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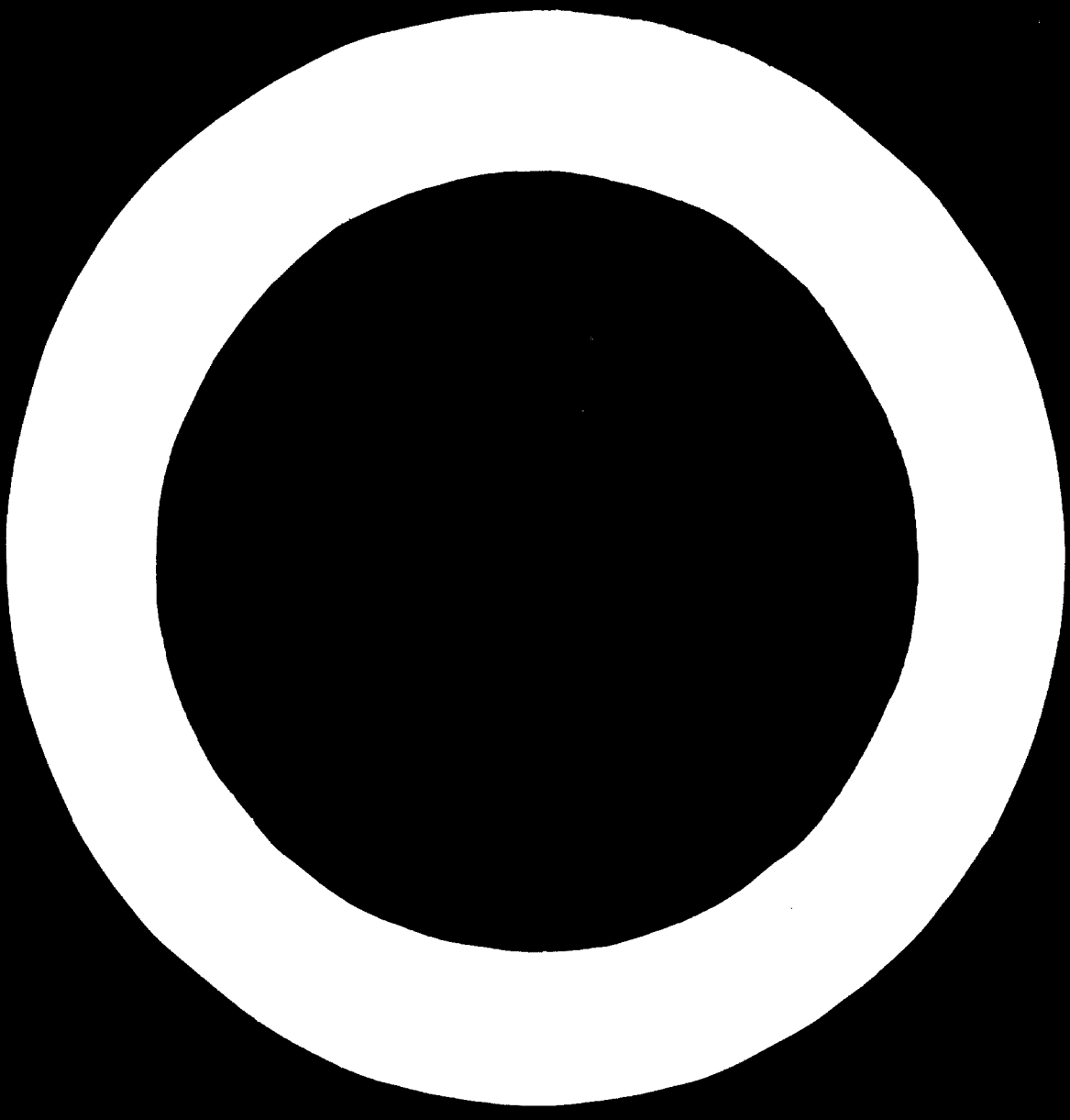
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

# Industrial Research and Development News

VOL. VI No. 1



UNITED NATIONS



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UNITED NATIONS PUBLICATION
Price: $U.S. 1.25 – Annual subscription $U.S. 4.50
(or equivalent in other currencies)

**UNIDO**
United Nations
Industrial
Development
Organization,
Vienna

# Industrial Research and Development News

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**VOL. VI No. 1**

**United Nations,
New York, 1972**

# The Founding of . . .

# Message from Dr. M. Shafquat Husain Siddiqui, President of WAITRO

I am delighted that UNIDO's *Industrial Research and Development News (IRDN)* is publishing the following article to introduce the World Association of Industrial and Technological Research Organizations (WAITRO).

The concept of WAITRO was propounded in July 1967, when the managers of industrial research institutes in developing countries, meeting in Athens under the auspices of UNIDO, recommended the establishment of such an international association. This recommendation was subsequently endorsed at the International Symposium for Industrial Development held in Athens in December 1967. Consequently, UNIDO invited a group of experts to meet in Vienna, to frame the terms of reference for such an association and to draft a constitution for WAITRO. The inaugural meeting of WAITRO was held in Vienna in October 1970.

The creation of a new international association is justifiable only if it caters to a need that a majority of countries feel is not being met by existing organizations, if its aims and objectives are of sufficient weight and merit and if its operational set-up is geared to meet those specific requirements in several vital areas that do not fall within the province of existing international establishments.

WAITRO has emerged precisely for the above reasons. It aims through mutual collaboration at fulfilling a need to assess industrial research potential and to identify research programmes of regional and interregional interest. It hopes to develop in emerging countries an awareness of the need for research by facilitating the establishment of new research institutes and strengthening those in existence.

WAITRO will serve as a common platform for exchange of experience and know-how by organizing general meetings and meetings of special-interest groups. It will act as a clearing-house for information on scientific and technological research for its members and through periodic publications keep its members up to date on current and proposed projects and the results of research.

It will endeavour to secure international assistance, where feasible, for projects of national or regional importance, thus enabling co-operation between WAITRO and other related international agencies. Very close association is envisaged with UNIDO, as the aims and objects of WAITRO complement and dovetail with those of UNIDO. It similarly complements the activities of several other regional and global organizations, but does not replace them.

There are many other areas in which WAITRO will be active. It wishes to promote research management, optimum organizational arrangements for research institutes, exchange of experts, specialists and managers, which is generally difficult owing to paucity of funds. It will seek to identify factors that inhibit the application of the results of scientific research and those that encourage easing of the "brain drain" of scientists and engineers from the developing countries.

It is hoped that many industrial and technological research organizations in the developed countries will join WAITRO either to promote regional development or to encourage research opportunities in the developing countries in order to contribute their pool of scientific knowledge to the uplifting of developing communities and the progress of man.

An international organization of this type is likely to encounter many difficulties and to make heavy demands on time, funds and energy. But we are confident that, with the willing co-operation of the members and the active support of the United Nations specialized agencies and other international organizations, philanthropic foundations and government agencies that are interested in promoting industrial and technological development, WAITRO will become a vital force in not only accelerating industrial and technological research and economic and social changes, but also in bridging the gap between the developed and the developing countries and thus contributing to social, economic and political stability in the world.

WAITRO is another significant step towards closer co-operation and collaboration among the countries of the world.

# PREFACE

This article describes UNIDO's role in founding the World Association of Industrial and Technological Research Organizations (WAITRO). It examines the need for WAITRO, goes into some of the background that led to its founding, outlines the main features of its constitution and organization and takes a brief look at its future. The article also describes in some detail the give and take of the inaugural meeting and provides background information on leading personalities who were instrumental in bringing the organization into being and on the research institutions that they represent.

Address all inquiries regarding WAITRO to:

Dr. P. C. Trussell
Secretary-General
WAITRO
c/o British Columbia Research Council
3650 Westbrook Crescent
Vancouver 167, B.C.
Canada.

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Industrial research is relatively new to the world of science, being little older than the century. But today there are literally hundreds of institutes devoted to research in industry or in its specific sectors, both in developing and industrialized countries. In the United Kingdom alone there are over 50 research associations serving particular sections of industry, from baking to hosiery manufacture, from ceramics to packaging.

But there has been no international focal point, no central organization through which these various research institutes could exchange ideas, personnel and information. Previously such exchanges depended upon the initiative of individual organizations. The research community has long felt the need for an effective and systematic means of liaison among its organizations, not only to avoid the duplication that is inevitable when scientists work in isolation, but also to help the industrial community apply the results of research for industrial development.

In developing countries, industrial and technological research institutes have been hampered by a chronic dearth of funds. Pressing problems, such as housing, education and communications, take priority. Thus industrial research in these regions has often had little or no financial support compared with the giant institutions of developed countries. Because of the nature of modern research, requiring costly equipment and highly skilled personnel, no money often means no significant results. There is also the need to integrate research into industry, not only to ensure industry's participation in financing and managing research, but also to make research a tool of industrial growth.

Although there has been a certain amount of two-way traffic between research organizations in industrialized countries and those in developing countries, it has been haphazard. There has never been a global clearing-house through which industrial scientists of developing countries could form productive partnerships with those of developed countries.

For these reasons, WAITRO has been created: to supply the missing bridge and radial point; to provide a forum and a meeting ground—a town hall—where research organizations can join forces to solve their mutual problems and meet face to face to discuss other matters of mutual interest.

## I

In July 1967, in Athens, 19 managers and directors of industrial research institutes participated in a UNIDO workshop meeting to discuss ways of increasing the usefulness of such institutes in developing countries. At the end of the two-week session, the participants recommended "that UNIDO be invited to take steps

towards establishment of an international association of industrial research establishments".

The International Symposium on Industrial Development, held also in Athens in December of the same year, subsequently endorsed the workshop's recommendation. The Symposium recommended that UNIDO, "because of the vital need for exchange of information and experience", consider establishing an association of research institutes "with the objective of facilitating co-operation in the exchange of experience, know-how, and professional expertise". The Symposium also recommended that UNIDO "promote international collaboration between (*sic*) research organizations".

Thus mandated, UNIDO arranged for ten executives of research organizations to meet in Vienna in May 1969 to consider the feasibility of setting up such an association.[1] UNIDO prepared a discussion paper, including a draft constitution, for the consideration of the expert group.

After due deliberation, the experts sent their findings to the Executive Director of UNIDO. "In the light of our individual knowledge and experience", stated their letter of transmittal, "we tried as thoroughly as possible to see whether the proposed aims and objectives . . . were of sufficient weight and importance to warrant the establishment of a new international organization. We took particular care to ascertain whether this would mean duplication of work already undertaken by existing organizations. We came to the conclusion not only that there would be no duplication, but also that an association of the type proposed could, in the long term, be of considerable benefit to the industrial research organizations currently operating and envisaged in all parts of the world."

The expert group, which included participants from Austria, France, Hungary, India, Iran, Kenya, Norway, the United Kingdom, Yugoslavia and Zaire, also recommended that the new organization be given a trial period of about five years, after which its performance could be evaluated.

## II

As a follow-up to this second mandate, UNIDO contacted organizations concerned with industrial research in most countries of the world, including governmental and those of a private or semi-public nature. The report of the expert group, containing a detailed enumeration of suggested aims and objectives of the proposed association, was circulated. Correspondents were asked to offer opinions and to indicate their interest in becoming founding members. More than 170 organizations from 63 developing and 22 industrialized countries answered favourably.

This response was encouraging and UNIDO started preparations for a founding meeting. With the co-operation of experts and legal advisers, and after a sifting and culling of numerous suggestions from research institutes, UNIDO prepared various documents, including drafts of a constitution for the new organization along with a set of by-laws and rules of procedure. UNIDO also proposed an agenda and schedule for the founding meeting.

A preparatory committee of thirteen convened at UNIDO headquarters in October 1970, just before the founding meeting to draft recommendations on several important questions.

## III

On 28 October 1970, under UNIDO's sponsorship, 96 officials representing 84 industrial and technological research organizations met at the International Congress Centre in the Hofburg, Vienna, in what proved to be the founding meeting of WAITRO. Most of the participants were directors of research institutes. They came from 54 countries, both developing and industrialized. Institutes of developing countries greatly outnumbered those from industrialized countries. Several organizations that had expressed interest in WAITRO could not send delegates but asked to be kept informed. The annex lists all the organizations represented at the meeting, including those that sent observers.

A statement from the Executive Director of UNIDO, Mr. I. H. Abdel-Rahman, opened the conclave. "Although UNIDO has taken the initiative in establishing WAITRO", he said, "its future lies in the hand of its members." Mr. Abdel-Rahman stressed that the issues to be decided at the meeting would not only effect the future of the Association but, through it, also the level of development of industrial research in various countries. He also pointed out that today's constant rapid developments in technology require more than ever before co-operation among research organizations to break down national and regional boundaries and to establish international links.

The officers elected for the meeting represented a wide range of institutes and areas:

*Chairman:* Dr. W. Bredo, Director of the International Development Center of the Stanford Research Institute at Menlo Park, California, USA.

*Vice-Chairman:* Dr. M. Noriega-Morales, Director of the *Instituto Centroamericano de Investigación y Technología Industrial* at Guatemala City, Guatemala.

*Rapporteur:* Mr. E. Lartey, Director of the Industrial Research Institute at Accra, Ghana.

[1] The *Industrial Research and Development News (IRDN)* reported on the recommendations of the Expert Group Meeting in an earlier issue. See "World Association of Research Organizations Recommended", *IRDN* (1969), Vol. IV, No. 3, pp. 39–40 (Sales No.: 69.II.B.40).

The meeting then heard the report of the preparatory committee, which presented detailed recommendations on membership, voting rights, fees, constitution and by-laws.

Briefly, the committee proposed two classes of membership, regular and associate, with such organizations as the UN agencies limited to observer status, proposed a careful study of voting rights to ensure fair representation and prevent domination by any bloc or group; recommended that membership fees be a minimum of $U.S. 200 and $ 500 from developing and developed countries, respectively; made recommendations on the membership of the Executive Committee and the length of term of the Executive Director; suggested amendments to the draft constitution and by-laws; and presented a work programme for 1971.

The most important item on the agenda was, of course, the Association's proposed constitution. This was read to the group, paragraph by paragraph, some of which, such as that on membership, provoked lengthy discussion. Indeed, so involved was the dispute on this paragraph, the meeting appointed a special subcommittee to examine the issues. The recommendation of this subcommittee, which followed the preparatory committee's proposal of two grades of membership, but substituted technical and sustaining membership for regular and associate membership, gained the unanimous approval of the meeting.

The meeting then considered the by-laws, which are complementary to the constitution but in case of contradiction subservient to it.

To study the knotty question of fees, the meeting set up another subcommittee, which endorsed the proposal of the preparatory committee. And with the addition of Spanish to English and French as official languages, the by-laws were approved substantially as proposed.

The meeting agreed upon the following criteria for the election of the officers and the members of the Executive Committee: the President should be from a developing country; three members of the Executive Committee should also be from developing countries; and of the three other members of the Executive Committee one should come from Canada, the United Kingdom or the United States; one from Western Europe; and one from Eastern Europe.

After electing its officers, the Executive Committee turned to the crucial election of a Secretary-General. The committee considered the scope, size, standing and location of each candidate's parent organization. Since the temporary seat of the secretariat would be the Secretary-General's home office, the facilities there would have to be adequate, particularly the potential supporting services that WAITRO's secretariat could use during its early life.

Thus taking one consideration with another, the committee unanimously decided to nominate Dr. P. C. Trussell of the British Columbia Research Council at Vancouver, Canada, for Secretary-General. The General Assembly approved this nomination. As WAITRO's first Secretary-General, Dr. Trussell will hold office for three years instead of the normal four. The Secretary-General may be reappointed.

With appointment of its Secretary-General and selection of Vancouver as its provisional seat, WAITRO, the "world's youngest international organization" was now a going concern.

## IV

Affecting as it does so many other issues, finance was a constant topic of the meeting. Contributions and fees from its members and whatever small revenue may come in from sales publications will be WAITRO's major source of funds.

The participants realized that membership fees would not meet the first year's budget, which all agreed had been pared to the bone. It would take 120 members from industrialized countries or 300 from developing ones to cover first-year costs. Such a large membership might be achieved in the future, but in the meantime, WAITRO would need extra funds from other sources.

The complete text of the subcommittee's recommendation is of interest, for it shows how unanimity can be reached on a disputed issue:

> "Technical membership shall be open to organizations actively engaged in industrial or technical research. Sustaining membership shall be open to organizations active in encouraging and promoting research and desirous of assisting the Association by financial support or otherwise advancing its aims. Both types of membership shall only be available to non-profit organizations. Non-profit organizations are defined as those which do not distribute profits to stockholders.
>
> "Representatives of all members in good standing will have equal voting rights except that a representative of a sustaining member will not qualify for the position of President nor will the sustaining members be qualified to have a majority representation in the Executive Committee or in the membership of the Association."

The constitution itself was unanimously adopted on a roll-call vote. It gives WAITRO a conventional organization—a secretariat headed by a Secretary-General, an Executive Committee made up of six members elected by the General Assembly from among its membership, giving due regard to geographical considerations, and a Chairman, who is also President of the General Assembly. The General Assembly consists of all members in good standing and is headed by a President and two Vice-Presidents who are elected by

majority vote. All officers serve two-year terms except the Secretary-General, who serves four years. Similarly, the General Assembly normally convenes only every two years and the budget is biennial, though audited annually.

The founding meeting set up an eight-member subcommittee chaired by Mr. A. Sharif, Principal Officer of the National Council for Scientific Research in Beirut, Lebanon, specifically to deal with finance. This group recommended that WAITRO adopt a differential in fees and that any special tasks it undertook in connexion with special committees, studies or activities be funded separately by grants or special contributions.

The meeting approved the work programme that the Executive Committee submitted to it. The founders emphasized that a good work programme was most important to success in raising money and that to survive WAITRO would have to make a strong impact from the start. Its work programme would have to attract a substantial membership and earn the respect and financial backing of philanthropic and international organizations interested in industrial and technological research. With this in mind, the meeting approved a tentative enumeration of the immediate tasks ahead.

These were:

- To announce the founding of WAITRO to Governments, international agencies, private foundations and potential members;
- To assemble and distribute a register of technical and sustaining members;
- To prepare and distribute to the membership all basic documents pertaining to the organization, operation and programme of WAITRO;
- To circulate a questionnaire to technical members to determine their needs and their desires;
- To develop a roster of potential membership;
- To undertake a vigorous programme for extending the membership;
- To prepare a quarterly newsletter;
- To prepare projects to promote the aims of WAITRO and vigorously seek financial support for these activities from fund-giving agencies;
- To begin activities as soon as possible to serve as an information clearing-house for members on matters within their spheres of interest;
- To maintain a calendar of meetings of interest to industrial and technological research organizations.

Major documents are to be issued in the three official languages, a decision that raised some qualms about finances. However, UNIDO indicated that during the formative years it may be able to assist in the translation and reproduction of some of WAITRO's major documents.

## V

At the end of the roll-call pledging, Dr. Bredo, Chairman of the meeting, accepted a formal motion that WAITRO be established as an organization in accordance with the terms of its constitution. The motion was unanimously adopted, and WAITRO was born. Fifty-two of the organizations present said they wished to join WAITRO.

Of necessity the work programme for the first year was mainly concerned with solidifying WAITRO's operational and administrative structure and with informing the world of its existence, make-up and functions. The inaugural meeting decided to devote considerable time at the 1972 General Assembly to the actual work of members and the problems encountered in industrial research. The constitution and by-laws provide for the establishment of technical committees to consider specific topics and fields of study.

Contracts for consulting work or special studies will be accepted by the Secretary-General, who will distribute them for execution to member institutes or to technical committees. By increasing research consciousness, WAITRO expects to assist in strengthening existing research organizations in developing countries and in the establishment of new ones. With the help of specialist groups, it will provide liaison between institutes concerned with parallel projects. Not only can WAITRO help member institutes to identify fruitful areas of research, but, because of the range of experience and the diverse fields that concern its membership, it can draw from a vast fund of practical knowledge and experience to solve problems of member organizations.

All founding members agreed that WAITRO's survival and growth would depend on its success in generating interest and financial co-operation from other world organizations with mutual interests. It was thus encouraging that international organizations sent to the inaugural meeting observers who expressed their organizations' intention of co-operating with WAITRO.

Through the regional and interregional organizations, WAITRO hopes to promote an exchange of experts and trainees. There are now bilateral exchanges of this sort, but a single clearing-house can make them more effective.

In addition to the many services it has rendered, UNIDO also agreed to include in its technical assistance programme projects identified by WAITRO; to make its network of contacts and correspondents, including those with other UN organizations, available to the Association, and to give space in its publications to WAITRO's achievements and projects.

UNIDO expects to co-operate closely with WAITRO. WAITRO could indicate training opportunities and build up a roster of scientific and management experts in industrial research whom UNIDO might call upon for field assignments. WAITRO might also act as adviser to UNIDO on industrial research.

# OFFICERS OF WAITRO

The following notes give a résumé of the career and present functions of the first officers and the Secretary-General of WAITRO and a brief description of their respective organizations as well as individual comments on the role and prospects of the Association.

