy makers in government departments with independent and authoritative advice and information on many different aspects of building. As the Government is responsible, directly or indirectly, for about half of all building in the United Kingdom, this represents a major commitment for the Station.

The Station also has many links with the British Standards Institution, and through it and British Standard Codes of Practice, many of the research results are integrated into current practice. The Station is represented on some 250 Standards Committees and over 100 Code Committees.

Contractors

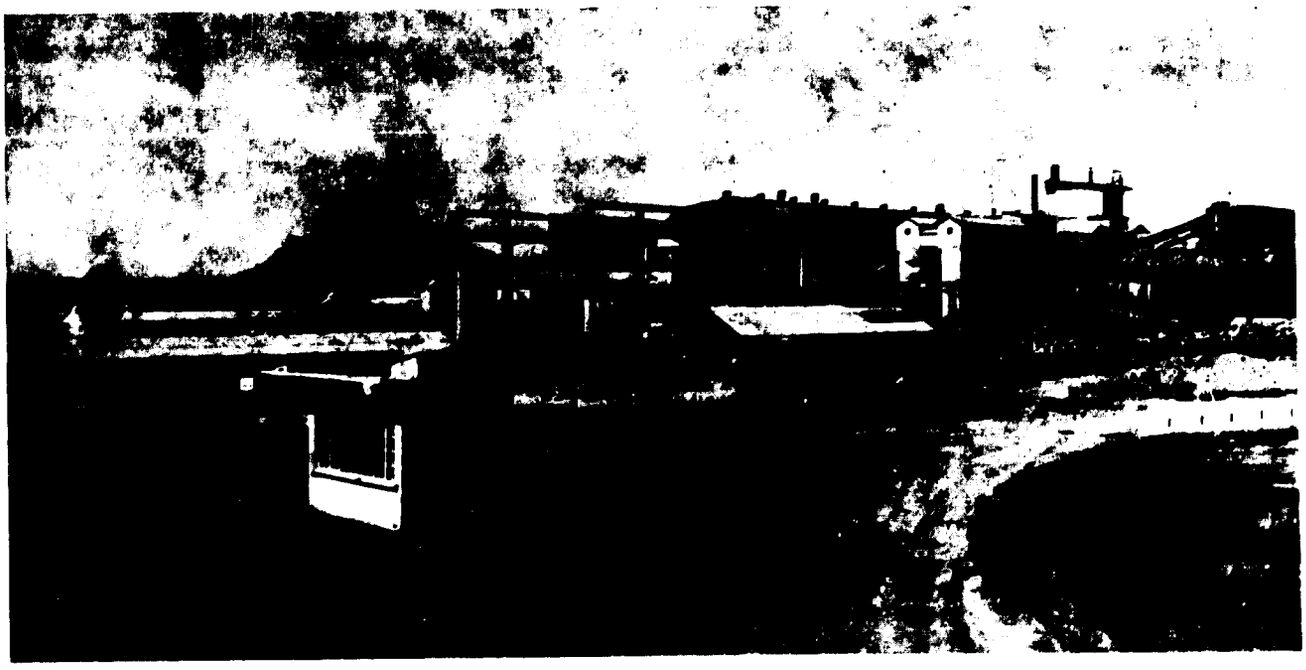
The contracting industry can make use of research on management, site organization and costs, the mechanization of building operations, materials, maintenance of buildings and other matters. The main formal links are through national and regional federations of contractors and their professional bodies, which form a collective channel through which the results of research can be brought to builders. Direct contacts with firms tend to be mainly with the larger and more advanced ones, particularly those having research and development groups.

Formal arrangements have been made with several trade organizations, in some cases with representation on committees set up by such organizations to consider their research needs. Special collaboration can lead to joint research studies in which the industry itself participates. Such arrangements ensure not only that the research undertaken is relevant, but also that the results are applied without delay.

Manufacturers

Close collaboration is maintained with manufacturers and distributors of building materials and with their national federation. Although the Station is primarily engaged in applied scientific research, certain development work is carried out either in pilot production plants attached to the laboratory or in full-scale trials. It is sometimes found that manufacturers or contractors (or even designers) will not develop innovations from applied research until the innovations have been demonstrated to be practicable and commercially viable, and the Station may have to undertake work in this direction. An example of this is the Station's development of a new technique for making large concrete panels by pressing. This project was taken to the full-scale plant stage before serious efforts were made to interest manufacturers. When the feasibility of the method had been established, it was publicized in the Station's Current Papers and demonstrated at an exhibition. Following this the Station undertook a design study for a prototype press for industrial use, the cost of this study being shared by the Station and interested firms. Recently, a consortium to exploit the pressing technique was set up and government financial support is now being negotiated.

BRS studies airflow patterns in the vicinity of buildings in this specially built wind tunnel.



This Uganda Cement Industry plant uses raw material rejected as unusable before research was carried out.

Designers

The Station keeps in close touch with the activities of the professional institutions concerned with design in the building and civil engineering fields, providing formal representation on some committees of these institutions. Members of the Station staff serve, in a personal capacity, on the councils and specialist committees.

The main clients in the design professions are architects, engineers and planners. Much work is done in collaboration with various groups, and this is one way of ensuring that research results are applied in practice.

Work of the Overseas Division

The Overseas Division is relatively small, having a professional staff of nine. It is not possible for its members to deal personally with all requests for help in the housing, building and planning fields, but the Division is able to ensure that the appropriate form of assistance is given and, in cases where projects are too large for its resources, that the right individual or organization is appointed for the task.

Although the Division's work is principally advisory, its members specialize in certain important aspects of their own work, such as planning and building legislation and the design of structures in earthquake and hurricane zones, and are able to give direct help.

The other divisions take an increasingly active interest and role in overseas work. Advisory visits have recently been made to Jamaica, for an examination of local clays and site studies of the house building industry, and to Bangkok, where a paper on the development of building materials was presented at a seminar of the Economic Commission for Asia and the Far East (ECAFE).

Members of the Overseas Division maintain liaison with other technical assistance agencies, individuals and governments throughout the world. They also assist work overseas by writing papers, giving lectures to such institutions as the Department of Tropical Studies of the Architectural Association, helping to organize professional study tours and courses, and assisting the Ministry of Overseas Development in many ways, including the recruitment of professional staff for overseas appointments and the formation of links between schools of architecture and planning in the United Kingdom and abroad.

The main responsibilities of the Overseas Division are: to keep abreast of developments both at home and abroad; to collect and collate information and to make it available to developing countries; to deal with inquiries from developing countries, providing information, advice or assistance where necessary; to help solve specific problems and carry out projects; and to advise and assist the Ministry of Overseas Development.

The Division's work can be roughly grouped into five main categories: design, structures, materials, planning and publications.

Design

Although the architect members of the Division occasionally undertake relatively small design projects, such as a secondary school for the Cayman Islands in the Caribbean, probably the most important aspect of their work is the examination of the many capital aid projects under-

taken by the Ministry of Overseas Development.

The Division comments on the need for individual building projects and is responsible for ensuring that designs are economical, meet established standards and are generally suitable for their purpose. Whenever possible, the Division keeps a watching brief on the larger projects during construction.

In 1967 the Division appraised more than 50 schemes, mainly buildings for educational and medical purposes, in more than 30 countries.

Structures

The Overseas Division has made a special study of the building problems of developing countries and the legislative framework needed to enable all forms of development to be effectively controlled. Model building regulations have been prepared that cover not only normal urban development, but also the construction of temporary housing and buildings in earthquake zones.

A number of developing countries have used these regulations as a basis for the preparation of their own building regulations, and a member of the Division has visited places as far apart as Malaysia and Swaziland to assist in such work.

Materials

By far the greatest number of inquiries received by the Overseas Division concern the behaviour and use of building materials, usually in tropical countries. Advice given in recent months has included answers to roofing problems in Cyprus, Gibraltar and Malaysia; special flooring materials in Hong Kong and Singapore; the use of lightweight concrete in Aden and Pakistan; and the prevention of corrosion in reinforced concrete in India and Pakistan.

The Station is attempting to systematize information concerning building problems in developing countries today and to circulate such information as widely as possible. Three comprehensive reports have been published recently, one on good design and building practice in tropical countries, one on block-work walls and the other on termites. An extensive study on the design of roofs will be available later this year.

Physical planning

The Division makes available advice and assistance on all aspects of land-use planning and helps the Ministry of Overseas Development assist developing countries in establishing and building up self-supporting, effective physical planning departments.

Developing countries often seek the Division's help in drafting legislation for the planning and control of land use.

The Division often examines requests for planning assistance received by the Ministry and advises on the action to be taken. This may require a visit to the country concerned.

Perhaps the most serious problem of all in this field is the severe shortage of trained planners. The Division not only is helping to place students from the developing countries in established planning courses in the United Kingdom, but also is encouraging the setting up of new courses more in keeping with the needs of the developing countries. The Division is carrying out a study of planning education in order to establish the extent of the present and future needs for planners, the additional planning courses that will be required to meet the shortage, the form these courses should take and the countries or regions in which they should be provided.

Publications

The Overseas Division publishes "Overseas Building Notes" every six weeks. This is distributed free to approximately 1,700 people or departments in countries throughout the world. The "Notes" include short items on housing, building and physical planning; digests of publications; and technical studies prepared by BRS staff members.

Recent topics have included industrial building, design and productivity; the metric system and the construction industry; corrosion of metals; school building in Pacific territories; and small-diameter sewers and drains.

Encouraging application of research results

As mentioned earlier, the Station places considerable emphasis on establishing direct links with the potential users of its research results. It also has various information services that provide more general publicity for these results.

BRS publishes about 80 papers a year in appropriate professional or scientific journals. It reprints many of them in Current Papers that are distributed to people who have indicated their interest in this field.

The Station has, over the years, acquired a considerable body of scientific and technological knowledge that it seeks to make available by the publication each month of a BRS digest. This digest deals particularly with subjects where conditions are changing or where there has been rapid technical development. There are now more than 200 current digests in two numbered series, and the system permits the revision of old subjects as well as the introduction of new ones.

The Station also publishes various books by members of the research staff. One book now being prepared deals with building climatology; another, with the thermal performance of buildings.

The Station also dispenses information through an advisory service that deals with more than 7,000 written technical inquiries and about 14,000 telephone inquiries each year and through post-graduate courses which help bring teachers up to date on new developments. Later, the Station hopes to provide courses for professional staff within industry and thus further to encourage the application of its results. Other methods of making the Station's work known include stands at exhibitions, lectures, films and symposia.

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The Chemical Industry of Pakistan: Development, Orientation, Current Trends

By Kamal Mohammad Habib

MOST SURVEYS of the over-all growth of a country's industrial sectors show the chemical sector as being in the lead. One reason for this is that this particular sector converts the raw materials into finished products; another is that its range is wider than that of any other sector. Most industries are directly or indirectly connected with the chemical industry, which could thus be regarded as the basis for both industry and agriculture.

The emergence of the chemical industry as such an important factor in development is relatively recent. Since the Second World War the rate of investment in the chemical industry has more than doubled in Europe and trebled in Japan.

In Pakistan the chemical industry has developed even more rapidly. When Pakistan became independent in 1947, it had only one chemical plant for the manufacture of soda ash and a far smaller sulphuric acid plant producing some 300 tons *per annum*. The former, at Khewra, West Pakistan, was operated by the Imperial Chemical Industries, Ltd., United Kingdom, and managed by the Alkali and Chemical Corporation of India, Ltd. It is now owned and operated by the Imperial Chemical Industries (Pakistan), Ltd. By 1970, the end of the Third Five-year Plan, the chemical industry will have grown to be over fifteen times the size it was a little over two decades ago.

As agriculture is still the linchpin of the country's economy, the chemical industry has been closely linked with one of the principal cash crop products, cotton. In fact, the growth of the chemical industry has corresponded to that of the textile industry and, to a lesser extent, with industries like those based on sugar, paper, and oils and fats.

Pharmaceutical industry

No pharmaceutical industry worthy of the name existed in Pakistan in 1947. Since then, however, both local and international firms have established plants there. Many foreign firms are still mainly distributing and semi-manufacturing agencies, but some, including Sandoz of Switzerland, Lederle Laboratories Division of the American Cyanamid Co. of the United States, Glaxo Laboratories of the United Kingdom and May & Baker Ltd. of the United Kingdom which is in partnership with the East Pakistan Industrial Development Corporation are progressively diversifying into the manufacture of drugs.

In two or three years, Pakistan should have at Karachi a sulpha drug manufacturing plant that will be able to satisfy about 25 per cent of the domestic demand.

Other plans for further expansion in the organic chemicals sub-sector include the manufacture of acetyl sulphanil chloride (ASC), the basic chemical for many of the sulpha drugs, and a 5,000-ton-*per annum* polyvinyl chloride plant being set up at Karachi by Arokey Chemical Industries, Ltd., in close association with the polyacrylonitrile plant of Hyesons, Ltd., with natural gas as the raw material.

Petrochemical industry

The petrochemical sector had no base at all in 1947, yet it is here that the most rapid growth has occurred. Valika Chemical Industries, Ltd., Karachi, has already invested about Rs. 80 million[1] in the annual production of: 2,100 tons of formaldehyde; 3,000 tons of methanol; 5,100 tons of urea formaldehyde resins; and 5,000 tons of polythene. The private sector already bids fair to exceed the Third Five-year Plan targets in the petrochemical sector. A Rs. 10 million manufacturing facility for synthetic resins now being established by Congothene Ltd. at Buhdo is expected to produce Rs. 40 million *per annum* of finished plastics goods. The facility will emphasize fabrication and chemical engineering techniques.

The biggest boost to the petrochemical sector should come from the country's largest petrochemical complex that is to be set up at Karachi by the Post-War Services Reconstruction Funds. The plant will be designed to produce annually: approximately 40,000 ton of ethylene; 20,000 tons of polypropylene; 13,500 tons of the C_4 fraction; and 32,000 tons of tail gas. It will also manufacture polythene, polyvinyl resins, polystyrene and polyester fibres, polypropylene packaging material and other polypropylene products, dodecyl benzene, and formaldehyde. By 1975, with the 40,000-ton *per annum* polyethylene plant of the West Pakistan Industrial Development Corporation in operation, the ethylene producing capacity of the country will exceed 100,000 tons *per annum*. The polyethylene plant is expected to be ready by 1970; it will use naphtha as a raw material from local sources.

