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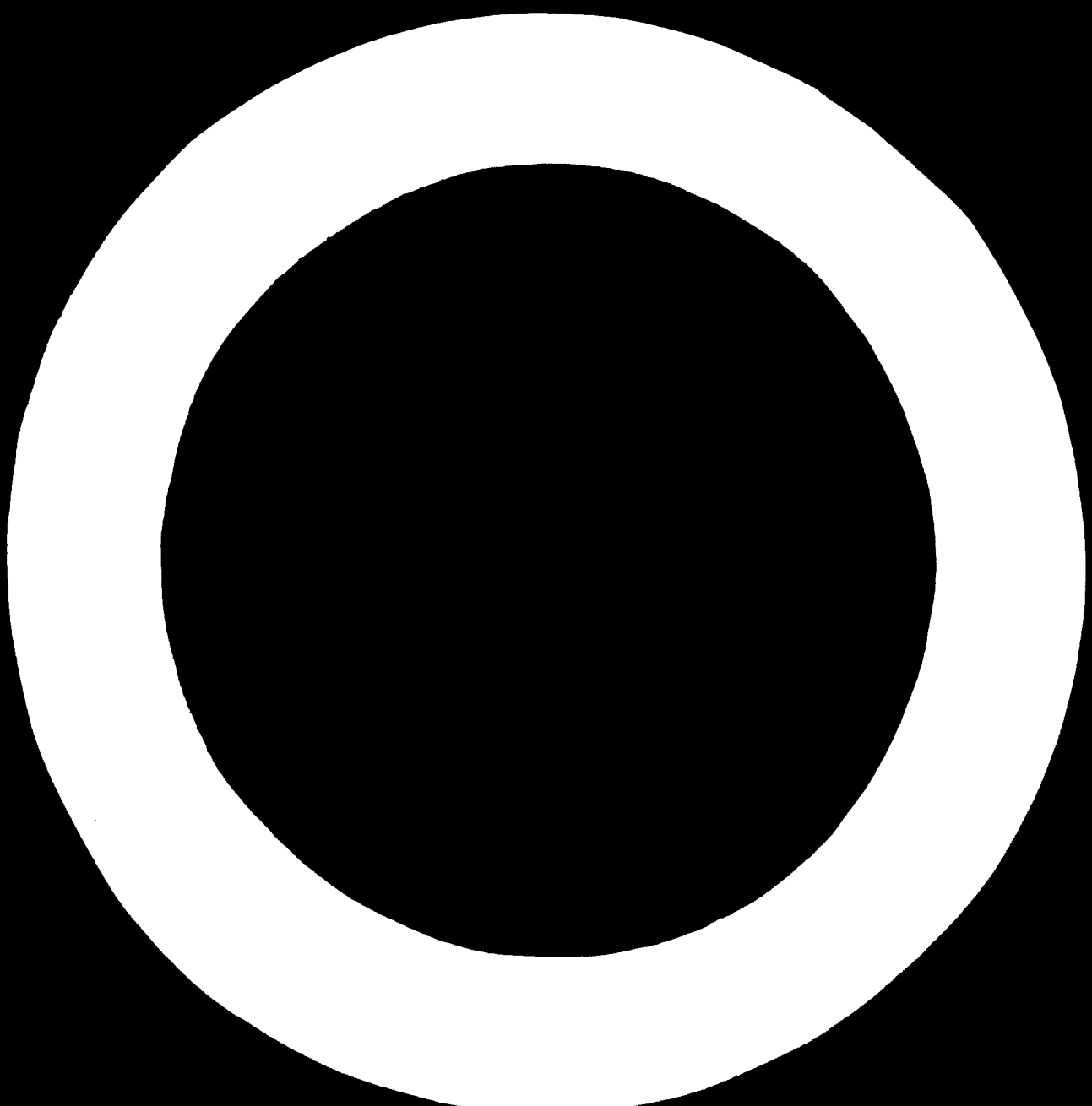

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Summaries of Feature Articles

Industrial Development Board Holds Third Session

The Industrial Development Board began its third session 24 April in Vienna. During its three-week session, the Board reviewed the work of UNIDO in 1968 and discussed future activities. A subsidiary of the 45-member Board, the Working Group on Programme and Co-ordination, met 8 - 22 April.

Le Conseil du développement industriel tient sa troisième session

La troisième session du Conseil du développement industriel s'est ouverte à Vienne le 24 avril. Au cours de cette session de trois semaines, les participants ont fait le point des activités de l'ONUDI en 1968 et ont procédé à l'examen de ses activités futures. Le Groupe de travail du programme et de la coordination, organe subsidiaire du Conseil qui comprend 45 membres, s'est réuni du 8 au 22 avril.

La Junta de Desarrollo Industrial celebra su tercer período de sesiones

La Junta de Desarrollo Industrial inició su tercer período de sesiones, cuya duración fué de tres semanas, el 24 de abril, en Viena. Durante el período, la Junta examinó las actividades de la ONUDI en 1968 y estudió sus futuras actividades. El Grupo de Trabajo encargado del Programa y de la Coordinación, órgano auxiliar de la Junta compuesto de 45 miembros, se reunió del 8 al 22 de abril.

The Automotive Industry in Developing Countries

by Fernand L. Picard

In deciding whether to establish an automotive industry, a developing country must consider such questions as the potential market, the national road system, the feasibility of ancillary industries and the availability of technical staff. The automotive industry in most developing countries will probably go through three phases: assembly, with most of the components imported; gradual incorporation of locally produced items; and national self-sufficiency in tooling and vehicle research.

L'industrie automobile dans les pays en voie de développement

par Fernand L. Picard

Pour décider s'il doit ou non créer une industrie automobile, un pays en voie de développement doit commencer par étudier les possibilités du marché, l'état de son réseau routier, la viabilité d'industries ancillaires et ses ressources en personnel technique. Dans la plupart des pays en voie de développement, l'industrie de l'automobile passera probablement par trois étapes successives: assemblage, la plupart des pièces et éléments étant importés; incorporation progressive de pièces et éléments de fabrication locale et, enfin, autoapprovisionnement en matière d'outillage et de recherche dans le domaine automobile.

La industria automotriz en los países en desarrollo

por Fernand L. Picard

Al decidir el establecimiento de una industria automotriz, los países en desarrollo deben considerar cuestiones como: el mercado posible, el sistema nacional de carreteras, la viabilidad de industrias auxiliares y el personal técnico disponible. En la mayoría de los países en desarrollo la industria automotriz atravesará probablemente tres etapas: montaje de piezas importadas en su mayor parte, introducción gradual de piezas fabricadas localmente y autosuficiencia nacional en la producción de herramientas y en las investigaciones sobre vehículos.

Capital Is Not Enough

Many developing countries have set up financial institutions which not only give the medium-term and long-term loans needed by fledgling industrial ventures, but also provide technical assistance and advisory services. The two institutions described — the Industrial Development Corporation of the Dominican Republic and the Medium Industry Bank of the Republic of Korea — serve specific national development needs.

Les capitaux ne sont pas tout

Un grand nombre de pays en voie de développement ont créé des institutions financières qui n'accordent pas seulement aux entreprises naissantes les prêts à moyen et à long terme dont elles ont besoin, mais leur fournissent aussi une assistance technique et des services consultatifs. Les deux institutions décrites — l'Office du développement industriel en République Dominicaine, et la Banque de la moyenne industrie en République de Corée — répondent à des besoins précis du développement national.

El capital no basta

Muchos países en desarrollo han establecido instituciones financieras que no sólo proporcionan los préstamos a plazo mediano y largo necesarios para las empresas industriales incipientes, sino que también prestan asistencia técnica y servicios consultivos. Cada una de las instituciones descritas — la Corporación de Fomento Industrial de la República Dominicana y el Banco de la Industria Mediana de la República de Corea — satisface necesidades nacionales concretas del desarrollo.

Dominican Republic: Financial and Technical Assistance from Development Bank

by José Andrés Aybar Castellanos

République Dominicaine: L'Office du développement industriel fournit une assistance financière et technique

par José Andrés Aybar Castellanos

República Dominicana: La Corporación de Fomento Industrial ofrece asistencia financiera y técnica

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Republic of Korea: Bank Encourages Small Industries

by Pan Young Lee

République de Corée: Une Banque encourage la petite industrie

par Pan Young Lee

República de Corea: El Banco estimula a la pequeña industria

por Pan Young Lee

Industrial Uses of Radioisotopes in Developing Countries

by Henry Seligman

Most industries use radioisotopes and most manufactured products are subjected to radioisotope radiation. Developing countries can use radioisotopes in many ways, including the assessment of water resources in arid regions, the irradiation of food, quality control, the control of industrial flow rates, sterilization of medical products and pest control.

Documentation and Development

by Jean Viet

Traditional methods of documentation are becoming less and less effective for national and international development agencies, which must identify quickly the items of information most useful to them. In the last few years much work has been done on developing an automated system of documentation involving the use of descriptors. UNIDO is now indexing by subject its documentation by means of a list of descriptors on industrialization.

Utilisations industrielles de radioisotopes dans les pays en voie de développement

par Henry Seligman

La plupart des industries utilisent des radioisotopes et la plupart des articles manufacturés sont soumis à une irradiation par radioisotopes. Les pays en voie de développement peuvent utiliser les radioisotopes à des fins multiples telles que l'évaluation des ressources hydrauliques des régions arides, l'irradiation des produits alimentaires, le contrôle de la qualité, le contrôle de la production industrielle, la stérilisation des produits médicaux et la lutte contre les parasites.

Documentation et développement

par Jean Viet

Les méthodes traditionnelles de documentation répondent de moins en moins aux besoins des institutions nationales et internationales de développement, qui doivent identifier rapidement les informations qui leur seront le plus utiles. Au cours de ces dernières années, un effort important a été fait pour mettre au point un système automatisé de documentation utilisant les services de descripteurs. L'ONUDI s'emploie actuellement à classer sa documentation par sujet grâce à une liste de descripteurs sur l'industrialisation.

Usos industriales de los radioisótopos de los países en desarrollo

por Henry Seligman

La mayor parte de las industrias utilizan radioisótopos y en la producción de la mayoría de los artículos manufacturados interviene la irradiación con radioisótopos. Los países en desarrollo pueden utilizar los radioisótopos para muchos fines: determinación de los recursos hidraúlicos en las regiones áridas, irradiación de alimentos, control de calidad, control del movimiento de productos en la industria, esterilización de productos médicos y lucha antiparasitaria.

Documentación y desarrollo

por Jean Viet

Los métodos tradicionales de documentación son cada vez menos eficaces para las actividades de los organismos nacionales e internacionales que se ocupan del desarrollo y que deben identificar rápidamente la información que les es más valiosa. En los últimos años se ha hecho mucho para establecer un sistema automatizado de documentación mediante el uso de descriptores. La ONUDI está preparando los índices de su documentación mediante una lista de descriptores sobre industrialización.

Seated at the speakers' table are Nikolai Grigoriev, Director of the Industrial Technology Division; Samuel Lurié, Senior Adviser; Ibrahim Helmi Abdel-Rahman, Executive Director; Ambassador Carlos Ortiz de Rozas, President of the Third Session and Permanent Representative of Argentina to UNIDO; Almamy Sylla, Secretary, Industrial Development Board, and Börje Billner, Rapporteur of the Third Session and Minister Plenipotentiary of the Permanent Mission of Sweden to the United Nations.

Industrial Development Board

THE THIRD SESSION of the Industrial Development Board, the principal policy-making organ of the United Nations Industrial Development Organization (UNIDO), was held at the Neue Hofburg, Vienna, from 24 April to 15 May 1969. In the course of the session, the Board adopted thirteen resolutions, reached a number of conclusions and made recommendations relating to the work programme of UNIDO.

The Board elected the following officers: President, Carlos Ortiz de Rozas (Argentina); Vice Presidents: Tenu Petrov (Bulgaria), Dikoko Quan (Cameroon) and Enver Murad (Pakistan); Rapporteur: Börje Billner (Sweden).

Working Group on Programme and Co-ordination

The session of the Board was preceded by a two-week meeting of the Working Group on Programme and Co-ordination, a subsidiary body set up by the Board at its second session to examine the past, present and proposed work programmes of UNIDO, assess their financial implications and review the central role of UNIDO in co-ordinating the activities of the United Nations system in the field of industrial development.

The Working Group examined the work programmes of UNIDO for 1968, 1969 and 1970 and also discussed the long-term work programmes for 1971 and subsequent years. In addition, it gave preliminary consideration to the question of the central role of UNIDO in co-ordinating the activities of the United Nations system in the field of industrial development.

The Board approved the report of the Working Group and incorporated it into the report of the Board, adding the observations made during the discussion of the report of the Working Group. The

Board also decided to maintain the Working Group on Programme and Co-ordination as a permanent subsidiary organ open to all members of the Board.

Agenda of the session

In addition to consideration of the report of the Working Group on Programme and Co-ordination, the fifteen-point agenda of the Board included a review of the co-ordinating role of UNIDO among United Nations agencies working in the industrial field; future policies and guidelines for the long-term programme of UNIDO; financial and organizational matters and questions relating to intergovernmental and non-governmental organizations.

Resolutions adopted by the Board

During the course of the third session, the Board adopted thirteen resolutions.

On the *Regular Programme of Technical Assistance*, the Board recommended that the General Assembly take budgetary action for the implementation of the programme proposals by appropriating the necessary funds within section 14 of the regular budget of the United Nations in 1970 and that the sum of US$ 1.5 million be taken as the planning level figure for the Regular Programme of Technical Assistance for industrial development in 1971.

On the subject of the *central role of UNIDO in co-ordinating the activities of the United Nations system in the field of industrial development*, the Board noted the bilateral arrangements on co-operation concluded between UNIDO and the International Labour Organisation (ILO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Economic Commission for Africa (ECA), the Economic Commission for Europe (ECE), the United Nations Economic and Social Office in Beirut (UNESOB) and the Economic Commission for Latin America (ECLA). It emphasized the need for reaching long-term agreements with all these organizations and requested the Executive Director to submit a comprehensive report on the implementation of this resolution to the Board at its fourth session.

The *programme of Special Industrial Services (SIS)* was the subject of another resolution. After noting that the number of requests for assistance under the SIS programme has increased at a rate that may lead to an early depletion of the resources available for new projects, the Board stressed the importance of the activities of the SIS within the framework of technical co-operation and endorsed the concern expressed by the Governing Council of the UNDP on the need to continue them on a more permanent basis. It hoped that the Governing Council of the UNDP would insure the availability of funds for the continuation of the SIS programme at a level consistent with past development and commensurate with future needs.

Another resolution adopted was on *industrial development field advisers*, whose number the Board found to be "limited and insufficient to provide adequate coverage and service to the developing countries". The Board urged the further working out of arrangements, under the agreement between the Administrator of the UNDP and the Executive Director of UNIDO, for the establishment and financing of the existing programme of UNIDO industrial development advisers, preferably before the end of 1969.

In a resolution on the *promotion of export-oriented industries*, the Board considered the need to avoid dispersal of effort between various United Nations bodies working in this field and requested the Executive Director to give special emphasis to standardization, quality control, product improvement, design, packaging and similar measures, in addition to subcontracting and licensing arrangements aimed at improving the market acceptance and competitiveness of the industrial products of the developing countries.

The Board, in a resolution relating to the *recruitment of experts*, expressed the conviction that "the existing resources of experts both in the developed and developing countries have not yet been fully utilized". It then asked the Executive Director to increase UNIDO participation in the recruitment of experts for Special Fund and Technical Assistance projects and to strengthen co-operation with national authorities. It also recommended that he simplify recruitment and assignment formalities and called his attention to the need to obtain the services of experts at a reasonable cost.

Another resolution dealt with the *utilization of computers and computer techniques for industrial development*. The Board recalled the General Assembly resolution on international co-operation for the utilization of com-

Holds Third Session

puters and computer techniques for development and invited the Executive Director to assist the United Nations Secretary-General in preparing his report on the subject.

In another resolution the Board expressed appreciation to the countries that had announced contributions for 1969 at the *UNIDO Pledging Conference* held on 4 December 1968 and called on the Executive Director to take steps to achieve a rational utilization of existing voluntary contributions. It also called on all countries participating in UNIDO to increase their support by announcing appropriate contributions at the 1969 UNIDO Pledging Conference and to make every effort to raise their contributions for 1970.

The resolution regarding *co-operatives in industrial development* listed ways in which the co-operative movement could contribute to industrial development and requested the Executive Director, in consultation with the International Labour Organisation (ILO), other specialized agencies and the International Co-operative Alliance, to prepare a report illustrating the role played by co-operatives in the industrial development of individual countries.

Regarding a *special meeting of the United Nations Industrial Development Organization*, the Board requested the Executive Director to consult Governments participating in the work of UNIDO to study the possibility of convening a special meeting of the member countries of UNIDO, within the framework of the twenty-fifth regular session of the General Assembly of the United Nations in 1970 (the year in which the twenty-fifth anniversary of the United Nations will be celebrated), in order to consider the long-term participation of UNIDO in industrial development in the developing countries and, in particular, its participation in achieving the objectives of the Second Development Decade. The Board requested the Executive Director to report the results to the twenty-fourth session of the General Assembly, together with the report of the third session of the Industrial Development Board.

In the resolution regarding *financial questions relating to the UNIDO Regular Programme of Technical Assistance*, the Board noted that the Governing Council of UNDP had recommended changes in the programming and budgeting procedures of the Regular Programme of Technical Assistance, under which a separate section of the United Nations budget was devoted to technical assistance for industrial development. The resolution goes on to state that the present procedure "has considerably expedited assistance" to developing countries and stresses the need for "advance planning in the field of industrial development" as well as "for having specific resources available for this purpose".

A resolution adopted by the Board concerning *UNIDO and the Second United Nations Development Decade* stated that the work of UNIDO in respect to the Development Decade, in accelerating industrial development in the developing countries, should receive high priority. It also decided that the contribution of UNIDO should be based on the concepts that:

- Developed and developing countries are partners in world economy where both have interdependent roles to perform;
- Present economic conditions have to be improved to make them conducive to the growth of both partners so as to enable the developing countries to secure a larger share of world production and trade that will provide their peoples with a reasonable standard of living and permit their economies to expand with a substantial increase in the industrial portion of the gross national product;
- It is desirable to give assistance to industrial development and such assistance should provide the opportunity for a substantial increase in the level and quality of industrial production in developing countries. This will require a co-ordinated effort by both developed and developing countries;

Delegates listen to discussions during the third session of the Industrial Development Board at the Hofburg, Vienna.

- While assistance is being extended to developing countries to accelerate their industrial development, simultaneous and concerted action should be taken by the international community to give the products of developing countries greater access to world markets under better terms of trade;
- The contribution of UNIDO to the Decade must be developed within its terms of reference and co-ordinated with the UNCTAD proposals and contribution to the Decade. The resolution asks the Executive Director to submit a report to the Board at its fourth session on the proposed contribution to the Decade, specifying the policy measures by sectors to be implemented on the national, regional and international levels.

The last resolution adopted by the Board dealt with *international co-operation in the field of industrial development*. It stated that while the main responsibility for economic and social development rested on the developing countries themselves, "complementary international co-operation" was important and should be attuned to the conditions and policies of those countries. It recommended that the industrialized countries and the developing countries should co-operate increasingly in the industrialization plans of developing countries; such co-operation should be free from political, economic and other pressures.

Conclusions and recommendations

The Board reached a number of conclusions and made recommendations relating to both the field activities and the supporting activities of the Organization.

With regard to field activities, the Board expressed the view that UNIDO should assume responsibility for an increased number of Technical Assistance and Special Fund projects financed by the United Nations Development Programme (UNDP).

The Board also recommended that UNIDO should maintain close contact with governments of both developed and developing countries, with UNIDO national committees and with the regional economic commissions of the United Nations. The role of the industrial field advisers in this respect should be defined and developed and their numbers increased, thus enabling them to serve as a channel of communication between UNIDO headquarters and the field.

Turning to the question of supporting activities, the Board expressed the view that these should be increasingly related to field projects. It suggested areas that might receive concentrated attention.

