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**REPORT ON THE
LEMBAGA ILMU PENGETAHUAN INDONESIA
NATIONAL ACADEMY OF SCIENCES, USA**

**WORKSHOP ON
INDUSTRIAL AND TECHNOLOGICAL
RESEARCH**

**DJAKARTA, INDONESIA
JANUARI, 1971**

VOLUME III

**WORKSHOP PROGRAM DESIGN, PRE-WORKSHOP PROGRAM;
LIST OF PARTICIPANTS, RESOURCE PERSONS AND OBSERVERS;
KEYNOTE-, OPENING-, AND CLOSING ADDRESSES, ETC.**

This report is published with the expectation that the observations, findings, and recommendations presented will be of interest and value to a wide audience in Indonesia, particularly to industrial research policy makers, the industrial community as well as research workers who are concerned with industrial development, organization of industrial and technological research, the building of R, D & E infrastructure and the application of science and technology to economic and industrial development.

LIPI-WAS WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

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LIPI-NAS WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

VOLUME III

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PREFACE

The Workshop on Industrial and Technological Research was held in Djakarta January 25-30, 1971, to formulate matters to be considered and to make recommendations to the Indonesian Government.

The recommendations should be a useful means for motivating, orienting, and developing research activities -- and for building the research, development, and engineering (R, D & E) infrastructure that is needed for an effective contribution to the national goals for both general and industrial development, as set forth in current and future five-year plans and other policy documents.

Supporting materials on the Workshop and the Summary Report, are contained in this Volume III of the three-volume Workshop Report. Volume I contains the overall findings and recommendations of the Workshop, and Volume II the results of Plenary Sessions and Working Groups. Immediately after the Workshop, the Summary Report of the Workshop was distributed during the Closing Ceremony and presented to President Suharto and the Cabinet Ministers who are responsible for economic and industrial development programs, as well as to the chairman of the National Development Planning Agency.

Background materials include, among others, the following documents:

1. "Industry," excerpt from Appendix to the State Address by H. E. the President of the Republic of Indonesia, at the Parliamentary Session of August 16, 1970;
2. "Research and Economic Development," by Emil Salim;
3. "Sector B Industry" of the First Five-Year Development Plan.

In addition, 15 papers were prepared by NAS panel members, 2 by other foreign panels, and 24 by Indonesian panel members.

In addition to the Academy's panel of 10 specialists, there were 15 experts and observers from Australia, England, Japan, Malaysia, the Netherlands, the Philippines, and Singapore, as well as regional and international agencies. The 90 Indonesian panelists, resource specialists, and observers were drawn from various ministries, universities, research institutes, and industries.

· LIPI-NAS WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

WORKSHOP PROGRAM DESIGN

MONDAY, January 25, 1971.

| Time | Group | No. | Topic |
|-------------|---------|-----|---|
| 08.00-09.15 | | | Opening Ceremony : Addresses by 1. Chairman of LIPI 2. President of NAS 3. Minister of Industry 4. State Minister for Economics, Finance and Industry 5. President of the Republic of Indonesia |
| 09.15-10.00 | | | Reception by Chairman of LIPI |
| 10.00-11.00 | | | Keynote Addresses : |
| | | 1.1 | 1. "Indonesian Economic Growth Potentials" by Chairman of BAPPENAS |
| | | 1.2 | 2. "Technology and Economic Development" by NAS |
| 11.45-12.15 | | | Registration |
| 12.15-13.00 | Plenary | | - "Workshop Program Design" by Chairman of Steering Committee. - Adoption of Workshop Agenda and Rules of Procedures |
| 14.00-14.35 | Plenary | 1.3 | "Current Status of Industrial R, D & E in Indonesia" |
| 14.35-15.10 | Plenary | 1.4 | "Planning Industrial R, D & E Activities" |
| 15.40-16.15 | Plenary | 1.5 | "Varieties of R, D & E Activities" |
| 16.15-16.50 | Plenary | 1.6 | "Developing a sectoral R, D & E Strategy" |

TUESDAY, January 26, 1971

| Time | Group | No. | Topic |
|-----------------------------------|------------------------|-----|--|
| 08.30-09.05 | Plenary | 2.1 | Varieties of National R, D & E Organizations |
| 09.05-09.40 | Plenary | 2.2 | Varieties of R, D & E Institutions |
| 09.40-10.15 | Plenary | 2.3 | Supporting R, D & E Infrastructure |
| 10.45-11.20 | Plenary | 2.4 | Special Requirements of R, D & E |
| 11.20-11.55 | Plenary | 2.5 | Industrial R, D & E in Developing Economies |
| 11.55-12.30 | Plenary | 2.6 | Industrial Extension |
| 13.30-15.30 and 16.00-18.00 | A + B | | Development of R, D & E Capabilities |
| 13.30-15.30 and 16.00-18.00 | C + D | | R, D & E Organization |
| 13.30-15.30 | E + F + G H + I + J | | R, D & E and Industrialization Program |
| 16.00-18.00 | E | | Small industries and Industrial Extension. |
| 16.00-18.00 | F | | Chemicals |
| 16.00-18.00 | G | | Food |
| 16.00-18.00 | H | | Textiles |
| 16.00-18.00 | I | | Pulp and Paper |
| 16.00-18.00 | J | | Metal and Machinery |

WEDNESDAY, January 27, 1971

| Time | Group | No. | Topic |
|--------------------|---------|-----|--|
| 08.30-09.05 | Plenary | 3.1 | Processes of R, D & E Management |
| 09.05-09.40 | Plenary | 3.2 | International Assistance |
| 10.10-10.45 | Plenary | 3.3 | Training and Education for Industrial R, D & E |
| 10.45-11.20 | Plenary | 3.4 | Standards and Quality Control |
| | A | | R, D & E Management |
| 11.35-13.00 and | B | | International Assistance |
| 14.00-15.30 and | C | | Training and Education |
| | D | | Standards and Quality Control |
| 16.00-17.30 | E | | Small Industries and Industrial Extension |
| | F | | C h e m i c a l s |
| | G | | F o o d |
| | H | | T e x t i l e s |
| | I | | Pulp and Paper |
| | J | | Metal and Machinery |

THURSDAY, January 28, 1971

| Time | Group | No. | Topic |
|-------------|---------|-----|---|
| 08.30-09.05 | Plenary | 4.1 | Information System for Industrial R, D & E |
| 09.05-09.40 | Plenary | 4.2 | Funding and Fiscal Incentives |
| 10.10-10.45 | Plenary | 4.3 | Career Requirements for Industrial R, D & E Personnel |
| 10.45-11.20 | Plenary | 4.4 | Patents |
| 11.35-13.00 | A | | Information System |
| and | B | | Funding |
| 14.00-15.30 | C | | Career Requirement |
| and | D | | Patents |
| 16.00-17.30 | E | | Small Industries and Industrial Extension |
| | F | | Chemicals |
| | G | | Food |
| | H | | Textiles |
| | I | | Pulp and Paper |
| | J | | Metal & Machinery |

FRIDAY, January 29, 1971

| Time | Group | Topic |
|-------------|-----------------------|---|
| 08.30-10.30 | Plenary | 1. Presentation of Working Group Reports and Recommendations |
| | | 2. Adoption of Working Group Reports and Recommendations |
| 11.00 | Selected participants | 3. Formulation of Workshop Summary Report and Recommendations |

SATURDAY, January 30, 1971

| Time | Group | Topic |
|-------------|---------|---|
| 09.00-10.00 | Plenary | Adoption of Workshop Summary Report and Recommendations |
| 11.00-12.30 | | Closing Ceremony |
| | | 1. Presentation of Workshop Summary Report to the Chairman of LIPI by Chairman of the Steering Committee. |
| | | 2. Remarks by |
| | | a. Chairman of NAS team |
| | | b. Representative of Indonesian Participants |
| | | c. Representative of Participants from other countries/international organization |
| 12.30-14.00 | | 3. Closing address by Chairman of LIPI |
| | | Lunch by Chairman of Steering Committee |
| 14.00-15.00 | | Press Conference |

WORKSHOP PROGRAM DESIGN

| Monday | Tuesday ORGANIZATION | Wednesday OPERATIONS | Thursday OPERATIONS | Friday RECOMMENDATIONS | |
|--|---|---|--|--|---|
| Opening Ceremony | Varieties of National R, D & E Organizations Topic No.2.1. | Processes of R, D & E Management Topic No.3.1. | Information System for Industrial R,D&E Topic No.4.1. | 1) Presentation of Working Group Reports and Recommendations | |
| Reception | Varieties of R, D & E Institutions Topic No. 2.2 | International Assistance Topic No. 3.2 | Funding and Fiscal Incentives Topic No. 4.2 | | |
| PLANNING | Plenary Topics | Training and Education for Industrial R,D&E Topic No. 3.3 | Career Requirements for Industrial R,D&E Personnel Topic No. 4.3. | 2) Adoption of Working Group Report and Recommendations by Plenary Session | |
| Indonesian Economic Growth Potentials Topic 1.1. | | Special Requirements of Industrial R, D & E Topic No. 2.4. | Standards and Quality Control Topic No. 3.4. | | 3) Formulation of Workshop Summary Report and Recommendations |
| Technology and Economic Development: Topic No.2.2. | | Industrial R,D&E in Developing Economies Topic No. 2.5 | | | |
| Registration | | Industrial Extension Topic No. 2.6. | | | |
| PLANNING (Continued) | | Group A + B Planning Development of R, D & E Capabilities | A R, D & E Management B International Assistance | Information Systems Funding | |
| Current Status of R, D & E in Indonesia Topic No.1.3. | | Group C + D R, D & E Organization | C Training & Education D Standards and Quality Control | Career Requirements P a t e n t s | |
| Planning Industrial R, D & E Activities Topic No.1.4. | Working Groups | E Small Industries & Industrial Extension | | | |
| Varieties of R, D & E Programs Topic No.1.5. | | F Chemicals | | | |
| Developing Sectoral R, D & F Strategy Topic No.1.6. | | G Food | | | |
| | | H Textiles | | | |
| | | I Pulp and Paper | | | |
| | J Metals and Machinery | | | | |

LIPI-NAS WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

Pre-Workshop Program

M O N D A Y, January 18, 1971

DJAKARTA

| | | |
|-----------------|---------------|--|
| ALL NAS PANELIS | 09.00 - 09.30 | Visit to LIPI <u>Introduction to</u> - Chairman, Deputy Chairman and Executive Secretary of LIPI - Members of Steering Committee Coordinator : Miss Sjamsiah Achmad |
| | 10.00 - 11.00 | Visit to Ministry of Industry Meetings with Secretary General and Staff (Briefing on Industries and Industrial Research Institutes to be visited) Coordinator : Mr. Sumantri |
| | 11.15 - 12.15 | Visit to Industrial Research Institute Coordinator : Mr. B. Kodijat |
| | 12.30 - 14.00 | Lunch by Chairman of LIPI |
| | 14.00 - 17.00 | Joint Session NAS (Panel Members) and LIPI (Steering Committee) |

DJAKARTA

| | | |
|-------------------------------------|---------------|---|
| Dr. RAO, K.N. | 09.00 | Visit to Dr. Edgar McVoy, National Assessment of Education |
| | 10.30 | Visit to Mr. Tatang Machmud, Director General for Manpower and Training Ministry of Manpower |
| | 12.00 | Visit to Mr. Sugeng Sundjaswadi Head, Bureau of Industry, National Development Planning Agency Coordinator : Mrs. A.S. Luhulima |
| Mr. GREEN, J.C. | 11.00 - 12.00 | Visit to Power Research Institute, Ministry of Public Works |
| | 13.00 - 14.00 | Visit to Directorate for Patent, Ministry of Justice Coordinator : Mrs. A.S. Luhulima |
| Dr. RAO, K.N. | 14.00 | Leave for Bandung, Accompanied by Mr. E. Suprijatna |
| Prof. BURTT, J.E. | 08.00 - 11.00 | Visit to "Senajan" Spinning Mill |
| | 11.15 - 13.00 | Visit to "Matamin" Batik Factory |
| Mr. GREEN, J.C. | 14.00 | Leave for Bandung, accompanied by Mr. Santosa |
| Dr. NELSON, M.E. Dr. CLARK, G.W. | 09.15 - 10.30 | Visit to Mr. Barli Halim, Secretary General, Ministry of Industry |
| | 10.30 - 12.30 | Visit to Mr. Agus Sujono Director General, Chemical Industries Ministry of Industry |
| | 13.00 - 13.30 | Visit to Mr. Harlan Bekti, Harlan Bekti Corporation (private industry) Coordinator : Mrs. A.S. Luhulima |
| | 14.30 - 17.00 | Visit to "WelleX" Plastic Goods Manufacturing Plant - "Haking" Plastic Goods Manufacturing Plant "Bastol" Shoe Polish Manufacturing Plant Coordinator : Mr. Agus Muchari |

JOGJA GROUP 08.30 Depart for Jogja by plane
 DR. LEHRER, R.N.
 DR. WILCKE, H.L.