Intermediate chemical industries

As the chemical industry has so far been oriented towards agriculture, the intermediate chemical sector has received little attention. In order to achieve balance and adjustment among the range of products, the Central Investment Promotion and Co-ordination Committee of the Government of Pakistan has approved the establishment of two solvent extraction plants. More extraction plants may be proposed on a pay-as-you-earn basis.

By 1970, certain sub-sectors of the chemical industry will also have emerged. The production figures for caustic soda, soda ash and chlorine, for example, will be more than doubled. The new plant of the West Pakistan Industrial Development Corporation at Jaranwalla, in West Pakistan, is already producing 15,000 tons of sulphuric acid a year, and the Dawood Chemicals plant has been designed to produce annually: 6,480 tons of viscose rayon grade pulp (with provision for doubling the capacity); 3,600 tons of viscose rayon filament yarn; 1,800 tons of transparent wrapping paper; 10,800 tons of sulphuric acid; 3,600 tons of carbon disulphide; 5,400 tons of sodium sulphate; 7,920 tons of caustic soda by the mercury cell process (on expansion); and 6,480 tons of hydrochloric acid. Five Japanese firms have provided the necessary technical expertise and installation facilities. Of the various projects sponsored by the private sector in Pakistan, this is by far the biggest.

Chemical Industries of Pakistan, Ltd., at Katgher, East Pakistan, has installed a basic chemical plant with a daily output of 15 tons of caustic soda, 13.7 tons of chlorine, 3 tons of benzene hexachloride (BHC), 11 tons of bleaching powder and 10 tons of sulphuric acid.

Kohinoor Rayon, Ltd. has already established a large rayon plant at Lahore at an investment exceeding Rs. 70 million. This company has also set up an insecticide plant near its bigger rayon complex from which the raw materials for the manufacture of four tons each of DDT and BHC a day are available. A DDT plant producing ten tons a day was completed at Chittagong in 1966. By far the most important plant, however, is likely to be based on *Makrolene* and *Petkolin*, the chlorinated hydrocarbon products prepared from petroleum cuts. This plant, with which the Pakistan Council of Scientific and Industrial Research is actively associated, will probably be set up with an initial investment of Rs. 60 - 70 million during the Fourth Five-year Plan.

Pattern of growth

The production figures that have been quoted reveal the pattern of growth that the chemical industry in Pakistan has followed so far. Its development has differed from that in the West and bears a close resemblance to the growth pattern of Japan's chemical industry.

Since 1850, the growth of the chemical industry in the West has developed from the increasingly large number of chemicals that have been isolated from the distillates of coal tar. In the United Kingdom and the Federal Republic of Germany this development was exclusively related to coal tar products whereas in the United States growth was based upon both coal and oil. Pakistan, Japan and India, being strong in the textiles sector, developed the ancillary textile chemicals first and other chemicals only later.

Pakistan has one great advantage that is a recompense for poor metallurgical resources and that is natural gas. This lends itself to the preparation, theoretically at least, of any number of organic compounds. Though, at present, costs rule out the production of some of these, a great many intermediate compounds, solvents and resins can be prepared from natural gas deposits available in the country. The following chemicals and products, for instance, can be economically produced from natural gas:

- Inorganic-industrial gases, carbon black, activated carbon, town gas, sulphur, nitrogen, urea fertilizers, calcium carbide, ammonium sulphate, rare gases;
- Organic-acetylene, Buna N rubber, PAN resin, urea-formaldehyde resins, *Plexiglas*, melamine and casein plastics, benzene, phenol, nylon 8, urethene resins, phenol-formaldehyde thermosets, nylon 66, solvents like xylene and toluene, polythene, polypropylene, epoxy resins, terylene, and many dyes;

[1] $US 1.00 = 4.802 Pakistani rupees.

• Pharmaceutical chemical-salicylates, sulpha drugs, polyvinyl alcohol blood plasma extenders, liquid paraffin, medicinal charcoal, alkyl halides and oxides and pyridine derivatives.

Pakistan's natural gas deposits have a slight disadvantage in that they are mainly methane rich (90 per cent in the Sui, 88 to 92 per cent in other deposits in West Pakistan, and 96 to 97 per cent in East Pakistan). Methane, on cracking, yields acetylene that is polymerizable to benzene. The natural gas deposits of Pakistan are quite unlike those of the United States (rich in saturated aliphatic hydrocarbon), or those of the Union of Soviet Socialist Republics (containing 80 per cent alicyclic compounds).

In spite of the disadvantage, Pakistan expects to build up a strong chemical industry by 1980. Major efforts are being made to exploit both natural gas and oil deposits, as, for example, the linking of the natural gas deposits of Karachi and Lahore (some 700 miles away), and of the extension of the natural gas pipeline to Peshawar, covering more than 1,000 miles in all. East Pakistan has also proved to be fairly rich in natural gas and the city of Dacca already has an adequate supply. In 1947, the refining capacity of Pakistan was only 125,000 tons a year; today the figure has increased to 5,000,000 tons a year.

Foreign collaboration

Foreign collaboration has been forthcoming, particularly from the Regional Co-operation for Development (RCD) countries. Jaffar Brothers, Karachi, has recently concluded an agreement with the Government of Tunisia whereby the company will be supplied with phosphate rock for the manufacture of superphosphate fertilizers. The Government of Kuwait has examined the scheme and expressed willingness to invest in it.

For the manufacture of fertilizers in the private sector, Hyesons, Ltd., has teamed up with Kaiser Aluminium and Chemical Corporation, USA; Dawood Industries, with Hercules Powder, Inc., USA; and Adamjee Industries, Ltd., with American Cyanamid, USA. These four fertilizer facilities will represent an investment of over Rs. 330 million. In all, the Third Five-year Plan target of 2.5 million tons of fertilizers will probably be reached, making Pakistan one of the major producers of fertilizers *per capita* in Asia.

A number of projects with the other two RCD countries have been proposed and tenders have been invited. One notable project is the establishment of a Rs. 50 million synthetic rubber plant using polyisoprene and polybutadiene, with the mononiers to be obtained from Iran. Negotiations are being channelled through the RCD Secretariat.

Another important RCD project is the manufacture of bank paper in order to supply the RCD member countries. Packages, Ltd., Lahore, is establishing a Rs. 88 million plant that is being jointly financed by the International Finance Corporation (IFC), Washington, D.C., and the Pakistan Industrial Credit and Investment Corporation (PICIC). The project will use raw materials available locally, such as wheat straw and cotton binders, and will have an output of 20,000 tons of pulp and 24,000 tons of various grades of paper a year. One of the principal products will be the *Tetra-Pak* base paper for making aseptic containers. AB Akerlund and Rausing, Sweden, are the collaborators who are also participating in the equity of the company.

Fifty more RCD projects were announced in November 1967, many of them in the chemical sector, for example the manufacture of reactive dyes, optical bleaches, PAS sodium (anti-tubercular) and *Diptrex* insecticide.

The role of research and development

In working towards a self-sufficient economy, Pakistan's chief source of worry is the lack of a metallurgical base. The Chittagong steel plant, currently producing some 0.150 million tons *per annum* of steel, cannot fulfil domestic requirements. In addition, other metals, such as copper, chromium, aluminium, beryllium, zinc, nickel and radioactive metals, are in very short supply. A possible answer to this shortage of metals would be the strengthening of the non-metallic chemical sector. Here, also, Pakistan's case is no different from that of Japan, which has to import most of its iron ore.

The building up of a non-metallic industry, however, will not be easy. Many of Pakistan's staple exports, such as jute, are already facing stiff competition from kenaf and polypropylene. Research and development have now become essential, not only for the development of the industry in general but also for shortening the time lag. Plants manufacturing on license are often already out of date when they begin operation, and so the gulf between the developing and developed countries keeps on widening. Each year big chemical companies write off millions of dollars as depreciation because of the adjustments that newer and more economic methods entail. One rather interesting instance is the development of computerized control of the reaction system of the acetic acid plant of British Petroleum in the United Kingdom by the direct oxidation of naphtha. Such methods can divert manpower to the sector where it is most needed, in research and development.

Research and development can help the chemical industry in Pakistan in many ways: by proving the feasibility of the manufacture of many natural drugs; by working out a scheme for the manufacture of by-products from petroleum and natural gas; by adapting processes that have been developed abroad to local conditions. But it is, finally, a question of the correlation of the chemical sector with research results that will constitute the main basis for the resolution of the problem. In part, the industry can help by pooling its resources and forming research associations in order to exercise, as it were, a supererogatory effort. So far the research and development effort has been confined either to central and provincial government organizations or to autonomous organizations. Research associations, in spite of handling competitive products, have proved themselves to be very useful in Western countries.

The other part of such a correlative effort will depend,

for some time, on increased Government grants to scientific research organizations.

To sum up, Pakistan's chemical industry demonstrates buoyancy in the agricultural, petrochemical and the pharmaceutical sub-sectors. With the Karachi steel mill and the Kalabagh steel plant in northern West Pakistan in operation by the time of the Fourth Five-year Plan, and with the total steel-making capacity of the country approaching the 1-million ton-per-year mark, it would be more practical perhaps to chalk out the directions to be taken by the industries of the country. For the present, however, the problem is one of self-sufficiency. This is demonstrated by the fact that the exports of the country since 1954 1955 have grown by some 300 per cent, from Rs. 1,222,957,000 to about Rs. 3,000 million, at the present rate. With many projects coming into operation, it is fair to expect that exports should increase at an even greater pace. With the private sector becoming more export-oriented, research and development should logically receive further stimulus.

UNIDO and ILO Joint Working Party Meets

Following the signing of a Memorandum of Guidelines for Co-operation between UNIDO and the International Labour Organisation (ILO), the joint working party of the two organizations held meetings in Vienna and Geneva during the spring and summer.

The three areas of common concern to UNIDO and ILO are: institutes of management and productivity; the development of specific industries; and small-scale industries and the development of entrepreneurship. In the three meetings which the Joint Working Party held before the review, specialists from the technical branches concerned participated in a concerted effort to enable the resources of the two organizations to be used with the greatest possible impact to help solve the industrial problems of the developing countries. The members of the Working Party discussed the possibilities of joint action in strengthening existing projects, identifying new projects that could usefully be undertaken jointly and exploring other possibilities for future co-operation.

UNIDO and ILO agreed that three projects already approved by the United Nations Development Programme and assigned to one of the two organizations could benefit from supplementary assistance from the other organization. These projects are a metal industry development centre in Singapore, a small-scale industries development programme in Turkey and an in-plant training centre for engineers in Turkey. In Ghana, Pakistan, the Philippines and the United Arab Republic, where projects have already been initiated with the assistance of one organization, it was agreed that further work would be carried out in consultation with the other organization. In six additional countries (Dominican Republic, Indonesia, Iran, Mali, Poland and Zambia) the Working Party envisaged the possibility of future joint action. Joint action is being undertaken or prepared on thirteen projects, and others will be studied by the Working Party at its subsequent meetings. In addition, efforts are being made to establish contacts between UNIDO and ILO on projects in the same country, such as in Algeria, Israel and Uganda.

Expert Group on Dies and Jigs

Thirteen experts from developing and developed countries and three to five observers participated in an Expert Group Meeting on Problems of Design, Production and Utilization of Dies and Jigs in Developing Countries from 9-20 December at UNIDO headquarters in Vienna.

Organized by UNIDO on an interregional basis, the meeting had two purposes: *(a)* to provide an opportunity to discuss the present state of and future trends in design, production and utilization of dies and jigs, in addition to economic aspects, and methods of organization of production of dies and jigs in developing countries and *(b)* to work out recommendations on the future activities of UNIDO and developing countries in this particular field. Participants heard papers on different aspects of the problems in question.

Representatives of the following countries participated in the meeting: Brazil, Cameroon, Czechoslovakia, France, Hungary, India, Portugal, Tunisia, the Union of Soviet Socialist Republics, the United Arab Republic and the United States of America.

By Lubor Karlik

Making the Best Use of Management Consultants

THE UNPRECEDENTED EXPANSION of industry in recent years has been accompanied by an equally impressive evolution of management functions. During the same period, professional management consulting has gained greater acceptance from many leading corporations and has been recognized as a problem-solving profession that can quickly execute assignments and submit to management either a set of alternatives or the best feasible solution. In spite of these merits, consulting is a frequent and often controversial subject of discussion.

Problems for consulting assignments

Generally speaking, specialized or unique problems are considered suitable for consulting assignments, while situations likely to recur are thought to be internal corporate responsibility. The advantages of management consulting are mainly in terms of the immediate availability of specialized knowledge and its application to certain types of industries, the consultant's objective approach to problems, his high degree of motivation and comparative knowledge of similar organizations. The disadvantages are the high cost, the consultant's unawareness of personal relationships, the exposure of internal and, often, confidential information and the fact that the skills of the consultant leave with him when the assignment is completed. In addition, some consultants tend to perpetuate their assignments and cause the client to become "consultant prone", which may gradually weaken management's capabilities and self-reliance. The development of management qualifications, although tedious, is of a more permanent value. The decision between dependence on internal capabilities and the use of consulting services is governed chiefly by such factors as the urgency of the problem, the availability of skills and financial considerations. A proper decision can be made on the basis of the following questions:

1. Can the problem be solved by corporate management? (If so, when and at what cost? What additional skills would have to be hired and for how long? What other implications may arise in the short and long run?)
2. How urgent is the problem? (Could the management skills be augmented or developed in the time available?)
3. What is the nature of the problem? (If it is routine and repetitive and skills can be generated in time, an internal solution may be preferred. If it is unique or specialized, it may be more suitable to hire outside consultants.)
4. Will confidential information, such as manufacturing processes, be revealed?
5. Is consulting service needed in order to ensure impartiality? (This would be true, for example, in the case of a management reorganization or a performance review of executives.)

