OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

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

ID

D02437

Distribution
Limited

ID/WG.2/Report
15 November 1967

Original: ENGLISH

United Nations Industrial Development Organization

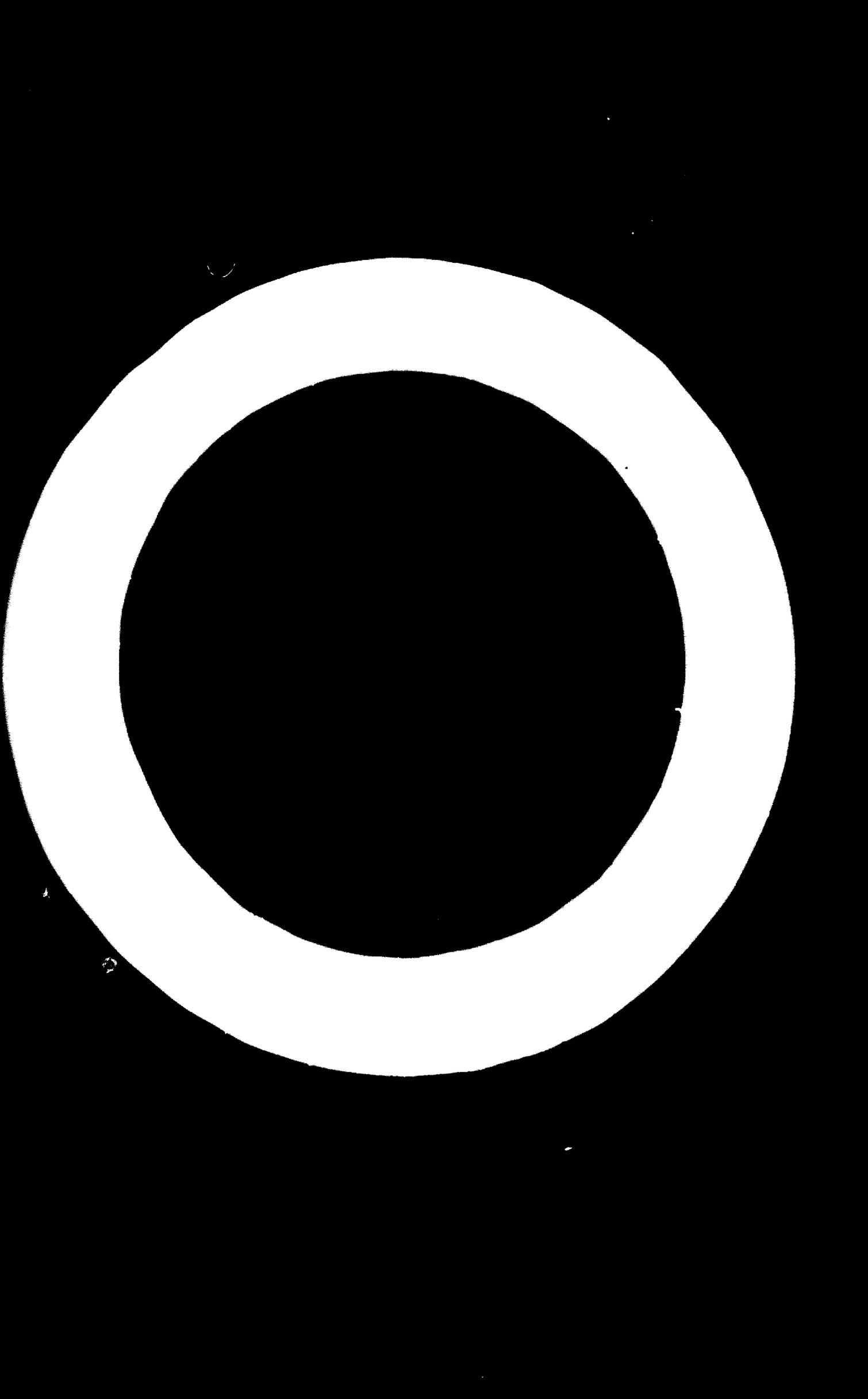
INTERREGIONAL WORKSHOP OF MANAGERS OF
INDUSTRIAL RESEARCH INSTITUTES OF
DEVELOPING COUNTRIES

REPORT OF THE INTERREGIONAL WORKSHOP OF MANAGERS OF INDUSTRIAL RESEARCH INSTITUTES IN DEVELOPING COUNTRIES

ATHENS, GREECE

4 to 18 JULY 1967

id. 67-159



Contents

		Paragraph	Page
I.	Background and organization		
	Background and purpose; opening ceremony; organization; participants; documentation, report and working languages; closing ceremony		
II.	Establishment and organization of industrial research institutes		
III.	Project selection		
IV.	Financial administration of industrial research institutes		
V.	Personnel policy in industrial research organizations		
VI.	Evaluation of industrial research institutes		
VII.	Case studies		
	A. Shri Ram Institute for Industrial Research, Delhi, India, and British Columbia Research Council, Vancouver, B.C. Canada		
	B. Organization for Industrial Research T.N.O., The Hague, Netherlands		
	C. Royal Norwegian Council for Scientific and Industrial Research, Oslo, Norway		
	D. The Federal Institute of Productivity of Yugoslavia, Belgrade, Yugoslavia		
VIII.	Country statements		
IX.	UNIDO's activities in connexion with industrial research institutes		
X.	Recommendations		

Annexes

Annex I List of papers prepared and delivered by experts at the workshop

Annex II List of experts, participants and observers

I. BACKGROUND AND ORGANIZATION

Background and purpose of the workshop

1. In realization of the need to promote industrial research and development activities in developing countries, the United Nations Centre for Industrial Development, as it was then called, organized an Interregional Seminar on Industrial Research and Development Institutes in Developing Countries; which was held in Beirut, Lebanon, from 30 November to 11 December 1964. The seminar provided a forum for careful discussion of the special problems and other aspects of the organization and operation of such institutes.

2. In continuation of this work of improving the usefulness of industrial research institutes in developing countries, and as a follow-up activity on the Beirut Seminar, the United Nations Industrial Development Organization (UNIDO) organized a Workshop for Managers of Industrial Research Institutes in Developing Countries, which was held in Athens, Greece, from 4 to 18 July 1967, on the premises of the Evgenides Foundation.

Opening Ceremony

3. The Greek Government and the United Nations Industrial Development Organization were represented at the Opening Ceremony by Mr. N. Economopoulos, Minister of Industry, and Mr. I.H. Abdel-Rahman, Executive Director of UNIDO.

4. Also present at the Opening Ceremony were: Mr. S. Loverdos and Mr. C. Panas, Governor and Vice-Governor respectively, of the Hellenic Industrial Development Bank; and Mr. S. Vrachnos, Vice-chairman of the Board of Directors of the Hellenic Industrial Research Institute.

5. The workshop was opened with an address by Mr. I.H. Abdel-Rahman, who emphasized the role of research institutions in industrial development. Welcoming addresses were given by Mr. N. Economopoulos and Mr. S. Loverdos. Addresses were also given by Mr. S. Vrachnos and Mr. L. Katkhouda.

Organization of the workshop

6. The workshop was organized by UNIDO in co-operation with the Bureau of Technical Assistance Operations of the Department of Economic and Social Affairs of the United Nations Secretariat and the Government of Greece, which acted as host country.

