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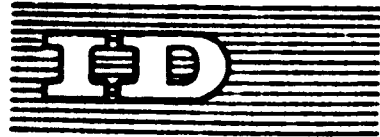
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Issues proposed by UNIDO to the Advisory Committee
on the Application of Science and Technology to
Development for its "Concerted Attack Programme"

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

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Introduction

At the Seventh Session of the Committee, held in New York in April 1967, the Executive Director of UNIDO addressed the Committee, delineating topics of mutual interest to the Committee and UNIDO. Because of the short time that had elapsed since the creation of UNIDO, comprehensive examination of UNIDO's role and programme of work was postponed. In a meeting with the UN Director for Science and Technology in June 1968, the Executive Director of UNIDO agreed that UNIDO would submit to the Tenth Session of the Committee an introductory document suggesting important issues for deliberation, consultation and further work to be undertaken by UNIDO and the Committee with a view to focusing the attention of legislative bodies, the UN agencies, the scientific community and industry in both the developed and the advanced countries. As science and technology has an impact on many aspects of industrialization, the choice of such problems has been rather difficult. In view of the fact, however, that both the work of the Committee as well as that of UNIDO is geared to the needs of the developing countries, UNIDO has attempted to select, after careful consideration, such issues which are of particular importance to those countries.

Foremost among such problems is the development of an optimum technology adapted to the particular conditions prevalent in these parts of the world. The document, therefore, discusses first the issues connected with the generation of a suitable new or the adaptation of known technologies to the circumstances of the developing countries and suggest a number of practical steps in this direction. It then deals with the substantive and institutional questions relating to industrial research within and for the benefit of the developing countries, the problems of product design adapted to their special needs, and of repair and maintenance of industrial equipment whose inadequacy or complete lack is one of the major obstacles retarding the speed of industrialization in developing countries. Equally important is the organization and the institutional prerequisites for the unhampered flow of scientific and technical information and of the transfer of technology which are taken up subsequently.

In addition one specific project of an Integrated Desalination and Chemical Product Plant is outlined since lack of usable water remains one of the biggest road-blocks in the way of industrialization requiring the unrelenting concerted efforts of the scientific and technological community for a speedy solution.

UNIDO is convinced that the Committee after discussing and supplementing these suggestions in the light of the vast experience of its members will concur with UNIDO in assigning to them the highest priority.

Optimum Technologies for Developing Countries

Introduction

The importance of utilizing appropriate technologies to accelerate the process of industrialization in developing countries is generally recognized. In 1965 the UN Economic and Social Council's Advisory Committee on the Application of Science and Technology to Development (UNACAST) in its Second Report expressed its agreement with the UN Centre for Industrial Development, the predecessor of UNIDO, that the problem of technologies "called for special attention". The Committee subsequently singled out this problem as an area in which concerted action was required. The need for a "vigorous employment of more appropriate technologies" was also stressed in the Report of the International Symposium on Industrial Development, which was held in Athens in 1967.

In conjunction with other members of the UN family, therefore, much of the work of UNIDO is already directed towards promoting the flow of industrial technology from the advanced to the developing countries.

While the adoption of an advanced technology will, in general terms, provide the necessary base for industrial expansion, it is, however, evident that techniques employed in industrialized countries are not necessarily appropriate to the conditions and needs of all developing countries. For the maximum benefit to be derived from the utilization of advanced techniques in developing areas, due allowance must be made for such local factors as investment potential, location of raw materials, size of the markets and the available labour force.

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

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

It is perhaps material to set out briefly some considerations which might be followed in the developing and developed countries within this framework.

Developing Countries

The creation of a local scientific and technological infrastructure has been repeatedly stressed by UNACAST. In its Ninth Session it recommended, inter alia, the establishment of a national policy for science and technology embracing education, vocational and technical training and the organization of research institutions and extension services for agriculture and medium-sized industries. These activities and institutions would, a priori, be concerned with the adaptation and utilization of existing technologies within their particular fields as well as the development, in appropriate cases, of optimum technologies suited to their particular needs.

Whether industry in developing countries is in public or private hands, the local government invariably has the ultimate task of equipping it with the most appropriate means of production and consequently promoting the relevant technologies. Not only must it be well-informed itself, but the government can also assist the private sector by providing the requisite information facilities on industrial techniques, problems and plant.

