Meeting the Challenge of Industrialization: A Feasibility Study for an International Industrialization Institute (1973)

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Meeting the Challenge of Industrialization:

A Feasibility Study for an International Industrialization Institute

Report of a Special International Panel
of the
Board on Science and Technology for International Development
Office of the Foreign Secretary

NATIONAL ACADEMY OF SCIENCES – NATIONAL ACADEMY OF ENGINEERING
Washington, D.C. 1973

This report has been prepared by an ad hoc advisory panel of the Board on Science and Technology for International Development, Office of the Foreign Secretary, National Academy of Sciences, in collaboration with the National Academy of Engineering, for the Office of Science and Technology, Bureau for Technical Assistance, Agency for International Development, Washington, D.C. under Contract No. csd-2584.

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The members of the committee selected to undertake this project and prepare this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. Responsibility for the detailed aspects of this report rests with that committee.

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OFFICE OF THE FOREIGN SECRETARY

August 1973

Dr. Joel Bernstein
Assistant Administrator
Bureau for Technical Assistance
Agency for International Development
Department of State
Washington, D.C. 20523

Dear Dr. Bernstein:

In 1972 the U.S. Agency for International Development requested the National Academy of Sciences and the National Academy of Engineering to examine the need, feasibility, and demand for an international institute to perform research on new approaches to international industrialization that would benefit developing countries. In response, the Academies convened an international panel of distinguished and knowledgeable persons from both developed and developing countries. These experts included engineers, scientists, economists, bankers, lawyers, and industrialists. I am pleased to submit herewith the report of this special panel.

The report conveys the panel's deliberations as well as discussions we held over the course of a year with more than 300 leaders concerned with economic growth in the developed and developing worlds. The consensus of those interviewed was that an institute as envisioned by the panel could contribute invaluably to the more orderly and harmonious industrial development of both worlds. Thus, it is the unanimous recommendation of the Academies' panel that an International Industrialization Institute be established.

I speak for the panel in expressing the hope that AID and other bilateral and international agencies concerned with development, as well as corporations, foundations, and financial institutions of all nations, will recognize the potential value of the proposed institute and will join forces with material and moral support to bring it about.

Sincerely yours,

Bruce S. Old
Foreign Secretary and
Chairman of Panel

A Letter to the Reader:

The panel earnestly commends this report to the attention of all in the world community who are concerned with the future of industrial development.

Some 300 persons in 12 countries have had the opportunity to consider the ideas in this report at varying stages of their evolution; indeed, many have contributed to it. This evolution has not ended with the publication of this document. Further comment and suggestions on all aspects of the analysis and the proposal will be gratefully received. Communications should be sent to

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2101 Constitution Avenue, N.W.
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Bruce S. Old
Foreign Secretary and
Chairman of Panel

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Preface

A critical challenge facing developing and developed countries alike in the decades ahead is industrialization. Increases in population, food production, and mobility combine to present overwhelming needs for jobs, improved income distribution, and city-regional balance, which can be met only by new and better use of the world's resources, both human and natural. To this end, effective industrialization is a vital factor.

Seminars held under the auspices of the United States Agency for International Development at Columbia, Maryland, 24 - 25 April 1971, and at Airlie House, Virginia, 17 - 19 December 1971, considered the prospects and problems of international industrialization and reached the following tentative conclusions:

1. The contribution of industrialization to fulfilling national goals, including employment, is complex, requiring an understanding of individual national factor endowments, such as natural resources, capital, labor, and infrastructure, and of alternative paths for their use and development.
2. Existing knowledge of the industrialization process is too limited, localized, and unsystematic, and its applicability to current and emerging needs too unexplored, to provide an adequate basis for effective industrialization policies or programs.
3. Although several international institutes have been organized to study ways of enhancing agricultural productivity, and another is being considered to study the social and economic effects of agricultural growth, no such institute exists to study industrialization.
4. To assist in evolving improved decisions on industrialization, the formation of a new multinational institute that would examine and illuminate these interacting forces could be of distinct value.

In view of these hypotheses, the National Academy of Sciences, through its Board on Science and Technology for International Development, and the National Academy of Engineering were requested by the Agency for

International Development to undertake a study of the need and demand for, and the organizational structure and possible program of, an international industrialization institute (see appendix B, Terms of Reference). To determine whether the proposed institute would duplicate or significantly add to existing institutional resources, the study was to include a review of current programs of international assistance to industrialization.

It was recognized at the outset that any such study must include large inputs from representatives of both industrial and industrializing nations. To believe in the utility of the institute and its findings, likely users of its studies and other outputs should participate in the evaluation, design, and development of the institute.

Therefore, the study of the need and potential practicability of an International Industrialization Institute was initiated with the convening of a Special International Panel in April 1972. Members of this interdisciplinary panel are listed in the front of this report.

At its first meeting the panel outlined the general concept of the institute. To test the concept, the study director and a consultant from an industrializing country undertook a comprehensive series of interviews of key international organizations, and of individuals respected for their thinking on industrialization problems, particularly of the developing nations. In November 1972 the panel reviewed the interview material and developed the concept presented in this report.

Part I, "An Innovative Institution: The Proposal," sets forth the panel's principal findings and recommendations. It first briefly defines the overall concept of the International Industrialization Institute. The interdependence and urgency of world industrialization issues are pointed out in part I-B. This provides the setting for part I-C, determining and defining the need for the institute. In part I-D, the recommended objective and character of the institute are presented, and in part I-E, an initial program focus is illustratively described. Recommendations on the founding procedure, structure, institutional relations, and endowment funding of the institute conclude part I.

Part II, "Institute Rationale and Design," documents the panel's conclusions in greater detail. It first describes the procedures adopted to determine the need and to define requisite institutional attributes. Priorities of need as assessed by study conferees are detailed in part II-B. To convey the contributions of many individuals to this process of evaluating, refining, and shaping the concept of the institute, conferees' judgments are presented, with permission when cited by name, in their own words.

The institute's suggested program orientation and style are presented in part II-C, which illustrates a relevant and feasible approach to program

development. Further aspects of the institute's feasibility and viability are examined in part II-D, which spells out the considerations that have shaped the panel's recommendations on founding, organization, endowment, and initial stage of development. Approaches to dissemination and extension of institute results, and its contribution to training programs, are delineated. Factors to be weighed in determining the location of the institute are noted.

The recommended role and character of the International Industrialization Institute are further delineated in part II-E, which notes activities discussed at some point in the study but finally judged to be outside the institute's appropriate purview.

Part III, "Selected References," is a selected bibliography on international industrialization, as well as a list of references for citations 1 - 7 found in parts I and II.

A. Concept of the Institute

The International Industrialization Institute will be a research institute devoted to enhancing knowledge of the industrialization process, with the aim of helping both developing and developed countries to maximize the contribution of industrialization to their economic and social development and to share equitably in its benefits.

The institute will be constituted in a way that ensures autonomy and perceptive awareness of critical industrialization issues. It will be governed by an independent, self-perpetuating board of trustees drawn equally from developing and developed countries. The institute will have a core staff of about forty professionals from various nations, expert in a variety of disciplines, including industrial economics, physical and social sciences, engineering, international economics and trade, and in industry location, marketing, and manpower development.

The institute's interdisciplinary work program will not duplicate that of any existing agency. Program activities will be carried out in close collaboration with other research groups at national, local, and international levels, and with industry and financial institutions. Location of the institute for maximum use of human and information resources will be determined by the board of trustees in consultation with prospective host countries.

The institute is designed to carry out prospective and sometimes controversial studies on emerging industrial opportunities and obstacles. To assure its ongoing capacity to face challenging issues with independence and objectivity, it is recommended that the institute be organized with assured funding to permit operations at a level of about $6 million per year including project income up to 25 percent of the total operating budget. Preference is indicated for an endowment yielding annual income to cover the institute's self-sponsored programs, but alternative modes entailing continual fund raising are also presented. These funds would be supplied by industrialized and industrializing countries, international organizations, international financial institutions, foundations, and private business corporations.

The program of the institute will emphasize applied research to create new linkages among policy, the market mechanism, and technology, thereby helping to guide industrial decisions toward development goals. The initial program focus would be directed toward the selection of appropriate industries and technologies by countries of varied circumstances, and toward identification of policies to promote the growth of the selected industries and to increase adjustability in advanced economies to accelerate desirable shifts of industries to new locales.

The International Industrialization Institute's creation is unanimously recommended by the Special International Panel convened by the National Academy of Sciences and the National Academy of Engineering to study its need and feasibility. During the assessment, the panel received generous support from some 300 key people in international organizations, in national industrial development in a widely representative group of countries, and in multinational and national firms who gave freely of their time to confer with the panel study team. (See appendix C.) The informed judgments that evolved are integrated in the panel report and provide the substantive and structural basis for the International Industrialization Institute.

B. The Challenge

The Industrial Revolution is entering its most promising and complex phase as it becomes global in scope. A better understanding of the industrialization process is necessary if new paths are to be found to overcome poverty and achieve better balance between industrialized society and the natural environment.

Sixty-five countries in Asia, Latin America, Europe, and Africa—with 60 percent of the world's population—are in the industrializing or semi-industrialized stages of development as categorized by the World Bank. Twenty others—with 8 percent of the world's population—are still building the social and physical infrastructure necessary to enter these stages.*

*See Selected References, 1, p. 85.

The majority of these nations are newly independent, intent on shaping modes and strategies of industrialization to meet their own goals, needs, and values. Their people are experiencing rapid social and political changes, and their opinions vary on the ways in which industrialization can serve their needs. These national orientations are arising at a time when international mobility of technology and resources is creating new forms of interdependence among nations. This interdependence will give rise to new opportunities for progress and to new clashes of interest, both domestic and international.

Industrialization holds the prospect of increases in world income, employment, and trade which will benefit industrial as well as industrializing countries. Applied scientific research in agriculture has diminished (though not removed) the threat of famine for the two-fifths of the world's people who live at subsistence levels, providing a critical impetus to progress, worldwide. The Green Revolution is raising rural incomes and creating expanded markets for local and imported manufactures. But, it cannot in itself overcome the lack of productive jobs or raise wages to acceptable levels. To narrow the acute gaps in productivity and income both within and between countries, young people moving off the farm in developing countries must gain opportunities, knowledge, and skills to participate in industrial and related activities suited to their countries' needs, resources, and trading potential. With considered policies toward industrialization, real world product can rise more substantially and appropriately than in any previous period.

Industry Selection

The identification of suitable modes of industrialization is pivotal in selecting specific industrial activities that create productive complementarities both within and between countries, achieve rural-urban balance, and improve economic relations between developing and developed countries. This achievement will require innovative, interdisciplinary effort to study means of shaping industrial development to peoples' needs, to avoid the mistakes and human costs of past industrial transformations. While making adjustments to international specialization, the industrialization process must also be adjusted to the principal values intrinsic in each culture.

Our present understanding of these dimensions of the industrialization process is clearly inadequate, as is our knowledge of the criteria that will guide developing countries in their new programs of industrial development. Moreover, existing approaches to problems of industrial location and international division of labor need reinterpretation in a world that is rapidly

changing and in which markets are often slow to adjust to the growth of competitive new industries.

Supporting Policies

Though most developing countries will for many years remain dependent on agriculture as their largest source of employment, it is the industrial sector that rapidly advances production and creation of wealth and provides important new surplus and revenues for reinvestment and modernization. Suitably designed, adaptable programs for integrating the agricultural and industrial sectors, supported by public works and local business improvements, would promote mutually reinforcing patterns of urban-rural development, employment, and land utilization. In industrializing as well as industrialized economies, urban congestion and pollution are adding motivations and criteria for locating new industrial capacity in less developed areas, and in smaller urban industrial centers. Identification and assessment of these opportunities at both enterprise and governmental levels are essential to foster effective linkages of industry with resource and infrastructure capabilities.

Adjustments in Advanced Countries

Structural shifts in industrial activities in both advanced and developing economies are essential to these transformations. Steadily increasing access is required for manufactures of industrializing countries to markets of industrialized countries. Increased flows of capital from rich to poor regions are required in forms that will result in rising productivity and wages in developing regions, as well as in lower international costs. The costs of present patterns of industrialization in environmental damage, resource depletion, and ecological imbalance, and their impacts on world trade and monetary patterns, are important factors in such shifts. Major international studies are needed to promote greater adaptability in existing industries and to define new policy frameworks within which the desired shifts may be achieved with equitable sharing of benefits and costs.

Equity and Efficiency

Advanced as well as developing countries lack adequate knowledge of how to harness the potentials of industrialization to the objectives of efficiency

and equity: efficiency in the economic sense of the best use of the nation's (and world's) resources, and equity in the sense of an acceptable sharing of the benefits of growth and in the process of decisionmaking and implementation of industrialization itself. Too often it is assumed that equity must be given up for efficiency, rather than seeking means of achieving both or, if necessary, making the trade-offs as rational as possible.

New methods of analysis and new information in an international perspective are required to identify and assess these trade-offs and to enable developing countries to participate fully in the international industrial decisions affecting their future.

Multinational enterprises, a major source of capital and technology for industrial development, have recently played an increasingly important role in determining the location of industry and the distribution of its benefits. Criteria used by these companies, though their performance is normally effective, do not necessarily take account of the impacts and costs imposed in the host economy by the creation of new industry. These social and economic effects are difficult to evaluate and to a large extent beyond the purview of individual companies.

Therefore, sustained effort is needed to enable governmental agencies, financial institutions, and companies to determine the workable and acceptable criteria for selection of industry and to develop methodologies and information for applying those criteria. New depths of analysis are needed to help countries and enterprises understand the alternative benefit-costs of different industries or industrialization routes and to clarify the time phasing of the processes of selection and implementation. These analyses, clarifying the nature and magnitude of gaps between social and private benefit-costs in different industries, would assist national and international agencies in devising more effective policy instruments to guide industry in investment and adjustment decisions.

Research Needed

The process of industrialization raises significant questions that no one country or interest group can hope to answer alone. Major policy issues involve several countries and decision groups simultaneously in the assessment of alternatives, opportunities, and costs. Appropriate timing and balance between phases of import substitution and export development, and identification of policies and lines of advantage suited to each phase, are among the issues calling for major empirical study. This research must be concerted, international and objective in character, and designed to relate government planning and policymaking, the market mechanism, foreign and local investment, and technology.

C. Need and Effective Demand for an International Industrialization Institute

In determining the need for a new research institute and identifying prospective users of its findings, the panel undertook to determine whether existing institutions are meeting, or can be equipped to meet, the critical need for new understanding of industrialization. To this end the panel devoted particular attention to obtaining assessments of the need and demand for the institute from administrators and professional specialists of international agencies and national and private research institutes concerned with industrial development. The wide selection of persons consulted in industrializing and industrial countries also included policymakers and professional specialists in governments, national and multinational companies, development banks, and related organizations.*

The panel consulted directors and professional staff of the following international organizations:

General Agreement on Tariffs and Trade (GATT)
International Bank for Reconstruction and Development (IBRD)
International Finance Corporation (IFC)
International Labor Organization (ILO)
International Trade Centre (ITC, of GATT-UNCTAD)
Organisation for Economic Co-operation and Development (OECD)
Organization of American States (OAS)
United Nations Conference on Trade and Development (UNCTAD)
United Nations Development Programme (UNDP)
United Nations Economic Commission for Africa (UNECA)
United Nations Economic Commission for Asia and the Far East (ECAFE)
United Nations Industrial Development Organization (UNIDO)
United Nations Institute for Training and Research (UNITAR)
United Nations Research Institute for Social Development (UNRISD)
World Intellectual Property Organization (WIPO)

*See Appendix C for conferees and their institutional affiliations. Individuals were consulted in their personal capacities; their judgments cited here do not necessarily reflect the views of their organizations.

Of the research institutions visited, those engaged directly in industrialization issues include:

Applied Scientific Research Corporation of Thailand, Bangkok
Council on Scientific and Industrial Research, New Delhi
Federal Institute of Industrial Research, Lagos
Harvard University, Cambridge, Massachusetts
Indian Institute of Management, Ahmedabad
Indonesian Institute of Sciences, Jakarta
Institute for Technological Research, São Paulo
Institute of Developing Economies, Tokyo
Institute of World Economics, Kiel
International Development Center of Japan, Tokyo
Massachusetts Institute of Technology, Cambridge
National Council of Applied Economic Research, New Delhi
Sardar Patel Center of Economic and Social Research, Ahmedabad
Singapore Institute of Standards and Industrial Research
University of Aachen
University of the Andes, Bogotá
University of São Paulo
University of Singapore

Consultations on research needs for industrialization as seen in individual countries were held in:

Brazil	Japan	Singapore
Colombia	Malaysia	Thailand
India	Nigeria	United States
Indonesia	Philippines	West Germany

Additional industrializing and industrial countries represented in the panel or in field consultations include Argentina, Canada, Mexico, Pakistan, Peru, Sweden, and the United Kingdom.

In these assessments, particular attention was given to priorities of research need and to qualities and attributes required to meet these needs. In this context the scope, staffing, methodologies, and client or user relations of current research programs of institutions visited were examined in consultation with responsible administrators and staff. Institutional attributes required to carry out effective international research were assessed with the assistance, in addition, of persons experienced in the founding and administration of successful international institutes in other fields.

Demonstration of Need and Effective Demand

The need and effective demand for an institute were convincingly demonstrated in these consultations. For example:

The field is wide open. The issues of industrialization of the developing countries are so many. The difficulty will be to have a proper choice of work and to identify the appropriate procedure of starting and operating the institute. In this respect the experience of the developing countries themselves should not be neglected. Studies should include practical situations, not merely theoretical models, and the object should be to enhance the understanding of industrialization as it actually takes place. There may be need for experimenting with several methodologies in order to break new ground. [I. H. Abdel-Rahman, Vienna]

We in the developed countries must begin to close the gap. Japan should perhaps build no more steel capacity. Very complex studies will be required to determine the best locations in each industry, in an international context . . . . I would like to see Japanese specialists working in an international center toward closing the gap, toward a new international division of labor. [Shigeto Tsuru, Japan]

We don't know the relevance of what we are doing. Available models are not persuasive. We have studied how others industrialized. That is our trouble. We need to take a completely fresh look. A developing economy must move on new paths. [N. C. Mehta, India]

The quality of research and data to guide use of technology for industrial development is just not adequate. [José Pastore, Brazil]

The international institute should develop methodologies for identifying branches of technology in which labor-intensive processes are feasible. This will provide guidance for national institutions to build capability in design of specific products and processes. [Sumantri, Indonesia]

The biggest gap is in data. Facts are fuzzy, speculative. The new generation of econometricians are not willing to get their hands dirty with facts. This is an intellectual gap. It is where a new institute should concentrate. [Senoh Unakul, Thailand]

Priorities of Need

Priorities of need established in these study conferences are directly relevant to the defining of requisite institutional attributes and the shaping of initial program strategies.

Policy issues of industry selection, national and international market development, employment, and technology were assigned highest priority by the study conferees. As described in part II-B (p. 27), conferees consider these key policy issues to be closely interrelated. Conferees also pointed to needs for new research approaches to questions of national industrial strategy and urban-rural balance, to issues faced in relations between industrializing

countries and multinational firms, to fundamental understanding of the industrialization process, and to questions of industrial manpower development, regional integration, and environmental policy.

Objective studies are regarded as essential in anticipating critical international industrial issues and in contributing to their resolution. As expressed by a conferee in Japan, studies are needed "which are neutrally conducted and recognized as neutral" and can thereby "make unnecessary reactions disappear in the discussion of objective problems."

Requisite Institutional Attributes

Institutional attributes required to meet these critical needs for applied policy research were explicitly identified. One central requisite is research autonomy. Autonomy is essential because the issues at stake touch vital interests of countries and enterprises. The second central requisite, to be achieved while assuring autonomy, is joint support by public agencies and private industry in industrialized as well as industrializing countries. Joint involvement is essential to achieve a realistic approach to these issues, obtain the necessary data, and assure the confidence of recipients and users of research findings.

Administrators and professional staff of international, national, and private institutions engaged in research on industrial development identified a further dimension of need and attributes. They pointed to the need for state-of-the-art advances in industrial policy research that can be achieved only with a new level of resources and through concerted effort. Such advances call for international collaboration in sustained, empirical work on well-posed analytical problems, including much detailed study at country and regional levels.

To attain these attributes, an institute of unique nature is required. It must be an independent, nongovernmental institute with a carefully selected multidisciplinary staff, and be multinational in all respects, including trusteeship, funding, and personnel.

Role of Existing Institutions

No existing institution has this orientation, or these combined attributes of autonomy and joint support, and no existing organization can provide the base on which to build these characteristics and capabilities. Administrators of international agencies concerned with industrialization welcomed the role such a new institute could play in complementing their own programs

and project-oriented research. The panel's recommendations (in subsequent sections) on assuring productive institutional linkages are of central importance to the success and utility of the proposed institute.

The Need for the Institute

The need for the International Industrialization Institute, to summarize, is based on these findings of the panel:

- Worldwide economic and social gains are great if there is an appropriate selection of industries among advanced and developing countries. Conflict and severe social costs can result from ineffective or incompatible policies.
- Our lack of ability today to evaluate alternative paths and policies for industrialization is apparent. No concerted research is under way on fundamental issues arising from the interdependence of industrial change in developing and developed countries. Both economic rates of return and social costs and benefits are complex; neither is easy to measure.
- The complexity of decision factors in industrialization is such that only intensive interdisciplinary research can illuminate the problem.
- Intergovernmental agencies cannot carry out objective studies in fields in which national policies are sensitive.
- The developing countries are forced to proceed with industrialization to provide employment and advance their economic capabilities. They urgently seek knowledge on suitable methods of procedure, for which the experience and resources of the developed nations and of multinational enterprises are highly significant. But, they will have confidence only in the results of research in which they have an active part, and in which they can bring into consideration their own economic and social goals.
- Finally, there is an urgent need to extend the study techniques developed by the proposed institute to other institutions around the world specializing in particular aspects of industrialization.

Based on this determination, the panel unanimously recommends the creation of the International Industrialization Institute, characterized by the fundamental objective, program orientation, founding process, organization, funding, and institutional relations set forth in this report.

D. Objective and Character of the Institute

Flexibility of Approach

The institute's approaches to the study of the industrialization process in both developed and developing countries will be especially pointed toward understanding:

The fundamental objective of the institute will be to develop and disseminate a body of knowledge that will help developing and developed countries to attain their interrelated goals of industrialization and to orient to course of international development toward faster economic growth and social advancement in developing countries.

- The problems and potentials of divergent patterns of industrialization, reflecting different national value systems and constrained by human and physical resource endowments, locational factors, and technological capabilities;
- The interrelationships between industry, agriculture, and other sectors within national economies;
- The policy implications of different routes to industrialization, especially related to employment, revenues, income distribution, and social welfare;
- The interactions of national, regional, and international programs of industrialization; the patterns and processes of international industrial integration and the resulting adjustments.

The institute will select the subject areas for which it can provide a depth and novelty of approach that promises new understanding. Empirical studies will test new methodologies and produce new data to illuminate alternative policy and investment choices.

In these exploratory studies the institute will not be limited to existing or orthodox structures and concepts of industrialization. It will be open to consideration of new ways of organizing production, patterns of consumption, and systems of distribution. It will seek new approaches to industrialization that may permit countries to pass over historical stages of industrial progression and to employ other appropriate technologies.

While concentrating on critical issues of international industrial development as its area of specialization, the institute will be cognizant of the broader aspects of modernization. Institute staff will include persons competent to plan and conduct studies in cooperation with institutions specializing in the historical, sociological, and psychological dimensions of change. The perspectives of each institution in contributing to new industrial modes should be enriched thereby.

Collaborative Style

The institute's research approach will be collaborative and designed to assure active involvement of industry and public agencies in both developing and developed countries. Program activities will be carried out in close association with other institutions, avoiding duplication and enhancing the institute's research capacity. At the country or regional level it will work with and through local research institutions, ensuring authentic country participation and continuing, reliable liaison with the local government. This decentralization sharply reduces the need for a field organization.

Involvement of other institutions in cooperative efforts may cover all phases of work, from identifying and conceptualizing problems to design of methodology, joint field work, analysis and formation of conclusions, and pilot measures toward implementation. The institute will actively encourage the seconding of personnel to and from industrial enterprises, development banks, United Nations organizations, and regional, national, or university and applied research groups. The multidisciplinary nature of projects will often lead to collaborative work with more than one specialized institute, thereby contributing to new methodologies and new forms of cooperation among local and regional institutions. The institute will, in particular, utilize applicable research of such organizations on demographic, agricultural, and environmental problems that impinge on industrialization. In addition to cooperating with organizations in developing countries, the institute will find it useful to work with groups such as the new International Institute of Applied Systems Analysis in Vienna.

Position on Policy Issues and Relation to Users

The institute will frequently be asking and assessing alternative responses to questions that have not yet been posed at the policy level by governments or businesses. Its capacity to anticipate and deal realistically with emerging problems should increase as its competence and experience develop.