With regard to industrial information the Board "assigned high priority to the expansion of the Information Clearing-house with the necessary strengthening of the local transfer facilities in developing countries". It also recommended that UNIDO, in close co-operation with the United Nations Conference on Trade and Development (UNCTAD) and the General Agreement on Tariffs and Trade (GATT), contribute to the expansion of trade of the developing countries in 1970.

The Board requested UNIDO to keep in mind the promotional aspects of the mandate given it by the General Assembly. One of the purposes of its promotional activities, it was noted, should be to help mobilize internal and external know-how, taking into account the results of work already done in this field.

Finally, the Board stressed the central role of UNIDO in co-ordinating the industrial development activities of the United Nations family.

Rise in Industrial Production in Last Quarter of 1968

An increase in industrial production was recorded for the principal regions of the world in the last quarter of 1968 over the comparable figure for 1967, according to the latest United Nations statistics.

Taking the year 1963 as a base (100), industrial production in the Soviet Union and eastern Europe rose from 137 in the last quarter of 1967, to 148 in the last quarter of 1968. For the developed market economies as a group, the comparable figure in 1968 was 141. In the developing countries as a whole the index reached 145 in the last quarter of 1968.

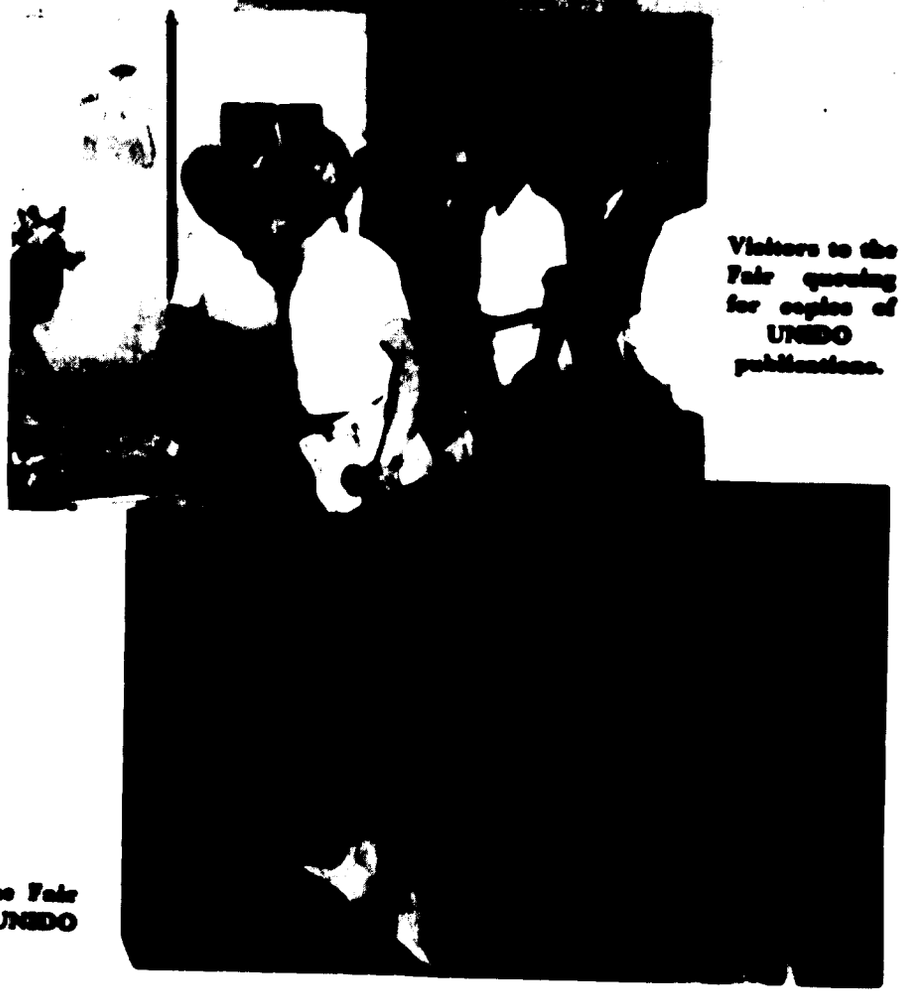
In the developing countries taken as a group, the highest production figures for the first quarter of 1969 were registered for electricity and gas (171); crude petroleum and natural gas (165); chemicals, petroleum and coal products (153); and heavy manufacturing (149).

Index numbers of world industrial production by branches of industry and by regions appear as a special feature in the August issue of the *Monthly Bulletin of Statistics*. Prepared by the Statistical Office of the United Nations, the *Bulletin* also includes a special table on world production of certain raw materials and electricity, which shows the volume of production and index numbers for coal, petroleum, cement, pig-iron, crude steel, copper, zinc, lead, tin, aluminium, natural rubber and electricity.

The *Monthly Bulletin of Statistics* is a bilingual printed publication with texts in English and French and may be ordered from the Sales Section, United Nations, New York or Geneva or through booksellers, price US $ 2.00. It provides monthly statistics on some 70 subjects from more than 180 countries and territories, together with special tables illustrating important features of world economic developments.

UNIDO Conducting Industrial Promotion Service at Fairs

Outside the Pavilion which UNIDO shared with Cuba, Morocco, Sweden and Syria at the Budapest International Trade Fair '69.



Visitors to the Fair queuing for copies of UNIDO publications.

Discussions between visitors to the Fair from developing countries and UNIDO officials during an Industry Day.

THE UNIDO INDUSTRIAL PROMOTION SERVICE participated in the Budapest International Trade Fair '69, 16–26 May, and will take part in the Second Asian International Trade Fair, Tehran, 5–24 October, in a further effort to promote contacts between industrial and business leaders from developing and industrially advanced countries.

At Budapest the Service concentrated on three major activities: arranging meetings between potential suppliers and consumers of technical know-how and financial and technical assistance; conducting Industry Days for the instrument and glass industries and reviewing the exhibits of developing countries.

As a result, negotiations are underway for joint ventures between developing and industrialized countries in the construction and operation of glass, medical instrument and microscope factories and in the establishment of a repair and maintenance workshop for medical instruments in developing countries. One developing country reached an agreement with an institute in an industrialized country for the provision of five one-year fellowships for engineers.

The Industry Days for instruments, 19–21 May, and glass, 22–23 May, were organized by UNIDO in co-operation with the Hungarian Chamber of Commerce and the Federation of Technical and Scientific Societies of Hungary (MTESZ). Some 25 participants held round-table and small-group discussions, visited factories and had preliminary talks on possible joint ventures. Among the main topics were repair and maintenance problems in developing countries, investment incentives offered by these countries and recent technical developments and assistance available through UNIDO and the industrialized countries represented.

UNIDO staff members interviewed visitors and exhibitors to ascertain the types of products being sought by potential consumers and the nature of the problems, such as questions of packaging, standardization and product design, that confront manufacturers in the promotion and export of products.

The Industrial Promotion Service (IPS) at the Second Asian International Trade Fair in Tehran will feature presentations and discussions on needs and technical developments affecting specific industries such as the manufacture of fertilizers, petrochemicals, and building and construction materials.

The Service will be an information and referral service, staffed by UNIDO experts with the assistance of the Ministry of Economy, Tehran, and is open to all Asian Trade Fair '69 exhibitors and visitors who are directly concerned with industrial promotion. Potential consumers and suppliers of financial and/or technical assistance to developing industry may list their special project interests, their needs and/or terms and the type of counterparts they would like to meet.

IPS will identify and bring together participants who have complementary interests. An IPS service will arrange for the participants to meet so that they can pursue their own private discussions or negotiations and explore the possibilities of joint ventures, the supply of technical know-how and the provision of financial assistance.

In addition, IPS plans to offer the following services to persons registering:

- Daily IPS Bulletins containing the names of persons newly registered, the organizations they represent and their addresses;
- IPS Bulletin Board for the posting of business notices and other investment-promotion information by IPS participants;
- IPS Display Counter where persons who have registered may leave relevant literature;
- Assistance in scheduling and publicizing industrial promotion presentations and meetings, which may include the showing of industrial films in the sponsor's own exhibit area or in various halls in the Fair grounds;
- IPS paging service to assist in locating participants and to provide assistance in arranging meetings between them in the IPS lounge;
- Informal advice and help by UNIDO experts, within the limits of the staff and time available, on problems of industrial promotion.

United Nations Secretary-General U Thant has made the following statement concerning the Trade Fair:

"The purpose of the Second Asian International Trade Fair is to promote trade among developing countries, especially those of Asia, and between these countries and the rest of the world. This is a highly desirable and practical objective which I strongly support.

"Participants in the First Asian Trade Fair, which was organized in 1966 by the Government of Thailand with the support of the United Nations, were successful in finding new markets for their products and in strengthening their existing trade links. The great success of the First Asian Fair showed that both developing and economically developed countries have much to gain by exhibiting their products at international events such as the Second Asian International Trade Fair, which the Government of Iran will organize in Tehran in October, 1969.

"I welcome the plan to hold seminars on trade promotion during the period of the Fair. These conferences will enable traders from developing countries to discuss with leading businessmen from the main trading centers of the world practical means of developing trade with economies of different kinds.

"I warmly commend the Second Asian International Trade Fair to all member governments of the United Nations. I hope they will take part in the Fair and will encourage commercial organizations in their countries to participate also. This Fair is an example of international co-operation which will benefit all who participate in it."

The Automotive

The Author: *Fernand Picard, an engineer (Ecole Nationale Supérieure d'Arts et Métiers, Lille), has been working in the automobile industry for more than 40 years. He is now a special adviser to Renault where he has held several positions, including that of Director of Studies and Research. He has received numerous national and international honours and has been an officer of several professional organizations, including the Fédération Internationale des Sociétés d'Ingénieurs des Techniques de l'Automobile. He has written many papers for presentation to professional groups and publication in their journals.*

Is it wise for a developing country to devote a large proportion of its means to creating an automotive industry when vehicles of every kind can be supplied more cheaply by industrialized countries? Is this the best use of human and financial resources? These questions must be carefully considered when examining the possibility of establishing an automotive industry in a developing country.

The development of such an integrated industry brings with it other basic industries and enriches the economy of a country. Large supplies of raw materials and manufactured goods, such as steel, castings, light alloys, plate glass, textiles, paint, chemical products and electrical apparatus, are required. To obtain these supplies, mines must be dug, new processes adopted and factories built.

As the industry needs trained men, the question of the provision of technical and teacher training colleges has to be examined.

Moreover, the standards required by automotive manufacturing are quality combined with quantity. Quality in production is difficult to achieve and harder to maintain, for it requires a strict mental and physical discipline. This new mental attitude, once acquired, is likely to spread beyond the factory to the home. Such beneficial effects are particularly apparent in the automobile industry, with its strict requirements, complexity of manufacturing processes and the popularity of its products.

It is, in addition, a promotional industry, fully justifying the high priority given to it in a number of countries.

Conditions for establishing an automotive industry

Before the creation of an automotive industry in a developing country, many questions must be carefully considered. An evaluation must be made of the available resources of the country, and the prospects of medium and long-term economic development must be assessed in order to ascertain the market for the product. Capital must be procured to finance the industry, qualified staff have to be found to manage and develop it and the supply of raw materials has to be assured.

Market. Every developing country should have a co-ordinated transport system for moving passengers and goods cheaply. A study of the potential market should, therefore, include transport requirements.

Much depends on the geographical characteristics of the country, the distribution of natural resources and of population. It is essential, therefore, to project the evolution of these factors for a period of from ten to fifteen years by an exploratory survey that should include, for example, such considerations as the decrease in the rural population in proportion to the increase in the industrial population.

The study should determine whether the existing systems of transport (seaports, railways, roads, waterways and airports) can be developed sufficiently to meet future requirements. It should also define the contribution of road transport, either long-haul (heavy trucks with semi-trailers) or delivery and cargo-transfer vehicles.

The level of passenger transport depends on general

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By Fernand L. Picard

Industry

in Developing Countries

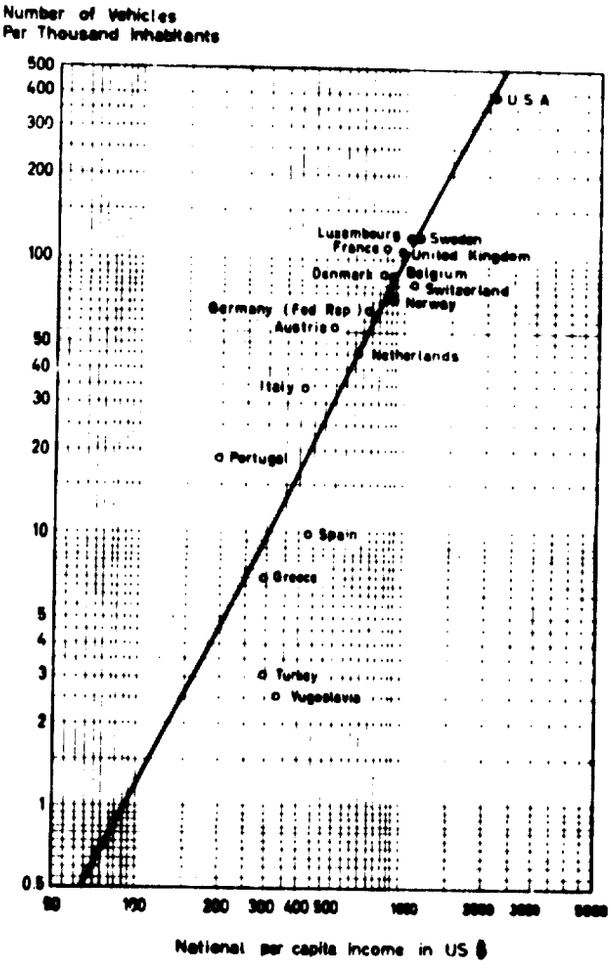
economic development, and in the initial phase there is always an increase in collective passenger transport. Smaller buses suitable for shorter distances have the advantage of being adaptable to traffic increases during transitional periods, of not requiring a heavy investment in infrastructure and of being immediately serviceable. Coach-building is economical and requires skills similar to those used in the building of horse-drawn vehicles.

Collective passenger transport is a transitional phase pending the development of private transport. It may be assumed that the vehicles can be manufactured quickly in sufficient quantity and that, thereafter, manufacture will be for replacement only, that is to say, 10 per cent of the pool a year. This percentage should be borne in mind when contemplating the construction of automotive factories.

Interesting studies have been made on the growth of national pools of private vehicles. One such, made in 1960 by Henri Hondermarcq, Director General of Roads and Bridges in the Belgian Ministry of Public Works, showed that in 1960 the vehicle densities per thousand head of population in relation to the *per capita* income of the countries selected were distributed in logarithmic co-ordinates more or less along a straight line (see figure 1). Another statistician concluded that the number of vehicles per thousand inhabitants varies proportionally with the exponent 1.8 of the national *per capita* income. (Number of vehicles per thousand inhabitants = *per capita* income 1.8.)

The maximum vehicle ownership that can be expected and its growth in proportion to the growth of *per capita* income can easily be calculated from these studies. The figures thus obtained, however, can only be taken as a rough guide and must be interpreted in

Number of vehicles per 1,000 population in relation to national per capita income.



accordance with the relevant social and political structure.

It must be borne in mind that these figures refer to private cars as single units, regardless of size. Moreover, in certain developing countries, the structure of the vehicle-owner population is different from that found in countries where there is a trend towards a homogeneous private car structure made up of vehicles of similar dimensions and characteristics, as in the United States of America.

For a country with, for example, ten million inhabitants and an annual gross national product *per capita* of about US$ 100, it would be unreasonable to plan on the basis of 500,000 private vehicles, as the Hondermarcq graph indicates only seventeen cars per thousand inhabitants, that is a total of 300,000 vehicles. These considerations should make it possible to plan a programme for ten years, forecasting (on the basis of the anticipated growth in the number of inhabitants and gross national product) the annual increase in the number of coaches and buses, utility vehicles and private cars on the road. The annual maintenance and renewal of the existing vehicle fleet necessitates the production of a number of vehicles roughly equal to one tenth of the existing population.

It is for the Government to decide the proportion of total vehicle requirements to be met by imports and by domestic production, and it must adapt the legislative and customs regulations accordingly. If domestic manufacture is to be encouraged, the Government, in order to attract private enterprise, must decide the number of vehicle manufacturers permitted to set up operations and the number of models that they will be able to manufacture.

Road system. A national system of roads is essential. It must be surveyed to ascertain whether it consists of paved or dirt highways; the proportions of each type of road; whether the roads become dusty or muddy according to the season; the maximum gradients in hilly country; the number and type of ancillary facilities, such as bridges and ferries; whether urban roads are paved or metalled and their condition. These facts must be known in order to be able to make a judicious choice of vehicles (utility, bus, coach or private car) suitable for use in the country in question and to decide how they can be made as efficiently and inexpensively as possible.

An automobile construction plant in Algeria showing the assembly of parts.

If motor production is to be encouraged, the Government should have parallel plans for the financing and development of the road system. If a progressive policy is followed, it may be possible to envisage a more rapid development of the motor vehicle construction programme and it may be easier to obtain both domestic and foreign aid.

Ancillary industries. If it is intended to create a local automotive manufacturing industry capable of satisfying average needs, the industries required to supply the basic materials such as steel and petroleum, must be established. Their establishment can be timed to suit the country's development plan, provided this is taken into account in fixing schedules for the incorporation of locally produced materials.

The steel industry must be designed to produce high-quality steel, as the manufacture of motor vehicles calls

for considerable quantities of high standard carbon and alloy steels containing alloying agents such as nickel, chromium or manganese that have to meet strict specifications. Priority must be established for the delivery of these steels by the local steel works in order that deliveries can fit in with the plans for the use of locally produced components. Highly specialized steels such as valve and stainless steels, which are used in small quantities, can be imported for several years without a serious effect on cost. The use of thin-sheet steel for the manufacture of car bodies necessitates the employment of skilled technicians; specialized installations should be imported, until the amount of thin-sheet steel required is sufficient to warrant the full use of such installations and to amortize their cost.

The petroleum industry is connected with fuel and lubricant requirements and the question of the establishment of domestic refineries requires careful study. It is essential that fuel specifications meet international standards.

Apart from primary materials, almost a quarter of the cost of a motor car is in the purchase of particular parts produced by specialized industries. Most countries today produce the glass and textiles they need, but an inventory of the production capacities of such industries should be made to discover whether they will be able to meet the quality and quantity requirements of a local motor industry. The establishment of factories to manufacture accessories such as fuel injection pumps and windshield wipers, should be foreseen.

Technical staff. The problem of the labour force is one of the most difficult to solve. Once a firm is established it can organize an apprentice school to train mechanics and provide advanced instruction for skilled workers. A technical and professional training system must be developed at several levels to provide the industry with the necessary technical staff. This is a government responsibility, and an early decision to set up technical schools, to secure assistance in working out programmes, and to obtain experienced teachers will stimulate industrialization. The lack of qualified personnel is perhaps the most difficult obstacle to overcome.

If the country already has universities providing scientific training, technical schools could be established within their framework. Adult training programmes should also be set up for the teaching of general mathematical and scientific knowledge necessary for the assimilation of foreign techniques. The engineers seconded from the co-operating manufacturer can participate in this programme and such collaboration will also have a favourable psychological effect on co-operation within the enterprise.

Selection of equipment. After the type of motor vehicle (utility or private car) has been decided upon, together with its price level, a choice must be made from all the vehicles produced of this particular type. The first factor in making a selection is the country of the co-operating manufacturer. The choice will obviously be influenced by ties of common language and interest. If two languages are involved, basic documentation must be translated and units of measurement may have to be converted, for example, from the English American system, to the metric system. Community of interest is also a fundamental consideration. Monetary zones, trade agreements, political systems and international relations are all factors to be taken into consideration.

Once the co-operating manufacturer has been chosen, it remains to select the vehicle to be produced. Financial considerations, particularly the question of the most favourable credit terms, may result in the selection of a vehicle that may seem to be technically less suitable. The next task is to adapt the vehicle to the climate, the terrain and the habits of the customers. The key staff of the licensee's trading, sales and service departments must take part in the work of modification so that they become acquainted with the product and are able to market it competently.