Governments can further promote local industrialization by means of tax exemptions and credit arrangements in respect of those areas where, for instance, raw materials or labour are readily available. In this connexion, they are also in a position to attract foreign industrial undertakings, firstly, by identifying local industrial needs and secondly, by offering favourable terms to potential investors.

In pursuing their function of promoting industrial development, local government should at the same time pay particular attention to the selection of technologies most appropriate to the specific conditions of the area in question.

Developed Countries

The assistance which can be rendered by the industrialized countries in the promotion of optimum technologies falls under two headings: the public sector and in the case of non-centralized economies, the private industrial sector.

The contribution which can be made from the public sector, apart from direct financial assistance, lies mainly in the field of industrial information and research. In as far as the transfer of technology necessitates the dissemination of information, the facilities of national documentation centres and the provision of technical experts for both individual projects and training purposes should be further expanded. Similarly the services of research institutes should be made available and their facilities brought to the attention of developing countries. Governments in advanced countries might also offer tax concessions to industrial concerns to undertake specific technical studies in developing countries.

As in the public sector, private industry should also be urged to mobilise its scientists and research departments and focus its attention on the problems of industrialization in developing countries. By becoming familiar with the technological difficulties encountered in developing countries, industrial concerns in advanced countries would not only be capable of assisting the latter in the solution of their problems, they would also be in a stronger position to extend their operations in new areas. Industrial organizations such as Chambers of Commerce and trade and research associations might be further encouraged to organise fact-finding missions in developing countries to identify potential industrial openings for their members.

As regards the current contribution of private industry in the field of research, it should be mentioned that large concerns in North America and Europe are already engaged on the design and development of a scaled-down plant for ultimate use in developing countries. In one particular case, a model factory has been set up and is operated under such stimulated conditions as might be the typical of any developing country. This is the Utrecht Pilot Plant, which merits a more detailed description:

In 1961, a well-known Dutch manufacturer of electrical goods, established in Utrecht a small factory for the production of transistor radios. The plant was erected away from the main production site with which communication is only by letter and is self-contained in every respect, from the management down to the locally recruited unskilled labour force. It has its own accounting system, production equipment and simplified administrative procedures and organization methods have been devised. It manufactures its own tools and tests new small, inexpensive and unsophisticated manufacturing methods.

At the Athens Symposium the extreme importance of establishing a small, but well functioning and self-supporting radio industry was stressed since radio is the sole means of communicating important information and education to predominantly agricultural populations. The Committee may wish to discuss the Utrecht Pilot Plant with a view to inviting other engineering industries in the developed market economies or in centrally planned economies to follow the Utrecht example.

In conclusion, the Committee may be able to propose additional approaches which might be adopted in the promotion of optimum technologies for developing countries.

Industrial Research

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

Industrial research in the advanced countries

Research institutions in the industrialized countries are, of course, interested primarily in the problems of their own industries. The great majority of such problems arise within the framework of the national technological, social and economic conditions and are not always of direct relevance to developing countries' conditions.

In order to mobilize the immense research possibilities of advanced countries to benefit developing countries, the most pressing research needs have to be communicated to the appropriate research institutions along with some incentive for working on these problems. Whenever a developing country does not have the resources to deal with a research problem, it may be wise for the government to request the assistance of an international agency, such as UNIDO, in analyzing the problem and in channeling its request for the solution to the most appropriate industrial research institution.

Almost all governments in the industrialized countries are stepping up research activities in their respective countries. They are to be urged to request government-assisted research institutions and universities to include research projects and activities of particular interest to the developing countries in their current and future work programmes.

Industrial research in the developing countries

On the basis of recommendations made by the Centre for Industrial Development (UNIDO's predecessor), the Committee selected areas for concerted attack (cf. Report of the Fourth Session of UNACAST, Nov. 1965, E/4026, par. 90-92). The Centre suggested establishing and strengthening local institutions in the developing countries, establishing more effective procedures in the industrial countries, and establishing procedures in the industrial countries to give due priority to the allocation of resources for the solution of problems referred to them.