The institute will not make specific policy recommendations to governments or enterprises; rather, it will clarify and document a meaningful range of policy alternatives and their benefits and costs. This should help countries and firms to choose mutually advantageous lines of development. On request, when appropriate, the institute will help countries and development agencies find specialized talent to assist in translating the results of institute research into specific policies.

The institute will not attempt to sell an approach or take a position, but will be prepared to enter areas of controversy and to encourage publication of reports that in the scientific tradition, represent divergent positions on issues of public concern.

The institute should be prepared to entertain requests by governments, development banks, aid agencies, and industrial corporations to undertake commissioned studies, carefully defined in purpose and scope. As detailed later, the panel recommends that such commissioned work be strictly limited to not more than about 25 percent of the institute's annual income. A principal yardstick for institute management to decide among such requests will be the extent to which the proposed activity contributes to the central learning mission of the institute. A further yardstick is its contribution to the test of realism that policymakers, financial institutions, and investors will wish to apply to new methodologies, information, and decision criteria that result from institute programs. Institute members should be permitted to collaborate with a local group, in carefully selected tasks oriented to policy or project implementation. They would thereby gain in effectiveness and research credibility through experience in the field.

E. Program Focus

An important test of the feasibility of the institute is its ability, as a relatively small organization, to build an international program sufficiently focused to achieve positive results amid the diffuse and conflicted issues of

industrialization. The panel concludes that program strategies with promise of real impact on these problems can be defined and carried out.

While the board of trustees, director, and staff of the institute will clearly have responsibility for establishing its strategy and program, the initial focus, illustrated in the next section, meets the tests of relevance and feasibility as applied during our study and elaborated in part II. This provides a reference standard for alternative programs that the institute management will weigh.

Applied Policy Research on International Industries

Interrelated policy issues of industry selection, market development, employment, and technology were assigned highest priority in our conferees' assessments of specific research needs. An integrated research focus on these issues can be achieved through international analyses of individual industries, directed to

- more effective selection of industries and technologies by developing countries,
- identification of policies encouraging the competitive growth of such industries in national and international markets, and
- better understanding of the benefits and costs of shifts in selected industries from advanced to industrializing countries and of measures to promote such adjustments.

The institute would analyze the international characteristics and development of individual industries to help developing countries select those they wish to stimulate and determine appropriate levels of operation, technologies, locations, markets, and related policies. Relationships of each industry (or subsector) to the circumstances of different countries would be examined—i.e., their linkages to other industries and sectors and the costs and policies required to prepare for and support their development. The same industrial analyses would be useful to advanced countries in identifying individual sectors that could be the focus of aid and investment programs or new trade initiatives, or the subject of adjustment assistance programs easing the shift of activity to the developing countries.

Though selection and entry into an international industry by national or multinational firms inevitably affects the national economies in both advanced and developing countries, the industry decision and its international consequences are seldom considered simultaneously by governments or investors. Bringing together the several disciplines and methods of analysis

required for simultaneous assessment of these questions would sharpen understanding of alternatives and contribute to systematic comparisons of impacts and trade-offs.

To indicate the perspectives sought, and the practical uses of such studies, analyses of five international industries are illustrated in appendix A and highlighted in Exhibit 1 in this section. The industries cited are not suggested for any particular group of countries; instead, they represent dynamically changing, mobile industries for which studies on these lines would point to emerging advantages and disadvantages in countries having different conditions.

In such applied industrial policy research, active participation of collaborating local institutes would be sought, especially on cultural and other local policy determinants. Such collaboration would permit development of data and analyses specific to national conditions and policy sets, strengthening the utility of the research results and enriching comparative analyses.

Projected Program Results

Institute studies of international industries, while facilitating improved investment and adjustment decisions in the subsectors concerned, would build the factual base for a broader program of comparative policy studies. Results of these expanded studies would meet the following types of issues:

- Workable criteria, methodologies, and information for selection of industries and industry segments;
- Evaluation of alternative strategies and paths of industrialization and benefit-cost and growth-equity trade-offs;
- Means of accenting complementary growth of employment and technology;
- Parametric guidelines for industrial research, development, and engineering (R, D & E);
- Location choices, intermediate industrial growth centers, and urban development; and
- Specific approaches to regional industrial cooperation and its institutional implementation.

Substantive approaches to problem-oriented studies, with an organizing strategy to relate these to the development and testing of new policy concepts, are set forth in part II-C (p. 60). As relations with specialized, national, and international research and operating groups are established, the institute would undertake more complex collaborative programs of goal-oriented research.

Exhibit 1 International Industry Studies

Industry studies designed to give initial focus to the institute's program are illustrated in appendix A (pp. 90 - 108). Their content and potential applications are sketched below. In each case, the objective and scope of study would be defined in close consultation with collaborating institutions in the countries concerned, and with industry representatives and development banks or other agencies whose participation in the study is sought.

Heavy electrical equipment. Three aspects of the competitive potential of semi-industrialized countries for increasing their participation in heavy electrical equipment markets would be explored:

- Potential cost advantages in specific product categories, especially intermediate heavy electricals;
- Possible institutional innovations to improve scheduling of equipment purchases, thereby reducing costs, through regional cooperation in procurement; and
- Elements of R & D that industry in selected developing countries might enter, and pertinent approaches to collaboration between multinational and national firms to this end.

Textiles. The primary aim would be to provide information and criteria needed for international expansion and redistribution of production in the textile industry, stimulating a continuing rollover as new countries determine the appropriate place of textiles in their programs for industrialization.

A major initial study would seek to identify textile subsectors tending to lose their competitive advantage in advanced economies, and offering increasing opportunities to developing countries if suitable measures for modernization and greater market access are introduced. Opportunities for complementary product development, material exchanges, and technology transfers would be examined. Benefits and costs to both groups of countries through the options would be demonstrated.

Results of this large-scale effort would be evaluated after a suitable interval to determine if such pinpointing of market opportunities and policy options in a dynamic world context has stimulated desired shifts in textile activity. Otherwise, a second phase of study might be carried out with the aim of providing specific quantitative guidelines and measures for the consideration of industrializing and industrialized countries toward greater trade through

progressive rationalization of textile development. If research toward such guidelines is undertaken, the results would be presented by the institute in forms serving to crystallize attention to potential courses of action. Policy decisions would, of course, be assumed entirely by individual nations and through intergovernmental agreement.

Iron and steel. Three lines of inquiry are indicated:

- Testing the claims and geographic implications of new technologies believed to favor smaller steel plants and new patterns of orientation to markets, raw materials, and energy supply;
- Combining such assessments with analysis of various existing patterns of integration in iron and steel making, and of environmental protection costs under different location conditions, to identify and weigh opportunities for greater spatial and regional dispersion of production; and
- Analyzing such trends and trade-offs to identify routes to an improved international division of labor in iron and steel, stimulating growth of these basic industries in developing countries that possess suitable markets and factor endowments.

Machine tools. Formation of markets for industrial machinery, and specifically for selected machine-tool categories, would be examined to identify gaps in management, marketing, design, and technical skills that retard the growth of productivity in user industries, or unduly distort investment choices in favor of capital-intensive methods. A two-tier scope of study is envisaged, oriented to different levels of development in machine-tool-using industries in participating countries.

Autos. Institute research on the auto industry would occur in a context in which basic planning by a country or region for transport systems is well advanced, and where the problem of developing the industrial base for transport has emerged. Probable requirements of automotive vehicles of various types would first be examined to determine if volumes are sufficient to induce regional or national production. For the selected vehicles, alternative national and regional mixes of production by stage, specialization, and componentry would be analyzed. Impacts of projected auto industry subsectors on each participating country would be compared, including costs of preparing for and supporting the mix, locational factors, manpower needs, and relations with secondary and tertiary industries.

F. Formation and Organization

The institute is to be an autonomous, nonprofit organization. It will be established by a board of founders whose five to nine members are eminent in the areas that concern the institute and drawn essentially equally from industrializing and industrial countries. Likewise, the sources of funds and staff for the institute would be from a wide variety of countries.

The board of founders, acting as individuals, would charter the institute, select the board of trustees, and gain appropriate recognition and basic endowment funding for the institute. The manner of formation and the structure envisaged are depicted in Figure 1.

This procedure for the founding and governance of the institute is designed to assure that its independence will be protected from political or special interests. Such assurance, as many conferees emphasized, is essential to the institute's success.

Trusteeship and Governance

The board of trustees would be self-perpetuating, and would be responsible for general supervision of the institute, approval of fields of investigation, and protection of the independence of the institute's work. The board would select the director, who would be the institute's chief executive officer, and define his authority and responsibilities.

In constituting the institute, the board of founders should give due weight to the desired attributes of independence, responsibility, and representation. A suggested formulation is to hold the trustees as not representing particular interests, but essentially above such interests, with a separate consultative body strongly representing the diverse interests of institute users.

In this formulation, the trustees would serve in their personal capacities, holding ultimate responsibility for the future of the institute. Such a board might consist of 15 members, with wide experience and original outlook, drawn more or less equally from developing and developed countries. Terms of board membership would be 5 years, except that term appointments for the first board would be staggered so that one-fifth of the membership would rotate off the board each year. The board would establish bylaws providing for the election of a chairman, the election of an executive committee with appropriate powers, and other committees as needed.

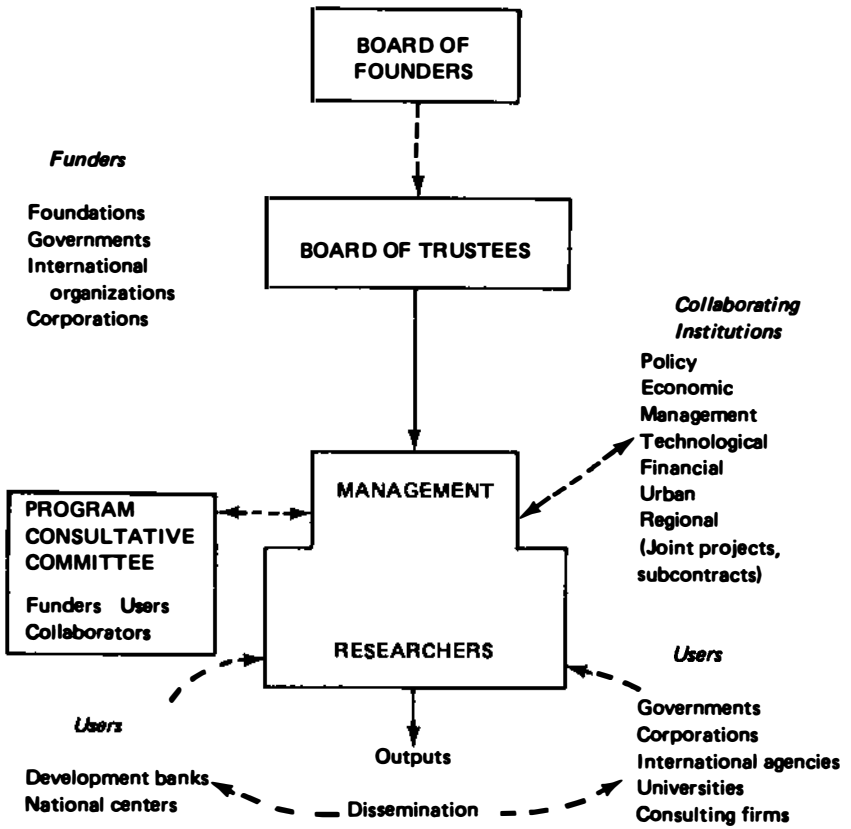

FIGURE 1 Formation and Organization of the International Industrialization Institute

Institutional Linkages

The board of trustees would determine the desirability of constituting a program consultative committee of perhaps 30 members, from diverse functional and geographic backgrounds. Members of the consultative body would be drawn on a rotating basis from industry, intergovernmental organizations, and the growing international community of industrially oriented institutions—which includes development banks, private and public industrial-development corporations, management institutes, national planning agencies, institutes of technological research, economic and policy research centers, techno-managerial consulting firms, and nonprofit organizations.

It appears desirable to constitute ad hoc committees of various types from time to time to assist the institute in carrying out certain projects, and in demonstration and extension services.

Involvement of potential users of institute results in such consultative committees is expected to enhance their commitment to the institute's success and increase their effective use of research results in decisionmaking. This will also facilitate the seconding of policymakers and researchers to the institute to participate, upon invitation, in specific studies and in developing and applying new methodologies. Officials of a significant proportion of the multinational and national companies consulted, as well as those of public agencies responsible for industrialization programs, have assured their cooperation in making available qualified staff and relevant information to contribute to such studies. Such exchanges would increase understanding of the interrelations involved in the industrialization process, and contribute to implementation of institute results.

Central Staff

It is contemplated that the director would assemble a core staff to be built to a size of about 40 professionals in the first 5 years. This closely integrated core group would be composed of specialists in industrial economics, physical sciences, social sciences, engineering, systems analysis, decision and information theory, marketing, manpower development, industry location, regional and urban development, and international trade. A significant proportion of the institute's research would be performed directly by this central group. The core staff would also administer research projects, and assure effective demonstration and extension of their results, through work performed collaboratively, or on contract, with local organizations in various countries.

Location

To further its goals, the institute will actively pursue its program anywhere in the world it can make proper arrangements. Mobility of staff will be high: individuals will reside in countries participating in intensive studies and move among countries. In a real sense, the institute will be operationally decentralized.

The central location is important, nevertheless, to the institute's integrative function and to lively communication among personnel of diverse origins and disciplines. This location of the permanent core group, to be determined

by the board of trustees, must be in a vigorous intellectual and industrial community with excellent centers of learning, libraries, data sources, communication and travel services, living conditions, and school facilities.

G. Funding

Financial autonomy through assured stable-base funding is critical to the institute's ongoing capacity to meet changing needs in international industrial development with independent judgment.

The institute will be required to undertake prospective and sometimes controversial studies on international industrial opportunities and problems. The institute's capacity to foresee and deal with changing needs will increase as it acquires strength in clarifying industrialization issues. Interests of potential sponsors should not be permitted to limit in any degree the institute's involvement in studies that in its best judgment are central to its main objective.

Estimates of the institute's annual program expenditure on a steady-state basis range upward from $5 - 6 million a year, including commissioned work. To provide for initial establishment costs, to meet this annual program minimum, and to provide an assured financial base, the panel recommends that the institute be established with a foundation endowment on the order of $100,000,000 to be contributed by industrial and industrializing countries, international organizations, foundations, and private business corporations.

Income of about $5 - 6 million a year would cover the institute's core operating program and would fund work on specific projects performed by collaborating institutions or on subcontract. Approximately half the annual expenditure would be for such collaborative and contracted research.

To keep the institute's focus on path-breaking projects, the panel believes that income from commissioned studies or services should not exceed about 25 percent of the institute's annual expenditure. Additional income for special projects could be provided by funding from international organizations, government agencies, or private foundations.

Although believing an endowment to be the most desirable form of financing, the panel recognizes that obtaining funds of the needed magnitude

within a fairly short time may not prove to be practical. The institute could become operational and its program evolve from a smaller endowment base, since its start-up needs in the initial years will be less than the estimated $5 - 6 million steady-state expenditures. Launching the institute on a lower endowment base would permit the application of the various procedures recommended for its establishment and designed to ensure from the outset the institute's autonomous, international character.

The point has been made to the panel that a fully endowed institution faces certain risks characteristic of many self-perpetuating bodies beholden to no one. The self-discipline engendered by the need for continual fundraising has been called a salutary constraint. This effect can be achieved at no expense to the essential concept of institutional independence by the formula of the shrinking endowment–i.e., causing the institute to draw its yearly operating funds from its endowment and obliging it to replenish the endowment through continual fundraising. This device is used by several privately endowed U.S. universities.

Initial Stage of Development

Should prospects of securing enough funds for an endowment not be favorable, the institute could be established on the basis of initial commitments by donor sources that assure it yearly funding for 5 years. Assurance of adequate funding for that minimum period is deemed essential to enable the institute to secure the services of top-flight personnel and achieve a significant output. Should the quality of its performance warrant, the institute could then proceed to build up an endowment base to attain in the longer run the stability and financial security the panel considers optimally desirable for an endeavor of this kind.

Part II

Institute Rationale and Design

A. The Panel's Procedure

The panel was responsible for determining the need and the effective demand for a new institute. Then, in the event findings were positive, it was to recommend the required organization, program approach, and funding.

The first step in this process called for analysis of the gaps in knowledge that hinder international industrial development. Four tests were applied in analyzing such gaps:

1. Does research—"doable" research—promise to reduce these gaps significantly?
2. What attributes or qualities are required to achieve relevant research findings and to assure their delivery to the concerned decisionmakers?
3. Can these qualities be achieved by strengthening existing programs and institutions?
4. If not, is there a reasonable probability that the requisite qualities can be built into a new international entity in strength sufficient to fill these gaps?

To bring realism to these judgments, the panel drew upon persons with experience in every aspect of industrialization, in countries at all stages of development. Following the initial meeting, the panel sent a progress report presenting its preliminary findings to prospective conferees as a basis for evoking detailed assessments of the concept. The report presented a preliminary ordering of issues centered on problems of international industrial adaptation and integration and described research directed to the specific needs for knowledge tentatively identified by the panel. This report stimulated open-ended, probing discussions on the need and potential orientation of an institute.

An extensive literature review was conducted to provided a basis for systematically structuring the needs for research on the industrialization process. This review began with a detailed examination and analysis of a comprehensive, current work on industrialization[2] that identified major

problem areas and issues. With this background, a review was made of select current works and periodicals on economic, industrial, and social development[3] and of the publications, reports, and research programs of international development agencies, e.g., the World Bank and the United Nations organizations.[4] Publications and reports of the institutes, development banks, research centers, and other agencies visited during the study tour were also assessed.[5]

Based on the literature review, a matrix of research issues related to specific industrial development goals was established. Under eight major goal-related issues, arrays of specific research questions were formulated. This matrix, articulating goal-related research topics but not attempting to set priorities, provided a framework against which to examine the priorities of need resulting from field consultations.

About 300 persons in five continents participated through detailed interviews and correspondence with the panel study team in assessing the need and refining the concept of the institute. These conferees (see appendix C) included policymakers, entrepreneurs, bankers, managers, engineers, directors of technological research institutes, specialists in medium- and small-industry promotion, economic analysts, and industrial administrators. Calling on people at many vantage points, the panel undertook to minimize distortion of judgment.

Each conferee was asked essentially these questions: "Is it desirable and feasible to found a new international institute to address research needs of industrialization? If desirable, what do you consider the priorities among needs that a new institute should address?" As indicated earlier, conferees were not given a checklist of needs or issues but, after the broad introduction provided by the progress report, were asked to offer their own judgments on research needs. The tabulation of priorities that follows in section B is based on the conferees' statements of need.

In this process, many conferees and panel members formed their own images of an institute, which reflected their sense of priorities and organizing strategies. Conferees also described obstacles and limitations facing such an institute and suggested qualities or attributes required to overcome them.

This report on priorities and characteristics of an institute cannot fully recapture each person's concept of the institute. Certain general modes emerged, however. To test degrees of congruence or incompatibility among these modes, a panel task force met periodically during the study to weigh and distill concept papers designed to define the principal modes advanced by conferees and panel members.

At its second meeting the panel assessed the report on the field consultations with the working proposal resulting from task-force discussions and unanimously agreed to recommend creation of the International Industrialization Institute, as set forth in this report.

B. Assessment of Need for and Attributes of an Institute

This section reports the conferees' detailed assessments, both blunt and subtle. This examination of specific needs is the foundation for the panel's overall assessment of the need and feasibility of the institute and for the recommendations on its objective, program, and structure.

A strong positive consensus resulted from our study conferences. Conferees who voiced a definite judgment for or against an institute number 137, of whom 112 favored and 25 opposed the concept.* This testimony is strong support, though the study is, of course, not a poll. Support is even stronger among conferees interviewed in developing countries. The ratio is 7 to 1 among the 67 conferees interviewed in these industrializing countries who gave a decisive view, against 3 to 1 for 70 conferees in international agency headquarters or in corporate or other positions in advanced countries.

Priority and Interaction among Needs

The priority of needs for the International Industrialization Institute, distilled from the judgments of conferees, is set forth in Table 1.

The most needed focus of research is policy-oriented analysis of individual industries, to facilitate improved selection of industries by industrializing countries, and to provide a base for policies encouraging competitive growth of such industries in national as well as international markets. Closely ranked with this need, and related in focus, is the issue of employment and technological choice, in its setting of international wage disparity. Evaluation and development of new technologies are a third very important concern to many conferees.

These three priority needs stand in sharp contrast to the rating of other needs in Table 1. In assigning such priorities, conferees recognize that all issues identified in the table are intricately related. Such relationships are

*An additional 44 conferees pointed out pros and cons but reached no conclusion; 25 discussed particular needs but did not react to the idea as a whole. Consultation with 35 conferees was on a specific aspect of the study in their areas of special competence; 45 conferees contributed to group consultations without offering an overall judgment.

TABLE 1. Needs for an International Institute, Ranked 1 - 10

Research Issues and Needs		Number of Conferees Recommending Action[a]
1. Policy-oriented industry analyses		61
Selection of industries	34	
Policies for competitive growth: domestic	18	
Policies for market development: international	28	
2. Employment and technological choice		53
3. Evaluation and development of new technologies		40
4. National industrial strategy		18
5. Urban-rural integration		17
6. Bridging developing country - corporate interests		15
7. Fundamental understanding of industrialization		15
8. Industrial education and training		8
9. Regional integration		7
10. Environmental protection		4

[a]Tabulation of judgments of 173 conferees–102 in nine developing countries and 71 in international agencies and industrial countries–who named one or more specific priority needs.

made explicit in many of the conferees' statements of needs. Nevertheless, the weights assigned to policy issues of industry selection, market development, employment, and technology can be taken as establishing, in the combined judgments of the conferees, a central set of critical issues for early attention by the institute.

A separate examination of these needs for an institute, in the order of ranking in Table 1, follows.

1. Policy-oriented Industry Analyses

Analyses of individual industries and industry segments are in critical demand to meet three closely related needs:

- More effective selection of industries to meet the varied circumstances of industrializing countries
- Identification of policy instruments suited to competitive growth of the selected industries
- Increasing adjustability in advanced economies to accelerate desirable shifts of industries to new locales

a) The Approach

The common element among these needs is seen if they are looked at from the standpoint of an investment decision by an individual enterprise in facing first the home market, then the international. We report in this sequence the ways in which various conferees perceive these needs. This brings out differing emphases and is useful in testing how far analyses of specific industries could provide a worthwhile, unifying focus for international collaboration.

(1) Selection of industrial activities

Thorough local knowledge is required for industrial investment decisions and project appraisals. But a great deal of generic information on the structure and characteristics of specific industries is needed as a basis for such local choices.

One of the biggest problems is to identify those sectors or subsectors that could remain in the medium-scale level without compromising global policies. [Jardy Sellos Correa, Brazil]

Feasibility studies sponsored by AID are typically for plants too large for local investors and experience. We need analyses showing opportunities for medium and small plants, suited to our resources and market. [Krit Sombatsiri, Thailand; Sugeng Sundjaswadi, Indonesia]

These questions now face the Philippines in electronics, wood products, shipbuilding, and metal products. What technical relationships link various parts of the electronics industry? What are minimum and desirable levels of output in specialized branches of the industry? What technical matrices or input-output relations at a subindustry level should be taken into account by a country seeking to enter the industry? What segments in the international market offer opportunity? In what pattern do multinational companies split off operations for overseas plants? What location factors would offer opportunities for smaller units outside the Manila metropolitan area? [T. W. Allen, Philippines]

Real competence in a subsector is required to determine a country's advantages and disadvantages. Do petrochemicals have any basis of comparative advantage in Southeast Asia? Should textiles be promoted on an integrated or nonintegrated basis? With great specificity, where should Indonesia start in setting up an electronics industry? Existing expert studies, including those of the recent World Bank team, do not leave us confident that these answers have been provided. [Gustav Papanek, Indonesia]

Take the "make or buy" approach for the country. Should Indonesia start with steel rolling or an integrated mill? You have to look at effects on the whole subsector. Needs of foundries for pig iron, the economics of future price relationships, and external benefits related to the industry need to be factored in. Then, is it more efficient for foundries to be integrated with machine shops and machine-building units; or should specialized foundries be encouraged? How do you approach small-scale industry development for Indonesia? ... Accent the differences between countries. The deviations are more important than the averages. [Development bank officer, Indonesia]

In what industries should vertical integration be encouraged? [Vichitvong, Thailand]

What sequences of development in an industry are advantageous? We are encouraging precision engineering. In what component markets should we start? With full employment, Economic Development Board policy is to welcome foreign investment only if it upgrades technology. How do we identify and assess such lines? [E. L. Tan, Lang Wong, Singapore]

Appropriate paths of electronic industry development in Turkey need to be examined—perhaps using sophisticated forecasting techniques—to give Turkish investors confidence on which to act. The 60,000 Turkish citizens now employed in electronics in Germany are a major resource. Turkey's projected 22-year transition to Common Market membership sets the context for intensive study of these opportunities on an industry-specific basis. [F. Norman, Vienna]

In addition to generic and structural features of different industries, emphasis was placed on the acute need for factual and timely information on the specific international market situation facing industrializing countries.