/...

7. Mr. J. Gerakis, Deputy Director of the Hellenic Industrial Development Bank, was chairman of the workshop. In the absence of Mr. A. Afifi, Chief of the Industrial Institutions Section of UNIDO, Mr. L. Katkhouda, a member of the staff of the Industrial Institutions Section, replaced him as director of the workshop.

8. The workshop unanimously elected the following officers:

Mr. S. del Caril (Argentina)	First Vice-chairman
Mr. K. Hussain (Pakistan)	Second Vice-chairman
Mr. E. Larty (Ghana)	Rapporteur

Participants

9. The workshop was attended by:

- Eight experts from research institutes, research management organizations and consulting firms, all of world renown, from the following countries: Canada, India, Netherlands, Norway, UAR, United Kingdom, U.S.A., Yugoslavia.
- Nineteen participants holding high managerial positions in industrial research institutes of their home countries. Eighteen countries were represented, namely: Argentina, Brazil, China, Colombia, Ghana, Guatemala, India, Indonesia, Israel, Malaysia, Nigeria, Pakistan, Senegal, Singapore, Sudan, Thailand, Tunisia and the United Arab Republic.
- Twenty-four observers from Greece.

A list of participants, experts, observers, and workshop officers with their addresses is included in Annex I of this report.

Documentation, report and working languages

10. English and French were the official working languages of the workshop. The documents submitted to the workshop consisted of:

(a) Discussion papers prepared by experts;

(b) Case studies on specific industrial research institutes; and

(c) Country statements prepared by participants on industrial research institutes in their respective countries.

A list of the discussion papers and case studies is given in Annex II.

11. After some discussion the workshop unanimously adopted at the closing working session a set of recommendations and proceedings of the workshop which served as a basis for the report reproduced thereafter.

...

Closing Ceremony

12. At the Closing Ceremony Mrs. Symon, Director of the Evgenides Foundation, and Messrs. Loverdos and Thanos were present. The latter addressed the audience. Mr. L. Katkhouda, on behalf of UNIDO and of the participants, expressed appreciation for the efforts of the host country and of the Hellenic Industrial Development Bank in contributing to the success of the workshop.

II. ESTABLISHMENT AND ORGANIZATION OF INDUSTRIAL RESEARCH INSTITUTES

13. The "Organization of Industrial Research Institutes and their Relationship with Clients" was presented in two sections, the first dealing with the organization of industrial research institutes and the second with the relationship between the institute and its sponsors. The first section dealt with the following broad headings, types of industrial research institutes, institutional patterns, management of multi-purpose institutes, and general management techniques.

14. In the discussion that followed, considerable interest was centred on the need for planning programmes of research prior to the recruitment of personnel. It was recognized that, as different countries were at various stages of development in industrial research, a single solution for universal acceptance could not be supplied. It was noted, however, that the preparation of research programmes and the recruitment of staff must take cognizance of areas and trends in the industrialization of the respective countries. With particular reference to developing countries, the hiring and training of staff should be undertaken once the broad areas of research activities have been defined. The relationship between industrial research institutes and agricultural research institutes was also considered, and the consensus was that, while in most developing countries industrialization had an agricultural base, it was necessary to ensure effective co-ordination between the industrial and the agricultural research institutes.

15. Reference was made to the United Nations Manual on "Management of Industrial Research Institutes in Developing Countries" which had developed out of the Beirut Seminar, and it was recommended that regular use be made of it as it gives good guidance in the work of industrial research institutes.

16. The relationship between the industrial research institute and its sponsors was discussed under the following headings: obtaining support; contracting sponsored work; communication with clients; periodic comparison of programme with contracts; and liaison with the smaller enterprise. The relationship between institute and sponsor was summarized as follows:

(a) Before entering into a contract, the problem should be precisely defined in order to ascertain what facilities are required and available for its execution.

(b) Agreement should be reached on a detailed technical programme, which must at the same time be flexible to permit alteration by mutual consent.

(c) The contract must be explicit in its terms.

(d) The institute and its sponsor must maintain close and friendly liaison at all times.

(e) The client should recognize that the institute is in essence operating as an extension of the client's own organization.

(f) A highly ethical position must be maintained in regard to confidential information.

(g) The client's organization should cultivate direct contact with some individual who will follow closely the progress of the work and serve as a focus for practical utilization of the results.

17. Considerable attention was given to the need for effective machinery for communication between research institutes and industry, particularly small industry, in developing countries. The consensus was that this presented a difficult situation. Small industry was often unaware of its problems; frequent factory visits by research personnel from institutes became necessary, and this was often expensive. It was considered that, as industrial research activities in developing countries required active Government support, the attention of Governments should be invited to this situation. The following draft Resolution was submitted:

> "Taking into account that in developing countries, as a rule at least, there is not always sufficient interest and demand for services of industrial research institutes, it seems justified to recommend to Governments of developing countries to create 'research consciousness' by levers of their economic policy and by other means, in order to ease and to accelerate the building-up of clienteles."

18. The attention of the discussion group was directed particularly to the Industrial Research Unit in Singapore, which takes the initiative in using quality control testing and research on samples of products from a factory to obtain the interest of the relevant industry in the work of the Research Unit, and in this way obtain clients.

III. PROJECT SELECTION

19. The discussion of this topic was introduced with the statement of a philosophy, namely, that technical people have a useful tool at their disposal which is the logic of scientific method, and that this tool should be used in planning and programming their work. A good working programme should begin with the objectives clearly defined and with a clear and precise statement of the technical effort required, the costs involved and time required.

20. Criteria for project evaluation, classification of technical activities, project systems, mechanisms for project evaluation, evaluation at successive major stages and multi-discipline project teams were dealt with in detail. The five main evaluation criteria listed were:

(a) Technical feasibility
(b) Engineering feasibility
(c) Marketing feasibility
(d) Comprehensive economic feasibility
(e) Managerial feasibility

21. Technical activities include shorter-range services and activities, such as information services, analysis, testing and quality control, technical service (often called "trouble shooting"), and standardization activities; small-scale technical activities such as exploratory research, product development, product evaluation and bi-product and waste utilization. Intermediate-scale projects, such as engineering development studies and pilot plants, were also discussed as were also evaluation programmes, including engineering, economic evaluations, market evaluations, feasibility studies, and surveys of natural resources.

22. Various mechanisms for evaluation of projects, both in-house and sponsored projects were set out in detail under this topic. The need for client contact - both at the top managerial level and at the operating level in the evaluation of sponsored projects - was highlighted.

23. Principles and uses of multi-discipline teams in industrial research work were discussed and this approach found highly useful and desirable.

24. Considerable emphasis was placed on the usefulness of time cards accompanied by regular reports as a vital means of ensuring efficiency in the work of

/...

industrial research. It was noted that the time of professional staff is a prime product that an industrial research institute has to sell. Time cards carefully designed and effectively used resulted in a more efficient utilization of the time of the staff, and also assisted in forecasting the requirements of effort in research projects. It was also considered essential that personnel engaged on such projects prepare reports on the projects, not only to supply information to management, but also because the preparation of the reports would benefit the personnel as they put the facts and figures together, would obtain recognition for their projects and would give management a measure for evaluation of the personnel making the reports.