Since these recommendations were made, UNIDO has helped to establish seven industrial research and promotion institutes and has assisted (as part of its regular programme and under UNDP) a number of industrial research and promotion institutes in outlining more effective procedures, planning and directing research programmes and identifying research policy. The Centre for Industrial Development, in co-operation with the Bureau of Technical Assistance Co-operation, held an Interregional Seminar on Industrial Research and Development Institutes in Beirut in 1964. Representatives from twenty-four developing countries, observers, expert consultants and Centre staff members participated. The Seminar covered three broad categories: the concept and objectives of industrial research institutes, industrial extension services, and organizational concepts and problems. The report of the Seminar (ST/TAO/Ser.C/77) includes recommendations that delineate possible areas of action by the United Nations and the governments of developing countries.

During the Seminar, management of institutes emerged as a problem of particular importance. In 1966, therefore, UNIDO published a "Manual on the Management of Industrial Research Institutes in Developing Countries" (UN publications, Sales No.: 66.II.B.3 ST/CID/6). In 1967, UNIDO held an Interregional Workshop of Managers of Industrial Research Institutes in Developing Countries.

Industrial research was discussed at the International Symposium on Industrial Development (Athens, 1967), which recommended the following:

- (a) Investigate all possible new uses for local raw materials;
- (b) Adapt existing technology to the prevailing conditions (human, capital and natural) in the developing countries;
- (c) Devise, wherever possible, linkages between products and stages of processing as a basis for viable industrial complexes. (10.cit.p.19)

At present UNIDO is playing an active role in the establishment of an International Association of Industrial Research Institutions which will facilitate the exchange of experience, know-how and professional expertise. UNIDO issues a quarterly magazine, "Industrial Research and Development News", as a liaison journal for those engaged in industrial research activities. In 1969 and 1970, UNIDO intends to compile and publish - in cooperation with the regional commissions of Africa, Asia and the Far East and Latin America, UNESOB and UNESCO - a directory of industrial and technological research institutes.

ECAFE has convened a Consultative Group for Promoting Co-ordinated Industrial Research upon whose recommendation the ECAFE Advisory Council for Industrial Research was established. The Committee may want to invite the ECA, ECLA and UNESOB to investigate the possibilities for setting up similar councils in their respective regions.

Problems which are of regional interest may be solved economically and efficiently through the establishment of regional institutions. Sectors of industry in a region may pool their sources and establish regional research institutes catering to specific needs or allocate specific research projects to each of the existing research institutes.

Attention should also be drawn to the necessity of close working relationships between local industry and research institutions. Industrial enterprises should be assisted in combining to set up co-operative research facilities. Governments in these countries should once again be advised to provide guidance as well as financial and other assistance to research institutions and to increase the research consciousness of industries. Governments should address themselves to the appropriate UN agencies, governments of industrialized countries and private foundations for financial and other support. As has been recommended by the Interregional Seminar, however,

"Industrial research and development institutes should be given the greatest possible autonomy to enable them to function in the most efficient manner without the inhibitive influence of ordinary government procedures and restrictions" (ST/TAO/Ser.C/77/Vol.1,p.13).

UNIDO suggests that the Committee urges governments of developing countries to earmark at least one quarter to one half of one per cent of their national budgets to industrial research.

Product Design Adapted to the Special Needs of
Developing Countries

The implementation of the results of industrial research often requires the redesign of established products or the design of new products.

The organization of product design varies considerably in the industrialized countries, ranging from independent firms or individuals specializing in certain activities to design departments in industrial research institutions or big enterprises. These firms or departments may be quite elaborate, comprising such services as drawing, testing, inspection, process planning and cost accounting. In the "affluent society", product design often remains the only weapon of firms in a highly competitive industry, such as the automobile industry in the United States. The few large companies spend millions of dollars in re-designing automobiles which have little technological improvement but attract buyers through new styles or additional gadgets.

The situation in the developing countries is generally quite different. The emphasis is not on style but on function, durability and price. One example is agricultural implements. As the FAO has pointed out,

"For widespread acceptance in developing countries improved implements should have certain essential characteristics. They should be simple to use, sturdy, inexpensive, capable of being repaired locally, and be significantly more useful and efficient than the existing implements. In most instances it is feasible to manufacture such improved tools in the developing countries themselves since investment costs are low, the techniques of manufacturers are simple and economies of scale are not pronounced. There is, however, considerable need for more research to improve existing implements, and to modify and adapt implements which have been developed elsewhere."