JOGJA

JOGJA GROUP 10.15 - 11.45 - Visit to Gadjah Mada University
 12.00 - 14.00 - Visit to "Mantrust" Meat Canning
 Factory
 - Lunch
 14.15 - 15.15 Visit to
 - Leather Research Institute
 - Batik Research Institute
 - Technological High School
 Coordinator : Mr. Abdul Rachmad

WEDNESDAY, January 20, 1971

DJAKARTA

Dr. NELSON, M.E. 08.30 - 09.30 Visit to Dr. Tan Siok Liat and
 Dr. CLARK, C.W. Mr. Budi Sudarsono,
 Atomic Energy Institute, Pasar Djum'at
 10.30 - 12.00 Visit to National Development Planning
 Agency
 12 00 Visit to Mr. Suksmono, Director,
 Credits Division - Central Bank
 Coordinator : Mrs. A.S. Luhulima
 14.30 - 17.00 Visit to "P.N. Intirub" Tire Factory
 "P.N. Zatas" Oxygen Plant
 Coordinator : Mr. M. Afiat

BANDUNG

Mr. GREEN, J.C. 08.30 - 10.00 Visit to Institute for Research &
 Development of Posts and Telecommuni-
 cation
 10.30 - 11.30 Visit to Regional Housing Centre
 12.00 - 13.30 Visit to Directorate of Metrology,
 Standardization and Normalization
 Coordinator : Mr. Sumarjato Kajatmo

| | | |
|-------------------|---------------|--|
| Prof. BURTT, J.F. | 08.00 - 11.00 | Visit to Institute of Textile Technology |
| | 11.00 - 13.00 | Visit to "Bandjaran" Spinning Mill |
| | 13.00 - 15.00 | Visit to "Tanatex" Textile Factory |
| Dr. RAO, K.N. | 09.00 - 12.00 | Visit to Bandung Institute of Technology |

JOGJA

| | | |
|--------------------|---------------|--|
| <u>JOGJA GROUP</u> | 09.00 - 09.30 | Visit to Tobacco Redrying Plant "Tandjung Tirto" |
| | 10.30 - 11.30 | Visit to "Citronella", Essential Oil Distillation and Extraction Plant Coordinator : Mr. Abdul Rachmad |
| | 14.40 | Take off for Djakarta by plane |

SURABAJA

| | | |
|----------------|---------------|---|
| Dr. KATZ, D.L. | 08.00 | Leave Gresik for Surabaya |
| | 08.45 - 10.00 | Visit to Glass Factory |
| | 10.00 - 10.45 | Leave Surabaya for Gresik |
| | 10.45 - 13.30 | Visit to Gresik Cement Factory |
| | 16.30 | Leave Gresik for Surabaya Airport Coordinator : Mr. Sotion Ardjanggi |
| | 18.00 | Take off for Djakarta |

BANJUWANGI

| | | |
|------------------|---------------|---|
| Mr. PAULEY, R.D. | 08.00 - 11.00 | Visit to Basuki Rachmad Paper Mill |
| | 11.00 - 15.00 | Travel Banjuwangi to Denpasar Bali, stay at Bali Beach Hotel |
| | | Accompanied by Mr. Gardjito |

SURABAJA

| | | |
|-------------------|---------------|--|
| DR. MUELLER, W.M. | 09.00 - 10.00 | Travel Gresik to Surabaya |
| | 10.00 - 12.00 | Visit to Navy Yard |
| | 12.00 - 12.45 | Travel Surabaya to Gresik, lunch and rest at Gresik Cement Factory Guest House |
| | 16.30 | Leave Gresik for Surabaya Airport Coordinator : Mr. Achmad Az. |
| | 18.00 | Take off for Djakarta |

THURSDAY, January 21, 1971

DENPASAR

Mr. PAULEY, R.D. 06.00 Take off for Djakarta
07.30 Accompanied by Mr. Gardjito
Arrive Djakarta

DJAKARTA

ALL NAS PANELS 09.30-10.30 Visit to National Scientific
(except Rao, Documentation Centre
Burt, Green) 11.00-12.00 Visit to "Senajan" Spinning Mill
12.30-14.00 Visit to Institute for Petroleum and
Natural Gas
Coordinator : Mr. H.W. Tampubolon
14.00 Leave for Tjiawi, stay at Hotel Happy
Valley
Accompanied by Mr. Gardjito
14.30-15.30 On the way to Tjiawi, visit to
"Indomilk" Factory

BANDUNG

Dr. RAO, K.N. 09.00-12.00 Visit to Bandung Institute of Techno-
logy
Coordinator : Dr. Muhammadi
Prof. BURTT, J.E. 09.00-10.00 Visit to "P.T. Lontjeng" Weaving
Enterprise
10.00-12.00 Visit to "P.T. Lontjeng" Weaving
Factory
12.00-13.00 Visit to "B.T.N." (Textile Industry)
13.00-14.00 Visit to "Tjipajung" Spinning Mill
16.00 Leave Bandung for Tjiawi, stay at
Hotel Happy Valley
Mr. GREEN, J.C. 09.00-11.00 Visit to National Institute for
Instrumentation
11.00-12.30 Visit to National Institute for Electro-
techniques
13.00-14.00 Visit to Foundation for Standardization
in Indonesia
Coordinator : Mr. Sumarjato Kajatmo

16.00 Leave Bandung for Tjiawi, stay at
Hotel Happy Walley

FRIDAY, January 22, 1971

BOGOR

| | | |
|-----------------------|-------------|--|
| <u>ALL NAS PANELS</u> | 08.00-11.00 | Visit to -Research Institute for Estate crops - Research Institute for Industrial Crops - Institute for Forest Research - Chemical Research Institute for Forest Products - Forest Products Research Institute - Bibliotheca Bogoriense |
| Mr. PAULEY, R.D. | 11.00 | Leave for Bandung, stopping at Padala- rang Paper Mill. Accompanied by Mr. Gar- djito |
| <u>ALL NAS PANELS</u> | 11.00-12.00 | Visit to National Biological Institute/ SEAMEO Regional Centre for Tropical Biology |
| | 12.00-13.00 | Lunch |
| | 13.00-14.00 | Visit to - Chemical Research Institute - Academy for Chemical Analysis - High School for Chemical Analysis. Coordinator : Dr. Dardjo Somaatmadja |
| | 14.00 | Leave Bogor for Bandung Accompanied by Mr. Suhartono Sudargo |
| | 17.00 | Arrive at Bandung, stay at Hotel Istana |

SATURDAY, January 23, 1971

BANDUNG

| | | |
|------------------|-------------|--|
| <u>TOUR I</u> | 08.00-08.30 | Visit to Directorate of Metrology, Standardization and Normalization |
| Mr. GREEN, J.C. | | |
| Dr. WILCKE, H.L. | 09.00-10.30 | Visit to Cellulose Research Institute (Laboratory) |
| Mr. PAULEY, R.D. | | |
| | 10.30-11.30 | Visit to Cellulose Research Institute (Pilot Plant) Coordinator : Mr. Gardjito |

| | | |
|-------------------|-------------|---|
| <u>TOUR II</u> | 08.00 | Leave Hotel |
| Dr. LEHRER, R.N. | 08.30-10.30 | Visit to Army Weaponry and Industrial Center |
| Prof. BURTT, J.F. | 11.00-12.00 | Visit to Directorate for Geological Survey |
| Dr. MUELLER, W.M. | 12.15-14.00 | Visit to Institute of Textile Technology and Ceramic Research Institute Coordinator : Mr. Wibowo Murdoko |

| | | |
|------------------|-------------|---|
| <u>TOUR III</u> | 08.00 | Leave Hotel |
| Dr. CLARK, C.W. | 08.30-09.00 | Visit to National Institute for Instrumentation |
| Dr. NELSON, M.E. | | |
| Dr. RAO, K.N. | 09.15-10.45 | Visit to Bandung Institute of Technology |
| Dr. KATZ, D.L. | 11.00-11.45 | Visit to Bandung Atomic Reactor Center |
| | 12.00-13.00 | Visit to Materials Testing Institute |
| | 13.15-14.00 | Visit to National Institute of Geology and Mining Coordinator : Mr. J. Kusnadi |

SUNDAY, January 24, 1971

BANDUNG

| | | |
|-----------------------|-------|--|
| <u>ALL NAS PANELS</u> | 10.00 | Leave for Djakarta, stopping at Puntjak Pass Hotel for lunch Accompanied by Mr. Suhartono Sudargo |
| | 16.00 | Arrive Djakarta stay at Hotel Kartika Plaza |

LIPI - NAS WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH
GUIDELINES FOR PLENARY DISCUSSIONS
and
LEADING QUESTIONS FOR
WORKING GROUP DISCUSSION
GUIDELINES FOR PLANNING

1. Analysis of present situation

- a. Objectives of the Indonesian Industrialization Plan in the short term
- b. Identification of the problems facing the various sectors
- c. Preparation for medium-and long-term plans
- d. Evaluation, adaptation, and conservation of natural resources

2. R, D & E strategy (in various sectors)

- a. Definition of, and recommendations for, R, D & E support required to solve the problems in the various sectors
- b. Recommended R, D & E objectives to meet the specific requirements of, and support for, the industrialization plans on a short-medium-and long-term basis.
- c. Recommendations on priorities and time scale for implementing R, D & E strategy

continued

WORKING GROUP

General considerations

Joint Group A + B

topic : Development of R, D & E
Capabilities

Joint Group E+F+G+H+I+J

topic : R, D & E and Industrialization
Program

Specific considerations

Group E : topic : Small Industries & Industrial Extension

Group F : topic : Chemicals

Group G : topic : Food

Group H : topic : Textiles

Group I : topic : Pulp and Paper

Group J : topic : Metals and Machinery

LEADING QUESTIONS ON ORGANIZATION

1. What should the structure of the organization be to develop and administer a national R, D & E policy and its relationship to the various related interests?
2. There are many institutions in Indonesia working in the scope of R, D & E. These are scattered among different Government Departments, as well as outside them
The problem is how to organize them such a manner that the most efficient use is made of their capabilities.
3. What are the basic objectives of the various R, D & E institutions (government laboratories, universities, etc.) in their proper setting and their interaction?

WORKING GROUP

Joint Group C + D : topic : R, D & E Organization.

LEADING QUESTIONS
ON
TRAINING AND EDUCATION FOR INDUSTRIAL R, D & E

1. Is a research worker a typical man with respect to
 - a. his training requirements?
 - b. the output of his performance ?
 - c. the kind of compensation or rewards for his performance ?

2. If industry lacks the tradition of research (thus lacking the ability to carry out training of research workers and technicians) should research training be carried out by
 - a. universities,
 - b. non-university research institutions, or
 - c. both ?

3. In connection with question no. 2, how should this training be done ?

4. The trio of industry - university - government should work together to organize research for development.
How should this be done ?

5. What kind of additional training programs and compensation would cause an increase of output of research workers and technicians ?

6. When and how should international assistance be utilized in
 - the training,
 - granting compensations, and
 - promoting the outputof research workers and technicians ?

WORKING GROUP

Group C : topic : Training and Education

LEADING QUESTIONS
ON
STANDARDS AND QUALITY CONTROL

1. What type of standards and quality control system are most suited to a developing country ?
2. What is the most effective way of establishing a standards system in Indonesia ?
 - a. preparation of standards, or
 - b. financing of standards organization ?
3. How should standards and quality control be implemented ?
 - a. legal enforcement via State Standards Laboratory, or
 - b. standards certificate via approved laboratories ?
4. How should standards and quality control be implemented from the point of view of government promotional effort for industry ?

WORKING GROUP

Group D : topic : Standards & Quality Control.

LEADING QUESTIONS
ON
INFORMATION SYSTEMS FOR INDUSTRIAL R, D & E

The present situation is that in general there is a lack of accurate data and coherent information urgently needed for effective R & D activities and for planning.

1. What steps must be taken to make more accurate data and coherent information available ?
2. Should this include the establishment of a well-organized integrated network, not only interconnecting R & D and higher learning institutions with industry but also linking up with international storage systems for science and technology ?
3. How should it be administered ?
4. What is the role of a centralized system with respect to
 - (a) its authority -- should it be executive or functional;
 - (b) developed know-how (1) reports (2) patents; and
 - (c) funding -- should it be on a national or regional basis ?
5. What are the manpower requirements and training for
 - (a) librarians,
 - (b) assistants ?
6. What new techniques are to be utilized ?
 - (a) Microfilm compared with books;
 - (b) Information retrieval -- use of telex, both national and international, and computer scanning ?

WORKING GROUP

Group A : topic : Information System.

LEADING QUESTIONS
ON
FUNDING AND FISCAL INCENTIVES

1. The part of the state budget allocated to R & D is not only insufficient for maintaining the existing level of activities, but also fails to cover expenditure for expansion. According to an estimate the present expenditure percentage of the GNP expended on science and technology is about 0.2%. It is expected that developing countries provide 1% of their GNP for R & D, and it was suggested that this should be possible by 1980.
2. How can we fill this gap ?
3. Further, what will be the role of LIPI in managing the existing funds for R & D to ensure the continuity of R & D activities ?
4. Funding of research in a developing country's economy.
 - (a) What should be the contribution from government sources, and how much should be contributed by the private sector.
5. How should funds be raised ?
 - (a) In the government sector -- from the general taxation system or by levies on sales ?
 - (b) In the private sector -- direct fixed cost or surcharge on products ?
6. What incentives can be given to
 - (a) industry (tax allowance for fixed costs or percentage of development expenditure funded from government funds); and
 - (b) workers (bonus calculated on improvement of profitability or time allowance to pursue lines of independent research) ?

WORKING GROUP

Group B : topic : Funding

LEADING QUESTIONS
ON
CAREER REQUIREMENTS FOR INDUSTRIAL R, D & E PERSONNEL

1. Is a research worker a typical man with respect to
 - a. his training requirements ?
 - b. the output of his performance ?
 - c. the kind of compensation or rewards for his performance ?
2. Is a graduate-level university training the most important requirement for a research worker leader, or is industrial experience more important ?
How should research leaders be developed in Indonesia ?
3. Is it necessary to have a special earning scale for research workers ?
4. What kind of additional training programs and compensation would cause an increase of output of research workers and technicians ?
5. When and how should international assistance be utilized in
 - the training,
 - granting compensations, and
 - promoting the outputof research workers and technicians ?

WORKING GROUP

Group C : topic : Career Requirements

LEADING QUESTIONS

ON

P A T E N T S

Indonesia is a member of the Paris Union. It should meet certain obligations and may enjoy benefits. The most important benefits are

- a. to obtain information on technical problems, and
- b. to obtain technical assistance.

Questions :

1. What philosophy should be incorporated in Indonesia's patent law so that economic development can be accelerated ?
2. Should Indonesia establish a fully fledged patent office immediately, or just maintain a patent applications registration office until the time when Indonesians start to produce patentable ideas ?
3. How would Indonesia be able to utilize the internationally available information for its development ?
4. What kind of technical assistance should Indonesia use for the development of its own patent law ?
5. Indonesia did not send technical experts on patents to the "Washington Diplomatic Conference on the Patent Cooperation Treaty, 1970." Does Indonesia have such experts " If not, how could Indonesia quickly have a reasonable number of such experts, at least for the purpose of getting the benefits of access to technical information and technical assistance ?
6. What financial elements are involved in acquiring and utilizing a patent ? (patent fees, licensing fees, royalties).

WORKING GROUP

Group D : topic : Patents.

LI I-NAS WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

GENERAL GUIDELINES FOR ALL WORKING GROUPS
AND
SPECIAL GUIDELINES FOR SELECTED INDUSTRIES

General Guidelines for all Working Groups

Summary Working Group Discussion Outline

- I. Analysis of the current situation
 - A. determining objectives (where do we want to go ?)
 - B. assessing R, D & E resources (what means are currently available to get there ?)
 - C. identifying problems (what is in our way ?)
- II. Identification of alternative courses of action (what alternative routes are available to get there ?)
- III. Selection of alternative courses of action most appropriate to Indonesia (how do we select which way to go ?)
- IV. Recommendations (where should we actually go ?)
- V. Implementation of recommendations (how do we make sure get there ?)

Special Guidelines for Selected Industries

Working Groups

(Group **B**, F, G, H, I, J,)

Working Group Discussion Outline

I. Analysis of the current situation of industry in selected sectors

1. What are the main problems currently faced by industries in this sector ?
 - a. What are the technical problems ?
 - b. What are the economic problems ?
 - c. What are the managerial problems ?
 - d. What are the manpower problems ?

II. Selection of Technological Development Alternatives

1. What are the development priorities in this sector ?
 - a. current five-year plan
 - b. second five-year plan
2. What other considerations should be taken into account in selecting technological alternatives ?
 - a. level of foreign private investment ?
 - b. level of international technical assistance ?
 - c. level of local technical development desired ?
 - d. degree of reliance on imported technology desired ?
 - e. Indonesia's comparative advantage in this sector ?
3. Which of the alternatives identified should be utilized in this sector ?