Choosing consultants

When it has been established that consulting services are desirable, the question of the choice of a consulting firm arises. In this decision the image of the consulting firm plays an important role, because it represents competence, integrity and other important professional qualities. For this reason firms frequently attempt to promote their image by various status symbols, such as a prestigeous

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address, luxurious offices and lavish entertainment. However pleasant these may be, they do not improve professional competence but do increase overhead costs. The façade of a consulting firm should not be confused with specific qualifications.

In addition, the well-established consulting firms have a tendency to oversell their reputation. Though an older firm may have an implied guarantee of competence, which a new firm may not have, the actual qualifications of the consulting personnel are of greater interest than the reputation of the firm. In fact, large and older organizations frequently suffer from a certain degree of coronary disease, that is the senior partners tend to reap larger profits and to make more administrative and social rather than professional contributions. The services of the large and reputable firms are therefore often overly costly.

Image not only helps to generate new business but also creates faith in the ability of the consultant. This enables him to function as a psychiatrist to his client, who often is suffering from preconceived ideas about his problems. A competent consultant will find a feasible solution and try to re-orient his client in the proper direction within the framework of business realities. This is one of the most difficult tasks: it requires not only the professional competence but also the diplomatic persuasiveness that will make the solution acceptable to the client. The faith of the client in his consultant is a prime factor in the success of the work done, so the choice of a qualified consultant is of crucial importance.

As yet management consultants, unlike doctors, are not required by law to have certain academic qualifications or to pass examinations. Nor does a consultant have to fulfil an internship by completing a certain number of cases to prove his ability. Consulting is an open field, and it may be difficult to recognize the best qualified professionals.

It is also important to differentiate between the consulting firm and the individual consultant. If one decides to undergo a medical examination, one may scan all available hospitals and doctors of good reputation. Yet it is far more important to choose a good physician than a good hospital. The consultant plays a role comparable to that of the doctor. Though the doctor's skills may be aided by a well-equipped institution and a qualified supporting staff, a well-known hospital is no substitute for a doctor's professional qualifications. This should be recognized beyond any doubt, and the consultant should be chosen as an individual, for his professional qualifications, and not for the reputation of his firm.

Consulting firms usually support their proposals with a list of top professionals. This does not imply that these men are available when the contract is signed. Often the client may be assigned less qualified personnel, or even someone who has been hurriedly hired to meet the commitments of the contract. The contract should be awarded, therefore, against specific names of professionals. If the consulting task depends on team effort, the project leader should be given an opportunity to form his team and submit it for the client's approval, since it is he who will have the professional responsibility for the assigned task.

Caution should be exercised when dealing with consulting firms which act as clearing-houses for professional talents and take credit for work accomplished by temporary professional staff. Their reports seldom carry the names of the responsible authors and are presented under the company name. This is an unsound policy that will decrease motivation and, in the long run, undermine the morale of the staff. Logically, no good professional wishes to remain anonymous in his field of practice.

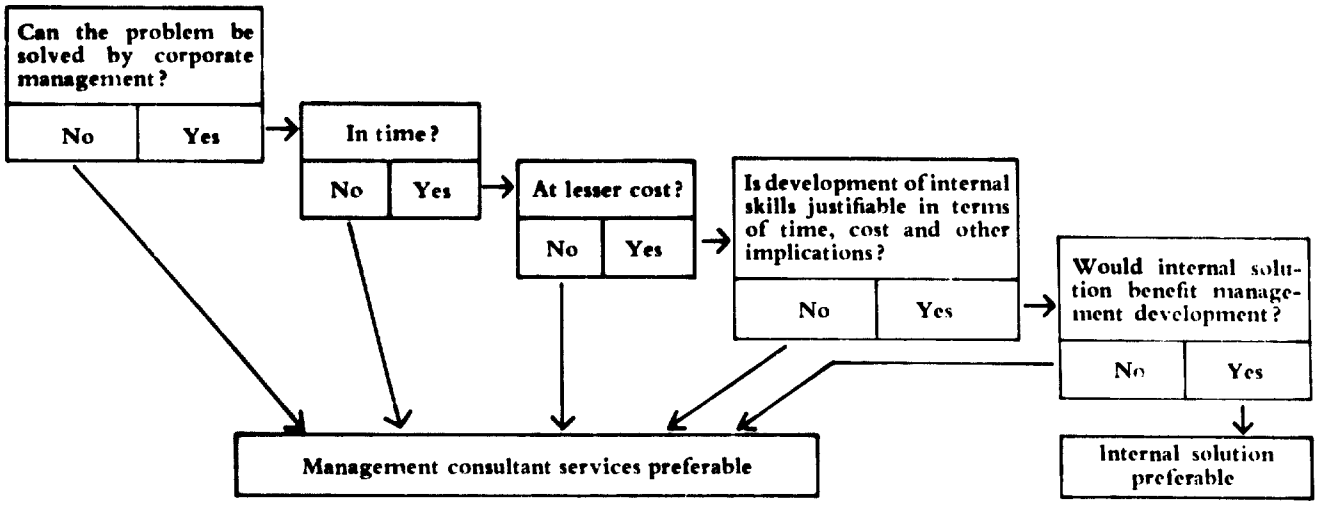
Even in the most reputable firms there may be some inadequately qualified consultants. It is interesting to note that such consultants often emphasize the so-called "practical approach", the term practical being used as a cloak for professional incompetence. This so-called "practical work" often consists of a literary exercise in paraphrasing other reports slanted to the requirements of the assignment. Such studies are, of course, almost invariably void of an original contribution or of professional convictions.

To ensure that the client's objectives are incorporated

Pros and Cons of Using Consulting Services

Advantages	Disadvantages
Relatively fast solution owing to specialized knowledge and experience	**High cost**
Ability to obtain personnel at short notice	**Expertise ends with departure of consultant**
Fixed fees	**Consultant may become familiar with confidential information, procedures, techniques, etc.**
High motivation	**Management may develop too great a dependence on external help**
Guaranteed results (within a time limit)	**Consultant may be hired by a firm wishing to dodge important decisions or controversial actions**
Knowledge of other organizations, which fosters objective comparison	**Consultant may create resentment in employees**
Objectivity as a result of independence from internal organizational problems	**Relieves the management of responsibility in case of bad results**
No obligation beyond contractual agreement	
Ability to review and reorganize management, which is beyond the capacity of the management itself	

Schematic Chart of the Decision Process



in the project, the consulting assignments should consist of three stages – diagnosis, prognosis and therapy.

The diagnosis is developed jointly with the client and is usually based on extensive discussions and interviews. The confrontation of ideas should establish a meeting of minds in regard to the scope and n ture of the project. This stage is of fundamental importance and requires broad experience and a thorough knowledge of the professional field as well as the intuition required to analyse intangible values that may play a decisive role.

The prognosis is concerned with a comprehensive study of the facts as diagnosed and the underlying causes. The main emphasis is placed on comprehensive knowledge in the field of practice. In this, academic qualifications are of prime importance.

The therapy consists of the implementation of the proposed solution. It requires skilful application of various methods and also a patient yet efficient approach.

Essential basic attributes

The evaluation of the qualifications of a prospective consultant should centre around four basic attributes: relevant academic background; applicable experience; creative capacity; and suitable personality.

In professional work academic qualifications represent the first consideration as these determine whether the candidate has adequate education to qualify for undertaking the proposed task. Education in the professional context means more than knowledge directly applicable to the assignment; it implies that that candidate has obtained a certain level of knowledge of theory and principles from which he can analyse and develop a unique solution for the assigned problem. On this point rests the difference between the professional and the technician.

A technician adheres to routine, and his capacity may be limited by lack of theoretical background and an unawareness of the underlying principles. A technician may be highly efficient as long as the basic pattern he is acquainted with is unvarying. If the pattern alters, his value is often impaired, whereas a professional can form new concepts based on theoretical ground rules and find satisfactory and rational solutions. Thus, experience is no substitute for education, particularly in management consulting, where profound knowledge of the underlying principles is of fundamental importance.

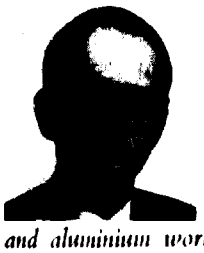
Experience is the second consideration. It tempers theoretical knowledge, purifies judgement and helps in applying knowlege to the particular problem. The value of experience is undeniable, but what should be recognized is the relevance of the experience. The number of years in consulting, if in an irrelevant field, is of little significance. In addition, the length of experience is governed by the law of diminishing returns. The redundancy of assignments and of technological development suggests that a maximum of ten years of experience should be taken into consideration. The first three years are probably the most important and may account for as much as 40 per cent of the total experience. In technological fields, experience of more than ten years is of relatively little value and should not account for more than 10 per cent of the total experience.

The third consideration – creative capacity – is important, but it is difficult to evaluate as it involves numerous intangible factors. Creative capacity should be reflected in past performance (namely the level of positions held), the results attained, the originality and ingenuity of solutions to different problems, authorship of publications and so on. The accomplishments, both practical and theoretical, of a consultant should reflect, with a reasonable degree of accuracy, his motivation as well as his creativity.

The personality of a consultant is an equally important attribute to a well-balanced profile. A tactful approach and pleasant manner will foster good relations and, consequently, create a spirit of co-operation without which very little can be accomplished.

Editors Note: Manual on the Use of Consultants in Developing Countries *(158 pages, Sales No.: E. 68. II. B. 10.; $US 2.00) 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. An article on UNIDO's Roster of Industrial Consultants will appear in* Industrial Research and Development News, *Vol. IV, No. 2.*

This ageing furnace is several storeys high.



The Author: *After receiving an advanced degree from the Budapest Technical University in 1939, Erwin Maetz was in charge of designing and constructing various civil engineering establishments. Active in the aluminium industry since 1943, he has taken part in the conceptional and detailed engineering of a number of new alumina and aluminium works and in the expansion of existing plants both at home and abroad. He is now Head of the Engineering Bureau of the Design Centre of the Hungarian Aluminium Industry. His assignment includes managing the growing export activity of the enterprise.*

Research and

THE RAPID DEVELOPMENT of the Hungarian aluminium industry shortly after the Second World War created the need for two supporting units: a research institute to conduct experiments and perform research activity for the individual branches of the aluminium industry and a design centre to meet the constantly increasing requirements resulting from modernization and new investments.

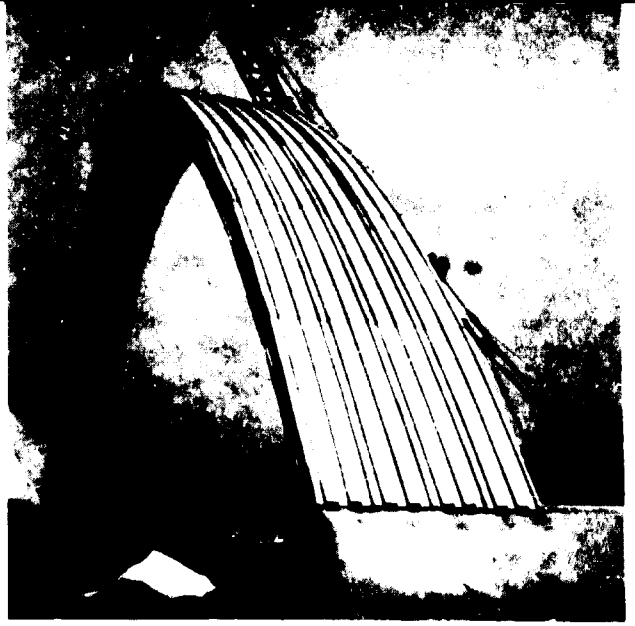
The first of these, the Research Institute for Non-ferrous Metals, recently celebrated its twentieth anniversary. It was organized on the basis of the branches of the aluminium industry, i.e. alumina production, aluminium electrolysis and manufacture of aluminium semi-finished products. Bauxite prospecting, however, remained a separate enterprise. Accordingly, the Institute had the following departments: technology, analytics, chemical technology and auxiliary design.

The other supporting unit, the Design Centre of the Hungarian Aluminium Industry, known as ALUTERV, was set up early in 1955. Some of ALUTERV's initial staff of 87 came from institutes of design; others were experienced plant specialists from industry.

Organization

As a result of the speedy development of the aluminium industry, both institutions have undergone thorough reorganization. At present the Research Institute is made

By Erwin Maetz



An aluminium structure arch is being erected.

Design for the Hungarian Aluminium Industry

The charging of alumina is one stage of the operation in this aluminium smelter.

up of specialized laboratories, the workers in each laboratory being experts in a specific scientific domain. This structure is preferable to the old one based on individual branches of industry, as it is now possible for the respective laboratories to solve pressing problems of vital interest without internal regrouping and loss of time.

For many years the research work has been planned on the basis of the Programme Evaluation and Review Technique (PERT) System, which has proved to be more advantageous than other methods.

In this system, for example, the Research Institute puts the research topic and the programme, rather than the action of different organs of the Institute, into the limelight as a main organizing unity and target, thus rendering comprehension of the research plan easier for those who are less familiar with problems of this kind.

The PERT System promotes the concentration of intellectual and material sources and facilitates the selection of the main tasks. It also calls attention to risks, uncertainties, unrealities and any inaccuracies, thus contributing to the realization of the plans.

Introduction of the System goes back to 1964. The initial results, such as concentration of forces, co-ordination, harmonizing of demands and possibilities, became apparent in 1965, and in 1966 the Institute achieved its goal.

Over the years, the role of the Design Centre has become more significant and its staff has increased. In contrast with other institutes of design, its scope of activity has always been both divergent and comprehensive. Among its numerous personnel are designers, technologists and experts from various plants of the aluminium industry.