(FAO: The State of Food and Agriculture, 1968, Chapter III, Subchapter: Role of Science and Technology, p. 93. Rome 1968.)

Product design is markedly similar to that in the industrialized countries only for export products, which must compete on the basis of appearance as well as function. In this connexion, designers must pay attention to making their products comply with standards in the prospective importing countries.

In the developing countries product design as a special branch of industrial engineering is still in its infancy. Usually foreign designs are bought or utilized under licensing agreements.

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

The Committee dealt with this issue in its Eighth Session and has proposed that planning and design bureaux in the developing countries should be promoted intensively. It has stressed the importance of such bureaux for small as well as large manufacturing enterprises. The Committee has pointed out that planning and design bureaux can contribute to better utilization of national resources and to introducing an optimum industrial technology based on that in advance countries. In conformity with these proposals UNIDO, acting as the Executing Agency of an approved UNDP project, assisted the United Arab Republic in establishing an Engineering and Industrial Design Development Centre.

This Centre is:

to provide the Government with a central facility to handle all aspects of planning, development and prototype construction of machinery and equipment, as well as for a large variety of mass-produced products for industry and commerce;

to serve as an experienced and practical organization for the most efficient screening of new or modified industrial developmental projects for both private and nationalised industries; and

develop an applied training programme in industrial design for graduate engineers through real work exercise.

As a prerequisite for implementing the project the Government has been requested to send a number of young engineers abroad for training in industrial design.

The Centre will have development, engineering, industrial design and prototype execution divisions.

Another example of such an institute operating in a developing country is the Central Machine Tool Research Institute at Bangalore, set up by the Indian Government with bilateral help. Among its functions are developing new designs, improving those already in existence and training designers for industry (Report of the Interregional Symposium on Metal-working Industries in Developing Countries, Moscow 1966, UN Sales No. 68.II.B.9).

These two examples show already that institutions for the promotion of plant and product design in the developing countries can either serve the whole industry of a country or one particular sector, depending on the size and diversification of the former. In both cases the Government has initiated and carried out the project and has financed it with some foreign help. Short-term assistance of foreign experts proved to be necessary.

In view of the importance of product design to the industrial development of the developing countries, a concerted attack on this problem seems to be warranted. The Committee ought once more to urge those agencies of the UN system which are dealing with industry, manpower and education as well as all governments granting bilateral financial or technical aid to ask their recipients to give high priority to establishing suitable institutions for engineering design in their requests for aid.

Repair and Maintenance

Devoting industrial research, in-plant or product design activities to generating new and adapting known technology to the particular needs and conditions in developing countries will produce little effect and may result in a considerable waste of capital and human effort if the utmost care is not taken in the repair and maintenance of industrial facilities which have been or will be installed in the developing countries. UNIDO feels, therefore, that repair and maintenance of industrial equipment constitutes a very important issue and deserves to be included in the concerted attack programme of the Committee.

In this respect, shortcomings in the developing countries have been clearly set out in the Report by the Group of Experts on Maintenance and Repair of Industrial Equipment in Developing Countries (UNIDO Document ID/1 of 21 April 67). These are:

- (a) Insufficient realization of the problem by both Industry and government;
- (b) Lack of adequately trained personnel;
- (c) Poor utilization of industrial equipment, excess capital investment and high production cost;
- (d) Inappropriate local attitudes towards repair and maintenance;
- (e) Neglect of preventive maintenance;
- (f) Serious problems of quality in terms of engineering technology, quality control and supply of raw materials of correct specifications in the local manufacture of spare parts.

In order to help alleviate these obstacles to the efficient utilisation of modern industrial equipment in developing countries, the Group of Experts formulated a number of recommendations for these countries, the industrially advanced countries and also for the United Nations. Of those directed to developing countries the following two should be of particular interest to the Committee:

- (1) Use of designs for special sturdy equipment with a minimum of gadgets and better tropicalization to reduce need for repair and maintenance;

- (2) Closer contact with design centres in developing countries to enable the promotion of local design for equipment and spare parts.