III. Analysis of the current status of R, D & E in selected sectors

1. Determining objectives
 - a. Can we state the R, D & E objectives (short, medium, and long term) of the Indonesian Industrialization Plans with respect to this industry ?
 - b. If so, what are they ?
 - c. How are these objectives determined ?
 - d. To what extent do research organizations participate in determining these objectives ?

- e. What are the implications of long-range planning for R, D & E activities in this sector ?
- f. Do we need a more effective arrangement for determining R, D & E objectives ?

2. Assessing the R, D & E resources currently available in this industry

- a. What is the strength of the current R, D & E capability in this sector ?
 - nucleus of trained personnel ?
 - commitment to developing Indonesian resources ?
- b. Which organizations have made important contributions to development in this industry ?
- c. Where are the major points of scientific and technological development in this industry ?
- d. Does an inventory of R, D & E resources need to be made in this industry ?

3. Identifying problems

- a. What are the major environmental constraints on R, D & E activities in this sector ?
 - government regulation ?
 - lack of fiscal incentive ?
 - unreceptive industrial climate ?
 - limited development in the private sector ?
 - ineffective relations between R, D & E organization and their clients ?
 - rigid organizational structures ?
- b. What are the major problems facing R, D & E management in this sector ?
 - funding ?
 - manpower ?
 - facilities ?
 - R & D productivity ?
 - applying research results ?
 - limited capability to make feasibility studies ?
 - limited participation of industry on boards of directors in R & D activities ?

- training programs ?
 - confidence of R & D personnel ?
- c. What are the major problems facing R, D & E technological personnel ?
- salaries ?
 - selection of projects ?
 - matching training skills and career opportunities ?
- d. What are the major bottlenecks in the innovation cycle (i.e., from idea stage to application of results) ?
- feasibility studies ?
 - research ?
 - development ?
 - engineering ?
 - testing ?
 - application of results ?

IV. Identification of technological development alternatives in selected sectors

1. What types of R, D & E activities are best suited to development of this sector at present ? For example,
 - a. How much basic research should be undertaken ?
 - b. How much applied research should be undertaken ?
 - c. How much engineering research should be undertaken ?
2. Which organization can undertake this research ?
 - a. government departments ?
 - b. government enterprises ?
 - c. foreign private industry ?
 - d. local private industry ?
 - e. universities ?
 - f. research institutes ?
3. What criteria should be utilized in selecting R, D & E project in this sector ?
4. Using this criteria, what specific R, D & E project or types can be undertaken at the present time ?

V. Recommendations (indicate timing and priority where possible)

1. What R, D & E programs are recommended ?
 - a. specific programs which can now be identified ?
 - b. areas recommended for further study ?
2. What type of R, D & E capability is required to implement these programs ?
 - a. specific changes that can now be identified ?
 - b. areas recommended for further study ?
3. What suggestion can be made to improve current operations ?

VI. Implementation of recommendations

1. What specific followup is recommended to ensure that the above measures are acted upon ?

LIPI-NAS WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

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Semarang

LIPI-NAS WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

OPENING ADDRESS

by

Professor Sarwono Prawirohardjo

Chairman, LIPI

Your Excellencies,
Ladies and Gentlemen,

I deem it a great honour on behalf of the Indonesian Institute of Sciences, to bid you all at the Opening Ceremony of the Workshop on Industrial and Technological Research, which is jointly organized by the National Academy of Sciences of the United States of America and the Indonesian Institute of Sciences, a cordial welcome. Special greetings I should like to extend to all the participants of the Workshop, who are here today and for the following days to discuss problems which are highly important for Indonesian science and technology and for the economic development of the country. In this connection I should like to state how much we Indonesians appreciate the attendance at this Workshop of the members of the NAS delegation, the representatives of the United Kingdom, the Netherlands, Japan, Australia, and the ASEAN member countries and of experts from UNIDO, UNESCO, and the Science Policy Research Unit of the University of Sussex. Their contributions at the discussions will, I am sure, be of the greatest importance for the success of this Workshop.

Your Excellencies,
Ladies and Gentlemen,

This is the second Workshop, which is being organized under the joint auspices of the National Academy of Sciences and the LIPI. The first one, the Workshop on Food, was held from 27-30 May 1968 and has proven to be a great success. At the time of the Workshop the Indonesian Government had already decided that in the forthcoming five Year National Development Plan, starting in April, 1969, the increase of food production would have the highest priority. In this connexion the recommendations of the Workshop on Food came just in the nick of time and many of them were incorporated in the five Year Development Plan, thereby contributing to the shaping of

this Plan. The Workshop on Food was therefore not just an intellectual exercise, but had great practical implications.

It has been stated that the principal aims of the present five Year Development Plan are

- (1) to increase the production of food;
- (2) to promote the development of industry which lends support to agriculture (agricultural tools, fertilizers, etc), which will save foreign exchange through the production of goods which are usually being imported (especially textiles), and which manufactures building materials;
- (3) to increase the foreign exchange earning capacity of the country through the export of mineral fuels, tropical agricultural products (including timber), and through tourism;
- (4) to rehabilitate and expand its infrastructure especially with regard to irrigation, communication, transportation etc.; and
- (5) to tackle the unemployment problem.

Industry has therefore already an important place in the present five Year Development Plan, and it is to be expected that its role in the next Plan will be even greater. This is understandable as the developing countries must industrialize as an important means to increase their production, in order to bring more prosperity to their people. The advanced countries have been successful through the application of science and technology to economic development in general and industrial development in particular, in achieving a high standard of living for their population. In this process of economic growth, technical progress, including better organization and management, more skillful labour, improved materials, processes and equipment have played and are playing an important role. For this purpose heavy investments have been made in education and training, in research and development, and in the chain of activities which we know as the process of innovation.

For developing countries it would be unwise and unnecessary to go through the same stages again which the developed countries have gone through in their development during many decades. If they do so, they will never be able to catch up, and the scientific and technological gap between

the developed and developing countries will become wider and wider. Therefore for the developing countries it is a must to make shortcuts by importing existing technical knowledge from abroad, which process is usually called "transfer of technology."

There is a great reservoir of technical information and managerial know-how in the world, which is partly freely available and partly either protected by patents and licences or being kept secret. Although there are difficulties to overcome in the procedures of transfer of technology, more difficult is to make the right choice in the importation of foreign technology which is suitable for, and meets the needs of, the developing country concerned.

The choice of technology will primarily be determined by the policy of the country with regard to its industrial development and many factors have to be taken into consideration in the process of decision making. It will be, in my opinion, one of the tasks of this Workshop in this respect to identify as many factors as possible which will have an influence on the process of decision making, based on the actual conditions of the industry and related fields in Indonesia, with its limitations and potentialities.

In view of these conditions, it is to be expected that for a long time to come especially on the village level, Indonesia has to use simple technology with a relative high need for unskilled labor. On the other hand, where the need is evident, as for instance in the production of fertilizers, etc., we should not hesitate to introduce the most advanced technology, even if it is capital intensive and labor saving. The solution would, therefore, be that Indonesia should develop a plural technology, where simple technology, intermediate technology, and advanced technology should have its place, according to the needs and conditions and with full consideration of the economic factors involved. In this connection, a comprehensive and up-to-date inventory on industrial enterprises, on the available scientific and technical manpower, and on the natural resources should be established.

Your Excellencies,
Ladies and Gentlemen,

Although Indonesia should use foreign technology to the fullest extent for its industrial development, the development of its own research capability should by no means be neglected. Without an indigenous scientific and technological capability we shall always lack the knowledge and the human skills to implant foreign technology on our soil and to adapt it to the conditions and circumstances in the country.

It would indeed give great satisfaction if in developing countries basic inventions could be made, leading to new technology, which could form the basis of a new industry. But, in general, in developing countries the possibilities are very limited for undertaking the risky and expensive innovations leading to commercial production. Therefore, most of the researchers in developing countries have to be content with less spectacular performance.

With regard to the role of industrial research in developing countries, I should like to quote from a statement, appearing in a manuscript which will be published soon by the ICSU Committee on Sciences and Technology in Developing Countries, entitled "The Role of Sciences and Technology in Developing Countries." This statement reads as follows :

The major roles of research in a developing country are

1. to help select and adapt existing scientific and technological knowledge to meet specific local needs;
2. to maintain contact with developments elsewhere of potential local importance;
3. to augment existing knowledge in fields of potential relevance, with particular emphasis on those areas which, for various reasons, are not or cannot properly be studied elsewhere as in relation to specific natural resources, climatic and soil conditions, or social problems;
4. as far possible within the limits of the foregoing, a necessary activity is the training of scientific and technical personnel and their teachers.

We should be aware that in developing countries most of the industrial enterprises, which are small-size or medium-size, do not yet strongly feel the need to improve their processes and products and that there is not yet much demand for R & D. This has as its consequence not only that the Government should take most of the initiative in establishing research institutes, but that these institutes should actively establish contacts with their respective potential users. In this connection the task of a research organization should be more than research and experimental development alone. It might be necessary to carry out engineering design work, to render technical services; it might even be required to conduct the chain of activities which we know as the process of innovation.

Technical services, are usually weak in developing countries. Scientific and technical information, standards and specifications, testing and quality control, technical managerial counselling, and extension services should therefore have a high priority in efforts to promote industrial development.

Your Excellencies,
Ladies and Gentlemen,

In this address I have touched upon some problems which to my mind are of great importance for Indonesia's industrial development and the research which has to support this development. I am sure that these and other problems will be fully discussed and that the results of these discussions will be of great value for the policy makers both in the field of industrial development as in that of research. The experience and knowledge of our friends from abroad will be a great asset in the forthcoming discussion.

At the conclusion of my address it is my pleasant duty to express my gratitude to the NAS for its cooperation and to those who have helped us in financing this Workshop. I would also like to thank those who in one or another way have aided us in the preparation of this undertaking; special thanks are being extended to the Steering Committee, the Organizing Committee, and their staff for all their efforts;

and to the Ministry of Education and Culture, which has made their facilities available for the meetings of our Workshop.

And last but not least, of course, the Governor of Djakarta for his generosity to make this beautiful hall available for the opening ceremony of this Workshop.

OPENING ADDRESS

by

H. L. Wilcke

Chief, U.S. Panel

It is my privilege and pleasure to bring you the respects and greetings from the President of the U.S. National Academy of Sciences, Dr. Philip Handler, and from the Foreign Secretary of the Academy, Dr. Harrison Brown. The Academy deeply appreciates the opportunity to send this very able group of research scientists to participate in this Workshop on Industrial and Technological Research.

Perhaps, with apologies to those of you who are quite familiar with our National Academy of Sciences, I should offer some explanation of the organization and of how it functions.

The charter for the National Academy of Sciences was authorized by an act of the United States Congress, but this charter provided that the Academy would not be an organization operating within the government, but rather that it would be an independent body which could, upon request, provide completely objective judgments on scientific matters. These judgments are advisory in nature, and no government agency is obligated to be governed by them. However, the prestige of the Academy, as it has been earned through the approximately one hundred years of its existence, has resulted in very serious consideration of its recommendations. The Academy has a paid staff, but its work is carried out through its action organization, the National Research Council, which operates by committees, which are appointed by the Academy on an individual project basis, drawing upon the best scientific talent available from universities, government, and industry. These scientists serve without compensation, except for reimbursement of actual expenses, so they are entirely free to express their opinions without restraint.

The Office of the Foreign Secretary is one of the major units of the National Academy of Sciences, and it deals with all contacts with scientific organizations other than those within the United States. This is the branch of the Academy that is responsible for the arrangements,

the selection of this panel, and all other matters in connection with this Workshop. The Foreign Secretary has had a long and continuous working relationship with the scientific organizations of Indonesia a relationship which has transcended political problems. We are looking forward to a long, continuing, mutually beneficial association.

We were particularly pleased to accept the invitation to this Workshop on Industrial and Technological Research because we are firmly convinced that the Workshop technique is the most productive approach to action problems. From our point of view, the Workshop on Food production, held in 1968, resulted in basic and sound recommendations because of the free interchange of ideas between our two groups, with strong agreement on both recommendations and action to be taken. We are confident that this Workshop, with the spirit of cooperation and the inputs from scientists from the other countries who have been invited, will result in equally fruitful recommendations. It is the discussions in the working groups which contrast the Workshop with symposia and seminars, where detailed information may be presented on limited subjects, but with no subsequent action.

The field of research must be placed in proper context along with all of the other functions necessary to move the economy of the nation forward. The results of research can only be applied when they are used along with other factors, such as management, marketing, financing (other than the financing of research), and others. These broad fields are not proper subjects for discussion at a Workshop as limited in time and scope as this, but their importance and their relevance must be recognized in order that research may serve its proper and very necessary functions. In these considerations, too, we must evaluate when, where, and why research programs are needed, and not consider research for the sake of research. We must view industrial and technological research as an investment which must pay dividends in the future, and which must compete with other needs for the funds which are available.

The term research, for the purposes of this Workshop, we think, should be defined very broadly, including feasibility studies, engineering process studies, raw materials, marketing, quality control, product development, and any other areas necessary to insure the success of the project.

The primary emphasis must be on applied and adaptive research, without precluding basic research when new knowledge is needed. However when research funds are limited, as indeed they are almost universally, and we are confronted with the necessity of developing an economy, there must be a very careful balance between applied and the more basic research programs.

It is with these attitudes that we approach this opportunity, with full appreciation for all of the careful and detailed planning that has been done by the Steering Committee and the Organizing Committee in preparation for the Workshop, in planning the minute details of the Pre-Workshop briefing for our panel members, and the plans for the agenda for this week. We have been impressed with the capabilities and the enthusiasm of the Indonesian scientists we have been privileged to meet during this past week. It is our hope that these dedicated people will be given ever greater responsibilities in defining and offering solutions for the problems which confront this country.

Certainly, it will be their responsibility to provide the background material and to define the goals in industrial development which will form the basis for our discussions. Then the training and experience of the panelists invited from the U.S. and from the other countries, may be integrated with that already present to arrive at sound and logical courses of action.

The recognition of the influence of the recommendations of this Workshop, properly executed, may have on the lives of the 120 million inhabitants of this country is a real challenge to the participants. It is a sobering thought. We approach our task with humility, but also with full confidence that sound practical recommendations will emerge, which will merit the complete support and implementation by your government and by your industry.

ADDRESS BY HIS EXCELLENCY LIEUTENANT GENERAL MUHAMMAD JUSUF
MINISTER OF INDUSTRY ON THE OPENING OF THE WORKSHOP ON
INDUSTRIAL AND TECHNOLOGICAL RESEARCH

Your Excellency President Suharto,
Excellencies,
Distinguished Chairman of the Lembaga Ilmu Pengetahuan
Indonesia - Indonesian Academy of Science,
Distinguished Guests of the National Academy of Sciences
of the U.S.A.,
Distinguished participants,
Ladies and gentlemen,

It gives me great pleasure to say a few words on the occasion of the Workshop on Industrial and Technological Research, which is being opened today with the attendance of so many distinguished scientists from abroad as well as from here in Indonesia.