**President: Dr. M. Shafquat Husain Siddiqui, Chairman of the Pakistan Council for Scientific and Industrial Research**[2]

*M. Shafquat Husain Siddiqui obtained his B.Sc. and M.Sc. in Chemistry at Osmania University, where he also served as a Lecturer in Chemistry. He then went to the United States, where he earned his Ph.D. at the University of Chicago in 1951.*

*Returning to Pakistan, Dr. Siddiqui joined the University of Peshawar and served there until August 1965, as Professor and Chairman, Department of Chemistry.*

*In 1965, UNESCO appointed Dr. Siddiqui co-director of a project for developing a new method of teaching chemistry in Asia. He remained with UNESCO until February 1966, when the Government of Pakistan appointed him Chairman, Pakistan Council of Scientific and Industrial Research (PCSIR).*

*Dr. Siddiqui has made substantial contributions to scientific research and education in Pakistan, which he has frequently represented at international conferences. In recognition of his services in chemistry, the scientific institutions of several countries have honoured him. He has won the Theodor Heuss Medal of the Federal Republic of Germany; has been elected a Fellow of the Royal Institute of Chemistry, London; and is a member of the American Association for the Advancement of Science, the American Chemical Society and the Pakistan Atomic Energy Commission.*

*Dr. Siddiqui was Chairman, Commonwealth Scientific Committee, London, from 1966 to 1968. He is an Overseas Member of the Tropical Products Institute Advisory Committee of the Ministry of Overseas Development, U.K. He was also Chairman, National Science Council of Pakistan from 1967 to 1969.*

*As the Chief Executive of the Pakistan Council of Scientific and Industrial Research, Dr. Siddiqui directs and co-ordinates its scientific work. One of his more important functions is to advise the Government on matters connected with the development of scientific and industrial research.*

*The Pakistan Council of Scientific and Industrial Research was established in 1953 to initiate, promote and guide scientific and industrial research primarily towards development of indigenous raw materials and industries based on them. The most important means to this end are the national research laboratories. The Council has so far established six multi-functional laboratories with a total personnel of 2,500, of whom over 800 are scientists and engineers. It also operates a Documentation Centre (Pakistan National Scientific and Technical Documentation Centre) and a Precision Mechanics and Instrumentation Centre.*

*Work in the Council's laboratories gives due consideration to national problems. Emphasis therefore is on such fields as natural resources, building materials, pesticides, food and nutrition, glass and ceramics, paints and plastics, fuels and minerals. In all its activities the Council constantly seeks close collaboration and co-operation with industry.*

*Dr. Siddiqui's comments on WAITRO are contained in his statement at the beginning of this article.*

**First Vice-President: Morten Knudsen, Director of the Technological Institute of Copenhagen**

*Morten Knudsen, a native of Denmark, obtained his Master of Forestry degree in 1951. He then did scientific work until 1958 in the Faculty of Forestry, Veterinary and Agricultural University, Copenhagen, with wood technology and forest planning his special interests. In 1959, he joined the Technological Institute of Copenhagen as Head of the Wood Department. In 1964, he took over the building section and in 1967 became Director of Planning. Mr. Knudsen was appointed Director of the Institute in 1970. He is a member of the Danish Academy of Technical Science as well as of several scientific and governing committees concerned with furniture, woodworking, general technology and industrial research and development. He also acts as an adviser to the Danish International Development Agency on bilateral projects, with particular reference to the establishment of industrial training centres. Mr. Knudsen's scientific publications have concentrated on wood technology, while his more general publications are concerned with industrial research and development, especially as related to the work of the Technological Institute.*

*The Technological Institute, Copenhagen, is an autonomous, non-profit institute for which the Danish Government provides two thirds of the budget. Its objective is to assist in the development of Danish*

[2] For further information on the Pakistan Council of Scientific and Industrial Research, see K. M. Habib (1968) "The Way and the Means to Industrial Development", *IRDN*, Vol. II, No. 2, pp. 44–47 (Sales No.: 67.II.B.13).

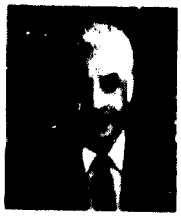
*industrial enterprises through applied research, documentation, advisory services and education. The range of work is rather broad, covering assistance on materials, machinery, processes and products for various branches of industry including building, metalworking, woodworking and furniture, plastics and leather, and certain chemo-technical processes including washing and cleaning.*

*The Institute is concerned not only with technical fields but also with industrial management. To a great extent the Institute's activities directly relate to practical problems encountered by small enterprises that have few or no highly educated employees. The Institute's personnel totals 450, of which 125 are engineers and scientists, 175 technicians and craftsmen and the remainder clerical and supporting staff.*

*Just as its research activities and advisory services are aimed at the shop-floor level, the Institute's educational work consists of short courses for skilled workers, technicians, managers, engineers and others engaged in the operation of industrial enterprises. The Institute has had a special interest in helping the developing countries to improve productivity in handicrafts and industry. The Institute has assisted in the planning of technological institutes and training centres in many countries in collaboration with the Danish International Agency as well as international organizations such as ILO, UNESCO and UNIDO.*

*Mr Knudsen has said of WAITRO: "I see WAITRO as a forum for international co-operation between research and development institutes in the industrialized and developing countries. During the inaugural meeting I had the opportunity of making many contacts which will surely prove valuable. The value and usefulness of WAITRO will depend on the work done, not only by the Executive Committee, but also by all member organizations. I would hope that this Association, in as far as it consists of highly respected institutes and organizations, can, through an effective secretariat, succeed in creating a clearing-house for information on the capacities and needs of different countries. Further, I trust that it will prove possible for funds to be raised to finance some of the important projects that will be formulated by the Executive Committee and ultimately by such subcommittees as may be created. I feel sure that WAITRO will, after an active recruiting campaign, be able to assume that a large number of research and development institutes will be interested in participating in its activities, thus enabling the Association to act as a dynamic and flexible centre for industrial and technological development. It is my hope that WAITRO will, through activities that are characterized by efficiency and objectivity as well as mutual respect and confidence, grow to become the natural adviser to UNIDO and other international organizations in their planning of projects concerned with assistance in the field of industrial research and development."*

**Second Vice-President: Dr. Manuel Noriega-Morales, Director of the Central American Research Institute for Industry (ICAITI), Guatemala City, Guatemala**



*Manuel Noriega-Morales is a graduate of the Universidad de San Carlos de Guatemala, in Guatemala City, where he earned the Degree of Public Accountant and Auditor and a Ph.D. in Economics. Later, he pursued doctorate-level studies in economic development and received a Master's degree in Public Administration from Harvard University. At home, Dr. Noriega-Morales served as Minister of Economy and Labour in 1945/1946 and again in 1949/1950 and was President for eight years of the Central Bank of Guatemala, which he helped found. He frequently lectures in economics and finance at the Universidad de San Carlos de Guatemala.*

*On the international scene, Dr. Noriega-Morales has represented Guatemala on the Board of Governors of the International Monetary Fund and the International Bank for Reconstruction and Development, and was a member of the "Committee of Nine" of the Organization of American States in Washington, D.C. He has attended numerous international conferences, among them the United Nations Monetary and Financial Conference at Bretton Woods, New Hampshire, in 1944, the United Nations Organization Conference, San Francisco, California, in 1945, the United Nations Conference on Trade and Employment held in Havana, Cuba, in 1947/1948 and many others.*

*During the last 15 years his interests have centred on science and technology for development.*

*Dr. Noriega-Morales served as Deputy Director of the Central American Research Institute for Industry (ICAITI) from 1956 to 1960 and as Director from 1964 to date. He has attended many international conferences dealing with industrial research and development.*

*He has been a member of the Group of Experts in Science and Technology of the Organization of American States. He has taken active part in formulating the Regional Programme for Science and Technology of that organization and is now a member of the Executive Committee of the Inter-American Council for Education, Science and Culture.*

*ICAITI is an independent regional institution chartered as a non-profit organization. It was founded in July 1955 by the Governments of the five Central American Republics—Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua—with the assistance of the United Nations Technical Assistance Administration. It began operations in Guatemala City in January 1956.*

*In its 15 years of existence, ICAITI has made significant contributions to the industrial development of the region. It has completed many technical-economic studies and applied-research projects on a wide variety of matters. ICAITI has put technological advances at the disposal of Central American industry and has assisted*

*regional authorities and manufacturers in planning, expansion and development.*

*The Institute provides technical assistance through its consulting and research services. ICAITI is engaged in general studies and consultations on industrial sectors and their economic perspectives. It undertakes research on the region's natural resources, especially raw materials for the food industry, on the preservation of foods; on textile fibres, on leather and skins, on wood, on agricultural waste materials and on plastic materials. It is concerned with the development of new processes and products and adaptation of known processes to local raw materials and conditions existing in Central America. It carries out feasibility studies or pre-investment studies for the establishment of new industries or expansion of existing industrial enterprises as well as studies in the countries of the Central American Common Market and in other countries to determine potential markets for Central America's exports. It prepares standards for products and industrial raw materials and for trade commodities within the Central American Common Market. It analyses the composition and quality of raw materials and industrial products and issues certificates of quality. It engages in microbiological studies of fermentation and food industries; training in research methods, especially in food technology; and geological and mining studies.*

*ICAITI has strengthened its capabilities by co-operative agreements with other scientific and technological institutions. At present ICAITI has established a relationship with such institutions as the University of California, the Battelle Memorial Institute, the Denver Technological Research Institute, the Nutrition Institute of Central America and Panama, and the national universities of the five Central American Republics.*

**Executive Committee Member for Africa: Mr. Emmanuel Lartey, Director of the Industrial Research Institute of Accra, Ghana**

*Emmanuel Lartey received his B.Sc. from London University in 1942 and his M.S. from Northwestern University, USA, in 1959. Among his previous positions, Mr. Lartey was Engineer-in-Chief of the Public Works Department of the Ministry of Works in his native Ghana as well as Director of the Building Research Institute. Besides being now Director of the Industrial Research Institute, he also acts as Co-ordinator of Industrial Research with the Council for Scientific and Industrial Research. He became President of the Ghana Institution of Engineers in 1970 and is Vice-President (Sciences) of the Ghana Academy of Arts and Sciences. For services rendered to his country the Government of Ghana awarded him its Grand Medal. Mr. Lartey was the Rapporteur at UNIDO's Workshop for Managers of Industrial Research Institutes in Athens in 1967.*

*Prevailing economic conditions and the industrial requirements of the country have necessarily influenced the direction of the work of the Ghana Industrial Research Institute. To support the Government's programme of industrialization, the Institute concentrates its work in these major divisions of industrial research: engineering sciences, physical sciences, and techno-economic sciences. At present the Institute has sections dealing with materials, electrical and electronics technology and industrial chemistry. It is developing a section on techno-economics.*

*In the planning and programming of the Institute's work, the managers have recognized the broad functions of industrial research. Services the Institute provides include feasibility studies, project evaluation and review, industrial consultancy, trouble-shooting, market research and advice on the use of local raw materials.*

*The Institute undertakes two basic types of projects: sponsored research, performed on behalf of a client or clients for an agreed fee and the results of which are kept strictly confidential, and in-house projects, initiated by the Institute and whose results are generally available to industry and government.*

*Thus, recent research projects have been commissioned by both the Capital Investments Board and the Steelworks Division of the Ghana Industrial Holding Corporation and as such represent a milestone in the work and achievements of the Institute.*

**Executive Committee Member for Asia: Dr. Pradisth Cheosakul, Secretary-General of the National Research Council and Director-General of the Applied Scientific Research Corporation of Thailand (ASRCT)[3]**

*Pradisth Cheosakul, born in Thailand in 1913, attended Chulalongkorn University, Bangkok, and the University of the Philippines in Manila where he obtained his Bachelor's and Master's degree in Chemistry. After a short period at the Swiss Federal Polytechnic, Zurich, he continued his postgraduate and research work in the United States, receiving his Ph.D. from Cornell University in 1944. Dr. Cheosakul remained in the United States, where he held various positions, which included five years in the Department of Biochemistry at Albany Medical College in Albany, N.Y., where he became an assistant professor and consultant in*

[3] For further information on ASRCT, see "ASRCT: Research Applied to Development in Thailand", *IRDN* (1969), Vol. IV, No. 4, pp. 4–11 (Sales No.: 69.II.B.41).

*biochemistry. He returned to Thailand in 1955, joining the Department of Science as technical adviser. He was appointed Deputy Secretary-General of the National Research Council in 1956 and Secretary-General in 1969. In the same year Dr. Cheosakul also became Research Director-General of the Applied Scientific Research Corporation of Thailand (ASRCT). He is a member of various societies and organizations, including the American Chemical Society, in addition to being a Fellow of the American Association for the Advancement of Science and the Secretary-General of the Science Society of Thailand.*

*The functions of the Thai National Research Council are: to promote and co-ordinate research in the various branches of science; to advise the Government on major policy matters concerning research, including the preparation of the research budget; and to arrange appropriate facilities for consultations among the leading scholars of natural and social sciences in Thailand.*

*The National Research Council was established to advise the Government on national policy for the promotion and support of research in natural and social sciences. It acts as a registry of scientific and technical personnel and research equipment and watches over research projects carried out in Thailand. With the assistance of UNESCO, the Council established the Thai National Documentation Centre, now transferred to ASRCT. It publishes several scientific journals, directories and reports of research findings. It provides financial support for research through grants for scientific projects (75% of total allotment), grants to university staff, and postgraduate fellowships. However, it does not operate any laboratories or research centres of its own, as these operations fall within the scope of ASRCT.*

**Executive Committee Member for Latin America: Mr. Carlos M. Añez, Executive Secretary of the National Council for Scientific and Technological Research (CONICIT), Los Ruices, Venezuela**

*Carlos M. Añez graduated as a Civil Engineer from the Central University of Venezuela in August 1959. After three years professional practice in structural design, he attended in 1963 an advanced course on reinforced concrete building at the* Politécnico di Milano *in Milan, Italy.*

*He became interested in general planning while working at the Central University of Venezuela on physical facilities planning and was awarded a scholarship for a two-year graduate course on economic and social development in Caracas. In 1967, he was called to co-ordinate the studies for the preparation of Venezuela's third Five-Year Telecommunications Plan (National Telephone Company). In August 1969, he was appointed to his present position, Executive Secretary of the National Council for Scientific and Technological Research (CONICIT) of Venezuela.*

*The Council is the official institution which formulates and implements the national science policy and works closely with the Central Planning Agency of the Venezuelan Government. During its first year of activities, the Council drew up a document entitled "National Policy for Scientific and Technological Research". It has developed a programme of grants for applied and fundamental research, a fellowship and educational loan programme for graduate studies and a science diffusion programme for the mass communications media. The Council is also studying the national scientific and technological potential to fit scientific activities into national plans for economic and social development. It has also begun to study the possibility of establishing a national centre for scientific information.*

*Regarding WAITRO, Mr. Añez has said: "As a member of WAITRO, CONICIT expects to establish contact with sister organizations and thus obtain information on technological research activities that would serve as orientation for Venezuela's science policy programme. Moreover, CONICIT considers very important the possibility that other Venezuelan industrial research institutions could derive experience and support from similar bodies from all over the world, through their participation in WAITRO as technical members. In this particular aspect, CONICIT understands that its active participation in WAITRO's initial activities could be an example that would bring in new members from Venezuela and other Latin American countries."*

**Executive Committee Member for the Eastern European Group: Dr. Slobodan Ristić, Director of the Yugoslav Centre for Industrial Organization and Development**

*Slobadan Ristić, born in Yugoslavia in 1928, obtained his B.Sc. in Electrical Engineering from the University of Belgrade. In 1965, he received his Ph.D. in Economics from the University of Zagreb. Besides being Director of the Yugoslav Centre for Industrial Organization and Development, Dr. Ristić is head of the production department of an automatic control equipment enterprise and Secretary of the Federal Chamber of Economy, in which capacity he is in charge of research and development. He is President of the Yugoslav Committee for Electronics and Automation and is a member of both the Federal Council for the Co-ordination of Scientific Activities and the Governmental Committee for New Technology. Dr. Ristić also serves as a professor in graduate programmes at several*

*Yugoslav universities in systems theory, information systems and management science. He has published articles as well as reports of international and national conferences, relating to systems theory, management information systems, transfer of technology and many other areas of technology.*

*The Yugoslav Centre for Industrial Organization and Development incorporates 12 Yugoslav institutes and consulting organizations working in management, computer sciences and operations research. Founders and members also include the Federal Chamber of Economy, several industrial associations, two banks and several industrial enterprises interested in promoting and guiding the Centre's applied research and consulting activities. The Centre's objectives are to provide practical assistance to enterprises in solving technological problems of production, to define policy and criteria for the transfer of technology, to give advice on marketing and export policy, to help in the planning and control of business operations and expansion including the use of computers; and to assist management in research and development.*

*The Centre implements these objectives through research and consultancy and training for high-level executives and specialists. It directs its efforts towards increasing the rate of industrial development by conducting research on existing and future management problems relating to engineering and the production and marketing of processed and manufactured products. The Government of Yugoslavia submitted a request to the United Nations Development Programme (UNDP) for assistance in developing management activities over a three-year period. UNDP approved the project and it is currently being implemented. The greater part of this assistance will provide international experts to help the Centre.*

*Of WAITRO, Dr. Ristić has said: "As the members of WAITRO will include leading research institutes and other organizations concerned with promoting technological progress, there is every reason to expect that WAITRO will make a significant contribution to the development of technological research as well as to the practical implementation of the results of such research and to more extensive international collaboration in this field. The various means through which these aims might be realized include: joint participation of research institutes in the implementation of projects that are of greater significance to technological development; more rapid collaboration in industrial and technological research; exchange of experience in programming and management for technology and technological research; training of executive and research personnel; assistance in the exchange of information; and collaboration with international organizations and the United Nations in the elaboration of over-all plans for technological progress. I expect that WAITRO will be able to offer special assistance to developing countries."*

**Executive Committee Member for Canada, the United States of America and the United Kingdom: Dr. William Bredo, Director of the International Development Center of the Stanford Research Institute at Menlo Park, California, USA[4]**

*Born in Calgary, Alberta, Canada, William Bredo attended the University of Alberta, where he obtained a B.A. (magna cum laude) in economics. Subsequently, he obtained an M.A. from Iowa State University and M.A. and Ph.D. degrees in Economics from Harvard University.*

*Dr. Bredo is presently Senior Economist and Director of the Development Economics and Agro-industries Program of the Economics Division of Stanford Research Institute (SRI). As Director of the International Development Center, he exercises a co-ordinating role on institute research and planning studies in the developing countries. His specialized professional competence is in social and economic planning for development, agricultural, agroindustrial, and general industrial development; industrial estates and regional development, and issues relating to social and economic development policies.*

*Prior to joining SRI in 1952, Dr. Bredo was a Research Program Director in the Bureau of Agricultural Economics of the U.S. Department of Agriculture. For a period he was Assistant Professor of Agricultural Economics at the University of New Hampshire and Executive Secretary of the New England Research Council on Marketing and Food Supply.*

*In addition to providing supervision and guidance on many studies conducted by the Development Economics and Agroindustries Program at SRI, Dr. Bredo has published numerous articles, papers and reports on economic development problems, and a book,* Industrial Estates–Tool for Industrialization *(1960).*

*SRI is a non-profit organization performing contract research for industry, government and foundations in the United States and abroad. The staff of about 2,650 includes 1,400 full-time professionals, 350 of whom have a Ph.D. or equivalent degree and 500 others Master's degrees. The Institute has a highly diversified competence in the broad fields of the physical and life sciences; engineering, including electronics and space technology; management and social systems; and economics. About 20 per cent of the Institute's work is international.*

*Since its founding in 1946, the Institute has completed some 7,000 projects valued at over half a billion dollars. Normally about 800 research projects are underway at any given time serving clients throughout the United States and in as many as 30 countries.*

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[4] For further information on SRI, see W. F. Harwood (1968) "Stanford Research Institute: A Worldwide Resource", *IRDN*, Vol. III, No. 1, pp. 24–29 (Sales No.: 68.II.B.15).

*In addition to spacious headquarters in Menlo Park, SRI has a major facility in Irvine, California, and offices in Washington, D.C.; New York; Chicago; Huntsville, Alabama; North Sydney; London; Zurich; Stockholm; Tokyo and Bangkok. Project offices are established in other locations as required. SRI has representatives in Paris, Milan, Lisbon, Manila and Bangkok.*

*Dr. Bredo has said the following about WAITRO: "I believe that WAITRO could provide an effective link between development institutions in the developing and the industrialized countries, by bringing together those institutions that require assistance and guidance and those that are able to meet these needs. Grouping, as it does, both industrial and technological research and development organizations in its membership, WAITRO will cover the whole spectrum of basic and applied research. Moreover, it will be a means of developing a stronger linkage and relationship between the members of WAITRO and aid-giving international or national organizations with research and development responsibilities in promoting industrial progress in the developing world.*

*"WAITRO should provide a useful clearing-house for information on important research being conducted throughout the world, much of which is not available through existing communication channels. WAITRO will be a catalyst among these institutions and a mechanism for developing and strengthening ties between member institutions that should help to hasten the spread of technical knowledge between countries."*

**Executive Committee Member for Western Europe: Mr. Jean-Louis Kahn, Engineer, National Association for Technical Research (ANRT), Paris**

*Jean-Louis Kahn, born in 1921, is an engineer at the National Association for Technical Research (ANRT), Paris, where he is responsible for the Department of Industrial Applied Research as well as for the administrative departments concerned with industrial property, the financing of research and development and the training of research workers. His publications cover industrial standards and automation as well as the economics of research and development.*

*ANRT is a private association officially recognized by the French Government. Its members comprise industrial research organizations and, more particularly, professional technical centres and research centres that work under contract and on whose behalf the Association acts in transactions involving the Government. ANRT's primary objective is to help improve the efficiency of member organizations by: developing or establishing necessary contacts; pooling of knowledge and expertise; exchanging experience; and implementing all types of collective study and action. The work of ANRT's committees often leads to the creation of advisory missions for the construction, equipping and organization of research centres and centres for scientific and technical studies, which in turn promote the flow of technology and experience to new industrial enterprises. ANRT assists developing countries in organizing conferences, meetings, exhibitions and study tours.*

**Secretary-General: Dr. P. C. Trussell, Director of B.C. Research, Vancouver, Canada[5]**

*P.C. Trussell graduated from the University of British Columbia and later received his M.S. and Ph.D. degrees in microbiology and biochemistry from the University of Wisconsin. He worked in research and as an adviser to production on antibiotics for a pharmaceutical company in Montreal and was then transferred to B.C. Research to set up the Division of Applied Biology. He was Head of the Divison of Applied Biology until 1961 and was responsible for beginning research into industrial control of marine borers, biological leaching of metal sulphides and water-pollution abatement. In 1961, Dr. Trussell became Director of B.C. Research. Dr. Trussell has produced over 40 scientific publications and six patents, of which four are being commercially exploited.*

*Founded in 1944, B.C. Research is the technical arm of the British Columbia Research Council. B.C. Research offers to industry and government technical services in the fields of applied biology, applied chemistry, applied physics, engineering, economics, market research, operations research, industrial engineering and technical information. Over the past five years, earned income has increased at an average rate of 10 per cent per annum and currently is about $1.4 million. In addition, B.C. Research receives from the government of British Columbia a grant that currently accounts for about 20 per cent of its operating budget.*

*In its life, B.C. Research has occupied three different quarters, starting with one-storey wooden shacks. Its current building, completed in April 1969, is located on the south campus of the University of British Columbia in Vancouver, Canada.*

*During 1970, the British Columbia Research Council set up a separate company, Techwest Enterprises Ltd. Through Techwest some of the new products and processes coming out of the laboratories will be*

[5] For more information about B.C. Research Council, see P. C. Trussell (1967) "British Columbia Research Council, Vancouver, Canada", *IRDN*, Vol. II, No. 1, pp. 53-54 (Sales No.: 67.II.B.4).