In many developing countries it is necessary to prevent excessive damage to equipment by climatic conditions and to provide protection against dust, sand, heat and humidity. The need for special durability and reliability on service of machines and machine-tools is very urgent, and further research for new materials, new methods of testing or additional technological improvements and some new system of repair and maintenance specially geared to the conditions in developing countries is required.

The organization of the most suitable repair and maintenance services in developing countries might be emphasized by the Committee as a means for better utilization and longer life of scientific and technological equipment. The Report by the Expert Group includes an analysis of the various organisation methods for efficient repair and maintenance programmes.

Repair and maintenance may be provided by the supplier of industrial machinery and equipment, but this has the disadvantage of an everlasting dependence on the original supplier and on the import of spare parts if the supply source is abroad. It also prevents or delays the building up of an indigenous system for repair and maintenance. Where equipment has come from different supply sources, this type of service does not provide uniform maintenance for all production equipment in a plant. The Experts, therefore, were in favour of providing a special indigenous repair and maintenance system which may consist of one or more locally or industrially centralized repair plants or of organizing in-plant repair and maintenance facilities, depending on the size of the enterprise and on the type of product made. The advantages of mobile repair and maintenance units, again either for all or for particular industries, or of co-operative set-ups of repair and maintenance facilities for some industries were also emphasized.

Testing the technological reliability of industrial equipment is an indispensable requirement for continuous good maintenance. Some of the special methods and instruments developed in industrialized countries need to be adapted for use in developing countries.

The developing countries should be advised of the availability of equipment designed to simplify the problems of repair and maintenance. Industrial research and design units in both developed and developing nations should place greater emphasis on completely sealed units which require no repair or maintenance over long periods and very simple mechanism which are easily maintained with parts available locally.

Nothing really useful with regard to repair and maintenance will be accomplished in a developing country unless the right attitude towards this problem prevails on all levels of production, from top management to the men and women at the production line. Management, in particular, has to be aware of the problems created by poor maintenance and has to see clearly the economic advantage of good repair and maintenance practices, instead of regarding the cost for maintenance as something that needs to be reduced because it adds nothing to immediate revenue. Foremen and production workers must also be educated to realize the importance of proper maintenance for a continuous maximum output and for high quality of the final product. Advice, education and material incentives are among the instruments for changing ingrained attitudes which are amiss in a newly emerging industrial society.

UNIDO is giving increased attention to activities in this field. It promotes the establishment and initial operation of pilot industrial equipment repair and maintenance centres in developing countries, issues and distributes monographs on this problem for particular types of equipment and provides technical assistance upon request, UNIDO also is helping developing countries, upon request, through its Advisory Service on the Supply of Industrial Equipment, which was established in response to ECOSOC resolution LL83 (XLI). This Service provides names of suppliers from an internationally based collection of industrial directories and, in response to technical assistance requests, advises on specific equipment requirements and the assessment of tenders and offers. A concerted attack, initiated by the Committee, would create or deepen the interest of the developing countries in organizing a well-functioning repair and maintenance system and thus enable UNIDO, together with other UN agencies, governments and industries in the advanced countries, to increase the impact of its activities in the repair and maintenance field.

Dissemination of Information on and the Transfer of Technology

Industrialization is to a great extent dependent upon the unimpeded flow of information in all fields of industrial knowledge and experience. No appropriate technology could be generated, no old one adapted for its utilization in developing countries, no industrial research could be carried out successfully, no particular plant or product design could be developed in or for the developing countries without the knowledge of scientists, engineers and technicians of, and their easy access to, the most recent advances in their respective fields. The Committee also has, at an early stage in its deliberations, recognized the importance of the most widespread dissemination of information for the application of science and technology to development, (vid. 3rd Report of UNACAST to the 41st Session of ECOSOC, E/4178 of 20 May 1966, Chapter III) and has dealt with this problem at its 4th and 7th Session. Similarly the Athens Symposium on Industrial Development included in its agenda this very important issue and formulated in its report a number of specific recommendations (vid. loc.cit., Committee I, Annex L, p.9). At the recent 2nd Session of UNCTAD there was general agreement as to the importance of the developing countries acquiring suitable foreign technology and a special working group discussed the transfer of technology (including know-how and patents). It tabled a draft resolution (ID/81/Add.1, Annex II of 17 March 1968) calling on the Committee to keep under review a number of recommendations and to expedite the completion of case studies.