Financing. Financing may assume widely varied forms depending on the degree of financial collaboration between the local and the co-operating manufacturers. The question of finance must be examined at the first stage of the planning of the project and must take into account all items in the investment and operating budgets.

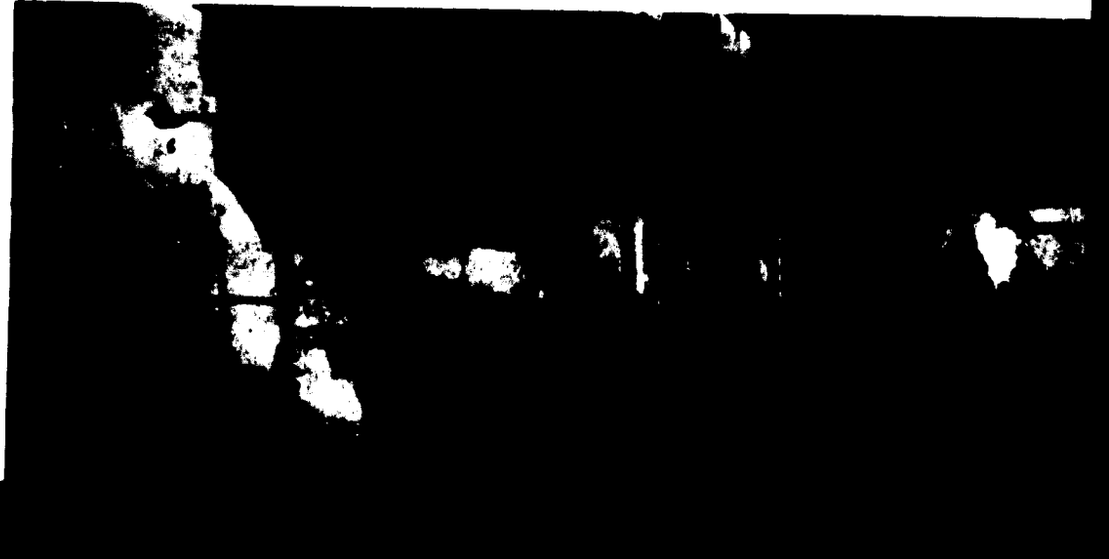
A scrutiny should include the following points:

- The financial plan must cover several years and should specify precisely the amount and timing of the various costs and ways of meeting them. The rate of integration of local industry must be in accordance with the means available for financing the investments needed to bring local industry into operation.

- A table of manufacturing costs should be made to ascertain the reductions expected from the measures outlined.

No item of expenditure must be overlooked in these forecasting studies, which should include:

- Investments in the purchase of land, the construction of factories and the purchase, transport and installation of machine tools;



A factory at Secunderabad, India, which has a production capacity of 9,000 tons of forged parts a year.

- Obligations concerning shipping and the manufacture and storage of parts;
- Costs for the establishment of sales and service facilities, particularly stocks of spare parts;
- Large-scale credit both to dealers and customers.

The phases of integration

Establishment of the factory. The choice of the location of the factory is of the greatest importance, for this choice affects the entire future of the enterprise. Will only vehicle assembly be attempted or is complete manufacture envisaged?

An assembly plant may be best located in the vicinity of a port equipped for handling heavy and cumbersome crates and in a position to dispatch vehicles throughout the country with ease and economy. The establishment of a free port may have advantages, if a large number of the vehicles assembled are to be exported to neighbouring countries. Distribution is always difficult and costly, particularly in areas where road and rail communications are scarce or unreliable. A port location also has the advantage of facilitating contact with the customs administration. Proximity to it may also reduce the time required to begin the production of finished vehicles.

In the case of local manufacture, the choice of location is more complicated, for in the long run economic considerations will be the deciding factors. The local manufacturing plant must be in immediate proximity to a meeting point of rail, road and, if possible, river communications, so that the raw materials and products purchased abroad or domestically can be transported economically to the factory and the finished vehicles to their delivery points. The location of the plant is extremely important and should be preceded by an operational study taking into consideration such future needs as the location of the main suppliers, the major customers and the area permitting the most economical distribution of finished vehicles.

The plant should be located in a large centre of population with cultural amenities and educational opportunities where high-quality labour can be easily recruited. The climate should be temperate so that a large output can be obtained from the labour force without the necessity of spending considerable sums on heating or air conditioning. It should also be dry, since humidity causes oxidation of parts during manufacture, necessitating costly special treatment. The site should be free from sand-bearing winds, as dust shortens the working life of machine tools and endangers the painting process. Finally, the site must be compatible with existing national development plans. Experience shows that the area of the site should be from three to ten times the area required for the initial project.

Seemingly time-saving and easy solutions, such as the purchase of an old vacant factory, should be avoided. Economical high-quality production calls for a plant designed for a specific purpose.

Phases of integration. There are three principal phases in the integration process: *(a)* assembly, when most of the components are imported; *(b)* gradual incorporation of locally produced items, made with imported tools until production is wholly local; and *(c)* national self-sufficiency in tooling and vehicle research.

The last is the ultimate objective, the time taken depending more on the over-all development of the engineering industry and of national education than on the automotive industry itself.

Assembly. This phase can be divided into two stages. The first, known as semi-knocked down (SKD), covers the final assembly of an imported vehicle. It entails the body work (a completely welded shell already painted), the mechanical components supplied in complete units and the interior trim and fittings ready to be put into place. This is a satisfactory temporary solution for small markets as it eliminates costly welding and paint shops, facilitates the training of a labour force, requires the establishment of an organization which includes a quality control department and provides an opportunity for organizing sales and services, for setting up spare-part depots and for the training of operatives for repair and maintenance services.

Once paint shops have been installed bodies can be imported unpainted. Customers often equate the quality of a vehicle with the quality of its finish; this operation should not be undertaken, therefore, until it can be done well.

The second stage is complete knocked-down (CKD) which usually entails the importation of such units as: body work without welding (platform frame, body panels, dashboards, bonnets and wings); mechanical parts (motor, transmission, steering gear, front and rear suspension in complete units) assembled and tested before dispatch; fittings and trim.

CKD can be subdivided into two stages: the first, where body items are shipped in the form of units; the second, where the units are in the form of subassemblies or sets of pieces that are put together on the spot. This method facilitates local fabrication of small sheet-metal items and requires the setting up of welding and body building shops.

A quality control section for outside supplies must be set up with the necessary apparatus for checking incoming articles against specifications. The co-operating manufacturer must take part in this work, sending his experts to visit the suppliers, checking the first deliveries in his own laboratories, making contact with licensers to secure their assistance so that the local licensees can achieve the necessary level of quality. Considerable preparatory work must also be undertaken at the manufacturer's home base, such as specifying the nature and the form of items to be forwarded and gathering them together for packing and shipping.

It is often difficult and expensive to deliver parts to workshops thousands of miles away in the same condition that they would arrive at the co-operating

manufacturer's own assembly line. Packing materials and labour for a Renault 10, for instance, cost as much as assembly of the same car in the manufacturer's workshops. This explains the high cost of SKD or CKD assembly when progressive development of local integration covering accessories is not part of the plan. The CKD formula is, however, worthwhile for distant destinations on account of the saving in freight.

The use of technical expertise during the assembly phase is very important. Welding and paint shop specialists are needed to help local management put the new plant into operation. An engineer must be seconded by the co-operating manufacturer to insure technical liaison, supervise the quality of accessories and equipment bought locally and arrange for the adaptations that might prove necessary. Similarly, a service technician should be seconded to set up the stocks of spare parts in co-operation with the local management of the undertaking and to train mechanics in repair and maintenance.

Incorporation of locally manufactured articles. Locally manufactured articles must be incorporated gradually to insure that vehicles assembled away from the factories of the co-operating manufacturer meet the same quality requirements at the lowest possible net cost.

The replacement of parts from the original manufacturer by locally manufactured parts will be necessary for various reasons:

- Parts may be difficult to transport or may deteriorate during the journey;
- Parts of large dimensions involve freight costs that considerably increase the price;
- Tariffs may protect local supplies by the imposition of a surcharge on imported parts;
- Certain parts may be cheaper to manufacture locally than to import;
- The maximum amount of local labour should be employed in skilled work.

Also to be taken into consideration are the financial relations between the licensee and local industrial groups or policies requiring a certain percentage of national production in the final product.

The selection of parts to be made locally and the moment for their incorporation call for detailed examination. Studies for the planning of local manufacture must be carried out either by the co-operating manufacturer or by a qualified engineering company. Locally manufactured parts will gradually be incorporated into production when they are of a sufficiently high quality. Facilities for producing blanks of advanced design, involving pressure casting in light alloys and foundry precision work with ferrous metals, will not be immediately available, and if it is impossible to import them, special designs will have to be made for the mechanical parts involved.

High-quality steels are required in vehicle construction. Importation of these steels will have to be allowed until the quality of the local product can be fully guaranteed. During this phase the role of the test laboratory and of its quality control facilities will be vital. Usually it will have to be under the direction of an engineer seconded by the co-operating manufacturer, and his judgement must be final. His findings will have to be confirmed by the technical departments of the co-operating manufacturer in the case of all the vital parts of the vehicle and of those affecting its safety. The local quality control section will have to guarantee that series production conforms strictly to the samples provided.

The manufacturing of the body work demands heavy capital investment. Amortization of the equipment over a reasonable period needs large series production. As the sheet metal of the quality required is difficult to obtain locally, local production of the pressings should not be considered in most cases. A more attractive financial proposition is to continue to import them and complete the shell and sub-units locally with tooling supplied by the co-operating manufacturer.

Self-sufficiency in tooling and vehicle research. The phase concerning national self-sufficiency in tooling and vehicle research is very difficult to foresee as it depends on a number of circumstances such as expansion and general prosperity. It will extend over a long period, arising at the beginning of the first assembly phase and becoming more pronounced during the phase of incorporation.

There is also the question of machine tools and equipment. The management should make provision in its investment budget for the purchases needed to expand facilities for the production of tooling and inspection equipment. Training for skilled workers in the industry must then be undertaken.

At first the research office will simply be a classifying and nomenclature registry. Later it will handle modifications and suggest improvements suitable to the tastes of customers. The local office will soon also be able to offer solutions to problems simultaneously with the co-operating manufacturer's research office, and the merits of the solutions can be discussed.

Current situation

Since 1946 the principal American and European manufacturers have been collaborating with the countries interested in promoting the development of automotive industries in their territories. In 1965 important automotive manufacturing countries controlled, either completely or technically, more than 395 factories or assembly lines in 55 countries. There are, however, fairly wide differences in the status of these establishments. They may be classified in three main groups:

- Subsidiaries, in which the company's holding is more than 50 per cent;
- Establishments in which the co-operating manufacturer has a minority financial interest; and

● Establishments wholly dependent financially on domestic companies undertaking assembly or manufacture with the technical co-operation of a foreign manufacturer.

The establishment of these local manufacturing or assembly units has been made necessary primarily because of customs duties and taxes imposed on imported vehicles. Some countries, such as Argentina, Brazil, Mexico and Spain, have progressively reached the stage of manufacturing 95 per cent of various models and, in some cases, the entire car.

Establishing an automotive industry in a developing country demands substantial resources in the form of competent staff, good organization and execution. Patience and time are needed because financial resources are limited. The most difficult task, however, is training, especially of the managerial and supervisory staff. In addition to being educated and skilled in their speciality, they must also be experienced, and experience takes time to acquire.

The methods outlined will enable a satisfactory result to be achieved, but the stages cannot be rushed.

A government can do a great deal to help the manufacturer, a prime necessity being consistency of policy. The programme must be feasible, and the production capacity should not be over-estimated.

Finally, it is essential to protect a developing industry with customs duty on finished imported vehicles to insure reasonable profitability for national investment and to offset the higher net cost due to the modest scale of production and the need to train manpower.

Relationship Between Strength of Plastics and Liquids Causing Defects

A fundamental relationship between the strength of plastics and the liquids that cause them to crack and break has been discovered which makes it possible to predict the susceptibility of any plastic to the formation of small structural defects when it comes in contact with certain liquids. These defects, called crazes, are weakened areas that form in glassy polymers (non-rubbery plastics) and eventually break apart to form cracks and then fractures.

It is believed that the new understanding of the resistance of polymers to liquids will help design engineers to select accurately the most appropriate type of plastic to meet product requirements. Knowledge of the relationship will also permit engineers to design greater strength into plastic products.

Tiny crazes grow into visible streaks as a stressed sample of plastic is immersed in alcohol.

During the research it was shown that crazes are neither solid polymer nor true cracks, even though they are shaped like cracks and reflect light.

Through the use of analytical techniques, including electron microscopy, it was shown that the feathery crazes that form when a piece of plastic is bent or stretched are, in fact, tiny regions interlaced with millions of submicroscopic holes. Because of this sponge-like texture, crazes become weak points at which cracks and fractures may be generated.

The case with which these minute holes form in a craze is dependent upon certain properties of liquids that are placed in contact with the plastic when it is stretched or bent. One of these liquid properties is the ability of the liquid to "wet" the polymer or spread over its surface, the other is the tendency for the liquid to be absorbed by the plastic. The most destructive liquids are those that both wet the surface of the plastic and are absorbed by it.

It is estimated that crazes produced in plastics during contact with liquids such as oils, gasolines, alcohols, lacquers, dry cleaning fluids and various household vapours are responsible for the crazing and eventual failure of transparent containers, airplane windows, eyeglass frames, hairbrushes and numerous opaque plastic articles in which the crazes are not visible.

Adapted from "General Electric Research and Development Center Public Information" (United States of America), 29 November 1968.

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Capital Is Not Enough

IN MANY DEVELOPING countries, the activities of commercial banks in the establishment and expansion of industrial ventures could be complemented. In response to this need, a special kind of bank, which may be called a corporation or an agency, has been evolved to give medium-term and long-term loans at low interest rates and to provide technical assistance and advisory services.

The *Industrial Research and Development News* is carrying a series of articles showing how these institutions operate in various countries. On the following pages are profiles of the Industrial Development Corporation of the Dominican Republic, which has helped finance and provide technical assistance for a wide variety of industrial ventures, including such major projects as an industrial estate and the Medium Industry Bank of Korea, which concentrates its efforts on financing small industries, partly through a credit guarantee reserve fund.

With varying degrees of success, these and other development institutions are helping their countries attract capital, develop managerial skills, identify feasible industrial projects, establish and operate industrial ventures, conduct applied research, provide technical assistance and, in general, accelerate industrial development.

Dominican Republic:

Financial and Technical Assistance from Development Bank

By José Andrés Aybar Castellanos

The Author: *José Andrés Aybar Castellanos has been the Director General of the Corporación de Fomento Industrial since 1966. Prior to this he held such positions as Secretary of State for Finance and Alderman of the city of Santo Domingo. He has represented his Government at international meetings, including the Conference of the International Monetary Fund and the Inter-American Committee on the Alliance for Progress (ICAP) held in Washington, D.C. in 1964, as well as the Inter-American Economic and Social Council Conference held in Lima, Peru, in that same year.*

The Industrial Development Corporation (Corporacion de Fomento Industrial, CFI), an autonomous State organization having its own resources, was established in May 1962 to promote the industrial development of the Dominican Republic in close cooperation with private enterprise.

Incorporating the lessons learned by financial institutions for development in other countries, CFI is empowered to provide supplementary financing for the establishment or expansion of any economically justifiable industrial undertaking and to offer it the necessary technical assistance.

The activities of the Corporation include preparation of projects for industrial ventures, establishment of pilot plants, supervision of the use of loans, awarding of scholarships for specialized studies at home and

abroad, and construction and maintenance of establishments for accelerated vocational training.

Besides the national resources at its disposal, CFI receives financial assistance from leading international organizations. This allows it to grant medium and long-term loans at low interest rates, to make capital awards and to promote the implementation of projects that are valuable to the Dominican economy, joining forces with private investors in order to bring about an efficient process of national industrialization.

Industrial priorities

To facilitate the performance of its specific tasks, CFI has adopted the following general policies:

- To promote and finance the establishment and expansion of industries that will help to meet the needs of domestic consumption, substitute for imports and encourage exports;
- To promote the industrial treatment of agricultural products, the development of mineral resources and the use of a higher proportion of indigenous raw materials;
- To promote the full use of industrial capacity, improve productivity and increase employment;
- To raise the standard of living generally, increase the purchasing power of the population and, in consequence, the domestic market for agricultural and industrial products;
- To attract unproductive savings to activities that are in the interests of economic and social development, and to foster a capital market that will facilitate partnership between Dominican and foreign investors.

Loan policy

Whenever favourable market conditions exist for the articles produced or likely to be produced without an increase being made in the prevailing protective tariff rates, CFI can grant long, medium or short-term development loans. Long-term loans, repayable in from three to ten years, are intended for the financing of the establishment of new industrial enterprises or for the expansion of existing plants when the technical, economic and financial analysis of the requests confirms the desirability of granting such loans.

Medium-term loans are repayable in from one to three years. These are to finance the purchase of machinery and plant for the modernization of industries with prospects for development, and/or for the purchase of raw materials and intermediate goods by enterprises in which the cycle of processing and sale is such as to provide economic justification for this type of loan. Short-term loans, repayable within one year, are intended to finance seasonal and emergency working capital requirements when this type of financing can speed the productive process and permit the optimum use of installed capacity. The applicants must show that they have exhausted all other possibilities of obtaining funds.

Within the periods mentioned, the recipient of the loan will be granted an adequate period of grace, during which he will pay only the interest due.

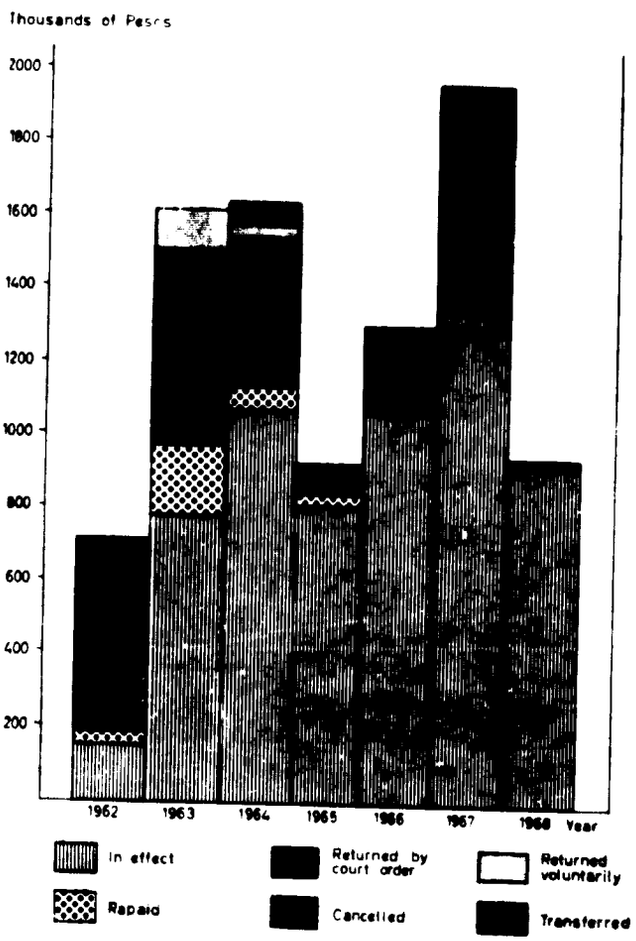
Operating procedures

CFI recently adopted procedures making its operation as a development bank more efficient, particularly in dealing promptly with requests submitted.

An applicant first approaches the Financial Division. Its Evaluation Section interviews him, assesses the project proposed and offers guidance regarding the programme on which he wishes to embark. If the investment requested is consistent with the industrial policy of the Corporation, the applicant is helped to complete a form for a loan request or to prepare the necessary project.

It is important that applicants supply all the information requested by CFI, consent to inspection arrangements, offer adequate guarantees for the loans

Breakdown of loans approved by CFI, by size and year of loan.



they request, use them in the manner decided upon and insure the repayment of capital and interest to the Corporation within the agreed period.

Technical assistance

The Corporation has a well-equipped Promotion Division that offers industrial entrepreneurs economic, financial and industrial engineering assistance. Enterprises financed by CFI receive technical assistance free, and other enterprises requesting assistance pay moderate fees.