The Department of Industry has always attached great importance to the role of Research and Development in Indonesia's progress and growth in industry and technology and shall always extend all its possible cooperation to these activities whether they come from Government-owned agencies or from private organizations.

It is obvious that in order to increase the services and activities of the Governmental Laboratories and Centres of Industrial Development, comprehensive planning, programming, and organization should be carefully done first. On the short-range, objective Research and Development activities should emphasize

- the increase of the present resources for successful implementation of the Rehabilitation Programme of the existing industries;
- the far greater use of domestic raw materials;
- the manufacture of import substitutes;
- the upgrading of the quality and an increase in the quantity of domestic production facilities to fulfill the domestic needs; and

- the preparation of modern technology.

On the medium-range objective, the Research and Development activities should be directed to more service to industry for the development of manufactured goods for export and better use of technology in conformity with the Industrialization Programme.

And on the long-range objective, the Research and Development efforts should be directed to further development of industry in terms of quality as well as in quantity.

Since all Research and Development activities require a large amount of funds, the Workshop should consider a system of fund raising in order that these activities can be implemented.

In conclusion, I wish this Workshop on Industrial and Technological Research much success, and I hope that the results of its deliberations will be beneficial for the future development of our industry.

Thank you.

WRITTEN ADDRESS OF THE STATE MINISTER FOR ECONOMICS,
FINANCE, AND INDUSTRY AT THE OPENING CEREMONY OF THE
WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

Mr. President,
Ladies and Gentlemen,

First of all I would like to thank the Indonesian Institute of Sciences (LIPI) for the honor given to me to deliver an address at the Opening Ceremony of the Workshop on Industrial and Technological Research. I would also like to ask you to excuse my incapability to be here with you at the opening of this Workshop because I have to go abroad on another job.

Ladies and Gentlemen,

After our economic condition improved, hyperinflation has been put under control; prices are much more stable, then we start to plan and execute our national development. In the first Five-Year Development Plan, of which we have now almost completed our second year, there seem to be improvements in every sector, especially the economic sector. Even though the first Five-Year Development Plan (PELITA) covers the development of sectors, yet priority should still be given to the economic sector because with the improvement of the economy, other developments can be planned and executed much more easily.

In the economic sector, main attention is being paid to the agricultural sector, simply because our economic structure is basically agricultural, and the major part of our society lives from this sector. But this does not mean that all other sectors, including the industrial one, are deleted from our development plan. Industrial development in the present PELITA has its own role in supporting and increasing industrial output in agricultural sector.

The history of economically developed countries has shown us that they also experienced a transition period from agricultural economies to industrialized economies, and that goods and services can be increased much faster, i.e., to counterbalance the population growth with new employment opportunities and more goods required for living continuation.

To increase the standard of living of our people faster, as is the target of all development plans, sometime at the right time we are also going to undertake industrialization. Here I really appreciate the initiative taken by the Institute of Sciences with the cooperation of the United States National Academy of Sciences to undertake a workshop on industry and technology, so I assume that the time for the present workshop is just right. Preparation for industrializing this country will have gone far before it gets started.

Ladies and Gentlemen.

A lot of preparation must be done before we start industrializing this country. In the field of education, for example, what is the curriculum of our ^{vocational} schools? Is it to the future need of skill requirement for industrialization? The next question should also be answered: How much (quantitatively) and what kind of skills will be needed later? And many more questions have to be answered, and this is only preparation for one aspect, i.e., the education system for industrialization purposes.

From the above mentioned example, there seems to be some very urgent research to be done earlier to prepare for industrialization. Experiences from the past have shown us that without serious research done beforehand, a mislocation of heavy industry might result, and this means misallocation of resources.

There are social problems due to industrialization programs that have to be taken into account in this Workshop. This is because the major part of our society up until today still draw their living from the agricultural sector.

In line with industrialization development, we always have to follow current technological development as well, since this is closely related with the increase of efficiency and productivity in industry. Technology can be imported from other countries, of course, but it is more important to carry out our own experiments in laboratorium in order to find out new things so that we can move faster.

Finally, I hope this Workshop can find out its own way smoothly and produce conclusions which can help us to carry out research, especially for industrialization, and further to support our national development.

Thank you.

STATE MINISTER FOR
ECONOMICS, FINANCE AND INDUSTRY

sgd.

HAMENGKUBUWONO IX

(Unofficial translation by J. Luthan, Leknas/LIPI)

ADDRESS OF THE PRESIDENT OF THE REPUBLIC OF INDONESIA AT
THE OPENING CEREMONY OF THE WORKSHOP ON INDUSTRIAL AND
TECHNOLOGICAL RESEARCH

Ladies and Gentlemen,

Let me first express my highest appreciation of the undertaking of the present Workshop on Industrial and Technological Research, sponsored by the Indonesian Institute of Sciences (LIPI) with the cooperation of the United States National Academy of Sciences. I would also like to welcome to Indonesia all of the participants who come from foreign countries, although I am sure that some of you are already familiar with this country.

I have much interest and hope for the present Workshop not only for its end-results but basically for such cooperation. Cooperation between developed and developing countries in the field of practical science is needed. Such cooperation has its own meanings for the benefits of all, for the benefit of the world and humanity.

In May, 1968, LIPI and the US - NAS conducted a "Workshop on Food." The results of the workshop were very useful in constructing our present Five-Year Development Plan, especially for the food sector. As it is known, the care of the present Development Plan is the agricultural sector.

The present Five-Year Development Plan is just the first stage of a series of stages that follow in development sequences.

The structure of the Indonesian economy at the present time is more agricultural, and it is clearly shown by the dominant role of the agricultural sector compared with the industrial and other economic sectors. In the long run, Indonesian economic development must focus on an economy with a strong industrial sector, with its own capacity to develop quickly and cumulatively, and which can eliminate economic weaknesses due to the agricultural-centric nature of the economy.

Shortly, the aim of the long-run purpose is a basic change in the Indonesian economy.

Such an aim requires sound and serious planning and a strong economic basis: food requirements should first be fulfilled; adequate infrastructure; preparation of the manpower and skill needed; mental attitudes and working patterns of the society; capability to import capital goods for industrial development; and so on.

In the coming second Five-Year Development Plan, we have to ensure that there will be a balance between agricultural and industrial development; with this there should also be a balance between development in material, as well as spiritual and social, welfare. Such a balance will strengthen each against the other; each will accelerate the growth of the other. Besides, the balance between material and spiritual welfare is an important aspect of the society to which we are aiming, and this must be reflected in every development stage.

All of these, nevertheless, will depend a lot upon the execution of the present Five-Year Development Plan.

Development preparations for such aims in the next development stages should have been made now.

We have done something for the industrial sector, either to support the attainment of targets stated in the present Five-Year Development Plan or for the preparation of future requirements. Industrial development at the present time is oriented toward these industries which support our agricultural sector, cloth industry, and toward medium and small industries to absorb manpower, and to these industries to support our balance of payments.

In line with this, we have to pay attention to survey and research activities as stated in the present Five-Year Development Plan.

Ladies and Gentlemen,

In the field of industry and technology we are as far as three decades behind. It is really a loss which has at the same time become an extra ordinarily big challenge. This is true especially if we remember that the success of the world today gets its impetus from success in industry and technology, which tend to accelerate.

In the efforts to catch up with the loss in industry and technology, we have to be pragmatic and realistic, to rely on our potential and on maximum possibilities. In this case, among the important steps we have to take is to stimulate our industrial research activities which are still far behind and lacking. The same thing for experimentation of the use of technology in industry. Also facilities that push the development of existing industries such as production marketing should be kept on.

Parallel with this, all existing funds and forces should be used toward efficient utilization. There should be consistency among research projects and foreign assistance and our National Development strategy. The same thing for foreign and domestic investment, they must be used efficiently toward industrialization.

Meanwhile, we have to learn from the experiences of the developed industrial countries. We have to find out and control those negative socioeconomic and cultural effects due to the industrialization itself.

These are problems I would like to present in this Workshop. I am sure there are more problems to be discussed which are not strange any more to any of you in this Workshop since you are experts with much experience. A comprehensive and intensive discussion of industrial and technological problems will clearly be of much importance for further development activities in Indonesia.

Since from the past "Workshop on Food" the Indonesian Government has utilized its results to construct our first Five-Year Development Plan, now I am hoping for the same thing. Results of this Workshop on Industrial and Technological Research will be provided by the Government to construct the coming second Five-Year Development Plan.

Thank you.

Djakarta, January 25, 1971.

PRESIDENT OF THE REPUBLIC OF INDONESIA

sgd

S O E H A R T O
ARMY GENERAL

INDONESIAN ECONOMIC GROWTH POTENTIALS

by

EMIL SALIM

Entering the 1970's the United Nations has urged the developing countries to reach as a target in the international development strategy for the second United Nations development decade at least the 6 percent average annual rate of growth in the gross national product, with the possibility of attaining a higher rate in the second half of the decade.

With an expected average annual increase of 2,5 percent of population, such a target allows for a 3,5 percent growth in average income per capita, and enables doubling of average income per capita in the course of 20 years.

To achieve a 6 percent average annual rate of growth, agricultural output should grow at a rate of 4 percent, and manufacturing output at 8 percent per annum.

Such a growth rate target also requires a steady increase of the ratio of gross domestic saving to gross product up to the level of 2 percent by 1980, and an average growth of imports at less, and exports at higher, than 7 percent per annum.

These growth rates are expected to be achieved through proper development policies of the country's economic growth potentials. In order to be able to launch a proper development policy, it is of utmost importance that correct information be available to exploit the most relevant and strategic economic growth potentials.

Within this context, it is appropriate if research, engineering, and development activities are geared toward obtaining the most suitable information to develop the most strategic growth potentials. As such an overall view on the most relevant growth potentials of the Indonesian economy could serve as a frame of reference for the formulation of a proper research, engineering, and development strategy.

1. Indonesia's Growth Potentials

Of the traditional four factors of production, Indonesia has available sufficient natural resources and manpower, but is lacking, however, in skill and capital.

Many centuries ago it was primarily the availability of Indonesia's natural resources that have attracted foreign countries to dominate Indonesia and reduced the country to a colony. During that period an economic structure emerged, based predominantly on the two major production factors, resources and labor. Such an economic structure was primarily agricultural with, its orientation toward exports.

While agriculture and exports have been flourishing, it was not possible to push the economy into the take-off. The agricultural and export base was too narrow, and limited to less than seven major export commodities. And the impact of growth was largely felt to benefit the colonial power, leaving poverty and backwardness in the colony.

Although Indonesia has the necessary growth potentials, without proper development policies these potentials could not blossom. An economic policy of exploitation, rather than development, and serving the colonial power's interest rather than Indonesia's interest, has failed to get the economy off the ground.

Since independence, more than 25 years ago, no fundamental change has taken place in Indonesia's economic structure. The structure of Indonesia's economy is still predominantly agricultural, and export still plays a major role in Indonesia's economy.

More than 50 percent of the national product is contributed by the agricultural sector, 17 percent by the trade sector and approximately 12 percent by the manufacturing and industrial sector.

Although Indonesia's economic structure has basically not changed, it is interesting to note that during the last decade, Indonesia's economic rate of growth has shown significant changes. During the period of 1960 - 1967 the rate of growth in national income has shown an average growth rate of 2 percent per annum in real terms. Considering that population grow at an average of 2.3 percent annum, it is clear that during that

period Indonesia was experiencing an effective decline in the growth rate of income per capita.

Since 1969, however, the growth rate in national income jumped to 6,6 percent. It is estimated that during 1969-1970 an average growth rate of above 6 percent has been achieved. With a 2,5 percent rate of population growth, it allows for a net increase of 3,5 percent growth rate in income per capita.

Such a rate of growth has been achieved by emphasizing major sectors, such as agriculture, infrastructure, exports and mining.

As elaborated in Indonesia's Five-Year Plan, covering the period of 1969/70-1973/74, priorities are given in the allocation of resources for the development of agriculture, primarily rice and exports; infrastructure both economic and social; and mining. This is to be developed while maintaining overall economic stability. The agricultural sector, and mainly rice, is expected to become the leading sector for growth.

Indonesia is currently still importing its basic staple food, such as rice, up to the amount of US \$ 125 million. In concurrence with the LIPI-MAS Workshop on Food recommendations (May, 1968), Indonesia has given major emphasis to food production in its Five-Year Plan. It is hoped that at the end of the Five-Year Plan, Indonesia can at least reduce import of rice to a zero level.

During the last 3 years, the production of rice and other agricultural crops shows a significant increase. While continuous growth in agriculture is expected, it should not be overlooked, however, that the ceiling for agricultural growth, especially food, is rather low. Furthermore, a large portion of agricultural output is sold for export. The market for Indonesia's traditional export crops, -like rubber, coffee, tea, tobacco, copra, and palm oil, -are not very stable or promising. As such, in Indonesia's case, the agricultural sector may well serve as the initial pusher and leading sector during the 5 years of the development, but should be accompanied by other leading sectors in the course of the development. Indonesia needs to find other significant economic growth potentials that allow Indonesia to reach a higher rate of growth.

In exploring these proper economic growth potentials, we should take

into account Indonesia's major ~~constraint~~ factor which limits the speed of growth, namely foreign exchange.

Being a country lacking capital and skill, most major capital goods, spares, and semifinal goods have to be imported. In most cases, double expenditure of foreign exchange is required for the same commodity. Foreign exchange is required for importing rice as a final consumer's product, but also for importing inputs and capital goods needed to produce rice; for the single purpose of providing rice, foreign exchange is doubly required.

Recognized foreign exchange as the major constraint factor, the choice and the development of Indonesia's economic growth potentials should be geared toward elevating the pressure of these constraints. In other words, the economic growth potentials which deserve high priority to be exploited should be those which are exportable. In this category, the major economic growth potentials to be exploited are forestry, mining, and export manufacturing.

2. Forestry, Mining and Industry

Indonesia's forestry resources belong currently to the category of scarce resources in Asia facing a demand, especially from Japan, which seems still far away from the saturation point. Approximately 120 million hectares of forest are available and, practically, not yet fully exploited. Indonesia's exports are currently growing rapidly, and limited in this initial stage to logging. In terms of value, logging is now becoming the number three major contributor to our total exports in 1970. The value of US \$90 million export in 1970 really doubles the last 1969 value of logging export.

The experience in South Korea has shown, however, that processed forestry products can also become major export commodities, growing at an astonishing rate. In 1959 veneer sheets were exported to the amount of US \$ 11,000, representing a meager fraction of the US \$ 20 million total exports.

In 1969 this export jumped to a level of nearly US \$ 80 million, or an increase of 80,000 times, representing 11 percent of total exports, of US \$ 700 million.

The quality of Indonesia forestry produce allows for a wider range of processed products, from veneer sheets to paper products. These forestry resources are in most cases available outside Java, and hence processing

these products provides various important benefits.