While the importance of disseminating available information on the generation and application of industrial technology to developing countries has been increasingly appreciated in recent years, the volume of such information keeps on expanding. In 1963, some 30,000 scientific and technical periodicals were published in the world comprising annually over two million articles. In 1967, the number of journals was estimated at over 40,000 being equivalent to an annual increase of about 10 per cent. Yet, journals represent only one medium, albeit an important one for the dissemination of scientific and technological information.

The considerable growth in the volume of available information is the result not only of the rapid expansion in science and technology, but also of the steady increase in demand for technical information. To meet this demand there should be available information on know-how, techniques, processes and equipment as well as legislative and administrative measures adopted in the various regions or countries in the world. Such information should also embrace reports on difficulties and setbacks encountered and how they were solved, specific data and formulae for meeting recognized problems, scientific findings, bibliographical information on available publications, etc.

Most of this information originates in the industrialized countries. For the purpose of gathering, sharing and evaluating scientific and technological knowledge, the industrialized countries have established effective procedures and institutions. There is therefore an urgent need to establish an adequate communication system between, on the one hand, governments, industry industrial research institutions, scientists and technicians in the developing countries, and on the other hand, the technological information sources in the advanced countries. The institutional framework in developing countries need not necessarily be identical to that in the industrialized countries; however, the structure and methods of operation of the latter may serve as a model which developing countries may need to adapt to their particular requirements.

Given the diversity of political, socio-economic, environmental and other conditions in developing countries, it is obvious that no single formula can be recommended which would be applicable to all of them. In the paper presented to the Athens Symposium, the Director of the All-Union Institute of Scientific and Technical Information has formulated the following two main requirements for transmitting industrial information effectively (Athens Symposium, loc.cit.Doc.Id/CONF.1/40 of 22 June 1967, p.11):

- (a) Information should be comprehensive and selective. The user must be confident that he is fully informed. However, in the vast flow of information, many banal communications of no interest are reported and some mechanism must be set up to eliminate redundant and trivial information.

- (b) Information should be objective. The user should receive objective data and judge its usefulness for himself. This should enable him to be free in his judgement, avoiding the influence of recommendations which in the majority of cases are subjective, even if they are made by prominent authorities in a given field of knowledge.

Structure and methods of technological information services

Generally speaking, such services may be organized centrally or they may be decentralized but intermediate solutions can also be found. In North America and most West European countries, decentralization seems to be prevailing, although the spreading of specialized information institutions and the increasing flow of scientific and technological information has necessitated the establishment of either a governmental or private co-ordinating body. In other countries, e.g. in the CSSR, in Poland and the USSR, the handling of information is centralized. In countries with a centrally planned economy, these focal institutions and the corresponding information networks are structured so as to cover individual scientific fields, sectors of industry or regions of the country.

In the United Kingdom, the government limits its contribution to directing and controlling the activities of its own research institutes and laboratories as well as the 48 co-operative industrial research associations which receive its financial support. The Government has further organized Industrial Liaison Centres at technical universities whose extension officers' main function is to visit industrial enterprises, particularly smaller firms, and explain to management how to make the best use of the scientific and technological information collections of various local and national institutions.

Media for disseminating scientific and technological information

A variety of institutions produce the media which serve to disseminate scientific and technological information. Among the institutions are governments and in particular ministries of industry, banks and private foundations sponsoring and financing industrial and scientific information services and agencies. Industries themselves or their national associations, in organizing fairs and exhibitions, contribute to the dissemination of information and also provide industrial information upon request to individual enterprises at home and abroad.

Professional engineering and scientific societies publish abstracts of scientific and technical periodicals.