*commercialized. In the future, successful divisions of this company may split from it to become separate operations under private ownership.*

*Dr. Trussell's comment on WAITRO: "B.C. Research looks forward to an expansion of its acquaintance with other industrial research institutes in the world through WAITRO. WAITRO will provide the opportunity for people in one industrial research institute to exchange ideas, problems and experiences with others engaged in similar operations. The problems faced by an industrial research institute in one part of the world with regard to selection of staff with the appropriate type of training, the choosing of programmes, that have not only technical but also economically sound potentiality, the establishment of effective management methods and the carry-through of research through development and industrial innovation are common to institutes in all parts of the world. Through WAITRO, the contact between institutes will be direct, and not through the intermediation of one or two other agencies. The communication thus will be quicker and, hopefully, more effective."*

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# ANNEX

## INSTITUTIONS REPRESENTED AT THE FOUNDING MEETING BY PARTICIPANTS AND OBSERVERS

**National research organizations**

| | |
|---|---|
| ALGERIA | Institut National de Productivité |
| | Centre d'Etudes Industrielles et Technologiques |
| | Bureau du PNUD à Alger (observer) |
| ARGENTINA | Consejo Nacional de Investigaciones Científicas y Técnicas |
| | Instituto Nacional de Tecnología Industrial |
| AUSTRIA | Forschungsförderungsfonds der gewerolichen Wirtschaft Österreichs |
| | Vereinigung der Kooperativen Forschungsinstitute der gewerblichen Wirtschaft Österreichs |
| | Österreichisches Institut für Bauforschung |
| BELGIUM | Institut pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture (IRSIA) |
| BRAZIL | Instituto Nacional de Tecnología Education and Documentation Division |
| | Ministério de Indústria e do Comércio |
| CANADA | British Columbia Research Council |
| | Research Council of New Brunswick |
| CEYLON | Ceylon Institute of Scientific and Industrial Research |
| CHILE | Instituto de Investigación Tecnológica University of Concepción |
| | Comisión Nacional de Investigación Científica y Tecnológica |
| CHINA (TAIWAN) | Mining Research and Service Organization |
| | Union Industrial Research Institute Ministry of Economic Affairs |
| COLOMBIA | Instituto de Investigaciones Tecnológicas |
| DAHOMEY | Institut de Recherches Appliquées |
| DENMARK | Technological Institute |
| DOMINICAN REPUBLIC | Corporación de Fomento Industrial Promotion Division |
| ECUADOR | Instituto Investigaciones Tecnológicas Escuela Politécnica Nacional |
| EGYPT | National Research Centre |
| FRANCE | Agence Nationale de Valorisation de la Recherche Technique (ANRT) |
| | Technical Co-operation Commission Association Nationale de la Recherche Technique (ANRT) |
| GERMANY, FED. REP. OF | Bundesministerium für Wirtschaft (observer) |
| GHANA | Building and Road Research Institute |
| | Forest Products Research Institute (FPRI) |
| | Industrial Research Institute |
| HAITI | Conseil National de la Recherche Scientifique et Technique |

| | |
|---|---|
| HUNGARY | Research Institute of the Electrical Industry |
| INDONESIA | Indonesian Institute of Sciences |
| ISRAEL | Centre of Industrial Research<br>National Council for Research and Development<br>Standard Institution of Israel |
| IVORY COAST | Institut pour la Technologie et l'Industrialisation des Produits Agricoles et Tropicaux (ITIPAT) |
| KOREA, REP. OF | Korean Institute of Science and Technology (KIST) |
| LEBANON | National Council for Scientific Research |
| MEXICO | Academia de la Investigación Científica<br>Instituto de Investigaciones Industriales de Monterrey<br>Instituto Mexicano de Investigación Tecnológica (IMIT) |
| NETHERLANDS | Central Institute for Industrial Development (CIVI)<br>Central Organization for Applied Scientific Research in the Netherlands Economic and Technical Department |
| NIGERIA | Federal Institute of Industrial Research |
| NORWAY | The Engineering Research Foundation at the Technical University of Norway (SINTEF) |
| PAKISTAN | Pakistan Council for Scientific and Industrial Research |
| PHILIPPINES | National Institute of Science and Technology |
| SENEGAL | Institut Universitaire de Technologie |
| SINGAPORE | Singapore Institute of Standards and Industrial Research (SISIR) |
| SPAIN | Asociación de Investigación Industrial Eléctrica (ASINEL) |
| SWEDEN | Royal Swedish Academy of Engineering Sciences<br>Swedish Board for Technical Development |
| THAILAND | National Research Council<br>Applied Scientific Research Corporation of Thailand |
| TRINIDAD AND TOBAGO | Caribbean Industrial Research Institute |
| TURKEY | The Scientific and Technical Research Council of Turkey |
| UGANDA | National Research Council (observer) |
| UNITED KINGDOM | Inveresk Research International<br>The British Non-Ferrous Metals Research Association<br>The Committee of Directors of Research Associations<br>Tropical Products Institute (TPI)<br>Ministry of Overseas Development |
| UNITED STATES | Battelle Memorial Institute<br>National Bureau of Standards (observer)<br>Stanford Research Center<br>International Development Center |
| VENEZUELA | Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICIT) |
| VIET-NAM, REP. OF | Centre de Développement Industriel<br>Counseil National de la Recherche Scientifique |
| YUGOSLAVIA | Association of Research Organizations of Slovenia<br>Boris Kidrič Institute of Nuclear Sciences<br>Institute "Kirilo Savić"<br>Institute of Food Science and Technology<br>Lead and Zinc Institute "Trepča"<br>Geological Department<br>Automation Institute "ISKRA"<br>Research and Development Institute "KRKA"<br>Metallurgical Institute "Hasan Brkić"<br>Mining Institute<br>Industrial and Technological Research Division |

| | |
|---|---|
| YUGOSLAVIA *(cont.)* | Yugoslav Centre for Industrial Organization and Development |
| | Institute for Electronic and Vacuum Technique |
| | Federal Chamber of Economy Research and Development |
| | Galenika Pharmaceutical and Chemical Industry |
| | Research and Development Department |
| ZAIRE | Centre de Recherches Industrielles en Afrique Centrale (CRIAC) |

**United Nations and affiliated agencies**

United Nations Conference on Trade and Development (UNCTAD)

United Nations Industrial Development Organization (UNIDO)

United Nations Office for Science and Technology

Economic Commission for Latin America (ECLA)

Food and Agriculture Organization of the United Nations (FAO)

United Nations Educational, Scientific and Cultural Organization (UNESCO)

World Health Organization (WHO)

International Bank for Reconstruction and Development (IBRD)

International Atomic Energy Agency (IAEA)

**Regional intergovernmental organizations**

East African Industrial Research Organization (EAIRO)

Industrial Development Centre for Arab States (IDCAS)

Central American Research Institute for Industry (ICAITI)

Organisation for Economic Co-operation and Development (OECD)

Organization of American States (OAS)
Pan American Union

**Non-governmental organizations**

European Industrial Research Management Association (EIRMA)

International Council for Building Research, Studies and Documentation (CIB)

International Federation of Operational Research Societies (IFORS)

Management Centre Europe

World Federation of Engineering Organizations (WFEO)

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P.O. Box 707
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Dr. P. C. Trussell
Secretary-General
WAITRO
c/o British Columbia Research Council
3650 Westbrook Crescent
Vancouver 167, B.C.
Canada

# Economic Integration and Industrial Development in Latin America

by J. Ahmad

**The Author:** *J. Ahmad is Associate Professor of Economics at Sir George Williams University in Montreal. He has studied at the International School of Social Sciences at The Hague and at the University of Pittsburgh. He received a Ph.D. in Economics from the Massachusetts Institute of Technology (M.I.T.).*

*Professor Ahmad has been associated in a professional capacity with M.I.T., Brandeis, Harvard and McGill Universities. He is the author of two books, including* Natural Resources in Low Income Countries *(University of Pittsburgh Press, 1960), and a number of articles in professional journals. He is currently publishing a book on* Trade and Development Policy in Economically Integrated Regions *in co-operation with the McGill University Center for Developing Area Studies.*

The formation of free trade areas and common markets among the less developed countries has received increasing attention in recent years, not only as a means of stimulating economic growth but also as a step towards greater cohesion and solidarity. Encouraged by the success of the European Economic Community, efforts are currently being made in diverse parts of the world to integrate national economies into regional and subregional groups.[1] The most advanced are those presently going forward in South America, where the Latin American Free Trade Association (LAFTA) and the Central American Common Market (CACM) have been in existence for nearly a decade. A more ambitious proposal for the union of these two groups (and possibly also of the newly formed Caribbean Free Trade Association) into a Latin American Common Market within the next 15 years was announced at a meeting of the Latin American chiefs of state at Punta del Este in April 1967.[2] Within the broader framework of LAFTA, five Latin American countries -Bolivia, Chile, Colombia, Ecuador and Peru- combined to form a subregional common market, the Andean Group, on 27 May 1969.

This trend towards regional solidarity has to be interpreted against the backdrop of a sharp confrontation between the less developed countries, which question the basic assumptions underlying the present world economic order and demand a drastic restructuring of world trade, and the developed countries, which are intent on maintaining the *status quo* in international trading arrangements.[3] Economic integration reflects in large measure a desire to sponsor autonomous development policies for the attainment of such objectives as structural changes and domestic viability- objectives that may diverge from the present structure of world trade and the international division of labour. These motivations are especially strong in Latin America, where the influence of external economic forces has not only shaped the actual course of development but has also circumscribed the range of possibilities.

Needless to say, however, economic integration both enlarges and confines the freedom of individual countries to act according to their own domestic interests. It enlarges their freedom by permitting a more rational employment of resources through a widening of markets, the exploitation of potential comparative advantage and external economies,[4] and generally through reducing the *ex ante* foreign exchange constraints to development. It confines their freedom by committing each country to a set of limitations on trade and development which it can influence only slightly

[1] For details of the integration schemes in the less developed countries, see M. S. Wionczek (Ed.) (1969) *Economic Cooperation in Latin America, Africa and Asia: A Handbook of Documents*, M.I.T. Press, Cambridge, Mass.; and F. Kalnert, P. Richards, E. Stoutjesdijk and P. Tomopoulos (1969) *Economic Integration Among Developing Countries*, OECD, Paris.

[2] The LAFTA/CACM Coordinating Commission is currently studying the technical aspects of the harmonization of trade policies in various subregional groups with a view to facilitating their eventual merger into a continental common market.

[3] Branislav Gosović (1968) "UNCTAD: North-South Encounter", *International Conciliation*, May.

[4] Bela Balassa (1965) *Economic Development and Integration*, Centro de Estudios Monetarios Latinoamericanos, Mexico; and UNCTAD (1967) *Trade Expansion and Economic Integration among Developing Countries*, New York.

## Latin American Free Trade Association

The arrangements for economic integration in South America (and elsewhere) are at varying levels of maturity and differ not only in their goals but also in the nature of instruments and institutions devised to achieve them. Nevertheless, four main features seem to be common to all of them: trade liberalization, regional economic development, development of manufacturing industry, and special dispensations for the relatively less developed partners.

The procedure for trade liberalization in LAFTA is based on product-by-product negotiations for reciprocal tariff concessions to be included in national lists and every three years in the common list.[5] By 1969, over 10,000 tariff concessions were agreed to for inclusion in the national lists. The first common list, agreed to in 1964, included roughly 25 per cent of the intra-zonal trade.[6] The almost insurmountable difficulties encountered in 1967 with respect to continued tariff reductions and eliminations largely stem from the desire to maintain self-sufficiency in basic commodities and to protect domestic manufacturing interests. By contrast, the Andean Group proposes to introduce an automatic annual reduction of 10 per cent in the intra-bloc tariffs on the products of the dynamic sector, namely, chemicals, automobiles, steel and light engineering.[7] Outside of the dynamic sector tariff reductions, whose scope and time limits are not yet clear, would lie effective through bilateral negotiations.

The basic purposes of LAFTA, however, go beyond a preferential trade zone and include a sound development of the continent's industrial structure. The Montevideo Treaty envisaged a system of regional planning and industrial co-ordination on the basis of industrial complementarity. One example of complementarity is a tariff arrangement whereby imports of certain components in country A can be freed in return for free entry of the finished product into country B. Another example is when an industry is subdivided into a number of processes and the participating countries specialize in designated processes and trade among themselves.

Multinational projects in the field of social overhead capital and river basin development are another prominent feature of the regional approach of LAFTA. The development of the River Plata basin sponsored by Argentina, Brazil, Bolivia, Paraguay and Uruguay is a notable example. It is hoped that such infrastructure projects will eventually pave the way for the establishment of multinational projects in more directly productive sectors and industries.

In the Andean Group, plans have been completed to establish the Andean Development Corporation a regional investment and planning institution designed to play a prominent role in initiating new industries and sectors.

The Montevideo Treaty explicitly recognized the wide disparities in economic levels between member countries, and designated Ecuador, Paraguay and later Bolivia as "less developed" members in need of special treatment. These countries can reduce their tariffs more slowly than the others in the Group and can be granted tariff concessions that apply only to them. As integration proceeds, however, the dissatisfaction of the less developed members with certain features of trade liberalization policies has become endemic. Powerful producer interests in the more developed countries have effectively blocked the granting of acceptable concessions. The emergence of the Andean Group as a subregional association in 1969 is at least partially a reflection of these pressures.

As one of the first prolonged attempts at regional economic integration among less developed countries, LAFTA affords a valuable case study of the interaction between trade and development. LAFTA was conceived as a necessary condition for breaking out of the economic impasse in which the Latin American countries found themselves in the 1950s. The economic depression of the 1930s, which resulted in a virtual collapse of export earnings from Latin American raw materials and a consequent disequilibrium in the balance of payments, stimulated the development of import-substituting industries in the more advanced countries of the region. The first stage of import substitution, however, was exhausted very quickly owing to limited domestic markets, slow growth of national incomes and the fact that forward and backward linkages failed by and large to materialize. The limitations of domestic markets are exemplified by Brazil, which with a population of 90 million in 1968 had a national income of only $27 billion. In most cases, therefore, import substitution was carried out behind high tariff barriers, supplying limited national markets and with virtually no export outlets. The process has consequently been accompanied by high costs, low productivity and excess production capacity.

To take the Latin American motor vehicles industry as an example, not only do several countries have an automobile manufacturing or processing industry, but there is also a proliferation of uneconomic plants within a single country. The over-all Latin American automobile market, estimated at some 300,000 units a year, is served by about 40 manufacturing or assembly plants

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[5] National lists include those products for which each country is prepared to grant concessions to all the others, the amount of the concession being based on a weighted average formula. The common list consists of goods for which all countries agree entirely to free trade.

[6] The products to be freed included cotton, coffee, cocoa and electrolytic copper, but few manufactures.

[7] CACM from the outset has been based on across-the-board tariff reductions, and by 1969 virtually all the existing trade flows had been freed.

TABLE 1. RELATIVE PARTICIPATION OF COUNTRIES IN INTRA-LAFTA TRADE

*(Per cent)*

| | *1952–1961* | *1961* | *1962* | *1963* | *1964* | *1965* | *1966* | *1967* | *1968* |
|---|---|---|---|---|---|---|---|---|---|
| Argentina | 36.2 | 34.3 | 31.6 | 30.2 | 32.3 | 34.7 | 32.2 | 34.1 | 34.8 |
| Brazil | 28.8 | 21.2 | 26.3 | 25.2 | 25.0 | 27.6 | 23.9 | 23.1 | 24.6 |
| Colombia | 1.8 | 2.4 | 2.6 | 2.8 | 3.7 | 3.9 | 5.9 | 3.6 | 4.3 |
| Chile | 13.4 | 19.6 | 15.5 | 17.8 | 15.2 | 12.5 | 13.2 | 15.6 | 13.8 |
| Ecuador | 1.4 | 1.8 | 1.3 | 1.4 | 1.7 | 1.6 | 1.4 | 1.9 | 2.2 |
| Mexico | 1.0 | 1.8 | 3.0 | 3.9 | 4.2 | 4.7 | 6.2 | 6.1 | 5.6 |
| Paraguay | 2.6 | 3.0 | 2.2 | 2.0 | 2.2 | 2.0 | 2.4 | 2.3 | 2.0 |
| Peru | 8.1 | 9.4 | 12.1 | 11.8 | 10.2 | 9.6 | 9.9 | 9.0 | 8.8 |
| Uruguay | 6.7 | 6.0 | 5.4 | 4.9 | 5.3 | 3.4 | 4.9 | 4.3 | 3.9 |

*Source*: LAFTA Secretariat, CEP/Repartido 1161, 17 June 1969.

in six countries.[8] In a similar fashion, the steel industry seems to be developing in a number of countries on a completely autonomous basis with the aim of producing the full range of products without regard to demand, interregional costs and economic plant size.

It has been affirmed that progressive liberalization of intra-Latin American trade will set the stage for the second phase of industrialization: the establishment of producer goods industries.[9] In addition, larger regional markets will also facilitate the expansion of the existing consumer goods industry, as well as the establishment of new ones in accordance with changes in tastes and technology. The manufacturing sector as a whole would thus supply not only the national markets but would be increasingly geared towards exports in and outside the region. Trade liberalization will automatically induce industrial specialization according to comparative costs, and result in an improved allocation of resources and in revitalizing the foreign sector. Thus, the freeing of trade in Latin America is seen as an instrument for advancing the progress and prosperity of what is potentially a rich continent. Despite many shortcomings and inconsistencies, LAFTA is an encouraging response to the economic preoccupations of the continent.

## Pattern of LAFTA trade

The Treaty of Montevideo, which established LAFTA in 1960, was signed by Argentina, Brazil, Chile, Mexico, Paraguay, Peru and Uruguay. Colombia and Ecuador joined in 1961, and Venezuela and Bolivia signed the treaty in 1966 and 1967, respectively.[10] The total population of the LAFTA area is 219 million people with a gross national product of $U.S.97.7 billion in 1967.

Table 1 shows the relative participation of the nine LAFTA member countries in intra-zonal trade for the period 1952–1961 and for each year from 1961 to 1968. In the later period, the value of intra-LAFTA trade increased from $659 million to $1,064 million in 1968, representing an increase of 144 per cent, while the share of intra-LAFTA trade of total trade of the LAFTA countries over the same period rose from 6.1 per cent to 11.1 per cent. Three countries—Argentina, Brazil and Chile—accounted for 78.4 per cent of regional trade, on the average, during the period 1952–1961, and for 73.2 per cent in 1968. The percentage participation of Argentina, Brazil, Paraguay and Uruguay was smaller in 1968 than during the 1952–1961 period. The only significant gains were registered by Mexico, which increased its share from 1 per cent in 1952–1961 to 5.6 per cent in 1968 and by Colombia, from 1.8 per cent to 4.3 per cent.

## Structure of LAFTA trade

Data on the structure of intra-zonal trade are sketchy. A striking characteristic of this trade, however, is the predominance of primary and semi-finished products. Tables 2 and 3 show the composition of intra-LAFTA trade by degree of processing, while table 4 itemizes the principal imports of manufactures. The primary commodities on an average comprise

[8] Placido Garcia Reynoso (1966) "Problems of Regional Industrialization", in M. S. Wionozek, *Latin American Economic Integration*, Frederick A. Praeger, New York.

[9] ECLA (1963) *Towards a Dynamic Development Policy for Latin America*, New York.

[10] Unless specified in the text, the trade figures generally refer to the nine countries and thus exclude Bolivia and Venezuela.