25. A major problem that faces industrial research institutes in developing countries as they attempt to translate the results of laboratory research into commercial development in industry is the acute shortage of the technologist described as a "process engineer". The provision of training facilities for this category of personnel was discussed, and it was suggested that advantage could be taken of fellowships granted under various United Nations technical assistance programmes to provide in-plant training for young professional staff from developing countries. It was also noted that use could be made of a system whereby research officers from laboratories in developing countries take their laboratory results to industrial research institutes in the more developed countries for further work with the assistance and under the guidance of the more experienced research personnel in these laboratories. In this way the research laboratory results are industrially developed to the level of production. The experience of T.N.O. (The Hague, Netherlands) in this system was considered a useful example. It was recommended that UNIDO be invited to establish national or regional study programmes, which would emphasize visits by personnel of research institutes in developing countries to industrial plants and research institutes to provide experience in this important area of industrial research and development.

IV. FINANCIAL ADMINISTRATION OF INDUSTRIAL RESEARCH INSTITUTES

26. As the purpose, structure, size and scope of the organization of different industrial research institutes vary, it was recognized that the optimum system for financial administration would also vary. Experience has shown, however, that certain basic principles of financial administration are common to industrial research institutes. Some institutes are supported solely by Government funds; some are supported by industrial contributions, possibly imposed by Government regulations; some exist strictly on the income from their research contracts; some have supported from an endowment or from an independent source of income; but most derive their operative revenue from a combination of at least two of these sources.

27. The subject was discussed under the broad headings of budget planning, project accounting, estimation of research costs and contract procedures. Sub-headings included such items as capital costs, operating expenses, overheads, staff time, technical services (including laboratories and workshops), reports processing and miscellaneous costs. Estimation of research costs dealt also with the research proposal, costing the programme and multi-discipline programmes. Contract procedures were then discussed, and it was suggested that, with the exception of small programmes in which agreement between institutes and client may be merely an exchange of letters, a formal contract was recommended. The use of a standard contract form was recommended to ensure that the institute-client relationships are clearly understood and to provide for uniform treatment of all clients.

28. The subsequent discussion focused on financial support for industrial research institutes in developing countries. It was recommended that Government support for such institutes be given for the establishment of the institute and for its operation, and that assurance of support on a continuing basis should be provided for a reasonable period in order to ensure satisfactory planning and programming of the work of the institutes. In this connexion, it was noted that the process of development from initiation of the institute to the stage of possible financial self-support would necessarily be a long one for several reasons: the long process of staff training; the need to impress on industry that it should pay for work done by the institute; and the fact that small industry does not have the resources to pay for such work. It was suggested that Governments

/...

should recognize the need for such continued financial support for as long as was considered appropriate in the circumstances of the particular institute, but that in any case continuous Government support should be given for a minimum of five years.

29. It was also recognized that industrial research institutes in developing countries would need additional or complementary assistance from international organizations or other financial sources until they reached a certain degree of self-sufficiency.

/...

V. PERSONNEL POLICY IN INDUSTRIAL RESEARCH ORGANIZATIONS

30. In the introduction of this topic, it was stated that the productivity of an industrial research organization depends on its ability to recruit able staff and to employ them on projects which the staff themselves feel to be rewarding, both technically and economically. Industrial research organizations employ a wide variety of staff and the over-all terms and conditions of employment would no doubt be agreed by the employing authority in the light of national and local requirements and standards.

31. The entire subject of personnel policy was discussed under the following broad headings: staff, including the director, professional staff, research fellows, administrative and clerical staff, technicians and workshop staff; recruitment, evaluation and promotion; staff records and emoluments; pensions and superannuation.

32. It was noted that professional staff, especially the physical scientists, would usually be profession-oriented rather than organization-oriented, and would tend to be individualists needing reasonable freedom from detailed supervision in carrying out their work; in particular such staff members should have freedom, when the nature of the work allows, to consult experts within and outside their own organizations. The professional staff would normally plan the details of the work themselves. It was recognized that the basic function of administrative staff is to help professional staff and not to control them. Administrative staff tended to regard professional staff as lacking in knowledge of business administration, and this is often resented by the professional staff.

33. In addition to technicians and assistants, who usually form supporting staff for the professional staff and carry out experimental and observational work within guidelines delineated by the professional staff, industrial research organizations employ trained labour for work in their workshops. Workshop personnel should be intelligent and should have technical school training, and versatility in their work is considered a useful quality in this class of worker. An instrument maker is considered a vital asset to the entire organization.

34. The following were recognized as the basic functions of a recruitment interview:

(a) To give the candidate information about the scientific or technical aspects of the job;

(b) To check the basic facts about the candidate;

(c) To observe the candidate's outward appearance and manner;

(d) To test the candidate's ablility;

(e) To test the candidate's personality;

(f) To persuade the candidate as necessary; and

(g) To give the candidate a chance to clear up any doubts and uncertainties in his own mind.

35. Techniques of periodic evaluation as a means of assessing the productivity of the individual, and details of promotion and dismissal procedures were discussed.

36. It was concluded that research is done by people; buildings and equipment were helpful, but only when occupied and used by the right people. The object of personnel policy should be to get the right people, treating them as individuals, yet in an organized and systematic fashion, so as to attain maximum productivity.

37. During the subsequent discussion, the question was raised as to the advisability of the director of the institute doing other work in addition to directing the affairs of the institute. In principle it was considered that the director of the institute should be a full-time officer. It was noted, however, that for the director and some of his senior staff to be made extraordinary professors in universities, giving lectures one day a week was good for the institute and for the university and also enhanced the status of the individual staff members.

38. Consideration was given to the relationship between the remuneration of research institute staff and that of university staff, and it was agreed that the institute and university should have the same conditions so as to avoid the drain of professional staff from the institute to the university.

39. In many developing countries, the salary levels of professional personnel in various types of employment show wide variations which appear to be inequitable. The inequalities can be forcibly brought to light by comprehensive, systematic, and quantitative surveys of professional and economic status. Useful techniques for such surveys were developed in the United States of America as

/...

early as 1941 and have been successfully adapted by at least one developing country. The data obtained from such surveys are influential in bringing about more logical salary policies.

40. The recruitment of foreign experts for research institutes in the developing countries received considerable attention. It was suggested that foreign experts should, as far as possible, not be recruited for executive positions but should be assigned rather to the training of local personnel and also for advice and consultation. In general the duration of the stay of an expert in a developing country should be as long as would be necessary to ensure that the maximum benefit was derived from the experience of the expert. The period could be determined by the kind of work assigned to the expert, the needs of the recipient country, and the performance of the expert.

41. Several problems were recognized in connexion with the recruitment of experts and the prospects of their successful work in the developing countries. One vital consideration - to which the attention of governments in developing countries should be drawn - was that indigenous professional and technical men should be used in the screening and evaluation of the papers and credentials of proposed experts before the selection of an expert.