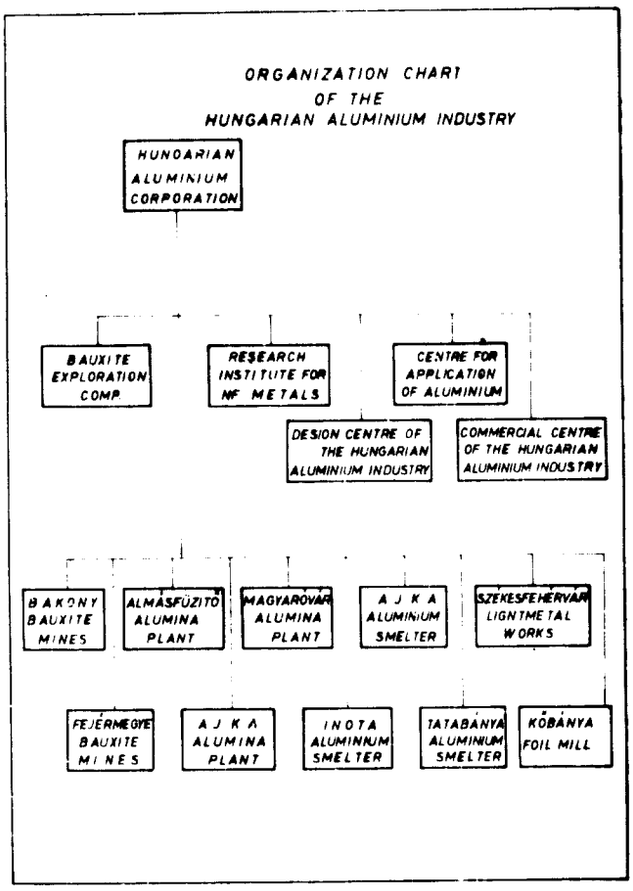
Initially, the Design Centre was organized horizontally, but due to the extensive development of the enterprise, a reorganization became necessary. It seemed advisable to switch from a horizontal to a vertical structure, reflecting the branches of the aluminium industry; there are design engineering units for bauxite mines, alumina plants, aluminium smelters and fabrication facilities in addition to aluminium structures. Each unit is able to furnish complete design documentation relating to its own line of work. For example, the unit on the design of alumina plants has sections for technology, power transmission, instrumentation and operational control, and mechanical, civil and building engineering. One of the latest additions is the engineering bureau.

In the last few years ALUTERV has prepared the projects and engineering designs for several new underground mines. Over and above routine solutions, a number of advanced techniques have been developed and applied. These include: protection against mine flooding, a necessary corollary of a mining industry that, beginning from open-cast pits, has had to follow the ore underground and under the karst water tables; the concentrated mining of groups of bauxite chrystal; the logistics of groups of small mines; advanced truck transport systems and facilities for servicing them.

In developing a mining system designed to meet the particular needs of various localities, the Design Centre has been concerned with such problems as large-diameter shaft boring, the widespread use of metal roof supports, advanced lighting methods, mechanization of transport, and improvement in working conditions and operational safety in the mines.

Alumina and aluminium

Both the Design Centre and the Research Institute have been active in developing the Hungarian alumina plants. The laboratory of alumina technology in the Research Institute concentrates on the improvement of technological and research methods connected with bauxite processing and alumina production.



As a result of the continuous twelve-year endeavour of ALUTERV to improve the alumina process technology (by such methods as the use of fuel instead of generator gas, the introduction of the wet-grinding method, spent-liquor dilution, continuous digestion, nine-stage flashing system, reduction in digestor liquor concentration and maximum utilization of waste-heat), in 1967 steam consumption for producing one ton of alumina dropped to about one third of the level of that for 1955. This achievement of a 3-ton specific consumption in steam for the production of one ton of alumina is outstanding even by international standards. In making designs for the expansion of alumina plants, either completed or under construction,

ALUTERV has developed equipment (such as high pressure digesters), up-to-date instrumentation, and operational control.

ALUTERV has also worked out a project report and preliminary studies for the new Ajka Plant. The plant, which is expected to have a final capacity of half a million tons *per annum* of alumina, will reflect the considerable headway made by the Hungarian aluminium industry.

For several years ALUTERV has applied computer optimization calculations in elaborating alumina plant technology. This method enables the designer to achieve the most economic selection of technology and equipment under the given conditions.

As far as aluminium metallurgy is concerned, workers in the electrometallurgical laboratory of the Research Institute investigate the process of aluminium electrolysis, examine the properties of raw, basic and auxiliary materials and are concerned with the quality improvement of the product. A significant drop in direct current power consumption (the present level of consumption corresponds to the world level) has been achieved as a result of the joint efforts of designers, researchers and plant experts.

The laboratory for aluminium semi-finished goods in the Research Institute strives to develop and improve the technology of the manufacture of these products.

Though the plans for large-scale investment and expansion of aluminium smelters preceded the setting up of ALUTERV, the organization has actively participated in the development of technical improvements and in the preparation of studies resulting in step-by-step production increases.

ALUTERV's foundation coincided with the beginning of plans for the large-scale development of manufacturing plants. The idea of enlarging the Székesfehérvár Light-Metal Works, for example, dates back to this time. In 1958 ALUTERV, in co-operation with other Hungarian institutes, began designing the modern extrusion plant and foundry for the Light-Metal Works on the basis of a project report from the Union of Soviet Socialist Republics. A significant assignment for ALUTERV between 1960 and 1963 was the expansion of the Köbánya Foil Mill.

In compliance with the Hungarian-Soviet Alumina Aluminium Agreement, the establishment of a 60,000-ton-per-year broad strip rolling mill was decided upon. ALUTERV has prepared the designs, much as it did those for the extrusion plant, and construction is going ahead at full speed.

Developing finished products

Since their foundation, both institutes have dealt with the problem of developing aluminium finished products. Laboratories of the Research Institute carry out experimental and research work for improving the technology of load bearing constructions made of aluminium and its alloys; they also promote the production of a wide range of aluminium finished products.

In this respect ALUTERV deals first and foremost with the design of architectural and structural aluminium constructions. Among its major achievements are aluminium exhibition halls, HUNGALU-type building elements, ateliers and lighting pylons.

In addition to the laboratories already mentioned, the Research Institute comprises:

- An analytical laboratory that solves analytical problems and works out new methods of analysis;
- An isotope laboratory which uses radioisotopes to solve various problems for plants in the aluminium industry;
- A test laboratory that devises new testing methods for adoption in laboratories of individual branches of the aluminium industry;
- A physical measurements laboratory that classifies metals according to their physical properties;
- A halogen-metallurgy laboratory that produces experimentally high purity metals.

Intellectual export market

As the high technical level of the Hungarian aluminium industry has aroused the interest of several countries, ALUTERV has offered its services on the intellectual export market.

ALUTERV has drawn up recommendations relating to the establishment of alumina and aluminium plants for some ten countries. The Design Centre has also accepted some contracts involving prefabricated aluminium building structures. After approving, at the end of 1967, ALUTERV's detailed project report for a 200,000-tons-per-year capacity alumina plant, the Indian Government entrusted ALUTERV with the preparation of the detailed engineering plans, the supervision of the erection and the initial operation of the plant.

Similarly, in 1967, the Design Centre was asked to prepare the preliminary designs for the 150,000-ton-per-year Bayer portion of the alumina plant in Žiar nad Hronom, Czechoslovakia. These were supplied to the Czechoslovakian partner early this year.

ALUTERV's export service covers a wide range of activities in the aluminium industry, such as designing and supplying machinery and equipment, complete plants and turnkey supplies and providing engineering, investigation and research services.

In 1967, ALUTERV and CHEMOKOMPLEX, Trading Company of Machines and Equipment for the Chemical Industry, entered into a partnership agreement by which export obligations are jointly settled by ALUTERV's new Engineering Bureau and by the Trading Company.

It is evident that in pursuing the activities outlined above the Research Institute and ALUTERV cannot dispense with the continuous and close assistance of the Hungarian Aluminium Corporation; nor can they do without the highly experienced branch institutions, such as individual plants and the Centre for the Application of Aluminium. On the whole, this co-operation and professional ambition ensure high quality work for both national and international clients.

ISO, UN Bodies Offer Assistance in Standardization

THE INTERNATIONAL Organization for Standardization (ISO) is an international non-governmental organization whose aim is to promote the development of standards in the world with a view to facilitating the international exchange of goods and services and to developing mutual co-operation in the spheres of intellectual, scientific, technological and economic activity.

ISO was created in October 1946 as a result of a meeting attended by members of the United Nations Standards Co-ordinating Committee (UNSCC) and representatives of the standardization bodies of certain other countries. The present membership of ISO includes the most representative national standards organizations of 56 countries. In addition, six countries are members through a combined standards organization, and eight are represented in ISO as correspondent members.

Standardization activities in developing countries

While the principal object of ISO is to promote the development of international standards, it also concerns itself with promoting the establishment and growth of standardization activities in developing countries. This aspect of ISO activity has gathered momentum during the last year or two, and ISO is strengthening its own machinery to assist in this promotional work in collaboration with the United Nations, in addition to expanding its technical work in the field of international standardization.

The UN has expressed concern that developing countries should initiate or accelerate the process of organizing institutional machinery to formulate national standards. The United Nations Economic and Social Council (ECOSOC), in its Resolution 1182 (XLI) of August 1966, invited the Governing Council of the United Nations Development Programme to pay due attention to the needs of developing countries in the field of standardization and also requested the Secretary-General of the UN to draw the attention of other UN organs, particularly those which deal with problems of industrial development, to the importance of this question and to the necessity of including it in their programme of activities. In passing the above Resolution, ECOSOC referred specifically to the work and decisions of the ISO on this subject.

The UN is able to provide technical assistance to developing countries in setting up and supporting their national and regional machinery for standards activities, upon the request of the countries involved. ISO and the International Electrotechnical Commission (IEC), a sister organization that specializes in standardization in the electrical and electronic field, work in close co-operation with the UN in these matters.

ISO and UNIDO organized jointly a Conference on Standardization in the Developing Countries (DEVCONF) in Moscow in June 1967. As a result of one of the recommendations of DEVCONF, a note is being circulated to all developing countries in order to inform them of technical assistance that the UN, ISO and ISO member bodies can offer them. This assistance falls into the five categories described in the following paragraphs.

High-level survey missions

At the earliest stages of planning to set up national standardization organizations in regional groups, developing countries may require high-level missions of authoritative experts to carry out a general assessment of the situation and to discuss with representatives of governments and top industrial or commercial management the salient aspects of standardization, including the need for establishment of national standards bodies and the benefits to be derived therefrom. Experienced authorities available through ISO member bodies could take part in such missions. When appropriate, ISO will work in conjunction with UNIDO and other UN organizations in organizing such missions and in formulating their reports.

Experts

Developing countries may require the services of outside experts, for instance, at the initial stages of setting up a national standards organization or subsequently during its growth and development. These experts may, for example, be of any one or more of the following categories: highly qualified experts to advise in the setting up of a national standards body in the country, or to help a body already set up; experts for the training of personnel for the national standards body; and experts on short-term secondment for specialized technical needs.

The ISO will arrange the selection and secondment of experts from ISO member bodies and UNIDO will consider the financing of such experts, on request, through its Special Industrial Services and other assistance programmes.

Training

Various ISO member bodies already conduct training courses on different aspects of standardization. These courses are intended primarily for nationals of the country in which they are located, but nominees from other countries may attend some of them. In addition, two or three ISO member bodies have organized training courses for representatives of other countries. It is possible that one or more ISO member bodies will set up more international training centres for standardization. ISO, UNIDO and other UN agencies will co-operate in arranging for the placement of nominees from the developing countries at any of the courses available.

Some developing countries may also wish to establish their own local training courses. ISO expects to be able soon to give some guidance on this, including the provision of a suggested curriculum, a training syllabus and advice on the organization of courses, provision of training aids and so on.

Testing and laboratory facilities

The national standards bodies of developing countries may need to establish, or improve, their own testing facilities, including those for checking conformity to standards, required for developing or implementing national standards. Several ISO member bodies have already established such testing facilities and have gathered considerable experience concerning them. The ISO would be glad to arrange for help and guidance to be made available to a developing country about to set up, or to improve, its own testing facilities.

Technical information

Many national standards have already been drawn up by the various ISO member bodies, and ISO is compiling a rapidly growing number of international ISO recommendations for standards. A study of the national or international standards in the relevant field could be of considerable help to a developing country concerned with standardization. ISO will be glad to help a developing country in the earlier stages in obtaining copies of standards in the specific fields in which that country may be interested. When a country becomes eligible to join ISO, either as a member body or, for a temporary period, as a correspondent member, it will automatically receive all ISO documents.

Submission of inquiries

Preliminary inquiries as well as requests for advice or help from the ISO should be addressed to the ISO Central Secretariat, 1 rue de Varembé, 1211 Geneva 20, Switzerland. Requests for technical assistance from the United Nations should be addressed through the UNDP Resident Representative in the country, with an indication of the priority that the Government attaches to these requirements. Such requests should be shown to have the support of the Government and the economic interests concerned with the development of standardization within the country concerned. The ISO Central Secretariat is willing to assist in the preparation of the requests.

Training Programme in Japan

A new in-plant training programme for engineers in the mechanical industry began in Japan on 30 September and ended on 8 December.

Organized by UNIDO in co-operation with the Government of Japan and the Japanese Association for Overseas Technical Scholarships, the programme was designed to prepare twelve senior engineers and managers from developing countries in Asia to assume greater responsibilities in their home countries by giving them concentrated practical experience in an industrial atmosphere under the close supervision of experienced staff.

The programme included: a two-week orientation course on Japan and its industry and modern trends in production management; a six-week in-plant training course covering modern organization and management of system and method engineering, production planning and control, plant layout and materials handling and cost and quality control; a one-week observation and field tour of a wide range of industrial fields; one week for the preparation of individual reports and their discussion and evaluation.

The programme will be repeated in 1969.

TEMPO and the Broad

How can a government ministry upgrade communication and transportation facilities through advanced systems engineering? What modern action programmes will best develop a new nation's human and natural resources? What agricultural and food-processing techniques can most rapidly increase world food production? How can the president of a large international bank prepare for the social and technological environment of 1980? How can a computerized management system improve the operating efficiency of a major industrial firm?

These are a few examples from the broad range of studies being performed for clients from many countries by TEMPO, the Center for Advanced Studies of the General Electric Company, United States of America.

Based in Santa Barbara, California, TEMPO is the unique long-range planning and interdisciplinary study organization of one of the world's major industrial corporations. Since the founding of TEMPO in 1956, it has conducted, under contract, hundreds of advanced studies of a highly diversified nature for leaders of national and local governments and private corporations. Staff members have experience in North and South America, Europe, Asia and Africa.