Since the beginning of its lending operations in October 1962, CFI has made 601 loans amounting to a total of 7,608,996.44 pesos.[1] Of these, 186 loans totalling 897,569.69 pesos were returned voluntarily or by court order or were impossible to recover, being mainly loans granted during 1963 and 1964 under a programme of loans to crafts and small industries, over 60 per cent of which never operated satisfactorily. Thus a balance of 415 loans, for a total amount of 6,711,426.75 pesos, remained.

These 415 loans are helping Dominican industry to an increase in industrial production of 20,134,000 pesos. It is estimated that 2,340 direct employment opportunities will be created, representing earnings of approximately 3,510,000 pesos, and that 7,020 indirect employment opportunities will be created, with approximate earnings of 7,020,000 pesos.

The 415 loans have been distributed among the following types of activity:

Type of enterprise	Pesos
Bakeries	228,567.07
Batteries	16,000.00
Building materials	906,767.66
Chemicals	360,000.50
Clothing	123,281.90
Communications	53,180.00
Engineering	135,000.55
Fisheries	92,905.02
Food products	440,892.82
Footwear	120,479.95
Grain mill products	94,319.80
Hotels	15,000.00
Jams	53,463.50
Knitwear	211,198.77
Laundries	50,476.50
Leather industry	119,306.00
Manufacture of dairy products	447,782.24
Manufacture of ice	171,353.50
Manufacture of textiles	129,000.50
Mattresses	267,767.67
Meat and meat preparations	274,900.00
Metal products	454,392.23
Miscellaneous manufactures	217,462.32
Paper and cardboard products	728,767.93
Porcelain and earthenware products	511,083.72
Printing	12,000.00
Rubber products	79,000.00
Soft and aerated drinks	87,673.00
Tobacco industry	56,636.25
Wood industry	156,300.00
	6,711,426.75

[1] US$ 1.00 = 1 peso.

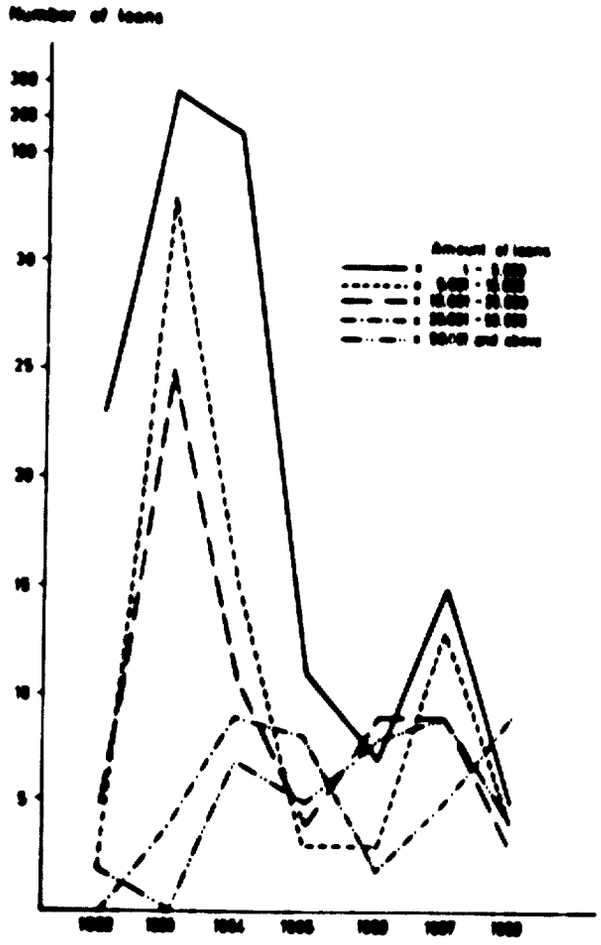
On the basis of the experience of the last three years, with improved specialization of staff and an increased demand for loans for sound industrial products, it is hoped to grant loans amounting to 2 million pesos in 1969 and 2.5 million pesos in 1970.

Herrera Industrial Zone

In an effort to promote industrial development, the Corporation seeks to use the best methods for facilitating the establishment of industrial enterprises by national investors. One of the most effective steps in this direction has been the acquisition of land in the Herrera district for the establishment of an industrial zone. Up to the present time, approximately 74,000 pesos have been invested by the State, as follows:

State investment in Herrera Industrial Zone	Pesos
Studies and planning	5,000
Streets and electricity	25,000
Land donated: 18,900 m² at 2 pesos/m²	37,800
Area allotted to streets (about 15%)	12,000
	74,800

Pattern of CFI loan activity for period 1962–1968.



These investments in the Herrera Industrial Zone have stimulated investments by the private sector in fixed capital assets to a value of 839,635 pesos, as shown below:

Investment by the private sector in the Herrera Industrial Zone	Pesos
Area sold on 5-year term:	
25,144.5 m² at 2.65 pesos (average value)	66,635
Area built on: 5,154 m² (buildings)	243,000
Purchase of machinery and equipment	500,000
Assembly and installations	30,000
Total investment in fixed assets	839,635

This mobilization of domestic savings has resulted in the economic and social effects described below, thus strengthening the zone and encouraging a steady increase in investment by the private sector.

Employment created: 152 posts	Pesos
90 skilled workers; annual wage	126,000
42 unskilled workers; annual wage	31,500
20 administrative employees	100,000
Social welfare payments, 25%	65,625
Total	323,125

These investments required intermediate inputs of 280,000 pesos, as set out below:

Intermediate inputs	Pesos
Provision of electricity, water, telephones etc.	30,000
Production and other materials	250,000
Total	280,000

Six plants are at the manufacturing stage at the present time, and six more are planned to begin production this year.

Breakdown of investment in the Zone	Value in pesos	%
The State	74,800	4.9
The private sector	1,452,700	95.1
	1,527,500	100.0

Now in operation in the Zone are: a clothing factory, sodium hypochlorite chemical works, sock manufacturer, carpet factory, plastics factory, and a small-scale metallurgical project.

One of the most significant projects undertaken in the last decade is the Dominican Metallurgical Complex (METALDOM), financed jointly by the Agency for International Development (AID), Camer International de Espana and CFI; it was opened in December 1968 and is expected to have a positive impact on the economic and social development of the country. More than 600 employees are working at the Complex at the present time, and the monthly pay roll exceeds 100,000.00 pesos.

The total capital cost of this project is 12 million pesos. The principal lines of production will be rolled products, iron tubes and pipes, galvanization, rods for use in construction, metal structures, carts and carriages, locks and furniture.

With the establishment of this industrial complex, it is hoped that the outflow of foreign currency reserves for imports of similar products will be reduced by approximately 5 million pesos annually.

Other current and future projects

CFI, anxious to develop industries in the industrially underdeveloped regions of the Dominican Republic and to take advantage of areas that are rich in agricultural resources, such as the Samaná region, has decided to establish a coconut industry there. The region at present exports copra without benefit to the country owing to the low prices obtained and to the small quantity that can be exported. In addition, there is a shortage of edible oils.

In establishing this industry, CFI is contributing to the economic and social development of the region and insuring a supply of copra that can be used by the industry as a raw material for the extraction of crude oil. The industrial project is at the final stages of installation and is expected to be in operation soon. Its total capital cost is about 556,000 pesos and it will give employment to 35 people; it will also help to reduce the outflow of foreign currency.

Studies have been carried out on specific projects to determine their feasibility. Studies on the following projects are now available to interested investors:

Activity	Total capital cost in pesos
Unbleached pulp for paper from sugar cane bagasse	2,700,000
Wood billets (herbicides)	1,200,000
Caustic soda and chlorine	2,000,000
Cassava flour for bakeries	117,000
Production of dehydrated forage from plantain and/or banana foliage and stalks	300,000
Corn flour for human and animal consumption	236,000

In keeping with its over-all objectives, the Corporation has participated actively in working groups of officials representing public and private bodies appointed to prepare various preliminary drafts for legislation on industrial protection and incentives; these efforts have led to the Industrial Incentives and Protection Law, No. 299, dated 23 April 1968.

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Republic of Korea: Bank Encourages Small Industries

By Pan Young Lee

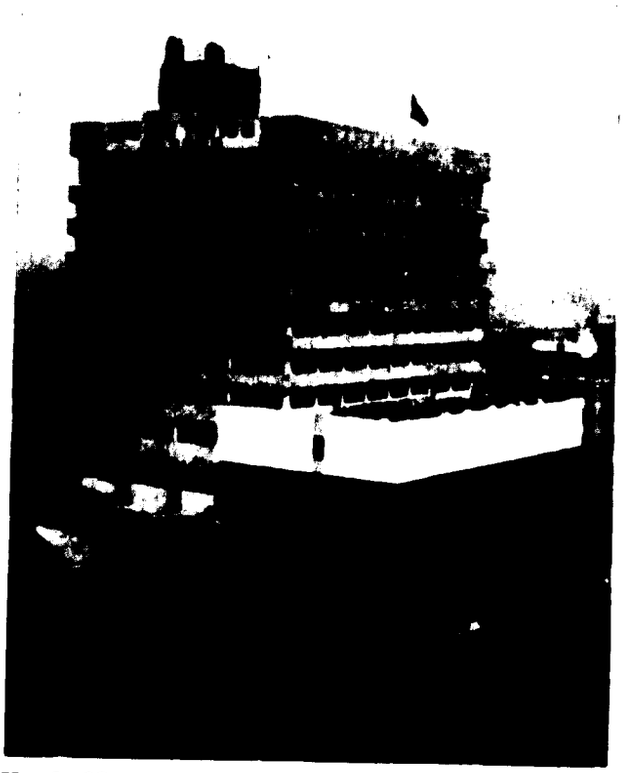
The development of small industry in Korea, as in other developing countries, is a most important factor in the economic, social and political aims of the country in view of the predominant part small industry plays in the over-all economy.

According to the Mining and Manufacturing Census for 1966, conducted by the Korean Reconstruction Bank, there were 24,264 mining and manufacturing establishments in Korea that employed more than five workers, including 23,854 establishments with up to 199 workers in the manufacturing industry and with up to 299 workers in the mining industry. The census also indicated that small mining and manufacturing firms accounted for 58.4 per cent of total employment figures and 44.8 per cent of the total value of production.

Little attention, however, had been given to the development of this sector of industry. It was only in 1961 that small industry began to receive more Government support. The most significant measure in this respect was the enactment of the Medium Industry Bank Act, dated 1 July 1961, designed to lay the foundation for financial support for the growth of small industry. A month later, the Medium Industry Bank (MIB) came into existence as the first financial institution specializing in financing small industry in Korea.

The purpose of the Bank is to promote the independent economic activities of small industry and to help develop its economic position by providing financing facilities.

Apart from normal lending activities, the Bank's functions include the organization of foreign loans, credit guarantees, extension services and research activities.



Head office building of the Medium Industry Bank of Korea, Seoul.

The head office of the Bank is in Seoul and there are 41 branches in principal cities throughout the country. In December 1968, the Bank had 2,269 employees.

Lending activities for small industry

Various factors obstruct the establishment and growth of small industry. These include inadequate production facilities, inferior management and production techniques and limited markets.

After small industry began to be treated as a separate economic category in 1952, the Government attempted to strengthen financial support for it by encouraging commercial banks to enter this field of finance and by providing fiscal funds to small industry on a preferential basis. Such efforts, however, did not prove very effective. Loans to small industry by commercial banks remained insignificant, largely because commercial banks in general were reluctant to handle this type of financing because of the greater risks involved. Even Government loans to small industry did not yield striking results.

As the only financial institution specializing in small industry in Korea, the MIB has been playing a leading role in improving the financial situation of this industry, although financing still seems to be far from satisfactory. As of 31 October 1968, loans to small industry by the Bank accounted for 22,910 million won (about US$90 million) or 24.2 per cent of small industry loans outstanding to all Korean banks.

In addition to its own capital resources, the MIB depends mainly on government loans, deposits received from private investors and foreign loans. At the initial stage, most of the Bank's loans to small industry were financed from government funds. In view of the limited availability of these funds, however, the Bank has made strenuous efforts to mobilize all its resources to provide the maximum number of industrialists with credit. As a result, the share of bank loans rose sharply from 44.3 per cent in December 1961 to 57.3 per cent in October 1968, whereas that of Government loans dropped from 55.7 per cent to 31.6 per cent during the same period.

It is also noteworthy that since 1965 the Bank has been channelling foreign loan funds to small industry. The importance of the Bank's participation in this field cannot be over-estimated in the light of the vital need for foreign capital to make up for the shortage of domestic long-term funds required for modernizing plants and equipment.

The Bank is at present handling three foreign loans: a loan for repair and maintenance from the Kreditanstalt für Wiederaufbau of the Federal Republic of Germany (KFW), a development loan from the Agency for International Development of the United States (AID) and a public loan from the Overseas Economic Co-operation Fund of Japan (OECF). All these were earmarked for financing the foreign exchange costs of installing, expanding, replacing or repairing production facilities of small industry.

The KFW loan committed the Bank to DM 15 million (US$ 3,750,000) following the loan agreement concluded in September 1965 between the Government of the Republic of Korea and KFN. The total amount of this loan was disbursed to 42 borrowers by the end of December 1968.

The AID development loan was initially approved by the AID in Washington in June 1966 for $5 million; $3 million was added in July 1967. The Bank has also submitted an application for an additional AID development loan of $10 million. By the end of December 1968, 20 small industry units had received $1,539,000 in sub-loans financed from the AID development loan.

The Bank acts as the handling agency for $90 million of the public loan from Japan allotted for small and medium-industry development projects. The loan agreement for $15 million for the first year was signed in July 1966, and $9,382,000 was loaned again by the end of December 1968 to 120 new borrowers. The Bank is currently conducting investigations preparatory to lending again the $15 million public loan from Japan.

Credit guarantee operation

The credit guarantee operation is a particular aspect of the Bank's activities. Generally speaking, the growth of enterprises is conditioned by the capital available to them. The basic solution to the problems facing the development of small industry can be remedied, therefore, by supplying the necessary capital. Unfortunately, however, most small enterprises lack the security required for bank loans, so that assistance must be forthcoming from outside. The introduction of the credit guarantee system was designed to supplement the credit of industrialists who experienced difficulties in obtaining bank loans owing to the lack of collateral.

The credit guarantee system in Korea dates back to 26 August 1961 when the Board of Policy of the Bank established the "Regulation Concerning the Operation of Credit Guarantee Reserve Fund" under which the Bank required its loan recipients to subscribe to the credit guarantee reserve fund at a fixed rate. The credit guarantee reserve fund served as the collateral for those industrialists who lacked security.

Up to 3 March 1967, when the Small Industry Credit Guarantee Act came into effect, the Bank handled credit guarantee operations only on a provisional basis, namely in such a way that the Bank made loans on the security of the accumulated credit guarantee reserve funds.

On 1 April 1967 the Bank was designated by the Government as the administrative agency of the credit guarantee operation and began to conduct this type of business on a more organized basis. The Bank issues guarantees to lending institutions for loans to small industry up to a maximum amount of 5 million won

(about US$19,600) per borrower or, in the case of industrial co-operatives, up to ten times the value of capital subscribed.

By 31 December 1968, the balance of guarantees made by the Bank reached 3,438 million won (about US$14 million) for 984 loans, comprising 3,306 million won (about US$13 million), or 916 cases for the Medium Industry Bank, 13 million won (about $51,000), or 17 cases for the Citizens National Bank, and 119 million won (about $467,000), or 51 cases for commercial banks.

Extension services

In addition to its financial operations, the Bank conducts a wide range of extension services to help small enterprises improve productivity and gain an international competitive position by modernizing their management and technology. The most remarkable of these services is the Joint MIB/United Nations Development Programme (UNDP) Extension Service undertaken in 1967 with the International Labour Organisation (ILO) as the executing agency. A plan of operation was prepared after discussions with UNDP, UNIDO and the International Bank for Reconstruction and Development (IBRD). It constituted the formal agreement between the Korean Government, the UNDP and the ILO which was signed on 11 August 1967. Under this project, planned for a period of four years, an international team of experts working in co-operation with local specialists provides small industries with consulting services on such subjects as management development, industrial and production engineering, cost accounting, manufacturing technology and product development.

As part of its own advisory services programme, the Bank sponsors training courses in management, accounting and technology for executives, accountants and plant managers of small enterprises. Bank specialists are also available in the offices of the Bank to advise on problems of banking, management, accounting, taxation and production. The Bank also issues management and technical publications of value to industrialists under the title "Management Guidance Series".

Research Activities

The Bank carries out a wide range of research and statistical activities not only for the benefit of its own financial operations but also to provide economic information for the Government on small and medium industry.

These research activities may be divided into three categories: statistical survey and analytical research on domestic small industry, research on overseas small industry, and the examination of small-industry policy and assistance in policy-making.

The industrial census is one of the most important research activities of the Bank. Four of them have been conducted so far on mining and manufacturing, transport, manufacturing plant and equipment, and small industry. In addition the Bank makes sample surveys on small industrial establishments; it also analyzes data on small industry in foreign countries for purposes of reference and publishes leaflets in English to bring Korean small industry to the attention of the English-speaking world.

Expert Group Recommends Founding of International Association

A group of ten experts meeting at UNIDO headquarters, Vienna, 27–29 May, unanimously recommended that UNIDO take steps leading to the founding of an international organization tentatively designated as the World Association of Industrial and Technological Research Organizations.

Such an organization had been suggested by the International Symposium on Industrial Development held in Athens in 1967.

The primary purpose of the organization would be to strengthen industrial and technical research programmes throughout the world and particularly in developing countries. Copies of a draft constitution and other papers approved by the expert group are being sent to a selected group of representative institutes and organizations throughout the world for additional comments and recommendations.

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70 Attend Investment Promotion Programme in Tunisia

Some 70 industrialists, investors and financiers from sixteen developed countries attended a meeting with representatives of Tunisian industry in Tunis, 28–30 May. They studied opportunities for co-operating in the development of both the public and private sectors of Tunisian industry, particularly the chemical, agricultural and food processing, building materials and textile sectors.

This industrial investment promotion programme was the first of its kind to be organized at the request of an individual country.

This wooden carving has been impregnated with plastic chemicals and then subjected to irradiation. As a result the wood has been converted into a new material which is hard, durable and resistant to fire and insects. This new technique of treating wood is being actively developed because of the advantages it may bring for building purposes and for the manufacture of tools. In some areas where there is a shortage of hard wood the new substitute materials have already been used for construction.

By courtesy of IAEA/Argensek

By Henry Seligman

Industrial Uses of Ra

in Develop

SHORTLY AFTER radioisotopes became available in abundance, owing mainly to the establishment of atomic reactors after the Second World War, their use in industry came to be recognized. Among the benefits that atomic energy and its by-products can give to developing countries, radioisotopes and their applications play a prominent part, for a number of clear-cut reasons. Radioisotopes are cheap, their instrumentation is relatively simple and not too costly, the training of people to handle them can be effected through a comparatively short course, and the maintenance of the necessary equipment is usually no problem. The most important fact, however, is that radionucleides (or radioisotopes), because of the ease with which their radiations can be detected and measured, can be applied in most fields of science, technology and industry.

As early as 1951 an international conference was held on the use of radioisotopes in all fields.

The emphasis of the work of the International Atomic Energy Agency (IAEA) during the first twelve years of its existence (1957—1969) was on radioisotope applications. Although we are at the beginning of an era when nuclear power reactors will be competitive with or cheaper than conventional power stations, the application of radioisotopes will not lose significance

The Author: *Having served as a Deputy Director General, Department of Research and Isotopes of the International Atomic Energy Agency (IAEA) for more than eleven years, Henry Seligman has recently become a scientific consultant to the Director General of IAEA. He has been working in atomic energy since 1940 when he became a member of the war-time team of the British Atomic Energy Project. He also worked with the British Canadian Atomic Energy Effort and served from 1947—1958 as director of the Isotope Division of the United Kingdom Atomic Energy Authority.*

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adioisotopes

oing Countries

Scientists from the IAEA's International Laboratory for Marine Radioactivity in Monaco drawing water samples from the Mediterranean to study the effects of radioactivity in the sea and on marine life.