VI. EVALUATION OF INDUSTRIAL RESEARCH INSTITUTES

42. This subject was presented as a manual (ID/WG.2/R.3), set out so as to be applicable to industrial research institutes in various stages of development. Chapter 10, captioned "Comprehensive Outline for Valuation" was followed as a guide for the presentation of the entire manual under the following broad headings:

(a) Evaluation as a managerial technique;
(b) Evaluation of financial position;
(c) Evaluation of technical productivity;
(d) Evaluation of staff capabilities;
(e) Evaluation of facilities;
(f) General Administration;
(g) Selection of programme areas;
(h) Administration of technical activities;
(i) Personnel administration; and
(j) Comprehensive outline for evaluation.

43. The selection of personnel for evaluation was given considerable emphasis in view of the fact that if the evaluation were to be meaningful, it should be objective and systematic, and should pinpoint the strengths as well as the weaknesses in the organization. The team should consist of a small group of talented men of varied backgrounds who should interview the staff of the organization individually and in confidence, so as to encourage frank replies. The report of these interviews should not indicate the sources of information or identify them with specific individuals. The author put forward three suggestions for forming the evaluation group, namely:

(a) strongly interested technical members of the board formed into a sub-committee;
(b) individuals from neighbouring institutions;
(c) individuals from an agency external to the institute.

44. In this connexion, it was recommended that UNIDO take steps to form, at the request of industrial research institutes, competent groups for evaluation of the performance of these institutes.

45. A systematic outline for evaluation was presented, covering in detail financial performance, sources of earned income, utilization of supporting

income, analysis of expenditures, and managerial policies and procedures. The speaker stressed that there should be a continual review in order to compare trends, growth rate and past policies, and to enable a careful projection to be made for the determination of future policy. The author considered a 5 per cent growth rate as moderate, 10 per cent as creditable and 15 per cent as excellent. If there was no growth for some years, the author considered that there was need to review the organization.

46. An important technique for encouraging development of appropriate levels of managerial skills in the non-executive staff echelons was pointed out: to provide systematic opportunities for such staff members to participate in the formulation of recommendations on selected topics for consideration by the director and his senior associates. It should be clearly understood that such activities do not infringe on the prerogatives of management, but that they are in the nature of an input of advisory evaluation from the point of view of individuals at the working level and not endowed with executive powers. The use of such ad hoc teams for assessment of technical projects and their contribution to setting priorities in the total programme would be enhanced by including an appropriate amount of engineering, marketing, and economic appraisal. This technique can be beneficially extended to administrative matters such as work assignments and project systems, details of personnel matters, store-room and library management etc., in order that the executives may have a better understanding of the effect of their policies and procedures on actual operations. In some highly industrialized countries, the managements of progressive enterprises make use of study groups, sometimes even going so far as the appointment of a "Junior Board of Directors".

47. In respect of analysis of expenditures, the experience of the author of the manual on evaluation indicated that in most developing countries analysis of in-house projects in research institutes was often inadequate. The criteria adopted were usually those of the director himself or some influential personality. He suggested that this was a serious weakness in research institutes in developing countries and recommended that a close look be taken at regular intervals to check on the way general funds were being used to support projects.

48. It was suggested that appropriate machinery be set up for examing proposals for in-house projects, and recommended that two criteria for approving such

/...

...

proposals should be:

(a) Whether the work would develop potentially a project of interest to a client; or

(b) Whether it would develop a new skill of interest to a client.

49. It was mentioned that if an institute is to remain viable, it must develop skills ahead of industry.

50. Work performance was discussed together with staff capabilities and general administration. Under general administration, reference was made to systematic programme planning and periodic evaluation of progress in relation to the plan. The author stressed that planning is a continuing process and that the plan should be communicated to the staff so that they are aware of the over-all policy of the organization and are not confronted suddenly with directives that imply major changes of policy.

51. Reference was made to some of the generally known techniques of management such as:

(a) Delegation of responsibility accompanied by the requisite authority;

(b) Clear definition of authority to avoid staff confusion as to whom to approach on different matters;

(c) Advanced planning; and

(d) Public relations.

52. A vital but usually unspectacular function of the management board of an institute was mentioned: that members of the board, through high-level contacts, can often open the door to prospective clients.

53. Emphasis was laid on the usefulness of having an effective suggestion system, enabling the staff to suggest projects or improvements to operative procedures. Positive action should always be taken on such suggestions, and decisions on the suggestions should be communicated to the members of the staff who make them.

54. Finally, a detailed tabulation for comprehensive evaluation was presented. In this connexion, however, it was stated that this tabulation should be regarded as a suggested list of topics institutes should use, providing useful guidelines for the evaluation of the performance of research institutes. Ratings were

/...

suggested for use in the evaluation: unsatisfactory, satisfactory, good, and excellent.

55. The manual generated considerable discussion during which the following points were made:

(a) Periods of consolidation interspersed with periods of growth and progress were desirable, as the consolidation periods provided opportunities for taking stock of the activities of the organization.

(b) The system of "rolling budgets", often used in industry, was considered beneficial; it was suggested that this system could be adopted in the budgetary policies of industrial research institutes.

(c) It was noted that the productivity of the professional staff in developing countries was often lowered by factors such as mechanical breakdowns, shortages of materials and spare parts etc. The following were suggested to alleviate the situation:

(i) Replacement parts - two years' supply essential, though this is often a heavy burden as it ties up capital;

(ii) Preventive maintenance - programme of inspection so as to effect replacement of the probable life of the equipment followed by a system of replacing parts at about 85 per cent of life.

(iii) Training of staff to work on more than one project at a time.

(d) It was agreed that it was in the interest of the institute to avoid taking on projects which were beyond its capability. Institutes should endeavour to make clear to clients how far they could go on a project. Instead of damaging the prestige of the institute, the refusal of the institute to undertake a project outside its capabilities might give the client the feeling that the institute had no illusions about its capabilities.

(e) It was noted that collaboration between institutes in developing countries and more advanced institutes or consulting firms in developed countries was a successful means of accomplishing projects which local institutes could not undertake alone on their own resources.

(f) It was recommended that UNIDO be invited to take steps towards the establishment of an international association of industrial research institutes.

VII. CASE STUDIES

A. Shri Ram Institute for Industrial Research, Delhi, India, and British Columbia Research Council, Vancouver B.C., Canada

56. Two case studies were presented to the workshop:

"Shri Ram Institute for Industrial Research - Some Lessons from its Organization and Work";
"The British Columbia Research Council - A Case Study".

The following points were noted in particular:

(a) There is not one set of rules for the successful organization and operation of an industrial research institute. Some of the rules may have application to research institutions in general; others will need to be formulated for each institute in order to meet conditions peculiar to its industrial community.

(b) The industrial research institutes, like the technological society it serves, must be prepared for constant change.

(c) Industrial research activity in developing countries should be started in a small way at the beginning and should be allowed to grow around successful men and their work.

(d) Research, development, design and engineering must all play their effective parts in the successful culmination of an applied research project.

(e) Research programmes have a greater prospect of success if they are oriented to practical problems (i.e. if they are compatible with the environment) and are given persistent efforts by research personnel, as such persistence will be carried over from the research laboratory to industry.

57. Arising from the suggestions about the stage in the development of an industrial research institute, discussion centred on the place of testing in an industrial research institute. In the case in question it had been indicated that testing operations decreased after the primary stages of the research institute, and disappear altogether in subsequent phases. Personnel requirements for routine testing were different from those for research work, the former being heavily technician-oriented, while the latter required more professional expertise. The conduct of routine testing in industrial research institutes therefore tended to be uneconomical. It was also noted that in developing countries testing organizations quite often undertook testing operations at a lower cost than research institutes could do.