By participating in the most advanced technological projects of the United States, TEMPO has had valuable experience in the development and application of the total systems approach. Extension of these capabilities to help solve the more general problems of clients in many fields is the unique study service offered by TEMPO.

Senior officals use TEMPO's findings as the basis for important decisions. Major organizations have supplemented the work of their own highly competent research departments with TEMPO's world-wide perspective and independent viewpoint.

While much of TEMPO's work is future-oriented, dealing with developments beyond the next five-year period, TEMPO is always cognizant of the problems of transition. Programmes undertaken by TEMPO demand expert analysis of critical future environments and interactions rather than simple extrapolation of past trends. Taking an objective, competent and advanced look at problems, TEMPO provides its high-level clients with creative and innovative solutions, with emphasis on the practical and useful.

In TEMPO's first few years of operation, the General Electric Company directed that certain funds be spent at TEMPO. At that time much of TEMPO's work was for the mother corporation, but the fledgling also procured contracts from other sources.

Since 1963, however, TEMPO has been entirely self-supporting on its fee income, which ranges from 7 to 10 million dollars a year. TEMPO is now completely independent in its selection or rejection of contracts from General Electric as well as from any other customer. At present, about 20 per cent of TEMPO's total sales are to General Electric.

Staff

TEMPO's full-time staff of 250 professionals has an extremely broad cross-section of skills and experience. Backgrounds are about evenly divided into three areas: physical sciences and applied mathematics; engineering disciplines; and social sciences and operations research with heavy emphasis on economics. About half of TEMPO's professional staff hold post-graduate degrees; individual professional experience ranges from 5 to 25 years.

Expert international consultants from universities, government agencies, industrial corporations and research organizations supplement TEMPO's resident staff of specialists.

The staff has access to extensive data resources, modern computer facilities, a highly competent library research

* This article has been prepared by TEMPO Information Support. Photo by Robert Catlin, General Electric Company.

Systems Approach*

These TEMPO employees are analysing data on an industrial problem.

staff and to General Electric's world-wide industrial and laboratory facilities.

The TEMPO staff is experienced in working together in interdisciplinary project teams. These teams are specially selected to analyse the nature, feasibility, cost and value of alternative solutions to a problem, taking into account future technological and economic trends, competitive developments and socio-political problems. They base conclusions and recommendations on close interaction with clients and on an understanding of their problems. The final reports, with selected alternatives, priorities and action steps, are fully documented and printed in the client's language. TEMPO considers the results of studies and all TEMPO-client communications as the client's confidential property.

TEMPO is also available to undertake follow-up work leading to the implementation of its recommendations. This includes establishing new activities, recruiting and training locally the client's personnel, and systems operation and management services.

As the concerns and demands of TEMPO's clients are constantly evolving with new social, economic and technological developments, TEMPO's study areas are continually changing. Areas of current major concern include: regional economic development; technology and management planning; computer and communication systems; and urbanization and industrialization.

Regional economic development

TEMPO's interdisciplinary study capabilities and broad systems approach are particularly suited to the complex requirements of economic planning for developing countries. TEMPO is well qualified to plan action programmes for the rapid and optimum utilization of human and natural resources.

Since 1956, TEMPO has had broad experience in agriculture, industry, transportation, power, communication and commerce, taking into account the effects of population dynamics, urbanization and fiscal questions. Examples of programmes now in progress or recently completed include:

- Preparation of complete long-range economic development plans for regions with populations of 50,000 to 3,000,000 and ranging in geographical character from an isolated desert oasis to a heavily industrialized city;
- A detailed study of the development of a major iron-ore deposit, including a thorough examination from a technical, operational, and financial viewpoint of mining, ore processing, and transportation alternatives;
- A thorough study of the optimum utilization of available water to develop agriculture and light industry in a desert plain. Among the projects considered were feasibility planning for a new dam, application of ground water recharge techniques, novel irrigation schemes, agricultural crop and livestock economics, and industrial development alternatives;
- Development of a new regional model and computer programme maximizing the number of balanced diets that can be produced from the potential agricultural resources of a river valley through efficient land utilization;
- Definition of future world food demand and supply imbalances based on projected population increases and the limited potential for growth of world food production. Unconventional means of food production were also studied to assess the most effective alternatives for solving the problem of feeding the world's burgeoning population.

Technology and management planning

Rapidly advancing technologies and industrial growth around the world have increasingly involved TEMPO in creating, extending and applying new management-system methodologies for complex enterprises. Clients for these studies include top officials of banks, industrial firms, and local and national governments. Studies recently completed for clients in government and industry include:

- A prediction of the long-range world demand for telecommunications and a forecast of new communication trends involving various alternatives, such as satellites, over-the-horizon radio and submarine cables;
- A forecast of future technological and economic developments in the gold industry;
- A review of future trends in electric energy and weather demand and supply, including a comparison of the economic advantages of nuclear *versus* conventional power, and desalinization techniques *versus* fresh water conveyance systems under various conditions;
- A projection of world-wide commercial ship construction trends from 1970 to 2000, with special emphasis on alternative propulsion systems, including potential technological developments beyond the current state of the art;
- The evolution of a general planning process specifically designed to assist national governments and large commercial organizations to maximize the cost effectiveness of their operations over a long-term planning period;
- A programme of planning and implementation for an industrial client, including the development of a mathematical model of the business, with planning elements programmed on a central time-shared computer made accessible *via* telephone lines and remote terminals to the company's staff members;
- The creation and temporary direction of a client's internal operations-research organization, including recruitment and training of competent personnel, professional assistance during the initial period of independent activity, and continuing consulting service as required after the organization reaches maturity.

In all TEMPO studies, feasible future technological developments are carefully identified and, where applicable, the most advanced solutions consistent with good economics are recommended. New technologies recently studied include: direct reduction and pelletizing of iron ores; weather modification; computer-assisted education and training; advanced logistics support system; nuclear fuel-processing techniques; community applications of computers; and all-electric urban transportation.

Computer and communications systems

Information scientists at TEMPO are developing new software programmes and management information systems to utilize the capabilities of present and future generation computers and communication networks. The research is directed toward the development of computerized information systems for government, business and education.

To gain direct experience in new applications, TEMPO operates a multi-access time-sharing computer service in Santa Barbara. By providing access to the computer to all organizations in the area, TEMPO makes available the full power of a large computer at a price comparable to a desk-top calculator. The extension to a nation-wide computer network in a developing nation is being studied.

TEMPO also furnishes computing and consulting services to the Santa Barbara school system on an experimental basis. Computer terminals in the classrooms are linked to the TEMPO computer for pupils studying mathematics and science. This programme is now under General Electric's Information Systems Division.

Urbanization and industrialization

TEMPO is increasingly concerned with urbanization and industrialization problems ranging from upgrading municipal management techniques and building new cities to rehabilitating depressed and under-industrialized regions.

In its urban studies, TEMPO is applying the systems approach to problem solving. For example, TEMPO has a pioneering programme with a leading American city to develop an integrated planning, programming and budgeting system for improved municipal services.

In the United States, TEMPO has been particularly concerned with institutional innovations designed to encourage co-operation between Government and industry in urban housing, municipal services, transportation and communication.

In under-industrialized regions around the world, TEMPO has initiated, designed and evaluated industrial development activities. Highly important to these programmes is TEMPO's ability to work with a nation's top talent from industry, government and education in a manner that adds to the country's existing capability.

UNIDO Executing 25 Special Fund Projects

As the executing and participating agency for projects financed by the United Nations Development Programme (UNDP) in the field of industrial development, UNIDO is in charge of 25 long-term Special Fund projects with a total value of about $US 50 million. UNIDO assumed the responsibility for executing these projects as on 1 July 1967, the organization having come into existence on 1 January of the same year. Of the 25 projects, ten are in Africa; five, in Asia and the Far East; five, in the Americas; and five, in Europe and the Middle East. UNIDO is also associated with a number of projects executed by other agencies of the United Nations.

Most of the Special Fund projects will help to finance pre-investment surveys and the dissemination and application of modern techniques. Among the projects now being executed by UNIDO are pre-investment studies for the promotion and marketing of fertilizer, petrochemical and other industries; the establishment of technological research institutes, engineering and industrial design centres, pilot and demonstration plants; the development of small-scale industry and the setting up of industrial estates.

Under the Technical Assistance component of UNDP, which is of shorter duration and more limited scope than Special Fund projects, UNIDO provides developing countries with technical support in the field of industrialization through experts and advisers in various sectors of industry. Under the Technical Assistance programme, 78 such experts, totalling 748 man-months, were working on UNIDO-supported and executed projects in some 49 countries in May 1968. The total value of this assistance amounted to $US 1,250,000. By the end of this year 60 additional experts, totalling 500 man-months, will have been recruited and sent out to the field at a cost of over $US 800,000.

Another aspect of the technical assistance provided by UNIDO under the Technical Assistance component of UNDP is the fellowship programme that provides facilities for the training of technicians from the developing countries. At present, more than 200 such fellowships, totalling 800 man-months, have been awarded. These figures are expected to be doubled by the end of the year.

Expert Group on Small-scale Industries

Fifteen participants attended the Expert Group Meeting on the Development of Small-scale Industries in Arab Countries of the Middle East that was held in Beirut 11–16 November. UNIDO organized the meeting in co-operation with the United Nations Economic and Social Office in Beirut (UNESOB).

After reviewing the policies, programme, institutions and facilities for the development of small-scale industries in Middle Eastern countries, the group discussed five major points: the future of the traditional sector in a modernizing country; the promotion of entrepreneurship; technical services for small-scale industries, financing of small-scale industry; and regional and international co-operation for the development of small-scale industry.

Industrial Training of Engineers and Technicians

UNIDO HAS BEEN providing technical assistance to the developing countries in various ways; one of them is the industrial training of engineers and technicians. In 1965, the Centre for Industrial Development, the predecessor of UNIDO, organized a new form of technical assistance, in-plant group training programmes for engineers and technicians in the most important industries, to supplement the existing form of training, individual fellowships.

UNIDO is now trying to launch an integrated programme for in-plant group training of engineers and technicians on a long-term basis. The programme consists of three levels:

1. Basic training (nine to twelve months) in engineering and management for engineers recently graduated from universities in their own countries;

2. Intermediate in-plant training courses (three to five months) consisting of extensive upgrading in a specific field for engineers and technicians who have had several years experience in industry in a developing country. The main purpose of these programmes is to help the technical personnel from developing countries improve skills, exercise their judgement in specific cases, and gain additional technical knowledge;

3. High-level courses, organized in co-operation with developed countries, for senior engineers and managers; these would be of short-term nature (four to six weeks) and would be used for intensive training in general managerial subjects.

The following courses of intermediate level have been organized in 1968:

1. Courses in electrical industries in Sweden (product planning, design, control, manufacturing, maintenance, safety, marketing, wages and the like), four months (March - July) for twenty participants;

2. Courses in the iron and steel industry, Ukrainian Soviet Socialist Republic (winter plant, blast furnace department, steel melting plant, slabbing mill, cold rolling mill, maintenance, automation of production processes, planning, management training, purchases and sales, wages, economic problems, production costs), five months (May - October) for 45 participants;

3. Courses in cement production in Denmark (production processes, laboratory control, small-scale manufacturing, repair and maintenance, technical information, organization, accountancy, safety and so on), three months (May - July) for twenty participants;

4. Courses in oil engines in Czechoslovakia (modern oil engines, design and calculation methods, injection equipment, fuels and lubricants, modern filtering techniques, governing of oil engines, maintenance and service, main fields of application, stationary engines, organization, control, testing, planning and management and so forth), five months (March - July) for 25 participants;

5. Courses in textile industries in Poland (prospectives of textile development and research, training of technical personnel in textile industries, raw materials, quality control methods, wool industry, cotton industry, knitting industry, garment industry, textile machinery, organization, planning and management, and so on) five months (May - September) for 25 participants.

In 1969 UNIDO expects to repeat the 1968 programmes and to organize five new ones:

1. Courses in the pulp and paper industry in Sweden for twelve participants;

2. Courses in machine tools and instruments in the Union of Soviet Socialist Republics for 25 participants;

3. Courses in the shoe industry in Czechoslovakia for 25 participants;

4. Courses in the mechanical industry in Japan for twelve participants from Asian countries;

5. Courses in food processing industries in the United Kingdom for 25 participants.

Official invitations to courses in the 1969 programme will be sent to the Resident Representatives, who will inform governments. Applications for participation in the programmes are submitted to UNIDO by governments through the UNDP Resident Representatives.

Research Projects

Quick Process for Fish Sauce Fermentation

Under a co-operative research programme, undertaken jointly by the Department of Science of the Ministry of Industry, the Department of Fisheries of the Ministry of Agriculture and the Applied Scientific Research Corporation of Thailand (ASRCT), Bangkok, a new biological process has been found by which good quality primary fish sauce (nampla) from Pla Kratak (*Stolephorus* sp.) can be obtained in two months.

Nampla is widely used by the Thai people and the people of neighbouring countries as a condiment imparting a salty taste and a specific flavour. In Thailand, the manufacture of nampla is a considerable industry involving almost 200 factories with a total annual production of more than 30 million litres.

In the conventional method, the freshly caught fish (commonly Pla Kratak, Pla Thu and Pla Soi) are mixed with salt in the proportion of two or three parts fish to one part salt, depending on the freshness of the fish. The salt-and-fish mixture is put into a big concrete or wooden tank or earthenware jar for eight to twelve months, or even longer, without stirring. The fish are weighted down with bricks or hard timber, and placed on top of a bamboo screen to prevent them from floating. At the end of the fermentation period, the fish extract is pumped out and filtered through sand, fish bones, or crude straw paper. The filtrate is then aged in the sun for a period of one to three months, during which time the salt crystallizes out and the flavour improves.

This primary fish extract is either sold as a special grade fish sauce or used to flavour the regular and lower-grade products which are obtained by adding more brine to the fish residue and allowing fermentation to continue until a reasonably good product is obtained. The liquid is then filtered and blended with primary fish extract, colouring matter and a little sugar. As many as three leachings are made.

The conventional method presents many problems: the fermentation time is too long and necessitates a large area and many tanks; improper amounts of salt and prolonged storage usually result in the loss of valuable nitrogenous material; and the equipment and procedure are unsanitary.