TABLE 2. INTRA-LAFTA IMPORTS BY DEGREE OF PROCESSING

| | 1962 | 1963 | 1964 | 1965 | 1966 |
|---|---|---|---|---|---|
| *Primary* | | | | | |
| Value (million dollars) | 232.3 | 298.6 | 388.6 | 446.9 | 429.3 |
| Percentage of total | 72.2 | 66.9 | 67.7 | 66.0 | 66.0 |
| *Semi-finished* | | | | | |
| Value (million dollars) | 70.7 | 116.7 | 136.1 | 175.2 | 153.4 |
| Percentage of total | 22.0 | 26.1 | 23.7 | 25.9 | 23.6 |
| *Finished* | | | | | |
| Value (million dollars) | 18.9 | 31.1 | 49.2 | 54.9 | 67.4 |
| Percentage of total | 5.9 | 7.0 | 8.6 | 8.1 | 10.4 |

*Source:* E. G. Cale (1969) *Latin American Free Trade Association: Progress, Problems and Prospects*, a report prepared under contract for the Office of External Research, US Department of State, Washington, D.C., May, Plate 40.

TABLE 4. VALUE OF PRINCIPAL INTRA-LAFTA MANUFACTURED IMPORTS, 1966

| *Manufactured imports* | *Thousand dollars* |
|---|---|
| Rubber tires for automobiles | 5,320.2 |
| Newspapers and printed publications | 2,493.6 |
| Other books, pamphlets etc. | 2,074.4 |
| Lathes for metals and metallic carbides | 1,631.6 |
| Dry batteries up to 1.5 volts | 1,616.1 |
| Books and teaching materials | 1,583.6 |
| Non-electric typewriters | 1,554.2 |
| Statistical and similar machines | 1,460.1 |
| Electric calculating machines | 1,358.1 |
| Receiving tubes and valves | 1,346.1 |
| Manual calculating machines | 1,330.3 |
| Sewing machines | 1,084.2 |
| Blades for razors | 1,039.4 |

*Source:* E. G. Cale (1969) *Latin American Free Trade Association: Progress, Problems and Prospects*, US Department of State, Washington, D.C., p. 39.

TABLE 3. VALUE OF INTRA-LAFTA IMPORTS BY DEGREE OF PROCESSING, 1962–1967

| | *Primary products* | | *Semi-finished products* | | *Finished products* | |
|---|---|---|---|---|---|---|
| | *Value (million dollars)* | *% of total* | *Value (million dollars)* | *% of total* | *Value (million dollars)* | *% of total* |
| Argentina | 937.9 | 53.3 | 164.6 | 17.4 | 218.6 | 39.7 |
| Brazil | 326.1 | 18.5 | 305.9 | 32.3 | 130.6 | 23.7 |
| Colombia | 26.7 | 1.5 | 14.5 | 1.5 | 23.2 | 4.2 |
| Chile | 68.1 | 3.9 | 195.0 | 20.6 | 55.9 | 10.1 |
| Ecuador | 64.4 | 3.7 | 5.1 | 0.5 | 6.4 | 1.2 |
| Mexico | 79.0 | 4.5 | 108.2 | 11.4 | 50.3 | 9.1 |
| Paraguay | 68.9 | 3.9 | 23.7 | 2.5 | 8.3 | 1.5 |
| Peru | 128.0 | 7.3 | 113.8 | 12.0 | 43.0 | 7.8 |
| Uruguay | 61.3 | 3.5 | 16.2 | 1.7 | 14.9 | 2.7 |
| Total | 1,760.2 | 100.0 | 947.2 | 100.0 | 551.3 | 100.0 |

*Source:* LAFTA Secretariat CEP/Repartido 1161, 17 June 1969.

TABLE 5. MATRIX OF TOTAL TRADE IN FINISHED PRODUCTS BETWEEN LAFTA COUNTRIES, 1962–1967

*(Thousand dollars)*

| | (1) Argentina | (2) Brazil | (3) Colombia | (4) Chile | (5) Ecuador | (6) Mexico | (7) Paraguay | (8) Peru | (9) Uruguay | (10) Total |
|---|---|---|---|---|---|---|---|---|---|---|
| (1) Argentina | | 120,101 | 15,727 | 99,082 | 541 | 26,390 | 12,929 | 55,708 | 9,423 | 339,899 |
| (2) Brazil | 120,101 | | 3,276 | 33,784 | 863 | 20,084 | 1,470 | 5,383 | 22,295 | 207,251 |
| (3) Colombia | 15,727 | 3,276 | | 2,828 | 13,056 | 7,820 | 305 | 8,029 | 52 | 51,092 |
| (4) Chile | 99,082 | 33,784 | 2,828 | | 1,598 | 21,234 | 735 | 14,443 | 3,969 | 177,672 |
| (5) Ecuador | 541 | 863 | 13,056 | 1,598 | | 2,202 | 10 | 232 | 15 | 18,518 |
| (6) Mexico | 26,390 | 20,084 | 7,820 | 21,234 | 2,202 | | 326 | 39,324 | 434 | 117,807 |
| (7) Paraguay | 12,929 | 1,470 | 305 | 735 | 10 | 326 | | 528 | 731 | 17,035 |
| (8) Peru | 55,708 | 5,383 | 8,029 | 14,443 | 232 | 39,324 | 528 | | 6,358 | 130,005 |
| (9) Uruguay | 9,423 | 22,295 | 52 | 3,969 | 15 | 434 | 731 | 6,358 | | 43,278 |
| (10) Total | 339,899 | 207,251 | 51,092 | 177,672 | 18,518 | 117,807 | 17,035 | 130,005 | 43,278 | 1,102,557 |

*Source:* LAFTA Secretariat, CEP/Repartido 1161, 17 June 1969.

approximately 66 per cent of the intra-zonal trade. Manufactured commodities, however, are increasing in relative significance; their proportionate weight in the total imports increased from about 6 per cent in 1962 to 10.4 per cent in 1966 (table 2). The value of intra-LAFTA imports in manufactured goods increased by 250 per cent from 1962 to 1966, while the corresponding change for primary commodities during the same period was only 80 per cent. Nevertheless, primary products still account for nearly three fourths of the total intra-zonal trade.

The rather small proportion of manufactured goods in intra-zonal trade is a serious shortcoming of LAFTA. This is basically a reflection of the dominant structure of production in Latin America. Close to 90 per cent of the imports of LAFTA countries originate in the industrialized countries, chiefly the United States and the European Economic Community, and consist of intermediate products and capital goods. More significantly, however, the main difficulty seems to have been that the tariff-cutting commitments made by members and embodied in the Treaty of Montevideo were interpreted to include only commodities that already had a substantial volume in intra-zonal trade and thus precluded the as yet non-existent but potentially important trade in manufactures. This difficulty was overcome to a certain extent by the incorporation in the Treaty of the so-called "Industrial complementarity" agreements, a subject that is discussed later.

The relative participation of member countries in trade in manufactured commodities also reflects the earlier patterns of concentration. Argentina and Brazil (and only to a minor extent Chile and Mexico) tended to dominate the trade in manufactured commodities over the period 1962–1967. The trading relationship in manufactured commodities that seems to be emerging is illustrated by table 5.

## Complementarity agreements for industrial development

Closely allied with trade liberalization in the Montevideo Treaty is the principle of industrial complementarity, whereby the member countries can co-ordinate their plans for specialization and expansion through vertical and/or horizontal integration of industrial sectors. Industrial complementarity rests on two underlying objectives: *(a)* to develop manufacturing activities in the LAFTA region so as to correct the structural disequilibrium in internal and external sectors, and *(b)* to ensure that such development is compatible with an equitable distribution of costs and benefits among member countries at different stages of development.

Complementarity agreements are designed to facilitate the incorporation into the trade liberalization programme of products that do not currently enter intra-zonal trade, to permit a fuller exploitation of economies of scale and to avoid wasteful duplication of uncorrelated capital investments. The process is best illustrated by the most important of these agreements, relating to the petrochemical industry, entered into by Bolivia, Colombia, Chile and Peru in July 1968. The four

countries have contracted to distribute among themselves the production of 39 items of the petrochemical sector, with a non-duplicating clause, according to which industries allotted to one country will not be established in others.

To date there are eleven complementarity agreements in force in LAFTA[11]. Most of the trade expansion in the manufactured products in LAFTA (table 2) is due to these agreements. Probably the largest increase in trade in manufactures has been in business machines and electron tubes, both of which are subject to complementarity agreements. Trade in business machines increased from $3,200 in 1962 to $1.33 million in 1966 and in electron tubes from $139 in 1964 to $1.7 million in 1966. In addition, there are nearly 25 proposed agreements in various stages of completion.

It is generally agreed, however, that notwithstanding their dramatic increase, the industrial complementarity schemes in LAFTA have not been very effective.[12] Too few agreements have been reached, and they involve only a narrow range of products and a small number of countries. Their preoccupation has been the reduction of tariff and non-tariff barriers to trade, rather than the initiation of substantial new areas of production. In addition, some basic industries in the public sector, such as steel, aluminium and fertilizers, have been left out of the integration process altogether.

## Regional disparities

It is clear, therefore, that a certain amount of specialization has taken place through complementarity agreements, although no new industries have been set up to serve the entire regional market. On the other hand, complementarity arrangements may themselves have contributed to the dissatisfaction of relatively less developed countries in LAFTA, which find it difficult to build viable manufacturing sectors within the existing framework of the treaty. In fact, the problem of the equitable distribution of potential industrial capacity in LAFTA is now one of the most critical issues facing the integration movement and is largely responsible for LAFTA's current difficulties.

The economic disparities between LAFTA countries are considerable: per capita income in 1966 ranged from $172 in Bolivia to $872 in Argentina (and $982 in Venezuela), while the relative weight of industry in the GDP ranged from 32.4 per cent in Argentina to a low of 12.9 per cent in Venezuela and 14.3 per cent in Bolivia. Argentina, Brazil and Mexico are much more advanced in industrialization and capital formation than any of the other LAFTA countries. Present imbalances in structure among LAFTA members almost make it inevitable that reciprocity will be far from automatic and will have to be achieved by more direct and open means of distribution. Excessive reliance on economies of scale may further complicate the problem, since countries that already have a viable industrial structure will tend to be favoured on grounds of comparative cost. An important consequence of this rigidity is that changes in savings rate, and hence in the rate of investment, in the lesser developed countries will not materialize to the desired degree and will become conditional on the composition of the (low) existing capital stock. Far from promoting any coherent goal of regional development, the mere freeing of trade without the necessary corrective mechanisms may ossify the existing distribution of capacity (and there is no presumption that this is optimal) and thus create more rigidity in the continental production and trade flows.

The crucial concern of industrial policy in LAFTA, therefore, must be with the allocation of potential industrial capacity according to criteria that go beyond the mechanism of freer trade. This does not imply that freeing rade is unnecessary; in fact, trade liberalization acts as a catalyst on other important phenomena of economic growth.

The largely unwarranted claim that efficiency can be based simply on static economies of scale (thus excluding the external economies, transport costs and intertemporal growth of demand) when it is combined with the search for reciprocity has created a kind of schizophrenia in LAFTA's industrial policy. These two objectives have divergent consequences. Efficiency impels industrial activities to concentrate in the already developed regions of the continent, while reciprocity inevitably requires their dispersion. It is clear that some form of bargaining process will have to be incorporated into the trade liberalization policy as a means of allocating industrial capacity. The frequently suggested method of lump-sum transfers to the disadvantaged groups in an integration area cannot be relevant if no institutional means exist for their implementation, as is typically the case in LAFTA. Even if such transfers were possible, they will do little to solve the problem of structural viability in the receiving countries. The most important, if not the only, means of redistribution may consist of increasing the rate of industrial development.

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[11] 1. Business and statistical machines (Argentina, Brazil, Chile, Uruguay). 2. Electron tubes (Argentina, Brazil, Chile, Mexico, Uruguay. 3. Household heating equipment (Brazil, Uruguay). 4. Electronic communications equipment (Brazil, Uruguay). 5. Chemicals (Argentina, Brazil, Colombia, Chile, Mexico, Peru, Uruguay, Venezuela). 6. Petrochemicals (Bolivia, Colombia, Chile, Peru). 7. Household appliances (Argentina, Uruguay). 8. Glass products (Argentina, Mexico). 9. Electric equipment (Brazil, Mexico). 10. Office machinery (Argentina, Brazil and Mexico). 11. Typewriters and accessories (Argentina, Brazil, Mexico and Chile). Cf. *LAFTA Newsletter*, No. 2. July 1970.

[12] H. Brewster (1970) *Methods and Procedures for Regional Development and Trade Expansion*, UNCTAD, Geneva (mimeo).

# Extension Services Available to Small-scale Industries in India

by J. D. Verma

**The Author:** *J. D. Verma is an industrial economist and has been working in the Small Scale Industries Development Organization of the Government of India for the last fourteen years. He is currently in over-all charge of the Organization's Industrial Information Service. Dr. Verma was previously a professor and Head of the Department of Economics of a Degree College in northern India. He obtained his Ph.D. in Economics from Lucknow University in 1955. He has been associated with a large number of techno-economic surveys concerned with identifying the potentials of small-scale industries. In addition to having been a member of Government delegations to Iran in connexion with the development of industrial co-operation between the two countries, he was also nominated by his Government to participate at the Interregional Seminar on Industrial Information in Tehran in 1970, of which UNIDO was a joint sponsor.*

## Industrial background

One of the significant achievements of planning in India in the last decade and a half has been the emergence of a closely knit small-scale industries sector.[1] Starting from an insignificant number in 1954, the small-scale industrial units now registered throughout the country with the State Directorates of Industries is reported to be 200,000. The actual number may be still higher, as registration is voluntary. The factories registered contribute nearly one third of the total industrial production in India and employ approximately the same proportion of the country's workers. Today, the range of production in this sector includes not only consumer goods calling for simple techniques but also some intermediary and sophisticated industrial products requiring a high degree of skill and technology. Besides small machine tools, small-scale industrial units are producing such goods as scientific instruments, domestic electrical appliances, sewing machines and parts, bicycles, dye-stuffs, paints and varnish and plastic goods.

The success of this programme is also evident from the fact that the large-scale assembly plants for automobiles, heavy machinery and machine tools are being supplied with a considerable quantity of parts and components from small-scale industries that have developed special skills and equipment at the instance of larger industries. In addition, small-scale industrial units are producing articles that were formerly imported. Thus, the programme for their development in India has brought about a much needed diversification in the economic and industrial structure of the country. More and more people are shifting from agriculture to industry, rural areas are being transformed into semi-urban areas and towns, and traditional skills are being replaced by advanced technology. Recently, the small-scale entrepreneur in India has begun to export, particularly to Japan, to the Middle East, to some European countries and to the United States.

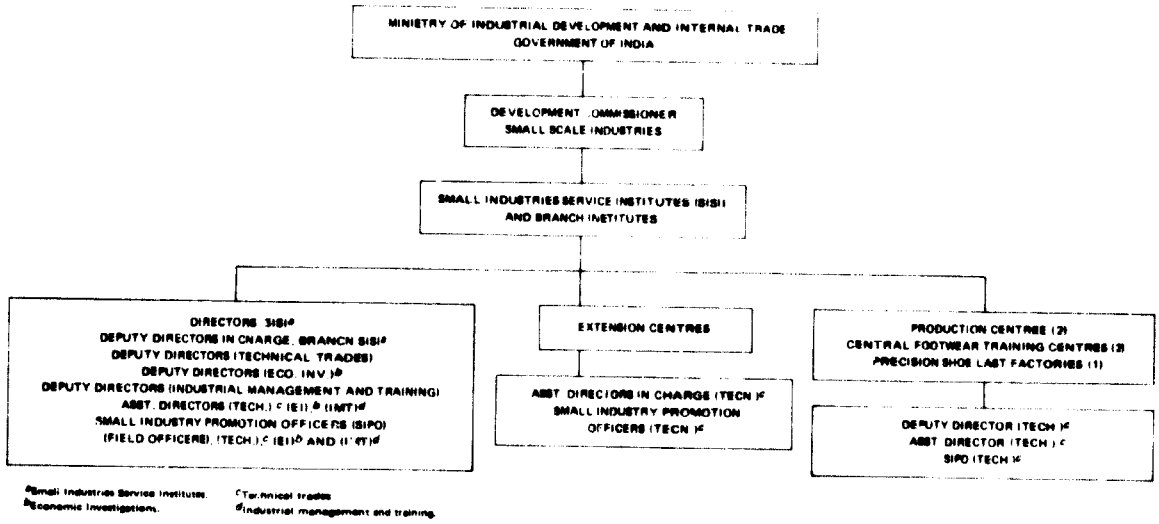
The role played by the Small-scale Industries Development Organization (SSIDO) has been unique in the growth of small industries in India. This is by far the most important technical extension service in the country. Its main task is to help small-scale enterprises improve their technology and expand their activities as well as to facilitate their integration into the over-all industrialization programme of the country.

## Need for extension services

The need for an advisory service for small industries arises because small firms lack technical and managerial know-how. This shortcoming is a major handicap in an era when sophisticated technology and management are the corner-stone of industrial progress. The small

[1] According to the present definition, a unit having a capital investment of Rs750,000 ($U.S.100,000) in machinery and equipment, irrespective of number of workers employed, is a small-scale unit. The capital investment limit is extended to Rs1,000,000 ($133,350) for those units that produce components and parts for supplying large-scale equipment assemblers under contract.

## ORGANIZATIONAL STRUCTURE OF THE EXTENSION SERVICES UNDER THE SSIDO (SMALL-SCALE INDUSTRIES DEVELOPMENT ORGANIZATION)




enterprise, because of its size and location, generally suffers from certain serious impediments, particularly the absence of up-to-date technical information and assistance, economic intelligence, and marketing and managerial techniques. The entrepreneur-manager may have a number of assistants with special knowledge, but normally he must perform all the functions of the various technicians that are usually available to a large-scale industry. The small entrepreneur must make more of the firm's decisions on such diverse and critical matters as product lines, production techniques, purchasing, marketing and management. He is generally not in a position to engage full-time technical personnel or consultants, nor is he able to keep informed about developing technology. His financial, managerial and marketing problems are many and acute, and the methods he adopts to solve them are frequently inefficient.

This problem arises in almost every developing country in varying degrees and is, therefore, no exception in India. In order to remove some of the main hindrances to small-scale industrial units in India and to provide facilities for improving their production techniques, product quality, utilization of raw material etc., industrial extension services have been made available by several organizations, of which SSIDO is one.

SSIDO, a Government of India Department, came into existence in 1954 as a result of recommendations made by an international planning team sponsored by the Ford Foundation, which had been invited by the Government of India to study and advise on a programme for the development of small-scale industries. In the beginning, besides the headquarters office, it had four regional offices located at New Delhi, Bombay, Calcutta and Madras. This regional set-up was subsequently decentralized, and at present every province of India has a fully operating Small Industries Service Institute (SISI). In addition to these institutes, there are 65 extension centres and production and training centres located in various areas where there is industrial concentration in several states. (See chart.)

### Scope of the extension services

The industrial extension services rendered by SSIDO consist of the following:

*(a)* Technical advice and demonstrations in the use of modern technical processes;

*(b)* Preparation of model schemes, designs, drawings and technical pamphlets;

*(c)* Techno-economic surveys and investigations;

*(d)* Advice on proper methods of industrial management, including export marketing;

*(e)* Integrated plant studies and "open house discussions" for improving management and production techniques;

*(f)* Market distribution aid surveys;

*(g)* Feasibility reports;

*(h)* Research on such questions as proper use of raw materials, improved design of machinery;

*(i)* Information on economic, commercial and technical matters.

To provide the above services, the SISI, or branch offices of SSIDO in each state, employ technical experts

specializing in the industries predominating in those states, e.g. mechanical engineering, metallurgical engineering, electrical engineering, leather footwear and other leather goods, leather tanning, chemical industries, metal polishing, ceramics and glass and industrial design. Each service institute is headed by a director who is himself a technical expert. Under him are deputy directors, assistant directors, small industry promotion officers and investigators to help him discharge his duties.

The technical and non-technical officers work as a team in providing a combined package of extension services to small entrepreneurs. The joint visits of technical, economic and managerial experts to various units deserve special mention. They exemplify the integrated approach of the extension service organization in solving the multifarious problems of a small-scale enterprise. In the national headquarters of SSIDO there is also a complement of experts in different fields at the levels of directors, deputy directors, assistant directors and small-industry promotion officers, whose functions, besides co-ordinating activities in the field, include advice to the Ministry of Industrial Development and Internal Trade, the National Planning Commission and various other central government departments in formulating the programmes and policies of the small-scale industries development programme. About 600 technical officers at different levels furnish the technical extension services of SSIDO.

## Technical advice

Technical officers attached to the SISI and extension centres advise small-scale units on proper production techniques, use of raw materials, plant layout, selection of machinery and equipment, quality control etc. The significant feature of this service is that the technical officers go directly to the entrepreneurs to provide on-the-spot assistance. Advice on scale of operation, size of the plant and application of proper technology is also given.

Technical officers also assist state governments and various central government departments from time to time in formulating their projects.

## Mobile demonstration workshops

In order to train rural artisans in the use of machinery and equipment, the institutes have been provided with mobile workshops fitted with modern machines and tools for use in such sectors as leather goods, sheet metal products, woodworking and shoemaking. The staff manning these workshops give information about specifications, prices, sources of machines etc., and explain to the artisans the hire-purchase scheme of the National Small Industries Corporation Limited (an organization of the Government of India that supplies machines to small-scale units on a hire-purchase basis on attractive terms.

## Preparation of technical literature

The Small Industries Service Institutes prepare designs, sketches and drawings of various types of improved machinery, equipment, tools, dies, jigs, fixtures, factory layouts, etc. for the benefit of small entrepreneurs and supply them to interested parties. The industrial design cell attached to the SISI at New Delhi undertakes the preparation of product designs after studying consumer demand, financial factors, aesthetic appeal and manufacturing capacities of the producers. The cell specializes in such product lines as cutlery, domestic utensils, domestic electrical appliances, furniture, ceramic products, leather goods and leather toys. A central designs section is also attached to the SISI at New Delhi. A lens grinding centre, which is another service of the SISI at New Delhi, serves industrial units in all parts of the country from which every type of request for assistance is received.