By courtesy of IAEA

for the developing countries, as there is hardly an industry that does not use them, or scarcely any product manufactured that has not been affected by a radioisotope during manufacture. It may well be said that what a computer is to big business, a radioisotope is to a manufacturing process, with, however, one significant difference: the computer usually replaces conventional methods, while many radiosisotope applications are not only replacing conventional methods, but are in addition yielding results unobtainable by established procedures. Nowadays when producing a quality product, whatever it may be, the control system must be absolutely rigid in order that the product can be competitive on the world market. To achieve this end an instrument using radioisotopes is usually essential.

Methods of measuring radioactivity

The rapidly increasing use of radioisotopes as an applied technological tool is partly the result of recently developed methods of measuring radioactivity. This has led not only to the making of better instruments with radioisotopes incorporated in them, but also to the achievement of greater accuracy in measuring weak radiation, from tritium, for instance, a radioactive hydrogen nucleus that is one of the important nuclei for the assessment of water resources in arid and semi-arid areas.

The radiations of bigger sources of radioisotopes have also had their impact on industry both in connexion with the sterilization of certain products, and with the creation of new materials by polymerization. These processes may be of great value to developing areas.

Another application (which was the subject of an article in Vol. III, No. 1 of this journal) is the irradiation of food for the purpose of extending its storage life. Agriculture in general has profited from radioisotopes through studies on fertilization, animal nutrition, genetics, entomology, and particularly the treatment of parasites. The importance of radioisotopes and radiation in agriculture is reflected in a United Nations Development Fund project recently concluded in Yugoslavia, which resulted in the setting up of a research and training institute to deal exclusively with the application of isotopes and radiation in agriculture. A similar United Nations Development Fund project has been started in India.

Apart from the more general applications of radioisotopes can be added their use in industrial gauging and quality control, including gauging thickness,

The National Institute of Radiation Breeding at Ohmiya, Ibaraki-Ken, Japan, operates a gamma field for the purpose of inducing plant mutations, particularly in rice. It is a large field, surrounded by a high wall with access only through a heavy steel and concrete door for shielding. The radiation tower can be seen on the left and the entrance gate to the right.

By courtesy of IAEA/Goldberger

measuring density and level and industrial radiography. For such important industrial applications radioisotopes are essential in most cases. A normal thickness gauge works on the principle of measuring the absorbed radiation when radiation goes through the material to be processed: the thicker the material, the greater the absorption. Another method is to measure the reflected radiation which depends mainly on the thickness of the material to be measured. Thousands of such gauges are in operation in practically every industry. Another simple but useful application is the determination of the levels of liquids or solids in a container. In many factories, in order to establish the level of packaged materials, isotopes are used for routine checking. The system itself works on the invisible ray principle, each package being automatically X-rayed as it passes the moving belt. Instruments for this purpose are widely used in a variety of industries. The coating thickness of materials, often difficult to measure during the production process, can also be checked by these methods.

A number of radioisotopes have been used as sources for X-rays. The main advantage over conventional X-ray methods is that no electricity supply is required; the source is small, is easily transportable and needs no maintenance; for example, the checks of weldings on a site are usually performed with radioisotopes as X-ray sources. Many other instruments have been developed incorporating radioisotopes; pressure gauges and torquemetres are among them.

Recently an excellent range of instruments for analysing materials in the field has come on the market. This is of great importance to prospectors and often saves sending thousands of samples to distant laboratories in order to assess, for instance, a specific metallic content. These instruments are based on the X-ray fluorescent principle. When the element to be investigated is hit by radiation, it is transformed and sends out the changed radiation, the intensity of which indicates the amount of metal content. Thus, there is a perfect method for a quick, cheap and immediate analysis that is most valuable for prospectors, a method independent of sources of electricity and easy to handle.

The list on pages 29–30 gives an indication of the wide application of such radioisotope instruments in different industries.

Tracer isotopes

Tracer isotopes have been used in a variety of industries and have helped in either the production processes or the checking. It is amazing how widely this method is used. Examples include the use of tracers in industry for: leak detection, the measuring of air movement, mixing efficiency, oil exploration, pollution studies, material transport, measuring the time liquids remain in containers (residence time), volume measurements, solvent extraction, chemical kinetics in solids, purity control, hydrological research, and many meteorological applications. This list, which is far from com-

plete, should give an idea of the very wide application of radioactive tracer techniques.

All of the major oil companies, for example, use radioactive engine parts for testing the efficiency of lubricating oils. Industrial flow rates in factories are controlled in this way because with radioisotopes it is easy to check what happens to materials used in the process. Leak detection by means of radioisotopes is perhaps one of the simpler tracer applications; radioactive gases are being used also for this purpose. The ventilation and checking of air-conditioning requirements are other standard uses.

The dispersion of pollutants, such as sewage and industrial wastes, into the sea has been the subject of intensive studies carried out by means of radioactive tracers. With the help of automatic recording systems and computer programmes developed for the purpose, this has become one of the most successful tracer techniques in use at present. In addition, airborne pollution studies are being conducted with radioactivity and are becoming more widespread. The list on pages 30–31 shows applications of radioactive tracers in different industries.

In recent years radioactive and stable isotopes have been employed to a large extent in solving hydrological questions. Formerly, many problems were resolved by adding radioactivity to the natural environment; now the tritium existing in the environment can be used, together with stable isotopes, to solve hydrological problems that could not previously have been dealt with. Some cases in which radioisotopes can be used to find a solution to a problem are the following: measurement of the rate of flow or the transit time; determinations in sedimentology for a study of the suspended load; sediment movements and erosion studies; determination of the water balance and leakage from lakes and reservoirs. Measurements of soil moisture and soil density have also benefited over the past few years through the use of these methods. The new tools are especially valuable for determining interrelations between water in the atmosphere and surface water, the evaporation from lakes, the salt water/fresh water relationships and generally for the definition of water balances.

Solving water problems in developing countries

As a subcontractor for the Food and Agriculture Organization (FAO), the IAEA has solved a number of water problems in developing countries. Usually the requirement is the exploration of underwater reservoirs in order to determine the volume and rate of the underground flow. Conclusions can then be drawn about the possibility of using the underground water for irrigation purposes. Here the environmental isotope technique has played a revolutionary part by solving problems with a few accurate measurements. Flow rates too, have been measured by using tritium in rivers. In a project in southern Turkey, a study was made on the interconnexion of lakes in the interior of the country with some large springs near the coast. The use of isotope techniques gave a clear-cut answer that no other method could have provided. In addition, the study had important implications for the use of water resources in the region and prevented major mistakes which could otherwise hardly have been avoided.

It may be interesting to note that the FAO and IAEA are collaborating on nine United Nations Development Programme (UNDP) Special Fund (SF) projects, in which the use of environmental isotopes has given, or is considered likely to give, valuable results in connexion with hydrological and hydrogeological investigations. Provision for increasing the use of these isotope techniques is being made in current plans of operation and in formulating new requests.

Of the current projects, two ("Hydro-Agricultural

A Chinese (Taiwan) trainee works with an Indian expert in the operation of a neutron spectrometer at the Atomic Research Centre in the Philippines. It is one of several regional activities supported by the IAEA to develop local facilities both for training personnel and for research.

By courtesy of IAEA/Goldberger

Scientists from the Middle Eastern Regional Radioisotope Centre for the Arab Countries taking readings of tritium-labelled water from a borehole sunk in the desert. Tritium, a radioactive species of hydrogen, considerable amounts of which were produced in the atmosphere during the testing of thermonuclear weapons, or the heavy non-radioactive isotopes of oxygen and hydrogen which are found in all natural waters, provide important, sometimes unique, ways of studying water.

By courtesy of IAEA/Goldberger

Survey of the Senegal River Basin" and "Survey of the Water Resources of the Chad Basin for Development Purposes") concern international river basins and the remaining seven are more limited. They comprise:

- National Resource Surveys, Agricultural Experimentation and Demonstration in the Hodna Region, Central Algeria;
- Pilot Development of Groundwater;
- Groundwater Survey of Two Areas of the Interior;
- Investigation of the Sandstone Aquifers of East Jordan;
- Hydro-Agricultural Development;
- Irrigation Improvement in the Sous Valley, Morocco;
- Hydrogeological Investigations in the Guadalquivir River Basin, Spain.

Industrial uses of big radiation sources

Big radiation sources have also been useful in industry. Massive radiation is applied, usually in order to kill bacteria, and much research effort has gone into the production of chemicals through the use of radiation.

Perhaps the most effective use so far is the sterilization of medical products, such as, for example, syringes or catgut. In one industrialized country, all disposable syringes are prepacked, then sealed and sterilized by gamma radiation. This eliminates any possible infection through the use of syringes and saves the hospital time and labour.

Another industrial application of big radiation sources that has been established through the use of gamma radiation is the curing of paint. In one country a number of chemical preparations are claimed to be produced through the use of gamma radiation, but this is a more complicated process as a number of side reactions are possible.

In medicine the use of big Cobalt 60 sources is widely known for the treatment of cancer, but the use of isotopes as tracers for many metabolic studies is of perhaps much greater significance to the medical profession. The following will give an idea of how widely radio-

activity is used in hospitals today for such purposes. Radioisotopes are used for the study of iron metabolism, red cell survival, vitamin B-12 behaviour, fat absorption, liver function, plasma protein turnover, kidney function, blood circulation, thyroid function and for the localization and determining the size of organs and tumours in the brain, thyroid, heart, lung, liver, kidneys, spleen and pancreas. In other words, it is no longer possible for a good hospital to be without an effective radiation and isotope laboratory. The contribution of radioisotopes to medical diagnosis is becoming increasingly important as a result of recent improvements in measurement techniques whereby smaller amounts of radioactivity and shorter-lived radioactive material are used for diagnostic purposes.

Isotopes have benefited the study of biology. They can be employed as tracers in all living cells and can also be used for analytical purposes. Where minute amounts of materials have to be analysed, the activation analytical method has been the method selected. It is based usually on the uptake of neutrons by the element to be analysed; this results in the emission of a characteristic radiation, so that the material can be carefully assessed.

Isotopes have been extensively used in agriculture as, for example, in the examination of the uptake of phosphorus and nitrogen in studies of plant nutrition. The IAEA has concluded successful co-ordinated research contracts in many developing countries on this subject in order to find the optimum conditions for the fertilization of such crops as rice and maize.

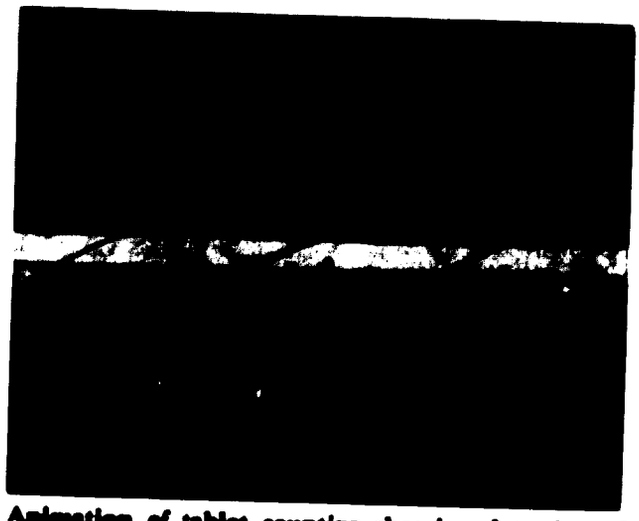
In the genetic field, the use of radiation is giving beneficial results and co-ordinated research is now being carried out on a wide scale. Pest control is beginning to be exercised through the application of the sterile male technique where the pest in question is cultured in the laboratory, the males made sterile by radiation and then released in the infested area. This technique is not equally suitable for all types of pests and a number of problems remain but good results have already been achieved. The importance of the application of isotopes and radiation in agriculture is so great that special institutes have been set up for that purpose.

In a survey of this type only the extremely wide application of radioactivity in many different fields can be indicated. However, every country can benefit greatly from the use of this relatively new tool, which is cheap and easily available. The IAEA has played a prominent part in the work of transplanting many of the applications to developing countries by granting fellowships, sending experts, giving field advisory services, technical assistance projects, awarding research contracts and through the work in its own laboratory. For many years to come, radioisotopes in different forms will be one of the most valuable benefits that developing countries will obtain through the development of atomic energy.

Applications of Radioisotope Instruments

Type of Gauge	Some Applications in Various Industries
	Food and beverages
T	Foods in sheet form, such as dough for biscuits; cheese and meat products
D	Liquid foods in evaporators; fat content of meat food for infants; pulp from distilleries; mass flow of, for example, sugar
L	Package monitors for controlling contents of cans, bottles, packets; counting containers Level gauges on silos, hoppers, storage vessels, process vessels
A	Moisture content of lactose. Analysis of foods
	Tobacco
D	Monitoring and controlling tobacco packing in cigarettes
	Textiles
T	Control of coating and impregnation process in production of cellulose fabrics, tufted carpets, leathercloth, tire fabric, artificial leather, linoleum, adhesive and abrasive cloth
D	Polymer solutions and synthetic yarn solutions before spinning
L	Contents of process vessels, e.g. viscose fabric in dissolvers
	Wood and cork
T	Plywood, chipboard, veneers, moisture and resin content of wood
	Paper and paper products
T	Paper of all qualities and thicknesses; paperboard, pulp; "bone-dry" weight of paper when combined with a dielectric gauge; studies of paper formation. Control of coating and impregnation processes
D	Process fluids, including lacquer and slurries of calcium hydroxide, clay and lime
L	Storage and process vessels, e.g. wood chips in preheaters; pulp and chlorine in bleaching towers
A	Paper leaching
	Rubber products
T	Rubber sheet, foam rubber
D	Latex solution used to make foam rubber
L	Products and processed materials in storage; transport and process vessels
	Chemicals and chemical products
T	Plastic film from extruders; laminated products; wall thickness of plastic tubes and bottles; wall thickness of pipes and tanks in chemical plant
D	Many products and process solutions, such as milk of lime, hot brine, organic materials, acids, alkalis, detergents
L	Level gauges on many product and process materials (e.g. acids, carbon-dioxide, sulphur dioxide, ammonia, asphalt, coal, cement, plastics) in storage and process vessels. Package monitors on such products as detergents, aspirins, toothpaste, cosmetics

T = thickness and mass per unit area; D = density; L = level (including monitors and switches); A = analysis and coating thickness (including moisture); M = miscellaneous (pressure gauges, torquemeters etc.).



Animation of tablet counting showing detection of incompletely filled packages.

By courtesy of the United Kingdom Atomic Energy Authority

Type of Gauge	Some Applications in Various Industries
A	Moisture content of products such as detergents; chlorine content of chlorinated hydrocarbons; potassium content of fertilizers; resin to glass ratio of glass-epoxy materials; concentration of uranium and plutonium in solution
	Products of petroleum and coal
T	Asphalt impregnated products (roofing paper and shingles)
D	Interface detection in pipeline pumping operations; catalyst in cracking units; amount of catalyst in oil; fluidized catalytic processes
L	Coke level in continuous coking unit; interface location (e.g. kerosene to water); level of butane and propane in cylinders
A	S, Co, Pb, N, O and Cl and F content and carbon/hydrogen ratio of petroleum products; boron in boron compounds
	Non-metallic mineral products
T	Paper and textiles coated with abrasives; glass sheet; glass and asbestos fibres; asbestos-cement sheet; slate; selection of refractory bricks
D	Sand, lime, cement; asbestos-cement slurries used in making pipes and shingles; clay slurries in cement manufacture; refractory bricks
L	Molten glass in furnaces; silt in silt basins; sand, clay, cement
A	Glass/resin ratio in fibre glass; boron, potassium, lead, selenium, in glasses; boron in a variety of forms; potassium in ores

Type of Gauge	Some Applications in Various Industries
	Basic metals
T	Pipes in ingots; hot and cold-rolled sheet metal; steel sheet sorting; wear of furnace walls
D	Powdered and slurried ores in processing plant
L	Charge in cupola of blast furnaces; liquid metal in crucibles and moulds; load level in electrothermal kilns and furnaces; dust in electrostatic precipitators
A	Elemental composition of metallic ores and furnace melts; composition of exhaust gases from furnaces
M	Density and temperature of exhaust gases
	Metal products
T	Coated and laminated metal products; bolts, collapsible tubes
D	Detonating fuse
L	Alignment of critical parts in ammunition
	Machinery
T	Sheet material used in machinery; condenser paper, porous rubber sheet and plates for batteries
D	Rubber latex; sulphuric acid for batteries
A	Thickness of coatings or platings on components
	Construction
D	Suction dredging; backfilling of trenches; location of reinforcing bars; evaluation of efficiency of concrete vibrators and control optimum vibration time; inspection of hollow concrete columns
L	Filling of wagons and tank cars; sand and cement in hoppers, mixers, crushers, furnaces
A	Soil density and moisture gauges in construction buildings, dams, roads, airfields

Applications of Radioactive tracers

Type of Application	Some Applications in Various Industries
	Food and beverages
MT	Washing efficiency studies; transfer of contaminants and additives from wrappings, tins, etc.; flow patterns in sugar subsiders
M	Efficiency of food mixers; distribution of vitamins, fats, additives and minor constituents in foodstuffs
Vol.	Sucrose content of sugar beet; water content of food pulps
LD	Storage tanks for beer and wine
ED	Factory waste in rivers and seas
V	Air movement in storage rooms and factories; air filter testing
L	Identification of wines by activable tracers
	Tobacco
M	Saucing efficiency in raw tobacco preparation
V	Air movement in storage rooms

T = thickness and mass per unit area; D = density; L = level (including monitors and switches); A = analysis and coating thickness (including moisture); M = miscellaneous (pressure gauges, torquemeters etc.).

MT = material transport; M = maxing studies; Vol. = determinatinn of volume; LD = leak detection; ED = effluent dispersion; V = ventilation; L = labelling; W = wear and corrosion.

Type of Application	Some Applications in Various Industries
	Textiles
MT	Residence times of fibres and viscose; washing efficiency studies; flow patterns in process vessels
M	Dye and colour distribution studies; distribution of lubricants on artificial silk, nylon and rayon; distribution of wool fibres during carding
W	Wear of fibres
	Wood and cork
MT	Impregnation studies with fungicides
M	Distribution of glue in laminates
W	Wear of wood-cutting tools
	Pulp, paper
MT	Flow rate of water, cooking liquors, pulp, chemicals, effluent and fibres; movement of chips in continuous digesters; concentration dynamics in bleaching towers; flow patterns in process vessels and on paper machines
M	Fibre distribution studies
ED	Waste dilution studies
W	Abrasiveness of filler and fibrous materials, e.g. asbestos
	Rubber products
MT	Residence times and flow patterns in extruders; permeability of gases and liquids through plastic and vulcanized materials
M	Mixing of carbon black, zinc oxide etc. and distribution in final products by using autoradiography
W	Tire wear
	Chemicals and chemical products
MT	Flow rates, flow patterns and retention times of gases, liquids and solids; catalyst loss, efficiency and poisoning; carry-over and re-circulation in process vessels
M	Mixing and blending of gases, liquids and solids
Vol.	Cooling water; gases and liquids in circulating systems
	Products of petroleum and coal
LD	Heat exchangers, double-walled process vessels, underground distribution lines, pressurized containers during storage
ED	Dilution of wastes in rivers and seas
L	Go-devil location
W	Corrosion of tanks and process vessels
	Non-metallic mineral products
MT	Retention, distribution, re-circulation and flow patterns in rotary kilns for cement; deposition of fuel and in rotary kilns; origin of inclusions in glass; flow patterns in glass furnaces and tanks
M	Portland cement concrete and bituminous concrete; additives in concrete
L	Concrete for particular mix identification
W	Grinding balls in cement mills; refractory linings in glass furnaces; corrosion of glass
	Basic metals
MT	Movement of charges in blast furnaces; flow rates and flow patterns of molten metals; liquid-solid interface studies; origin of inclusions; decomposition studies of ores; exchange reaction studies
M	Distribution of alloying components; element distribution studies, e.g. tungsten and cobalt in steel
Vol.	Slag and metal melts
L	Special melts
	Metal products
MT	Flow patterns in aluminium castings; plating studies
L	Joints in wire drawing
W	Corrosion of tanks, etc.
	Machinery
MT	Rate of build-up of deposits and combustion efficiency in internal combustion engines, flow rates in cooling systems; filter efficiency for gases and aerosols
L	Machine parts, e.g. turbine blades
W	Machine parts, e.g. gears, bearings, pistons, dies and cutting tools
	Construction
MT	Distribution of cement and asphalt injections
M	Concrete, asphalt and additives
LD	Water seepage in dams and buildings; newly laid water mains
L	Buried survey stakes
W	Brick and fireclay

MT = material transport; M = mixing studies; Vol. = determination of volume; LD = leak detection; ED = effluent dispersion; V = ventilation; L = labelling; W = wear and corrosion.