It could not only absorb labor, but may well become a powerful pull factor in transmigration. As such, the processing industries of forestry products may provide the needed stimulus to growth in our economy.

Processing and developing forestry resources, however, also requires knowledge of rapidly growing technology. In order to be competitive in the world market, it is of utmost importance for the forestry sector to gain from the growing technology. As such, proper research, engineering, and development strategy in forestry may well boost the growth in this field.

In the field of mining, thus far has been established that Indonesia possesses vast resources of oil, coal, tin, lateritic nickeliferous iron, and low-grade nickel ores. Taking into account however, that out of the total land area of Indonesia only about 5 percent has been mapped geologically in any detail, 75 percent only cursorily reconnoitred, and the remaining 20 percent completely unknown, while the offshore regions are scarcely known, there is reason to believe that mining may have sufficient potential wealth.

From the existing and known resources however, the indicators show that mining may well become soon a major factor in our export and economic growth.

Crude oil production, for instance, has risen steadily over the last 5 years at a rate of almost 10 percent annually, from a level of 170 million barrels in 1964 to 271 million barrels in 1969. In 1970 it is expected that production may reach 310 million barrels. Such a growth affects favorably the increase of Indonesia's oil export.

Tentative estimates show that export has increased from US \$ 830 million (1968) to US \$ 366 (1969) and US \$ 426 million (1970), indicating an average increase of approximately 20 percent per annum.

In addition to oil, Indonesia has also other hard mineral mining as main foreign exchange earners, such as nickel, tin, bauxite, and copper. In the early 1960's mineral production suffered a serious setback, because of the deteriorating conditions of infrastructure and an unfavourable development policy, such as inflation, fixed exchange rate system, etc.

After stabilization, however, and since the beginning of the development plan, rehabilitation programs were implemented and further explorations initiated.

Being the main producer of nickel ore in Southeast Asia, Indonesia is selling practically all its output to Japan. This export shows a significant increase from 259,000 tons in 1969 to an estimated 425,000 tons in 1970. In the meantime, exploration is being done by various foreign firms in the areas of Halmahera, West Irian, and Southeast Sulawesi.

Although explorations have shown that vast deposits of nickel ore exist, the important challenge becomes to develop the proper technology of nickel extraction from these resources. In this connection, a proper RED plan may contribute significantly in the exploitation of these resources.

Nearly 10 percent of the world's tin mine production is contributed by Indonesia. During the period 1954-1966 tin production declined from nearly 36,000 MT in 1954 to 12,000 MT in 1966. Currently, this drop of production has been reversed, and reached in 1969 the level of 17,000 MT while at the rate of 1,000 MT per annum it is expected that in 1972 production will reach 20,000 MT.

Parallel with the growth of production, the export of tin is also steadily rising, in spite of the disturbances and decline in the world market prices. The potential for recovering the former tin output and even extending it is obvious. In this field improved technology may well push up the quantity and quality of our tin products. Being a latecomer in the increase of tin production, the system of setting quotas by the International Tin Council, and the intention of the United States Government to release stock gradually, may make future market prospects not fully bright. This calls for a constant effort of improving quality and reducing cost, to make Indonesian tin competitive in the world market. In this context RED planning may also contribute significantly.

In the production of bauxite, market limitation proved to be the major constraint for expansion. Production has, however, increased steadily, especially since 1966. Over the past 5 years, production has increased, reaching 770,000 MT in 1969 as compared to 648,000 MT in 1964. Important to note is that improvement in harbor facilities and other infrastructural requirements has pushed export and production upwards.

7. further development of providing cheap electric power may become a crucial factor in transforming bauxite into alumina, and perhaps aluminum. Currently, several interested private foreign investors are exploring this possibility. This development, if feasible, may open a wide range of other opportunities for which RED also could contribute its share.

A new item in Indonesia's potential export mineral product is copper. A large United States firm is currently following promising leads in West Irian. Here again, the proper technology may be the answer to exploiting these deposits in the most economic way.

While other mining products are also available, it has been sufficiently demonstrated that mining will become in the future a major economic growth potential. The successful exploitation and development of these resources are closely linked with the utilization of proper technology. In this context, it is fair to say that RED programming may become an effective tool to make this growth possible.

The third major economic growth potentials are concealed in manufacturing. Differently as compared with agriculture, industry has the benefit of having the capabilities of higher growth potentials. History has shown that traditional primary exports cannot assure a rapid rate of economic growth. Higher rate of increase in productivity in manufacturing, its ability to create employment has made industry for most developing economies identical with the symbol of development.

In Indonesia, the limitation of growth potentials in raw primary products, the limitation of foreign exchange as the major constraint factor, the availability of industrial resources, and the rapid increase of supply of labor, forced Indonesia to attain further development in industry. This stage, however, cannot be obtained in a jump, rather it should be achieved through several stages. Presumably the next Five-Year Development Plan (1974/75-1979/80) will become the first major step toward building the proper base of industrial development, allowing full-fledged industrial growth in the Third Five-Year Plan (1980/81-1985/86).

3. "Outward-Looking" strategy

During the past period of 1959-1965, Indonesia was adhering to the policy of industrial development, emphasizing the growth of basic-industries and import-substituting industries.

The inflationary policy of that period, combined with a too protective policy, relying on tariff-duties, special levies, import purchases, multiple exchange rate system, and other basic price measures policies, has produced, however, a rather distorted pattern of industry. The contribution of industry to national income and export remained stagnant, producing an economic growth rate below the rate of population growth.

Learning from experiences in our recent past and looking to the strategies of industrial development in several developing countries, it is perhaps useful to have a fresh approach toward industrial development. Imposed by the limitation of the domestic market and the limitation of foreign exchange, Indonesia may be induced to have an "outward looking" strategy, focusing on the world market in developing its industries.

In preliminary study, Richard N. Cooper from Harvard's Development Advisory Service, drew the tentative conclusion that South Korea, Mexico, Taiwan, and Malaysia-countries which are identified as following an "outward-looking" industrial development strategy, catering to the world market-show a better growth performance, compared with countries such as India, Philippines, Argentina, Brazil, Pakistan, etc., which are identified as adopting a so-called "inward-looking" industrial development strategy catering to the domestic market.

The very nature of facing a more tough competitive market in the world, as compared with competition in the domestic market, enforces more efficient operation and hence a better performance.

Indonesia has for a long time had basically an "inward-looking" industrial development strategy, indicated by policy measures of excessive protection, import substitution policies, banning of certain imported commodities, and activities catering primarily the domestic market.

Indonesia has, however, sufficient potentials for developing industries to cater to the world market. We have briefly explored the potentials in forestry and mining. A further exploration into the various vast resources reveals that Indonesia could well develop export manufacturing industries, using inputs such as fish, meat, natural hair, rubber, textile, garments, components of bicycles, transistors, handicrafts, etc.

These major growth potentials-forestry, mining and export manufacturing-have the characteristics of not yet being fully exploited and developed in the country, while on the other hand, world market demand is steadily increasing. Indonesia has the necessary required material input, labor, and skill. A minimum period of training is in many cases necessary and feasible. Those sectors have also the ability to absorb labor, which currently and perhaps also in future years, is still competitive in wages, compared with other Asian countries. These sectors have the characteristics to increase foreign exchange earnings. They are applicable for large-scale production methods. In many cases, they are also the fields of production where technological change is possible, imposed by the nature of competitiveness of the world market.

In brief, these major sectors have the ability to be highly productive, and as such may become the crucial push-factor to get the economy over the hump and into the take-off.

But technological change and increased level of productivity requires continuous effort in research, education, and development. As such, the proper programming of R & D activities in these major growth potentials can become vital in helping our economy to grow.

While this has been said, we don't underestimate other important sectors of economic activities, such as basic industry, petrochemical industries, aircraft industries, etc. These sectors may also have a future. But given the limitation of skill, resources, and market opportunities, it is fair to say that these industries rank below those export manufacturing industries that are able to enter the world market.

We recognize also that the development of these economic growth potentials requires a massive effort of rehabilitation and development of infrastructure, either social or economic.

Also, we should not overlook the dimensions of difficulties facing the efforts in developing these growth potentials. As a country at the initial stage of development, Indonesia is facing numerous problems, such as shortage of long-term and short-term capital; the absence of capital markets; the inadequacy of a favorable growth-inducing corporate law; the rigidity and constant changes of government regulations; the inadequacy of our labor law; the various extra-legal or illegal payments; the low salary scale; the absence of proper technical, managerial, and supervisory skill; the absence of an inspiring research and development climate; the limitations of the budget; etc.

Going down this list it seems almost impossible to overcome these difficulties and get the economy off the ground.

Looking backward however, to the road we have traveled and the difficulties we have encountered, it is clear that these problems are no more difficult than those we have faced in the recent past. It is hence most likely that in due course of time also these difficulties can be overcome.

Furthermore, looking closer at the nature of the problem, it is obvious that many of these problems are inherent in the nature of the underdevelopment of our economy. The research and development programme aiming at developing our economic potentials should therefore take into account the constraint imposed by the very nature of the underdevelopmental environment in which they operate.

While these short-term difficulties are being met, it is important, however, to focus all our efforts, including research and development activities, to these strategic economic growth potentials that may push the Indonesian economy into self-sustained growth, because it is not only most rewarding, but also crucial for the survival of this nation which has suffered too much for too long.

Realizing the fact that even though Indonesia will fulfill the United Nations' recommendation, as set in its strategy for the second United Nations Development Decade, and double its income per capita within the course of the

next decade, it is worth remembering that such a doubling of income per capita still represents only one tenth of Japanese income per capita today.

Realizing this, we do not envy or despair, but it symbolizes the urgent need to run fast, to speed up our rate of growth, even beyond the target growth rate set by the United Nations. Such a higher growth rate is within reach through proper development policies, incorporating proper research and development activities, focusing upon strategic growth potentials, towards the goal of self-sustained growth.

May God bless our effort and yours in meeting this challenge.

Djakarta, January 25, 1971.

TECHNOLOGY AND ECONOMIC DEVELOPMENT

by

K. NAGARAJA RAO

Your Excellencies, Ladies and Gentlemen,

An occasion such as this, which brings together thoughtful scientists and ~~statesmen~~, research administrators, and technologists from industry from more than a dozen countries is truly an international forum for discussion of common concerns. At a time when serious doubts are being cast on the very values that created science and parliaments in the first place, we are gathered here for the constructive purpose of considering how science and technology can be used for the betterment of the human condition. We want to hope, plan, and work for the future and not despair over the mistakes of the past or be disheartened by the problems of the present. We meet here to share what we know, and to learn what we do not know. We meet in humility, but will constantly summon the essential logic of science to clarify our objectives and plan our actions--all to enhance the material and intellectual development of the people of Indonesia. It is a privilege to participate in such an exciting venture.

My claim to this honored place this morning is not my scientific and technological accomplishments. Others gathered here have much more of those than I. But I do claim the distinction, for an outsider, of having been associated with scientific and technological development in Indonesia for 2 decades--starting in 1950 with the development of research institutes of the Department of Industry and with the development of a national system of training of industrial teachers through the early 1960's, and now participation in a present workshop related to science and technology policy. Please accept this address as a personal homage to a country and people, whom I have come to love and respect.

The more than 35 papers that have been prepared by you for the conference make the job of the keynote speaker very easy especially when the papers are so thoughtfully and tastefully presented and speak to the issues with such refreshing frankness and objectivity.

The message you wish to convey is clear:

1. Indonesia must now provide an unprecedented impetus to the development of science and technology as instruments of national development.

2. REPELITA, the National Development Plan, indicates the priorities and provides the guidelines for the development of agriculture and industry and the physical infrastructure to support them. The principles enunciated here provide the points of departure for planning research and development programs to be conducted by industry, government, and university research laboratories.

3. On account of politico-historical reasons and patterns of industrial and agricultural development inherited from a colonial administration, Indonesian research capacity has remained at a low level. There is urgent need for the rationalization of the institutional structure of research to lead to the elimination of the duplication of institutions, facilities, and programs.

4. There are significant deficits in the scientific and technological research manpower in Indonesia that must be eliminated if research is to progress from a purely cultural activity to one contributing to industrial and agricultural development.

Since creativity is at the heart of research, the conditions of employment of scientists and engineers must be improved significantly to attract the best talent for research. Management of the research enterprises of the future requires the identification and training of capable research administrators.

5. The isolation of Indonesia from the international world of science and technology can be prevented by a more aggressive development of a scientific documentation and information service. Another important element in the transfer of technology is the development of norms, codes, and standards in keeping with national needs and capabilities and to facilitate trade.

6. A strong educational system is basic to modernization. A limited number of centers of graduate education in the sciences and engineering and more efficient programs for training of engineering technicians and craftsmen, and the improvement of teaching of science and mathematics at the high school level, are priority actions in education.

7. The resources being made available for research and development in Indonesia are not equal to the needs, especially when one considers the major job of rehabilitation and modernization of equipment that must be undertaken to restore research institutions to minimal operating conditions. The allocative machinery for research and development must be reexamined to direct financial resources, which are always in short supply, to priority areas of development.

The seriousness of purpose displayed in your analysis and the identification of the array of problems lead me to sound the keynote borrowed from Francis Bacon: "There is not so much a lesson to be learned as a task to be done." If Bacon were living today, he would have said more plainly, "Let us get on with the job."

While the general structural deficiencies are easy to identify, and under the impetus of a well-defined national science and technology policy, even to effect the structural reforms needed, the more difficult step is the selection of the actual problems on which to do research. In a workshop similar to this one held in Brazil, the following criteria for establishing and ranking research priorities were considered and, listed:

1. Government plans
2. Current economic and social importance
3. Market potentials
4. Availability of personnel and funds
5. Scientific importance
6. Use of national resources
7. Colonization of less developed areas
8. Benefits in relation to cost of research
9. Urgency
10. Likelihood of similar research being undertaken elsewhere
11. Likelihood of results being adopted and implemented on a wide scale

With these criteria in mind, sectoral studies are undertaken and within each sector, each industry is then examined to assess in which technological changes are likely to yield the greatest benefits. The next step, a much more difficult one, is the determination of the most appropriate technology for the social and economic situation in a given country or region. Once the appropriate technology has been defined, the developing country has the

choice of (1) importing the technology available and using it without modification; (2) modifying the imported technology to suit local conditions, and (3) undertaking domestic research and diffusing the results of research to industry. The processes described here are now fashionable described as the transfer of technology.

Transfer of technology across national borders and within nations is indeed an old game with a new name. Colonization usually brought some technology; and, in more recent times, private investment, joint ventures, licencing arrangements, and outright purchase of technology through acquisition of patents, construction, or management contracts are some of the other methods of technology transfer. A few of the problems that developing countries face in the acquisition of technology from outside are (1) a lack of knowledge of the most appropriate technology for a country's need; (2) the lack of foreign exchange to pay for them; (3) the difficulty of acquiring spare parts once the equipment has been bought; and (4) the inability to monitor the technological changes in the industry and the consequent obsolescence and loss of profitability of the process. Ideally, an industrial research institute in a developing country should be able to perform these functions and act as a kind of "sieve" for the new technology imported from abroad. This assumes that the institute is engaged in front-line research in the specific field. As Oldham has observed, "The problems of transfer of technology are different from those of the transfer of science."