## Common facility services

Workshops and laboratories are attached to the institutes and extension centres. Common service and tooling facilities are provided by the extension centres and institute workshops to those small-scale units that cannot afford costly essential machines and equipment. The extension centres have such plant and machinery facilities as electroplating, heat treatment and testing equipment, which may be required by the industries concentrated in a particular area. These facilities are available to small units at reasonable cost. They are also utilized by SSIDO technical officers for trying out improved methods of production and evolving new processes and compositions. These centres play another important role in training artisans in modern techniques.

## Other services

Other services organized or planned under the industrial extension service programme of SSIDO include the following:

*(a)* A centre for the production and supply of standardized shoe lasts to small-scale manufacturers of footwear;

*(b)* A model unit for the manufacture of surgical instruments in Bombay;

*(c)* Quality marking and testing centres for raw materials and finished products;

*(d)* Testing laboratories for electroplating, electric batteries and paints manufactured by small industries;

(e) Three prototype production-training centres have been set up at Okhla (Delhi), Rajkot and Howrah, by the National Small Industries Corporation with the assistance of the Governments of the Federal Republic of Germany, the United States and Japan, respectively. The main functions of these centres are to develop prototypes of machines, implements, components, etc. suitable for production in small-scale enterprises in India; to give practical and theoretical training to skilled workers and technicians of small units and the SISI; and to provide common facilities and execute job orders covering phases of manufacture that cannot be carried out by small-scale units.

## Economic information service

Each SISI has a team of economists who conduct various types of surveys and supply economic information to guide entrepreneurs in choosing suitable industries and their location. The data based on the surveys and studies conducted by the economic divisions of the SISI assist prospective entrepreneurs in making preliminary investment decisions and are an aid in formulating policies relating to the small-scale sector as well as in basic economic planning.

## Surveys and studies

The types of studies undertaken include: *(a)* "industry prospect sheets" which contain basic data on number of units, production capacity, demand trends, and indicate prospects for new units; *(b)* area development surveys of selected districts which point out the possibilities of developing industries in these areas and the types of facilities that are required for this purpose; *(c)* regional market surveys on selected items to highlight industrial demand and price trends, competitive situation, marketing methods and patterns and marketing organization; *(d)* distribution aid surveys to study the particular marketing problems of the small entrepreneur such as the nature and extent of the market for his products, methods of advertising and selling adopted by competitors, the trade practices, market channels, terms and incentives offered, in order to devise ways of promoting sales; *(e)* feasibility studies to assist the individual entrepreneur in making investment decisions and in establishing a unit in an area of his choice (these studies help small entrepreneurs understand the economics of producing items in a particular area or for a given market and indicate the appropriate scale of investment and plant operation in the context of anticipated availability of inputs and prevailing market prices); and *(f) ad hoc* studies and surveys of specific industries at the request of agencies such as the Tariff Commission and all-India panels on specific industries.

## Industrial information service

On the basis of the information collected by these various types of surveys as well as the information made available by the technical sections of the institutes, the economic investigation divisions of the SISI provide an industrial information service on the economic, technical and managerial aspects of small-scale industries to enable prospective entrepreneurs to make appropriate investment decisions. This service handles about 25,000 to 30,000 inquiries per year at present. The inquiries relate to the advisability of starting new units, marketing prospects, types of assistance available from various sources, availability of raw materials, machinery, credit, etc. The service also follows up the efforts made by individual entrepreneurs to start an industry, if necessary in liaison with other developmental agencies such as the state industries departments, with a view to securing prompt assistance for such individuals.

One important type of information provided to existing small industries relates to the production of quality goods according to acceptable standard specifications. For this purpose, complete lists of standard specifications of the Indian Standards Institution (where SSIDO is represented) are maintained in each Small Industries Service Institute.

## Industrial management advice and training programmes

SSIDO, through its institutes, trains small entrepreneurs in methods of industrial management. These training courses are designed to meet the needs of small entrepreneurs and their employees engaged in managerial duties, and are conducted at convenient places and times. Subjects include export marketing, financial accounting, cost accountancy, factory legislation and personnel management. There are three types of courses conducted in the field of industrial management:

*(a)* Management appreciation courses that cover financial aspects, production and marketing management;

*(b)* Specialized courses in such subjects as production management, work study, marketing management;

*(c)* Export marketing courses which, besides teaching the techniques of export marketing, provide information to exporters.

In addition, short courses are offered on the specific tools and techniques of management—inspection, quality control, work simplification, cost control, production planning and control, product development—in answer to the request of a large number of small units in the field.

## Management consultant service

The management consultant service provided by the SSIDO ranges from *ad hoc* advice on specific problems posed by small entrepreneurs (which is termed problem-oriented consulting) to complete integrated plant studies covering various aspects of finance, production and sales.

## Problem-oriented consulting

Advice on management problems, depending on their nature, is given at the SISI across the table or after the SISI management specialists have visited the unit. Most problems relate to possibilities of expansion, commercial and labour laws, maintenance of accounts and improvement of quality.

## Integrated plant studies

Intensive consultant work is carried out in a programme of "integrated plant studies" whereby a detailed analysis is made of the problems of a given small unit—its organization, personnel, finance, production and sales. A team of SISI officers, who are specialists in management techniques, undertakes the study in such a way that one aspect is not viewed separately from the others. This approach enables the officers to obtain the best results in the given plant situation. During the study, special attention is paid to such aspects as cost reduction, work simplification, quality control, cost accounting and marketing. After the study has been carried out, a report is prepared making recommendations to the management. Once the management has accepted the suggestions, the officers help the unit implement them.

## Training in technical skills

Regular and *ad hoc* training courses in various technical skills are conducted by the SISI and extension centres for skilled and semi-skilled artisans, and for supervisors to help them improve their skills and competences. The training courses cover the following:

*(a)* Training in trades such as fitter, tool maker and machinist, as distinct from the basic apprenticeship;

*(b)* Training in industrial processes such as heat treatment, foundry practice, electroplating, glass blowing and tanning;

*(c)* Training in the manufacture of such products as thermometers, footwear, surgical instruments and electric motors;

*(d)* Courses in blueprint reading, which is a basic requirement for skilled technicians.

Besides the above, training is given by the central footwear training centres at Agra and Madras in the manufacture of different types of footwear, and courses are also offered in advanced technology for footwear manufacturing.

The extension centre at Solan conducts two-year training courses in the manufacture of clinical and industrial thermometers and a one-year course in the manufacture of scientific glass apparatus.

*Ad hoc* training courses are also arranged for short periods of from one to three months, related to various processes and products, to meet the specific requirements of local small-scale units.

## Conclusion

The objective of providing well-co-ordinated and integrated technical and non-technical extension services to the small entrepreneur through a chain of multipurpose technical institutes has been largely achieved in India. A number of improvements are still called for, however, and some of these will be put into operation under the Fourth Five-Year Plan.

# Local Consultant Capability in Iran

by F. Sid Askari

**The Author:** *Mr. F. Sid Askari is Managing Director of Technolog Inc., which is described in this article. He has a B.S. in Mechanical Engineering from the University of Nebraska and a Master of Business Administration (MBA) from the University of Missouri, where he specialized in the fields of quantitative and systems analysis. He also holds certificates from the School of Pipe Line Technology, University of Texas and from the Electronic Computer Program, University of Missouri, Kansas City.*

*Mr Askari has worked in the United States and Iran as a project engineer concerned with the co-ordination of large projects, operation and maintenance of pipelines, analysis, budgeting and control of engineering systems programmes, integrated systems evaluation and design; and economic analysis of investment decisions. He is a registered professional engineer and a member of the American Management Association, American Society of Heating, Refrigeration and Air Conditioning Engineers, and of the Association for Computing Machinery.*

In 1967, a consultant service was established in Iran to provide planning, engineering and technological services to the country's growing industry. The new organization, Technolog Inc., Engineering and Industrial Consultants, has rapidly developed its capabilities and is playing an energetic role in the industrialization process in Iran.

Industrialization is now accepted as essential to the process of development in developing countries. The relative scarcity of vital factors of production in many of these countries requires a well planned and carefully evaluated strategy for industrialization in order to make optimal use of available resources. This involves both macro-level industrial planning and programming and the detailed planning, evaluation and design of individual projects. The process of industrialization is a complicated venture involving the interaction of diverse specialties and disciplines.

Consultants play a crucial role in the industrialization process both during the formulation of the over-all plan for development and in the planning, design and implementation of projects that are a part of a macro-level programme. To better appreciate the contribution consultants make to this process, it would be useful to recapitulate the stages of development that generally apply to most developing economies.

## Evolution and implementation of an industrial development programme

Industrial programming at the macro-level involves certain well defined steps:

*(a)* Basic development strategy to identify the areas of industrial activity in which investment funds must be concentrated for optimal results in the over-all economic development. An industrial strategy indicates whether industrialization will take the course of import substitution of consumer goods, the production of industrial intermediates and/or basic industrial commodities, the manufacture of export-oriented products etc., and suggests the requisite mix of industry types for balanced growth;

*(b)* Study and analysis with the object of determining economic needs of specific geographical regions (needs survey);

*(c)* Appraisal of raw material and similar resources that can be channelled into productive economic activity (physical resource studies);

*(d)* Evaluation of existing and potential financial resources that can be marshalled for industrial development (fiscal resources analysis);

(e) Allocation of available resources to various sub-sectors of industrial activity in order to ensure a balanced and dynamic growth of the industrial sector as a whole. Such an allocation is normally carried out on the basis of input-output studies and the whole process may be referred to as sectoral balance studies;

(f) Assurance that the evolution of the broad industrial programme occurs on the basis of needs and resources in order to facilitate balanced industrial growth;

(g) Identification of industrial projects within the programme and determination of major parameters for these projects such as import requirements, wealth generation capacity, manpower absorption capacity;

(h) Allocation of priorities to individual projects;

(i) Finalization of specific projects in the industrial programme.

Once the over-all plan has been drawn up and the specific projects broadly identified, the next stage is the detailed planning and establishment of specific industrial units. The activities involved during this phase of the development process include:

(a) Market survey and demand studies. Although the over-all programme is based on a survey of requirements, this survey can rarely supply the kind of detailed information about demand by quality, size etc., that alone can provide the basis for for determining the product mix of specific units. Hence a more intensive study of demand is necessary to determine the pattern of production for the proposed units;

(b) Feasibility study. A techno-economic study to analyse the technical feasibility and economic viability of the proposed project. The study provides sufficient information on marketability, plant size and production programme, technology to be adopted, equipment and constructional requirements, production costs and profitability to enable an investment decision to be taken;

(c) Sometimes the feasibility study is followed by a detailed project report, which incorporates technical solutions of the various problems and is thus the basic guide for the detailed engineering of the project. Inasmuch as technical solutions are worked out and incorporated in this project report, the estimates of capital costs and operating economics that it contains are much more exact and represent more closely the actual circumstances of plant operation. The detailed project report is not, however, an essential stage of the work, particularly if the detailed engineering of the plant is carried out by the same agency that conducted the feasibility study;

(d) Preparation of detailed working drawings, specifications, bills of quantities, tender papers, etc., for the actual construction and implementation of the plant. In the event that a detailed project report has already been prepared, in this stage the technical solutions contained in this project report are translated into the drawings and documents required for actual implementation. If, however, the detailed engineering directly follows a feasibility study, technical solutions are worked out and the design for the solutions adopted are developed prior to preparation of working drawings and specifications;

(e) Selection of contractors and suppliers of equipment;

(f) Supervision of actual construction and erection at site of works, including scheduling and follow-up;

(g) Inspection of equipment as necessary;

(h) Commissioning of equipment and start-up of plant;

(i) Structuring of organization, development of job specifications for various cadres of manpower, recruitment and training of personnel;

(j) Preparation of technical documentation specifying product design and processes, and preparation of detailed production planning schedules and plant operation procedures;

In most cases in developing countries, at least in the earlier stages of the industrialization process, such technical documentation must be borrowed from more developed countries. However, imported technology often needs to be evaluated and adapted to suit local conditions and to correspond to the stage of development of the recipient country. Details of technology, such as concepts of plant size, are very much dependent on the economic environment, and the wholesale transplantation from one economic climate to another may often cause incalculable harm. The adaptation of an imported technology to local conditions can be achieved by persons who have an intimate and first-hand knowledge of local conditions.

## Role of consultants in the industrialization process

Since the over-all industrialization programme is a part of the over-all development plan of a country, macro-level planning and programming for industrializa-

tion are generally carried out by organizations of the Government, normally a planning commission or an executive ministry specifically charged with over-all planning. Such a procedure is necessary since the evolution of a development programme does not merely concern economic phenomena but must be integrated into the social and cultural framework and conform to the aspirations of the people. However, the government planning organizations in most developing countries are staffed with economists and planners oriented towards policy formulation, and lack experts who could conduct the more detailed studies necessary for the evolution of the programme. Consultants provide these services and supplement the functions of the planning body. The economic services that consultants are most frequently called upon to render for macro-level programming are:

*(a)* Surveys of requirements;

*(b)* Evaluation of physical resources;

*(c)* Development of input-output models; and

*(d)* Identification of specific projects within the broad programme.

In some cases, specific governmental agencies are created to make systematic studies of physical resources, e.g. of minerals and metals. Similarly, government ministries (such as the Ministry of Economy in Iran) prepare estimates of national needs in various cases. Nonetheless, the use of outside agencies is not uncommon or infrequent.

Once the over-all plan has been drawn up and the constituent projects identified, the entire range of activities for planning and implementation at the unit or sub-system level are normally carried out by consultants. These activities extend from demand studies and feasibility reporting to detailed engineering, construction and erection supervision, plant start-up and commissioning. In Iran, as in other developing countries, these services are provided by engineering and industrial consultants. For the most part, such consultants provide services in specific areas (e.g. civil engineering) rather than comprehensive project engineering services.

The above refers to industrial consultant services dealing with project engineering. Additionally, consultants also offer specialist advice in matters of organization and staffing, recruitment and training of personnel, evaluation of plant operating procedures, productivity improvement, product line diversification etc. Such services are not, however, yet fully available locally in most developing countries. In Iran, a start has just been made in certain areas of management consulting.

Technical consulting for development of products and processes is often provided by specialist consultant groups or by engineering and process development departments of manufacturing companies. Development of products and processes calls for laboratory and pilot plant testing facilities and hence consultants specializing in this area need to be equipped with their own facilities or work in collaboration with the development departments of operating units.

In most developing countries, local facilities for technical consulting are almost non-existent. This situation is true of Iran except in the field of petroleum exploration and refining.

## Consultant services in Iran: genesis of Technolog Inc.

Iran embarked on a policy of planned economic development with the First Development Plan, which spanned the years 1948–1955. The country is now in the period of its fourth Development Plan. The aim of the Plans, as far as the industrial sector is concerned, is to broaden the base of industrial activity and to accelerate its growth so that it can take the lead in economic development. A number of new industrial ventures have been established to fill gaps in the national economy, largely with foreign technical collaboration.

The diversification of industrial activity created the need for engineering and industrial consultants and revealed the serious shortage in the country of comprehensive project consulting. Owing to historical circumstances and Iran's long tradition in oil exploration, expertise has existed in this field as well as in planning, designing and implementation of refinery installations.

Other areas in which local expertise has been developed relate essentially to architectural and civil engineering, including heating and ventilation. Even in this area, however, available know-how has been largely oriented to the design of commercial and residential buildings rather than to industrial installations.

The situation in Iran made it necessary for Iranian entrepreneurs to depend on foreign sources for feasibility studies and project engineering services. In a large majority of cases, feasibility studies were prepared by prospective equipment suppliers and lacked objectivity. The project was often elaborated on the basis of the equipment marketed by such agencies, and concepts of plant size and product mix did not reflect fully or accurately the realities of the local situation.

Foreign technical collaborators in project engineering generally supplied design solutions that were not conducive to optimal use of local materials and that resulted in diseconomies. The idea was conceived to establish a local consultant service at a time when massive investments in industry were being planned under the Fourth Development Plan (1968–1972).

In 1967, just before the initiation of the Fourth Development Plan, the Government of Iran set up the Industrial Development and Renovation Organization of Iran to promote the dynamic and balanced growth of industry. The functions of the new organization (IDRO) included promotion and operation of industrial units in

the fields of manufacturing, metallurgy, mining, etc. The first few units implemented and operated by IDRO involved the manufacture of machine tools, tractors, heavy engineering equipment, light manufactures and aluminium smelting. IDRO recognized from the outset that the existence of a well organized and competent local consultant service was an essential prerequisite for the healthy growth of industry in the country and immediately set about to fulfil that need.

The result was the establishment of Technolog Inc. The objective of the new company was to provide consultant services to industry both at the feasibility and project formulation stage and in detailed designing and engineering work.

## Growth of Technolog and evolution of its services

As was to be expected, the new consultant organization could not immediately fill the need and offer the entire range of services from project feasibility studies to start-up and commissioning advice unless it borrowed heavily from outside sources. The range and complexity of services that Technolog offered, therefore, evolved with time, and its evolution was also influenced by the increasing acceptance of its services by entrepreneurs.

In the initial stages the work assigned to Technolog consisted mainly of evaluation of project reports prepared by other agencies. This evaluation was normally concerned with determining a project's compatibility with local demand, equipment utilization, adherence to local norms and standards, and computations of realistic estimates of costs and profitability under prevailing local conditions. Another category of work handled during the early stages was the provision of technical services to newly established industrial units not yet equipped with an adequate technical staff of their own.

Later, Technolog assignments comprised the preparation of feasibility studies and evaluation of offers for plant and equipment from the standpoint of technical suitability and fair prices. The engineering expertise required by these assignments was markedly higher and the reputation of the organization's technical capabilities grew with its completed assignments.

A still later stage in the evolution of Technolog's services included detailed engineering of projects, e.g. detailed design and preparation of working drawings and specifications, advice in selection of contractors and equipment suppliers, and site supervision of construction and erection.

Technolog now offers the complete range of engineering and industrial consulting services from demand studies and feasibility reports through detailed drawings and specifications and construction and erection supervision.

Technolog's in-house capability as well as its complement of technical personnel have grown in the course of its evolution. At the same time, through affiliations with other organizations in Iran and outside, it has achieved a capacity to provide comprehensive planning and project engineering services to clients, obviating the need for them to deal with a multiplicity of consulting agencies. Through the Industrial Management Institute of Iran, it provides consultant services on project management, organization structuring and staffing, financial management, and operations research problems. Through the National Industrial Development Corporation Limited of India, with whom Technolog collaborates, and other international associates the company has available expertise in any area of technical specialization dealing with a wide and diverse range of industrial activity.

## Problems of local consultant organizations

Despite its achievements, Technolog has had to contend with some serious problems during the past few years of its operation, problems that are common in varying degrees to consultant organizations in all developing countries.

Perhaps one of the most serious impediments to more accelerated growth has been the uncertainty as to its continuous and future work load and the consequent restriction on long-term planning for corporate growth. It is admittedly a paradox that when the country is progressing at an accelerated tempo of industrial activity and the demand for consultant services is increasing proportionately, a local consultant service experiences spells of inactivity. The reason is that the local entrepreneur is unwilling to use the services of local consultants who might be dealing with a specific type of project for the first time. Added to this is the new local firm's poor competitive position vis-à-vis the more experienced foreign consultant, particularly in Iran where wages for trained and experienced technical personnel are relatively high. The entrepreneur feels that he would be paying too much for an inexperienced local consultant. The new consultant's position certainly improves as completed assignments give proof of his competence. But meanwhile his existence is highly insecure.

Technolog's way of remedying the situation has been either to enter into active collaboration with an experienced foreign consultant firm in order to offer more acceptable conditions for the client or to quantify the risks involved for the client in each component of a total project in such a way as to demonstrate that these are not as great as is generally imagined. On the other hand, instances occur in which a foreign consultant, unaware of local circumstances, perpetrates diseconomies in plant design and operation by introducing technology and design completely out of keeping with the economic and social environment.

Another major problem for consultants operating in Iran, as in most other developing countries, is the lack of organized information. Information required by consultants may be broadly categorized as follows:

*(a)* Information on availability of local material and equipment, specifications and prices;

*(b)* Information on local conditions such as meteorological and soil conditions, wage rates, industrial rules, plant operation practices, freight rates and levies;

*(c)* Information on equipment produced elsewhere, prices and performance;

*(d)* Industrial planning information such as industry profiles and input-output coefficients.

Consultants in developed countries have the advantage in that such information is readily available as published material or can be obtained from well organized libraries and information centres. In most developing countries, the consultant must create his own information centre for his own needs. The initial efforts of Technolog were, in fact, devoted to the creation of a properly organized information centre where industrial information of all kinds is collected, classified, up-dated and stored for easy reference.

As far as international prices of equipment, industrial planning information and the like (not of a local character) are concerned, it is felt that world bodies like UNIDO can play a very useful role in organizing information centres on a country to country basis to supply consultants and other local organizations with such up-to-date information.

The need for collecting, compiling and analysing information of a local character is particularly great in a country such as Iran (where a local consultant has to evaluate and adapt imported solutions to fit the local situation) because of the absence of comprehensive local norms and standards. The Iranian Standards Institution has begun the work of preparing national standards for Iran, and it is expected that in a few years' time these will be readily available for consultants. For the present, however, the consultant must evolve his own house standards to guide design work.