Drying sections of element bearing solutions of rock specimens at the Tunis/Carthage Nuclear Centre.

By courtesy of IAEA

By Jean Viet

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Documentation and Development

A BASIC REQUIREMENT for any research worker who is anxious to make a valuable contribution is to be constantly informed of the work that is being done in his particular field, so that he can immediately apply the results of the findings of others. Nowadays this need is being met by rapidly growing scientific information services that specialize in different fields of learning in varying degrees which are more or less attuned to new developments, depending on whether their antennae are extended to pick up international or merely national transmissions.

Transfer of experience and documentation

A pre-condition of economic and social development, in all its aspects, is that experiences should be transmitted from regions or countries which have an abundance of them to those that lack them. This requires, in other words, the ability to detect rapidly the specific information best suited to a particular need and to mobilize it so that it can be passed on rapidly to a given point.

Bearing in mind that much available information is to be found in the form of printed texts, books, articles, expert reports or conference proceedings, we are able to comprehend the role that can be played by information, and specially by the analyzing and abstracting of documents, in promoting development.

Automatic data processing

In the last few years services specializing in the processing of information on economic and social development have been established both in international organizations, suchas the International Labour Organisation (ILO), the Food and Agriculture Organization of the United Nations (FAO) and the Organisation for Economic Co-operation and Development (OECD), and in national agencies, such as the various ministries for co-operation, planning bodies and foundations, like the German Foundation for Developing Countries in Bonn.

These services very soon found that with the traditional methods of documentation, based on the use of bibliographies, card files or catalogues, they could not cope with the increasing flow of written documents, or identify the items of information considered most useful in each of these documents. They needed abundant storage space and a complex system of symbols for the prompt location of the document sought. Only an automated information system based on the use of electronic computers, could fill these needs. Even such a system, however, would not be without its problems and each organization had to experiment on its own before it could agree with others on the basis for co-operation and a division of labour.

The major problem is that presented by processing (abstracting and analysing) information designed for recording on a machine. If, out of a disorganized mass consisting of thousands of documents, one wishes to find the text or texts that can provide a pertinent answer to a given question, one must clearly be able to analyse the content of the documents in great depth. This exactness is normally to be found in the language of the analysis, either as regards the terms used or the links one eventually decides to establish between them.

Only by retracing the thread of thought and considering the various combinations of terms which best express the content of the documents recorded will it be possible to find the necessary information. Hence, the need to devise an information language. It can be either at the point of input or output of the system and it can be very close or very far removed from the natural language; lastly, it is always coded in some way. The terms it comprises must always be designed to avoid ambiguity, as far as possible, and each term has a clearly defined position in respect of the others in the semantic field. These terms are generally known as *descriptors* and are in strict order so that they can be used for the storage and retrieval of the documents. They are used to identify data, describe them, or if preferred, to code them, each item of information entering and leaving the computer solely on the basis of the co-ordinates provided by the descriptors.

Obviously the number of descriptors in an information language will depend on the extent and diversity of the field in which it is applied. In view of the nature of the concepts of economic and social development, they can only be properly conveyed by the use of a large number of terms. In fact, if we were now to count the terms used in the various vocabularies concerned with development, we would find a total of several thousand descriptors.

Establishment of specialized information centres

In recent years, a number of international and national institutions have found it necessary, in order to fulfil their functions properly, to set up information centres which often provide question-and-answer services on all subjects concerned with economic and social development. Not all of these centres, however, can afford equipment for automatic processing of the data at their disposal, and consequently they are not yet as effective as they might be.

Of those which already have such facilities, special mention should be made of the Central Library and Documentation Branch of the ILO at Geneva and the Documentation Centre of FAO in Rome. The former compiled a list of descriptors which was published in August 1966, with subsequent amendments going up to July 1968. The list was built up empirically as the documents produced by the ILO or received at its library were analyzed, and it now provides an information language for its team of analysts, enabling them to publish a weekly bulletin on their findings and to process their data efficiently by computer. The FAO Documentation Centre also compiled a list of descriptors in June 1967; this enabled it to keep track of a large number of documents issued by the organization up to that time and to make up-to-date analyses of new studies.

However broad the field covered by these two organizations might be, it cannot stretch to the maximum possible dimensions of economic and social development. The mere fact that the vocabulary they use is that of a specialized agency of the United Nations means that a number of sectors are beyond their scope or are not fully represented in them. The problems of industrial development, for example, are definitely outside the scope of the questions dealt with in the information language of FAO; apart from the descriptors which relate to the food or wood industries, very few terms that have any connexion with the work of UNIDO are included. Even the language of the ILO, although it can express certain important aspects of industrial development, such as those relating to production, productivity or manpower, was not directly conceived with this context in mind and consequently fails to shed any light on quite a broad area of industrial development.

If the lists of descriptors compiled by ILO and FAO are taken as basic guidelines, and if proper advantage is taken of the invaluable experience gained by these two organizations in automated information, there will still be a need for a more comprehensive coverage if the more successful efforts in the field of information are to be merged into a single whole.

Aligned List of Descriptors

Being specifically concerned with economic and social development, the Development Centre of the OECD seems to have been fully aware of this need as early as 1966. Having a network of correspondents stationed in its various member countries and being confronted, through its Development Question-and-Answer Service, with requests from developing countries, it naturally had to find a means of mobilizing the information received from some countries so as to transmit it to others as quickly as possible. It had a further incentive for this task in that already in 1964 the United Nations Secretariat had suggested the compilation of an international information glossary on economic and social development.

Word-lists were drawn up, culminating in 1966 in the publication of a first *Aligned List of Descriptors*, the main feature of which was to provide some form of compromise between the existing glossaries (those of the ILO and FAO and also those of other international organizations such as the International Commitee for Social Sciences Documentation, or such national bodies as the German Foundation for Developing Countries), reducing them to simple elements (uniterms) that could be used for multiple combinations and providing a relatively short list easy to use in the preparation of analyses.

A test of this first list was made in 1967 by the OECD Development Centre, with help from fourteen international or national organizations which had been associated with the venture since 1965 and from the Statistical Division of the OECD, which made available an IBM 1401 computer and helped with the programming. Some 2,500 documents were analysed by

using the terms on the list, the analysts in the various centres being allowed considerable latitude to make combinations from these terms or to use new ones. Once the analyses had been stored, it was possible to determine the frequency of use of the descriptors, the proportion of new terms to old, and the type of links established between uniterms to obtain compound expressions; for each descriptor used, a network of the other terms appearing in the same analysis was traced and a count was made of their frequency. Questions based on those received by the Development Question-and-Answer Service were fed into the computer and the relevancy of the replies, in the light of the number of documents recorded and the research strategy employed, was carefully studied. As a result of the findings, it was decided that the *Aligned List* should be revised.

While the test had shown that the processing of the documents could be decentralized using a single glossary, the same analytical procedures and uniform cataloguing rules for computer storage and retrieval, it was also clear that the compilation of the glossary required greater rigour and precision. If analysts were left to compose their own descriptors on the basis of a list of uniterms and no one maintained control of the vocabulary that was really useful for retrieval, countless ambiguities could arise, making access to the various memories in the network very difficult.

The compilation of the new *Aligned List*, which began at the end of 1967 and continued through 1968, was undertaken in a spirit of strict adherence to existing usage in international organizations. The task this time was not to draw up a list of key-words so as to be able to cover the other glossaries by means of an arbitrarily selected common denominator, but to incorporate all current vocabularies into a single and unified whole, with the organizations responsible making the adjustments they considered necessary by common agreement. The foundations were thus laid for genuine international co-operation in the field of information.

It is remarkable that this co-operation was maintained throughout the entire period of compilation, with contributions from the ILO, the FAO, the International Committee for Social Sciences Documentation, the German Foundation for Developing Countries and the Development Centre of the OECD. It has now resulted in the publication, in three languages (English, French and German), of the new *Aligned List*

USE OF DESCRIPTORS IN UNIDO

Descriptors are standardized terms that can be applied to the indexing of recorded information. Their standardization facilitates computerization of information storage and retrieval. Through the use of descriptors, the UNIDO services described below will be completely interrelated and will be able to respond quickly to the requests received.

Industrial Documentation Unit. Descriptors will be used to describe the contents of information material such as documents, economic development plans, technical assistance reports, periodical articles, pamphlets and books.

Industrial Inquiry Service. As inquiries are answered, descriptors will be assigned to them so that they can be used to help answer future inquiries.

Advisory Service on the Supply of Industrial Equipment. Descriptors will provide a subject approach to sources of information on the many types of equipment about which inquiries are received.

Roster of Consultants. With the help of descriptors, the Roster can be searched to find the best combination of skills for a particular job.

Industrial Promotion Service. The matching of sources of assistance and potential users of such assistance will be facilitated through the use of descriptors assigned in accordance with subject interests.

Below are examples of descriptor lists for two articles in this publication. The words between diagonal markings are descriptors. Each descriptor has a code number which is fed into the computer for storage and retrieval purposes. The descriptors also serve as subject headings when manual retrieval methods are being used.

Picard, Fernand L., "The Automotive Industry in Developing Countries", *Industrial Research and Development News*, Vol. IV, No. 2 (September 1969), pp. 10–16.

Deals with /automobile industry/ in /developing country/s projecting /passenger transport needs/, need for back-up /steel industry/ and /petroleum industry/, and problems of /transfer of industrial technology/, /location of industry/, /transportation/ of components and finished products, /industrial research/.

Seligman, H., "Industrial Uses of Radioisotopes in Developing Countries", *Industrial Research and Development News*, Vol. IV, No. 2 (September 1969), pp. 24–31.

/Radioisotopes/ in /developing country/s have /industrial applications/ such as in /food preservation/, /chemical assay/, /radio tracer/, /pollution control/, /hydrology/ and /pest control/.

of Descriptors, which was adopted by the Secretariat and various specialized agencies of the United Nations Inter-Agency Working Group on Indexing at UNESCO on 28—29 November 1968, as the instrument for their exchange of information.

Use of the Aligned List

In its present form, the *Aligned List of Descriptors* should greatly facilitate a co-ordination of effort in the processing of useful data on economic and social development. Using a single vocabulary for their storage and retrieval operations, the various information centres will be able to exchange magnetic tapes — so long as they have computers of similar design — and each will be able to benefit from the work accomplished by the others; it should be possible to envisage a genuine division of labour.

In addition to the agencies which participated directly in the compilation of the *Aligned List of Descriptors*, other organizations are already thinking of devising vocabularies dealing with their special spheres. This is the case with UNIDO, General Agreement on Tariffs and Trade (GATT) and also UNESCO.

The *Aligned List* thus constitutes a sort of nucleus which, if carefully handled by the group of agencies using it, can be expected to grow in three different directions. First it will expand by the inclusion of new terms found necessary as a result of analyses prepared or as new vocabularies arise. It will also grow in depth as new definitions are provided for its terms or as certain relations between descriptors are more clearly defined. Lastly it will discard a number of terms for which no use has been found or which prove too ambiguous for efficient retrieval.

Ultimately it is the actual application of the *Aligned List*, even more than its compilation, that will provide the touchstone for international co-operation that, even now, can be viewed as an aid to development. Perhaps the best basis for development is a dissemination of information; after all, the exchange of information is often crucial to economic advancement and may be even more profitable than the exchange of goods.

Expert Group Sets Guidelines for Food Preservation

At the invitation of UNIDO, an expert group met on problems of preservation and refrigeration of food in developing countries 24—27 February in Vienna. Johann Kuprianoff, Director of the Federal Research Institute for Food Preservation, Karlsruhe, Federal Republic of Germany, acted as chairman of the group, which was composed of food technologists from eight countries and the United Nations Economic Commission for Asia and the Far East (ECAFE).

The expert group recommended that developing countries use the simpler techniques of food preservation in the production of low-cost food and reserve the use of more sophisticated methods, such as deep freezing and freeze drying, for special circumstances, for example, preserving high cost commodities intended for export.

The need for flexibility in the approach to fruit and vegetable processing and storage in the tropics was also emphasized. Developing countries were urged to grow for export only vegetables, such as mushrooms, which are widely acceptable and competitive in production costs.

There was general agreement on the need for improved refrigeration services and modern cold storage facilities in many meat producing areas. For local consumption by low-income groups in developing countries, the experts recommended techniques of simple chilling, drying, smoking or salting.

The expert group was of the view that the industrialization of fish fermentation processes should be encouraged as they have wide potential applications. It noted, however, that much research is still necessary in this field and that long-term planning of fishing industries should be considered.

With regard to the dairy industry, the group recommended the introduction by developing countries of sterilization techniques, possibly combined with modern plastic packaging.

In the view of the expert group, it would be premature to recommend food irradiation as a method of preservation in developing countries, but a need exists for more intensive research on factors controlling the quality of tropical foods and the economics of processing. UNIDO, it was felt, should pay special attention to the industrialization of traditional staple foods such as soya sauce, fish paste, wheat flour substitutes, coconut products and rice. The group also suggested that UNIDO should co-operate with other agencies and scientific and industrial organizations in building up and disseminating information on new processes for the production of proteins and amino acids.

Throughout the discussions members of the group emphasized the inter-relation of all aspects of food production, processing, storage and supply, and expressed the hope that UNIDO and other United Nations agencies would work closely together on all food projects, as well as in supporting additional research.

Research Projects

Use of Polyethylene Sheets Increases Agricultural Production

Sheets of polyethylene are now being used in the Republic of China to conserve water in sandy loam soil, to protect plants from the cold and insects and to package bananas for marketing.

Research into the use of polyethylene to conserve water began because western Taiwan had some 100,000 hectares of sandy loam with poor drainage. As fertilizers washed away and top soil substitution was prohibitively expensive, a water conservation layer of asphalt was put down and covered with 50 centimeters of soil. This layer prevented the water from running off and a good rice crop was grown where no rice had been cultivated previously. Subsequent experimentation showed that sheets of polyethylene are considerably more effective than the asphalt.

Taiwan farmers also use polyethylene sheeting to cover young rice plants during the cold season and to shroud banana trees in order to protect them from cold and insects. It has been found that bananas shipped in plastic bags have a storage life ranging from seven to ten days longer than those packed in bamboo baskets with cardboard liners.

A newly opened plant at Kaohsiung produces the polyethylene from ethylene prepared by a local petroleum corporation.

Adapted from "Plastics Help to Grow Rice in Sandy Land", Asian Productivity Monthly Bulletin *(Japan)*, *5 January 1969, pp. 7–8.*

Air-Cushion Support of Ceramics During Firing

The Hoverkiln, a small cross section high-speed kiln for the ceramic industry, introduces the use of air-cushion support of a load during firing. Developed during a five-year research programme, the Hoverkiln is available in two versions: a low temperature electrically heated kiln with a maximum temperature of 950°C and a high temperature gas heated kiln for firing up to 1300°C.

Basically, the low temperature Hoverkiln consists of a passage two and a half feet wide and six inches high through which two streams of ware move in opposite directions. Fans create the cushion of air by forcing air upwards through perforated hearths which form two parallel channels. Only a small force is needed to transport ware through the chamber, as there is little friction when the load is supported on an air cushion. Air is blown through heating elements placed above the two channels, drawn down through the centre of the kiln to the fan and forced upwards again through the perforated hearth. The air serves as both a support and a heating medium; the airflow has been designed to utilize heat from the first ware to preheat in-going ware.

In the high temperature kiln, the load moves in one direction and a reverse flow of gas recuperates heat from the cooling zone.

The ceramic ware is transported through the chamber by one of two methods. In one, unglazed flat tiles

are supported on the air cushion and pass through the kiln as a continuous stream. These tiles are fired in the high temperature gas-fired kiln where the hearth is slightly sloped to assist forward propulsion of the load through the kiln. The speed of flow is regulated by the output conveyor, and a gravity roller input conveyor may be used.

In the other method, tableware and other non-flat items as well as tiles with glazed edges are supported on refractory pallets or bats which are carried on the air cushion. In the electric kiln, an input conveyor with a low-torque slipping clutch drive and a matched output conveyor control the speed of the bats through the kiln. In the high temperature gas kiln the bats are handled on a sloping hearth in the same manner as tiles.

In the low temperature electric kiln, the air cushion acts as the direct heating medium for the underside of the objects or carrier bats. It promotes about 100 air changes a minute in the upper chamber of the kiln, and this assists greatly in the rapid, even heating of the load. The same heat transfer medium operates through the cooling cycle of the load.

The extremely high rate of circulation around a small section load is considered one of the major factors in attaining the rapid firing cycles. Most rapid firing kilns have relied almost entirely on radiant heat transfer, which may cause differential heating because of shadowing and geometrical effects. Also, dark-coloured portions of ware may be heated faster than light-coloured ones.

Donald Shelley, the Hoverkiln inventor, inspecting the chamber of a high temperature kiln.

Decorated cups on trays about to enter the kiln.

The kiln is divided into a number of sections, each fitted with its own air-cushion fan, heating and temperature control systems. The sections are mounted on flanged wheels which run in tracks in the floor. The sections are compressed together during operation but can be quickly taken apart for internal inspection and maintenance.

Among the uses envisaged for the low temperature electrically heated Hoverkiln are:

- Firing on-glaze decoration on china, porcelain and earthenware;
- Hardening-on of prints before glazing;
- The first or bisque firing of felspathic porcelain;
- Biscuit and glost firing of tiles;
- The annealing and decoration of glass;
- Metallizing of electrical porcelain insulators; and
- Vitreous enamelling.

Some of the uses envisaged for the high temperature gas heated kiln are:

- Biscuit and glost firing of earthenware and tiles;
- Glost firing of bone china;
- Firing pressed electrical porcelain insulators;
- Firing of electronic and special ceramics; and
- Firing of grinding wheels.

The Hoverkiln is designed to operate for as many shifts or hours as the management requires and it reduces considerably the handling of goods.

The National Research Development Corporation of the United Kingdom has given the Hoverkiln project financial backing from an early stage. The development programme, which is being carried out by Shelley Furnaces Limited, Stoke-on-Trent, England, is continuing with emphasis in the fields of special ceramics, metal heating and the processing of composite materials.

Adapted from Inventions for Industry, *National Research Development Corporation (United Kingdom), January 1969, pp. 15–16.*

Building a House in a Day

The shells of houses, factories, warehouses and other buildings can now be constructed quickly and economically through a new technique resembling that used by a spider in spinning its web. With a few drums of epoxy resin as the raw material and a specially adapted truck as equipment, the walls, roof and floor for a house can be "spun" on site in a few hours.

The truck transports both the erector machine and all the material required for a one-family house to the site in one trip. The erector is an articulated boom mounted on the truck. A mould, consisting of two parallel flat steel plates, is at the end of the boom. The resin and a foaming agent, both in liquid form, are fed along the boom and metered together into the mould.

The liquid resin is heated to about 95° C and reacts in the mould to give a rigid-cell foam with a density of about six pounds cubic feet within ten seconds. The steel plates are cooled, and as the expanding mass is forced against the sides of the mould, a dense skin forms on the foam. The skin has high tensile strength, chemical stability and resistance to weathering.