Attempts have been made in the past to speed up nampla production. The Department of Science developed a rapid method involving acid hydrolysis and the Department of Fisheries carried out further experimental work on the process. Unfortunately, the flavour of the product did not meet with consumer acceptance and the method has not been taken up industrially.

The method being developed at ASRCT is based on the adjustment of the salt content and the maintenance of the fermentation at higher temperatures (37° C to 49° C). It appears that a good aroma is dependent on temperature, and different kinds of aroma can be produced to suit the taste of each particular group of consumers, including those in neighbouring countries. Through this new method nitrogen is retained, but the ammonia content is kept to a minimum in the finished product. It is believed that sanitary and good quality nampla can be produced by the new method in a modern type of plant without too much technicality and added cost.

—*Adapted from* ASRCT Newsletter *(bi-monthly publication of Applied Scientific Research Corporation of Thailand, Bangkok), Number 9, November 1967, pp. 1–2.*

Aluminium Technical Testing Programme To Investigate Alloy Property Data

The Aluminium Association Technical Committee on Engineering and Design has announced that the Association and the Metal Properties Council will sponsor a materials research programme to determine basic property data for selected aluminium alloys. Initial tests in the long-range programme will concentrate on long-term tensible creep, mechanical properties at high strain rates and low cycle fatigue.

The Metal Properties Council is an autonomous organization sponsored by the Engineering Foundation, the American Society for Testing and Materials (ASTM), the American Society of Mechanical Engineers (ASME) and the American Society for Metals (ASM).

The first series of tests is on long-term tensible creep. They are being conducted by the University of Michigan, in part at the Materials Technology Laboratories at Ann Arbor.

The creep tests will provide data for periods extending to 100,000 hours and will take almost twelve years to complete. A start will be made with two alloys, 1100 and 5454; 6061 will be added at a later time. Subsequent tests will explore the effects of heat treatments, alloying and cold working on creep properties at elevated temperatures.

The second series, mechanical properties at high strain rates, will test alloys 6351, 6061, 5083, 7075 and 2014 at room temperature at tensile loadings up to those required to produce extension at the rate of 1,000 inches per inch per second.

The final test in 1968, low cycle fatigue, investigated alloys 6061 and 5454 at stress levels chosen for 10 to 10,000 cycles at temperatures up to 3,000° F. The ratio of minimum strain to maximum strain will be zero, strain cycle to be long hold time (1 cpm) trapezoidal.

Other programmes in planning will accumulate toughness data, stress relaxation data and mechanical properties at low strain rates.

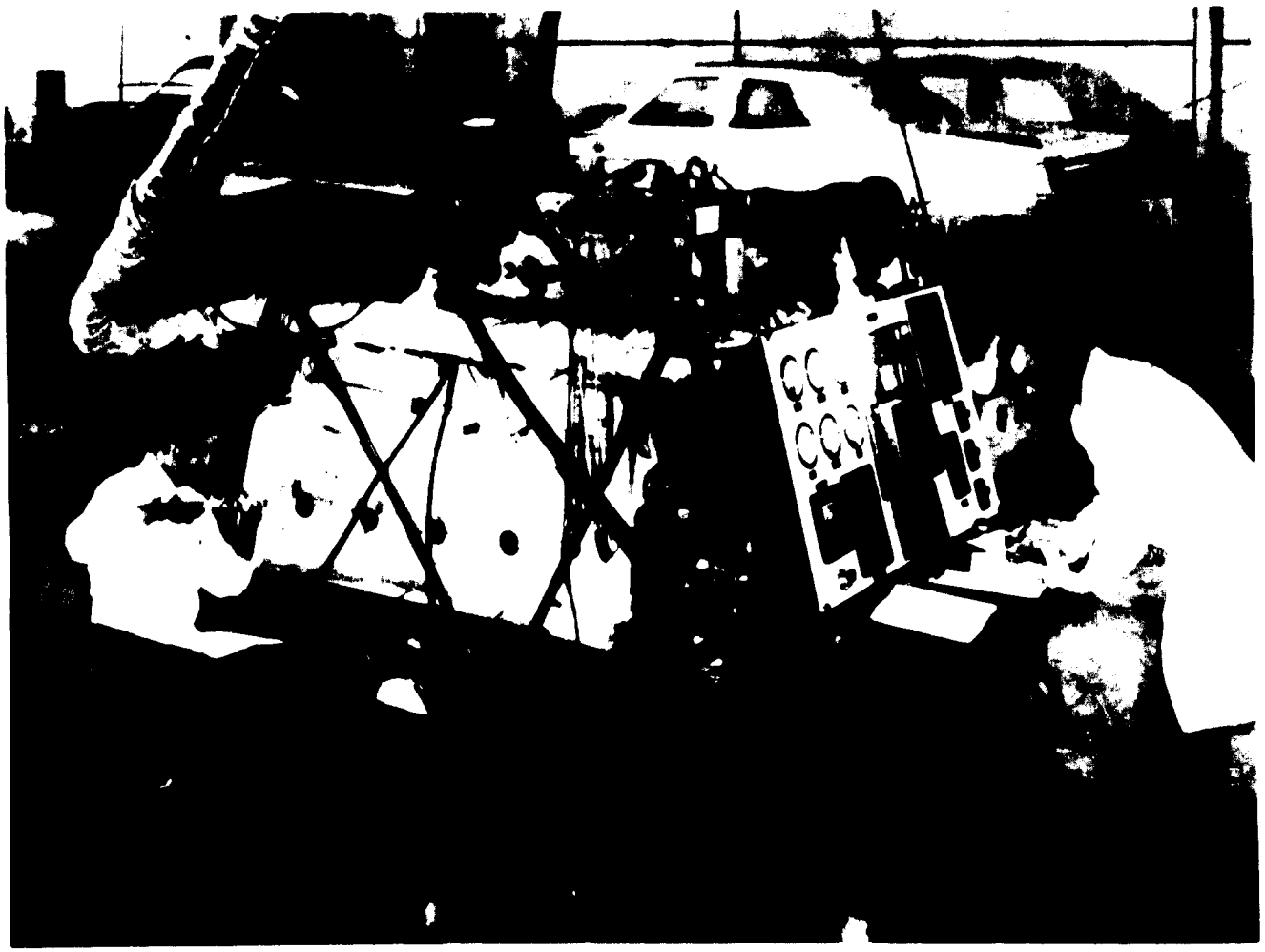
Portable Test Unit for Solvent Fume Problems

A portable fume incinerator was used to determine the parameters necessary to control the emission of fumes from the auto-paint bake ovens at the Ford Motor Company's assembly plant in Los Angeles.

Especially designed by the Air Preheater Company, Inc., Wellsville, New York, the portable unit was installed in the Ford plant to evaluate the effectiveness of direct-flame incineration in eliminating fumes from bake ovens. Data obtained by the fully instrumented portable fume incinerator, together with information from laboratory tests, were used to establish design parameters for the manufacture of 11 Cor-Pak direct-flame incineration systems. These units are now being installed on primer and finish-colour bake ovens for auto bodies and parts at the Ford Plant.

A recuperative heat exchanger, incorporated in the

Workers in an automobile assembly plant use a portable fume incinerator.



portable fume incinerator, was used to evaluate the heat recovery potential. As a result of the evaluations, the systems were designed not only to eliminate organic vapours but also to recover sufficient heat generated by the incineration process to reduce fuel requirements substantially.

New Food Drying Process

By means of a new method developed by Wilhelm Groth, head of the Institute for Physical Chemistry of the University of Bonn, foods can now be dried so that they retain their original minerals, vitamins and aroma. Installations for this drying process are now being built in the Federal Republic of Germany and in Italy.

The drying is done in a room with a trellised floor that is covered by a membrane; food is placed on the floor and dry gas is let through the membrane. The food disintegrates into many individual particles and the drying process is repeated until the product is reduced to a fine and porous dry powder which can be dissolved in cold or warm water.

One advantage of this drying process is that harvest surpluses, which usually lead to a drop in price, could be preserved and stored to be marketed when the demand is greater.

The process can be used for fruits, vegetables, milk products, whole or separated eggs, fruit juices, coffee and tea.

Research on Underwater Joining of Pipes

A research programme to develop techniques and equipment for joining pipes underwater has been proposed by the Columbus (Ohio, United States of America) Laboratories of Battelle Memorial Institute. The details of the programme were outlined in a recent meeting attended by representatives of 31 companies engaged in various phases of offshore oil and gas recovery.

A major effort will be made to develop joining processes and equipment to increase the efficiency and reduce the cost of underwater fabrication and repair operations. Although the processes and equipment will be designed primarily for joining pipe, it is expected that they will be readily adaptable for use in fabricating other underwater structures.

The proposed three-year programme, budgeted at $US 750,000, would require the joint support of at least ten companies.

The increased interest and activity in offshore oil and gas recovery and the subsequent demand for speeding up construction of offshore gathering and transmission lines are important reasons for initiating the research. Types of joining to be considered will include: arc welding, brazing, exothermic welding and brazing, explosive welding, friction welding, adhesive bonding, and mechanical fastening.

The study will concentrate on processes that can be operated by divers with normal proficiency in handling underwater tools, but the processes will be as mechanized and automated as is feasible. The aim will be to reduce the need for excessive manipulation and high dexterity on the part of the diver, to increase the speed with which the total operation can be performed and to improve the quality of the resulting joints. Processes will be developed for use at depths at which divers are now working.

The proposed research programme will consist of three phases: evaluation of processes for underwater joining in order to select those for further consideration; adaptation of processes or development of new ones; manufacture and evaluation of prototypes of the preferred underwater joining equipment or systems.

Dielectric and Freeze-drying of Cotton Cloth

The Cotton Producers Institute, New York City, is sponsoring a one-year research programme on two new methods for drying cotton cloth—dielectric and freeze drying. Scientists at the Columbus Laboratories of Battelle Memorial Institute are conducting the research.

Organic chemists are assessing the techniques as a means of improving wearability and crease retention of durable-press cotton fabrics. The distribution of the agents used in the treatment of a fabric is affected by drying because the agents tend to migrate to the driest region. With some drying techniques, the treatment agent becomes localized on the surface, since this is the region that dries first.

Dielectric drying does not depend on heat transfer from

the surface to the inner fibres. All the fibres are heated simultaneously by energy that has been absorbed. The energy input is balanced with the amount of moisture present to produce the final fabric moisture content. With freeze drying, the water is frozen in place and then vapourized under vacuum.

Portable Crack Detector for Ferrous Materials

The National Research Development Corporation, London, recently licensed to two British manufacturers a portable crack detector that detects both visible and invisible surface cracks in ferrous materials. Originally developed at the Admiralty Materials Laboratory, Holton Heath, Dorset, United Kingdom, for detecting hair-line cracks in the hull of the nuclear-powered submarine "Dreadnought", the instrument should be of use to ship-builders, railway authorities, civil engineers and motor and high pressure vessel manufacturers.

The crack detector can be used over paint films, rust and dirt. With a probe, it can also be used under water. Its utilization saves more than 80 per cent of the time required for doing the job by conventional magnetic methods.

Eddy current techniques are employed in the instrument which consists essentially of a probe, a balance circuit, a transistor oscillator and a voltmeter in circuit with a diode and two transistors.

In recent years, eddy current techniques have been applied in instruments designed to sort non-ferrous metals and to carry out non-destructive testing of non-ferrous metals. Up to now, however, the application of eddy current techniques to portable apparatus has been limited in so far as ferrous metal is concerned. The reason for this was the interfering effect caused by variations in the distance between the face of the search probe and the surface of the material being examined. This air gap is the dominant feature in the magnetic circuit established between the search coil and the ferro-magnetic material. If the characteristics of the interference effects can be properly controlled, the air gap can be used to minimize interference arising from variations in the magnetic properties of the materials being examined.

These considerations led to a study of the behaviour of the coil as it was removed from the surface of the ferro-magnetic material when it was discovered that the impedance of the search coil varied along a circular arc. If a reference point is taken at the centre of this arc, therefore, the voltage measured to a point on the arc will be essentially independent of the distance between the search coil and the piece of metal being examined. Because of this, any crack-like defects in the surface of the metal under examination will cause an increase in the magnitude of the voltage that can then be detected by suitable instruments.

—*Adapted from* Inventions for Industry *(Bulletin of the National Research Development Corporation, London), Number 32, July 1968, p. 17.*

Underground Cables for Transmitting Electric Power

Underground cables that have been chilled by liquefied gas to temperatures several hundred degrees Fahrenheit below zero may help to solve the problem of transmitting large blocks of electric power into the expanding cities of the United States of America.

At the temperatures of these cryogenic (very cold) fluids, ultra-pure metal conductors lose much of their resistance to the flow of an electric current. As a result, a cryogenic underground cable theoretically offers the potential for transmitting extremely large amounts of power in a restricted space.

Under a $US 1,050,000 project financed by the Edison Electric Institute and the Tennessee Valley Authority, the General Electric Research and Development Center will explore the technical and economic feasibility of using cryogenic underground cable to transmit large blocks of electric power into congested urban areas from distant generating plants. Conventional underground transmission lines that use oil-filled cable are already in use over short distances in some urban areas, but their capacity is limited.

The three-year project is part of a $US 17,000,000 underground transmission research programme of the Electric Research Council (ERC), which is composed of representatives from segments of the electric power industry including investor-owned companies, co-operatives and federal, state and local agencies.

The work of the General Electric Research and Development Center for the Edison Electric Institute will seek to demonstrate that the design, fabrication and operation of

A researcher demonstrates a possible configuration — in model form — of a cryogenic underground cable.

cryogenic cable are feasible and that this cable can transmit large blocks of power at a lower cost per mile than conventional oil-filled cable can.

At the temperature of liquid hydrogen (about −425° F), the resistivity of very pure copper is reduced by about 500 times. According to one estimate, based upon exploratory work at the Center, a single cryogenic underground cable inside an insulated pipe 18 inches in diameter could carry 3,000 megawatts, enough to supply one third of the total power requirements of the city of New York.

The three-year cryogenic cable project began in February 1968 and will consist of three phases, each to last approximately one year.