The third major problem that faces a local consultant in Iran operating in non-traditional areas such as industrial consulting is the shortage of experienced personnel. Trained personnel are no doubt available in Iran, but they are scattered and need to be sought out and brought together into a harmonious working team. Furthermore, many are trained abroad and need to be oriented to local conditions. The task is no mean one considering the inevitable movement of personnel to more lucrative opportunities in a constantly growing industrial economy. The consultant therefore has the constant problem of training assistants and of maintaining a basic nucleus of trained personnel.

## Conclusion

All these difficulties in the way of a new local consultant can be surmounted, as Technolog has in some measure done, but at a price. Creating an information centre, continuous training of personnel, borrowing services from collaborators—all these are costly and must necessarily be reflected in the cost of consultant services offered, unless some form of subsidy or soft credit is available. If, in addition, periods of idleness occur because of lack of orders, the survival of the organization itself becomes precarious.

The situation warrants some form of protective action by the authorities, perhaps through extending the principle of protection often granted to infant industries in developing countries. If local consultant services are to be recognized as a vital factor in the sustained growth of local industry, there can be no justification for treating them differently from local industry.

# UNIDO Projects

## Chile's new Metalworking Industry Testing Centre

### Expertise, Fellowships and Equipment Provided Through UNIDO to Benefit Suppliers, Manufacturers and Users

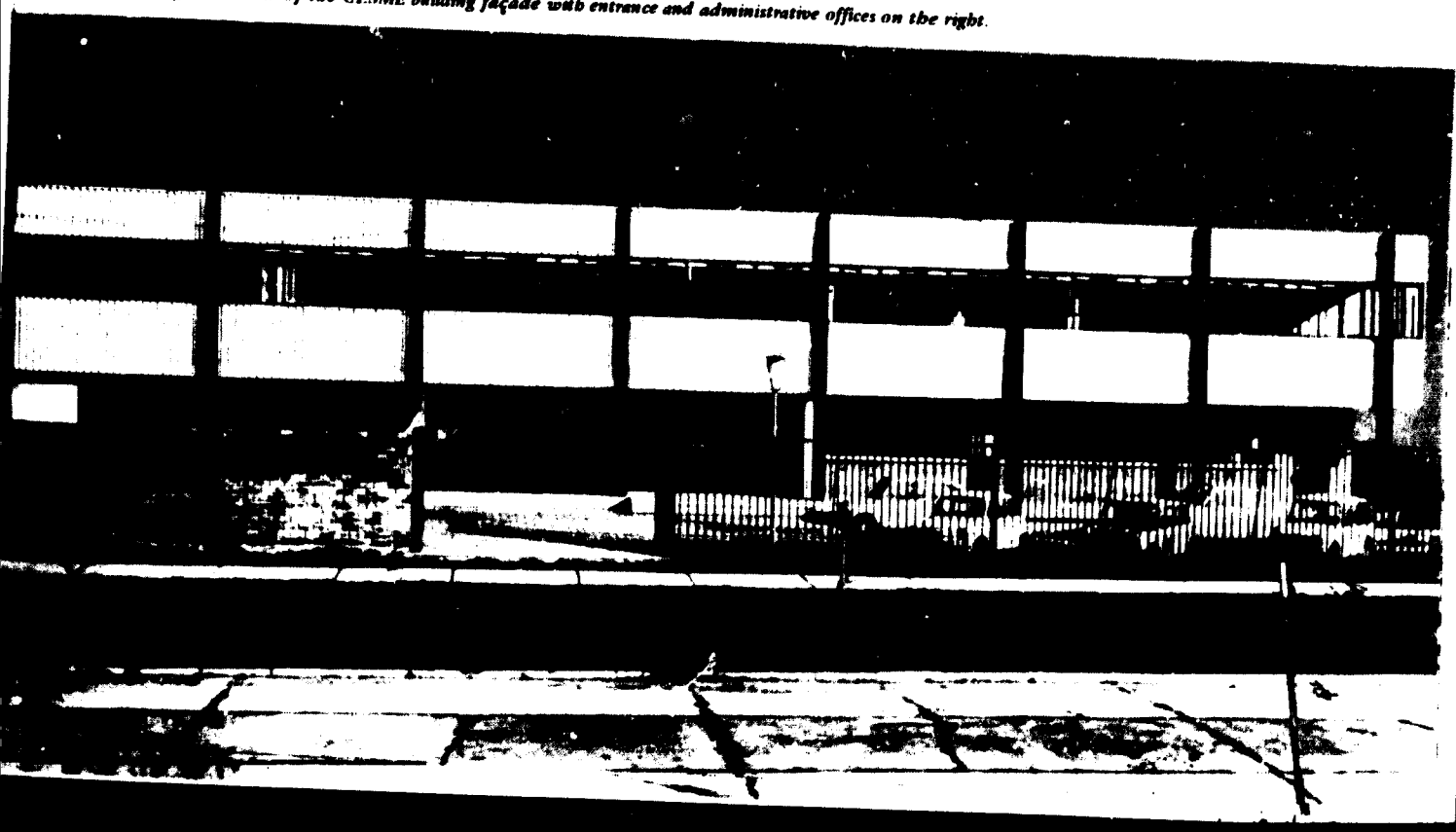
Little more than two years after ground-breaking, a group of laboratories housed in a specially designed building has arisen in Santiago, Chile. It is the Central Metalworking, Industrial and Domestic Equipment Testing Laboratory. The complex is the result of a plan developed by the Chilean Government, approved by the United Nations Development Programme (UNDP) and carried out by UNIDO.

Commercial activities on behalf of suppliers, manufacturers and consumers are now starting in the laboratories, known locally as CESME (Centro de Servicios Metalúrgicos). The objective is to raise the standards of industrial production through the application of the philosophies, practices and concepts of quality control. In close collaboration will be the National Standards Body (INDITECNOR); the Technical Co-operation Service (SCT), which promotes small and medium-sized industries; the National Vocational Training Institute (INACAP), which is responsible for training; the Chilean Enterprise Management Institute (ICARE), which is responsible for management and productivity training; and the Association of Metalworking Industrialists (ASIMET), the manufacturers' association, which represents potential users of the centre's services.

The Production Development Corporation (CORFO) through the Chilean Steel Institute (ICHA) represents the larger metalworking industries and will act as the Chilean executive organization.

Chile has thus been provided with the services of an industrial laboratory and workshop for testing materials and finished products; services to control and calibrate measuring instruments; technical services in fields that require specialized equipment and instruments not

*A general view of the CESME building façade with entrance and administrative offices on the right.*



*President Salvador Allende of Chile cuts the inaugural ribbon, officially opening the CESME laboratories for business.*

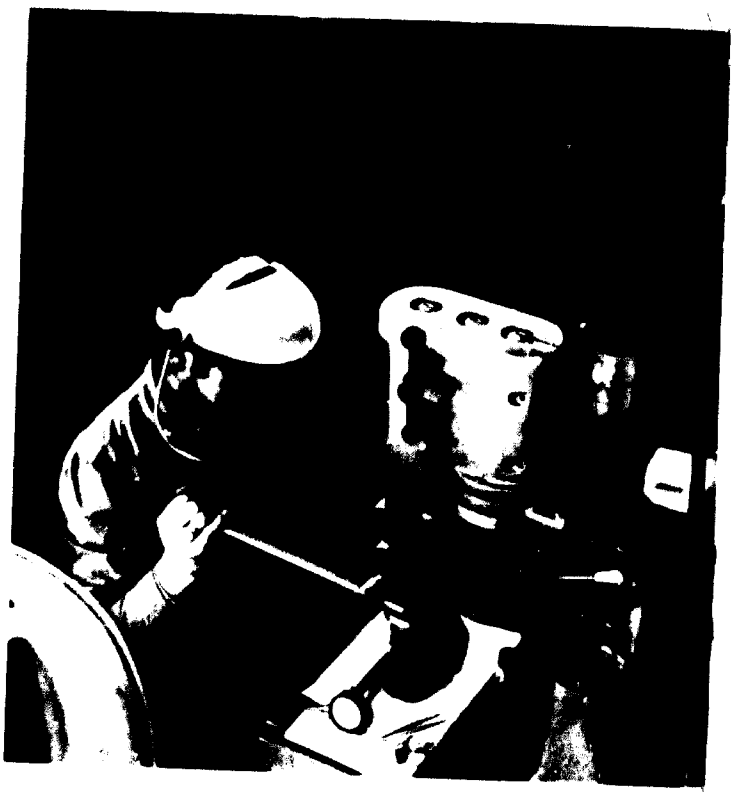
end of December. More than half of the equipment ordered has now arrived, and 12 staff members recruited locally are being assisted and trained by the UNIDO Project Manager and two experts one on metrology, the other on testing of metals. Two other experts appointed by UNIDO have prepared special studies in the Federal Republic of Germany and New Zealand on spectro-chemical analysis and non-destructive testing. Two more are about to take up duties related to finished products testing and non-metallic materials testing.

Products that have already been tested include kitchen mixers, heaters, fire-fighting equipment, automobile wheels, plating for cans and several welded and cast parts.

The Government of Chile has contributed 15 million escudos ($978,000) for the project and the UNDP allocation is $590,000, of which nearly half has been used.

The President of Chile, Salvador Allende, inaugurated CESME on 25 October 1971.

***Well-equipped machine shop is typical of CESME's up-to-date appointments, which include chemical and analytical laboratories; a mechanical test laboratory; piped-in air, steam, gas and vaccuum; and an employees' lounge and cafeteria.***



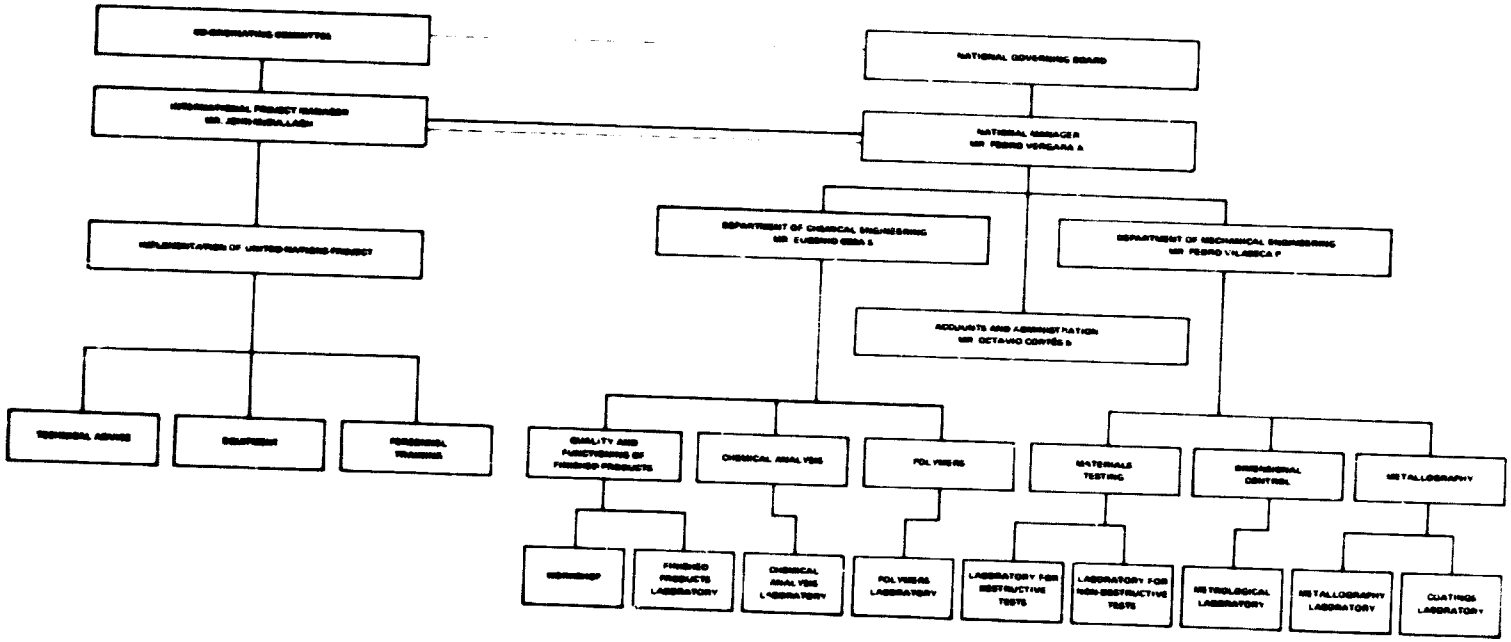
available to small manufacturers; and advisory services aimed at improving technical standards. As activities expand the centre will devote one of its sections to quality control of refrigerators, washing machines, stoves, gas heaters and other products for domestic use.

A physical measurement and dimensional control laboratory equipped with high-grade mechanical measuring apparatus forms one of the sections. There are also chemical and metallography laboratories for testing materials, shops for physical testing and for casting sands, a small workshop and a laboratory for testing elastomers.

The major task lying ahead is to supply high-level professional services in the field of testing and general quality control, for which there is a high demand in the metalworking industry.

The plan of operation was signed at the beginning of November 1970, and the building was occupied at the

## ORGANIZATIONAL CHART OF THE CENTRO DE SERVICIOS METALURGICOS (CESME) LTDA.



# Ferro-cement Fishing Boat for the South Pacific

## Fijian Students Build UNIDO-designed Prototype

Chicken wire and mortar were the basic raw materials used by unskilled students from a technical institute in Fiji to build a ten-metre fishing boat that is now sailing successfully. Both the fishing and the boat-building industries of Fiji will benefit from this work, which was initiated and supervised by an expert sent to the South Pacific by UNIDO.

UNIDO assigned Arne Sannergren of Sweden, a specialist in shipbuilding and repairing, to Fiji towards the end of 1969 in pursuance of a request of the Government, which wanted an assessment made of requirements for boats and the facilities for building them. Since he has been there he has designed, among others, two types of boat to stand up to conditions peculiar to the islands of the area, and both have been built. One is a nine-metre-long, shallow-draft boat with a plywood hull intended for use at Naivilaca Fishing Scheme, part of the Fisheries Division of the Ministry of Commerce, Industry and Co-operation, to which Mr. Sannergren is attached.

The second type was built of reinforced concrete, or, more correctly, ferro-cement, a method of construction that has been comparatively recent in other parts of the world but of which there was no experience in Fiji. Mr. Sannergren had to design the boat, work out plans for the foundations and roof covering for construction, prepare mouldings to ensure the correct alignment of the boat's framework, develop ways to bend pipes for the frames and go into all other details so that work could be started. Since the boat was to be built upside down, a method had to be devised to turn it over for the final stages.

An example of ingenious use of available material was the means adopted for bending metal. This involved obtaining two blocks of wood each about a metre long and half-a-metre square, standing them on end at fixed distances apart, placing the metal rods or wire between them and hitting them with a two-pound hammer.

Then the building work began. The Derrick Technical Institute, a training school, provided 14 young Fijians who in fact finished the task in 858 man-hours. A comparatively long period of 28 days had to be allowed for curing, a process which consisted of spraying the inside and outside of the hull with fresh water very soon after plastering was finished and then covering it with sacking, which had to be kept wet.

For the finish, an epoxy paint made locally was used, with two undercoats and two finishing coats. During fitting out it was found that a mix of epoxy and cement made a strong filler, and bunks, cupboard frames and other fitments were fixed to the bare concrete before painting.

Ordinary chicken wire was used for the reinforcement, using eight layers tightly fastened. Once plastering was started it had to be completed in a continuous operation. Plastering consisted of pushing the cement, made after careful testing, through the mesh, with workers operating from inside as well as outside the hull to smooth off the surface and apply the finishing touches. A wooden framework was built so that the whole of the hull could be reached without difficulty.

As Mr. Sannergren summarized, what is now called ferro-cement is in fact a very highly reinforced mortar using Portland cement and fine sand trowelled on a framework of pipe, rod and chicken wire. The result is a strong, thin and flexible slab with a very good distribution of reinforcement. Its advantages in the climate of the South Pacific are that it needs very little maintenance, can be left on the beach in the sun without damage, never rots and is resistant to borer insects and fungus. Repairs can easily be undertaken with the simple resources of many of the islands and with comparatively unskilled labour.

The cost of materials is low, with the result that imports that would be needed for other surfaces such as steel or fibre-glass can be saved. While the labour component is probably greater than is required to build other types of hull, there is no shortage of labour in Fiji, and little construction machinery is required.

Since conditions vary from island to island, the UNIDO expert thinks it will be difficult to find a design that is acceptable to all the islanders, and in any case many of them will want to construct their own. If larger boats are built, small slipways with a lifting capacity of about 200 tons may be needed, and UNIDO is studying

*Nine-metre shallow draft reef fishing boat with plywood hull built in Fiji to the design of a UNIDO expert.*

requirements for boats of this size. For the time being, boats between five and fifteen metres long appear to be suitable for most fishing purposes in the South Pacific, and Mr. Sannergren has produced designs to meet these different specifications. The smaller crafts are based on the lines of the traditional New Caledonian fishing canoe and similar to some now being built in New Zealand. Others are similar to existing New Zealand, Australian and North American boats, and the larger ones resemble Scandinavian and North American combination trawlers. All of them can be motor- or sail-driven.

The important fact is that the building in Fiji of the first boat from chicken wire and mortar has proved that it can be done. The trials have shown that the vessel is seaworthy and easy to handle. And the decision of the Fijians to build a series of them means that a new dimension has been added to the boat-building industry of the islands.

*Prototype ten-metre boat with ferro-cement hull built by Fijian students.*

# Research Projects

## Leaves: a Source of Protein?

Leaves of fresh, young green plants form an important and neglected world protein resource, though, indeed, it is tapped, largely through the grazing of cattle on spring meadows and the limited human consumption of bamboo shoots and leafy vegetables. But in the main, this source is not drawn on for protein, plants being eaten for their other properties by humans and animals alike.

What use there has been of leaf proteins as such has been in animal feeds where they go to produce more protein of a different order. And here is where the future for any expanded exploitation of this reserve in a protein-short world probably lies. People do not like to eat things that taste like grass.

Leaves can be surprisingly high in protein; young alfalfa leaves contain as much as 61 per cent. The high protein content of young grass is one reason that cattle do so well on spring pasture. But as the leaves age this concentration drops rapidly to the point where crude cellulose, digestible only by ruminants, predominates.

Rather simple mechanical techniques can extract the protein from the leaves. In its cruder forms, the extracted material can fortify conventional animal feeds and fodder to provide the protein normally found in spring pasturage. Enough refining can make the protein concentrate tasteless and nearly white, fit for human consumption. But so far, there are easier and cheaper ways to produce non-animal proteins for people. Beans, for instance.

UNIDO keeps an interested eye on research aimed at unlocking this huge store of protein. And there is a significant amount of research underway. Pioneer work has been done in England, paralleling other research at the Budapest Polytechnic Institute in Hungary and the University of Lund in Sweden. Indeed, work has progressed so far in Denmark, Sweden and particularly Hungary that these three countries have agreed to co-operate in the exploitation of a commercially feasible process for leaf protein concentrate (LPC) recovery. A commercial unit using a different process has been operating in Israel since 1964.

Hungary already has under construction a commercial plant for its process, called "Vepex". This plant and additional ones planned will produce LPC for animal fodder.

The process itself is fairly simple. High-speed milling shatters the leaves and releases the lipid proteins from the structural material. Chemical treatment and centrifugation concentrate the lipid-protein fraction to a paste, which is then extruded and dried as noodles or pellets. This high-protein product, intensely green in colour and having a grassy odour, can be fed directly to animals. It is particularly valuable for poultry and as a starter feed for animals that cannot tolerate much fibre in their diets.

Despite the world's abundance of green leaves, it may be difficult to provide a sufficient supply of them to a large LPC industry, since only young leaves are suitable for processing. Some experts estimate that to keep an LPC plant going, leaves would have to be harvested every day. This could be an agricultural development problem of greater magnitude than the industrial development problem the process itself presents.

## Extraction of Inorganic Compounds from Seawater

From Ghana, the Industrial Research Institute of the Council for Scientific and Industrial Research reports that it is currently examining the ways in which inorganic compounds extracted from seawater may be best utilized locally.

The climate that prevails along the south-east coast of Ghana is most suitable for the production of common salt from seawater by solar evaporation. In addition to common salt, however, useful inorganic compounds such as gypsum, magnesia, potassium salts and bromides, among others, may also be obtained.

At present, research is being undertaken at the Institute to determine the right conditions to attain maximum precipitation of gypsum and to purify it for ultimate use in the ceramic and cement industries.

The bittern, the solution that is left over after the common salt has crystallized, contains a high percentage of magnesium and potassium salts. Attempts are also being made at the Institute to precipitate the magnesium hydroxide with local lime for the requirements of high-grade refractories.

Research work is also underway on the production of potash for use as a fertilizer.

# ASRCT Research Leads to Kenaf Pulp Industry

The Technological Research Institute of the Applied Scientific Research Corporation of Thailand (ASRCT) has, with technical assistance provided by UNIDO, developed several processes for the production of various grades of pulp from locally grown kenaf. ASRCT research has shown that not only is kenaf pulp of a quality comparable to that of imported wood pulp but that its industrial production is technically feasible and economically viable.

As a result, a kenaf pulp industry is to be established in Thailand, which will benefit the national economy in two significant respects. In the first place, it will lead to a considerable saving in foreign exchange that is currently required to import wood pulp; and, second, kenaf farmers will enjoy a more secure livelihood than they have in the past.