A wide spectrum of media is at the disposal of industrial information services. Books, journals, scientific and technical reports and manuals are the main media for disseminating information. Patent literature - annually over 300,000 patents and authors' certificates are issued - is one of the most valuable sources. By processing the above-mentioned primary sources of information, reference literature, reviews, abstracts, bibliographies and indices make it to some extent possible to select from the considerable volume of material available - some 75,000 books on science and technology are published annually - those items which are of interest to a particular industry in a developing country. Exhibitions and industrial fairs have already been mentioned. Films on technology are among the most efficient media for introducing modern techniques into developing countries. Meetings and conferences at international, regional or national level also offer an effective medium for conveying industrial information to the people most immediately concerned. Seminars, fellowships and missions by engineers and scientists are equally valuable in acquainting them with the newest developments in industrial technology.

As most of these information media come from the industrialized countries, they are normally addressed to a rather sophisticated audience. On the other hand, it is clearly necessary that information transferred to developing countries should be presented in such a form as to be easily understandable by the user. As has been stated by the Russian author mentioned above, "if scientific documents are to fulfill their main function - to spread knowledge from one geographical point to another and from one generation to another - it will be necessary to work out scientific principles for the preparation and dissemination of documents" (loc.cit. p.9, Par.29). The Committee may want to discuss the possibility of initiating work based on these principles, suggesting a suitable forum where scientists and all those concerned with industrial and scientific information might meet to discuss and, if possible, to elaborate such principles.

Developing countries need to set up a central clearing-house which would be able to channel local inquiries to the most appropriate external source of information. The final choice of one of the alternative solutions outlined earlier must be left to individual developing countries. But the acquisition of scientific and technological information will have to be adapted

to the particular circumstances of the country and industry in question before being disseminated to them. The establishment of an industrial extension service will ensure that the information not only reaches the people who can best use it but also that it is understood and properly applied.

Training of Information specialists

As in all other fields, industrial information requires specialists. Developing countries should be reminded of the importance of training an adequate number of people in all the related subject matters and to make use of all opportunities for training competent information officers offered by UN agencies or by other international organizations.

Industrial property

The flow of information is often impeded by the existence of industrial property. The General Assembly resolution 2151 (XXI) has charged UNIDO to undertake "measures for the improvement of the international system of industrial property, with a view of accelerating the transfer of technical know-how to developing countries and to strengthening the role of patents consistent with national interests as an incentive to industrial innovations".

In conclusion, it should be stressed that UNIDO is anxious to initiate further positive action to enable developing countries to benefit from the technical advice and assistance which can be provided by industrialized countries. It is, therefore, suggested that the Committee could include, besides the development of principles for the preparation and dissemination of information mentioned above, such issues as technological information services, the training of information specialists, the transfer of industrial property, etc., in its "concerted action" programme, thereby calling for the overall co-operation of UN agencies as well as both public and private international organizations.