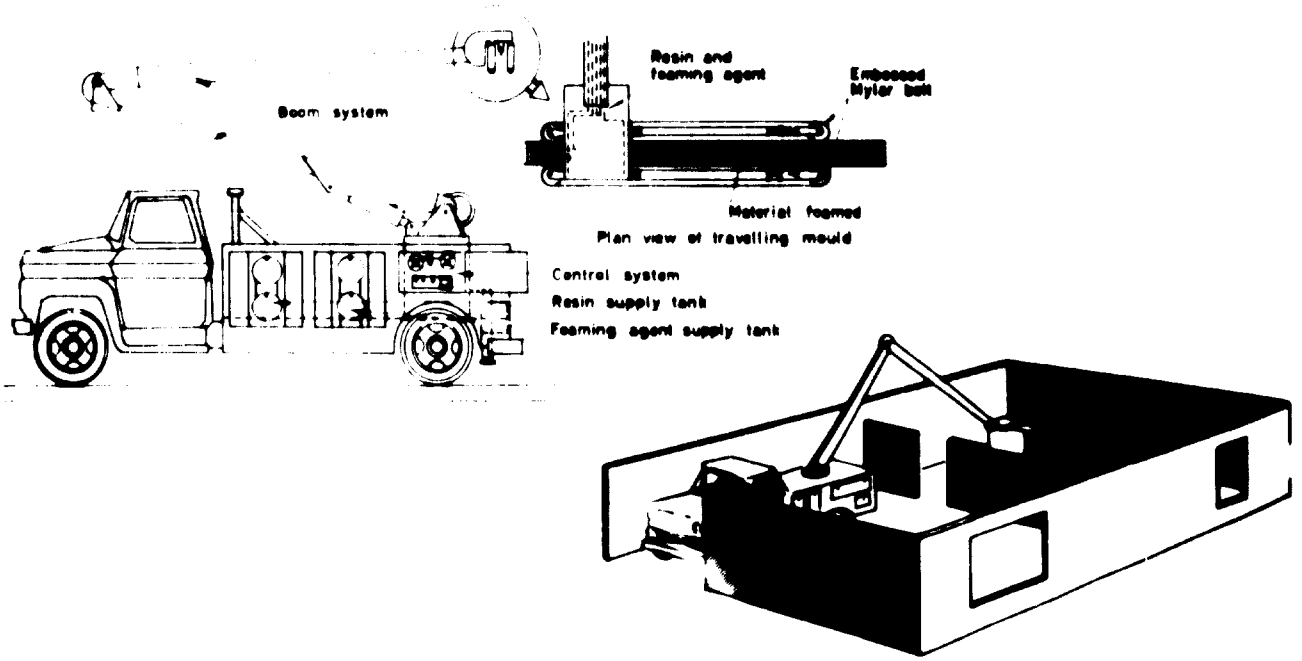
The mould plates are covered with continuous belts of plastic mylar which does not stick to the resin. The belts rotate as the mould moves along a wall section depositing the formed resin slab continuously. The mylar can be embossed to give the walls a suitable pattern or texture.

The material forms as a sandwich three to four inches thick composed of tough outer skins of compressed and rapidly cured resin, and an internal rigid foam which is light in weight and an extremely effective insulator. Along any run of the moulding head the slab is continuous and good adhesion is attained between one slab layer and the next.

Talc or clay fillers can be added to the liquid resin when it arrives on site to increase its durability and rigidity, and also to make the material extremely resistant to fire, more than half the bulk of the foam could consist of these low-cost fillers. Flammability has been reduced in some formulations to the point where the oxidizing part of a Bunsen flame will only cause the skin to char.

The small dead weight of the foam sandwich means that extensive foundations are unnecessary, even for several-storey buildings. An adequate foundation is

Equipment required for building



simply an area of flattened earth. A fibrous mat is spread on the earth and the moulding machine starts layering the walls, leavings gaps for doors and windows. Before the first floor or roof is put on, a layer of earth is spread inside the base walls and flooded with liquid epoxy, which binds the earth and produces a suitable smooth floor. Earth is also heaped against the outside walls to anchor them firmly so that concrete is completely unnecessary. The foundations are, in fact, mainly required to anchor the buildings on to the ground as a protection against storms and hurricanes. The foam is not only cheaper to lay and buy than concrete, but it can also be laid all the year round. The foam cures as it leaves the moulding heads, and so spans and curves can be cast without formers.

Filling the house with basic services — electricity, water and plumbing — can be accomplished quickly enough using factory built modules. One plastic-encased module containing wiring, piping and ducting with the necessary entry and exit points can be set in the floor as it is laid and connected to other complete units as the house is finished.

Finishing inevitably becomes less amenable to mass production as the house nears completion, but with walls, roofs, floors and basic service requirements completed by two men in one working day, the system will certainly cut both labour and materials costs by appreciable amounts. The cost of experimental houses with ground areas of about 1000 square feet was about US $ 3.8 per square foot, which compares very well with $ 16 to $ 20 for a conventionally built house and $ 10 for the most advanced modular building systems being used. Future schemes to reduce costs include numerical control of the building mould by tape from designs transcribed by computer, so that a contractor will be able to buy a building programme along with the basic materials.

The new building technique was developed mainly by Midwest Applied Science Corporation, an industrial enterprise associated with Purdue University, Lafayette, Indiana, United States of America.

Adapted from "Cocoons for the Millions", New Scientist (United Kingdom), 27 June 1968, pp. 675 -676.

Laser Beam Cuts Diffusion Masks

New techniques developed in part from grants supplied by the Ministry of Technology in the United Kingdom under its Advanced Computer Technology Project have enabled Standard Telecommunication Laboratories (S.T.L.), Harlow, to reduce the time taken to make a set of six diffusion masks for semiconductor integrated circuits from four weeks to about two days.

The chief components of the techniques are: the use of plastic tiles for building a model circuit layout; processing circuit data by computer into punched paper tape; and the automatic production of the mask by laser beam machinery using the paper tape as input.

These elements replace the conventional drawing and photographic reduction processes. The masks, ten times larger than the actual circuit, are used for final reduction and repetition for the production of micro-circuit wafers.

The plastic tiles are arranged on a co-ordinate-grid layout table and their interconnexions are drawn and taped on to a transparent, gridded overlay. The main co-ordinates are transferred to punched cards and are the input of the computer.

The process is regarded by S.T.L. as an interim measure to be replaced eventually by entirely computer-aided circuit design that will produce automatically controlled tapes without manual aid.

The laser beam is focused on a spot of between five and fifty microns diameter. The mask blank is a glass substratum coated with film which is exposed to the beam. The blank is carried on a co-ordinate table moving by punched-tape directions, which also switch the laser on and off. The time taken to machine each mask is about 30 minutes. The pulsed helium-neon laser was developed at the Services Electronics Research Laboratories, Baldock, Hertfordshire, England.

Adapted from The Times, *London, 10 January 1969, page 21.*

Answers to Industrial Inquiries

How to avoid casting spots in the sanitary ceramic industry

The UNIDO Industrial Inquiry Service receives requests for possible solutions to a wide variety of industrial problems. Each issue of the Industrial Research and Development News, *beginning with Vol. IV, No. 1, carries a selected list of questions recently answered by the Service so that readers with similar problems may send for copies of the answers. The column also publishes replies to questions concerning problems likely to be encountered in a number of developing countries.*

The topics and identification numbers of several questions and the names of the organizations submitting them are given below.

Techno-economic information on a plant for producing urea from natural gas (213)
Centro Nacional Boliviano de Documentacion Cientifica y Tecnica, La Paz

Recent trends in palm oil prices, production, consumption and trade throughout the world (217)
Banco Central de Costa Rica, San José

The provision of technical know-how for the establishment of a monosodium glutamate factory (219)
Yugoslav Enterprise

The identification and collection of United Nations publications and other material relevant to economic development policy in Africa in general and the Congo in particular (239)
Office National de la Recherche et du Développement, Kinshasa, Congo

Storage, warehousing and industrial processing of potatoes (251).
The Scientific and Technical Research Council of Turkey, Ankara

Information on the beneficiation of magnesite for refractories production and on the beneficiation of chrome ore for refractories as well as on ferro-alloys production (252)
UN Adviser, Lahore, Pakistan

Promotion of export-oriented industries and the encouragement of existing industries to expand their export promotion efforts (255)
Federal Industrial Development Authority, Kuala Lumpur, Malaysia

Methods and equipment for brazing of joints and tubes of bicycle frames. Production methods for the production of bicycle frame joints (257)
United Nations Development Programme, Cairo

Quantitative comparisons on level and rate of industrial development, by main indicators and branches (291)
Economic Planning Authority, Jerusalem, Israel

Tanning and dyeing of goat skins (295)
Greek Productivity Center, Athens

Avoiding casting spots

A UNIDO expert on duty in Ceylon supplied the following answer to a question recently sent in by the Israel Ceramic and Silicate Institute in Haifa on how to avoid casting spots in the sanitary ceramic industry (256).

Casting spots are vitreous annular rings which will not take a glaze properly. According to the technical literature they are due to incorrect compounding of the body, unsuitable deflocculants, wrong viscosity, haphazard methods of filling the moulds and badly made or dried moulds.

Incorrect compounding of the body. The ratio between plastic and non-plastic plays an important role. If the percentage of plastic is lower, the casting spots decrease. If the raw materials contain mica, this fault occurs. In that case it is difficult to keep the homogeneity of the body because mica tends to separate out as an upper layer. If the same body does not contain mica, the casting spots cease. The plasticity of the clays

used is also very important. If the plasticity is higher, the casting spots are higher too.

Unsuitable deflocculants (electrolytes). These play a very important role in casting spots. Specially sodium silicate allows the development of casting spots. The addition of deflocculants must be as low as possible. Sometimes it helps to replace sodium silicate with sodium and barium carbonate. Experts attribute this to the separation of the different body constituents brought on by the electrochemical properties of the divided deflocculated clay colloids.

Wrong viscosity. The wrong viscosity contributes to mica separating and becoming the upper layer.

Haphazard methods of filling the moulds and badly made or dried moulds. The casting spots occur very often at the contact area between the stream of casting slip and the empty plaster mould, and again on the sides if there is any splashing. It sometimes helps to paint with thin slurry or cover with body powder the area of first contact of the plaster mould with the slurry. Casting spots can be reduced by bringing the outlet of the slurry as near the bottom of the mould as possible. When the ceramic is casted, the greater the absorbing power of the plaster mould, the worse the fault. In over-dried moulds casting spots increase.

From my experience it is evident that casting spots are excessively fused places on the cast body. Higher fusing may occur because the content of fusible material is higher in those places where casting spots will be developed after firing. When we analyse the casting slip, we see that the following fusible materials may be found there: fusible impurities in raw materials, such as mica and dolomite, and deflocculants, such as sodium silicate or sodium carbonate.

To avoid the casting spots the raw materials which contain mica (mica is most dangerous because its specific gravity allows the mica particles to separate from the body) should be removed and as little sodium silicate as possible should be used as a deflocculant; or, if possible, the sodium silicate should be removed and replaced by other deflocculants. If the sources of raw materials are limited or if it is not possible for other reasons to follow the above advice, the whole dry sanitary body must be scraped before glazing to remove the thin skin where the content of fusible materials might be higher. After being scraped and sponged, the body must be glazed. This is the method factories use to avoid the occurrence of casting spots.

For a full description of the Industrial Inquiry Service, see "UNIDO Provides Answers to Industrial Inquiries", *Industrial Research and Development News*, Vol. III, No. 1, pp. 22–23.

Questions or requests for further information should be addressed to:

Industrial Inquiry Service
United Nations Industrial Development Organization
P.O. Box 707
A-1011 Vienna, Austria

Expert Group Meeting on Agricultural Machinery Industry

Approximately 25 participants and observers from developed and developing countries, industry and specialized agencies attended the Expert Group Meeting on the Agricultural Machinery Industry in Developing Countries, 18–22 August, in Vienna.

Among the questions for discussion were the following:

- How can existing facilities not fully utilized be adapted to agricultural machinery production?
- What is the current status of the design and technical capability for agricultural machinery in the countries represented at the meeting?
- Can existing facilities be utilized adequately to produce spare parts economically?
- What is the status of agricultural machinery usage today?
- What possibilities of changes in farming will influence agricultural equipment?

A report of the meeting will be published and distributed to the developing countries.

UNIDO Establishing Roster of Industrial Consultants

Recognizing that the role played by consultants in the transfer of technology to developing countries is a most significant one, these countries are making increasing use of consulting and engineering services in implementing their industrialization programmes.

Such services, ranging from the preparation of pre-investment and feasibility studies to the construction and installation of plants, are provided by a growing number of specialist organizations located, for the most part, in the industrialized countries.

As a result of this rapid expansion in both supply and demand, developing countries are often confronted with problems in connexion with the selection of suitable consultants for a specific project and the subsequent procurement of their services. These problems are usually attributable to the limited availability of relevant information on consulting organizations in general.

In response to a recommendation made at the first United Nations International Symposium on Industrial Development in Athens in 1967, and as a follow-up to the publication in 1968 of the *Manual on the Use of Industrial Consultants in Developing Countries*, UNIDO has recently established a Roster of Industrial Consultants as one of the components of its Industrial Information Service. In complementing the *Manual*, the purpose of the Roster is to enable unbiased data on consulting organizations registered with UNIDO to be furnished in response to requests from developing countries for information on the availability of specific skills and services. The Roster data also constitutes a comprehensive reference source for internal use in connexion with the procurement of contractual services for projects for which UNIDO is the executing agency.

The UNIDO Roster currently contains data on approximately 1,500 firms and organizations located throughout the world, while the aggregate consulting and technical services recorded cover every aspect of industrial development.

Prior to registration with UNIDO, a consulting firm (or individual consultant) submits detailed information on such matters as the services it is able to provide, its professional personnel and details of its past experience in the industrial sector. UNIDO obtains this data by requesting potentially relevant consulting firms to complete a questionnaire, which thus constitutes the primary source of information for the comparative assessment of available skills and disciplines required for a given project. It should be stressed that, in the selection and listing of consultants, particular regard is paid to the qualitative evaluation of the capabilities of individual organizations within the framework of the project in question.

The handling of Roster information will be carried out, to an increasing extent, with the assistance of electronic data processing facilities. Computerization of the Roster will ensure not only that the service is more rapid but also that a higher degree of objectivity in the information provided by UNIDO can be attained. Moreover, the flexibility which is afforded by computer operation, with particular regard to the retrieval of Roster data, will facilitate the supply by UNIDO of significantly more comprehensive information on consulting organizations in response to requests of a generalized or specific nature.

UNIDO Initiates Country Survey Missions

UNIDO has recently initiated a new service through which a country may request an industrial survey team to survey the industrial structure of the country and collect the relevant information that would enable it: to assess the resources and market availabilities for industrialization, to identify and evaluate new investment opportunities in the manufacturing sector, to assist in revising industrial policies and programmes and to evaluate further technical assistance requirements. It is hoped that such missions, through the training of national counterparts, will play an important role in enhancing the capacity of the developing countries to carry out their own industrial surveys.

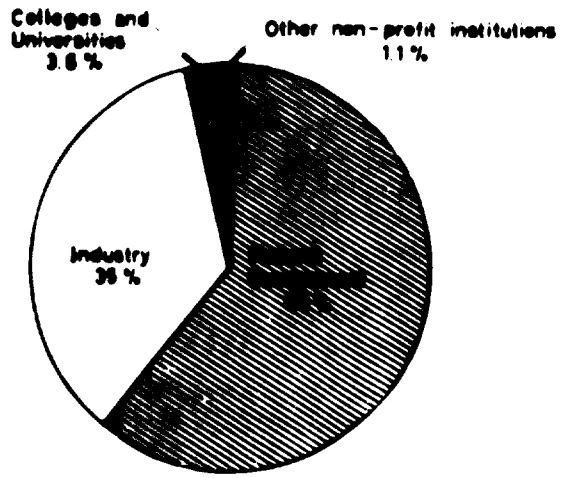
These broad terms of reference vary from one country to another and in drawing them up the specific situation of the country is taken into consideration. The composition and duration of these missions are determined in the case of each individual country in the light of circumstances.

Preparations for survey missions to two countries, Ecuador and Kenya, are already in an advanced stage. Survey missions to other countries are also being planned.

USA Spending Estimated $ 25.9 Billion on R & D in 1969

Total 1969 expenditures for research and development in the United States of America are expected to reach US $ 25.9 billion, according to the annual research and development forecast by the Columbus Laboratories of Battelle Memorial Institute, Columbus, Ohio, USA.

Source of research and development funds



This is an increase of 3.6 per cent over estimated 1968 expenditures of $ 25 billion, but represents a distinctly slower rate of growth than in any year since 1953 when expenditure figures were first compiled. The growth rate from 1967 to 1968, for example, was an estimated 5 per cent, and from 1966 to 1967, it was 7.1 per cent.

The modest increase predicted in total 1969 expenditures is likely to result largely from additional funds provided by industry and by colleges, universities, and other non-profit institutions. Federal support of research and development in 1969 is expected to remain at about the same level as in 1968.

Breaking down the expenditure estimate for 1969 by source of funds, it is expected that Federal Government spending will total $ 15.6 billion; industry, about $ 9 billion; colleges and universities, about $ 938 million; and other non-profit institutions, about $ 295 million. Thus, the Federal Government will be the source of about 60 per cent of all research and development funds; industry, about 35 per cent; colleges and universities, about 3.6 per cent; and other non-profit institutions, about 1.1 per cent.

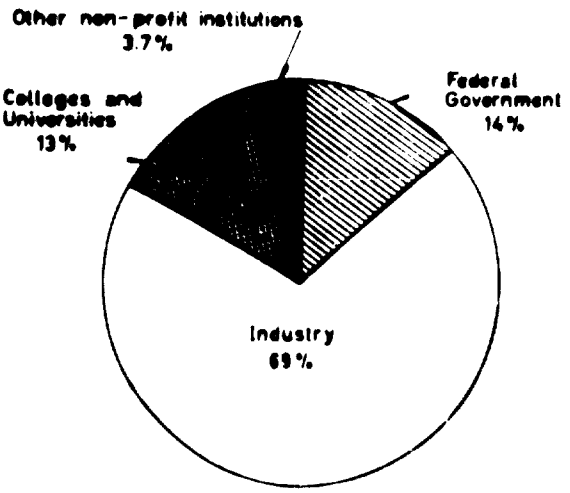
The funding by industry would represent an increase of $ 725 million, or 8.7 per cent; that by colleges and universities, $ 98 million or 11.7 per cent; and that by other non-profit institutions, $ 25 million, or 9.3 per cent.

The declining growth rate of Federal expenditures represents the continuation of a trend. Over the past ten years, Federal expenditures on research and development grew at a compound rate of 9 per cent per year. The growth rate over the last four years, however, has slowed to about 6 per cent per year.

Although the Federal Government is the dominant source of research funds, industry performs about 70 per cent of all research and is, in its own right, a substantial and growing source of finance for research and development.

Non-profit institutions such as colleges, universities, and independent organizations, both fund research and conduct research supported by Federal agencies and by industrial firms. In 1969, the non-profit institutions are expected to provide 4.8 per cent of all funding, reflecting, in part, money received from foundations and state and local governments. They are expected, however, to perform about 17 per cent of research and development. By way of comparison, in 1953 non-profit institutions provided 4.2 per cent of research and development funds, while performing about 11 per cent of the total research.

Bodies carrying out research and development



Adapted from "News from Battelle Memorial Institute Columbus Laboratories" (United States of America), 13 December 1968.

For Your Information . . .

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

Chemical Fertilizer Projects: Their Creation, Evaluation and Establishment, 52 pages (Sales No.: E.68.II.B.17; $ 0.75).

The population explosion and the rising standards of living of the developing countries have combined to cause a serious shortage of food, a situation that is becoming increasingly acute in the world today. How to enlarge food supplies effectively and quickly is, therefore, a critical problem confronting mankind.

As explained in the foreword to this monograph, the first in a series on the fertilizer industry, one of the methods of increasing agricultural production is by an expansion of the fertilizer industry, particularly in developing countries. The aim of the series is to help developing countries establish and/or expand a fertilizer industry by making available up-to-date technical and economic data in this field.

Monograph No. 1 outlines the steps to be taken from the inception of a project to its operation and post project appraisal, suggests procedures that should be followed by those wishing to establish chemical fertilizer projects in developing countries and lists the basic information required on such aspects as the projected market, product data, raw materials, management and labour, and finance. A project evaluation list is also included.

Other monographs in the series deal with the building of an ammonia fertilizer complex, the reduction of sulphur needs in the manufacture of fertilizer, the ammonium chloride and soda ash dual manufacturing process in Japan and the production of phosphatic fertilizer using hydrochloric acid.