What is the world market? The Bank [Brazil National Development Bank] doesn't have this information to judge whether industries we support can compete. What is interesting is the world structure of companies and figures on market trends. [Jardy Sellos Correa, Brazil]

Hard data ranging from iron ore resources to the specific categories of steel required by major developing countries are simply not available as guides to investment. Information for investment should be more dependable than the "whispering hunches" on which companies must often make these decisions. [I. H. Abdel-Rahman, Vienna]

In petrochemicals—or new subsectors like petroproteins—authoritative, unbiased determination is needed of new capacity levels for which industrializing countries should aim. These should take account of world supply-demand and price factors, national requirements, and emerging comparative advantages. [M. C. Verghese, Vienna]

An international perspective is needed for each industrial subsector. The World Bank would be able to turn to the proposed institute for this. It is not found in present reports. [N. N. Agarwala, India]

Independent international assessments would help countries balance investment choices involving tied aid. India, for example, now has the engineering and material capacity to put up a small steel plant, perhaps serving the South. Alternatively, by obtaining aid she can build a 4,000,000-ton plant. Authoritative analysis of economies of scale in steel as related to location factors would assist in weighing the trade-offs, taking into account secondary effects on the economy and the implications of tied aid. [A. G. Menon, Thailand]

(2) Policy instruments for competitive growth: domestic

Differences in the conditions of entry and competition in various industries have not been systematically analyzed in industrializing countries, but are at the center of a growing set of difficult policy issues.

Japanization of industry succeeded, among other factors, due to encouragement of entry by an adequate number of firms to promote competitive technologies and cost performance. In fertilizers, for instance, five companies with different technologies were encouraged from the outset of the industry in the 1920s. [Toshio Shishido, Japan]

The transformer industry in Colombia is fragmented among 12 firms, including several with different international affiliations. The market is expected to double in 5 years, but no policies are available on common standards, what to produce within the country, what materials to import, or how to tax imported intermediate materials and components. One industrial-engineering graduate student is trying to determine what policy would best promote the industry, but can find few guidelines. [Francisco Rodriguez, Colombia]

Thai law requires that the government approve entry of new firms. In the match industry, for example, seven existing firms are operating at only 50 percent capacity, but we have an application for a new company claiming that it can economically run a new plant near the southern border. By what standards can we test such applications? Should we have such a law? Private industry supports the law, to limit entry. [Vichitvong, Thailand; similarly, Geh Sim Hong and Cheah Tek Kuang, Malaysia]

Empirical study on the number of firms making for optimal competition in different branches of industry is important and, to my knowledge, is not being done. Factors in competitive behavior vary in different cultures. Government monopoly policy is based more on received notions than on factual differentiation of conditions by branch of industry. Differential industry structure also needs to be clarified as a basis for policy on industrial licensing, or reservation of entry to small-scale firms. This must start at a disaggregate level, building to the necessary levels of aggregation. [K. S. Krishnaswamy and James Raj, India]

Models of industrial markets as related to country size and levels of protection could be tested. But will this not depend on the technological intensity of the industry? [K. K. Subramaniam, Geneva]

Planning is bargaining. It uses and improves the price mechanism, not trying to beat it. Large countries—and some medium—have bargaining advantages which they are not equipped to use because they do not understand the structure of different industries in which their position may offer advantage. Estimate future demand, study scale and technologies, break down components and subprocesses, establish make-or-buy policy, and develop negotiating sets for each industry. Bargaining means getting done within your country what you want done most efficiently .... We don't use our theory of oligopoly to understand how firms move in international markets. Policy instruments based on an understanding of negotiating opportunities in each industry need to be invented, tested, and used. Indonesia is starting out on a policy of tenders for long-term manufacturing projects. Whole new sets of arrangements will emerge. The Japanese are showing particular interest in bidding on such tenders: for example, for two truck factories. We should realize that there is no such thing as *an* automobile factory. It depends how far it is advantageous to structure it or break it down one way or another, and what terms the country wants and can afford to set for foreign participation. The tender system will show where the country's advantages are, at least as seen by international companies who believe they are in the best position to work within that country's framework. [Development bank officer, Indonesia]

(3) Policies for market development: international

International perspective on the dynamics of individual industries is required as a basis for increased exports by industrializing countries, and to promote greater adjustability in established markets.

If we start garment production, we can't export to the United Kingdom or the United States. What we can do cheaply, we can't export. Can the proposed institute get this across to the rich countries? Take tapioca. We have feasibility studies for increasing tapioca production in several states. However, if the United States negotiates for greater sales of barley and maize to the EEC, this will cut margins on tapioca to levels too low in most states. As to rubber, how are we to get out of it, or find new markets? Here politics comes in. If we can make available a large area for timber, will Japan buy the plywood? [Geh Sim Hong and Cheah Tek Kuang, Malaysia]

We must turn down the barriers. Your textile lobby is now beginning to look at nonquota countries like the Philippines. We need growing markets in lines in which we have advantages . . . . We are getting two short ends of the stick. Our export price index is stable. For imports the index has risen 24 percent. We need manufactured exports to help overcome these worsening terms of trade. [Conrado Sanchez, Philippines]

We in the developed countries must begin to close the gap. Japan should perhaps build no more steel capacity. Very complex studies will be required to determine the best locations in each industry, in an international context. These should take account of transport costs, new technology and resource development, pollution, and other effects. I would like to see Japanese specialists working in an international center toward closing the gap, toward a new international division of labor. [Shigeto Tsuru, Japan]

An important field of work would be the projected effect of growing competition on existing industries in advanced economies, and necessary adjustment measures. [Moeen Qureshi and Helen Hughes, Washington]

On these issues, the question can be asked whether the missing ingredient is fuller knowledge, or whether there is simply reluctance on the part of advanced economies to make the necessary adjustments. Crystallization in detail of a program and thesis for resolving such situations is often helpful in moving the effort along. [Bernard Bell, Indonesia]

An important area is to study methods invented by various countries to assess injuries from new imports and to compensate. Build on earlier work at Fletcher and Brookings on the economics of transition and adjustment. In an early ILO study on the combined effect of new competition, prospective increased income, and new opportunities, I concluded that the net effect depends on the country's adjustability. Studies in the 1930s indicated positive correlation between growth and the percent of the country's exports representing new products. Such studies can suggest lines of dynamic advantage. [Eugene Staley, India]

Unity among the above perceptions of need, to sum up, arises in the generic problem faced in each investment decision. An enterprise or country evaluating a new project must have adequate knowledge of the industry's structural characteristics and trends, as well as short-run supply-demand

factors. To an increasing extent, changes in international markets and technology impinge on each local decision. Uncertainty is inevitable, since simultaneous but often unpublicized decisions are being made in the same and related industries in other places.

International perspective on the structural dynamics of important industries would contribute to the information content of investment and adjustment decisions, reducing uncertainty and errors in judgment. A perspective that provides understanding of the structure, tendencies, policies, and practices that characterize individual industries is necessary, moreover, as the factual basis for evolution of policies that will offer new opportunities for industrializing countries to strengthen their position in world markets and technology.

b) Assessments

As a basis for assessing the feasibility and significance of an institute founded to face such priority needs, two further assessments were advanced by our conferees: one consisted of obstacles, opposition, and limitations to such individual industry analyses; the other was composed of the attributes of work necessary to overcome or mitigate these difficulties.

(1) Obstacles and opposition

(a) Intrusion on particular interests

In industry everything touches real interests directly. The result is always a compromise, even in terms of the number of plants and their location. Direct involvement of national interest impinges directly on operating problems. [United Nations official, New York]

Will the reports be confidential? If they are very general, they will be of little value. If they reveal particular circumstances, they may work against a certain company or country. [Luis Prieto and Gabriel Poveda, Colombia]

The firms that are most suitable may not want to cooperate. [D. S. Mulla, India]

(b) Policy prerogatives

A lot of mutual suspicion exists. In the name of devising better policies, one creates controversy about the kind of industry to be fostered, or whether a country should have industry. The institute will be suspect if it is involved in policy, financial, or trade issues. Take only neutral problems. Technological research pertinent to developing countries, bringing the expertise of Western industry to bear. This work could be useful as well as durable. Keep out the glamour of dialectics . . . . The institute looks too ambitious. It will get a structure. A power structure. Partly a money structure, but more importantly a structure based on sources of available competence. [I. G. Patel, India]

(c) Political reality

Research toward market shifts is utopian. I believe developing countries should start new activities. The developed should cut protection. Let the best location win. But there is extraordinary resistance. Essentially, power politics will prevail. The major powers won't yield. It is a very important problem. There is no easy way out. [Peter Wodtke, Japan]

Most difficult decisions are based on politics, not studies. Therefore intergovernmental agencies are the best place for solution. [Francesco Gallo, Japan]

(d) Doubtful applicability of results

How can an international group sufficiently disaggregate the problem to reach local, particular needs? [Ade Oyelabi, Nigeria]

It is more important to build local managerial ability to weigh and make these choices. Local case studies used in up-to-date management training have much higher priority than broad international research. [James Culliton, Philippines]

(2) Requisite attributes

Qualities that would be needed in an institution to meet these difficulties were emphasized by numerous conferees.

(a) Tough independence

The institute looks as if it would be tough. It must have ability to resist pressure. For example, it should not agree to favor a particular sectoral plan under pressure from either a government or an international agency if in the institute's judgment the plan is not warranted . . . . The institute may be unpopular with some in the short run. If it is to be popular in the long run, it may have to be unpopular at first. [Saburo Okita, Japan]

The institution would have to be extraordinarily tough. [Peter Wodtke, Japan]

The institute should have very strong autonomy. Assemble a few people who are characters enough so everyone will know they won't be pushed around. The institute should not be selling an approach. It should be taking hard looks at these basic questions and uncovering new facts and solutions. [Development bank officer, Indonesia]

(b) Joint involvement

The capacity of the institute to interact productively with persons and authorities responsible for either policy or investment decisions in industrializing and industrialized countries will depend heavily on its structure. Structure is examined in parts I - F (p. 18) and II - D (p. 72), which also draw on conferees' suggestions. In the present context, the following qualities of joint participation are crucial.

The institute should not be based on altruism. This we should forget. We will only get ahead in international development if programs are of benefit to both sides. [B. V. Bhoota, India]

This should be a joint effort, not an aid institution. Jointness is a feature of the International Rice Research Institute which should be adopted. [Lang Wong, Singapore]

Combine strong people from industry and the education-research world. Man the institute largely from developing countries: there is enough talent. [Ravi J. Matthai, India]

(c) Bridges between policy and technology

To provide information for policy asks of us a certain height. [Yoginder Alagh, India]

I am glad to see ... that more systematic attempts have been made in dealing with industrialization and economic development based on firm technological characteristics. It is important to establish a theoretical ground for optimal choice of industry and technology by which many developing countries can save the cost of trial and error. [Saburo Okita, Japan]

Without feedback between what industrial users need and policy decisions that determine what mix of steel is to be produced, there is little point in worrying about broad policy issues. [W. David Hopper, Canada]

(d) Selectivity

A high degree of selectivity, several conferees stressed, would be necessary to enable the institute to make sustained, original contributions. The institute should be free to make its own choice of industries and related subjects for study, to define the specific purpose and scope of each effort, and to set its own criteria for responding to invitations for assistance in implementing its findings.

c) First Priority: Conclusion

The unique concept that emerges is an institute combining the paradoxical attributes of tough independence and joint involvement. The jointness is itself two-dimensional: joint cooperation of industrial and industrializing countries, and of public and private interests.

An institute combining these qualities of independence and joint participation would bring unique objectivity and international perspective to the issues of industry selection and national and international market development emphasized by our conferees. Three elements would combine in this mission:

- A joint view of dynamic trends in specific industries would contribute to the evolution of policies and criteria for sharing the benefits and costs of their international development.
- Scientific method would be applied through comparative study of industries in countries having different characteristics, in collaboration with industrial and public groups in these countries.
- Industry analyses with an international dimension would be used to bridge the gulf between policy and technology, relating both to social goals.

2. Employment and Technological Choice

Employment and technology are dominant features of the industrialization process of concern to many conferees. Overcoming poverty will require massive increases in jobs and skills of people in developing regions. Employment and enhancement of skills are required in those specific branches of technology and forms of organization suited to each country's resources, stage of development, and international trading opportunities.

a) Alternative Approaches

Various conferees examined selection of technologies with the industry-selection and adjustment policies considered above and presented their conclusions under the following topics:

(1) Using and building on the dual economy
(2) Methodology for identifying promising industrial subsectors
(3) Inventory of relevant alternative technologies
(4) Measurement and activity analysis to determine appropriate technologies
(5) Orientation to management decisions
(6) Policy orientation for technology choices

(1) Using and building on the dual economy

Japan's strategy of industrialization through a dual internal wage structure, and its success in the past 20 years in reversing and narrowing this wage gap, is a path advocated by several conferees for countries with severe unemployment. Research is needed on specific contrasts in today's markets and technology that may either vitiate the example or call for detailed local modifications.

The process of using a dual economy is the essence of development. It takes time for the two sectors to move together. This is evident whether in Taiwan or China. Use primitive technology as long as it fits particular needs, but supplement it when and where appropriate. The combination of two levels of technology is the secret . . . . We talk of "shadow prices," but these are actually the real social costs. It is more meaningful and correct to speak of them as real costs. [Development bank officer, Philippines]

The Mafatlal group and the Silk and Art Silk Manufacturers' Industry Research Association have taken steps to upgrade the power loom industry of Marathwada—maintaining its traditional skills and jobs—by introducing a central finishing and marketing facility. Financial institutions and business houses are looking for similar ways of using the putting-out system of Japan. [V. V. Bhatt, India]

Using reasonable opportunity costs for capital and labor in Indonesia, a Stanford Food Research Institute analysis shows small huller mills economically superior to the modern Japanese rice mill favored in a recent feasibility report. This finding results from coupling an appropriate analytical framework to the consulting firm's engineering data. [John Harris, Indonesia]

Difficulties and costs of managing paddy procurement make dispersed sheller mills better than large-sized modern rice mills which have to cover much larger procurement areas than the sheller mills. The modernization of sheller mills would be made economical by the use of rubber rollers. Some improvements are needed in the manufacture of rubber rollers. At the suggestion of the Indian Institute of Technology, Kharagpur, this work is being taken up by rubber technologists. [D. K. Desai, India]

What is needed are robust, labor-intensive but efficient technologies. These are expensive to document and to develop. The institute could act as a coordinator, with expertise in both marketing and technology. [Gustav Papanek, Indonesia]

(2) Methodology and identification of subsectors

This is of great concern. The international institute should develop methodologies for identifying branches of technology in which labor-intensive processes are feasible. It should also search for specific sectors and technologies. This will provide guidance for national institutions to build capability in design of specific products and processes. [Sumantri, Indonesia]

(3) Inventory of relevant alternative technologies

No systematic examination and inventory of alternatives in different branches of industry has been done. [K. S. Krishnaswamy, James Raj, India; Bernard Bell, Indonesia; David Bell, Frank Sutton, Ford Foundation]

This is a major need. The range of alternatives with respect to labor-capital substitution, and scale and location of plant, needs to be documented for relevant sets of factor costs. These options should be combined in policy packages with maximum-minimum incentives made explicit to encourage appropriate expansion paths. [John Harris, Indonesia]

(4) Measurement and activity analysis to determine appropriate technologies

Enormous benefits could result for countries with small markets by a proper choice of technique. An engineering-economic approach to this question hardly exists. Engineers and others who design plants and set standards of performance are not trained to think this way. No one really knows the production functions. Activity analysis on a segmented basis for specific branches of technology has not been tried because it is too expensive and calls for too many skills in combination. Try it intensively in selected areas, and see what benefits accrue. [Kirit Parikh, India]

(5) Orientation to management decisions

Focus the analysis clearly on the decision points. Identify incentives that operate at each decision level, following Churchman's approach. Be sure the factors covered in the analysis are relevant to trade-offs in incentives as seen by decisionmakers.
[Seguti Hasibuan, Indonesia]

We have technicians in India who know how to analyze alternative technologies. But management is not convinced. Results must be in terms relevant to management. We especially need knowlege of technologies suited to medium and small companies.
[B. V. Bhoota, India]

(6) Policy orientation for technology choices

"Capital-stretching" techniques are very important. But do not look at this too narrowly. What are the effects of present government policies on choices of techniques? Inducements for dispersal of industry in Maharashtra are through low interest rates. Would it not make more economic sense to shift, for example, to free training programs? [Eugene Staley, India]

The shift in Taiwan and South Korea to open exchange rates, bringing capital and labor costs closer to true levels, stimulated new industries with high labor content and led to greater labor content in existing industry. A correct policy set is the precondition for movement in this direction. [James Grant, Washington]

In short, the need for a new institutional resource was expressed as follows:

It is urgent that answers on technology be given. Even people who believe in this approach can't answer specific needs. What can you deliver to the four countries–Colombia, Kenya, Iran, Ceylon–where employment missions have urged this route? A clearinghouse on appropriate technology outside the United Nations is needed, in addition to the major program the ILO has mounted within the system. We are being charged with interest in obsolete techniques. Combined thinking is needed to dissipate the confusion. This can only be done with concrete results. [Abbas Ammar, Geneva]

The actual programs of work implicit in each of the above submodes differ sharply in content and magnitude. From methodology to inventory is not just a difference in quantity, but in kind. Here the special role of a potential new center must be brought in focus—and related to the work of national institutions as well as existing and future international institutions and programs.

b) Assessments

In making their assessments of this potential role, conferees saw several obstacles, as well as characteristics, required to deal with them.

(1) Obstacles and opposition

Difficulties of several kinds arise in an international research approach to issues of employment and technology.

(a) Myriad of local, particularized judgments

I have no time for problems in the transfer of technology. There is no limit to industrial technology. There is no single appropriate technology. The transfer of technology happens in a myriad of cases. Every foreman is creating technology . . . . You don't select a technology, you select an industry. The industry selection is governed by the market. [United Nations official, New York]

We need to do much more homework on our own resource processing, only going outside for very new and difficult technology. [Sugeng Sundjaswadi, Indonesia]

(b) Cultural setting for effective labor-intensive techniques

Wide education and a disciplined work tradition are required to make labor-intensive methods cost competitive. Success in South Korea and Taiwan compared to Southeast Asia reflects these ingredients. Southeast Asia presents a pessimistic situation for entrepreneurship. Technology is simply transferred, not adapted. Sociological factors are weak. Very serious political and social results are likely to occur. [Shigeru Ishikawa, Japan]

(c) Data constraints

In attempting to identify labor-intensive openings in metal-mechanical industries, we find that manufacturers are unable to provide the specific technical and cost data required in the analysis. The net impact of official policies on capital and labor costs, moreover, is difficult to measure. [Jaime Silva, Colombia]

(d) Lack of communication between disciplines

Engineers and economists are often on closed circuits. It is not easy to get effective interdisciplinary results. Cases are known of functional relations estimated by economists being both misunderstood and objected to by technicians. Technicians do not find it easy to get economists involved in their detailed ideas on microprocesses. [Yoginder Alagh and N. C. Mehta, India]

As economists we find it difficult to convey our underlying hypotheses even to other social scientists. We have great difficulty in penetrating the hypotheses of technicians and persons in the physical sciences. In Japan, moreover, research is very individual. It is very rare to find a team working jointly on a major project. It may be even more difficult to achieve interdisciplinary teamwork on an international basis. [Shigeru Ishikawa, Japan]

The International Development Center of Japan is experiencing the problem of how to combine engineers and economists. Many issues on which we are asked to work by developing countries require a common approach by both. [Saburo Okita, Japan]

(e) Industry disinterest or opposition

I doubt if industry will contribute much to the development of labor-intensive technologies. Government credit policy may, however, create incentives in this direction. [Sumantri, Indonesia]

We are told by certain governments that large industry is not a "safe" area for attention to appropriate technology. We will attract less opposition by working in agriculture, construction, services, and small industry. [Abbas Ammar, Geneva]

(f) Uncertainty of potential and costs

The real magnitude and range of relevant options is unknown. How to combine past practices with new in a useful way has no simple answer. [Eugene Staley, India]

To apply appropriate technology requires a running commentary. We usually don't get the latest assessments. Time lag between analysis and conclusions may vitiate their application. I do not say this in any negative sense. International development must have an impact on employment. We must have policies to limit career sacrifices within peoples' lifetimes to levels that they can endure. [Robert K. A. Gardiner, Ethiopia]

(2) Requisite attributes

Recognizing these difficulties and risks, conferees considered that particular measures and attributes could meet these obstacles.

(a) Dirty hands

Young men must be attracted who are willing to get their hands dirty in the details of technical problems. We do not find this easy. [Shuji Tamura, Japan]

(b) Measurement

The biggest gap is in data. Facts are fuzzy, speculative. There is no indigenous Wesley Mitchell or Simon Kuznets in the developing countries themselves. This is very grubby work. Too tedious for most economists. I worry about the new generation. They are not willing to get their hands dirty with facts. This is an intellectual gap. It is where a new institute should concentrate [Senoh Unakul, Thailand]

You will have to authenticate much of your data. This will cut across the method of operation of the institute. [I. A. Akinrele, Nigeria]

(c) Intensity and relevant accuracy

If broad applications emerge out of specific ones, which is likely, so much the better. But one may never get to specifics if the focus is on general questions. [Gustav Papanek, Indonesia]

(d) Interdisciplinary premises

We will continue to build useless theories unless we accomplish a great deal of mundane data work. The language barrier between disciplines is very serious. Some things that can be handled quantitatively provide a bridge for common work between technologists and social scientists. But factors that are qualitative offer little grip for communication. [N. C. Mehta, India]

Real interdisciplinary teamwork may be easier to achieve in an international institute than at home. The career motivation is new. Fewer institutional walls must be overcome. [Juergen B. Donges, West Germany]

(e) Comparative analysis

To meet conceptual and data problems, international collaboration on methodologies for comparative analysis would be worthwhile. [Jaime Silva, Colombia; Yoginder Alagh, India]

Linking economics to technology in manufacturing is much more difficult than in agriculture, which has homogeneous outputs, few inputs, and definable response functions. Very difficult conceptual work is needed before we can find an adequate approach. Differences by branch of industry mean that a different conceptual framework must emerge for each major branch. We have a promising new start in the work at Stanford by Lau and Tamura.[6] They suggest that three familiar categories of manufacturing–process, assembly, and machine-building–can be described by three distinct mathematical functions. Scale of output and labor-capital substitution figure differently in each. Preliminary use of this threefold breakdown to test China's development of labor-intensive techniques yields a tentative picture of interest: scale-down efforts in process industries have a poor cost profile despite transport savings for plants serving regional markets; production of consumer goods is at satisfactory costs; while machine building is in between. This suggests that further use of the Lau-Tamura categorization is worth pursuing. [Shigeru Ishikawa, Japan]

(f) Participation of industry

The real gap is in doing, demonstrating adaptive technology. Unless you do it, you may simply produce reports. The effort of the Intermediate Technology Development Group in London is to implement results on site, though they work on a shoestring. A component unit of the proposed institute should be close to industry–say in the United States–generating funds and engaging the competence of industry. This work needs to be highly specialized. To get real specialization, one must tap industry and institutions on a collective basis, or on subcontract. [Keith Marsden, Geneva]

c) Second Priority: Conclusion

Countries with large unskilled labor forces and sharp internal wage gaps face difficult choices of industrialization strategy, especially in seeking to combine rapid growth with better opportunities for each member of society. The choice, in such dual economies, depends critically on internal characteristics of the society. The international framework of opportunities and constraints faced in the choice is also important, however, given the rapid changes taking place internationally in industrial technology and trade.

The international industrial economy is in a significant sense an analogue of such dual domestic economies. Strategies applicable in a national economy may have either positive or negative impacts and lessons internationally. Issues of employment and technological choice raised by our conferees in their national contexts, therefore, are of obvious international importance.

Combinations of engineering and business education, or engineering and economics, are still so rare that common standards of definition and measurement must be established for the particular purpose of each interdisciplinary effort. Measurement is common to managerial economics and industrial engineering and can serve as a unifying element. But measurement of what? Toward what physical and accounting relationships? At what costs in data generation? With what tests of verification? These questions of logic and language in the approach to "facts" must be plumbed and resolved from the distinct standpoints of the policy questions, the management decision, and technical trade-offs and implementation.

The need for a new institutional resource to advance methods of decision-oriented analysis on issues of employment and technological choice arises directly from the requisite qualities we have identified:

- Comparative international approach
- Required degree of intensity and accuracy
- Intensive, in-depth focus
- Genuine interdisciplinary premises
- Involvement of industry

As is evident in our conferees' assessments earlier, this combination of qualities is not achieved in existing programs. The need for such attributes in a new center is augmented by other priorities in international industrialization.