The first phase will include further testing in order to obtain basic data and evaluate alternative types of cryogenic cable systems. In the second phase, one cable system will be selected for further development and evaluation. Finally, in phase three, the Center will design, build and initially operate a test cable to confirm predicted operating characteristics and cost estimates for electric utility systems.

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The Author: *William C. Farmer, Executive Director of Oceanic Research Institute and President of Oceanic Resources Information Center, Inc., La Jolla, California, retired from the United States Army as a colonel in 1961. His service included assignments in research and development, industrial operations and operations research activities. From 1961–1965 he served as director of planning of the space division of the Northrop Corporation.*

Oceanic Research Institute

WITH THE OCEAN covering more than 70 per cent of the earth's surface, less than 30 per cent remains to support a rapidly growing world population. Since much of this 30 per cent is taken up by rivers and lakes, inaccessible and uninhabitable mountain tops, streets, canals and drainage areas, commercial and industrial building sites, schools, airports, parks and recreation areas and even automobile parking lots, obviously man must learn to make better use of the ocean's resources which can provide not only the basic necessities of food, clothing and shelter, but also many materials vital to industrialization. In the foreseeable future, economic benefits will stem from research involving scientific and economically controlled exploration and exploitation of the sea.

Oil and minerals

A cubic mile of sea water contains 166,000,000 tons of valuable minerals, chemicals and metals, including copper, cobalt, boron, manganese, uranium, silver and gold, and enough energy to process these basic raw materials into finished goods with a final by-product of fresh water. Estimates have been made that the ocean floors may hold 10^{12} tons of manganese nodules and 10^{10} tons of phosphate nodules. The large-scale commercial exploitation of such reserves is not yet possible but the progress in scientific and engineering techniques now taking place will undoubtedly make it feasible in the future.

Heavy minerals, including ilmenite, zircon, magnetite

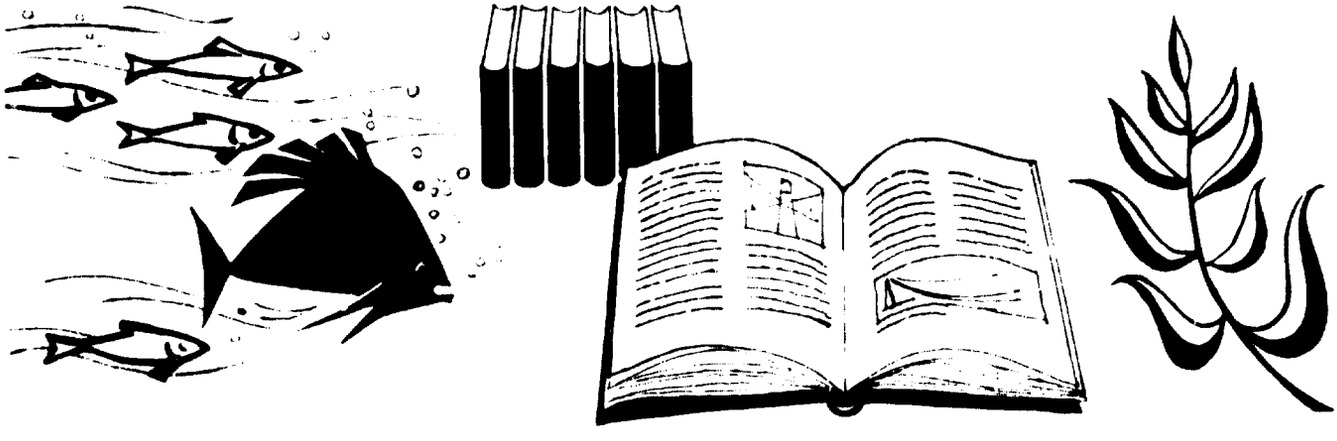
By William C. Farmer

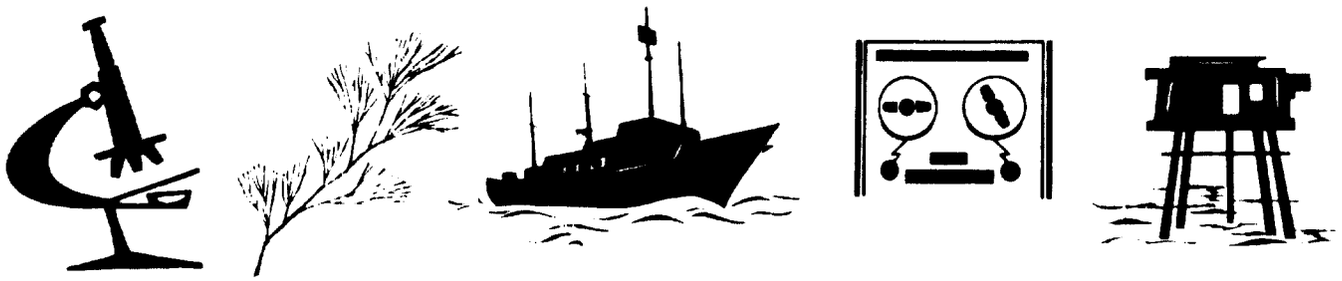
Seeks To Master Paper Tide

and rutile, are bedded off the coasts of Argentina, southern Australia, Chile, Costa Rica, Guatemala and India; iron, potassium, and aluminium silicates exist near the west coast of Africa, Japan, New Zealand, the Philippines, Scotland, South Africa and the west coast of South America. Other workable undersea mineral deposits include:

- Magnetite of high value on the continental shelf of New Zealand;
- Titanium sands, believed to be near Australia, Ceylon, India and Japan;
- Tin off Malaysia, Indonesia and Thailand where mining is now in progress at a reported depth of 200 feet;
- Diamond-bearing gravels off the southwest coast of Africa (these gravels produce a five-carat-per-ton yield, compared to the one-carat-per-ton ratio for on-shore diamond fields);
- Oil now being drilled by crews in the North Sea, the Persian Gulf and off the East and West Indies, Ecuador, Egypt, Japan, Libya, Nigeria, Peru and Venezuela;
- Oil now being both explored for and commercially pumped off the coasts of the United States;
- Iron that is being mined from the bottom of Tokyo Bay; and
- Coal that is being mined off the coast of the United Kingdom.

All marine mining at present is in waters less than 400 feet deep. Economically feasible mining at greater depths must depend upon future research and development efforts.





Utilization of vegetation and fish

The oceans are known to be vast sources of vegetation, and seaweed is harvested in economically significant quantities. It is processed for animal food (France), human food (Japan) and for preparing extracts for use in food and medicines (Canada and the United States). Seaweed extracts form gels that thicken liquids with which they are mixed and hold other materials in suspension. They have been used to stabilize ice cream, chocolate milk, mayonnaise, jellies, tooth-paste, canned meats, candies, pharmaceutical preparations and many other materials. In 1964, seaweed production accounted for $US 40,000,000 in revenues and by 1970 with proper research it could be many times this amount.

The present annual world fish catch has been estimated at 40,000,000 metric tons. It is believed that the annual catch that could be sustained indefinitely without depleting stock is around 200,000,000 metric tons per year, or five times the current amount. This would represent 50 per cent of the world's current protein diet requirements. If optimization of the potential fish harvest is to be realized, however, research must be performed on the ecology of fish and their distribution, more efficient management techniques for harvesting must be developed and international agreements must be reached.

Over the next ten years the US Bureau of Commercial Fisheries alone is planning to spend approximately $US 173,000,000 that will contribute directly to the better management of fish resources in the sea. During the same period, this Bureau will also devote $US 69,000,000 to the study of certain species of fish and will spend another $US 185,000,000 on basic research.

Other research areas

Much research is being conducted on the effect on ocean life of man-made poisons. The dumping of sewage and radioactive waste must be controlled and research undertaken that will prevent such hazards from being introduced into the ocean. The research efforts to curtail contamination of the ocean should be no less than similar efforts to control and eliminate contamination of the atmosphere. Marine pollution is of world-wide concern. In the United States alone, the amount spent on research for the safeguarding of health for the seaside population accounts for 4 per cent of the oceanographic budget.

The prediction and eventual control of weather is intimately connected with the interface between the ocean and the atmosphere. Research in this area is not only directly applicable to weather at sea, but will enable more land-grown food, both animal and vegetable, to be produced.

Weather is also a factor in safety at sea. Research in ship routing and also ship hull design for specific wave and weather conditions is receiving attention and money.

Seaside recreation, such as boating, fishing, surfing and swimming, is a major world-wide industry, and millions of dollars are spent annually on research on marine biology, beach erosion and the prevention of recreational boating accidents.

Paper tide

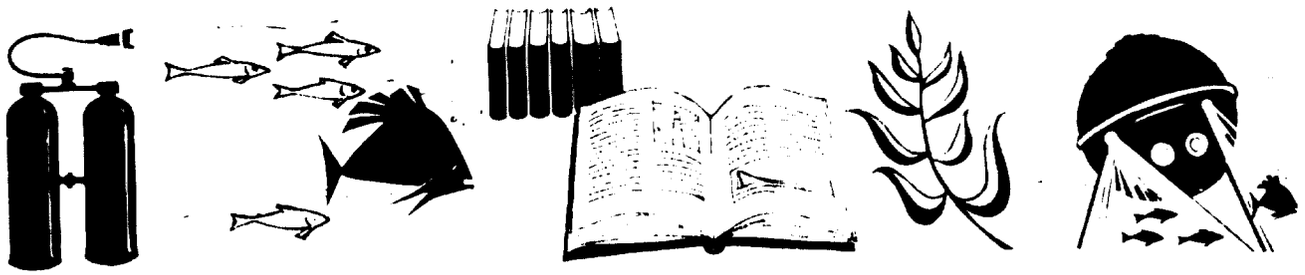
The 1964 issue of the *International Directory of Oceanographers* listed 2,563 oceanographers from 93 countries. In addition to the oceanographers, thousands of other workers are involved in research and development on specific hardware, such as underwater cameras, devices for study of the ocean from airborne or space vehicles and support systems.

The results of the entire gamut of research in the general field of oceanics are published in thousands of journals, books, government reports, technical papers, symposia, dissertations, and "in house" research publications of hundreds of government agencies and privately owned companies. Even if the technically trained and linguistically qualified personnel were available, sorting out and placing these published results in usable form would cost each such research agency at least $US 150,000 a year.

In spite of this apparent large-scale research effort, our knowledge of the depths of the ocean has been likened to the knowledge of earth that a man from outer space would gain by circling miles overhead in a spaceship on a pitch-black night and trailing a butterfly net that he would occasionally hoist and examine.

In 1963, a group of California businessmen funded a feasibility study to determine the best method for accumulating, on a continuing basis, all this oceanographic-related research and development information. As a result of this study, they established the Oceanic Research Institute, a non-profit corporation, in La Jolla, California. This organization, assisted by the libraries of Scripps Institution of Oceanography, the US Naval Electronics Laboratory and the main library of the University of California at San Diego, initiated a campaign to secure access to this information on a world-wide basis.

The staff is assisted by a panel of consulting editors and an editorial advisory board from Scripps Institution of Oceanography, Woods Hole Oceanographic Institution,



Smithsonian Institution, US Naval Electronics Laboratory and private industry. Each consultant and member of the editorial board is recognized as an expert in his particular field. In addition, the editors have direct access to a Marine Mammal Research Committee and a Foundation Advisory Committee.

The indexers and abstracters read, on a programmed basis, thousands of journals, books and papers from 45 countries and published in 12 languages. Personnel who are academicaliy proficient in the subjects concerned index all articles by key words, title, authors, the journal or other published source. All this information is arranged in specific categories and is published nine times a year as the *Oceanic Index -Citation Journal*. The *Citation Journal* is augmented by three cumulative issues of the *Oceanic Index*. At the end of each year the accumulated citations, KEYTALPHA (key word) Index, Author Index, Author Affiliation, and Publications Indexes make up the complete *Oceanic Index*.

The complete *Oceanic Index* (including the *Citation Journals*) is available to research personnel throughout the world for $US 300.00 per calendar year. The *Citation Journal* only, without the additional Indexes, is priced at $US 95.00 per calendar year.

Universities, government agencies, libraries and industrial organizations have found the *Oceanic Index* and *Citation Journal* to be invaluable tools for researching the World Ocean and for controlling the flow of the paper tide.

Textile Engineers Take Part in In-plant Training Programme

Sixteen engineers in the textile industry from eleven developing countries in Africa, Asia, Europe, the Middle East and Latin America met in Łódź, Poland, to participate in an in-plant group training programme organized by UNIDO in co-operation with the Government of Poland.

The six-month programme, which opened on 5 May, was one of five similar in-plant projects scheduled for 1968. These were designed to provide, in a relatively short time, the practical experience that is ordinarily gained under normal working conditions over a much longer period. All these programmes are organized by UNIDO in co-operation with host governments.

For six weeks the trainees, selected from nominations made by governments, attended lectures and carried out laboratory work in the textile research institute in Lódz. Afterwards they had practical training in textile installations dealing with spinning, weaving, dyeing and other processes. Study trips to textile and machinery plants in Poland enabled participants to see the application of methods covered in the programme.

The last two weeks of the training course were devoted to a review of the programme. Among the topics to be discussed were the following: perspectives of textile development and research centres of the industry, staff training, raw materials for the textile industry, quality control methods, the wool industry, the cotton industry, the garment industry and textile machinery.

All trainees were granted United Nations fellowships on the basis of the qualifications of the candidates submitted, with regard to geographical distribution and other relevant considerations. Governments were invited to nominate up to three candidates, with preference for applicants with practical experience in manufacturing, repairing, maintenance, servicing and the operating of textile machinery and equipment.

The fellows took part in the training programme in their individual capacity and not as representatives of their governments. At the end of the programme, each fellow was expected to prepare and submit to the United Nations a report evaluating the programme and the degree to which it can be applied in his home country. The reports will be submitted by each fellow to the United Nations.

Participants in the textile industry programme came from Bolivia, Bulgaria, Cuba, Ecuador, Guinea, Iran, Iraq, Syria, the United Arab Republic, Uruguay and Yugoslavia.

For Your Information . . .

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

Industrial Processing of Citrus Fruit (A Technological Survey), 88 pages (UNIDO/ITD/9).