Only a relatively small part of the transfer can come from books or journals. Like learning to fly or swim, technology can only be absorbed or learned by doing."¹ However, the drive is on by the developing countries for a mastery of the technologies. As multinational corporations are demonstrating, technology transfer can become a two-way street if countries do not impede this process by following policies of technological autarky.

¹C.H.G. Oldham. "Science, Technology, and Economic Development: Science Policy and Science Aid," Science and the Human Condition in India and Pakistan, edited by Ward Morehouse. New York: Rockefeller Press, 1963. pp. 133-137.

Although the technological transformation of traditional societies has been proceeding inexorably for several decades, it is only recently that the need for certain modifiers of past trends is being pressed for urgent consideration.

In a recent essay entitled "Science and Policy for a New Decade," Caryl P. Haskins of the Carnegie Institution summarizes his views:

When too rapid, over-enthusiastic and under-critical adoption of technologies from the developed world is combined with a much slower pace in the growth of a truly rooted indigenous science and an accompanying understanding of it in the developing nations, there is real danger that an imbalance can develop that in the long run may seriously threaten the cultural, and even the political, integrity of recipient countries.

Further [many hold that] an indigenously developed science (unlike advanced technology rapidly adopted for purely pragmatic reasons in a cultural vacuum) is, or can become, a vital element in a developing society, not only for its practical contributions in enabling a new to monitor its course in an increasingly technological world, but in allowing it to draw on that technology with a strengthened cultural integrity.²

Appropriate Technologies

While views such as these are a timely caution for the developing countries, the case for more appropriate technologies and more thoughtful methods of their introduction rests on more immediate and persuasive reasons. The transfer of industrial technology backed by fairly massive international aid has not reduced the gap between the rich and poor nations, and between the rich and the poor within countries. The gap seems to be getting wider. The capital-intensive technology being imported by the developing countries is not creating the new jobs needed for expanding populations of developing countries.

² Caryl P. Haskins "Science and Policy for a New Decade," Foreign Affairs, Vol. 49, No. 2, January 1971, pp. 237-270.

Modern industries concentrate, instead of distribute, power in the hands of the few and population in the cities.

"At present in the developing countries plenty of examples of sophisticated technologies exist--but as islands of modernity in a sea of stone-age technologies."³

It is becoming more evident that unemployment is growing at an alarming rate in the big towns of the less developed countries. In addition, underemployment is growing in rural areas and in urban marginal centers. This represents a colossal waste of the LDC's most abundant resource: manpower. The only solution may now be to look in all economic sectors for methods of production which will use more manpower and less capital and still keep the overall costs competitive. This will require the active cooperation of foreign investors for whom the path of least resistance and profit is the transfer of the already developed technology, which is usually labor saving.

The goal of "intermediate technology" is the development of technologies which are more effective and more viable than indigenous traditional technologies and, at the same time, far simpler and cheaper than the modern--simple enough to educate the people. The goal is to create millions of work places, instead of the few that modern industry creates at great expense.⁴

The concept of "intermediate technology" is not suited, however, for certain highly developed sectors, which are irrevocably committed to the most modern methods and can afford them. In an essay, Dr. E. F. Schumacher of the Intermediate Technology Development Group, Limited of Great Britain, says,

Intermediate technology is not a stupid man's fancy that something quite second rate would do. No, it is the appropriate employment of our best intelligence.

³J.E. Stepanek. "An Engineer Scans the Developing World." Olin Lectures, Yale University, October 1961.

⁴E.F. Schumacher. "Economic Development and Poverty," Bulletin of the Intermediate Technology Development Group, Limited (9 King Street, Covent Garden, London, W.C.2.). pp. 3-9.

It cannot be achieved just by good will, not just by voluntary service overseas of schoolboys or young students, excellent as their efforts may be. No, it should be backed by the best scientific and engineering knowledge that we can muster.⁵

It appears to me that the place for innovation in intermediate (and I prefer the word "appropriate") technologies is at the interface between agricultural and industrial sectors. To cite experiments right here, 20 years ago the Department of Industry of the Government of Indonesia initiated the program of Central Production Units (Induks) in several consumer goods industries--ceramics, textiles, leather products, agricultural handtools, metalware, food, etc. The Central Production Unit equipped with appropriate machinery provided help to the home produces in improving raw materials, design, finishing, and marketing of the products. The related industrial research institute provided the research back up. Similar techniques are now being used to help the poor of the urban ghettos in the United States by an organization called VITA. (Volunteers for International Technical Assistance).

In the Bandung Institute of Technology, Iskandar Alisjahbana is trying out some labor-intensive techniques even in a sophisticated field such as electronics and microwave technology. Technology combined with new methods of organizations is at the heart on this process, which the present advanced countries practiced in the early stages of their industrialization.

But unless there is a deliberate policy on the part of the Government, engineers and equipment salesmen of developing countries themselves contribute to the importation of the most capital-intensive technology. Among actions that developing countries could take to increase employment through labor-intensive technology are

1. Reeducate the engineer;
2. Break products down into components of varying complexity;
3. Make graduate research institute the centers of such innovation;
4. Reward such innovation;
5. Develop a good information system;
6. Build prototype plants using appropriate technologies;
7. Process or semi-finish raw materials before export; and
8. Make teams of engineers and economists to formulate new design

⁵ Ibid., p. 8.

parameters for industrial plants.⁶

However, with all the euphoria about labor-intensive technologies, case studies of industrial processes suggest that

1. The effective use of abundant labor materials and skilled human resources and managerial capacity. /often

2. In many industrial processes, the more capital-intensive processes are simply the more physically efficient beyond a minimum scale of output.

3. For certain types of products, equality and precision requirements limit the use of human skills.

4. Indirect costs to utilize abundant factors may be excessive.⁷
problem

In spite of these /every sector and examine every process to see where the abundant factor of manpower can be optimally used in the developing countries. Infrastructural development, housing, food technology, agriculture, and even education and other service industries are some of the most promising areas for innovation.

Population Growth, Natural Resources, and Environmental Quality

The phenomenal growth of population throughout the world and especially in the developing countries, the intense technological development in the last few decades, often dependent on the consumption of finite natural resources, and the resulting uncontrolled decay in environmental quality have for the first time closed in on mankind all at once, we are coming to realize that "we may be groping toward the ceiling in human events." To use Peter Drucker's phrase, we may have reached a point of discontinuity in the human story. The discussions of the causes for these conditions are popular subjects for conferences like this and run the gamut of forecasts of imminent doom to ebullient hope of a new technology supported by rational policies and international actions forging a new society of man in equilibrium with nature.

In a recent editorial in The New York Times, David B. Hertz summed this up as follows:

The price of sane economic and thermodynamic equilibrium will be a retreat from the consumption syndrome of the world's

⁶ J. E. Stepanek. op. cit.

⁷ See Jack Baranson. "The Influence of Economic Structure and Financial Resources on Engineering Technology for Developing Economies," pp. 48-54; and Walter A. Chudson, "The Dialog between Economists and Engineers," pp. 55-61, in Industrialization and Development, edited by H. E. Hoelscher and M. C. Hawk, San Francisco: San Francisco Press, Inc., 1969.

over-indulged to an environmentally balanced set of demands.

In this setting, the sane consumer may call for simpler, but perhaps more satisfying, products instead of the technological complexities of the developed nations' life styles. Once the basic needs of shelter, clothing, and food have been met, virtually all else is a matter of individual decision. And the pattern of this choice is the essence of civilization. So, the price of a new set of product demands that brings survival might turn out to be not so great after all. More symphony orchestras and fewer SST's might be a bargain indeed.⁸

A more pragmatic approach⁹ is to reconcile the ecological and the economic viewpoints by adjusting the value placed on the efficiency of each isolated economic operation whether it is in agriculture or industry. We need a new definition of efficiency different from the one which says "if a calculable output in a given economic operation exceeds calculable input, then operation is desirable."

The last words on the new roads to be travelled by man have not yet been said. We do not yet know the limits to the capacity of the water and air systems to serve as sources or sinks to pollutants created by man and his technology. What kinds of global and national monitoring systems are necessary are still subjects of debate among scientists of the world. Social scientists who often tend to use science and technology as the whipping boy are no more enlightened on the social costs of environmental degradation--pollution, noise, crowding, collapse of tradition, and erosion of ancient cultures.

A short-sighted view of some of the developing countries is that the time has not yet arrived for them to be concerned about these issues. "We need," a delegate to the U.N. from a developing country is reported to have said, "more factories and more pollution." No, the time is here, and the message is clear, while there is no cause for hysteria, there is urgent need for pragmatic actions and policies at the national and international level to improve human condition and preserve precious resources. The following are some of these, and their implication for research is obvious.

⁸ David B. Hertz. "The Cancer of Growth." The New York Times, January 14, 1971. Vol. CXX, No. 41263. p. 37.

⁹ See International Education: Four Perspectives, a pamphlet published by the Institute of International Education, New York, October 1970.

1. An active program of research and education in reproductive biology, demography, and social sciences related to population, couple with national programs of population control and family health.

2. Significantly higher allocation of financial resources for the increase of food production and research related to agriculture--research especially aimed at minimizing the second-generation problems resulting from the application of improved production technologies.

Controlled use of fertilizers and close monitoring of pesticides are especially important fields for research and action.

3. There is ample evidence to suggest that families migrating to cities from the rural sector actually fare worse from the nutritional standpoint. It has also been shown that the mere improvement in per capita income does not guarantee that the poor will invest in more nutritious food. The search for new and improved sources of proteins is a priority area for research, as is action to alleviate nutritional deficiencies of young children.

4. True conservation means wise exploration, efficient production, and economical use of natural resources not renewable. Safeguards to prevent environmental contamination in each of these activities are a must. In the case of renewable resources, exploitation without provision for renewal is a travesty on nature and a loss to the nation. Environmental and ecological criteria must be included in the choice of technology for resources exploitation. It is easy to give lip service to this concept and not enforce the laws that are already on the books.

While mineral resources are an important asset of a nation, they are not indispensable, as Japan has amply demonstrated. Continuous monitoring systems on the location of minerals, rates at which they are being exploited, and the technological alternatives of exploitation and utilization that are being developed abroad, including trade-offs between exporting minerals as they are found and partial processing of them in the country, are important elements of a good mineral exploitation and conservation policy. Mineral economics and the broader field of resource economics are undeveloped disciplines. The data base on mineral availability and rates of utilization is weak in many developing countries.

5. Perhaps in common with Brazil, Indonesia is a country in which there are ecologically undisturbed areas--areas in their natural state and untouched by the march of technology. Scientists here have a responsibility to identify these areas and convince policy makers of the need for such

areas to be protected from exploitation--for scientific investigation, for recreational use by a growing population, and for posterity.

The list above is intended not to be exhaustive but merely indicative of the range of problems on which actions should now be taken to prevent ecological disasters in the future. Eternal vigilance is the price for technological progress.

Education and Technology

I now come to the last, but perhaps the most important, element in modernization and that is education. A country with an antiquated system of education cannot actively promote development. Most often it is a drag on development. The revitalization of this sector is indeed urgent. Rich and poor nations alike find themselves in an educational crisis--a crisis of maladjustment between the educational system and their environment. The common response to the explosive demand for educational services everywhere is, to use Phillip Coombs' phrase, "a strategy of linear expansion--more schools, more teachers and more expenditure of public funds." The proportion of GNP devoted to formal education has risen from 2 percent in 1955 to 4 percent in 1970. Enrollments are increasing by 30 percent or more per decade. Education is experiencing an economic crisis because of a slowdown of the rate of growth of educational expenditures and the rise in internal costs. The social demands is, however, not abating. "Education is a labor-intensive industry with a high wage bill.

The big question today in education is how the developing countries (and even the developed countries) can replace the cottage-industry type of technology of education and improve its efficiency and productivity. Great Britain has recently taken the giant step of the "Open University," offering higher education to all who want it. Experiments on the use of educational TV, radio, improved texts, and mixes of these technologies to offer education to all are on the increase. The research methods, long familiar in science and engineering, are being extended to the long-neglected sector of education. If innovation is the name of the new game, education is a wide-open territory in which scientists of all kinds can work together. The new cry in education is not just relevance but accountability and the good old red schoolhouse is where the action is likely to be in the future. It is tantalizing to speculate on the possible technological approaches to bringing educational services to the 3,000 islands of Indonesia

and the effect they might have in forging a national consciousness, in addition to their other modernizing influences. My plea here is simply that innovations are needed in a long-neglected but a vital sector of education, if development goals of a nation are even partially to be attained. Science-education improvement from elementary to postgraduate level is a cardinal element of any country's science and technology policy.

An educational system that does not exclude the disadvantaged in both the urban and the rural sectors must be fashioned if social justice is to be made a reality.

A Final Note

National will is the most intangible factor in development and the climate for change is often difficult to build and maintain.

A Latin American scientist and educator, Dr. Jorge Sabato, speaking before the VIII Congress of the Latin American Iron and Steel Institute in Lima, Peru, put it very forcefully when he said,

The problems of underdevelopment will be overcome not by the application of a magic recipe, but by the simultaneous implementation of different policies and strategies.

Very slowly and almost reluctantly, Latin America is becoming conscious of this vital element; there are still too many government officials who think that research is a luxury reserved only for developed countries, and for too many entrepreneurs who are satisfied with just buying patents and paying royalties. They forget that the nation which ignores that task risks being left out of history, without being able even to understand the dialogue among the more advanced countries. They would only be able to display the traditional trappings of sovereignty that will then be empty symbols of a dead past.

These are fighting words indeed. In a world beset by a growing number of politico-technical problems such as the nuclear arms race, satellite communication, nuclear power, control of space and the seabed, and the transfer of technology through multinational cooperations, it is most important that each country have its own techno-scientific capacity for decision. The stronger the economies of developing countries, there is a better basis for international trade and commerce and, hopefully, peace.

I must conclude by telling you of the French marshal who told his gardener, "Plant a tree tomorrow." The gardener responded, "But it won't bear fruit for one hundred years." "In that case," said the marshal, "plant it this afternoon."

The time is now and the task is yours.

I wish you well in your deliberations.

PROGRAM DESIGN OF THE WORKSHOP
ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

Address

by

Sumantri

Chairman of the Indonesian Steering Committee

Distinguished panelist, resource persons, and observers,

In the design of the Workshop program, consideration has been taken that the objective (purpose) will be deliberations in order to formulate, conclude, and recommend aspects pertaining to the development of R, D & E capabilities which revolve around

1. Science and technology as the basis of activities;
2. Research, development, and engineering as the subject under scrutiny;
3. Industry as the source of problems and plans for R, D & E actualization and, as the recipient of R, D & E results, the object of the R, D & E activity.