This series of monographs is intended to provide a source of reliable information that will prove highly valuable to those in developing countries who are concerned with the question of fertilizers, their production, development and application.

Estimation of Managerial and Technical Personnel Requirements in Selected Industries, 230 pages (Sales No.: E.68.II.B.16; $ 2.50).

Employment and manpower problems besetting the developing countries, particularly at the level of industry, are examined in this new UNIDO publication.

One of the most critical hurdles faced by many developing countries on the road to industrialization is the shortage of qualified personnel at all levels and in key posts in industry. Although raising the general educational level of the industrial labour force is a long-term task, a great deal can be accomplished on a short-term basis by organizing practical training programmes designed to bring occupational skills up to the required levels.

Much of the success of such a programme depends on accurate forecasts of manpower requirements in cases where plans are being drawn up for the construction of specific industrial plants in developing countries. It would thus seem essential for information on the occupational requirements in specific production processes to be much more widely available than is the case at present. The purpose of this volume, therefore, is to provide information that will help to narrow the gaps in essential data, as well as to improve short-term manpower planning methods.

The study deals with the problem of estimating managerial and technical personnel requirements in particular industries including cement, fertilizers, pulp and paper, sugar, leather, glass and metal processing. (Early drafts of these studies formed the basis of one of the main discussion documents presented at the

International Symposium on Industrial Development in Athens in 1967. Although the various industry studies differ in approach and emphasis, most of them use the same basic method for arriving at manpower estimates, that of "international analogy" based on comparable industries in the industrialized nations.

While this type of information can be very useful, the study points out that its limitations should not be ignored. The book does not claim to do more than provide "a rough sort of guidance for occupational staffing patterns. It lists a number of tentative conclusions concerning the formation of skills for industry, suggesting that additional research along similar paths may be warranted. These conclusions relate to the applicability of data from developed economies to conditions in newly industrializing nations, the relative value of different approaches to forecasting manpower requirements, and the problem of identifying the various factors that determine the type of skills needed.

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

Functions and Activities of United Nations Industrial Development Organization, 38 pages (ID/14).

This handbook defines succinctly under nine headings: the purpose of UNIDO; UNIDO programmes of technical assistance; Special Industrial Services; long-term pre-investment projects (Special Fund); seminars and workshops, in-plant training and expert group meetings; how to request assistance under UNIDO programmes; field representation; the organizational structure of UNIDO; and its fields of activity.

The opening pages describe the purpose of UNIDO and outline its main objectives, which include surveying industrial development possibilities, advising on projects at various stages of implementation, and providing assistance in, for instance: making efficient use of new and existing industrial capacity; developing techniques of marketing and distribution; technical and management training; the dissemination of information on technological innovations and know-how; promoting domestic and external financing for specific projects; and establishing or strengthening institutions dealing with such aspects of industrial development as planning, project evaluation, applied research, standardization and quality control.

These activities are supported by action-oriented studies and research.

Charts demonstrate the growth of the Special Industrial Services programme since its inception in March 1966 and the value of UNIDO technical assistance in field projects in Africa, Asia/Far East, the Americas and Europe/Middle East.

A highly important part of the pamphlet is "How to request assistance under UNIDO programmes". It gives eight criteria that are common to all requests and indicates that the United Nations Development Programme resident representative will advise Governments on procedures which vary with each programme.

The handbook includes a chart of the structure of the Organization.

For reference . . .

Below are short reviews of three of the recent books on industrialization which serve as reference books in the UNIDO Industrial Documentation Unit.

Analyse du Sous-Développement en Afrique Noire; l'Exemple de l'Economie du Cameroun, by Philippe Hugon, Presses Universitaires de France, Paris, 1968, 325 pages, F 22.

"Using Cameroon as an example we intend to construct a model which can be generalized for the other African economies; through its geographic, ethnic and historical position, Cameroon constitutes a synthesis of all other African countries" states Philippe Hugon in the foreword of his book about the former French colony. While Hugon's book is a standard work on the social and political problems of the development of French-speaking Africa, his thesis does not seem to be equally applicable to the former British possessions in East Africa. Yet the book is one of the most comprehensive studies of a developing country, and one from which valuable lessons can be learned by everyone interested in the struggle of the developing nations to improve their economic situation and raise their standards of living.

After a brief survey of the economy of the Federal Republic of Cameroon, the author discusses in the first part the social, cultural and economic barriers to development, dealing with the psychological, socio-political, socio-juridical and economic roadblocks that hinder the transformation of an ancient and mainly agricultural society into a modern state. Turning to economic problems, Mr. Hugon stresses the disintegration of the domestic economy into separate sectors, those of traditional subsistence, indigenous agriculture and modern, predominantly foreign, enterprise. He emphasizes the dependency of Cameroon on the export of a few agricultural commodities and the effect on the balance of trade and international payments in addition to the unilateral orientation towards France. In the second part, the disequilibria of growth are examined; among these, subjects related to the demographic explosion, such as budgetary pressures, inflationist tensions and the unequal distribution of income, are of major importance. The third part, entitled "The Strategy of Growth", describes the experience of planning in Cameroon with a proposal for a new strategy.

Industrialization has made great progress in Cameroon; the sales of manufactured products have increased by 30 per cent between 1960 and 1965. The share of industry in the Gross National Product has risen in this period by 56 per cent, an average annual rate of 14 per cent. Private industrial investment more than doubled between 1959 and 1964, and industrial exports represent almost a quarter of total exports, an impressive performance for a newly independent country in Africa. Nevertheless, the problems common to developing countries faced with industrialization are to be found. Although labour is abundant, existing industrial enterprises owned and managed by foreigners use mostly modern labour-saving techniques and hardly affect the labour market or appreciably increase the total wage bill. While availability of cheap labour is advantageous in building up an indigenous industry, even though the labour force would have to be trained, it is much more difficult to remedy the situation when there is a complete absence of local entrepreneurship and a shortage of domestic capital. Another obstacle to industrialization is the smallness of the domestic market; 80 per cent of the population are still on the subsistence level and have a very limited purchasing power. Export possibilities exist only in industries with indigenous raw materials or those operating under specially favourable conditions.

In spite of the difficulties, new industries, mostly producing non-durable consumer goods as a substitute for imported ones, mark the beginning of a really integrated industrialization which, however, needs a new orientation in order to guarantee the continuing growth of the economy. The most important elements of such an orientation are a strong government able to settle tribal rivalries, widespread vocational training of the local labour force in technologies adapted to indigenous conditions, a change of attitudes through education, the building up of an indigenous class of entrepreneurs, research on new uses for local raw materials and industrial processes, and assigning priority to industries that absorb a maximum of the underemployed labour force.

While domestic capital could be better mobilized and could help in financing small industries geared to an expanding local market, foreign private capital ought to be encouraged to invest in up-to-date industries for export. In addition, foreign financial and technical aid is necessary to accelerate the transformation of the economic and social structure and to make Cameroon a viable modern industrial society.

Industrial Research in Britain (6th edition), 1968, Advisory Editor, I. D. L. Ball, Harrap Research Publications, 182 High Holborn, London, W.C. 1., 923 pages, £ 8 8s. net.

An entirely revised and substantially enlarged sixth edition of this standard work of reference concerning aspects of industrial research in Britain has just been published. It contains not only a complete listing of industrial research facilities, both private and public, in Britain and of the leading personalities associated with them, but also a section on the principal international organizations concerned entirely or partly with industrial research, with their addresses. Unfortunately, UNIDO is not included among the organs of the United Nations system that appear in this section. Each entry for the organizations and institutions in Great Britain gives information about the main officers and lines of activity. Besides official bodies engaged in industrial research, names are supplied in this extensive directory of industrial firms, trade and development associations, consulting scientists, universities, technical colleges, professional and learned societies, libraries etc. A bibliography of British periodicals and abstracts covering industrial research completes the wealth of information contained in the volume. A comprehensive list comprising three indexes of names, organizations and subject matter provides easily traceable references to information on industrial research in Great Britain.

Towards a Strategy for Economic Development, With Special Reference to Asia, by H. B. Chenery, F. Baade, J. Kaufmann, I. M. D. Little, L. H. Klaassen, J. Tinbergen, Rotterdam University Press, 1967, 104 pages, US $ 4.

In 1966, the Netherlands Economic Institute organized a Conference on Asian Development, the report of which was published a year later. The booklet contains the full text of the lectures and short summaries of the discussions together with introductory and concluding remarks by J. Tinbergen.

In speaking about "The Effectiveness of Foreign Assistance", H. B. Chenery stresses that the aid provided in the last ten to fifteen years has made a great difference in some developing countries, but goes on to make a strong case for doubling the rate of increase of such aid and suggests abolishing a number of controls exercised by donor countries while asking recipient countries to follow sounder policies in their domestic economies.

"The Agricultural Problems of Turkey, Pakistan and India" are, according to F. Baade, very grave. But while the food deficit in Turkey may be overcome in about ten years by implementing an eight-point agricultural development programme recommended by a team from the Food and Agriculture Organization (FAO) under Mr. Baade's leadership, the situation in India and Pakistan is much more serious. Even if these two countries agree to work closely together on such schemes as damming the Brahmaputra River and reduce their expenditures on armaments in favour of education, it would still be necessary to continue importing food and other aid at a much higher scale than heretofore.

Of particular interest to UNIDO are some of the

"provocative propositions" put forward by J. Kaufmann in his lecture on "Trade Policies for Developing Countries". These include re-structuring world industrial production in the sense that the industrialized countries concentrate on specialized production lines as, for example, electronics and chemicals, while the developing countries could concentrate on less specialized sometimes more labour-intensive industries. In order to promote exports of manufactured and semi-manufactured products from developing countries, tariff preferences which, in most cases, discriminate against finished products ought to be modified. A third proposition to limit the use and production of synthetics encountered strong opposition from many discussion speakers.

I. M. D. Little discussed the advantages and disadvantages of different kinds of aid programmes, especially the various conditions imposed with the acceptance of aid, and L. H. Klaassen reported on "Some Experiences in Transportation Planning in the Republic of Korea". A final chapter summarizes the discussion, at a special session of the Conference devoted to "Factors in Economic Growth", of some econometric growth models in different countries.

The Conference wanted to appeal to Western European public opinion, with the help of the latest scientific findings obtained by economic research, for greater assistance to the developing countries. Whether "not the least important part of (this) activity ...consists in publishing, in concise form, the lectures given and the summary of the debate" remains, however, doubtful, because understanding the lectures and the discussions requires a profound knowledge of modern economics and of the problems of development aid.

Business Opportunities Service Established

A service designed to provide firms in the United States of America with access to information about new business opportunities has been established by a company, which holds a large portfolio of unexpired patents. This Business Opportunities Service offers subscribers the opportunity of acquiring through license agreements, rights to certain products, processes, machines, tools and instruments that have been carefully evaluated for business potential.

In January 1969, the Service began to issue a bi-monthly publication listing at least ten new business opportunities in a number of fields, such as those of electrical machinery, scientific instruments, metal processing and manufacture, plastics, construction equipment, and chemicals and allied products and processes.

A major obstacle to obtaining patent rights in the United States, particularly for small businesses, is the enormous effort and expense required to screen and evaluate thousands of patents for technical feasibility and market potential. In the new Service, such screening is performed in advance by professionals.

The Business Opportunities Service is unique because it provides technical information and know-how with the product or process to be licensed.

The bi-monthly publication will, for example, describe a product or process, state its advantages or benefits, suggest possible uses, provide a scrutiny of the potential market, outline the scope and amount of additional information available, and state the terms regarding availability for licensing.

If a subscriber is interested in exploring further any of the business opportunities described in the publication, he will be able to obtain additional information of a non-confidential nature. This will cover topics such as manufacturing capabilities needed, the stage of engineering development reached, projections for the nature and size of the potential market, an analysis of cost factors, and a summary of the know-how that will be made available as part of a licensing programme.

The Business Opportunities Service is designed to handle a two-way flow of information on patents. A subscriber will be able to list his own issued US patents with the Patent and Technology Marketing Operation. Without additional charge, the availability of these patents will be made known to 170 operating components of the parent company, each of which functions essentially as an individual business.

The service, a subscription to which will cost US$ 150 per year, will be administered by the Business Opportunities Service, Patent and Technology Marketing, New Businesses Development Operations, General Electric Company, One River Road, Schenectady, New York 12301.

Calendar of Meetings

International Congress of Chemical Engineers, Chemical Equipment and Automation (CHISA)

Mariánské Lázne, Czechoslovakia, 15–20 September. Czechoslovak Chemical Society, P.O.B. 857, Prague 1.

Fundamental Research Symposium on Papermaking Systems and their Control

Oxford, United Kingdom, 21–26 September. Technical Section, British Paper & Board Makers' Association, Inc., 3 Plough Place, Fetter Lane, London, E.C.4., United Kingdom.

Second International Congress on the Theory of Machines and Mechanisms

Zakopane, Poland, 24–27 September. Professor J. Oderfeld, Organizing Committee, Al. Niepodleglosci 222, Warsaw 10, Poland. Polish Society of Mechanical Engineers and Technicians; Warsaw Technical University, Chair of Theory of Machines and Mechanisms.

International Foundry Congress

Belgrade, 7–12 September. Professor M. B. Pajevic, Saves Drustava Livaca SFRJ Karnegijeva 4, Belgrade, Yugoslavia. International Commission of Foundry Technical Associations with an International Foundry Exhibition.

International Congress on Metallic Corrosion

Amsterdam, 7–14 September. P.O.B. 52, Shoemakerstraat 97, Delft, Netherlands.

International Council of Societies of Industrial Design (ICSID) Congress

London, 10–12 September. ICSID 69 Congress Secretariat, 12 Carlton House Terrace, London, S.W.1., United Kingdom.

International Federation for Information Processing / International Federation of Automatic Control Joint Conference on Programming Languages for Numerically Controlled Machine Tools (PROLOMAT)

Rome, 15–17 September. Dr. Edwin Harder, Westinghouse Electric Corp., 1204 Milton Avenue, Pittsburgh, Pennsylvania 15218, United States of America.

International Synthetic Rubber Symposium and Exhibition

London, 30 September–2 October. Mary Taylor, c/o Rubber and Technical Press Ltd., 25 Lloyd Baker Street, London, W.C.1., United Kingdom.

Conference on Automation of Small and Medium Batch Production in Machine Building

Esztergom, Hungary, 6–8 October. Scientific Society of Mechanical Engineers, Szabadság tér 17, Budapest V, Hungary.

International Conference on Quality Control

Tokyo, 21–24 October. Union of Japanese Scientists and Engineers, 5–10, Sendagaya, Shibuyaku, Tokyo, Japan.

Electronic and Aerospace Systems Convention (EASCON)

Washington, D.C., 27–29 October. The Institute of Electrical and Electronics Engineers, Inc., Technical Activities Board, 345 East 47th Street, New York, N.Y. 10017, United States of America. Exhibits.

Engineering and Inspection and Quality Control Exhibition and Conference

London, 1–13 November. Business Conferences and Exhibitions Ltd., Mercury House, Waterloo Road, London, S.E.1., United Kingdom.

Australasian Convention of Foundry Institutes

Auckland, 4–8 November. A. W. Sham, Secretary, P.O.B. 2225, Auckland, New Zealand.

Conference of Plastics in Machinery and Vehicle Industry, TECHNOPLAST, '69

Budapest, 10–15 November. Laszlo Prockl, Deputy General-Secretary, Gepipari Tudomanyos Egyesulet, Szabadsag Ter 17, Budapest 5, Hungary.

Technical Conference on Tin

Bangkok, 18–22 November. M. C. Piriyadis Diskul, c/o Dept. of Mineral Resources, Rama VI Road, Bangkok, Thailand. W. Fox, International Tin Council, Haymarket House, 28 Haymarket, London, S.W.1., United Kingdom.

Reliability Physics Symposium

Washington, D.C., 2–4 December. Adolf Goetzberger, Bell Telephone Laboratories, Murray Hill, New Jersey 07971, United States of America.

Vehicular Technology Conference

San Francisco, 2–4 December. William Chaney, Lenkurt Electric Co., 1105 County Road, San Carlos, California 94070, United States of America.

Circuit Theory Symposium

Miami Beach, Florida, 4–6 December. B. Kinariwala, University of Hawaii, Honolulu, Hawaii 96822.

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

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

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

Contributions, suggestions and questions should be addressed to:

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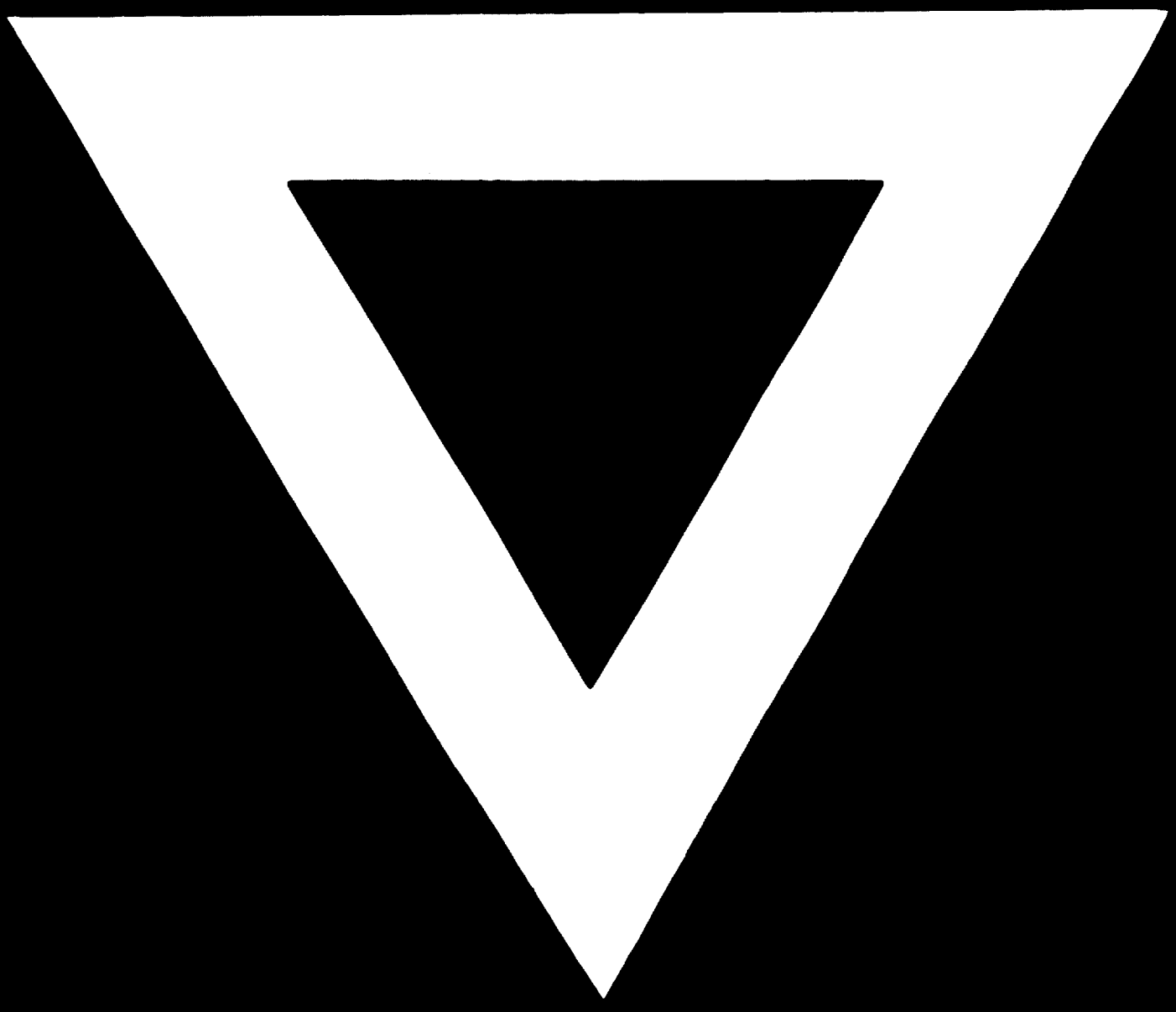

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