58. On the other hand, some large institutions found it advantagepus to provide both research and testing services; in such cases, however, it was

/...

considered necessary that these functions be kept separate in view of the different personnel and other requirements. The case of T.N.O. was a good example of such an arrangement.

59. For developing countries, it was important to recognize that testing could be successfully used to promote industrial research consciousness within industry. In the conditions prevailing in these countries with regard to availability of human and material resources, it had been found advisable for standards and quality control work to be taken in with industrial research work in the industrial research institutes. Examples were seen in the institutes of standards and industrial research in Iran, Chile and Ghana.

B. Organization for Industrial Research T.N.O., The Hague, Netherlands

60. One principle observed in the relationship between research institutes and their clients was that the institute initially attract the client into its shop by advertising its skills through reports and lectures. When the client has been drawn into the institute, it should be the duty of the institute to listen carefully to the client's statement of his problems and try to find solutions to them.

61. The ultimate goal of industrial research and technical information was seen to be the improvement of industry. Every research institute or technical service should therefore follow up the result of its work by going to industry to find out whether the results had been applied; if so, to what degree of success; and if not applied, why not.

62. On the basis of statistics on various developing countries, comparison was made between educational conditions in the Netherlands and those in a hypothetical developing country. Particular attention was drawn to the contrasts in training facilities and in trained manpower in the technical fields in the developing countries.

63. It was suggested that a developing country needed first to set up a good technical consulting and information service, including consultancy in management. An industrial testing and quality control service should be established next, and from that stage the industrial research institute would be a logical further development.

/...

64. The structure of the Netherlands Central Organization for Applied Scientific Research (T.N.O.) was then discussed with particular emphasis on the Central Organization and the special organizations under it. One of the special organizations is that for industrial research.

65. The Organization for Industrial Research consists of several institutes; the structure and operations of this organization were further described in some detail.

66. Several questions were raised requiring detailed information on the operations of T.N.O. and the Organization for Industrial Research, and the relevant data was supplied by the expert. Mention was made of the mental attitudes and approach to work of research and other staff in industrial research institutes. No solution of general application could be suggested, however, as this was a matter requiring the adoption of the generally known tools of managerial control and direction, with due regard to the economic and administrative conditions in the country.

67. Information was supplied on the way that technical assistance could be obtained from T.N.O., and this was found to be along the general lines of Government-to-Government bilateral aid procedures.

C. Royal Norwegian Council for Scientific and Industrial Research, Oslo, Norway

68. This Council is a semi-governmental organization charged with the task of promoting scientific and industrial research as a tool for promoting the economic development of a country. As an introduction, basic information was supplied on the natural resources and economy of Norway and on its organization of scientific and industrial research.

69. In fields where there had been a national need for concentrated research, government research institutes had been established, e.g. geological survey, fishery research institutes and research institutes in agriculture and forestry, as well as the Norwegian Defence Research Establishment.

70. A new feature in Norwegian research organization was the establishment of research councils, of which there were three, namely: the Royal Norwegian Council for Scientific and Industrial Research attached to the Ministry of Industry; the Norwegian Agricultural Research Council attached to the Ministry

of Agriculture; and the Norwegian Research Council for Science and the Humanities attached to the Ministry of Education. These Councils have the triple task of promoting research, co-ordinating activities and initiating the development of an over-all research policy in their respective fields.

71. The Royal Norwegian Council for Scientific and Industrial Research has been actively engaged in recruitment policy in its field of activities; its second activity is the grant programme. In fields of national interest where it was considered that there was a need for concentration of research effort over a longer period, the Council established new research institutes, of which there were now eighteen, employing 1,300 persons approximately one third of them qualified researchers. Fields in which the Council has research institutes include industry, building, electricity, shipping, transport, atomic energy and pollution.

72. The Council's main sources of income are the state budget, football pools, levies, contributions from trades and industries, income from sponsored research, and contributions from other countries.

73. Important functions of the Council are the co-ordination of existing activities and the planning of new ones. An example of the co-ordination function is the establishment of the Industrial Research Centre at Blindern, just outside Oslo which now has 20 institutes employing approximately 1,200 people. The grouping of these institutes on one site, close to the University of Oslo, has proved beneficial.

74. As an example of forward planning, the Council, upon request from Parliament, had organized a survey of research activities in the scientific and industrial field and had prepared a research report of the survey, with recommendations for new activities as well as improvement of existing ones in the research field.

75. During the discussion, several questions were raised requiring detailed information on the operations of the Royal Norwegian Council for Scientific and Industrial Research, and the relevant data was supplied by the author, who cited examples of technical information services in the Building Research Institute and the Institute of Wood Technology.

76. Participants in the discussion recognized a major problem facing re-

/...

search institutes in developing countries in the transfer and adaption of technology from highly developed countries. It was noted that fundamental science was easily transferable through such means as scientific journals. The transfer of industrial technology, however, presented problems arising from matters concerning patents, industrial secrets etc.

77. Technological information could to some extent be transferred through a more developed technical information service and also through contacts among individuals, research institutes and industrial companies, it was stressed that real technological competence could only be built up during the process of technological activities. The transfer of technical know-how to developing countries would therefore be dependent on their technological development programme and their need for technical knowledge in this connexion.

D. The Federal Institute of Productivity of Yugoslavia, Belgrade, Yugoslavia

78. The introduction to this case study consisted of brief information on the natural resources and the economy of Yugoslavia. It was further suggested that developing countries must find answers to questions such as the following: Why industrial research? Is it not better to buy the results of research? Yugoslavia had gone through this exercise and its experience showed that good answers came only after a thorough examination of the contribution a new institute could make to the level of general economic development of the country.

79. The improvement of productivity was a basic aim of an industrial research institute. With the use of clearly designed charts, the speaker illustrated the following groups of factors which constitute the productive capacity of industry:

(a) The labour force, its education, skills and motivation;
(b) Natural sciences and technology;
(c) Management sciences and economics;
(d) Equipment;
(e) Natural recources.

80. Before giving advice on the creating of industrial research institutes, the Federal Institute of Productivity made feasibility studies. The speaker illustrated with diagrams how these studies made use of the law of diminishing costs and the law of growing yields.

/...

81. Industrial research institutes could be grouped under three main types, namely: institutes of users or user organizations, independent institutes; and institutes centred in universities. The advantages of each of the types were outlined, as well as the national conditions that should guide the selection of type.

82. The Federal Institute of Productivity, established to carry out research in the field of productivity and to prepare studies and proposals for the Federal Executive Council and its other agencies, had the following sections and departments:

(a) Department for the Management Sciences;
(b) Department for Vocational Training;
(c) Group for the Measurement and Analysis of Productivity;
(d) Group for Industrial Safety;
(e) Group for Relations with other Organizations;
(f) Secretariat.

The budget of the Institute was part of the Federal budget of Yugoslavia.