3. Evaluation, Development, and Acquisition of New Technologies

Building industrial and institutional capability in R, D & E and in evaluation and screening of new technologies is increasingly important to many industrializing countries.

a) Alternative Approaches

In the eyes of various conferees, several aspects of this process call for creation of a new international vehicle:

(1) Well-informed technological appraisals

Needs here run from assessment of the broad impact of technology on development goals (Saburo Okita, Japan; Dean Aldana and Jorge Rodriguez Arbalaez, Colombia) to the specific evaluation of major project proposals. The latter need is more concretely defined:

Well-informed technological appraisals are needed by governments on proposals they receive from prospective investors and from consulting firms. Governments cannot develop the capability to assess major projects in many fields, but should not be forced to rely on a single source for evaluation of a complex project. No independent source exists. [Donald Mazden, Thailand. Similarly, Stig Andersen, New York]

We often come in conflict with investors over their requirement that sources of equipment be tied into the investment agreement. Investors will often say, moreover, that they cannot use the findings of an independent consulting report. Can the proposed institute find a way of assisting? Then it has the character of a consultancy unit, servicing someone in particular. It will have to grow, establish field offices, thereby assisting countries in implementing projects. This is a definite need. [I. A. Akinrele, Nigeria]

Even though the consulting profession in India is developing rapidly, we definitely see the need for an international source of integrated, in-depth, multidisciplinary consultancy. Do other countries agree? Then why do we not have it? Has it not been thought of for UNIDO? If not, it should be examined. If it has been concluded UNIDO cannot build such high-level, multidisciplinary competence, then the proposed institute might meet the need. [M. S. Pathak, India]

(2) Facilitating acquisition on favorable terms

For an individual industry or company, improving the pace and adequacy of technology transfer would be of greatest use. How can the proposed institute accelerate transfer of information on new processes? Will it be of much use if it cannot obtain proprietary information? (The example of multiclient technology appraisals screening information from the public record is of interest.) [J. J. Bhabha and Harish Mahindra, India]

For heavy and medium industry, we can meet our own requirements except for front-end technology: new processes and equipment design. An international resource making these available at lower cost, or separating them out from basic process units and plant design which we can do ourselves, would accelerate our growth. New technologies for small-scale industry are also needed. [M. S. Pathak; also B. V. Bhoota, India]

Terms vary with capacity. If I have the capacity to improve on the technology, the terms are easier. The poorest are least able to obtain good terms. [R. V. Raman, India]

(3) Pinpointing R, D & E needs and mobilizing resources to reach solutions

The research and design capability of industry in advanced economies needs to be attracted to problems arising in the market and resource situations of developing countries. For example, medium-size countries need an economic plant capable of multipurpose polymer or pesticide production. Can the institute identify such needs and assist in engaging industrial interest? [M. C. Verghese, Vienna]

The proposed industrial information service in Southeast Asia will identify research needs and gaps in information. It could contract with the institute to meet these or to organize steps to meet them. [Lang Wong, Singapore]

(4) Evaluating threshold levels for R & D in various industrial sectors

What is a project that will pull Brazil together to create new high technology (such as the U.S. space program; the French Concorde)? We are still looking for a formula to stimulate new technology. [Jardy Sellos Correa, Brazil]

How did Germany come up with the right formula for importing and developing technology? The quality of research and data to guide use of technology for industrial development is just not anywhere. [José Pastore, Brazil]

The notion of a storehouse of information about technology is useless. How do we spark flights of innovation based on the existing status of technology in our own environment? Is there some threshold in each branch of industry of a nucleus of applied knowledge to attract good men? On what lines should a country move to develop this threshold? [Arun Kumar Ghosh, India]

It is difficult to find opportunities for research and development in Malaysia, in the face of the strong laboratories which giant international firms have in their own operations. Can you attract the best brains here for R & D? How can we compete? We can't develop and retain the necessary scientific manpower. [Cheah Tek Kuang, Malaysia]

(5) Complementing industrial research institutes

National and local institutes could channel research or consultancy problems raised by local industry for participation by the international institute where necessary. If a particular industry is posed for attention in management and financial as well as technical aspects, a local technology institute may not be able to bring these specialized talents to bear. The central institute, in turn, would find it difficult to give effective assistance to an industry in its local setting without such linkages. Working through a local institute, the central group could reach the individual enterprise. Assistance must be in practical forms which the implementor can use, if it is to be worthwhile. [I. A. Akinrele, Nigeria; similarly, Alberto Ospina, Colombia]

(6) Linking IRIs to the investment process

Surveys in eight states by the Industrial Development Bank of India reveal a gap between project making and technological research. Absence of links causes industry to go one way, national laboratories another. We have asked bank teams to identify research questions for the laboratories, but with little success. [V. V. Bhatt, India]

The institute could help bridge the gap between bench-scale models developed in technology institutes and pilot-stage trials as well as ultimate investment. One step would be to help reduce the risk that a development bank faces in sponsoring projects at this stage. The institute could name an expert committee to review the laboratory results and make a recommendation to the institute's finance committee. Upon acceptance of the experts' recommendation, the finance committee could canvass financial institutions or investors to take the project the next step. A second need arises in the negotiation of terms on which investors obtain rights to processes developed in public laboratories. In the case of a pulping process, an investment group contributed financially to bring the bench-scale process to batch-level operation in a government mill. The group now want sole rights to the process, in a $20,000,000 project. Another group has negotiated with us for 2 years for a homogenization process. They also want sole rights. These transfer gaps are serious. [Pradisth Cheosakul, Thailand]

b) Assessments

Disagreement on one or more of these views of the need for an international institute to facilitate technological development and evaluation was expressed by both public and private spokesmen.

Present approaches to assessments of technology are satisfactory in Colombia. Several phases are required in a country's approach. A strong institutional arrangement for negotiating purchase of technology is first needed. We now have this. We have interdepartmental committees, supported by technical experts, to review every purchase contract. In the past year we have cut the country's payments for new technology from $20 million to $10 million but increased the number of contracts five times. The second stage is to build capability for choice of technology better suited to the country's conditions. We are moving into this phase. The third, later stage is to build our own technology. [Alejandro Figueroa, Colombia]

PICA (Private Investment Corporation for Asia) does not try on its own to put together packages of management and technology. PICA, however, is well suited to introducing local partners to established foreign companies, and vice versa, thus setting the stage for company-to-company technology transfer, as well as for the creation of sound investment projects. [Peter Wodtke, Japan]

If the institute tries to make a technology known to some known to all, a clash will occur. [Amphon Tiyabhorn, Thailand]

In this judgment, this bank's meagre resources have higher priority uses than liaison with technology-research institutes. Such institutes may typically lack an investment focus. They may be motivated by highly specialized staff interests. It may be a long-term process to shift their emphasis to more applied work during which time it may not be possible for projects of a bankable sort to emerge. [C. S. Krishna Moorthi, Philippines]

c) Third Priority: Conclusion

The generic need at the root of all these submodes is that of each nation to create conditions and impetus for growth of indigenous technology. Submode (4)—identifying steps to create a starting nucleus or nuclei of industrially oriented R, D & E—is thus the institute's most basic technological concern. The institute should build comparative international knowledge that will help various countries and regions to identify those market needs and sets of industrial activities conducive to the launching of such nuclei in different environments.

With respect to the other submodes advocated by various conferees, the panel deals with suitable program guidelines by examining approaches to institute program development in part II-C (p. 60) and by discussing activities outside its central purview in part II-E (p. 80).

4. National Industrial Strategy

a) Approach

Timing and linkages between industrial development and development of infrastructure, agriculture, and other sectors is of critical importance and, as seen by several conferees, is open to clarification through comparative international studies and by applying new methodologies to the study of individual countries.

How can the Green Revolution and expansion of the manufacturing sector be combined? Much more serious concern must be placed on this issue. No one is handling it as a combined question, because of the bad effect of division of labor between institutions working on agriculture and those responsible for industrial questions. If the demand for agricultural inputs is absorbed only by international corporations—such as fertilizers and

tractors—this will not augment the dynamics of the agricultural revolution. The multiplier effect will taper off. Except in Punjab, stimulus to small-scale enterprises through the agricultural revolution is limited. [Shigeru Ishikawa, Japan]

A critical issue is the relation of agribusiness to peasant agriculture. Under what conditions is a shift to plantation agriculture desirable? What is the indirect economic effect? The social and political consequences? Thailand is on the brink of becoming the next major pineapple economy. Unions are forcing costs up in Hawaii, and multinational enterprises are starting to look for large, new, and assured cannery supplies. Should this mean a move from peasant to plantation agriculture? What is the real effect on society? What is known from other societies where this has happened? The issue is faced for a growing number of agro-industries. Issues between size of farm and farm inputs, especially mechanization, and between small farm patterns and alternative industrial growth patterns need fresh examination. [Senoh Unakul, Thailand]

In our strategy of development for the third plan, exports based on agriculture and increased specialization in resource use will be stressed. In order to implement this strategy, we need coordination of industry with other sectors, including transport and communication .... We have men qualified to take part in such analysis but are not organized for this work on a modern, systematic basis. [Krit Sombatsiri, Thailand]

Is a planned or an ad hoc industrial estate most effective, and under what conditions? More important, are free export zones good for the country? This is not only a question of stimulus to backward linkages, or absence of linkages, but also of competition with existing industries in the rest of the country. What is the net effect, overall? This issue is badly understood, with much discussion but little evidence. [Senoh Unakul, Thailand]

Should Indonesia develop three or four industrial estates, or twenty? What is the lesson from other countries? There is need for studying problems like that of locating manufactures, supply of services to industry: electricity, water, transport. [Gustav Papanek, Indonesia]

Better knowledge of linkages and sequences among projects is needed to form a strategy for lagging regions within the country. [V. V. Bhatt, India]

How can the period of industrialization be shortened? Can we really jump over certain processes? Perhaps we can skip some steps, not others. Which? [Lee Kum Tatt, Singapore. Also Isaac Kerstenetzky, Brazil]

b) Assessment: A Division of Functions

These complex issues of sectoral and dynamic strategy accentuate the need for an institute. They further complicate the choice of focus, as stressed in this dialogue.

The ambition of the preliminary proposal is terrifying. It covers the whole field of development, not just industry. My advice would be to narrow it down to the industrial question. Nothing would be more dangerous than to fall into the trap of setting up an international development institute. [International agency official, Geneva]

You can't take industrialization out of the entire development process. This leads to a distortion of approach: to treating industrialization as an end in itself. [Abbas Ammar, Geneva]

A natural division of emphasis suggests itself between the principal thrust of a central institute and the simultaneous work of collaborating national organizations. A holistic country approach is of most urgent concern to each individual nation. Marshaling comparative knowledge and organizing new methodologies for uncovering critical relationships between industry and other sectors are areas of strength that could logically be built up in the International Industrialization Institute. Such a division and sharing of focal emphases is elaborated in part II-C (p. 60).

5. Urban-Rural Integration

a) Approach

The need to achieve a balance in urban and regional policies is widely recognized. Such a balance would help gain locational efficiency and avoid excess urbanization and drain of talent from densely populated interior regions.

Infrastructure is not available outside Bangkok. This must be looked at for major regions in the country. We have had a World Bank and USAID combined study in the Northeast and a UNDP study in the North. Our staff is too small to evaluate and fully assimilate these regional approaches. [Krit Sombatsiri, Thailand]

Location policy, including environmental factors, is a high priority. ECAFE does not have resources to do any significant new work on location. Present work is very general .... No methodology exists that is adequate to provide policy guidance of this type .... Location and sector planning should emphasize the need for employment and the need to avoid excessive urban poles. This means identifying opportunities for smaller plants more widely distributed, calling for study of economies of scale in relation to location. [A. G. Menon, Thailand]

If industry is developed without a regional policy, everything will be in Java. [Sugeng Sundjaswadi, Indonesia]

Questions of the regional pattern of industrial location within a country are very serious. Whether these should be tackled by a new institution is another matter. The problem is to evolve a suitable methodology. No suitable methodology has been thought through and put into effect. Nobody is satisfied that there is a challenging way of approaching these problems. This is a very active issue here. It is assumed that equal regional distribution and equity are synonymous. Up to now arbitrary decisions have been made. Not less than a certain percentage of total investment must be in each region. The real question is to evolve optimal regional location patterns, rather than regional equality or balance. People from the Tinbergen institute have worked on this but only on a very abstract level. There are no facts to support their analyses. The fact-gathering process is extremely difficult, but essential. [Bernard Bell, Indonesia]

The need for urbanization should be called into question. Take potential new technologies into the picture. Then what would it cost to develop decentralized

communication and information systems to achieve the economies of urbanization? Differences between the size pattern and distribution of German industrial cities and those of France or England suggest that options for locations are greater than usually recognized. Choices open to developing countries are much wider than in developed. Since the costs of building an urban infrastructure are phenomenal, this is very important. [Kirit Parikh; also James Raj and K. S. Krishnaswamy, India]

There is an acute need to identify kinds of opportunities that can be met by Malays, and by state development corporations, in the less developed regions of the country so as to reduce the disparities in incomes and opportunities. We also need to know the policies and infrastructure that are essential for these specific opportunities to materialize. [Hamlin Robinson, Malaysia]

b) Assessment: Division of Scope

Specialized urban and regional development institutes are engaged in dealing with these issues. The International Industrialization Institute's specialized competence in problems of industrialization should complement and contribute directly to their programs. Analysis of industrial location and scale factors, including industrial segmentation, is an essential ingredient of regional and urban planning. The institute's method of approach, as well as specific research findings, should therefore open the way to productive collaboration with national agencies and regional study centers on strategies for intermediate growth centers and urban-rural integration.

6. Bridge for Developing Country and Corporate Interests

a) Approaches

An independent entity helping to focus on the interests of developing countries and modes of operation of multinational corporations was seen by a number of conferees as a distinctive need. Several patterns were advanced.

The institute is as much needed by developed countries as by developing regions, to approach questions from an international viewpoint . . . It could be useful to corporate planners in multinational companies. Managers in the field move quickly to make profits in the short-run period for which they are locally responsible. They may even shift portable plants between countries and even states. This creates friction between the states. It creates an ugly image which corporate headquarters must live with. Policy-makers at corporate level want long-term stability. The institute can keep headquarters aware of long-term factors, helping to bridge conflicts of objectives within the company . . . . The world is only interested in what we have to offer. If the institute comes to aid, it won't work. It will be a charitable organization. What does the multinational company get out of it? A long-term planning perspective so the man in the field will not foul things up. Japan is also interested in this . . . . The institute can inform international companies what the thinking is in different countries. [Development agency executive, Singapore]

The institute should serve a different purpose to different regions. For developed countries it would provide information for purposes of investment. For developing, it will stimulate new enterprises and investors. Its analyses should be relevant to the particular developing region .... I see this concept not strongly motivated as assistance, but to facilitate the balancing of industrialization in the world. Developing countries can upgrade their economies only with a greater outflow of investment from developed countries .... This is the basis on which the institute can survive. It will only survive if it attracts a flow of funds from developed countries to encourage the decentralization of industry to developing countries. If this were done in textiles, for example, it would really make an impact .... Location must be based on the criterion of ensuring an outflow of investment from highly industrialized to less industrialized countries. [I. A. Akinrele, Nigeria]

Services of the institute would be sought and paid for by parties interested in creating joint ventures. An example was the success of the International Trade Centre, then under GATT, in assisting a Yugoslav enterprise negotiate a joint venture with Fairchild on an electronics project, with Fiat and Philips on subcontracts. The OECD funds enabled the ITC to assist in market research, introductions to suitable companies, and negotiation of know-how agreements. With UNDP funds we are now prohibited from promoting interbusiness relations. There is a great need for this, by branch of industry. Analyze growth areas on both sides and see where they do not conflict. The service would earn its way. [Victor Santiapillai, Geneva]

Developing countries need to know multinational corporation interests, and how MNCs [multinational corporations] perceive their interests, in order to form policies as far as possible harmonizing their own and MNC interests. The institute should produce an understanding of how MNCs work and are motivated. A consistent image is needed. What does the international environment look like to the MNC, in its own sector? If the institute studies markets, it may help MNCs more than developing countries. If it studies the MNC operating environment, it may be more helpful to developing countries. [Guillermo Perry, Colombia]

There would be value in an independent institute of this kind being a participant in the development of regional projects. There is a chance that if this had been the case, Ford might have gotten farther with the ASEAN car project. Ford was suspect. The vision of the project was therefore clouded by doubt. The institute could perform an intermediary role in such situations as part of its wider role once it establishes its analytical capability. [Bernard Bell, Indonesia. The ASEAN (Association of Southeast Asian Nations) car project was also cited by Lang Wong, Singapore, to illustrate the institute's potential].

b) Assessments

(1) Obstacles and opposition

Conferees recognize this as a hard role. Pressures to support one side or the other would be strong. Suspicions on both sides are an element of the atmosphere in which the institute must work.

This looks like an interesting forum. It could provide unity in methods, recognizing diversity in conditions. But it might try to direct industrialization, as a superinstitution.

This is not what growth is about .... It may serve efforts by multinational corporations to get developing countries to grow according to their pattern. This is greatly feared in countries like Nigeria. We fear our creativity will be curbed if we look to wise men outside. We want to develop our own creativity .... The institute would look mainly at large strategies, with the West as center of gravity. Africa wants its own centers of gravity. If America sets up an institution, all right, but I doubt if it will be much help. It will serve its founders. [D. Ehigie Osifo, Nigeria]

It would be a Trojan Horse for multinational corporations, and for advanced economies in general. Whoever puts up substantial money will call the shots. Information is not neutral. Those with power can use it to best advantage. Institute results will therefore be of more practical value to rich than to poor countries. Any notion of objectivity is highly unrealistic. [Presidential staff member, Philippines]

(2) Attributes

Group discussions in which these dangers were posed concluded in consensus that it would be possible to found and structure the institute in ways safeguarding against such distortions.

The staff should be as professional as possible. Active collaboration with national institutions is essential. A federation among national institutes might be an effective pattern, with clear criteria for each class of institute. The institute should not be too diverse at the start. Don't try to be universal. Start on projects that particular countries can use. [Abe Oyelabi, Nigeria]

The institute should be neutral .... The program should not be too much policy, not too much economics, but mid-between. In order to intermediate this very delicate balance, I may suggest that the amounts of influence from various countries have enough practical ground to form a basis for reasonable discussion. Involve the U.S., Europe, Australia. Bring in the experience of business executives. Bring in owners of businesses in developing countries, and government officials, with some academic people, for specific studies .... If your studies are neutrally conducted and recognized as neutral, both sides will contribute to objective discussion .... It can make unnecessary reactions disappear in the discussion of objective problems. If neutral, it can play a part. [Hiroyuki Hisamizu, Japan]

Neutrality is here advocated in the context of regional integration as well as national - corporate interests. The statement proposes a further special quality as a standard for the institute: "It can make unnecessary reactions disappear in the discussion of objective problems."

7. Fundamental Understanding of the Industrialization Process

a) Approach

In the opinions of several conferees, penetrating, sustained examination of the industrialization process and its complex interaction with development goals in itself calls for an interdisciplinary, international center.

There is great dissatisfaction with our understanding of development questions. We don't know the relevance of what we are doing. Available models are not persuasive. Social, political, economic, technological, and organizational aspects are not clearly identified and related . . . . We have studied how others industrialized. That is our trouble. We need to take a completely fresh look. A developing economy must move on new paths. The gap is not temporal or historic, unless we wish to be a dependent copier of someone else's path under different technical and market circumstances . . . . [N. C. Mehta, India]

The third eye is necessary. Awkward questions must be asked. [Y. Nayudamma, India]

Gaps in knowledge between the industrial and industrializing countries will increase over the rest of the century. This follows from the size and state of the respective research communities. It is important to find bridges, particularly in transfer of technology in critical areas of development. [A. Mitra, India]

Who is thinking in a systematic way to give intergovernmental and bilateral agencies the general lines on which they should work? [Hans A. Havemann, Germany]

As a dissent:

I am skeptical about the utility of an effort to develop a systematic theory of industrialization. People with the necessary talent and proclivity to do this can work on it where they are, not in a new institute. We will not get far in this direction through a new institution. [Bernard Bell, Indonesia]

b) Conclusion

The antithesis is unnecessary. The testimony points one way. To set up a center seeking basic understanding of the industrial process without simultaneous engagement in real-world problems would bar the learner from much of the evidence he seeks. Equally, to launch a center for applied research on industrialization without a nuclear conceptual group would limit the validity of day-to-day work and reduce opportunities to gain ultimate insight. The institute's theoretical axis should be lively.

8. Industrial Education and Training

a) Approaches

Training of industrial teams, ranging from entrepreneurs and middle management to supervisory and key functional personnel, is emphasized by several conferees as crucial to progress in industrialization. A few conferees, as we have seen, give training such a high priority that they oppose use of new resources for an international research capability. A larger number see research and training as closely interrelated. They see innovative training content and methods as a direct by-product of applied international research on industrialization. In addition, conferees pose generic training needs as an important object of the research.

Managerial training for technological and financial entrepreneurs. We have cases of technical men who fail in marketing or finance. Men for medium-size projects from $500,000 to $2,000,000 in capital are the kind required . . . . Banks and other financial institutions are establishing technological consultancy centers, to do feasibility studies. A conceptual framework for linking technical, financial, and managerial inputs in pre-investment analysis is lacking. [V. V. Bhatt, India]

Training of engineer-economic teams to evaluate medium projects. [S. O. Sodipo, Nigeria]

Training of middle and upper-middle industrial managers and project-appraisal teams. The institute would contribute not by original research but by pedagogical research on the scope and methods of needed training. [K. S. Krishnaswamy, India]

Thorough competence just below the level of brilliance. Groups of people in an organization doing things effectively, each on his own without much detailed direction. Experience means perception. How to teach professional judgment? The maturing process could be accelerated by intensive practice on simulated problems, each disaggregated to the necessary detail. Computer techniques can be adapted to program large numbers of problems for intensive courses. [Kirit Parikh, India]

Training of whole production teams, from the top down. [Development bank officer, Indonesia]

Managers and supervisors, responsive to local conditions. [Ehigie Osifo, Nigeria]

No accepted model for foreman training has been found. It varies country by country. [H. W. Quednau, Geneva]

The quality and kind of training is at stake, not quantity. ILO and many national, as well as other international, agencies have been engrossed in training the past 25 years. Developing countries have made progress unthinkable 20 years ago. A new elite is operating in Africa on terms entirely different from 10 years ago. People are now looking for new types of training, new techniques, closely related to new technologies. [International agency official, Geneva]

b) Conclusion

Industrial education and training are not envisioned as the primary function of the institute, and should not be introduced as a program element that detracts from the central research mission. In several modes to be advanced in part II-D (pp. 77 - 78), however, the institute can serve as a significant resource for successful and innovative training approaches to accelerate the process of industrialization in developing economies. This is an area, moreover, in which international comparisons are useful. The institute will be in a position to study and evaluate different experiences, in cooperation with national and international training agencies, and to participate in disseminating the results.

9. Regional Integration

Conferees, without exception, concur in the need for evolution of regional market accords and specific industry agreements within a regional framework, but differ sharply in judgment on how far a new institute could significantly strengthen this process.

a) Approaches

Some foresee an early contribution by the institute in certain regions that have reached political accord and have set up machinery for implementation, but have need of specialized, interdisciplinary competence to work out sector and subsector programs.

The bank for Central American economic integration is moving to a new phase, from major support of infrastructure to support of industry. Ways must be found of equipping the bank–and similar regional banks–for the complex techno-economic analyses required to identify a suitable mix of industrial opportunities for countries of the region. [Edgar Gutierrez, Washington]

Political decisions by the Andean Group allow the Andean secretariat to make certain concrete proposals. One could see the Andean junta cooperating with the proposed institute in an objective, multidisciplinary approach to division of labor among the countries of the group, including socialist countries. [J. Viteri, Geneva]

In the eyes of other conferees, there is an important role for a nongovernmental, international body in regions that have taken steps toward cooperation, even though substantive accords and machinery do not yet exist. Here the institute's road would be more uphill, however.

As an example, the ASEAN group is looking at the idea of an ASEAN car. UNIDO has sent some experts, but the practicality of implementing the idea has yet to be sorted out. If a nongovernmental body like the institute were to study this problem, it could be helpful. . . . Most governments want someone who will bring them together. It doesn't exist. [Development agency executive, Singapore]

The government people of some Asian countries expect Japanese business circles to give advice for a master plan for industrial development of Southeast Asia in order to avoid excessive competition and to promote international division of labor. For Japan, however, this is a very delicate task. But the aim exists on both sides . . . . If you take industry by industry, you may be able to form a way of approach for a region, with participation by several countries . . . . Regional integration is not easily fulfilled. But the process of participating is itself very meaningful. There should be many variations of style in organizing such studies. Many industrial questions are approached country by country. A more overall approach should be introduced. [Hiroo Sasaki and Hiroyuki Hisamizu, Japan]

Asymmetry among member states even in established regional groups leads other conferees to more negative conclusions.