The author, Zeki Berk, senior lecturer in the Department of Food and Biotechnology at Technion, The Israel Institute of Technology, makes a general presentation of the characteristics of the citrus fruit industry, such as its market, sources of production, display problems and industrial development. From these general aspects the author goes on to deal with the problems presented by specific fruit varieties, such as transport, storage, washing and sorting, extraction of juices, the most advanced techniques for processing, the phases of processing, the most advantageous uses for citrus juice and quality control. He also describes the canned citrus fruit processes according to the citrus species. In the section on production, the author presents a list of other commodities, such as essential oils, canned products, dehydrated citrus juice and other goods that can be produced from the waste peel.

An appendix includes a basic model of a feasibility study for a small plant, a description of the equipment, raw materials, building and services required and an estimate of the cost and suitability of the various products. Statistics and a comprehensive list of literature are also included.

Intended to serve as a guideline for practical use, especially in the preparation of citrus industry projects, this book is the first of a series. UNIDO will also publish:

The Use of Centrifugal and Expanding Flow Evaporators in Food and Biochemical Industry;

Water Saving Techniques in Food Processing Plants;

Packaging, Packaging Materials and Techniques in Developing Countries;

Production of Foodstuffs and Protein Enriched Mixtures and Concentrates;

Presentation of Up-to-Date Flash Sterilization Methods for Milk Processing in Developing Countries;

Starch Production in Developing Countries.

The Nature and Role of Industrial Co-operatives in Industrial Development, 144 pages (ID/WG. 25/1).

The Committee for Industrial Development, at its Sixth Session in May 1966, authorized the United Nations Centre for Industrial Development, UNIDO's predecessor, to undertake a study of the nature and role of non-governmental organizations and support services concerned with the acceleration of industrial development in developing countries.

The present report examines the organization, administration and productive activities of a particular category of non-governmental organizations, namely, industrial co-operatives.

The report is confined to industrial co-operatives and other societies of industrial production that are non-governmental in the sense that they are neither state owned nor part of a government apparatus, but are societies of private shareholders engaged in some form of co-operative industrial production.

The primary object of the study is to examine the types of co-operatives engaged in industrial production, look into their historical evolution, analyse their organizational structure and discuss their methods of financing, administration and production, with special emphasis on their role in industrialization.

The report is directed mainly at the developing countries, although it also covers the developed countries where the industrial co-operative movement was founded. Attempts have been made throughout the report to examine aspects of the nature, organization, administration and production of co-operatives in the developed countries that are of particular interest to the developing countries. The report also attempts to portray characteristics common to most of the co-operatives engaged in industrial production and to draw attention to variations among them concerning background, development, productive activities and objectives.

The report also examines many other types of co-operatives that are not strictly industrial but are engaged partly in industrial production. These activities are broken down in the report according to the product produced and the process or the industrial services performed. Geographically, the report covers co-operatives engaged in industrial production in Africa, Asia, Europe, Latin America, North America and Oceania.

Part I looks into the background and development of industrial co-operatives, including definition, historical development, statistical assessment and legislation. Part II surveys the types of industrial productive co-operatives that have been established in the developed and in the developing countries. Part III analyses the structure, administration, finance and production methods of industrial co-operatives. Part IV surveys other forms of co-operative

activity in industry, such as co-operative labour contracting and co-operative credit. Part V analyses the administration, finance and production methods of non-industrial co-operatives engaged partly in some form of industrial production.

This document was issued originally for the Seminar on the Organization and Administration of Industrial Services in Africa held in Tangier, 14–30 August 1967.

Report of Expert Group Meeting on the Selection of Textile Machinery in the Cotton Industry, 83 pages (ID/WG. 8/1), and

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

Two reports designed to promote the growth of textile industries in developing countries have been published recently by UNIDO. Both have their origin in the discussions and recommendations of the first United Nations Interregional Workshop on Textile Industries in Developing Countries, held in Łódź, Poland, in September 1965.

The first report deals with the problem of selecting machinery in the cotton industry. It stems from a recommendation that resulted in the establishment of a group of textile machinery experts assigned to formulate guidelines for the selection of textile machinery. The cotton industry was chosen as the first area for study because of its importance to developing countries.

The report of the Expert Group, which met in Vienna 23–28 October 1967, provides comparative data on the levels of technology currently available to the cotton textile industry and sets out criteria for the acquisition of equipment.

The information contained in the report will be of particular value to members of industrial planning or governmental agencies in developing countries who have the responsibility for the selection of industries suitable for development. Planners will be able to use the data on capital equipment, labour intensity, productivity and power requirements for purposes of evaluation and comparison with other industries.

Another group that is expected to benefit from the report, the textile specialists who are already familiar with processing techniques, will be able to use the mill balance, production and equipment data in drawing up plans for productivity and the selection of staff.

The second report is based on a working paper on the textile industries in developing countries, submitted to the Interregional Workshop by the forerunner of UNIDO, the United Nations Centre for Industrial Development.

Revised and expanded, the working paper contains information on raw materials for the manufacture of textiles, products and processes, new production and administrative methods and other aspects of the development of the textile industry. It is intended to serve as a preliminary guide for those responsible for policy-making in the textile industry in developing countries.

Technical Assistance and Training in the Implementation and Follow-up of Industrial Projects, 23 pages (ID/12).

UNIDO prepared this report to help developing countries in making requests for assistance in developing effective procedures for programming and control of project implementation; establishing adequate systems for implementation and follow-up; organizing advisory missions to review problems and examine procedures of project implementation and provide training for local personnel.

The report includes illustrations of types of UNIDO assistance and samples of job descriptions and requests for UNIDO assistance in the field of industrial project implementation.

Seminar on Clay Building Materials Held

Thirty participants and two observers from countries in Africa, Asia, Europe, Latin America and the Middle East attended an interregional seminar on the development of clay building materials industries in developing countries.

UNIDO organized the seminar, held in Copenhagen from 12 to 25 August, in co-operation with the Government of Denmark as a result of recommendations by the Economic and Social Council and other United Nations organs for the development of a building materials industry making maximum use of local raw materials.

Clays represent a natural resource of considerable magnitude and clay-using industries are of fundamental importance to the economic development of nearly every country. Furthermore, high capital investments are not necessarily involved in developing such industries. The main problems facing developing countries in this field are the necessity of making a careful selection of materials and of adapting manufacturing techniques.

The seminar brought together officials and specialists from both developed and developing countries to discuss technical, economic and other aspects of the setting up and operation of manufacturing plants for clay building materials in developing countries. Participants exchanged views on such problems as increasing output and improving the quality of traditional building materials, including bricks and tiles. In addition, they studied the use of local raw materials for the manufacture of building materials, how to develop new building materials and the extent to which mechanization can be used at the different stages of operation.

Another purpose of the seminar was to enable the developing countries to make the best use of United Nations technical assistance in this field.

The director of the seminar was J. Bryup, a leader of the Danish brick and tile industry, and the co-director was Janos Fath, Chief of UNIDO's Industry Sector Development Section.

Calendar of Meetings

January to June 1969

Conference on the Importance of Patents and Inventions and their Exploitation by Industry

London, January. Business Conferences and Exhibitions Ltd., Mercury House, Waterloo Road, London, S.E.1., England. Institute of Patentees and Inventors. Within the framework of 1st London International Inventions and New Products Exhibition (Impex), 6-11 January.

Symposium on Heat Transfer in Glass Manufactura

Ormskirk, England, 7-9 January. Society of Glass Technology, Thornton, 20, Hallam Gate Road, Sheffield, 10, England.

International Symposium on the Effects of Temperatura and Haat on the Enginaaring Bahavior of Soils

Washington, D.C., 16 January. Highway Research Board, U.S. National Research Council, National Academy of Sciences, 2101 Constitution Avenue N.W., Washington, D.C. 20418.

International Symposium on Information Thaory

Ellenville, N.Y., 28-31 January. Information Theory Group, Institute of Electrical and Electronics Engineers, 345 E. 47th Street, New York, N.Y. 10017.

International Plastics Exhibition

Brussels, 22-30 March. Palais des Floralies, Ghent, Belgium. Two one-day conferences: Plastics in building, Plastics and electrotechnical appliances.

Yugoslav Seminar and Exhibition of Regulation, Measuring and Automation-Jurema

Zagreb, Yugoslavia, 19-27 April. Jurema, Uinska Ul., P.O.B. 123, Zagreb.

International Conferance on Structure, Solid Mechanics and Engineering Design in Civil Engineering Materials

Southampton, England, 21-25 April. M. Te'eni, Dept. of Civil Engineering, University of Southampton, Southampton. The Concrete Society and R.I.L.E.M.

International Symposium on Cotton Textila Research

Paris, 22-25 April. Institut Textile de France, 35, Rue des Abondances, 92 Boulogne, France.

Commonwealth Mining and Metallurgical Congress

London, 5-10 May. Hon. Secretary of the Congress, Commonwealth Council of Mining and Metallurgical Insitutions, 44 Portland Place, London, W. 1. Followed by two weeks of tours of mining and metallurgical operations in the United Kingdom.

International Conferance on Arid Lands in a Changing World

Tucson, Arizona, 3-13 June. T. L. Smiley, Department of Geochronology, University of Arizona, Tucson 85721, USA. Includes field trips. American Association for the Advancement of Science with the support of UNESCO.

International Fadaration of Operational Rasaarch Societias

International Conference, Venice, 23-27 June. The International Federation of Operational Research Societies, Permanent Secretariat: c/o Operational Research Society, 62 Cannon Street, London, E.C. 4., England, Attention: Mrs. M. Kinnaird.

Austria Announces Architectural Competition For Design of UNIDO's Permanent Headquarters

The Republic of Austria, represented by the Federal Ministry for Building and Techniques, is conducting a public architectural competition for the design of a permanent headquarters for UNIDO, the International Atomic Energy Agency and a Conference Centre in Vienna.

The competition began 1 November and will close on 1 May. It is in concurrence with the rules of the *Union Internationale des Architectes*. All architects who can certify that they are members of an architectural organization in their home country are authorized to participate. The protection fee for the competition material is $US 100.00; this will be refunded after projects have been submitted. An international jury will judge the entries.

The task of the competitor will be to design a large building complex, approximately 700,000 cubic metres of floor area, that is in harmony with the architecture of the city.

Those interested in the competition should address their inquiries and requests for material to:

Ziviltechnikerteam für die Vorbereitung des
Internationalen Wettbewerbes
Amtssitz Internationaler Organisationen
Architekten Appel Fleischer Lintl Schwanzer
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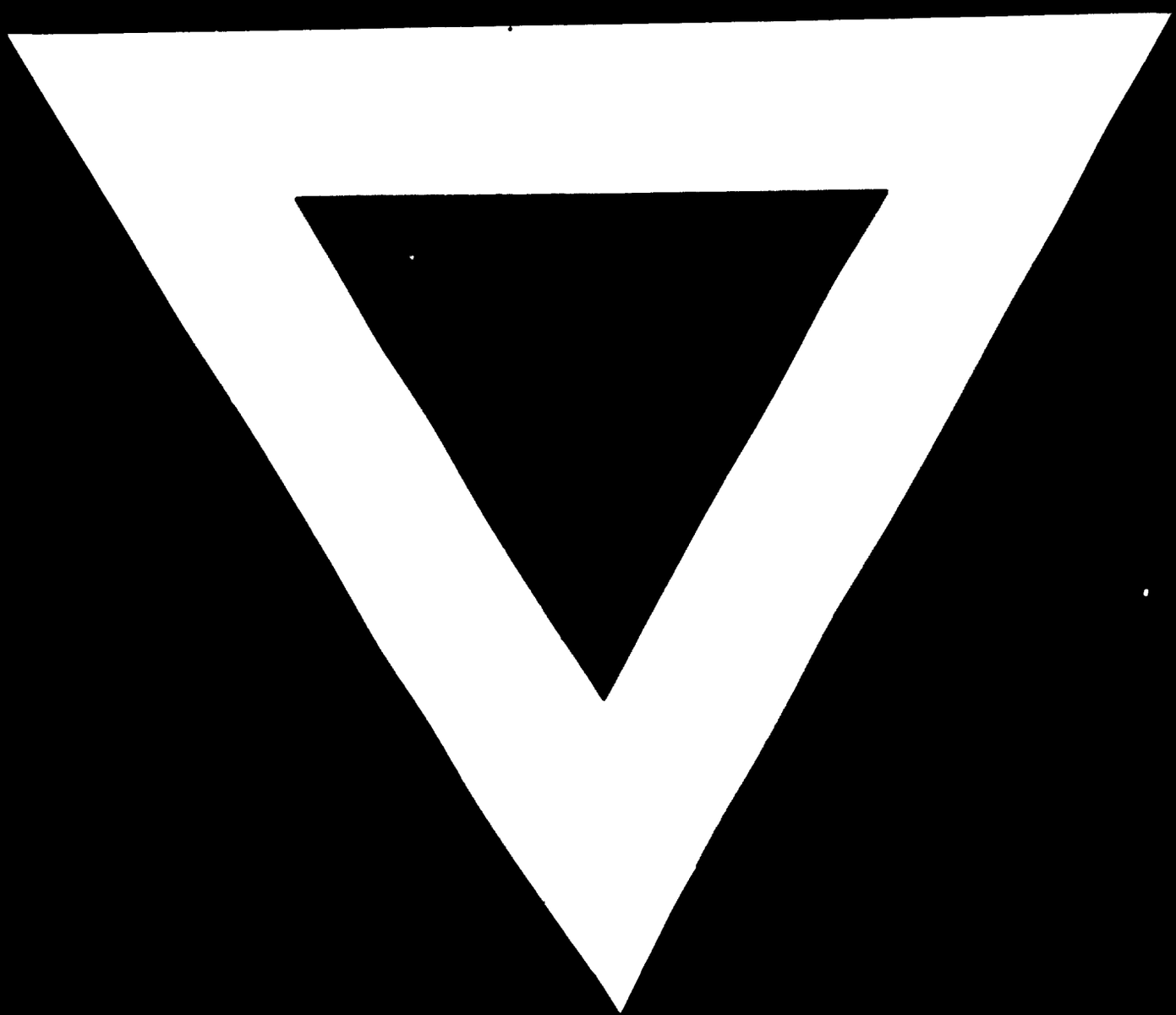

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