Therefore, the problems to be discussed are the R, D & E activities and how to develop their capabilities in accordance with the needs of industry, of which an analysis of

1. the opportunities and constraints in the economic environment,
2. the present situation of R, D & E capabilities, and
3. the present situation of the industry

form the basis for planning current R, D & E activities in accordance with the situation at hand, while possible forecasts in the economic environment and its reflection upon future industrial growth form the basis of planning R, D & E capabilities to meet future demands of industry.

Borrowing management concepts, planning phase mentioned above is to be followed by the organizing phase; and here various alternatives are to be considered from international and national experience in order to obtain the most effective system to be utilized.

In the actuation phase of the management concept, a favourable climate is to be created for the effective operation of the R, D & E system as seen from its required inputs in order to meet the expected output in accordance with the plans deliberated upon as mentioned above.

Utilizing the industrial concept as an analogy, describe the inputs for R, D & E as follows:

1. Its raw material is the information system.
2. Its labour and machinery are the research workers.
3. Its management is the research leader.
4. Its finances are the funds available.

The products of R, D & E are valued through patents, utilized for standardization and quality control, and marketed through extension services.

In accordance with the ideas mentioned above, the Workshop has been designed:

1. topics chosen,
2. schedules made, and
3. scientists and experts allocated as discussion leaders and panelists

with the hope of obtaining reasonable results from the deliberations in the form statements, conclusions, and recommendations within the limited time available to us.

In the organization of the Workshop, the plenary session and working group session method has been utilized, where

1. in the plenary session, appropriate topics according to the design are presented and discussed primarily to clarify and expand points developed during the presentation of the topic; and
2. the working group sessions, oriented by the plenary sessions discussions, should cover the topics in greater depth to result in appropriate statements, conclusions, and recommendations presented to the final plenary session to be adopted as the result of the Workshop.

For the purpose of obtaining quick results, an outline of the comprehensive reports of the Workshop has been formulated to be filled with statements, conclusions, and recommendations as a result of the working group deliberations and the final plenary session deliberations.

Distinguished panelists, resource persons, and observers, the planning and organization phase of the Workshop on Industrial and Technological Research is over, and we are now proceeding into the execution phase of the Workshop; it is up to you to obtain effective results aided by the Steering and Organizing Committees.

We hope that you will enjoy many stimulating discussions and in a spirit of teamwork obtain concrete results for the benefits of the advancement of R, D & E in Indonesia.

Thank you.

CLOSING ADDRESS

by

Sumantri

Chairman, Indonesian Steering Committee

Bapak Ketua Lembaga Ilmu Pengetahuan Indonesia,

Mr. Chairman of the Indonesian Institute of Sciences,

First of all, permit me to say a few words of thanks to the participants and resource persons of this Workshop. On behalf of the Steering Committee, I would like to express our deep appreciation and sincere gratitude to all the participants and resource persons from the United States, from third countries, from international agencies, and of course also to the Indonesian participants and resource persons from the various agencies, universities, and private enterprises, for their participation and valuable contribution rendered during the Workshop. I would like to convey special thanks to the chairman, co-chairman, and rapporteurs of the various working groups, also the members of the drafting committee and, last but not least, to those who have prepared papers for the Workshop.

Mr. Chairman of the Indonesian Institute of Sciences,

The experience, expertise, and calibre of the participants and resource persons of the Workshop, have made the job of the Steering Committee an easy one. It is as if there is already a built-in automatic guiding and control system in the Workshop, so that the services of the Steering Committee have almost entirely been of an administrative and secretarial nature, which has been done well by the First Secretary, Mr. Kodijat, and the Second Secretary, Miss. Achmad, with their staff. The honour is theirs.

Now permit me to present to you the Summary Workshop Report and Recommendations. It is indeed a privilege and a great honour for me to do this on behalf of all the participants of the Workshop.

REMARKS AT CLOSING CEREMONY

by

H.L. Wilske

Mr. Chairman, Ladies, and Gentlemen,

One of the finest results of a Workshop such as this is that it brings fellow scientists together, so they can become better acquainted personally, and also discuss common problems. I would carry this one step further in the case of this Workshop, because it has brought together scientists from the United States and from other countries. We hope the friendships formed here will result in further communication, and that each of you will feel free to call upon the U.S. representative in your field for advice and information when needed. I can assure you that there will be wholehearted response, and requests may be coming the other way as well.

Another result of a Workshop such as this is that every one of the participants found it necessary to analyze his problems, and in so doing, was compelled to accumulate data and examine them critically. This was true of the U.S. scientists, as well as for the Indonesian group. Self-analysis can be very rewarding, and I suspect that there will be changes in the programs and methods of operation of many of the foreign visitors when they return to their own jobs.

I have detected recommendations in almost every report that research be coordinated, and that coordinating bodies be established. This certainly is not an attempt to criticize present organization, or present methods of operating. Rather, it is an attempt to help you avoid some of the steps we have had to go through in the evolution of research management. This is not to say that we are recommending organizations that are widespread in the United States. It is a recommendation, jointly evolved, which is in harmony with what we think we should have in the United States, in Great Britain, and in other countries. Maximum efficiency is essential in the management of the research scientist and the research budgets. This is one of the places where Indonesia can move ahead in adopting new practices, and use better management than many of the cases in more developed areas.

We have said, and expect to recommend again, that research scientists should take more interest in, and be given a greater voice in, determining public policy. Just one word of caution. This is happening in our country, but many of our scientists are suddenly becoming experts in every area imaginable. Botanists are becoming ecologists overnight, and, of course, we have the much-published case of Dr. Pauling's recommending vitamin C as a treatment for the common cold. This resulted in greatly increased sales of vitamin C, but it has also put scientists in general in a rather bad light, resulting in a very serious set-back to the efforts of others to advance the prestige of the scientists.

This morning we received the summary report of the Workshop. This was an outstanding accomplishment of Drs. Dardjo, Aroef, Clark, Afiat and Kodijat. They are highly commended, and they certainly were meticulous, for they were given a limit of nine pages, and their report is exactly nine pages in length.

The work of this Workshop could not have been such a success had it not been for the comprehensive background material provided by the Indonesian group. We appreciate this material, and also the opportunity for free and frank discussion during the Workshop sessions. The simple part of the work is drawing to a close with the completion of the report. The more difficult task, that of implementation, still lies ahead.

Thanks for inviting us to participate in this Workshop on Industrial and Technological Research. It has been a rewarding experience for all of us.

CLOSING REMARKS

by

Prof. Sasongko S. Adisewojo

Mr. Chairman of the LIPI,
Ladies and gentlemen, Friends and Participants,

On behalf of all participants of the Indonesian Group, I would like first of all to express our greatest and sincere appreciation for the honour and privilege of having been asked to participate in this Workshop. Our appreciation goes to LIPI and the U.S. National Academy of Sciences, especially for the opportunity to make contact with experts in other fields and to learn more from others, from the foreign experts in particular. We really do hope that occasions like this will be arranged more and more frequently, and that after we part today, cooperation, either institutionally or personally, locally or nationally, will be extended.

Indeed, many implementations of the recommendations of this Workshop are on our own shoulders. In fact, to be frank, each of us already knew several of the problems that the Workshop has compiled, and even some of the solutions were indeed in our minds before this Workshop started. However, something seems to be lacking that prevents us from executing and eliminating our problems. That is what makes us really hope that the LIPI with all the authority it has, will be able to initiate and systematically bolster the implementations of this Workshop's recommendations.

To our U.S. and other foreign friends I would say, please don't say "out of sight, out of mind." May these sessions in the Workshop be just a start for closer relations and cooperation. We sincerely appreciate your being with us and your way of thinking, concentrating more on action recommendations than on theoretical advice.

Last but not least, to our foreign guests, we wish you all a pleasant journey back home. And to all of us : May God's blessings be with us

Thank you.

LIPI-NAS WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH

R E M A R K S

by

Mr. John Shelton

on behalf of "other participants"

Professor Sarwono, Ladies and Gentlemen,

It is an honour to have been chosen to speak on behalf of the participants from other countries and international organizations. Indonesia is Australia's nearest neighbour, and there are strong and ever-growing ties between our countries. The ties between Indonesia and the other participating countries are no less strong.

We "other participants" are most grateful to the organizers of this Workshop--both Indonesian and American--for the opportunity to take part in it.

I would like, on behalf of us all, to thank the conference organizers and the LIPI staff, and to compliment them on the efficiency and thoughtfulness of the arrangements. Somebody once said genius consists in the infinite capacity for taking care of details, and that surely describes the way we have been looked after. Nothing has been too much trouble. Changes in programme and arrangements have been made without any hitch. We are most grateful for all that was done for us.

As we leave, each of us will be asking ourselves what will be our lasting impressions of the Workshop. I have consulted several of the other participants on this question, so I do not speak only for myself.

Firstly, we will remember that it has been a very strenuous week of work, but that it was a stimulating, interesting, and fully worthwhile experience.

Secondly, we will remember the many new friendships we have made, and hope that we will be fortunate enough to renew these friendship in the future.

Thirdly, we leave Indonesia having learned a great deal. There are no instant answers to any of the difficult questions that we considered, and the decisions on the questions concerning Indonesia will best be made by the Indonesians themselves. Prof. Sasongko has just said that you had already identified many of the problem areas before the Workshop began. Let me go further, and say that we have found during the week that you also have many of the answers. We hope that the Workshop will strengthen and confirm your confidence in your own solutions to your problems.

Dr. Rao said during the Workshop that the most important resource is people. You are fortunate in having already what the summary report calls a substantial nucleus of dedicated and trained personnel in the several government research institutes and universities. We leave Indonesia with the confidence that the future of your science and industry is in good hands.

It has been an honour and a pleasure to take part in the Workshop, and we thank you.

CLOSING ADDRESS

by

Professor Sarwono Prawirohardjo

Chairman, LIPI

Ladies and Gentlemen,

Today we are coming to the end of the NAS - LIPI Workshop on Industrial and Technological Research, which was opened on Monday, January 25th, 1971. During this week foreign and Indonesian scientists have been working laboriously on problems which were presented in the topics which were included in the agenda of the Workshop. I have been informed that the discussions were being held in a spirit of frankness, open-mindedness, understanding, and good faith with the single purpose of getting results, and that the general feeling was that the time spent during the week was well spent.

We must realize that a Workshop of this kind, where there is a joint participation of foreign and native scientists, has great advantages but also has limitations. For the Indonesians who are not only acquainted but also have to struggle daily with the problems mentioned in the topics of the Workshop, it is highly important that experienced scientists from abroad are taking a fresh look on these problems, and are giving their views based on their large reservoir of knowledge and experience and which not seldom are thought of, or realized by the Indonesians concerned.

On the other hand, the foreigners do not have the knowledge of the local conditions with its limitations and potentials, which only the Indonesians can provide. In this process of interchange, a clear understanding and a mutual respect for each other's opinions is a conditio sine qua non for the success of the Workshop; and I believe that these have been achieved at these meetings. It would be ideal if the participants coming from advanced countries had some experience in working in developing countries, but this is too much to expect. Therefore, I very much welcome the participation of the colleagues coming from developing countries and from the same region with many similar problems.

I must acknowledge and apologize that the arrangement for their participation was made at rather short notice, but I hope that their participation in future Workshops will become a tradition. We from our side will certainly be most happy to participate in Workshop organized by our neighbours.

Ladies and Gentlemen,

I have heard with great interest the Workshop Report and Recommendations, which have been presented by Mr. Sumantri, Chairman of the Indonesian Steering Committee. You have been aware that in his Address the President of the Republic of Indonesia expressed a great interest and had great hopes concerning this Workshop. Therefore we shall see to it that the Report will reach him as soon as possible. Many Government agencies, especially the Ministry of Industry and the BAPPENAS, and of course the LIPI, will certainly study the report carefully, and I am convinced that those recommendations, wherever feasible, will be implemented. Although the main emphasis of the Workshop is on Research and Development and related services, important indications will certainly be found in the Report concerning the direction of our industrial development. In this connexion I should like to quote from the Keynote Address of Dr. Emil Salim, stating that "presumably the next Five-Year Development Plan 1974/75-1979/80 will become the first major step towards building the proper base of industrial development, allowing full-fledged industrial growth in the Third Five-Year Plan 1980/81-1985/86. This base should be planned during the coming 3 years, and I hope and believe that the Report of this Workshop contains many important suggestions, which can be used in the formulation of its concept.

Ladies and Gentlemen,

I hope you will permit me to quote also from my Opening Address. "Although Indonesia should use foreign technology to the fullest extent for its industrial development, the development of its own research capability should not be neglected. Without an indigenous scientific and technological capability, we shall always lack the knowledge and the human skills to implant foreign technology on our soil and to adapt it to conditions and circumstances in the country." The theme of ~~this~~ Workshop is "Industrial and Technological Research," and certainly will be a wealth of information upon the development of this capability in its proceedings. The U.N. General Assembly in launching the Second United Nations Development Decade starting from 1st January, 1971, included a statement on science, from which I quote the following sentences:

1. Developing countries will continue their expenditure on research and development and will endeavour to attain, by the end of the Decade, a minimum average level equipment to 0.5 percent of their gross product.
2. Within the framework of their individual aid and technical assistance programmes, developed countries will substantially increase their aid for direct support of science and technology in developing countries during the Decade.

I am not sure, but I presume that the figure of 0.5 percent of the GNP refers to R and D proper with exclusion of the related services, because in the UNESCO Document SC/MS/93, from 31st July, 1970, the following sentence reads:

Developing countries should continue to increase their expenditure on science and technology (research, experimental development, and related scientific and technological activities), with a view to attaining, by the end of the Second U.N. Decade, a minimum level equal to 1.0 percent of their gross national product; of this, at least 0.5 percent of the gross national product should be for research and experimental development proper; those which have still not attained these objectives should aim at increasing the financial resources devoted to science and technology by about 15 percent each year.

LIFI is prepared with the support of the scientific community to do its utmost to achieve this goal, but this should be done in a responsible way. We have to convince those who are holding the strings of the purse, that this money spent on science and technology will not be wasted, and will for the largest part be used for carrying out programmes oriented to the development of technologies that are relevant to the needs of the country.

However, the developing countries cannot do this task alone; they need the help from developed countries, international agencies, and private foundations. Besides the usual forms of technical assistance, there are great possibilities in research and related activities in which developed countries can assist the developing ones. There is, for example, much research going on in advanced countries to develop synthetic products to substitute for primary products; I think that in these countries equal

emphasis should be given to research to find other uses for these products and to help the developing countries in strengthening their capabilities to do such kinds of work.

Ladies and Gentlemen,

Coming to the end of this Address I should like to thank all the the participants, whether they are full participants, or resource persons, or observers, for all the time and effort given to achieve successful results of this Workshop. I should like to extend my special thanks to those who came from abroad and many of whom have been travelling around half of the globe to come here. The statesmanship of Dr. Wilcke, Chairman of the U.S.A. Panel, has contributed much to the success of this Workshop. On this occasion, I should like to thank the National Academy of Sciences for its excellent choice of their panel members and last, but not least, for sending to us the indefatigable Mr. Earl Young. I am also grateful for the representatives of the third countries, whether developed or developing, and of the international agencies for their attendance and for their important contributions.