Colombia has half the market of the [Andean] Group. If we move to freer trade, competition will tend to give Colombia advantage in many lines. Therefore, we want minimum programming. Only a few large projects. The other countries want extensive programming, to gain definite lines of entry. Thus our basic strategies are different. [Alejandro Figueroa, Colombia]

Trade agreements are often more difficult in developing than in developed countries. From my own experience the idea of regional economic integration is not particularly attractive to many developing countries. Each looks to its own benefits. Only spillover projects which don't appear to have much importance for the particular country are regarded as suitable for regional accord. If the agreement goes haywire, then no harm to the country will happen. Countries look very sensitively on these questions in terms of their own policies. [I. A. Akinrele, Nigeria]

We recognize the limits to import substitution. Therefore, we are working toward an ASEAN regional market. It is difficult to reach agreement because our countries can't afford it. Although, objectively, a common market makes sense, we are not rich enough to say, "Let's compete." Every nation here is in a hurry. Each wants to corner the market, and is very calculating. . . . Regional cooperation without a regional tariff is not workable. [Geh Sim Hong and Cheah Tek Kuang, Malaysia]

As regards the regional division of labor, it is not a technical problem. We know where the comparative advantage lies, but the problem is political. . . . In East Africa, everyone wanted a steel mill. Here it is cement. [Gustav Papanek, Indonesia]

International division of labor does not come about by research, but by events. Studies bring economic facts to bear, but not further. The problem is political. [James Raj, India]

Problems of regional integration are complex, especially in the field of industry. Although the need is widely recognized, especially for countries with a small home market, progress towards harmonization of industrial development among countries

that are members of regional subgroupings has been so far very slow. In only very exceptional cases have multinational industries been established. The main obstacle is not lack of economic studies, but the lack of political will of governments to make progress towards the integration of industries. Studies may be useful only to the extent that they do not aim at elaborating theoretical plans or criteria in a vacuum, but lead to practical programs that could be politically acceptable by governments. They should be pursued step by step, consultations with governments taking place at every stage. [F. Le Guay, Vienna]

Study of regional trade, regional planning, and maximization of benefit through proper location should not be taken up at the outset, though they may be later. The World Bank, UNCTAD, national groups, and the United Nations regional commissions are working on these issues. Advances in technological and activity analyses are in any event prerequisite to significant work on regional division of labor and trade. [K. S. Krishnaswamy, India]

b) Conclusion

The institute's intensive industry analyses, covering contrasting national economies, should illuminate trade-offs and means of sharing costs and benefits in development of various industry segments. Results of these studies should significantly add to the realism and negotiating equipment with which countries face the process of regional integration. Apart from this indirect contribution, the institute should stand prepared to engage in specific analyses upon initiative by a regional group or development bank that exhibits the motivation and preparatory groundwork for an effective collaborative effort. Such direct engagements are likely to be limited in number during the institute's early years, but could reach significant proportions in the future.

10. Environmental Protection

Environmental standards are last among the priorities nominated for institute attention by conferees in industrializing countries. Perhaps the following statement captures the reason.

The pollution of poverty is quite different from the pollution caused by propserity. [Y. Nayudamma, India]

The importance of environmental protection is nevertheless widely recognized. Several conferees, already cited, emphasize locational shifts in process industries that are taking place as a result of new environmental standards in advanced economies. Competition for industry by countries or areas willing to disregard such standards produces a new form of Gresham's

law: bad industry drives out good. Three conferees from industrializing countries recommend environment as a subject for institute attention.

We advocate inclusion of environment as an explicit aspect of institute industry analyses. These analyses should assist in clarifying the differential impacts—direct and indirect—of varied industrial configurations on human settlement and ecology.

Attributes Required To Meet Priority Needs

High priority needs in international industrialization, as established in this consultative process, concern policy issues of industry selection, national and international market development, employment, and technology.

Institutional qualities required to meet these priority needs have also been established. Central among these qualities are a paradoxical combination: of independence in policy-oriented research, with joint encouragement by both public agencies and private industry in industrialized as well as industrializing countries. The quality of autonomy is essential because the issues at stake touch the vital interests of countries and enterprises. The principle of jointness is critical to assure a shared, realistic approach to these issues.

Independent, objective studies are regarded as essential to anticipate emerging international industrial issues and to contribute to their potential resolution.

The institute must be totally professional. No vested interests on the part of the staff or direction. Otherwise, it is not worth starting. This means complete integrity in how it is organized, and how staff are selected. [M. S. Pathak, India]

To accomplish these new research functions, added qualities and resources are required. Interdisciplinary studies—both in people and in premises—are needed to bridge gaps between policy, the market mechanism, and technology. Comparative international analyses are called for, to the degree of intensity and accuracy needed to span these gaps. To attain these standards, selectivity in content and scope of work must be exercised. In short, state-of-the-art advances are sought that can be achieved only through a new magnitude of concerted effort and, consequently, through new and increased commitments of research resources.

Research Programs of Existing Agencies

The most broadly based programs relating to these issues are those of governments, United Nations agencies, and international development banks.

It is at sovereign and intergovernmental levels that key policy decisions affecting alternative courses of industrialization must be made. The immediate influence of national interests involved in reaching these decisions significantly restrains such agencies from undertaking the objective holistic inquiries necessary to develop new policy analyses and information.*

Intergovernmental agencies responsible for promoting industrialization through technical and financial assistance and trade development conduct and sponsor studies having particular relevance to their operating programs. Such studies are an important contribution to the development of empirical knowledge and analytical techniques needed in evaluating industrial policies and plans, particularly when these studies embody the results of specific country experience acquired by administrators and advisers of these agencies on assignments in developing regions. These studies as a whole, however, do not constitute an integrated attack on these complex questions, and are too sharply limited in scope, flexibility, and resources to approach the needed level of advances in industrial policy research.

The United Nations Industrial Development Organization, principally responsible within the United Nations system for promoting and accelerating the industrialization of developing countries and for analyzing various United Nations industrial programs to assist in their coordination, has as its most concentrated research activity a program of support to industrial studies and development centers in selected countries and regions.† The Industrial Policies and Programming Division of UNIDO supports such field operations through country/industry surveys; through studies on topics such as techniques for the selection of priority industries and guidelines for project evaluation; through analysis of production and cost characteristics of individual manufacturing establishments; and through compilations and projections of programming data. These studies, while contributing to UNIDO's significant publication program and to the development of data needed for program and project evaluations, are necessarily limited in scope and depth by their operational orientation, lack of interdisciplinary content, and fragmented resources in time and funds. Each UNIDO division specializing in a given functional activity or industry group also conducts studies in direct support of its operations. The overriding operational role of

*The General Agreement on Tariffs and Trade, for example, postponed for 2 years a decision to undertake a recommended study of international textiles and upon agreeing to the project, reduced its scope to a primarily statistical rather than policy-oriented analysis.

†Support to such centers is currently provided or programmed in Guinea, Iran, Saudi Arabia, Tanzania, Tunisia, and the Magreb.

UNIDO, however, sharply limits its resources, in personnel or time, allocable to such supporting studies.

The most sharply focused set of studies carried out by an intergovernmental body to promote industrial expansion in developing countries, with some concentration of resources, is that of the International Trade Centre (established by UNCTAD and GATT) in international market research. Four major market research studies are carried out annually on commodities of interest to several developing countries.* In the specific subsectors covered, these studies contribute to international market development. The International Trade Centre, in addition, has major responsibilities for technical assistance, training, and documentation in support of export promotion and marketing.

Research sponsored by the United Nations Conference on Trade and Development (UNCTAD) has concentrated since 1968 on specific problems encountered in expanding trade among developing countries. These include analyses of bilateral trade agreements, methods of relaxing quantitative restrictions, approaches to limitation of protection among developing countries, trade expansion based on existing industrial capacity, and administrative problems involved in trade control.

The World Bank Group, at a fundamental level, has carried out a sustained series of studies on trade and protection, resulting in major publications as well as individual monographs. Monographs and published studies on specific industries have also been produced, typically by individual authors.† More recently, in an expanded program, analytical studies have been undertaken to develop and test new programming methodologies and on such subjects as economies of scale and tariff levels, conditions and definitions of dumping, and marginal pricing. Such studies command inputs embodying the expertise and international experience of World Bank Group personnel, but each is normally produced by an individual author within the framework of a single discipline, typically economics.

In addition to the programs of these and other intergovernmental agencies,‡ major elements of the needed industrial policy research are being carried out in many places, but cannot be combined in sustained, interdisciplinary efforts because of institutional fragmentation:

*For example, as programmed for 1972: major European markets for oilcakes; major markets for selected wood-based panels other than plywood and veneer; directories for selected exportable engineering products; selected markets for tropical products used in pharmaceuticals.

†These include, since 1968: the aluminum, automotive, cotton-textile, food-processing, heavy-electrical, and selected capital-goods industries.

‡For example, the International Labour Office, the United Nations Institute for Training and Research, the regional economic commissions, and the Organisation for Economic Co-operation and Development.

- Universities have made theoretical advances, but do not have the mission, multidisciplinary character, or resources to carry out empirical and practical research to fill gaps opened by theory.
- Corporations fill many critical gaps, pioneering or applying current analytical advances to data of concern to company decision centers. But corporate advances are not fully accessible to other private bodies or public agencies and do not encompass many critical international needs.
- Consulting firms and applied research institutes have made significant advances in publicly available, applied techno-economic knowledge. Their mission, however, is not focused on the needs we have identified. Typically, they are too constrained by the specific, short-term nature of assignments to perform sustained, integrative work on such issues.

Industrialization research is also fragmented geographically. Researchers with whom we have conferred in major centers suffer from a communication gulf between countries among those working on the same issues. Barriers to interdisciplinary work are increased by this geographic and institutional separation.

Facing these institutional gaps, two alternatives to the creation of a new international institute have been suggested: first, a series of research grants to supplement in critical areas the programs of existing institutions–following a long-term perspective of attack on critical industrialization issues; second, stimulus to decentralized initiatives among such institutions to increase lines of communication and collaboration. Both courses are desirable, but in our judgment neither can be expected to bring about the combination of qualities that are needed and would be gained by creation of an international industrialization institute.

C. Program Development

The board of trustees, guided by the fundamental objectives set forth in part I-D (p. 11), will establish the program objectives of the International Industrialization Institute, as well as criteria for success against which to

measure its progress. The board will be able to shift the institute's program emphasis from time to time to meet and anticipate changing requirements.

An early concern of the trustees will be to appoint the institute's director, who will have principal responsibility for attracting and selecting the core staff. This professional group can be expected to develop new horizons of inquiry leading to effective organization of the institute's program.

It is clear that the panel cannot assume this vantage point or attempt to define the institute's program. In this connection, however, it does have two obligations: first, to set forth its view of the institute's program orientation and style to provide a frame of reference for funding, organizational, and staffing decisions; second, based on the assessments of needs and attributes just summarized, on review of literature, and on the members' discussions of the role and opportunities of the institute, to set forth an illustrative but coherent approach to program development in concrete terms to demonstrate the practicability and potential worth of the institute.

Applied Policy Research and New Concepts

The principal emphasis of the institute, we recommend, should be on applied research to bridge gaps between policy, the market mechanism, and technology, thereby helping to guide industrialization more effectively toward development goals. Applied research projects should be comparative in nature and large enough in scope to attain new levels of insight and detail. Studies should link planning and policy criteria to market dynamics and thereby to investment and technological choices. Each problem tackled will be of sufficient complexity to evoke new methodologies or to produce working applications of methodologies already conceived but not previously put into use. Such projects should stimulate cumulative results and spin-offs in applications by agencies and enterprises that collaborate with the institute or use its research findings.

Discipline in probing specific problems to the depths needed to reveal practicable alternatives and clarify their benefits and costs is essential to the institute's developmental utility and to its long-term learning process. Each project would engage several staff specialists in an interdisciplinary team effort. Adaptive staff will be sought, motivated to cut across barriers of experience, training, and terminology. Applied inquiries of the anticipated depth and scope are expected to provide a stimulus to specialists of the first rank from industry and development agencies to participate as members of institute project teams.

The role of the institute staff would not be solely as research entrepreneurs or managers. Staff would participate actively in field work and in

empirical analyses, often in close partnership with collaborating institutions. With such detailed attention to operating situations and data problems, the image of a "think tank" is unsuited to the institute. Encouragement of original thought would be assured, however. Perhaps one-fourth of each staff specialist's time should be free of project involvement, to foster integration of field lessons with wider institute concerns.

Each applied study, while justified in its own terms, is not seen as an end in itself. The wider purpose is to enrich the institute's capacity to ask more searching questions about the industrialization process and to formulate new ways of increasing its contribution to development goals.

Applied policy problems arise in part because the concepts and understanding of "facts" at issue are not clear or mutually consistent or are not formulated in a sufficiently dynamic context to point the way to resolution of conflicting interests. As pointed out by a conferee:

> Conceptual and data problems can be handled at a worthwhile level from the viewpoint of research relevant for policy needs. Very worthwhile work is possible in the borderline area, where received theory interacts with policy problems on the basis of field data. International collaboration of this type would provide a clearinghouse for operationally relevant and empirically testable concepts. Such collaboration, provided a sufficient number of people with interests in diverse industrial situations participate, can . . . in due course, lead to meaningful methodologies, being developed for comparative analysis rather than imposition of theoretical structures from above, as is generally the case at present. [Yoginder Alagh, India]

Coupled with applied research, we recommend a core of vigorous and innovative conceptual development. A small group of generalists should be largely free to set their own pace and program in wide-ranging exploration of relationships among industrial phenomena and their influence in attaining development goals. Generalists might include persons experienced in institutional aspects of public industrial policy, long-range corporate planning, the sociology of industry, and in mathematical or systems approaches.

Each generalist should have half or more of his time at his own disposal. He should also have substantive responsibility in applied studies, generating and in turn gaining insight into current industrial problems.

The proportions of emphasis we visualize are suggested in the following breakdown of staff positions and time:

Staff Category	Number of Staff	Proportion of Staff Time		Institute Man-Years	
		Applied	Theory	Applied	Theory
Applied	32	3/4	1/4	24	8
Conceptual	8	1/2	1/2	4	4
	40			28	12

Such proportioning is only indicative. It is intended to suggest a cycle of interactions in which all staff would participate.

In planning the institute's work program, time necessary for staff members to grasp the multidimensional, international implications of each project must be taken fully into consideration. This is particularly the case for project staff seconded by institute invitation from governments, corporations, or development banks—providing two-way learning experiences for both core and short-term staff.

Illustrative Program-Development Strategy

The organizing strategy illustratively sketched in part I-D (p. 11), directed to the priority issues of industry selection, market development policy, employment, and technology, initially focuses on international analyses of individual industries. Such industry analyses would be directed to:

- More effective selection of industries and technologies by developing countries,
- Identification of policies encouraging the competitive growth of such industries in national and international markets, and
- Better understanding of the benefits and costs of shifts in selected industries from advanced to industrializing countries and of measures to promote such adjustments.

Such a program focus fits the institute style recommended earlier, with its emphasis on applied, integrative studies. This illustrative program strategy is described later in some detail, as an example providing a point of departure for those who will plan and launch the institute's initial program.

1. Objectives of International Industry Analyses

As indicated in pages 15 - 17, the objective and design of each industry study will be determined primarily by the kinds of critical issues faced in creating conditions for competitive growth of the industry in developing countries, and in assessing and advancing its contribution to development goals. Studies will vary sharply depending on the nature of the industry, its significance and problems in the range of countries participating in the study, those internal and external market mechanisms that inhibit or distort its growth, and its principal impacts on national and international economies.

Objectives of the institute's series of industry analyses taken as a whole (but not for each study) would include the following:

a) To produce adequate information on the structure, markets, product and process mixes, scale, technologies, and locational factors in different types of industry to assist selection decisions by enterprises and industrializing countries. The pilot nature of this function should be stressed, namely: to set a standard of relevance and improve methodologies for mobilizing and organizing information in the type of industry concerned, oriented to decision needs of the types and sizes of country involved.

b) To prepare, in relevant industries and on a pilot basis, indicative geographic projections of supply and demand, as a tool for use at the discretion of countries and enterprises in evaluating alternative paths to the distribution of new capacity.

c) To illuminate the role of industrial R & D and of public information, market and technological, in the competitive dynamics of the industry.

d) To develop criteria, methodologies, and information for evaluating the contribution of the industry to development goals, and trade-offs among such goals; and for mechanisms toward better sharing of benefits and costs of movements in the industry between industrialized and industrializing countries.

e) To test the adequacy of market mechanisms in guiding investment choices in the industry and to assess the effects of policy instruments designed to improve or alter the functioning of price and other market signals.

(1) Validity and adequacy of price and other information available to the enterprise to compare financial rates of return in alternative markets and alternative product or process opportunities.

(2) Areas, degrees, and causes of divergence between economic and financial rates of return. Do divergences typically run one way for certain industries and types or sizes of enterprise and the opposite for others? Can such differences, if observed, be categorized as a means of improving estimating procedures?

(3) Costs and uncertainties involved in improving information used in decisionmaking: for differences in financial returns; in economic returns.

(4) Incidence and effectiveness of existing or prospective policy instruments (e.g., tariff levels, entry restrictions, R & D tax write-offs, credit conditions, regional incentives).

f) To suggest institutional innovations, at times experimental in nature, that may contribute to the resolution of planning and market issues typified in the industry.

Detailed studies would be designed to probe contrasting industries and their policy implications systematically.

The international or regional emphasis of each industry analysis, strengthened by active participation of national institutions, would be on identifying the preconditions, incentives, and initiatives needed; and the benefits and costs of introducing the industry in countries having the structural characteristics embodied in the research.

2. Criteria for Industry Selection and Approaches to Market Development

Each industrializing country has in common with other countries the objective of providing new types of goods and services for its people and new outlets for their creative capacities. A careful selection of industries and branches of industry, as emphasized by our conferees, is therefore a critical necessity for each country. Selections must be appropriate in terms of basic factor endowment; impetus to growth of productivity, income, and employment; and other social-economic benefits and costs, including urban-rural linkages and external effects through international trade payments.

To assess industrial advances and their differential effects among contrasting countries and regions requires taking into account a set of parameters that is itself changing in composition and effect—social, technological, ecological, political. It is therefore hardly surprising that at present there is no set of commonly applicable criteria for guiding decisions on which industrial sectors should be developed in each country.

Much attention is now being devoted by the World Bank and other development institutions to methodologies for estimating and applying the economic rate of return, designed to measure the social benefits and costs of an investment course. This measure, to the degree it can be estimated, is one of the appropriate criteria for evaluating the developmental effects of a project. With such a measure it is formally possible to compare the benefits and costs, say, of expanding an industry in one country at the expense of its stagnation or disappearance elsewhere. Countries may then weigh the trade-offs. If necessary and appropriate, they may then negotiate transfer mechanisms or arbitration agreements to accommodate the shifts.

Currently, the prospective benefits from developmental shifts of industrial location offer a substantial base for internal adjustments within advanced economies. Trade-offs between liberalized trade and the costs of maintaining uneconomic industries can be evaluated in terms of economic rates of return. A recent estimate by the Organisation for Economic Co-operation and Development puts the current costs of protection in the advanced economies—through tariff and nontariff barriers—at $50 billion a year. Mech-

anisms to regain and use even part of this cost to move workers and capital from declining industries—opening lines to increased manufacturing trade from industrializing countries—would make Trade Not Aid a reality, not just a slogan.

The reckoning of economic return and its translation into policy instruments, however, raise major technical difficulties, which are stressed in the World Bank's *Industry Sector Working Paper* (pp. 32 - 35).* In terms of development impetus, such as mobilization and articulation of activities at "growth poles" or in "development regions," estimation of positive and negative externalities is extraordinarily elusive. In effect, one would need to capture the first-order input-output and spatial linkages, not based on those existing in some other economy (if, indeed, they have been measured) but as such linkages would dynamically evolve if a suitable mix of activities were launched. How does one quantify and test, for example, the hypothesis that a competitive industrial mix that fosters numerous subcontract relations is a better seedbed for entrepreneurship and innovation than one with a limited number of self-contained process plants?†

The rule of thumb stated by a conferee is instructive:

> In evaluating the economic development contribution of a project, we aim to be 80 percent right, based on our wits. We can't afford to be 90 percent right at the cost of a half year's further work and delay. [Peter Wodtke, Japan]

Such a rule of thumb may be misleading, however, in cases of sharp divergence between economic and financial return. Here is the crux, for purposes of applied research. What orders of magnitude are at stake, in different industries, in the divergence between private and social benefit-costs? How do contrasting conditions of market entry affect these divergences? How is the cost of "creative destruction" of existing industry by new competitive investment to be assessed? (Not only the traditionally recognized fixed costs in plant and equipment, but, more importantly, the career and job displacement of existing personnel.) How do these differences and effects vary from one stage of development to another? From one country or type of economy to another?

Order of magnitude differences in estimating factors for both financial and economic return are important here. Valid international price data on manufacturing intermediates, for example, are needed for both purposes. On

*See Selected References, 1.

> .... These center around the identification of appropriate long term international prices for proejct outputs and inputs, the measurement of external economies and diseconomies, the estimation of shadow prices for the primary factors, and the rate at which project efficiency will improve over time. (p. 33)

†See, for example, Benjamin Chinitz. "Contrasts in Agglomeration." *In* Karaska and Bramhall (Selected References, 3).

the other hand, if the information content of prices is poor because of market or technical factors, this may be of first-order importance in financial returns, and therefore more significant for decisionmaking than a second-order difference in indirect benefit-costs. To sort out these contrasts, detailed research on industrial markets is required.

An important function of the institute, therefore, is to contribute to the development of workable and acceptable selection criteria, and of methodologies and information for applying these criteria. Detailed analysis of the impacts of various criteria in different industries will be required, including analysis of the interplay between policy incentives and market forces. Comparative international analyses of individual industries, while contributing to improved investment decisions for the specific industries, should be designed to build understanding of appropriate approaches to selection criteria and policies for their use in fostering appropriate new modes of industrialization.

Central to the determination of workable criteria is the role of markets and prices. To varying degrees in different industries, market imperfections and barriers weaken the validity of prices as guides to entry even on the test of financial returns. Addition of effects external to the enterprise, skewed differently for different industries, greatly complicates the selection issue. The mix of criteria, information, and error conveyed by prices in different industrial markets is therefore a key question for investigation.

3. Accenting Complementarities in Employment and Technology

No existing institution, equipped for sustained empirical research, focuses on the interaction between selection of industries in an international context and their contribution to development in industrializing countries. The effort to analyze these dual aspects of the selection problem simultaneously, contributing to actual decisions and to workable selection criteria, will be a central institute concern.

Two dynamic factors among the many forces causing increased mobility of industries, including movement to industrializing countries, are wage differentials and technological change. As has been true historically, these forces interact with benefits to some and with costs, at least short-run, to others.

Growth and equity goals may be directly addressed by seeking avenues that offer high complementarity between job creation and technological change. Facing the urgency of job creation in developing countries and recognizing its potential contribution to world economic growth, the institute's analyses of international industries could assist in identifying such specific lines of complementarity.

This effort would contribute, methodologically, to the formulation and application of acceptable criteria—including, but not confined to, employment goals—to guide selection of industries and technologies.

Innovations in manufacturing methods in industrialized economies have typically been laborsaving. In offshore movement of industries and industry segments, this sequence is in a sense reversed, contributing to a new cycle of technical adaptations and innovations suited to wage costs in developing countries. Industrializing countries seek to participate in an international division of labor that would increasingly transfer to low-wage countries the labor-intensive activities vacated by the rich countries, followed by progressive upgrading of productivity as skills and methods are advanced. Such progression from wage disparity to rising average wages and narrowing disparities is a major challenge facing the international industrial economy in the 1970s and 1980s.

Relations between employment and technology are highly complex. The direct contribution of the manufacturing sector to employment is less than often assumed. Given sustained attention, these interactions would be clarified and made operational in much of the institute's program.

We suggest four main elements in the institute's approach to these issues:

- A prominent criterion in selecting industries for detailed analysis should be the potential contribution of the industry to employment in developing countries and the interaction of such employment with technical change, on the one hand, and its impacts on employment in industrialized countries, on the other.
- Systematic research to identify and measure factor price distortions that inhibit job creation in industrializing countries, and to illuminate the incidence of these distortions in different industries, should be an ongoing effort of the institute. An illustrative description of policy-oriented analysis of factor prices is appended.
- An integral element in the institute's industry studies should be the development and testing of methodologies through which firms in industrializing countries can improve their choices among technological alternatives. This element is spelled out on the next page.
- The institute, in selected industry studies, should be alert to the potential role of industrial R, D & E in contributing to the industry's growth in various countries. As appropriate, the institute would assist in defining criteria and parameters through which national institutes and firms, often in collaboration with multinational firms, can direct their research and development efforts to realistic human and physical needs and endowments. Such institute orientation is outlined in the next pages.

a) Enterprise Choices of Technology

If strategies to narrow world wage disparities are to succeed, steps to raise productivity by use of capital-stretching methods, where appropriate, must be taken through decisions in countless individual enterprises–at management, engineering, design, and supervisory levels. The vital role of realistic factor prices, the subject of an illustrative project in appendix A, is thus underscored.