Kenaf is a cash crop grown mainly in northeast Thailand from which some 350,000 tons of retted fibre are produced annually. It is usually grown on poor, unfertilized soil as a side line to cultivation of rice and other food crops. Retting is carried out by the growers during the wet season. Mature kenaf stalks produce coarse retted fibre and are usually discarded, representing a loss of about 10 per cent of the total crop. The local demand for retted fibre, primarily for the manufacture of gunny sacks, is limited and accounts for approximately 20 per cent of the crop. Most of the retted fibre is, therefore, exported at prices that fluctuate widely, reflecting the jute market in India and Pakistan. There is hardly any market for kenaf seed, since most growers produce their own.

The rationalization of the kenaf industry requires the diversification of the end uses of kenaf, especially for domestic needs. It was with this objective that the ASRCT examined the possibility of using kenaf as a raw material for the manufacture of pulp and paper, for which there is a potentially large market in Thailand.

ASRCT's research into the industrial processes for the production of kenaf pulp was conducted in collaboration with the Royal Forest Department and the Ministry of Industry's Bang Pa-in Paper Mill. Sponsored by the United Pulp and Paper Company (UPPC), ASRCT studied the economic feasibility of kenaf pulp. For this purpose, it also undertook the plant-scale manufacture of bleached pulp from kenaf stalks and the production of acceptable writing paper, composed largely of this pulp, in the Bang Pa-in Paper Mill.

With the backing of the Board of Investment, UPPC is proceeding to implement the project, which will result in the annual production of 33,000 tons of bleached kenaf pulp, with whole kenaf stalks being used as the basic raw material. In addition to the construction of a pulp mill, the project also includes the establishment of a commercial kenaf seed farm. ASRCT is being retained by UPPC to provide technical services for the plant design, processing operations and the cultivation of kenaf for seeds and fibre. The total cost of the project amounts to slightly over $U.S. 16 million. However, since the country's current requirements for imported wood pulp will be fully met by the domestic production of kenaf pulp, the annual saving in foreign exchange will amount to approximately $7 million.

In view of the growing domestic market for pulp, the establishment of a kenaf pulp industry in Thailand will have far-reaching effects on the cultivation of kenaf, which could well become a regular plantation crop for the industry in the future. This will benefit kenaf farmers in various ways. While the traditional uses for kenaf necessitate a laborious retting process, whole kenaf stalks and even old seed stalks that would otherwise be discarded—can be utilized for the production of pulp. Thus, for small growers, the production of retted fibre will depend on the price offered for kenaf stalks by the pulp and paper industry, compared with that offered for retted fibre. This could lead to a stabilizing effect on the price of kenaf fibre and also induce specialization in the cultivation of kenaf. The setting up of kenaf seed farms will similarly assist small growers by relieving them of raising their own poor-quality seed at the cost of lost production of retted fibre.

As the domestic market for pulp grows, kenaf may be cultivated as a crop for pulp in rotation with rice. This would enable kenaf growers to market their stalks, fresh or dry, to the paper industry when there is a shortage of water or family labour for retting or when the price of retted fibres is too low to justify their retting.

If cultivation of two annual crops of kenaf with different varieties proves possible in Thailand, the kenaf growers could have a crop for early harvest in the wet season for retted fibre, followed by a second crop for harvesting in the dry season for pulp and seed. This may encourage the establishment of large kenaf plantations for intensive cultivation of kenaf for the paper industry.

The breakthrough in establishing a new industry in Thailand has been made. Moreover, the UPPC kenaf pulp mill, which will be the first modern mill of its kind in the world, will be based on process development research conducted locally by ASRCT. The importance of this kenaf pulp project is, however, not of purely local significance as was evident from the interest shown in the project at the UNIDO-sponsored investment promotion meeting held in Manila in September 1970.

In addition to the utilization of kenaf as a raw material for the pulp industry, kenaf seed has a 35 per cent oil content, which could be a source of vegetable oil. This possibility is to be investigated in the second phase of the ASRCT research programme that is being carried out with the assistance of UNIDO experts.

# Answers to Industrial Inquiries

*The UNIDO Industrial Inquiry Service receives requests from developing countries for possible solutions to a wide variety of industrial problems. To give readers an idea of the topics covered, each issue of the* Industrial Research and Development News *publishes selected questions recently received by the Service, in addition to the answers provided.*

*Readers are invited to write to the Industrial Inquiry Service for further details on the answers to the questions published below, quoting the reference number, or to submit inquiries on other industrial problems.*

## Peanut butter production (1584–86)

In Senegal, a company wishing to establish a peanut butter processing plant for the production of butter conglomerates, through trituration, for the African market and conglomerates of decorative scented butter for the export market, requested information on the following:

*(a)* The procedures used in peanut butter manufacturing;

*(b)* Completed market studies or references to publications on this subject;

*(c)* References to publications dealing with the various uses of peanuts.

UNIDO forwarded this request to the Tropical Products Institute, London, whose reply included the following information and advice:

Only best-quality, hand-selected, decorticated groundnuts are used in the manufacture of peanut butter. In the United States peanut butter is usually made from a mixture of Spanish and Virginian varieties, since butter made solely from Spanish nuts is too oily, and that made from Virginian nuts too dry.

After decortication, kernels of a suitable variety are roasted carefully in a rotary roaster with continual agitation until they begin to brown. Care is necessary in roasting because if it is carried too far the butter will have a dark colour and burnt taste. If the nuts are under-roasted, the butter lacks flavour and colour and does not keep well. After roasting, the kernels are cooled and passed to a split-nut blancher, where the kernels are split in halves and germ and the skins or testa are removed. The presence of germ is reported to cause the butter to go rancid more quickly, while the skins show up as red specks and give a slightly bitter taste. The white kernels are then made into a paste in a grinder. At this stage it is usual to add salt, sugar and any other flavouring, according to taste, and also a predetermined amount of hardened groundnut oil or glyceryl monostearate to stabilize the butter and produce the desired consistency. It is usually not necessary to add any chemical preservatives. The butter is finally packed in suitable containers, such as glass jars or tins.

The inquirer was provided with the names of manufacturers and suppliers of machinery and equipment including: groundnut decorticating machines; roasting and blanching machines; grinding mills; and complete plant for peanut butter production.

The Institute supplied the following literature:

"The Chemistry of Peanut Butter Production", *Food Manufacture* (1955), 2-part article, Vol. 39, pp. 190–197 and pp. 361–365.

A report prepared by the Economics Division of the Institute on the market for peanut butter.

The following references were also supplied:

"Production", *Canner and Packer* (1960), Vol. 129, No. 10, pp. 112–116.

Farnworth, V. N., "Prices, Marketing, Origins and Uses", *Market Research Report No. 624*, US Department of Agriculture, Washington, D.C.

United States Government (1964) "Standards", *Federal Register*, Vol. 29, pp. 15173–15174.

United States Government (1965) *Federal Register*, Vol. 30, No. 130, pp. 8626–8627.

For information on the various uses of peanuts in the industrial and food sectors, the inquirer was referred to the Agricultural Research Service of the US Department of Agriculture.

## Utilization of animal carcasses for fertilizer (2361–64)

An inquiry was received from a regional development service in Niger with regard to the utilization of animal carcasses in the production of fertilizer. Details on the forms of utilization, on the means and costs of pulverization, and on the chemical composition of carcasses and horns were requested.

UNIDO received a reply to this inquiry from the National Renderers Association, Inc., of the United States and also referred the inquirer to the FAO

Agricultural Development Paper No. 75, "Processing and Utilization of Animal By-Products". The reply from the National Renderers Association included the following information:

The processing of animal carcasses involves removal of moisture and separation of fat from the protein-mineral mixture. Depending upon the volume of raw materials available and the relative costs of labour and equipment, this process may be carried out either with very simple or with very sophisticated equipment.

The removal of moisture, or drying, and separation of fat from protein, collectively called rendering, may be effected very simply by the open-kettle method. The carcasses are cut up into small pieces, preferably no larger than 4 $cm^2$ and placed in a large open kettle. This kettle may be heated from underneath or, if steam is available, a jackered kettle may be used and heated by steam. Thus the moisture is evaporated and the fat cells are ruptured, releasing free fat, which is poured or drained off when dry. The protein residues must then be pressed to remove as much fat as possible and ground in a hammermill before use as fertilizer.

The open-kettle method is suitable only for small batches and has the disadvantages of requiring considerable labour and causing air pollution through odours emanating from the evaporating moisture. Furthermore, difficulties are encounrered in handling bones.

Where larger volumes of raw materials are to be processed, the so-called dry melters are used or one of the new continuous rendering systems. The continuous systems are designed for high-volume production and may cost from $U.S. 750,000 to $3,000,000 depending upon size. The dry melters are components of a batch system, and the total cost for a plant including raw material grinders, cookers, presses and protein residue grinders will range from about $80,000 upwards, again depending upon the volume to be processed.

The chemical composition of a final product from animal carcasses will be about 8.2 per cent nitrogen, 12 per cent fat, 5 per cent phosphorus, 10 per cent calcium, and 6 per cent moisture. The chief fertilizing constituents, nitrogen and phosphorus, do not, therefore, represent a very high proportion. However, the organic matter in the material does improve the texture of soils.

Horns contain about 15.8 per cent nitrogen, but the nitrogen will not be released fast enough in soils to be of much value unless the horns are treated under high steam pressure and ground to a very fine texture. Grinding of horns is difficult, even after steam pressure treatment.

## Castor oil processing (1618)

In Ecuador, as a result of a pre-investment and feasibility study, a new factory for the processing of castor oil is to be erected. A consultant at the Development Centre (CENDES) in Ecuador requested UNIDO's assistance in procuring information and reference material on both agricultural and industrial processing aspects of castor oil.

UNIDO sent the following reply:

Castor oil is the only commercially important oil containing major amounts of hydroxy acid. In general, two grades of castor oil are recognized in international trade.

The first grade is obtained by cold pressing of castor beans. Continuous-screw presses cannot be used because the pressing temperatures developed are too high. The production process prescribes hydraulic presses and a low pressing temperature. This procedure leaves a rather large amount of oil in the press-cake so that the yield is low and consequently the price of cold-pressed castor oil is high. The oil obtained by the cold-pressing process is practically colourless and is used for medical and pharmaceutical purposes.

The second-grade castor oil, known as oil No. 3, is produced either by second pressing of the press-cake obtained from cold pressing or by single pressing using automatic screw presses. The pressure is higher and pressing temperatures increase. The second-grade castor oil is coloured and can be used only for technical purposes.

Castor oil is distinguished from other oils by its high acetyl or hydroxyl value and by its high specific gravity. Unlike other oils it is miscible with alcohol but is only slightly soluble in petrol ether at room temperatures. Castor oil is much more viscous than other oils and when completely hydrogenated has an abnormally high melting point (86–88°C). An accepted standard for castor oil is:

| | |
|---|---|
| Specific gravity at 25°C | 0.945–0.965 |
| Refractive index at 25°C | 1.473–1.477 |
| Iodine value | 81–91 |
| Saponification value | 176–187 |
| Unsaponifiable matter | Not over 1.1% |
| Acetyl value | Not less than 144 |

Castor seed press-cake is sometimes solvent-extracted. Solvent extraction, however, is not very common, since it requires a minimum daily capacity of 100 tons of press-cake with a residual oil content of over 10 per cent. As a solvent, alcohol is recommended from the chemical point of view. The solubility of castor oil in high-percentage alcohol has led to a rather simple extraction process. The press-cake is granulated and treated with minimum 70 per cent alcohol at low temperatures. The miscella obtained is mixed with water so that the castor oil separates. Then the two liquids (oil and alcohol-water solution) are separated by centrifuges. This process, however, needs a rather expensive alcohol-treatment plant, as only concentrated alcohol can be used as a solvent.

Castor cake is extremely poisonous and contains rather high amounts of allergen. Three dangerous components are found in the meal, namely:

(a) A violently poisonous heat-labile protein called ricin;

(b) A toxic alkaloid called ricinine;

(c) A very powerful and very stable allergen, which is known as CB 1A and can reach a level of 12 - 13 per cent.

Only small quantities of castor seed are needed to cause death to cattle if fed to them by mistake or if included in a food product as a result of negligence. It is most difficult to ensure that machinery that has been used to process castor seed is sufficiently clean and free of toxic suhstances for it to be utilized to produce cattle feed from other oil-seeds. Methods are presently being developed to detoxify castor meal and make it suitable for feedstuff production. However, such methods are not yet used commercially.

Castor oil No. 3 has become a very important raw material for the chemical industry. The oil is unique in that its component fatty acids consist of about 90 per cent ricinoleic acid. Processing treatments of castor oil include: sulphation, hydrogenation, dehydration, thermal decomposition, alkali fusion and oxidation. These processes, however, are undertaken by the chemical industry and form a special technology that is completely different from castor bean processing.

The following references were given to the inquirer:

Bailey, A. E. (1951) *Industrial Oil and Fat Products*, Interscience, New York.

Gardner, H. K. *et al* (1960) "Detoxification and Deallergenization of Castor Beans", *Journal of the American Oil Chemists' Society*, Vol. 37, No. 3, March, pp. 142–148.

Henderson, B. (1954) "Chemicals from Castor Oil", *Canadian Chemical Processing*, Vol. 39, October, pp. 94–98.

Kirschenbauer, H. G. (1960) *Fats and Oils, an Outline of their Chemistry and Technology*, Van Nostrand-Reinhold Books, New York.

Mattil, K. F. *et al.* (1964) *Bailey's Industrial Oil and Fat Products*, Interscience–Wiley, New York.

## Manufacture of nicotine (2365)

In response to a request from a Greek productivity centre for information on the manufacture of nicotine from tobacco leaves, the following reply was received by UNIDO for transmission to the inquirer.

Commercial nicotine is a 40 per cent aqueous solution of nicotine sulphate and is usually obtained as a by-product from tobacco waste. It can also be obtained from tobacco leaves as follows:

The tobacco leaves are dried, powdered and extracted with water in a continuous extraction apparatus. Concentration of the resulting liquor gives tobacco extract, and this is treated with lime or another alkali and steam distilled. The crude nicotine is extracted from the distillate by solvent extraction with ether or another organic solvent, or the distillate is neutralized with sulphuric acid and concentrated to yield commercial nicotine sulphate. The commercial product is semicrude but is sufficiently pure for use as a horticultural insecticide.

Difficulties may be encountered in the steam distillation process because of decomposition of a certain percentage of the alkaloid due to prolonged action of alkali and steam. This difficulty has been overcome by mixing the powdered tobacco waste with water and a solution of lime to a thin paste and pouring this down a series of columns similar to those used to remove the last traces of alcohol from fermenting mash. The steam moves up the columns and removes ammonia and nicotine with other volatile alkaloids. The steam is cooled and condensed in dilute sulphuric acid.

There are many patents dealing with refinements of the extraction process. The details given above represent a general outline of the procedure.

The UNIDO correspondent also supplied a copy of an article from *Industrial and Engineering Chemistry*, describing in detail the process of obtaining nicotine sulphate from tobacco leaf by liquid-liquid extraction. By this method, juice pressed from the plant *Nicotiana rustica* is limed, clarified and extracted with kerosene, and the kerosene extract is reacted with sulphuric acid solution to produce a 40 per cent nicotine solution as nicotine sulphate. This process entails pressing the green plant immediately after harvesting, but, once limed, the juice can be stored indefinitely.

# For Your Information . . .

*The following publications may be purchased from United Nations sales distributors, through local book dealers, or directly from United Nations Publications, I.X 2300, New York, N.Y. 10017, United States of America, or United Nations Publications, Palais des Nations, CH 1211 Geneva 10, Switzerland. Prices are given in US dollars but payment may be made in other currencies.*

**UNIDO Monographs on Industrial Developments, Industrialization of Developing Countries: Problems and Prospects**

**Industrial Information**

Monograph No. 13, 56 pages (Sales No.: E.69.II.B.39 Vol. 13, $0.50).

Industrial information defined in the monograph as "specific items of scientific, technical and economic knowledge that can be communicated and applied in order to facilitate and accelerate the process of economic growth" is a prerequisite for industrial expansion in the developing countries. The monograph outlines how this information may be transferred to developing countries and adapted to meet local conditions and needs.

Chapter 1 illustrates existing systems that have been set up for the transfer of industrial information for utilization by, and application in, industry. The diversity and complexity of the approaches adopted by industrialized countries demonstrates the need for each country to build up a system best suited to its particular situation and requirements. Supranational systems designed to make better use of the funds of information in a specific region or in a particular branch of industry are also reviewed.

Chapter 2 discusses the responsibilities of Governments of industrialized and developing countries to promote the flow of industrial information. The main functions of an industrial information service are considered: identification of the type of information needed; stimulation of the demand; location of courses; adaptation to local conditions; and promotion of the application of information in industry. The importance of ensuring that the flow of information is two-way, both between the end user and the supplier and between the developing and the developed countries, is stressed. The information needs of industry are classified as falling into two main categories: information aimed at industry generally, covering such subjects as industrial legislation, management techniques, new industrial processes and equipment, applied research results; and specialized information supplied in response to a specific request. The qualities required from the personnel of industrial information services and their functions are outlined in this chapter, which concludes with a listing of some of the channels and media for the transfer of information.

Chapter 3 summarizes the issues, the discussions and the recommendations of the International Symposium on Industrial Development, held in Athens, in 1967.

The scope of the action taken by the United Nations system to promote the flow of industrial information to developing countries is outlined in chapter 4. The field activities of UNIDO in this domain include assistance to developing countries in setting up local information systems; while at its headquarters in Vienna UNIDO provides an international clearing-house for industrial information and a referral centre.

**Industrial Planning**

Monograph No. 17, 49 pages (Sales No.: E.69.II.B.39, Vol. 17, $0.50)

Given the propulsive role of manufacturing activities, the complex and dynamic nature of industrial investment, the relatively large financial and economic requirements of industrialization, and the necessity for inter-sectoral linkages, the need for planning industrial development is obviously great. Although it is difficult to elaborate planning machinery that effectively integrates all the various elements of plan formulation and implementation in a consistent manner, attempts must be made to do so. Without either adequate formulation and evaluation procedures or serious and realistic implementation, industrial development cannot proceed in the co-ordinated manner necessary to achieve optimum utilization of the economy's resources for growth. This monograph offers a brief survey of the techniques and issues involved in industrial programming and project formulation, evaluation and implementation.

Chapter 1 discusses the general criteria to be used in formulation of plans. An industrial plan should incorporate an explicit strategy of industrialization. Its targets should be consistent, and the resources necessary to achieve them should be identified. The plan should be based on a dynamic interpretation of comparative advantage.

Chapter 2 discusses the requirements for implementing plans. The Government can decisively influence implementation through its policies, through the supports of various types that it may offer, and through action to eliminate red tape.

Chapter 3 considers the criteria for evaluating industrial projects to determine whether they are consistent with the Government's policy and the over all industrial programme and are economically feasible. Chapter 4 discusses the requirements for the successful implementation of industrial projects. Follow-up should be considered as important as formulation and evaluation.

Chapter 5 analyses the principal factors influencing the location of industry and the techniques of regional planning. These techniques should be adapted to the specific requirements of the country or region and to the level of planning skills available in developing countries.

Chapter 6 examines the data required for industrial planning at the three main levels of programming: the economy-wide, the sectoral, and the project level.

Chapter 7 gives an account of the issues presented to the International Symposium, the discussions held and the recommendations approved relating to industrial planning.

Chapter 8 discusses the role of the United Nations in assisting developing countries to formulate better plans and to implement them.

### Regional Co-operation in Industry

Monograph No. 18, 59 pages (Sales No.: E.69.II.B.39, Vol. 18, $0.50)

Regional co-operation in industry includes all types of joint or co-ordinated action in the economic field among countries of the same region. This action may develop in various forms, depending on the conditions prevailing in the particular region. It may be limited to a specific project, or it may encompass the formation of a free trade area (abolition of trade barriers among member countries), a customs union (establishment of a common tariff policy towards non-member countries), a common market (free movement of factors of production and of commodities within the area), or a complete economic union among the member countries. This monograph seeks to highlight appropriate opportunities for fostering regional co-operation in industry among developing countries.

Chapter 1 discusses the effect of regional integration on the general structure of industry within the co-operating countries. Economies of scale resulting from industrial specialization are emphasized.

Chapter 2 describes some of the difficulties encountered in attempting to achieve a regional integration of industry among a group of countries, each of which is at a different level of industrial development. A number of principal advantages and disadvantages to the participating countries are listed.

Chapter 3 focuses upon policy approaches to regional industrial co-operation. The need for harmonization of not only industrial policies, but also fiscal, financial and trade policies, is emphasized. Various multinational institutions that aid in financing regional industrial development are described, and then a number of agreements among Latin American countries are presented.

Chapter 4 reviews the issues discussed at the International Symposium and the recommendations approved. Among the issues raised were those of general versus sectoral co-operation, and the identification of sectors in which regional co-operation might be both effective and politically feasible.

Chapter 5 sets forth the areas of regional co-operation in industry in which the United Nations currently offers technical assistance, and also describes briefly the technical assistance provided by the United Nations to eight regional organizations.

### The Development of Clay Building Materials Industries in Developing Countries

50 pages (ID/28; Sales No.: E.69.II.B.18; $1.00)

This is a report on the Interregional Seminar on the Development of Clay Building Materials Industries in Developing Countries, held in Copenhagen from 12 to 25 August 1968, under the sponsorship of the United Nations and the Government of Denmark. The programme for the seminar was developed jointly by UNIDO, the Danish Board for Technical Co-operation with Developing Countries and the Danish Brick and Tile Association.

The purpose of the seminar was to bring together responsible officials of developing countries from both the policy-making and technical sectors to meet clay industry experts from Denmark and elsewhere in order to discuss all aspects of the production of clay building materials.