Integrated Desalination and Chemical Product Plant

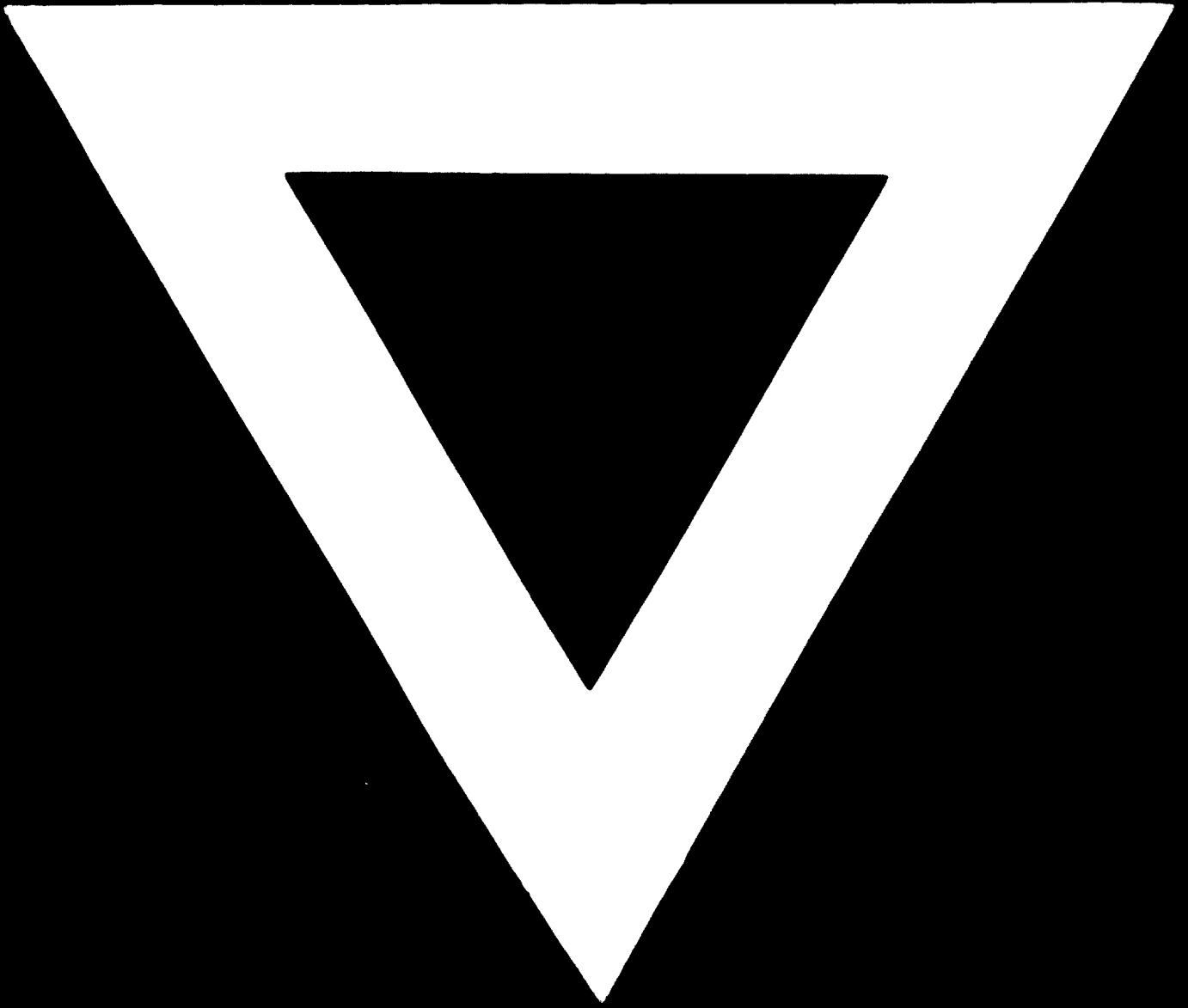
Usable water is one of the scarcest natural resources in many parts of the world, particularly in the developing countries which are in arid and/or tropical zones. The Committee has included "water resources" in the selected programmes for the World Plan of Action, and the latest draft of the Plan Frame (17 June 1968) mentions sun, wind and tides as possible non-conventional power sources for increasing the water supply. In view of the need, research projects for the efficient and economical production of desalinated water ought to be undertaken by all interested and competent organisations, institutions and industries.

Since this problem first gained the attention of the Committee (cf. UNACAST, Fourth Session, Doc. STD/4/2/Add.2, Problem 2 of 5 Nov. 1965), considerable advances have been made in water desalination, a number of alternative processes having been developed. Of these the distillation method is the most advanced commercially; in many cases costs have been lowered to a stage where water can be produced for human consumption and for certain industrial purposes for which the still considerable costs are not of decisive importance. In order to make this method more generally useful for industrial and agricultural purposes, ways and means have to be found to reduce further the cost of the distillation process or to increase the returns from it.

One promising approach for the latter would be the commercial utilisation of the by-products from the distillation process, e.g. sodium, magnesium and potassium salts and bromine. These products can be obtained from a desalination plant's concentrated effluent, which has to be further evaporated so that the various salts and other by-products can be extracted from it. The most economical methods of evaporation and extraction need further investigation.

Utilizing these by-products commercially would require building up a large chemical complex based on sodium chloride and producing, among the products, sodium carbonate, caustic soda and chlorine. This plant might use atomic energy as its power source. Detailed technical studies, cost analyses and market research for both the desalinated water and the by-products would be needed to decide whether such a complex scheme would be economically feasible and, if so, which developing country should launch it.

UNIDO suggests that the Committee give serious consideration as to how these studies can best be carried out and their results implemented.



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