Beyond correct market signals, external steps to help firms improve these decisions must, as pointed out by several conferees, fit the motivations and mix of managerial decision factors in the specific types of enterprise concerned.

A framework for such analysis could be to simulate an enterprise in possession of the relevant information it would need from international experience to make viable decisions in its own circumstances. The institute and collaborating groups could perform such simulations, as appropriate, in carrying out international industry analyses. Boundaries and measurement factors for the relevant range of technological alternatives in the industry would thus be established. In selected industries, particularly involving medium and small companies, procedures by which enterprises can analyze relevant technological alternatives would be defined and demonstrated.

Such definitions of the nexus between managerial decision needs and relevant sources of technological information in different countries should clarify the role and limitations of public information in advancing industrial know-how and improving investment choices. The realism, scope, procedures, and costs of public information services to assist firms–particularly medium and small firms–in such choices would thereby be clarified. This would contribute to current efforts by UNIDO and other development agencies, national and international, to establish information services providing industrial decisionmakers with relevant and adequate knowledge of technological alternatives and methods for their assessment.

Such advances in methodology, measurement, and analysis would equip the institute to play an active role in the evaluation of strategies for relating technological progress to employment goals.

b) Contributions to Technological Development

In early discussions of the institute, and in the assessment reported in part II-B (p. 27), its potential contribution to the growth of industrial R, D & E oriented to resource endowments and design requirements of developing economies were emphasized. Six potential modes of such technological contributions emerged in our conferees' assessments (pp. 43 - 45).

The need for radical new approaches to product and technology design is so great that many sources of corporate and public expertise must be mobilized through international efforts. Our survey indicates, however, that the International Industrialization Institute will contribute most effectively to this goal by directing its specialized competence to carefully defined areas in which institutional gaps between technological groups, public and private, are identified. The institute itself should not attempt to serve as a vehicle for technological innovations or systems designs.

We attempt here to define this institutional role in concrete terms, though its nature will inevitably be subject to change as the institute gauges its early experience. In the institute's principal realm of comparative advantage, this function may be seen as follows.

A generic need is that of each developing region to create a starting nucleus of industrially oriented R, D & E to promote growth of indigenous technology. The International Industrialization Institute should build comparative knowledge that will help identify, for various regions, those market needs and sets of industrial activities conducive to successful launching of such nuclei.

In carrying out international studies, in linkage with national institutes and with industry, the institute's specialized interdisciplinary teams can be expected to see new opportunities for promising industrial research and development. In each industry, the role of R & D has its own dynamics. The institute, as it gains knowledge of these characteristics, particularly in interaction between developed and developing countries, should be able to illuminate steps that companies and public agencies in particular industrializing countries and regions can take to speed entry into worthwhile R & D in the industry.

The role of multinational enterprises is especially significant in this context. These enterprises are recognized as major vehicles for the development and transfer of technology. They have a demonstrated ability to sustain scientific research through the complex, lengthy, and costly process required for successful, profitable innovation. Their foreign investments usually have powerful complementary backward and outward linkages to supplying firms and to customers, thus multiplying their innovative impact on the economy.

As the institute advances its understanding of various industrial sectors and their growth sequences, its appreciation of R & D parameters should permit its staff to foresee key opportunities for developing countries or regions to attract meaningful nuclei of industrial R & D talent. In selected instances, as a pilot effort, the institute may proceed to formulate guidelines designed to assist a country or regional institution, or association of commodity producers, in engaging participation by multinational firms in the creation of R & D programs to overcome present bottlenecks and diversify local industry.

Such guidelines could include an analysis of necessary and suitable incentives to attract international firms to such opportunities for local or regional innovation.

Further, the institute could in selected cases contribute to the identification of realistic parameters, based on demographic and physical resource factors, to shape the course of R & D efforts. This is a missing institutional link. Development banks, for instance, are alert to broad sectoral and environmental requirements that should shape the course of industrial research and design, but do not have the specialized competence to reduce these requirements to specific design parameters. Consequently, we have seen (p. 45) that efforts by industrial research institutes to obtain worthwhile R & D appraisal and guidance from industrial development banks lead to few results. Neither industry nor technological institutes in developing countries typically possess the combination of sophisticated design knowledge and local market analysis required to define useful design parameters for new products or processes.

The institute will in no sense have specialized design competence. For those industries in which the institute carries out intensive analyses, however, the project team will include international specialists who have the technical understanding to be able to show what kinds of factors change cost structures, quality, and performance, and within what range. With participation of local specialists, and in active consultation with design engineers in countries where relevant branches of the industry are well developed, the institute team will be able to determine, imaginatively and with confidence, the realm of feasible and promising design innovations. For significant opportunities, particularly as relevant to employment and manpower development, the institute's analysis could be extended on a sufficient basis to define the parametric boundary conditions for relevant product or process designs.*

Such an institute role, to be selectively exercised, is illustrated by the second phase of the machine-tool industry study in appendix A. In this regard, the institute's principal role would be to identify realistic parameters and approaches for local technological innovation.

4. Concepts and Hypotheses for Comparative Studies

The complexity of generating a description of the industrialization process within a country, let alone between countries, is enormous. No one institu-

*For projects leading to direct industrial application, institute procedures should be established to make results available on an equitable basis or through appropriate charges.

tion can comprehend the dynamic, complex relationships between the factors involved in the process of industrialization, though many efforts are under way in existing institutions to elucidate various aspects of these relationships. The International Industrialization Institute, in helping to build this body of knowledge, would participate in ongoing efforts to develop, expand, define, and test useful conceptual models of the industrialization process and to gain insights into the requirements of constructing such models and the validation of different results.

D. Feasibility, Viability, and Implementation

Can it be done? This question reflects the skepticism that responsible persons convinced of the need for the International Industrialization Institute pose to the Special International Panel. Recognizing that no field includes more special interests, these individuals question whether an objective international institution can be formed.

The panel has examined, with assistance from conferees, several aspects of the feasibility and potential viability of the institute:

- Can people of the requisite caliber be attracted to a new institution, involving high personal mobility, without severely depleting the sources of scarce personnel available to work on these problems in industrializing and industrialized countries?
- What founding process can create the combined independence and jointness that are essential to anticipate and withstand potential clashes of interest in international industrial development? Can a new institution achieve and maintain such independence and integrity in the face of its long-term need for financial resources?
- What procedure will gain the recognition and support of governments and intergovernmental agencies and of industrial corporations but not compromise the professional independence of the institute?

- Can the institute remain objective and still address itself to problems in ways that will facilitate new policy positions on the part of both governments and business? How can it get its results (and suggestions) seriously considered by policymakers?
- Where should the institute be located?

International Sources of Initiative

The form and capacity of the organizational mode envisaged for the institute is projected in two statements by conferees on opposite continents:

> Choose a very decentralized form. Seek an extremely flexible mode, providing for great flows of personal information among groups working on similar issues. Such communication is more important than critical mass in one place. [Guillermo E. Perry R., Colombia]

> It takes an expert to use an expert, to collaborate .... You are asking the right questions to consider a new institute. It will not be easy. The center should have a certain strength, an interdisciplinary focus; otherwise, regional conditions will take over. [Yoginder Alagh, India]

By drawing on decentralized centers of autonomy and initiative in developing the institute's program, and by providing lively working and communication links, these two modes of emphasis can be reconciled in the building of a central, interactive research group.

National and local institutions specializing in various aspects of industrialization have crossed the threshold of effectiveness in several developing countries in the past 10 years. Such institutions have acquired confidence in their specific role and that sense of specialized accomplishment that is necessary to use or collaborate on equal terms with other specialists. These groups and individuals constitute the base for productive linkages with an international institute.

Each institution tends to be specialized, however, in a single dimension of the industrial process. Panel conferees in the 30 - 40 age span include executives in development banks and private or state industrial development corporations; in management institutes; national planning agencies; institutes of industrial and technological research; techno-managerial consulting agencies and firms; economic research centers; and personnel-development institutes. As might be expected, in no region is there an integrative, interdisciplinary institute bringing together the several capabilities involved in assaying the policy and market environments essential to the healthy growth of new enterprise.

Numerous new industrial enterprises—large, medium, and small—are the only integrative entities. Yet they operate, as already noted, within only part of the relevant information and criterion system.

Substantial personal talent is at work in leading and carrying out the tasks of these modernizing centers. From the sphere of industry and from growing private and public centers of specialized industrial capability, sources of staff initiative for an international institute are promising. In the organizational mode visualized, the institute would serve to stimulate, diversify, and multiply these rosters of talent and reinforce their contributions to the progress of developing countries and regions.

Formation and Organization

In the words of various conferees:

The institute must be tough, totally professional, free of vested interests, capable of high neutrality in the face of pulls either personal or political. Full integrity must be evident in the process of creating and staffing the institute. [Saburo Okita and Peter Wodtke, Japan; M. S. Pathak, India]

The recommended founding procedure and governing structure are designed to meet these requirements. In arriving at this approach, the panel has carefully examined the experience, founding processes, and structure of recently established international institutes in other fields of development. Their lessons are not directly transferable, but by consulting persons responsible for such institutions and by studying their forms of organization and critical evaluations of factors in their success,[7] the panel formulated the distinctive approach recommended in part I-D (p. 11) for the formation and organization of the institute.

In considering means of launching the institute and ensuring its viability, the panel examined the need and possibility of an interim institute, which would prove and pave the way for an expanded program as warranted by accomplishments.

The panel also considered the following approach to financial resources:

To assure strong independence, a high endowment component in the institute's funding is desirable. To assure institute responsiveness to genuine needs in developing and advanced economies, sources of support should be as widely based and multinational as possible from the outset, including international agencies, government agencies, foundations, corporations, and individual donors.

The appreciation gained in the study conferences of the qualities of independence and jointness essential to the institute's objective enables the panel to clarify these questions of durability and resource base.

The panel recommends that the institute be created on a permanent—i.e., not trial—basis. The ultimate image and structure of the institute must be established from the start. Its program success would otherwise be prejudiced, since only its character of autonomy and objectivity can ensure the credibility of its program.

Interim approaches that have been examined do not guarantee these qualities. A proposal for an initial organizing phase to be administered by a national academy would incorrectly identify the institute with a single country. Launching by an association of academies or by an intergovernmental agency would tend to build into the institute the structural patterns of the parent group. Flexibility and innovation in the organizational process would thus be thwarted.

It has been pointed out that the institute may have to be unpopular in the short run to be popular, and successful, in the long run. In anticipation of mutually advantageous industrial opportunities that the institute believes will be recognized after groundwork is laid in intensive study, it should not be forced to refrain from research because of resource constraints based on short-term, asymmetrical interests. Practical limits to the institute's research freedom should, and in any event will, be its ability to maintain a high level of credibility in the international and industrial communities of which it is a member.

The panel recommends, therefore, that the funding of the International Industrialization Institute be through an endowment large enough to guarantee the independent life of the institute, of a size adequate for effective work.

Through an initial stage of staff and program development, the institute could become operational before attaining the full endowment. This should be undertaken, however, through the full procedure recommended to establish the institute on an autonomous, international basis, and in the context of an accepted schedule of commitments to reach the total endowment.

Administration

The role of the director of the institute, who will be selected by the board of trustees, is vital to its personality and unity. We suggest a 5-year term for the director's initial appointment, renewable by board approval up to 15 years if it is considered advantageous in firmly establishing the international tradition of the institute.

The director will need a high order of international experience and innovative ability in building a multinational, interdisciplinary staff. He should above all have the capacity to attract a richly diversified group of personalities and inspire the discipline of discovery in sustained team en-

deavors. He should be a person of strong stature in forming, defining, and carrying out program policies, within the general framework established by the trustees. He should have the capacity, gained through significant experiences in industrializing and industrial countries, for novel, fresh initiatives in response to emerging opportunities.

The institute is to be staffed by the best talent available regardless of nationality, with good geographic distribution among industrializing and industrial countries. A core staff, building from about 20 professionals in the first stage to about 40 professionals within 5 years, is anticipated. This strength will be multiplied in both numbers and experience through the institute's active collaboration with other institutions, and by annual appointment of 10 - 15 experienced practitioners and scholars and fellows-in-residence. The core staff would be selected on the basis of their competence and willingness to make a commitment to the institute for 3 - 5 years or longer.

The institute will be flexible and will be structured so that it can seek any necessary combination of talent and interact with interested nations on a professional-to-professional basis as well as an institution-to-institution basis.

Recognition and Support

Policy decisions on industrialization must be taken, it is evident, by sovereign governments and through established intergovernmental agencies. These lines of national responsibility, as we have found, often do not permit the innovative, objective studies required to illuminate a significant range of policy alternatives for resolving the contentious issues of international industrialization.

The panel believes that the tradition of independence to be built into the International Industrialization Institute by the founding, governing, and endowment processes described above will be widely seen by governments, intergovernmental agencies, and private industry as a guarantee of the institute's capacity to be effective, and therefore as essential to their common long-term interests. It is anticipated, therefore, that the institute's independence will be encouraged by sovereign, intergovernmental, and private bodies alike.

The panel also believes that governments of both industrializing and industrial countries—and United Nations agencies and other international organizations—will wish to find appropriate means of according public recognition and encouragement to the institute. The board of founders should explore appropriate procedures to this end with governments of industrializing and industrial countries and with relevant intergovernmental agencies.

Dissemination and Extension Systems

The success of the institute will depend not merely on the creation of a relevant body of knowledge but also on effective demonstration and extension of its results.

For this highly innovative institution, the impact of its research results will very much depend on the care exercised in identifying problems of research. Although the institute's program will largely be self-initiated, active two-way communication between the institute and the users of its results is crucial for effective implementation. The formation and role of the program consultative committee suggested earlier in terms of institutional linkages (p. 19) is of central importance in this connection. To provide fresh interactions in such program guidance and development, 3-year terms are suggested for committee members, with active rotation among different geographic regions and organizations.

For commissioned research, the delivery system is largely predesigned. For self-initiated work and work launched in response to a need felt by several potential users, suitable steps for demonstration and dissemination should be planned and built in from the outset of the research.

The panel points, in particular, to the following modes of dissemination:

Reports. By virtue of the high selectivity of problems for research, major reports will be few in number, pointed to specific audiences and presentation of policy options, and are therefore expected to be used effectively.

Presentation. The institute will be active in public presentation of appropriate reports and in select presentations to policy groups.

Involvement. Involving the right interests at every stage from design to operation of each research project and experiment is crucial for effective implementation of its results. Steps to achieve such involvement include:

- Engaging the motivation and decision of relevant organizations and persons in the initial stages of defining the dimensions of the research problem;
- Seeking the participation of collaborative institutions, industry, and prospective implementing agencies in the design and methodology of the research project;
- Joint efforts in collection of data, fieldwork, analysis, and formulation of conclusions; and
- Working together in follow-up, including practical tests of the results and pilot implementation programs.

Staff interchange. The institute core staff will be augmented for each project by suitable seconding of experts from other institutions or enterprises. Institute staff will also work on specific projects in collaborating institutions. Such staff interchange would provide training for personnel of both developing and developed countries, who will also become communication agents for the institute's philosophy, method of working, and results.

Exchange of staff with international development organizations for longer periods may also prove desirable to strengthen design of projects and use of results.

Training. The training potential of each institute project should be explicitly identified to multiply its outreach. Upon successful development of new methodologies and information, steps would be taken as appropriate to hold seminars and to develop prototype courses or course designs for implementation either by the institute or, more typically, by national or international training institutions.

Advanced study by fellows-in-residence at institute invitation will augment the outreach and catalytic effect of program innovations.

Location Criteria

To further its goals, the institute will actively pursue its program anywhere in the world it can make proper arrangements. Mobility of staff will be high: individuals will reside in countries participating in intensive studies and move among such countries. In a real sense the institute will be operationally decentralized.

The central location of the core group must be in a vigorous intellectual and industrial community with excellent centers of learning, libraries, access to industrial data, communication and travel services, and living and schooling conditions. The board of trustees should give major weight to these criteria in determining the institute's location.

Apart from these major criteria, the study produced arguments for locating the institute in an industrialized country, and in an industrializing country.

Proponents of an industrialized country listed the following advantages:

- Greater availability of data.
- Closer interaction with sources of industrial investment and technology. This consideration gains weight to the degree the institute is seen as stimulating flows of investment to assist in balancing industrialization in the world.
- More attraction for excellent people, including people from developing countries.

- Less likelihood of shaping the institute to the conditions of a particular region and locale.

An industrializing country was said to have the following advantages:

- Greater sense of sharing and ownership by developing countries.
- Where the problem is. Keeps focus on real problems of market entry and expansion. Feel of the industrialization process and emerging issues.
- Sharpens approach to obtaining relevant data. Since it is more difficult to get reliable data in developing economies, the institute as a pacesetter would benefit from being in this situation and being forced to improvise new ways of defining and meeting data needs.
- Contributes to building of centers of excellence in developing world.
- Less likely to keep talented personnel permanently away from their home country.

Another argument that if the institute is not located in a developing country, it should be in Vienna also found support, on these lines:

- It would share UNIDO's orientation to developing country problems and serve as a resource to UNIDO.
- Communications and economies of scale in interaction of talent on industrial problems would be fostered, with both UNIDO and the new International Institute of Applied Systems Analysis, which has complementary fields of concern.
- It is important to strengthen the international agencies already active in industrial development.
- Austria is a politically neutral country and plays no significant role in the world economy.

Disadvantages of Vienna were also advanced:

- The industrial, technological, and commercial activity of Vienna is too limited to keep the institute in touch with the mainstream of international industrial change.
- The program might become too heavily influenced by UNIDO's operational needs or political processes.
- The institute needs its own clear image; it should not appear to be an appendage to any existing agency.
- Institute staff's time might be disproportionately absorbed by interaction with the much larger UNIDO staff.

Other specific locations suggested in discussions with the panel and study team include Boston-Cambridge, Palo Alto, Brazil, Japan, Lausanne, London,

Singapore, Turkey (specifically in the trans-Bosporus Uskudar area), and North Carolina's Research Triangle.

The board of founders will wish to continue systematic exploration of the principal advantages of various institute locations, presenting to the board of trustees the information and judgments it has obtained. The panel recommends, however, that the determination be made by the board of trustees.

E. Activities Considered outside the Scope of the Institute

During this institutional assessment, suggestions have been made for various activities that, on examination, the panel considers beyond the institute's functions. Without seeking to limit the institution's growth, the panel lists such activities below to set in relief the institute's central functions, as defined earlier.

The institute is clearly not visualized as an operating agency. It would not, for instance, provide organizing skills or "seed money" for working capital to develop markets for machinery suited to small farms. Pilot financial and technical assistance of this type is certainly needed in some industries and regions, notably for linkage with agriculture, but is appropriately the function of development corporations. The International Industrialization Institute could well pinpoint such new institutional needs, as a recommendation stemming from its applied studies.

Information responsibilities of the institute should be limited to carefully defined fields. The industrialization institute, like the international agricutural institutes, should become a principal bibliographical center in its own field of specialization: industrialization research. In other information fields, the institute would contribute primarily by pinpointing public information needs and by helping to define minimum and maximum standards of relevance and practicality for information services. It should identify means for meeting significant industrial information needs, and recommend suitable institutional vehicles to this end.

Examples in technological and market information may be given.

In selected industries the institute, as discussed earlier, would develop methodologies and measurements to assist enterprises in evaluating relevant technological alternatives, based on international experience. Such analyses would also help to define the dimensions and typical content of feasible and needed information services for the specific industry. Methods of generalizing the results to similar industries would also be tested. The institute would not, however, assume a clearinghouse, coordinative, or inventory function with respect to such technical information. This is an information-dissemination function on subjects outside the institute's central area of specialization. The institute would seek to coordinate its pilot, methodological work in this regard with the network of information services now in the making, in particular with UNIDO.

In completing assessments of market entry requirements and trends in an intensively studied industry, the institute will face the question of how the resulting information can be kept current and usable by industrializing countries. Analytical series required on a current basis for the institute's own work, such as price analyses, might in special cases be developed as a subscription service. If new statistical or analytical series pertaining to an individual industry or region are developed, the institute would typically seek to determine the interest and capacity of an existing agency–for example, the International Trade Centre (UNCTAD-GATT)–for maintaining the service, perhaps as a subscription service that the agency concerned would offer after an initial phase of testing the methodology. If the International Industrialization Institute conducts an industry study in collaboration with an association of the industry concerned, assistance to the association in designing and installing a market-intelligence procedure could well be a specific task of the study.

The institute would not offer consulting services in the fields of competence of existing organizations. Specifically, it would not accept requests to perform high-level technological evaluations of individual projects on the lines described on pages 43 - 44. Acquisition of highly specialized competence in a large number of fields would be required if such services were to be provided; this is beyond the institute's proposed capabilities. The institute's contributions to technological development, as indicated in part II-C (p. 60), would be in determining relevant parameters–geared to the circumstances of developing regions–for R, D & E in selected branches of industry in which the institute develops high specialization.

The institute should not attempt to serve as a substitute for bilateral links between an industrial research institution in a developing country and its counterparts in industrialized countries. Nor should it serve in the role of clearinghouse or transmitter of proposals for project links or support, an approach under consideration in the United Nations Office of Science and

Technology. Such project links apart, the institute will wish to evaluate in terms of its own learning objective the initiatives made by development banks, national research institutes, and international agencies for exploratory studies to enhance the role of indigenous R, D & E on lines suggested in submodes (3) and (5) on pages 44 and 45.

A number of conferees have suggested that the institute, to assure use of its results, should possess "indirect teeth" in the form of an implicit agreement by financial institutions to use their leverage to gain acceptance of criteria or recommendations advanced by the institute. The panel recommends that such sanctions should not be sought or attempted. Any impression of leverage by the institute to gain acceptance of its findings, or to pose as a balancing factor in an industry, could be self-defeating. Even indirect access to such teeth could imperil the institute's autonomy. The influence of the institute should be through its reports, analyses, and insights. Eyes and voice—not teeth—are its distinctive features.

Upon performing a specific study, particularly when commissioned by a development bank or agency, the institute should bring its results as near the pre-investment stage as appropriate to the circumstances and scope of work. The institute should not promote investment pursuant to its findings, but should consider the purpose missed if its conclusions in a commissioned study do not clarify the principal alternatives, benefits, and costs in terms sufficiently firm to lead to policy and investment decisions by the responsible parties.

Part III

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Appendix A
Illustrative Research Projects

The content and potential applications of industry analyses designed to give initial focus to the institute's program are illustrated here. These industries are not suggested for any particular group of countries. However, they represent dynamically changing, mobile industries for which such studies would assist in clarifying emerging advantages and disadvantages in countries with different conditions.

The objective and scope of study and its methodology would in each case be designed to strengthen the ability of the countries concerned to identify and to assess new opportunities for participation in the industry or industry segment. The study design would be defined in close consultation with collaborating institutions in these countries, and with industry representatives and development banks or other agencies whose cooperation in the study is envisaged.

The contents of this appendix are listed below.

International Industry Study: Heavy Electrical Equipment

Introduction

The manufacture of heavy electrical equipment–specifically equipment for power generation, transmission, and large industrial motors and electric

furnaces–provides opportunities for industrialization in selected developing countries.

In a recent World Bank publication* an analysis of the growth and competitiveness of the heavy electrical equipment industry in developing countries is based on field information from Argentina, Brazil, Mexico, Pakistan, and Spain; internal World Bank data; and interviews with major international manufacturers of heavy electricals. The analysis compares the prices and costs of heavy electrical equipment manufactured in developing countries with that produced in industrialized countries. Although the existence of considerable unused capacity at the time of the study has led to a period of low world market prices, the analysis points to certain areas of potential cost advantage in developing countries. This analysis provides a unique basis for the further research needed if future expansion of manufacture of heavy electrical equipment in industrializing regions is to be on sound lines.

Further research, international in scope and conduct, is needed to identify and analyze: (1) the potential for expansion and redistribution of production by product by country and (2) the preparation of policies and operational mechanisms necessary to bring about desired new patterns of location and production.

The scope of study outlined below accents three aspects, in particular, of the competitive potential of various semi-industrialized countries for increasing their participation in heavy electrical equipment markets:

1. Potential cost advantages in particular product categories (2.1, 2.4, below);

2. Possible regional cooperation in procurement (2.2, 2.6) to improve scheduling of production orders and reduce costs; and

3. Facets of R & D that industry in certain developing countries might launch, in appropriate collaboration with international corporations (2.4, 2.7, 2.9).

Specific Research Topics

1. Industrial Goals Research

– Identify the development goals in which achievement requires the production of electricity and quantify from existing sources these electrical requirements over time by geographical region.

*Oyhan Cilingiroglu. *Manufacture of Heavy Electrical Equipment in Developing Countries*. World Bank Staff Occasional Paper No. 9. Washington, D.C., 1969.

– Translate the electrical requirements into indicative needs for heavy electrical equipment.