Now I should like to thank the Steering Committee under the chairmanship of Mr. Sumantri, and the Organizing Committee under the chairmanship of Miss Sjamsiah Achmad, and their staff for the heartbreaking work that they have undertaken. From previous experience, I know what is involved in this kind of work; but I have heard nothing else but praise for the work that the Committees have done, so it must be really good.

Before closing, I must not forget to mention one important aspect of the Workshop. Scientists from abroad and those from Indonesia have been in close contact for one week, and ties of friendship between people who did not know each other before have been established. Science is sometimes an official business, but far more important for the progress of sciences are the unofficial aspects. It is my sincere hope that many of the personal ties, established during this week, will remain and will fulfill their useful function of informal communication for the sake of the advancement of science.

I wish you all a safe journey home, and au revoir. Heroby, I declare the NAS - LIPI Workshop on Industrial and Technological Research closed.

WORKSHOP ON INDUSTRIAL AND TECHNOLOGICAL RESEARCH: ADOPTED SUMMARY REPORT

INDUSTRIAL AND TECHNOLOGICAL R, D & E

IN SUPPORT OF

THE ECONOMIC DEVELOPMENT OF INDONESIA

Introduction

Indonesia aspires to a 6 percent annual growth rate in GNP. Since the population is increasing at a rate of 2½ percent per year, this leaves 3½ percent for raising the standard of living of the people. The current growth rate has been achieved by emphasizing major sectors such as agriculture, infrastructure, exports, and mining. The growth rate in agriculture is expected to level off at 4 percent, but it is not yet at a level to eliminate food importation. The remaining part of the 6 percent growth rate must be found through development of other economic growth potentials.

The main constraints in improving the speed of growth are lack of foreign exchange, technical skill, and capital. Economic growth potentials which deserve high priority are therefore those whose products are exportable, such as mining, forestry, and export-oriented manufacturing; for without foreign exchange, the inward-looking enterprises, which are also important, cannot grow in their service to the people. In implementing this strategy, one cannot overlook dimensions of difficulties facing the efforts in developing these growth potential, such as the absence of capital markets, the inadequacy of a favorable growth-inducing body of corporate law, and an environment which does not fully encourage research and development in support of industry.

The strategy of utilizing research, development, and engineering (R, D & E) to accomplish the desired industrial growth is the concern of this Workshop. The planning of the R, D & E needs is to be done now, in anticipation of the industrial growth. Proper decisions can assure the provision of the necessary technical support needed by industry to close the gap in the 6 percent GNP growth rate. To do this we must know our present status, the difficulties to be encountered, and the decisions which are to be made to overcome them.

What should be done, and how the proper environment can be developed for R, D & E to flourish and achieve its desired purpose, are the concerns for deliberation of the Workshop.

THE INDUSTRIAL AND TECHNOLOGICAL RESEARCH SYSTEM:

THE ORGANIZATIONAL FRAMEWORK

A. Varieties of National R, D & E Organizations and Institutions

There is no standard pattern for national R, D & E organizations, even in the developed countries, that could be directly used. In those countries where most of the industry is state-controlled, the R, D & E organization is wholly government operated, but in countries with mixed economies, state, and quasi-private organizations occur.

There is a variety of R, D & E institutions, some of which specialize in either basic or applied R, D & E. An example of the former is the Max Planck Institute in West Germany and of the latter, the Welding Institute in Britain, which includes information facilities. On the other hand, there are some which are multidisciplinary, e.g. the T.N.O. in the Netherlands.

It is clear, therefore, that the type of R, D & E organization and institution established in this country must be designed to meet its own conditions and needs.

B. Supporting R, D & E Infrastructure

At the present time, R, D & E infrastructure is not well developed in Indonesia. To establish a good scientific climate it is necessary to have vigorous postgraduate research institutions which have established themselves ^{as} centers of excellence. The reserves of expert manpower, equipment, library and information services thus enables R, D & E programs to be quickly implemented. The rate at which R, D & E programs can be implemented in Indonesia will therefore depend to a large extent on the speed with which a R, D & E infrastructure is built up in the country.

C. Special Requirements of Industrial and Technological R, D & E

In order to effectively serve the industrialization program, R, D & E effort must be organized and disciplined at a reasonable cost. Research projects need careful planning, accurate budgeting and scheduling, and monitoring of their progress. Competent technical staff has to be developed in order that the latest scientific and engineering techniques can be applied to the solution of R, D & E problems.

D. Environmental Constraints on Industrial R, D & E

REPTELIA provides the goals for planning the industrial R, D & E. The restrictions are the inadequately developed infrastructure, lack of funds, and lack of motivation of the R, D & E manpower. A well-defined national science and technology policy may improve the possibility of having a better coordination of R, D & E efforts/

PROBLEMS AND PLANS IN SELECTED INDUSTRIES AND THE R, D & E ACTION STRATEGY

A. Small-Scale Industry and Handicraft

Obsolescence of equipment and technical skills are problems in the small-scale industries, largely as a result of lack of capital. Research and new-product development are handicapped, and in general, the quality of the products is lower than desired. Regional research centers for small-scale industries should focus attention on research to correct those deficiencies, needed rehabilitation of equipment, and capabilities. Research effort is directed to the utilization of indigenous raw material and the improvement of quality of products for export.

B. Chemical, Pharmaceutical, and Fertilizer Industry

The plan of action proposed is to rehabilitate, modernize, and expand the existing industries, and to provide surveys and studies for the preparation of a master plan. Studies are to be made on the mineral resources of the nation to provide local raw materials. The encouragement of foreign investment would serve as a complement to the national economic development and research within the sectoral group.

C. Agro-Industry and Food-Processing Industries

Food wastage caused by lack of adequate preservation, processing, and distribution systems is the primary area for improvement. The lack of coordination of use of research facilities, manpower, and programs is a serious problem.

Research programs are needed to provide the technology necessary to solve these problems under the conditions prevailing in Indonesia. Coordination and supply of more adequate facilities to train manpower can be provided by a Center of Food Technology.

D. Textile Industry

The inherent problems in the textile industry are the dependence on imported raw material, the intersectoral imbalance of capacity, and the structure of the industry. The transitional problems are undercapitalization, inefficient operating conditions, and the attitude of industrialists resulting from their past experience in obtaining underpriced raw material allocations from the government.

Problems of research institutions are lack of funds, qualified personnel, instruments, and information facilities.

The short-term program of textile industrialization is concerned with the rehabilitation of existing facilities; the correction of imbalances; and the improvement of policy on priority credits, protection, and preinvestment expenditure for survey, research, and upgrading. The long-term program is concerned with increasing production, improving quality, and promoting employment.

Research projects will be needed to explore the possibility of manufacturing man-made fiber and to select the most appropriate cotton variety for Indonesia.

E. Pulp and Paper Industry

In addition to general problems mentioned in other sectors, the pulp and paper industries are faced with problems of fuel-price policy and high interinsular transportation cost.

Research activity in these industries includes the exploration of the use of indigenous cellulosic material.

F. Metal, Machinery, and Equipment Industry

A problem, other than those mentioned above, faced by these areas of industries is education, i.e., to educate the people to be oriented to the use and maintenance of metal-working machines and equipment.

The Metal Industries Development Center is being constructed in Bandung and will have liaison offices in other cities.

Research programs needed in these areas are in foundry, welding, and heat treatment techniques, as well as machining practices and metallurgy.

FACTORS CONDITIONING R, D & E AND TECHNOLOGY TRANSFER PROGRESSES

A. Extension Services

Extension services bring the results of research, and information from the library, to the user for adaptation and application. Such an organization must gain the confidence of a "client" and find a way to demonstrate that it can be of assistance. Problems are identified, and the service then provides practical information, and, if necessary, assists in its application. There are several obstacles to the development of useful extension services in Indonesia. Examples are

1. An inadequate supply of qualified personnel;
2. Concentration of technical manpower in major urban centers, which makes it difficult to tackle problems in dispersed areas; and
3. N. organizational structure capable of drawing upon existing scientific and technical resources which are the necessary supports of effective extension.

B. Standardization and Quality Control

The ultimate objective of standardization is to promote the exchange of goods and services, including the protection of the consumers interests. Basically, it consists of the formulation of standards, their issuance and implementation.

For developing countries, standardization plays an important role in the development of industry. In Indonesia, it is at an early stage. The legal framework exists, but the statutory decrees and facilities for control are still lacking. Relatively few national standards exist:

Testing methods to assure quality are largely based on foreign standards, either wholly or partially adapted to Indonesian conditions. The difficulties in selecting the most suitable standards-testing methods for Indonesia are manifold; for example, poor condition of the majority of testing facilities, lack of skilled personnel, and lack of information on foreign standards.

C. Patents

The exclusive right to an invention conveyed by a patent stimulates progress in four ways:

1. It encourages research and invention;
2. It induces the inventor to disclose his discoveries;
3. It offers a reward for the expenses involved in development of the idea; and
4. It induces firms to invest capital in new lines of production which they might not risk unless some protection is afforded.

The first three of these incentives are applicable in Indonesia today. The fourth will come into existence as the drive toward industrialization succeeds. A legally authorized and operating patent system would help this situation in Indonesia.

KEY FACTORS CONDITIONING THE OPERATION OF INDUSTRIAL AND TECHNOLOGICAL R, D & E ACTIVITIES

A. Management of R, D & E

There already exists a substantial nucleus of dedicated and trained personnel in the several government research institutes and universities. The problem of increasing their effectiveness and productivity is at the heart of more efficient management of research. Delegation of greater authority to the research directors, lump-sum funding, promotion authority, and encouragement to seek funds from outside sources are some of the methods of building confidence and competence in research managers. Attendance at management schools and frequent meetings among research managers and managers from industry are other familiar ways for spreading new research managements techniques.

B. Training of Scientists, Engineers, and Technicians for R, D & E

Creative scientists are some of the most valuable assets of a developing nation. Because of the limited present stock of scientists and engineer and the need to plan carefully for the development of additional

members, manpower surveys are the first step to be taken. L.I.P.J and the Manpower Department have already started such an inventory. Once completed, this will help to identify the deficits in the various categories of specialized manpower.

In a country where the industrial research tradition is yet to develop, universities and government laboratories are often the only sources of scientific and technological manpower. Appropriately, these are also the places to produce more such researchers. Graduate education (post-Sardjana) and research based in selected university laboratories and with cooperative programs in government research establishments provide a strong institutional combination to produce researchers. Graduate education programs are expensive. They must be adequately supported over a long period of time. The concentration principle already applied in the support of a manageable cluster of centers of excellence in Indonesia is also applicable to research.

Academies are now producing science and engineering technicians and these are essential for the support of industrial research. Many countries in the region, including Indonesia, have started experimentation in new methods of teaching science and mathematics at the secondary level. However, the diffusion of these new methods and curricula, and the training of larger numbers of teachers, in the new methods often are not adequately financed.

C. Career Requirements

The lack of satisfactory schemes to provide monetary and professional incentives is an urgent concern of the research community in Indonesia. While it is difficult to expect that salary scales could be changed overnight to correct this condition, reexamination of salary scales, job reclassification, equity in conditions of compensation and promotion between research workers and administrators serve to relieve the present difficulties of researchers. The concern in many developing countries is that a person in whom a great deal of investment has been made, may drain away if such incentives are not provided.

D. Information Systems

The process of technology-transfer depends to a great extent on an efficient information system linked to sources of information abroad.

Scientific journals, texts and reference materials, periodic conferences on science subjects are some of the means to transfer information. There is indeed an explosion of information around the world, and acquisition and dissemination of pertinent information at a time when needed are aspects of a new science of information storage and retrieval. Indonesia has already a National Documentation Center and a system of libraries, both of which are unfortunately inadequate to serve effectively a growing body of scientists and the industrial community. Problems of disseminating information into a geographically dispersed country are indeed challenging. The need is urgent to fashion a system suited to Indonesian conditions.

E. Funding and Fiscal Incentives

Most developing countries have the problem of providing adequate support for research. Several developing countries are now trying to tap new sources of funds. These include the creation of research foundations, matching grants for research, a small percentage levy on industrial loans, and incentive and contributory plans for domestic and foreign enterprises. Although funds may be available, streamlining budgets, and timely disbursement of funds already allocated, increase the effectiveness of the funds invested in research.

F. International Technical Assistance

In the solution of many of the problems listed, technical assistance from other countries and from international agencies and foundations has been a major source of help. However, on account of the high cost of such assistance and the difficulty of synchronizing it with the needs of the country in time and substance, there is need to use the assistance with care, and selectively to put major emphasis on the development of indigenous research capacity.

RECOMMENDATIONS AND ACTION PROGRAM

The studies of working groups resulted in numerous recommendations, of which the salient features are presented here.

At the level of the national government, the issuance of a national science and technology policy was urged as a guide to future actions affecting the interaction of R, D & E with the planned industrial development. It was recommended that the policy guidance be separated from the executive function.

Throughout, cooperation and coordination between industry and the research and technological community is emphasized.

Many operational constraints that inhibit the realization of the full capability of the Indonesian R, D & E effort were identified and recommendations made to remove or change these.

Trained manpower was recognized as the key factor to the future success to the country's R, D & E effort, and numerous recommendations were made about their training at several levels; assigning greater responsibilities to accompany greater autonomy for the individual institutes; or newly formed groups; encouraging them through different kinds of incentives; and recognizing the important role they must play.

Upgrading of the R, D & E infrastructure is needed, and recommendations were made to do this in several additional areas, such as improvement of laboratories and facilities, information systems, personnel procedures, funding, and training.

The importance of small-scale industry was underscored by several recommendations for its improvement, through centrally coordinated, but operationally decentralized, extension services with provision for participation of research institutes and universities.

Recommendations were made in several areas that are of interest to others, as well as to the R, D & E programs. These included patent matters, standardization, international assistance, and aspects of the information systems.

Among the specific actions proposed was the issuance of a national science policy. It was recommended that a national standards body be created, as well as a joint committee, to plan for a future information system. The value of the extension services to industry would be improved by a single organization to be created to plan and coordinate the program.

Concerning industries in the various sectors, the Workshop recommended that since many existing industries are obsolete in technique and technology, every effort should be made to transfer modern technology and approaches to their production.

It was also recommended that industrial, techno-economic information-and-engineering service groups be established to make feasibility or national studies of the various sectoral industrial R, D & E objectives.

A study of the means to facilitate the merging of small-scale industries in larger groups was recommended.

A recommendation was made to establish repair and maintenance services for machinery and research equipment in the main industrial and research areas.

Consideration of the establishment of an integrated forest-product industry was recommended.

Research on the various objectives in food processing, such as drying, refrigeration, canning, variety studies, packing, irradiation, and other unit operations is recommended, to start in the near future to make the implementation possible during the next Five-Year Plan.

Some new research centers were proposed to be established and existing ones up-graded, for example, specialized centers such as the Center for Food Technology.