83. Recognizing that a policy aimed at the growth of productivity could not be satisfactorily effected through the activity of only one central productivity institute, bureaus for productivity had been established in the six republics of Yugoslavia on the initiative of the Federal Institute. Co-operation in this important field of productivity studies took the form of regular consultations of representatives of the Federal Institute, the regional bureaus and some industrial research institutes, as well as the Federal Centre for Management Education in Zagreb.

84. The Federal Institute devoted much attention to information activities. Considerable emphasis was put on the provision of systematic information to professional personnel and to the general public about the concept, importance, and the factors of productivity. Through lectures, seminars, publications and films, the Institute disseminated knowledge and laid the groundwork for a proper understanding of the problems of productivity.

85. Training and education must be given high priority in a productivity drive, particularly in developing countries. The Federal Institute of Productivity had a successful programme for high-level post-graduate courses designed to

train specialists in the fields of work study, operations research and business management. The Institute also organized courses on statistical quality control and the evaluation of the level of organization in enterprises.

86. Considerable attention was given both in the presentation and in the discussion to the question of whether industry could be best assisted by conducting research in universities or through industrial research institutes. The strong points and weaknesses in respect of university research on the one hand and research by institutes on the other were discussed by the author of the paper and by several delegates. Some felt that the university tended to place lower emphasis on applied science as compared with pure science. Examples were cited of unsatisfactory experience in developed countries in conducting industrial research in universities. Certain trends in universities in the developing countries hindered the successful prosecution of industrial research. It was generally agreed that the approach should not be one of "either ... or" but rather of a combination of the two. Such an approach, based on the particular circumstances of the country, would lead to a satisfactory workable decision on the prosecution of industrial research and would result in the establishment of a system that would make the best use of available resources to the benefit of industry.

VIII. COUNTRY STATEMENTS

87. At suitable points during the course of the Workshop, statements were made by participants on the organization and conduct of industrial research in their various countries. The statements were made in the following order: Argentina, Brazil, China, Colombia, Ghana, Guatemala (ICAITI for Central America), India, Indonesia, Israel, Malaysia, Nigeria, Pakistan, Senegal, Singapore, Sudan, Thailand, Tunisia and the United Arab Republic.

88. The country statements indicated that, as there were various stages of economic development in these countries, the industrial research activities also differed in magnitude and emphasis from country to country. There were, however, several points of similarity in the organizational aspects of industrial research institutions in these developing countries, particularly in the role taken by the Governments. The acceptance of governmental responsibility for adequate financial support of the institutes appeared to be a matter of common interest to all the institutes in the developing countries.

89. In most of these countries, industrialization has a strong agricultural base. Programmes of industrial development were therefore initially oriented toward the processing of primary agricultural products, and consequently, industrial research was initiated in these areas. The existence of agricultural research institutes also appeared to be a common thing in these countries. The need for effective co-ordination of the activities of industrial research institutes and agricultural research institutes in the developing countries was therefore highlighted in most of the statements.

90. The following emerged as common problems of industrial research institutes in developing countries.:

(a) Staff. Shortage of scientific and professional staff with the requisite research experience. Recruitment of such personnel has not been entirely satisfactory because of worldwide shortages, and because of local problems of remuneration and general service conditions.

(b) Remuneration. Salaries of research personnel appeared to be geared to normal governmental salary structures and proved unattractive to professional personnel with the requisite experience. In cases where salaries of research personnel had been equated to those of university staff, this problem appeared to have been alleviated.

(c) Promotion. The promotion of research personnel based on length of service and establishment requirements, has appeared to be the case in some institutes due to governmental influence leading to frustration and a high turnover of professional staff.

(d) Finance. There was general recognition that the day of self-sufficiency for such institutes in most developing countries was far away. The inability of small industry to pay for sponsored research constituted a further financial problem in the developing countries. The need for effective means of educating industry to realize that it should pay for work done by institutes was also noted.

(e) Training. The problems of training both professional and technical staff were underline in the country statements. In respect of the professional, the emphasis was on industrial orientation of an often already acquired basic training; for the technician, the need was to acquire appropriate skills.

...

IX. UNIDO'S ACTIVITIES IN RELATION TO INDUSTRIAL RESEARCH INSTITUTES

91. At the request of participants, the director of the Workshop presented an account of the organization and functions of UNIDO.

92. UNIDO was composed of five divisions, namely: Finance and Administration; Technical Co-operation; Programme and Policies; Technology; and Industrial Institutions and Services. The Industrial Institutions and Services Division had three sections: Management and Training; Small Industries and Industrial Estates; and Industrial Institutions, the latter handling matters concerned with industrial research institutes, standards, patents, consulting and manufacturing associations, and being responsible for the publication of the Industrial Research and Development News.

93. The director then gave an account of projects assisted by UNIDO in various countries, and set out the procedures under which UNIDO could be of assistance to developing countries within the sphere of its functions.

X. RECOMMENDATIONS

94. At the outcome of the Workshop the following recommendations were presented and adopted:

1. Taking into account that in developing countries there is not always sufficient interest in and demand for the services of industrial research institutes, the Workshop recommended that Governments of developing countries create "research consciousness" through their industrialization programmes and by other means in order to accelerate the utilization of their services by industry and other sponsors.

2. The Workshop recommended that in recognition of the vital role of industrial research in the economic development of a country, and from the experience of industrial research institutes in the more developed countries, Governments of developing countries organize and co-ordinate their industrial research institutes within the framework of autonomous statutory bodies.

3. The Workshop recommended that Governments of developing countries give financial support to the industrial research institutes in their countries for the establishment of the institutes, where they do not already exist, as well as for the operation of the institutes; and that assurance of such support on a continuing basis for a reasonable period be given by Governments to ensure satisfactory planning and programming of the work of these institutes.

4. The Workshop recommended that, at the request of industrial research institutes, UNIDO take steps to form competent groups for evaluation of the performance of the institutes, and suggest measures for improvement.

5. Taking into account the usefulness of the "systems approach" the Workshop recommended the inclusion in the set of criteria used in all feasibility studies of the criterion of improving the over-all productivity of the country.

6. The Workshop recommended that similar workshops be held at regular intervals, e.g. once every two years, to review progress and discuss problems of management of industrial research and development in developing countries, as well as to promote and consolidate co-operation between industrial research institutes in the developing countries and those in the highly industrialized countries.

7. The Workshop recommended that one of the future workshops of managers of industrial research institutes be devoted primarily to the economic and organizational aspects of industrial research in developing countries.

8. Recognizing that the supply of experienced industrial technologists capable of adapting laboratory research findings to a pilot plant scale and further to commercial production is extremely limited in developing countries, the Workshop recommended that UNIDO establish

/...

regional and international study programmes with emphasis on plant visits to develop competence among industrial research personnel in this important area of industrial research and development.

9. The Workshop recommended that UNIDO continue to organize regional and international seminars and study programmes on industrial standards and quality control so as to disseminate modern techniques of quality control and also promote quality consciousness for the benefit of the growing industry in the developing countries; and further that UNIDO continue to assist actively in the establishment of Standards Organizations whenever and wherever needed.

10. The Workshop recommended that UNIDO be invited to take steps towards establishment of an international association of industrial research institutes. For this purpose, it was felt that a preparatory committee consisting of a small group of experts should be appointed by UNIDO to work out a formal proposal which will detail the objectives, membership, financial requirements, plan and programme activities for the association.