– Identify and compare alternative international strategies and their benefits and costs for the production of heavy electrical equipment necessary to achieve the development goals. What are the implications of these strategies on alternative geographical distributions of production?

2. Industry-specific Research

2.1 Product

– Identify products whose local production is appropriate to market and factor conditions in select industrializing countries (for example, the intermediate range of heavy electricals such as 5 to 20 MVA transformers as identified in the World Bank report).

– Identify the impact of emerging technologies on this range of heavy electrical manufactures, particularly the effects of nuclear power production.

– Analyze the degree of production and market differentiation among countries at different stages of development in terms of product structure and quality standards.

– Investigate the need and opportunities for new product design or adaptation appropriate to production, raw material, and market conditions in developing countries.

2.2 Markets

– Identify present world demand, supply, and production capacity for the select range of products.

– Develop time series of trade patterns for this specific range of heavy electricals.

– Prepare short- and long-term demand forecasts.

– Identify procurement practices of principal users of the select products and their effects upon market opportunities for prospective new manufacturers in industrializing countries.

– Identify the effective trade barriers for intermediate heavy electrical equipment used in the industrialized countries. How may these barriers be reduced to foster industrialization of intermediate heavy electrical equipment in industrializing countries? What impact would such reduction have in industrializing countries? In industrial countries?

2.3 Technology and Scale

– What are the forecasted technological changes in intermediate heavy electrical equipment?

– Identify the potential for separation of production activities, by product or process center, to reflect differential economies of scale and to increase options in relocation of subsectors of the industry.

– Identify the potential for increasing the labor component through redesign of production machinery, changed tooling and fixtures, increased utilization of facilities, substitution of labor in machine-peripheral activities, and reduction in production-unit size of intermediate heavy electricals.

2.4 Costs

– Identify the costs characteristics for intermediate heavy electrical equipment that significantly affect the ability of industrializing countries to price-compete on the international market. The World Bank analysis suggests that intermediate production scale, standardized technology, and reduced level of R & D requirements are significant contributors to the potential competitive production of intermediate heavy electricals in industrializing countries. This needs to be empirically tested, and the results applied to other heavy electrical categories.

– Identify the effects of distortions in monetary exchange rates on developing the export potential of intermediate heavy electrical equipment.

– Analyze compilations of international comparison of prices and factor costs for select countries with short-term forecast price changes.

– Identify and analyze the occurrence of wage factor distortions on the viability of manufacturing heavy electrical equipment in developing countries.

– Identify and quantify the effects of scale of production on costs for intermediate heavy electricals.

2.5 Location Requirements

– Identify what financial facilities are needed in new locales to support manufacturing of heavy electrical equipment, particularly requirements to finance work in process and long-term repayments.

2.6 Market Development

– Analyze potential for regional trade among industrializing countries. What are the complementation agreements necessary within the heavy electricals group by major region?

– Identify the specific groups of heavy electrical products that might be included in regional complementation agreements to increase opportunities for balancing distribution of benefits attributable to location within the region. Identify alternative groups of industries to which heavy electricals are complementary to facilitate regional agreements.

– Investigate the need and feasibility of cooperative procurement scheduling in a region that could serve to forecast and consolidate market and user demand for intermediate heavy electricals and to reduce the effects of demand fluctuations in increasing production costs and scheduling problems.

– Assay potential role of regional financial institutions in facilitating market development.

2.7 Structure of Industry

– Identify opportunities and practices pertinent to industrialization of heavy electrical equipment in developing areas in terms of arrangements of international firms such as licensing agreements, pricing agreements, and market integration.

– Evaluate the need and opportunity for potential new enterprises in select subsectors and industrializing regions.

– Review with major international producers the potential for relocating manufacture of select heavy electrical equipment to industrializing areas.

2.8 Interindustry Linkages

– Identify and analyze the viability of ancillary industries supportive to the manufacturing of intermediate heavy electrical equipment.

2.9 R, D & E

– Identification of changes in R, D & E programs necessary to support the technological advance of intermediate heavy electrical equipment in industrializing regions.

2.10 Development Criteria

– Identify the development criteria that should be used to select specific products within the heavy electrical group in which relocation to industrializing countries should be considered. For example:

—— monetary costs in terms of foreign exchange, consumer prices, government revenues, and private profits;

—— interindustry linkages both vertical and horizontal potentially resulting from, and needed in support of, the relocation;

—— direct and indirect employment in the recipient countries and parallel unemployment in the industry-exporting countries;

—— training opportunities provided in the recipient countries and retraining requirements for unemployed resulting from relocation in the industry-exporting country;

—— infrastructure costs in terms of both direct requirements such as plant facilities and services and indirect requirements for support of workers such as housing, schools, and health facilities;

—— pollution effects and their clean-up costs.

– Evaluate the changes in benefits and costs attributable to specific relocation plans for select subsectors of the heavy electrical group, such as intermediate equipment, by comparing the identified development criteria.

– Determine the weight of each criterion in overall benefits and costs. Assess variation, if any, in the significance of such criteria among different countries.

Industry Analysis: World Textiles

Objective

The primary objective would be to prepare information and criteria needed for international expansion and redistribution of production in the textile industry and the progressive freeing of trade in mill products, apparel, and man-mades.

Expansion of production and trade in the world textile industry requires some guidelines to permit the creation of activities in industrializing countries that both meet domestic requirements and permit exports, and to accelerate shifts in the advanced countries into new activities. To achieve these goals will require a modernization (or at least improvement of performance) in developing country industries plus a movement of the industry to the available labor supply and to locations from which the markets can be best served. Such modernization will require new management practices, transfers of technology and skills, the sale of machinery by advanced countries to the developing countries, and worldwide marketing efforts.

To permit sales by the developing countries to advanced country markets will require improvement in the quality of products, diversity of styles, and low-cost production. Pressure against imports into the advanced countries must also be reduced, which can be done only by a program of sectoral rationalization within and among these countries.

A program of rationalization must be a continuing one, for new countries will seek to enter the road to industrialization through textiles. A continuous roll-over of the industry is required, passing from the more advanced sectors within a country to less advanced and out to other countries—as is occurring in the Far East, for example, the Japanese policy of limiting the number of spindles in operation by each plant and adapting to the shift of production to Southeast Asian countries. A removal of redundant and inefficient production is required in the advanced countries, which means a concentration of the industry or at least an elimination of marginal operations.

For the industrializing countries, guidance is needed in programming new investments and expanding existing plants—not only in terms of capacity, but also in terms of technology used, product lines, sales efforts, management, and financing. The objective is not merely to establish *an* industry but also to provide employment in supporting and complementing activities. In providing guidelines, some criteria will have to be developed to determine the stages at which it would be advantageous for different industrializing countries to expand into export markets.

Scope of Study

To provide information for these objectives, studies would be required that cover every significant facet of the industry: potential markets in industrializing and industrialized countries, existing capacities, changing technologies and the appropriate one for each country, intercompany ties within the industry and across national boundaries, industrial structure, efficiency, production levels, materials supplies, marketing techniques, quality control, management techniques, labor supply, location, transport, import barriers, export incentives, financing, and trade in materials and products with the Eastern countries.

Each of these studies should be undertaken with reference to the three main categories within the industry: mill products, apparel, and man-mades. The problems in the cotton sector are different from those in wool or synthetics; shifts in consumption patterns will alter the capabilities within the industry over the world. A particular problem is raised by the possibilities of swaps of fine fibers (such as alpaca) from the developing countries to the advanced for processing, in exchange for low-quality fibers more useful in developing country markets—or, alternatively, the establishment of industry in developing countries for manufacture of fine fabrics for marketing in advanced economies. At present, the use of fine fibers in industrializing countries wastes valuable resources for earning foreign exchange. A similar swap is feasible in the synthetics and blends.

An examination will be necessary of the impacts of different technologies (more or less labor-intensive) on the performance of textile mills in industrializing countries, on the problem of employment, on incomes, on exports. It is conceivable that labor-intensive techniques will provide fabrics only for the domestic market and that export markets must be served through use of more advanced technologies (at the other extreme, the cottage handmades may be exportable, but the volume is small).

Methodology

A number of useful studies have already been made of the textile industry, most related to the period up to 1966, e.g., on the U.S. industry by the Tariff Commission, on the Latin American by the Economic Commission for Latin America, and on the British rationalization experience. The United Nations has sponsored some conferences on the industry, for which substantial documentation was provided. The first task would be to update these materials, where needed and relevant.

The study would then examine such questions as the following:

– What criteria can be established as a basis for identifying the segments of the textile industry that would benefit from international relocation?

– What categorization of product structure is relevant to identifying the segments likely to benefit from locational shifts? How do such shifts relate to phases of product life cycle? To varying rates of market growth? To costs of production inputs–including labor costs–at various stages of development?

– What criteria are usable to identify regions to which such segments can or should relocate?

– What facets of R & D can countries at different stages of textile-industry development feasibly launch, and with what results? In what segments of the industry can developing countries reasonably seek to introduce new product varieties or gain entry during early and expanding phases of product life cycle?

– What quantitative effects in different categories of industrialized and industrializing countries are implied by such shifts in different segments?

– What estimates of benefits and costs can be made in connection with possible quantitative shifts: in terms of employment, retraining, effects on particular regions and companies, and secondary multiplier effects?

Regional and country studies would be made to permit assessment by each group concerned of the benefits and costs of alternative courses for the future development of the textile industries. At this point, the initial phase of the research might be concluded with detailed presentation of the findings, for

evaluation and possible agreement by various countries concerned on lines of action to be pursued.

Included within the findings of the initial phase would be specific recommendations for action of the following kinds:

– Deficiencies within the textile industries of developing countries caused by obsolete and poorly utilized equipment and poor management should be removed, with assistance from the advanced economies.

– Sale of textile machinery to developing countries should be accompanied by arrangements permitting earning of exchange to pay for the machinery, or grants provided.

– A mechanism should be established to assist in the transmittal of technology and in the inspection and certification of sales of secondhand equipment.

– Financial management of companies should be improved by better procedures for use of capital generated internally (instead of the decapitalization which now takes place). Attention must be paid to the impacts of unstable exchange rates on both materials imports and product exports and to possible impacts of high interest rates in preventing development of export capability.

– Redundant plant in advanced countries should be eliminated by forced scrapping of old equipment when new equipment is installed, and other adjustments should be facilitated.

Experience following this major analytical study would be observed to test its effects: to determine if such detailed illumination of specific lines of advantage to expansion of the textile industry in developing countries, and shifts from advanced economies, leads to satisfactory progress. Variations in results in different branches of the textile industry and in different regions would be analyzed and interpreted for the light they may throw on the structural characteristics and adjustment problems of the segments and areas concerned.

If results are generally unsatisfactory, a second major phase of study might be designed. This could seek to formulate specific guidelines, quantitative in nature, for changes in advanced countries and for allocations of growth potentials among various categories of industrializing countries. The success of various national programs of rationalization would be compared and lessons drawn. Comparisons would also be made with cooperative arrangements in other industries, such as the United States - Canada auto agreement, to test what conclusions or new approaches might be applicable also in the textile industry.

Results of such a second phase, if conducted, could be in consistent guidelines for complementary allocations of growth potentials to various groups, fostering increased trade between the developing and advanced

countries based on a willingness to follow broad criteria on investment policy, quality control, modernization, and market penetration. Indicators and various price mechanisms would be suggested to help guide countries on investment and rationalization programs.

Experience of catalyzing and coordinating such joint studies would contribute to the identification of possible institutional mechanisms, such as an International Textile Rationalization Agreement and supporting instruments, to give effect to efficient, equitable lines of development of the kinds explored in the research.

Iron and Steel Industry: Technological Change, Scale, and Market Integration Factors

The iron and steel industry is almost always thought of in terms of an integrated industry. It is also believed that there are substantial economies of scale, and that the larger the plant size, the more efficient and viable it is. For example, one often refers to the experience in Japan, where there are steel plants of 12-million-tons capacity, e.g., the Fukuyama Plant of NKK, which is currently producing over 12 million tons and is undergoing expansion and will have a capacity of 18 million tons by October 1973.

Yet, many steel plants in Japan and elsewhere are much smaller. Even with basically the same technology, there is a wide choice of plant size and combinations of various inputs and levels of integration that may be suitable for a particular country at a particular stage of development, taking into account the different factor prices and relative costs of various inputs relevant to that country. An in-depth study would be interesting and useful of the efficiency of steel plants of different sizes in Japan, Germany, India, and elsewhere, with thorough comparisons of technological input-output relationships, norms of consumption, tap-to-tap times, and costs.

Even a cursory examination of the iron and steel industry suggests that economies of scale may lie principally at the steel-making stage, namely in the blast furnace - LD converter - continuous-casting complex. The production of bars and rods and wire rods can perhaps be done as efficiently in smaller rerolling mills spread around the country or in different countries of a region. The same may apply to further processing of wire rods into wires and wire productions. Similarly, converting bars and rods into twisted bars need not necessarily be done in the same place as the rerolling of billets into bars and rods. The same questions apply to tinning lines, galvanizing lines, corrugation of sheets, decoiling and shearing of coils, and, of course, cold-rolling and other processing of hot-rolled sheets/coils. A detailed study might also indicate that even the production of hot-rolled sheets/coils need not be done

in an integrated steel plant, but that conversion of slabs into hot-rolled sheets/coils/plates can be done economically in smaller units located far away from a steel plant producing basic steel or slabs/blooms.

In the context of market development for iron and steel sections and intermediate products in a large developing country, or region of several countries, to what extent can each segment or component of the industry be considered as an industry in itself? Market relationships are here of central importance. Knowledge is also required, for each segment, of its own economies of scale, range of input-output relationships, requirements of skilled labor, and choice of technologies. Such data would permit, for various market areas, analyses to work out the appropriate size, technology, and location for each segment individually, rather than treating the iron and steel industry as if it is an indivisible and integrated single industry.

Studies might reveal that there are some economies in the integration of various components or segments of the industry, but it is important to know what the trade-offs are. What do we lose in economic terms when we go away from the concept of an integrated industry, as against advantages we may have in de-integrating and dispersing—locationally and otherwise—different segments of the industry? Similarly, it will be useful to know what the pros and cons of different scales of the industry are, i.e., what the trade-offs are when we go away from the largest economic size of plants to smaller sizes.

Such studies have wide implications for developing economies. The resource base, location of existing and prospective consuming industries, factor proportions, and relative availability and prices of different inputs vary widely between developed and developing countries and between one developing country and another. Experiences of the developed countries are not likely to be entirely relevant unless analyzed in depth from the viewpoint of developing countries.

The analysis could be even richer if it considers the new technological developments now taking place, for example, direct reduction or production of sponge iron/prereduced pellets. As of now, units producing steel based on sponge iron/prereduced pellets use these along with scrap as feed material directly in an electric arc furnace. These are small plants. These processes should be studied in sufficient depth to work out the mix of technologies that is most suited to particular sets of conditions. The sponge iron/electric arc furnace route, for example, is very power consuming. In an economy where power is in short supply or is expensive to generate or may just not be available in the intensity required in the electric arc furnaces, the solution may lie in skipping the electric arc furnace, producing sponge iron/prereduced pellets using noncoking coal and feeding it into a blast furnace. This could reduce coke consumption substantially—perhaps from 900 - 1000 kgs in an integrated steel plant in a developing country to 300 - 350 kgs per ton of hot

metal. This would be particularly relevant for countries like India whose coking coals are poor in quality and of high ash content, and which, from want of foreign exchange, cannot afford to import better-quality coking coals.

If a major effort is mounted, collecting operational data as well as data on costs, both capital and running, from steel plants in several countries, as well as from research institutions that are working on new technological development, a basis will be achieved that is not available today for making decisions on the development of the iron and steel industry. Alternatives to be assessed may be in the direction of using more labor-intensive techniques, at least in certain segments of the iron and steel industry; toward descaling in certain segments and spatial dispersion between either different regions of the same country or different countries of a region like Southeast Asia. Ecological effects and costs of steel production in alternative geographic configurations would also be assessed. This information will permit analysis of the relative economics of shifting steel industries or segments thereof from developed countries like Japan, Germany, or the United States to less developed countries, with potential benefits and economies to both the developed and developing countries.

One can visualize a situation in which the comparative advantage of setting up a steel industry in a country like Brazil or India might be higher than in a country like Japan, particularly for certain segments of the industry, say steelmaking proper. If production of steel up to the ingot or slab/bloom stage can be more economically done in India than in Japan and Japan undertakes the rolling activity only, benefits to Japan could include reduced costs, concentration on high-value rolling activity, and reduction of pollution. India would benefit because it would be exporting steel to Japan instead of iron ore, as at present, and in the process earning more foreign exchange and generating greater economic activity and employment at home.

Formation of Industrial Machinery Markets: Machine Tools

How industrial machinery markets are formed in developing countries is pivotal to the course of their industrialization, but has been subjected to little systematic study. Decisions by both buyers and sellers of industrial machinery are influential in shaping the country's industrial structure. Applied studies of key machinery markets, such as markets for selected machine tools at different stages of development, could contribute to sound growth of the industries concerned and to understanding of their wider ramifications.

Characteristics of Machine Tool Markets

Several inherent features of industrial machinery markets shape the scope of useful applied research, at different stages of development.

1. In early phases of industrialization, demand estimates for industrial machinery may prove wrong as often as they prove correct. Procedures for estimating demand by quantity, value, variety, and quality of machinery are difficult to evolve because of variable factors, which include shifting of industrial strategies because of national exigencies, cut-and-try methods during early planning periods, unbalanced growth of interrelated industries, and erratic market development because machinery buyers do not yet know what they need. In a developing country the rate of growth of technology is, in one sense, faster than in an advanced economy because of the low starting base. The result is rapidly changing customer preferences with growing exposure to modern technology and tools, leading to redundancy of investment in supplying industries.

2. Many machinery markets are marked by sharp duality. In one sector, small, labor-intensive firms produce low-precision, low-volume machines for their own use or for labor-intensive production in other industries. The organized sector is served by imports, or by larger, relatively modern plants. A sizeable gap in marketing skills and finance, sizes and grades of machinery, and production methods exists between the two sectors.

3. Product differentiation among machine tools is also acute. This retards dissemination and exchange of valid information on specific types of machinery suited to local conditions. User industries tend to prefer machinery that has been well established internationally, often without close determination of its suitability to local requirements.

4. Machine tools typically involve high labor content of technical, skilled, and semiskilled categories. They also require talented, trained design and engineering personnel, whose preparation involves many years' lead time. Machine tool product design in turn significantly affects the labor-adaptability of user industries.

5. Medium-size firms play an important role, but are at a handicap internationally in gaining sufficient knowledge of marketing factors and design parameters to build a sound base for licensing and joint venture arrangements.

6. Recent technical advances conflict in labor-capital propensity. Numerical printout devices measuring the tolerance of finished parts, for example, can potentially make lower-precision, labor-using machine tools economic at certain wage sets. Opportunity exists for identifying design parameters to achieve factor use at lowest costs, geared to realistic expansion in employment.

Levels of development of user industries, design, and engineering skills are key factors in determining a country's ability and readiness to enter industrial machinery manufacture. The International Industrialization Institute's analysis, with suitable collaboration, of international machine tool development could therefore be organized with respect to two different groups of countries.

Formative Phase for Newly Industrializing Countries

1. Carrying out market research in three to five newly industrializing countries to penetrate beneath the array of machine tools now available to determine types and sizes of machine tools needed to improve productivity, given the country's endowments.
2. Supporting such estimates through industrial engineering analyses of alternatives in choice of machine tools.
3. Disseminating to machinery buyers, plant superintendents, foremen, salesmen, polytechnic and skilled machinist schools of analytical guides to choices of machines.
4. Including national personnel in institute study teams so that they gain experience in how to assess market requirements by type of machine, price level, output, and quality.
5. Identifying the infrastructure that needs to be developed for the emerging industry.
6. Planning for the requisite manpower, especially for design and engineering personnel, and for their advanced training and in-company placement overseas for development of specialized skills.

Productivity Increases in Semi-industrialized Countries

1. Disaggregation of design parameters governing machine tool technology in advanced economies to identify alternative parameters relevant to lower-volume output and labor-intensive product design in semi-industrialized and industrializing countries.
2. Assessment in select semi-industrialized countries of requirements of medium-size user companies for machine tools, especially in the gap between special-purpose, high-volume machines used in advanced economies and the general-purpose, low-output, uneconomic machines typically available.
3. Determination of design parameters to meet machine tool gaps, in terms of type, volume, levels of precision, rates of feed, and principal attachments and subunits.

In a region of several medium-size, semi-industrialized or industrializing countries, this second phase of study could be extended to specific possibilities for regional cooperation. Here, market requirements, design parameters, and proposed manufacturing technologies would be examined in the context of possible regional standardization. Suitable attention would be given to development of subunits such as clutches, braking devices, lubrication pumps, optical units, and other controls, with a view to dividing tasks among various countries. Finished and semifinished subunits and components with scope for export from developing to advanced economies could also be identified.

Such preliminary approaches to applied research for machine tool market development would be elaborated and detailed in consultation with potential collaborators such as engineering industry associations; the Central Machine Tool Institute, Bangalore; and agencies like UNIDO or UNDP whose resources may contribute to the development of engineering and design personnel required to implement guidelines and programs for machine tool development resulting from the international analyses.

Automotive Industry: Country and Regional Analysis

In the study of major industries, the standpoint adopted would be that of helping countries to determine their best industrial means of meeting their needs for construction, transportation, communcation, and other basic public and private demands in the society.

As an example, the institute might examine the problems of developing the industrial base for transport systems (nationally and regionally among a group of countries). The first questions on the demand for different types of transport and the facilities in existence and the costs of alternative routes and facilities might well be answered by relying on work already done by several countries or specialized groups. The second questions on what types of transport are needed or sought by various countries would be answered by discussions with them and analysis of various development plans. Out of these examinations would come a judgment on different transport facilities that would be useful—perhaps including the use of rapid mass transit, urban transit, passenger autos, and other facilities. Analyses would be made on the economic, technological, and environmental feasibility of each type of facility.

Assuming that use is to be made of passenger autos and the volume is sufficient to induce some type of production within the country, questions such as those in the following list would be pursued.

A. Industry Analysis

1. What type of vehicle should be produced–for mass consumption? multipurpose? service? cargo transport? luxury?

2. What market should be served–local? regional? international? What shifts in the markets should be anticipated, from the national to regional and international?

3. What locational factors need to be considered for different auto industry segments?

4. What stage of production should be within each country–assembly? high local content? complete fabrication and assembly?

5. What degree of specialization in componentry should be sought? What particular parts, pieces, or components should be produced? What technology used? What potential trade patterns could be expected from specialization in particular components–from the standpoint of both regional specialization and international specialization?

6. What industrial structure and what company structure should be sought?

7. Would it be desirable to integrate the sector created with activities of multinational enterprises in the auto industry? How should this integration be developed–through licensing? joint ventures? wholly owned affiliates? government-private joint ventures?

B. Country and Regional Analysis

1. What capital availabilities would be required to support an auto industry, given the different structures of the industry and company relations posited in A?

2. What are the manpower needs and availabilities? What training would be required? What management skills and level of entrepreneurship are required?

3. What are the effects on secondary and tertiary industry?

4. What are the balance-of-payments effects of the industry on the country, for example: What aids would be required to develop an export activity in this industrial sector? What would be the capital-import requirements, as well as the capital-payment requirements over future years?

5. What are the effects of the auto industry on fiscal policies, and what are the effects of various fiscal policies on development of the auto industry?

6. What are the ecological effects of the auto industry and the use of its products? Pollution?

7. What would be the impacts on urbanization, and on various segments of infrastructure such as water supply, housing, education, and other services?

*8. What are the socio-psychological effects of different technologies and different industrial structures and management techniques on the individual workers?

*9. What institutional changes would be concomitant with the creation of the auto industry or segments thereof–in terms of habits of work, retirement, marketing modes, housing, and living modes?

Industrial Factor Prices, Distortions, and Impacts

Recent studies show that industrial factor prices in many developing countries have been distorted, principally through overvalued labor rates and undervalued cost of capital, particularly foreign capital. These distortions, typically associated with protection policies and import substitution, have significantly influenced the course of industrial development. Because of undervaluation of capital, industry has overpurchased capital equipment, particularly equipment that is not labor intensive. This action is supported by the overvalued labor wage rate in the modern sector. This tendency toward capital-intensity has been compounded by the availability of foreign aid and tied loan agreements that subsidize capital equipment, particularly capital equipment coming from areas where price factor relationships warrant capital-intensive production facilities.

Research is required on industrial factor prices and distortions in several areas: first, on the basic identification and quantification of international industrial cost factors, and distorting factors; second, analysis of their impact on specific industries and on overall industrial development in different types of economies; and third, on various policy measures promoting movement to factor prices commensurate with the factor endowments of developing regions.

In its contributions to comparative industry analysis and to the development of criteria, methodology, and information for industry selection, the institute would be concerned with establishment of analytical series such as the following:

– Identification of cost factors pertinent to specific industries or groups of industries in indicating comparative advantage.