Participants presented 25 papers. These were followed by discussions on the application of the subject matter to the circumstances and needs of developing countries in general, and to the specific conditions in the participants' countries.

### Modernization and Mechanization of Salt Industries Based on Seawater in Developing Countries

67 pages (ID/26)

The Expert Group Meeting on the Modernization and Mechanization of Salt Industries Based on Seawater in Developing Countries was held in Rome in September 1968. The purpose of the meeting was to collect and analyse information that would be of value to developing countries wishing to develop sea-salt industries.

Presentation of the expert papers was followed by a discussion of the papers and a summary of the discussion by a moderator. After consideration of government and regional papers and a general discussion, the participants joined in formulating technical recommendations and

recommendations for specific UNIDO action to be taken to implement the conclusions arrived at during the meeting.

The present publication includes the report and conclusions of the Group (Part I) and summaries of expert, government and regional papers discussed or considered during the meeting (Part II). Papers were presented by experts from France, India, Italy, Japan, Kuwait, Portugal, the United States and Venezuela. Government papers were available from Algeria, Argentina, Brazil, Bulgaria, Chile, China, Cuba, Haiti, Malta, Nicaragua, Peru, Sudan, Turkey, the Union of Soviet Socialist Republics and Uruguay. The United Nations Economic Commission for Africa presented a paper on production and consumption of salt in Africa. In addition, UNIDO presented an introductory paper.

The introduction to the report contains a description of the process of obtaining salt by solar evaporation.

The report has three main parts:

- Conclusions and recommendations discussed and adopted by the participants, defining specific forms of technical assistance and offering guidance for policy-makers and managers;
- Summaries of the lectures given at the seminar;
- Annexes giving the programme of the seminar; lists of participants, lecturers and observers; lists of papers presented to the seminar; and a brief description of the plants visited.

**Fertilizer Industry Series**

**The Reduction of Sulphur Needs in Fertilizer Manufacture**

Monograph No. 3, 61 pages (ID/Ser. F/3; Sales No.: E.69.II.B.26; $0.75)

**The Ammonium Chloride and Soda Ash Dual Manufacturing Process in Japan**

Monograph No. 4, 33 pages (ID/Ser. F/4; Sales No.: E.69.II.B.20; $0.75)

**New Process for the Production of Phosphatic Fertilizers Using Hydrochloric Acid**

Monograph No. 5, 31 pages (ID/Ser. F/5; Sales No.: E.69.II.B.23; $0.75)

The purpose of this series of monographs is to provide the developing countries with the most recent technical and economic information on the fertilizer industry and advice on the steps that must be taken to establish it. Each monograph deals with one aspect of the industry. (For a review of Monograph No. 1, *Chemical Fertilizer Projects: Their Creation, Evaluation and Establishment* (ID/Ser. F/1; Sales No.: E.68.II.B.17; $0.75), see *IRDN*, Vol. IV, No. 2, page 44. Monograph No. 2, *Guide to Building an Ammonia Fertilizer Complex* (ID/Ser. F/2; Sales No.: E.69.II.B.10; $0.75) is reviewed in *IRDN*, Vol. IV, No. 3, on page 45.

*The Reduction of Sulphur Needs in Fertilizer Manufacture* has four main sections: patterns of world sulphur supply and demand, patterns of world fertilizer supply and demand, sulphur-consuming fertilizer processes and sulphur-saving fertilizer processes. The summary and conclusions include recommended alternative processes and fertilizer products designed to offset a sulphur shortage and rising sulphur prices.

The situation regarding future supplies of phosphate fertilizer has been viewed by many with apprehension because sulphuric acid is by far the most popular solubilizer for phosphate rock, and although the sulphur shortage, with correspondingly high sulphur prices, is less acute than it has been, it appears to be continuing. To ensure the continued availability, at reasonable prices, of fertilizers that normally require sulphur for their manufacture various alternative production methods have been proposed, and several new types of fertilizer using little or no sulphur in their manufacture have been developed.

Certain alternative processes for manufacturing fertilizers are of particular importance to developing countries because they offer the possibility of manufacturing other products simultaneously, and this may result in savings in foreign exchange. Typical examples include the production of phosphorus and corresponding phosphoric acid of high purity; the use of iron-sulphide minerals to make sulphuric acid, blast-furnace feed and electricity; and the use of low-cost minerals such as anhydrite to make sulphuric acid and cement.

Monograph No. 4, *The Ammonium Chloride and Soda Ash Dual Manufacturing Process in Japan*, also contains four parts: present situation and prospects, the ammonium chloride and soda ash dual manufacturing process, the manurial effect of ammonium chloride, and high-analysis compound fertilizer based on ammonium chloride.

The main disadvantage in manufacturing soda ash in Japan, which lacks domestic supplies of salt, is that all industrial salt must be imported. The cost of manufacturing soda ash is, therefore, much higher than in other countries and causes a heavy drain in foreign currency. Furthermore, about 30 per cent of the salt used in the Solvay process for making soda ash and nearly 100 per cent of the chlorine in the salt are lost. With these facts in mind, four Japanese companies manufacturing soda ash by the Solvay process began to investigate possible alternatives. After years of research, they found that by manufacturing ammonium chloride concurrently with soda ash full utilization of the raw common salt is achieved. Later, the excellent manurial effect of ammonium chloride became apparent not only in Japan but also in other countries, and the demand for it increased. The dual process has now attained a high level of efficiency.

At present, Japan is the largest producer of ammonium chloride fertilizer, with a capacity of about 800,000 tons *per annum*. Because of the present expanding demand for ammonium chloride, it is planned by 1970 to re-equip all remaining conventional soda ash plants with ammonium chloride plants so as to give an estimated output of about one million tons per year each of soda ash and ammonium chloride.

The last of the series, *New Process for the Production of Phosphatic Fertilizers Using Hydrochloric Acid*, has two main sections: production of phosphoric acid using hydrochloric acid (IMI process) and phosphate fertilizers and intermediates produced from phosphoric acid. An annex carries a description and diagram of a liquid-liquid contactor, and a number of references are given.

The solubilization of phosphate components from phosphate rock by means of hyrdochloric acid rather than sulphuric acid has been considered commercially impracticable in the past because calcium chloride, which is highly soluble, cannot be separated from phosphoric acid by mechanical methods. The Israel Mining Industries (IMI) process overcomes this difficulty by introducing into the system an additional phase of an organic solvent that has good extraction capacities for phosphoric acid ($H_3PO_4$), but does not extract calcium chloride ($CaCl_2$). The solvent, $C_4$ or $C_5$ alcohol, is only partly miscible with water; by extracting the phosphoric acid from the reaction mixtures it displaces the equilibrium in the desired direction. Solvent losses by the application of this technique have little effect on the cost of production, since more than 93 per cent of the solvent is in a closed cycle at ambient temperature without any distillation.

Liquid-liquid extraction entered the field of inorganic chemical technology in the 1940s with the advent of various extraction processes for producing uranium, but in the heavy inorganic chemical industry solvent extraction was not normally put to practical use. Now, the new technology developed by IMI permits the production of salts and acids from primary raw materials by solvent-extraction.

**Fertilizer Production in Six Selected Countries with Good Natural Gas Resources**

68 pages (ID/5; Sales No.: E.69.II.B.5; $0.75)

This publication is a report of the *Ad Hoc* Expert Group on Fertilizer Production which met at United Nations headquarters in December 1966 to examine the possibilities of large-scale production of fertilizers using natural gas in six selected countries, Iran, Kuwait, Libya, Nigeria, Saudi Arabia and Venezuela. The meeting was a follow-up of the recommendation made by the Interregional Seminar on Fertilizer Production held in Kiev in 1965.

The purpose of the meeting of the Expert Group was to:

- Collect and collate the facts relevant to the availability of natural gas, together with costs, transport possibilities and the like, in connexion with the production of nitrogen fertilizers in the six countries;
- Analyse and determine the economic and market factors that may be retarding the development of large nitrogen fertilizer projects in these countries;
- Analyse the technical factors and apply the new technology for the production of ammonia that has been developed during the past five years in industrialized countries;
- Determine the indigenous consumption of natural gas in the six countries and its transport and export to other developing countries;
- Examine the possibilities for financing such projects.

The report contains nine main sections, seven annexes and eighteen tables. The topics of the sections are: availability and price of natural gas; infrastructure, utilities and labour supply; customs duty and taxes; investment policies and capital availability; the fertilizer industry in the six countries; production costs of ammonia and solid nitrogen fertilizer; marine transport of liquid anhydrous ammonia; markets and regional co-operation in production and marketing.

The annexes include lists of participants and working papers, a questionnaire on factors relating to fertilizer production based on the conversion of natural gas to ammonia, and a list of refrigerated vessels suitable for carrying anhydrous ammonia. Among the tables are the following: natural gas production, reserves and utilization; production costs in a urea plant; capital cost for a 14,000-ton ammonia terminal; and estimated status of the nitrogen market in 1975/1976.

For information on the first study in this series, *The Use of Centri-Therm, Expanding-Flow and Forced-Circulation Plate Evaporators in the Food and Biochemical Industries* (ID/Ser. I/1; Sales No.: E.69.II.B.14; $0.75), see *IRDN*, Vol. IV, No. 3, pp. 46–47. A review of No. 2, *Industrial Processing of Citrus Fruit* (ID/Ser. I/2; Sales No.: E.69.II.B.9; $0.75) is in *IRDN*, Vol. III, No. 2, p. 42.

**Industrial Planning and Programming Series, No. 2 and No. 3**

**International Comparisons of Interindustry Data**

270 pages, (ID/Ser. E/2; Sales No.: E.68.II.B.14; $3.50)

The United Nations Centre for Industrial Development, the work of which UNIDO took over in 1967, had incorporated in its work programme a series of inquiries and studies collectively referred to as the Industrial

Programming Data Project. The specific terms of reference of this project describe its objective as "establishing extensive catalogue data of operational use for industrial planning and programming on the basis of the existing statistical and technical information in various countries and examining the adaptability of such catalogue data to the practical need of developing countries".

This publication concerns only one of the themes being pursued under the project: the adaptibility of existing interindustry data of various countries to the needs of developing economies. Even for this particular theme this volume is intended as a point of departure rather than as an end product. The articles collected in it constituted the main part of the proceedings of the meeting of an *Ad Hoc* Group of Experts convened at the United Nations Centre for Industrial Development in November 1965 to review various technical problems and experiences relevant to the issue and to formulate a concrete scheme of work to be carried out in this field by the Centre. The special studies initiated after this meeting will be published in a separate volume at a later date. The results of other lines of work being undertaken under the project, such as the inter-country inter-establishment comparisons of the structural and functional characteristics of various specific manufacturing plants, will be published in subsequent issues of this series scheduled in connexion with the project.

The subtitle of this volume is "Proceedings of the Meeting of the First *Ad Hoc* Group of Experts on Industrial Programming Data, held in New York, November 1965". It begins with the report and recommendations of the Group and then proceeds to the articles. These are presented in two parts: characteristics of national interindustry data and approaches to international comparisons.

Topics in the first part and their authors are:

- Input-output Tables of Japan: Basic Framework, Primary Data and Intertemporal Comparisons (Shuntaro Shishido);
- Statistical Unit, Classification and Aggregation in Finnish Input-output Study (Osmo Forssell).
- Factors Affecting Technical Coefficients: Some findings from the Hungarian Interindustry Data (Vera Nyitrai);
- Input-output Statistics and Analysis in Yugoslavia (Nikola Petrović),
- Intersectoral Balances of Production and Distribution for a National Economy: Key Aspects of the Practice in the Union of Soviet Socialist Republics (Ivan M. Denisenko);
- Characteristics of the USSR Input-output Tables (Vladimir G. Treml).

Topics in the second part and their authors are:

- A Comparative Study of the Input Structure of the Chemical Industries in Several Industrially Developed Countries (Hans Wittmeyer);
- Approaches to the Problem of Inter-country Comparison of Input-output Relations: A survey and Suggestions for Further Research (Tsunehiko Watanabe);
- Note on the Possibilities of Utilizing the Techniques and Data of International Comparisons for Industrial Programming in the Developing Countries (Henri Aujac);
- An Industrial-complex Approach to the Compilation and Analysis of Interindustrial Programming Data (Vera Cao-Pinna);
- The Hierarchical Structure of Interindustrial Transactions (Ernst Helmstädter);
- Modifiable Rectangular Input-output Matrices (T. I. Matuszewski).

For further information see *Profiles of Manufacturing Establishments*, Volumes I and II (Sales Nos.: E.67.II.B.17 and E.68.II.B.13; $5.00 and $6.50 respectively) reviewed in *IRDN*, Vol. III, No. 1, p. 45 and *IRDN*, Vol IV, No. 1, pp. 46–47 respectively, as well as *Industrial Programming Data*, a report of the first session of the International Working Party on Industrial Programming Data, Vienna, 18–27 November 1968, of which limited copies are still available from the Industrial Documentation Unit, UNIDO, Vienna.

# Calendar of Meetings

**Modern Metallography in Metallurgy**

Cambridge, 17–19 July. The Institute of Metals, 17 Belgrave Square, London S.W.1, United Kingdom.

**Third Inter-American Conference on Materials Technology**

Rio de Janeiro, Brazil, 14–17 August. Mr. D. Black, Southwest Research Institute, International and Brazilian Agencies, Box 28510, San Antonio, Texas 78284, United States.

**International Mining Exhibition and Fifth International Strata Control Conference**

London, 18–25 August. Mr. W. J. Adcock, National Coal Board, Hobart House, Grosvenor Place, London S.W.1, United Kingdom.

**Thirteenth International Congress of Theoretical and Applied Mechanics**

Moscow, 21–26 August. Prof. G. K. Mikhailov, Leningrad Avenue 7, Moscow A–40, U.S.S.R.

**Chemical Engineering at the Service of Mankind International Congress**

Paris, 2–9 September. Société de Chimie Industrielle, 80, route de Saint-Cloud, Rueil-Malmaison, France.

**Fourth International Congress of Chemical Engineering, Chemical Equipment Design and Automation**

Mariánské Läznë, 11–15 September. Chisa '72, 4th Chisa Congress, P.O. Box 857, Prague, Czechoslovakia.

**Fourth Conference on Fluid Machinery**

Budapest, 11–16 September. Scientific Society of Mechanical Engineers, P.O. Box 451, Budapest, Hungary.

**Second International Conference on the Hydraulic Transport of Solids in Pipes (Hydrotransport II)**

Coventry, 19–22 September. Mr. H. Stephens, BHRA, Fluid Engineering, Cranfield, Bedfordshire, United Kingdom.

**Conference on the Effective and Economic Use of the Special Characteristics of Aluminium and its Alloys**

Zurich, 25–29 September. The Institute of Metals, 17 Belgrave Square, London S.W.1, United Kingdom.

**Symposium on Reinforced Plastics – Recent Advances in the Marine Field**

Southampton, 27 September. Mr. D. Cohen, Assistant Secretary, Plastics Institute, 11 Hobart Place, London S.W.1, United Kingdom.

**1972 Mining Convention**

San Francisco, California, 17–20 September. American Mining Congress, 1102 Ring Building, 1200 18th Street, Washington, D.C. 20036, United States.

**Seventh International Congress on Electro-Heat**

Warsaw, 18–22 September. British National Committee for Electro-Heat, Trafalgar Buildings, 1 Charing Cross, London S.W.1, United Kingdom.

**Autumn Meeting of the Institute of Metals**

Zürich, Switzerland, 25–29 September. Institute of Metals, 17 Belgrave Square, London S.W.1, United Kingdom.

**Aluminium Conference 1972**

Székesfehérvär, 2–7 October. Hungarian Mining and Metallurgical Association, Azabadság tér 17, Budapest 5, Hungary.

**Seventh Machine Tool Congress**

Budapest, 9–14 October. Scientific Society of Mechanical Engineers, P.O. Box 451, Budapest 5, Hungary.

**American Concrete Institute 1972 Fall Convention**

Hollywood, Florida, 28 October–3 November. Mr. W. A. Maples, American Concrete Institute, Box 4754, Detroit, Michigan, 48219, United States.

**Eighth International Reinforced Plastics Conference**

Brighton, 10–12 October. Mr. A. D. Hippisley Coxe, The British Plastics Federation, 47 Piccadilly, London W.1, United Kingdom.

**First Pacific Chemical Engineering Congress**

Kyoto, 11–14 October. The Society of Chemical Engineers, Japan Kyoritse-Kaikan, 4–6–19 Kohinata, Bundkyo-ku, Tokyo, Japan.

**Symposium "Walzen von Leicht- und Schwermetallen"**

Frankfurt, 2–3 November. Ausschuss "Walzen- und Schwermetalle" der Deutschen Gesellschaft für Metallkunde, An der Alteburger Mühle 12, 5 Köln 51, Germany.

**Extractive Metallurgy Division Symposium, Metallurgical Society of the Institute of Mining, Metallurgical and Petroleum Engineers**

Chicago, Illinois, 4–5 December. Metallurgical Society of the American Institute of Mining, Metallurgical and Petroleum Engineers, 345 E 47 Street, New York, N.Y. 10017, United States.



*The* Industrial Research and Development News *is published in three language editions, English, French and Spanish. The annual subscription rate for each edition is $U.S. 4.50. Readers in Africa and Europe who wish to subscribe should write to:*

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Palais des Nations
CH–1211 Geneva 10
Switzerland.

***Readers in other parts of the world should send their requests to:***

United Nations Publications
LX 2300
New York, New York 10017
United States of America.

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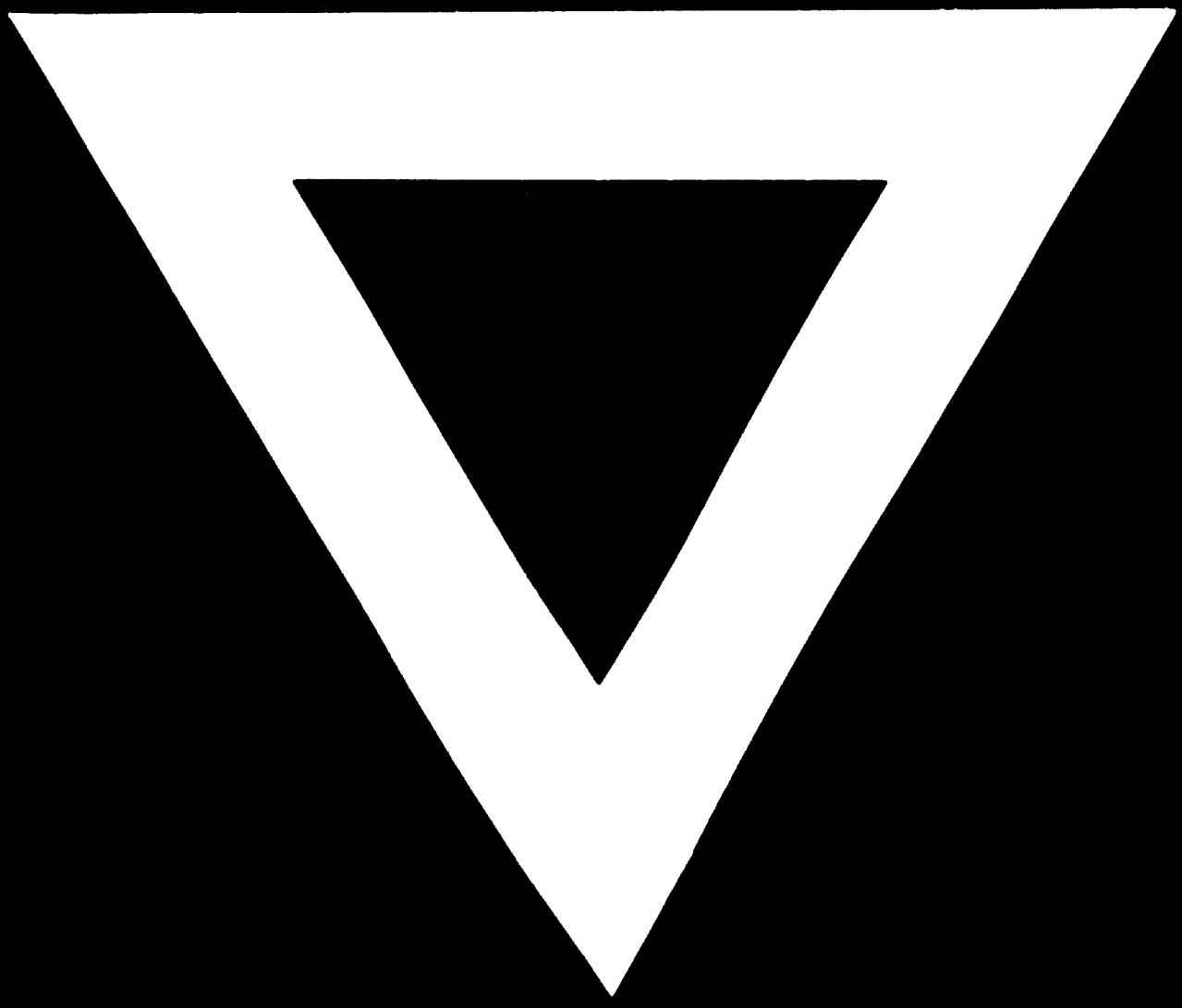
**The Editor**
**Industrial Research and Development News**

United Nations Industrial Development Organization
P.O. Box 707
A–1011 Vienna
Austria.

Printed in Austria
71-9226–June 1972–3,400

Price: $U.S. 1.25 – Annual subscription $U.S. 4.50
(or equivalent in other currencies)

United Nations publication
ID/SER.B/15



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