ANNEX I LIST OF DOCUMENTS PREPARED IN CONNEXION WITH THE WORKSHOP

Note: ID/WG.2/R.1, 2, 3 and 4 were issued in preparation for the meeting and are not available for further distribution.

ID/WG.2/R.5 "Financial Administration of Industrial Research Institutes", by R.R. Adams, Battelle Memorial Institute, Columbus, Ohio, U.S.A., presented by Mr. El Halfawy

ID/WG.2/R.6 "Project Selection, Definition and Evaluation", by L.W. Bass, former Vice-President Arthur D. Little, Inc., New York, USA

ID/WG.2/R.7 "Manual for the Evaluation of Industrial Research Institutes", by L.W. Bass, former Vice-President Arthur D. Little, Inc. New York, USA

ID/WG.2/R.8 "Personnel Policy in Industrial Research Organizations", by E.S. Hiscocks, former Director, Tropical Products Institute, London, England, presented by P.C. Trussel

ID/WG.2/R.9 "The British Columbia Research Council - A Case Study", by P.C. Trussel, British Columbia Research Council, Vancouver, Canada

ID/WG.2/R.10 *

ID/WG.2/R.11 "Organization of Industrial Research Institutes and their Relationship with Clients", by F. Neville Woodward, Director, Arthur D. Little Research Institute, Midlothian, Scotland, United Kingdom

ID/WG.2/R.12 "Shri Ram Institute for Industrial Research, Some Lessons from its Organization and Work", by V.B. Chipalkatti, Director, Shri Ram Institute for Industrial Research, Delhi, India

ID/WG.2/R.13 "Tasks for Technological Institutes in Developing Countries", by J. Hamaker, Director General TNO, The Hague, Netherlands

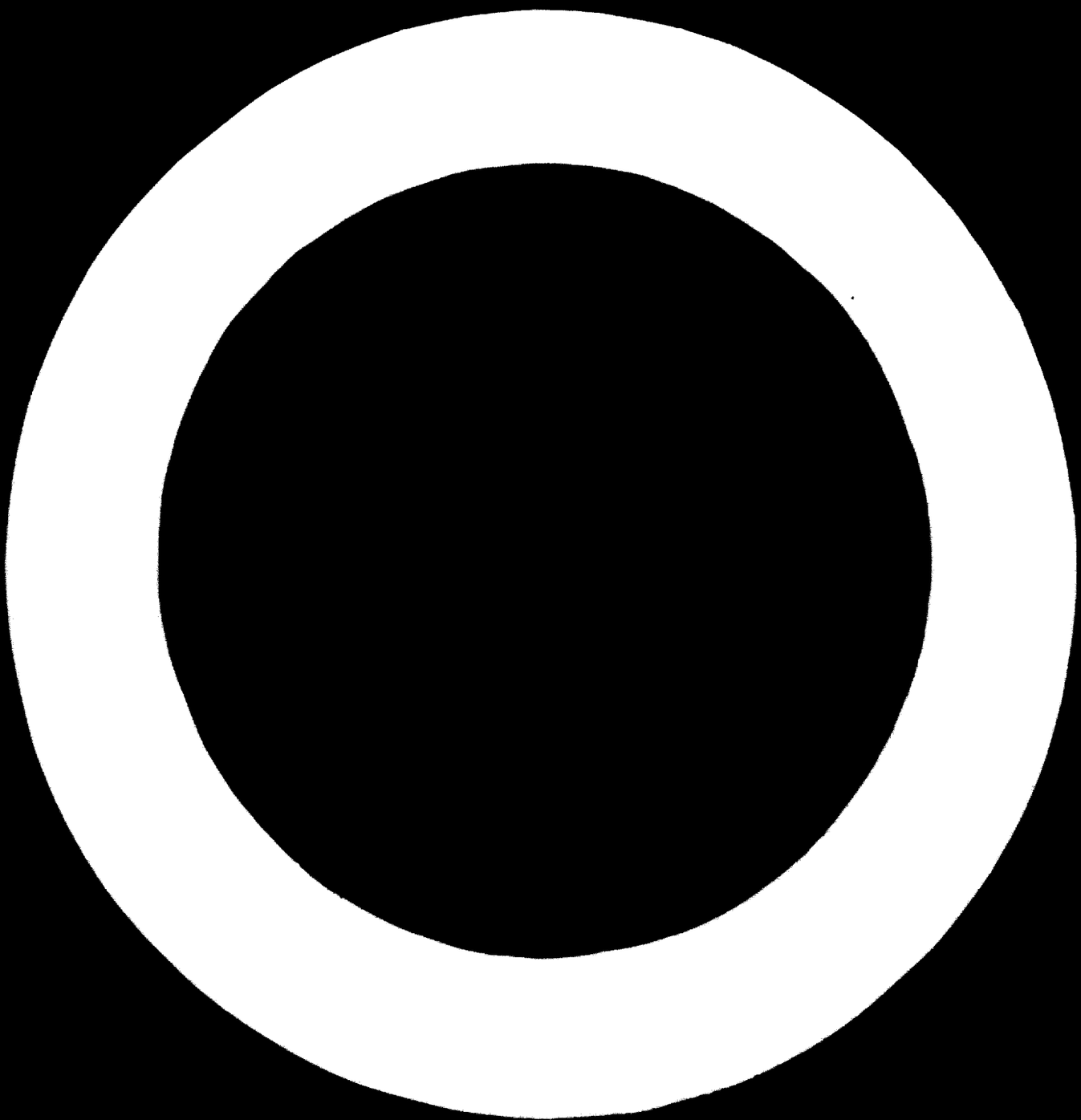
ID/WG.2/R.14 "The Federal Institute for Productivity of Yugoslavia - A Case Study", by S. Han, Professor at the University of Beograd, Yugoslavia

ID/WG.2/R.15 "Aims and Activities of the Royal Norwegian Council for Scientific and Industrial Research", by R. Major, Administrative Director of the Council, Oslo, Norway

ID/WG.2/Report Report of the Interregional Workshop of Managers of Industrial Research Institutes in Developing Countries

---

* Not distributed because it was considered too general in nature.



ANNEX II LIST OF EXPERTS, PARTICIPANTS, AND OBSERVERS

A. EXPERTS

(listed alphabetically by name)

1. Mr. Lawrence W. BASS,
Former Vice-President, Arthur D. Little Inc.,
630 Fifth Avenue,
New York, N.Y. 10020, USA

2. Mr. Vasant B. CHIPALKATTI,
Director, Shri Ram Institute for Industrial Research,
P.O.B. 1458
19 University Road
Delhi 7, INDIA

3. Mr. Mohamed EL HALFAWY,
U.N. Project Manager, Sudan Industrial Research Institute,
c/o UNDP Resident Representative
P.O.B. 913
Khartoum, SUDAN

4. Mr. Jacobus HAMAKER,
Director General, Industrial Organization TNO,
Postbus 297
The Hague, NETHERLANDS

5. Mr. Stjepan HAN,
Professor at the University of Belgrade,
Former Director of the Federal Institute on Productivity
31 Visokog Stevana,
Beograd, YUGOSLAVIA

6. Mr. Robert MAJOR,
Managing Director of the Norwegian Council for
Scientific and Industrial Research,
Gaustadalléen 30,
Oslo 3, NORWAY

7. Mr. Paul C. TRUSSELL,
Director, British Columbia Research Council,
Vancouver 8, CANADA

8. Mr. F. Neville WOODWARD,
Director, Arthur D. Little Research Institute,
Inveresk Gate,
Musselburg, Midlothian, SCOTLAND, U.K.