*Questions 8 and 9 call for collaboration with specialized research institutions, beyond the usual collaboration with host-country planning agencies and potential industry participants.

– Development of systems of data collection and analysis to identify industries and industry segments whose relative comparative advantage is changing among regions and countries.

– Development of an international industrial factor price comparison system, industry specific, disaggregated to show regional differences and thereby facilitating comparative cost analysis.

– Development and testing of an "international" price to substitute for a shadow price where needed.

– Analytical procedures for adjusting factor prices to variations in exchange rates among different countries.

– Criteria for factor-pricing guidelines of industrial subcomponents and intermediates where production is distributed among countries with separate monetary systems; and analysis of international prices for selected items in comparison with such criteria.

The institute, as a background to, and concomitant of, specific industry analyses, would seek to develop systematic information of the following kinds on industrial factor price distortions:

– Identification of major industrial inputs and products subject to price distortions in developing countries and compilation of international prices on a limited set of these items for use by developing countries.

– Identification of price distortion on nontraded goods in developing countries and analysis of their impact on industrial pricing and investment decisions.

– Identification and analysis of distortions in industrial factor prices particularly due to trade barriers, administrative controls, and exchange rates, particularly as they promote, inhibit, or distort industry growth.

– Identification and analysis of the principal factor distortions that significantly contribute to unfulfilled development goals. Description of the resources, information, policies, and institutions necessary to correct these distorted factor prices.

With specific regard to labor wage rates, questions to be examined include:

– Analysis of the historical development of wage differentials between the modern manufacturing sector and other sectors, and within the manufacturing sector.

– Analysis of the price of labor as it reflects its social and economic cost.

– Description of relationships between overvalued labor wage rates and distortions in monetary exchange rates.

– Identification of specific labor skill areas in which wages are overvalued.

– Identification of the industries or industrial products in which overvalued labor wages cause significant product-cost increases.

– Quantification of these cost increases.

– Description, analysis, and evaluation of past performance of methods of reducing labor cost through wage subsidies, indirect or direct.

– Identification of possible innovative forms of wage subsidies in the industrial sector.

– Description of the mechanisms and institutions necessary to implement them.

– Evaluation of their potential effectiveness in stimulating the industrial sector; in shaping its course of development.

– Evaluation of the potential benefits and costs of such measures in the development of the industrial sector vis-a-vis other sectors of the economy in contributing to employment, income, and other development goals.

Appendix B
Terms of Reference

The terms of reference for the study, as defined by AID in collaboration with NAS, are as follows.

A. To assess the need, feasibility, and potential viability of an International Industrialization Institute, which in relation to developing countries would:

1. have the capability for research, demonstration, and extension functions, focusing on industrialization as one element of development;
2. have as its general objectives:

a. to improve the understanding of the industrialization process in the developing countries during the next decade in relation to the total development process,

b. to explore, develop, and test operational methodologies and project approaches designed to enhance the industrialization process that can form the catalytic basis for full-scale application by the developing countries—emphasizing participation of the industrial sector in both developed and developing countries,

c. to disseminate, in ways that will have an impact, the knowledge and experience gained to the private and public sectors of both developing and developed countries, as well as multinational agencies concerned with development;

3. have as its principal outputs:

a. conceptual knowledge of direct relevance and interest to developing countries in a usable form,

b. tested approaches that are feasible for adoption by developing countries and have demonstrated high benefit/cost ratios,

c. a cadre of experienced experts available to work on a sustained basis in problems of industrialization.

B. To examine reasonable alternatives to meeting the need for an institute.

C. To recommend for such an institute:

1. general character structure
2. types of problem focus
3. initial program directions
4. modes of operation
5. nature of outputs and clientele
6. relationships with private and public sectors of both developing and developed countries
7. relationships with existing national and multinational assistance agencies.

D. To make recommendations regarding an Interim International Industrialization Institute which might be established for limited operation during a 3-year period to test the concepts for an International Industrialization Institute and explore possible operating procedures, including:

1. desirability and feasibility
2. scope and objectives
3. character, structure, and organization
4. requirements and possible sources for management, staff, funds, and facilities
5. steps and timetable for establishment.

E. Other techniques or means for testing the viability and demand for the services of the proposed institute will be investigated as possible alternatives to the establishment of the interim institute.

General Character of Study

If an institute (or alternative) is found to be desirable, the study should provide a rationale, as well as concept, of organization and operation sufficiently developed to serve as a basis for management decisions concerning initial investments.

The study should include a review of previous and current programs of foreign assistance in the industrialization sector; articulate and, to the extent possible, document the aspects of the proposed institute that will enable it to meet the needs of developing countries more effectively than existing institutes. In describing the institute, particular attention should be given to:

1. close linkages with developing countries

2. relevance of activities to societal problems as perceived by developing countries
3. multinational participation
4. involvement of the industrial sectors of both developed and developing countries
5. flexibility and responsiveness to developing country interests
6. multidisciplinary and innovative approaches that offer high payoffs
7. excellence of effort

Appendix C
List of Conferees

The following persons were consulted in the course of the study of the need for and feasibility of an international industrialization institute. The list is arranged by date and by place.

NEW YORK AND WASHINGTON

25 February 1972

JOEL BERNSTEIN, Assistant Administrator, Bureau for Technical Assistance, AID, Washington, D.C.

2 March - 5 April 1972

DAVID BELL, Vice President, International, The Ford Foundation, New York
FRANK SUTTON, Deputy Vice President, The Ford Foundation, New York

OJETUNJI ABOYADE, Lecturer, Economic Development Institute, IBRD,* Washington, D.C.
WILLIAM DIAMOND, Director, Development Finance Companies Department, IBRD, Washington, D.C.
HELEN HUGHES, Chief, Economics of Industry, IBRD, Washington, D.C.
GEORGE KALMANOFF, Deputy Director, Industrial Projects Department, IBRD, Washington, D.C.
FREDERICK T. MOORE, Economic Adviser, Industrial Projects Department, IBRD, Washington, D.C.
GRAEME J. THOMPSON, East Asia and Pacific Department, IBRD, Washington, D.C.
STOKES M. TOLBERT, Chief, Indonesia Division, IBRD, Washington, D.C.
DONALD J. WOOD, Eastern Africa Department, IBRD, Washington, D.C.

WILLIAM GAUD, Executive Vice President, International Finance Corporation, Washington, D.C.
MOEEN A. QURESHI, Economic Adviser, International Finance Corporation, Washington, D.C.

EPHRAIM BIEGUN, Consul for Scientific Affairs, Consulate General of Israel

*A dictionary of acronyms follows this list.

AVRAHAM HERMONI, Scientific Counselor, Embassy of Israel, Washington, D.C., New York

LESTER BROWN, Overseas Development Council, Washington, D.C.
JAMES GRANT, President, Overseas Development Council, Washington, D.C.

STIG ANDERSEN, Director, Office of Technical Cooperation, UN, New York
BENJAMIN BARG, Chief, New Technologies Section, Office of Science and Technology, UN, New York
RAJNIKANT DESAI, Deputy Director, Office of Science and Technology, UN, New York
PAUL GOLLONG, Senior Scientific Affairs Officer, Office of Science and Technology, UN, New York

ARTURO CHAVEZ, UNDP, New York
A. B. HARLAND, Senior Technical Adviser, Bureau for Program Coordination, UNDP, New York

ADLY ABDEL-MEGUID, Chief, Export Development Unit, UNIDO, New York
A. J. AIZENSTAT, Director, UNIDO, New York

WILLIAM BREDO, Vice Chairman, Executive Committee, WAITRO
P. C. TRUSSELL, Secretary-General, WAITRO

SIMEON O. ADEBO, Executive Director, UNITAR, New York
BERNARDO DE AZEVEDO BRITO, First Secretary, Delegation of Brazil to the UN, New York
W. DAVID HOPPER, President, International Development Research Centre, Ottawa
SHARAD S. MARATHE, Economic Minister, Embassy of India, Washington, D.C.
GEOFFREY OLDHAM, University of Sussex, England
RUTHERFORD POATS, Vice President, Overseas Private Investment Corporation, Washington, D.C.
ANDREW RICE, Executive Director, Society for International Development, Washington, D.C.

PARIS

15 - 16 May 1972

MARC CHAPDELEINE, Science Policy Division, UNESCO
WILLIAM PLATT, Director for Educational Planning, UNESCO

PAUL - MARC HENRY, President, OECD Development Centre
PATRICK MORRIS, U.S. Delegation to OECD
MARTHE TANZER, OECD Development Advisory Committee
ANDRE VINCENT, OECD Development Advisory Committee
MONTAGUE YUDELMAN, Vice President, OECD Development Centre

VIENNA

17 - 19 May 1972

G. E. ELEISH, Chief, Survey Section, IPPD, UNIDO
MILAN FRANEK, Chief, Export Industries Section, IPPD, UNIDO

FRANCOIS LE GUAY, Director, IPPD, UNIDO

HANS FAHLSTROM, Adviser to the Director, ISID, UNIDO
LOUAY KATKHOUDA, Chief, Industrial Institutions Section, ISID, UNIDO
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JACCE LEVITSKY, Small-Scale Industry Section, ISID, UNIDO
SUBRAHMANIAM NANJUNDAN, Small-Scale Industry Section, ISID, UNIDO
ARNE RUBIN, Industrial Institutions Section, ISID, UNIDO
JOSEPH E. STEPANEK, Director, ISID, UNIDO

N. K. GRIGORIEV, Director, ITD, UNIDO
FRANK NORMAN, Officer in Charge of Engineering Industries Section, ITD, UNIDO
M. C. VERGHESE, Chief, Fertilizers, Pesticides and Petrochemicals Industries Section, ITD, UNIDO

I. H. ABDEL-RAHMAN, Executive Director, UNIDO
JORGE PABLO FERNANDINI, Ambassador, Permanent Representative of Peru to UNIDO, Coordinator, UN-UNIDO Review Panel
GANGADHAR S. GOURI, Chief, Coordination and External Relations Section, UNIDO
LENNART MASRELIEZ, Head, Swedish Delegation, UNIDO

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20 - 24 May 1972

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IGNACIO AGUILAR, Gerente General, ANDI
GABRIEL POVEDA, Vicepresidente Tecnico, ANDI
LUIS PRIETO, Presidente Nacional, ANDI

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HERNANDO GOMEZ, FEDESARROLLO

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JORGE ATUESTA, Presidente Encargado, Sociedad Colombiana de Ingenieros
MIGUEL BERMUDEZ PORTOCARRERO, Director, FICITEC
RAMIRO CARDONA, Jefe de la Unidad de Desarrollo Regional y Urbano, Departamento Nacional de Planeacion
ALEJANDRO FIGUEROA, Viceministro de Desarrollo Economico, Ministerio de Desarrollo Economico
SIMON GONZALES,Presidente, INCOLDA
EDUARDO NIETO CALDERON, Presidente, Banco Popular de Colombia
ALBERTO OSPINA T., Gerente, Fondo Colombiano de Investigaciones Cientificas

GUILLERMO E. PERRY R., Director, Center for Development Economics
JORGE RODRIGUEZ ARBALAEZ, Director, Instituto de Integracion Cultural
RODRIGO URIBE ECHAVARRIA, Presidente, Coltejer
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JARDY SELLOS CORREA, Vice President, Chief Economist, BNDE
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ROMEO DINIZ DE CARVALHO, Ministry of Planning (Science and Technology)

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JOSE PELUCIO FERREIRA, Presidente, Ministerio do Planejamento e Coordenacão Geral, FINEP, (Deputy-Secretary General of the Ministry of Planning, in charge of Industry, Science, and Technology)

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WILLIAM ELLIS, Director, USAID Mission
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ANTHONY J. INGHAM, Diretor-Servicos Tecnicos, ADELA
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ALBERT HIRSCHMAN, Professor of Economics, Harvard University
MILTON KATZ, Professor of Law, Harvard University
MAURY KILBRIDGE, Dean, School of Design, Harvard University
EDWARD S. MASON, University Professor, Harvard University
HENRY J. STEINER, School of Law, Harvard University
ROBERT STOBAUGH, Professor of Business Administration, Harvard University

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PETER EIGELSON, School of Engineering, MIT
PETER GRIFFITHS, School of Engineering, MIT
EVERETT HAGEN, Professor of Economics, MIT
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SHIGETO TSURU, President, Hitotsubashi University

HIROYUKI HISAMIZU, Economist, Research Department, Industrial Bank of Japan, Ltd.
HIROO SASAKI, Manager, Research Department, Industrial Bank of Japan, Ltd.

HIDEO FUJIMORI, Economic Growth Division, Institute of Developing Economies
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TOSHIO TOYODA, Chief, Economic Growth Division, Institute of Developing Economies
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23 - 26 June 1972

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27 - 28 June 1972

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SINGAPORE

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INDONESIA

2 - 4 July 1972

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WASHINGTON, D.C.

5 July 1972

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BOMBAY, INDIA

5 - 9 July 1972

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RAMU PANDIT, Secretary, Indo-American Chamber of Commerce
F. F. RICHARDSON, Management Consultant

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10 July 1972

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ATUL SARMA Junior Economist, Sardar Patel Institute of Economic and Social Research

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11 July 1972

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ADDIS ABABA, ETHIOPIA

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ADE OYELABI, Nigerian Institute of Social and Economic Research, University of Ibadan

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WASHINGTON, D.C.

12 & 13 December 1972

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ALEXANDER SHAKOW, Bureau for Asia, AID

11 January 1973

JOEL BERNSTEIN, Assistant Administrator, Technical Assistance Bureau, AID

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NEW YORK, NEW YORK

1 March 1973

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CHARLES REED, Senior Vice President, Corporate Executive Staff, Technical Resources, General Electric Corporation
STANLEY SMITH, Senior Vice President, Corporate Administrative Staff, General Electric Corporation

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WILLIAM H. WENDEL, President, Carborundum Company

WASHINGTON, D.C.
5 April 1973

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CHARLES WEISS, Science Adviser, Office of the Vice President of Development Policy, World Bank

STAMFORD, CONNECTICUT
12 April 1973

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ROBERT SCHNEIDER, Assistant to the Chairman of the Board, Xerox Corporation
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Acronyms

ACOPI	Asociación Colombiana Popular de Industriales (Colombian Association of Small Industries)
ADELA	Atlantic Community Development Group for Latin America
AID	Agency for International Development (USA)
ANDI	Asociación Nacional de Industriales (National Association of Manufacturers, Colombia)
ASCRT	Applied Scientific Research Corporation of Thailand

BADESP	Banco de Desenvolvimento de Estade de São Paulo (Development Bank for the State of São Paulo, Brazil)
BAPPENAS	Badan Perentjanaan Pembagunan Nasional (National Development Planning Council, Indonesia)
BNDE	Banco Nacional de Desenvolvimento Econômico (National Bank for Economic Development, Brazil)
BNH	Banco Nacional do Habitação (National Housing Bank, Brazil)
BOI	Board of Investments (Philippines)
CVRD	Companhia Vale do Rio Doce (Valley River Company #12, Brazil)
ECAFE	Economic Commission for Asia and the Far East (UN)
FEDESARROLLO	Fundación para la Educación Superior y el Desarollo (Foundation for Higher Education and Development, Colombia)
FICITEC	Fundación para el Fomento de la Investigación Científica y Tecnólogica (Foundation for the Promotion of Scientific and Technological Research, Colombia)
FINEP	Financiadora de Estudos e Projetos (Financing of Studies and Projects, Brazil)
GATT	General Agreement on Tariffs and Trade
IBGE	Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics)
IBM	International Business Machines Corporation (New York)
IBRD	International Bank for Reconstruction and Development
IDCJ	International Development Center of Japan (Japan)
ILO	International Labor Organization
INCOLDA	Instituto Colombiano de Administración (Colombian Management Institute)
IPEA	Instituto de Planjamento Econômico e Social (Institute of Social and Economic Planning, Brazil)
IPPD	Industrial Policies and Programming Division (UNIDO)
IRRI	International Rice Research Institute (Philippines)
ISID	Industrial Services and Institutions Division (UNIDO)
ITD	Industrial Technology Division (UNIDO)
MIT	Massachusetts Institute of Technology (USA)
MITI	Ministry of International Trade and Industry (Japan)
NEDB	National Economic Development Board (Thailand)
NISIR	National Institute of Scientific and Industrial Research (Malaysia)
OECD	Organisation for Economic Co-operation and Development
PETROBRÁS	Petróleo Brasileiro, S.A., (Brazilian Petroleum, Inc.)
PICA	Private Investment Company for Asia (Japan)
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
WAITRO	World Association of Industrial and Technological Research Organizations

L'essentiel de L'institut

L'Institut International d'Industrialisation sera un institut de recherche ayant pour mission d'accroître les connaissances du processus de l'industrialisation, dans le but d'aider les pays en voie de développement et les pays déjà industrialisés à élever au maximum la contribution de l'industrialisation à leur développement économique et social et à recevoir une part équitable de ses avantages.

L'institut sera établi de manière à assurer son autonomie et à lui permettre de percevoir clairement les problèmes cruciaux que soulève l'industrialisation. Il sera dirigé par un conseil d'administration indépendant, auto-renouvelable, ou siégeront un nombre égal de représentants des pays industrialisés et des pays en voie de développement. L'institut aura un personnel de base qui comprendra environ quarante experts de nationalités différentes, spécialisés dans diverses disciplines et notamment: l'économie de l'industrie, les sciences physiques et sociales, engineering, l'économie et le commerce internationaux ainsi que le choix des sites industriels, la commercialisation et la formation de cadres.

Le programme de travail interdisciplinaire de l'institut ne fera pas double emploi avec celui d'aucun organisme existant. Ce programme sera exécuté en collaboration avec d'autres groupes de recherche aux niveaux national, local et international, ainsi qu'avec des organismes industriels et financiers. Le siège de l'institut sera choisi, en vue de l'utilisation maximum des ressources humaines et des informations, par le conseil d'administration en consultation avec les pays hôtes eventuellement interessés.

L'institut est destiné à effectuer des ètudes prospectives, et parfois controversables, sur les opportunités ainsi que les obstacles prévisibles dans le processus de l'industrialisation. Pour assurer sa capacité à long terme de faire face avec indépendance et objectivité aux problèmes qui lui seront posés, il est recommandé que l'institut soit organisé de manière à disposer d'un financement garanti, qui lui permette de fonctionner avec un budget d'environ 6 millions de dollars par an, qui comprendrait des revenus de projets pouvant atteindre 25 pour cent du budget de fonctionnement total.

Une préférence est indiquée pour une dotation dont le revenu annuel permettrait de couvrir les programmes choisis et financés par l'institut lui-même, mais des variantes sont aussi proposées, qui nécessiteraient des appels de fonds continuels. Ces fonds seraient fournis par les pays industrialisés et en voie d'industrialisation, des organisations internationales, des institutions financières internationales, des fondations et des sociétés privées.

Le programme de l'institut accordera une grande place à la recherche appliquée visant à créer de nouveaux liens entre politique, mécanisme du marché et technologie, et d'aider ainsi à orienter les décisions de charactère industriel vers les objectifs de développement. Le programme initial serait centré sur la sélection des industries et des technolgies appropriées aux pays en fonction de leur situation particulière; l'identification des politiques visant à promouvoir la croissance d'industries sélectionnées et à rendre les économies avancées plus ajustables de manière à accélérer les transferts souhaitables d'industries dans de nouvelles localités.

La Commission internationale spéciale réunie par la "National Academy of Sciences" et la "National Academy of Engineering" pour étudier si ce projet est possible et dans quelles conditions il peut être réalisé a recommandé à l'unanimité que soit créé l'Institut International d'Industrialisation. Lors de cette étude, la Commission a bénéficié du large soutien de quelque 300 personnalités appartenant à des organisations internationales, à des organismes nationaux de développement industriel dans un grand nombre de pays très divers, et à des sociétés multinationales et nationales, qui n'ont pas ménagé leur temps pour s'entretenir de cette question avec le groupe d'étude de la Commission. Les conclusions qui ont été formulées à l'issue de ces entretiens figurent dans le rapport de la Commission, et fournissent les éléments essentiels de la base et de la structure de l'Institut International d'Industrialisation.

Concepto del Instituto

El Instituto Internacional de Industrialización será un instituto de investigación dedicado a intensificar los conocimientos relacionados con el proceso de industrialización con miras a asistir tanto a los países desarrollados como a los en vías de desarrollo a aprovechar al máximo los aportes de la industrialización en su desarrollo económico y social y a compartir equitativamente sus beneficios.

El instituto estará constituido de una manera tal que asegure autonomía y una conciencia perceptiva de las cuestiones críticas relacionadas con la industrialización. Lo dirigirá una junta directiva independiente y autoperpetuadora, cuyos miembros se designarán por igual de países desarrollados y en vías de desarrollo. En su personal el instituto contará con un núcleo de cuarenta profesionales de varias naciones, expertos en diversas disciplinas, incluyendo economía industrial, ciencias físicas y sociales, ingeniería, economía internacional y comercio, y en localización industrial, comercialización y desarrollo de recursos humanos.

El programa interdisciplinario de trabajo del instituto no duplicará al de ningún otro organismo o agencia actual. Las actividades programadas serán llevadas a cabo en estrecha colaboración con otros grupos de investigación cuya esfera de acción abarque niveles locales, nacionales e internacionales, y con la industria e instituciones financieras. La ubicación del instituto de modo a utilizar al máximo recursos humanos y de información será determinada por la junta directiva previa consulta con los países sede en perspectiva.

El instituto está concebido para llevar a cabo estudios de prospección y en algunos casos de controversia sobre nuevas oportunidades industriales y los obstáculos del caso. Para asegurar su capacidad progresiva de hacer frente a los problemas con independencia y objetividad, se recomienda que sea organizado con fondos garantizados que le permitan operar a un nivel de aproximadamente $6 millones anuales, incluyendo ingresos de proyectos hasta el 25% del total del presupuesto de operación. Se ha expresado preferencia por una dotación de fondos que rinda un ingreso anual que financie los programas patrocinados por el instituto mismo, pero también se han presentado a consideración modalidades alternativas que contemplan una

continua recaudación de fondos. Estos fondos serían provistos por países industrializados o en vías de industrialización, organizaciones internacionales, instituciones financieras internacionales, fundaciones y corporaciones privadas de comercio.

El programa del instituto pondrá enfasis en la investigación aplicada con miras a establecer nexos entre la política, los mecanismos inherentes al mercado y la tecnología, ayudando de este modo a orientar las decisiones relativas a la industria hacia las metas del desarrollo. El enfoque inicial del programa estará centrado en la selección de las industrias y tecnologías adecuadas según los países y sus características particulares; identificación de las políticas con miras a promover el crecimiento de industrias determinadas y a aumentar la capacidad de ajuste de las economías avanzadas para acelerar los cambios de localización que son deseables en las industrias.

La creación del Instituto Internacional de Industrialización ha sido recomendada por unanimidad por el Panel Especial Internacional convocado por la Academia Nacional de Ciencias y por la Academia Nacional de Ingeniería para estudiar la viabilidad y necesidad de un tal instituto. Durante la evaluación llevada a cabo, el panel recibió el generoso apoyo de más o menos 300 personas clave procedentes de organizaciones internacionales, de sectores nacionales de desarrollo industrial de un amplio grupo de países representativos, y de compañías multinacionales y nacionales, que dedicaron largas horas a discusiones con los miembros del panel de estudio. Los juicios y opiniones emitidos se han incorporado en el informe del panel y proporcionan la base sustantiva y estructural del Instito Internacional de Industrialización.

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Advisory Studies and Special Reports

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1. *East Pakistan Land and Water Development as Related to Agriculture.* January 1971. 67 pp. (out of print) Reviews World Bank proposed action program in land and water management. NTIS Accession No. PB 203 - 238.
2. *The International Development Institute.* July 1971. 57 pp. Endorses concept of new science-based technical assistance agency as successor to AID; examines its character, purposes, and functions. NTIS Accession No. PB 203 - 331.
3. *Solar Energy in Developing Countries: Perspectives and Prospects.* March 1972. 49 pp. Assesses state of art, identifies promising areas for R&D, and proposes multipurpose regional energy-research institute for developing world. NTIS Accession No. PB 208 - 550.
4. *Scientific and Technical Information for Developing Countries.* April 1972. 80 pp. (out of print) Examines problem of developing world's access to scientific and technical information sources, provides rationale for assistance in this field, and suggests programs for strengthening information infrastructure and promoting information transfer. NTIS Accession No. PB 210 - 107.
7. *U.S. International Firms and R, D & E in Developing Countries.* 1973. 92 pp. Discusses aims and interests of international firms and developing country hosts, and suggests that differences could be mitigated by sustained efforts by the firms to strengthen local R, D & E capabilities.
8. *Ferrocement: Applications in Developing Countries.* February 1973. 89 pp. Assesses state of the art and cites applications of particular interest to developing countries–boatbuilding, construction, food-processing equipment, etc. NTIS Accession No. PB 220 - 825. $4.25.
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13. *Meeting the Challenge of Industrialization: A Feasibility Study for an International Industrialization Institute.* 1973. 133 pp.

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