/...

B. PARTICIPANTS

(listed alphabetically by country)

1. Mr. Salvador DEL CARRIL,
President,
Instituto Nacional de Tecnologia Industrial,
Buenos Aires, ARGENTINA

2. Mr. Angelo Calmon de SÁ,
President of the Governing Council of
Aratu Industrial Centre,
Av. Princessa Isabel, 29 - Salvador,
Bahia, BRAZIL

3. Mr. Manoel J. E. BARROS SOBRINHO,
Rua Manoel Barreto 9 - Apto 202,
Salvador, Bahia, BRAZIL

4. Mr. Hong-Chien YUAN,
Director,
Union Industrial Research Institute,
P.O.B. 100,
Usinchu, Taiwan, CHINA

5. Mr. Morton YOUNG,
Director,
Instituto de Investigaciones Tecnologicas,
Calle 13, No. 15-61,
Bogota, D.E. COLOMBIA

6. Mr. Emmanuel LARTEY,
Director,
Institute of Standards and Industrial Research,
Ghana Academy of Sciences,
P.O.B. M32,
Accra, GHANA

7. Mr. Manuel NORIEGA MORALES,
Director, ICAITI,
Avenida de la Reforma 4-47, Zone 10,
Guatemala, GUATEMALA, C.A.

8. Mr. P. S. GILL,
Director,
Central Scientific Instruments Organization,
Chandigarh, INDIA

/...

9. Mr. Mulso HARSONO,
Deputy Director of the Institute for Industrial Research and Training,
Ministry of Basic/Light Industry and Power,
c/o Lembaga Penelitian dan Pendidikan Industri,
Departemen Perindustrian Dasar/Ringan/Tenaga, Kebonsirih 35,
Djakarta, INDONESIA

10. Mr. Meir BEN-ZVI
Head of Research Administration,
National Council for Research and Development,
84 Hachashmonaim Street,
Tel Aviv, ISRAEL

11. Mr. Abu Kassim bin HAJI MOHAMED,
Director,
National Productivity Centre,
P.O.B. 64
Petaling Jaya, Kuala Lumpur, MALAYSIA

12. Mr. Isaac AKINRELE,
Acting Director of Research,
Federal Institute of Industrial Research,
P.M.B. 1023,
Ikeja, NIGERIA

13. Mr. Akhtar HUSSAIN,
General Manager and Project Director,
Pakistan Industriel Technical Assistance Centre,
Ferozepur Road, POL-322,
Lahore 16, PAKISTAN

14. Mr. N'Dêné N'DAO
Administrateur d'entreprise chargé de la promotion des petites industries,
Direction de l'Industrie et de l'Artisanat,
Ministère du Commerce, de l'Industrie et de l'Artisanat,
Dakar, SENEGAL

15. Mr. Arthur RAJARATNAM,
Director of Industrial Research Unit,
Economic Development Board,
P.O.B. 2611,
Prince Edward Road,
SINGAPORE 2

16. Mr. Mansour Ali OSMAN,
Industrial Management Specialist,
Sudan Industrial Research Institute,
P.O.B. 268,
Khartoum, SUDAN

17. Mr. Pradisth CHEOSAKUL,
Executive Officer and Governing Board Member of Applied Scientific Research Corporation of Thailand (ASRCT)
32 Soi 23, Sukhumwit Road,
Bangkok, THAILAND

18. Mr. Mounir GOUTA,
Chef de la Section II à la Division du Développement Industriel,
Secrétariat d'Etat au Plan et à l'Economie Nationale,
Place du Gouvernement,
Tunis, TUNISIA

19. Mr. Fouad SOBHY,
Deputy Director General,
The Egyptian Organization for Standardization,
2, Latin America Street, Garden City,
Cairo, U.A.R.

OBSERVERS

(listed alphabetically by name)

1. Mr. Andrew ALIBRANTIS,
Chemical Engineer,
Hellenic Industrial Research Institute,
88 Academias Street,
Athens, GREECE

2. Mr. Orestis ANGELIDIS,
Chemical Engineer,
Hellenic Industrial Research Institute,
88 Academias Street,
Athens, GREECE

3. Mr. Christos N. ATHANASOPOULOS,
14 Argyrocastrou Street,
Papagos, Athens, GREECE

4. Mr. Tilemachos BELLOS,
Chemist,
Hellenic Industrial Research Institute,
88 Academias Street,
Athens, GREECE

5. Mr. George D. COUMOULOS,
Physical Chemist,
Hellenic Industrial Development Bank,
20 Amalia Ave.,
Athens, GREECE

6. Mr. Aristide DELIDIANNIS,
Manager of Research and Development Department of
"Piraiki-Patraiki Co.", Cotton Industry,
Lukianou 15
Athens 139, GREECE

7. Mr. Christofer DIAKOPOULOS,
Economist (Dr.),
Deputy Director of ETBA,
20 Amalia Ave.,
Athens, GREECE

8. Mr. Christos DIMITROULAS,
Chemist,
Greek Atomic Energy Commission,
N.R.C. Dimocritos,
Agia Paraskevi Attikis,
Athens, GREECE

/...

9. Mr. Const. KACARAKIS,
Chemical Engineer,
Hellenic Industrial Research Institute,
88 Academias Street,
Athens, GREECE

10. Mr. Efthymios KATRAOURAS,
Economist,
Hellenic Industrial Development Bank,
20 Amalia Ave.,
Athens, GREECE

11. Mr. Apostolos KAVOUNAS,
Mathematician-Production Engineer, M. Sc.,
Hellenic Industrial Development Bank
20 Amalia Ave.,
Athens, GREECE

12. Mr. Sotirios LOUCOPOULOS,
Economist,
Hellenic Industrial Development Bank,
20 Amalia Ave.,
Athens, GREECE

13. Mr. John MARSELLOS,
Economist,
Hellenic Industrial Research Institute,
88 Academias Street,
Athens, GREECE

14. Mr. Panayotis MILAS,
Metallurgist Engineer,
Hellenic Industrial Research Institute,
88 Academias Street,
Athens, GREECE

15. Mr. Panagiotis MARIS,
Mechanical and Electrical Engineer,
36 Lochagou Dedousi-Cholargos,
Athens, GREECE

16. Mr. Elias PANOPOULOS
Physicist,
Hellenic Industrial Research Institute,
88 Academias Street,
Athens, GREECE

/...

17. Mr. Takis PAPADIMITRIOU
Chemist,
Greek Atomic Energy Commission,
N.R.C. Democritos,
Agia Paraskevi Attikis,
Athens, GREECE

18. Mr. Ephthimios PETRIDES,
Chemical Engineer,
Hellenic Industrial Research Institute,
80 Academias Street,
Athens, GREECE

19. Mr. Vasilios POULLOS
Electronics Engineer,
Hellenic Industrial Research Institute,
80 Academias Street,
Athens, GREECE

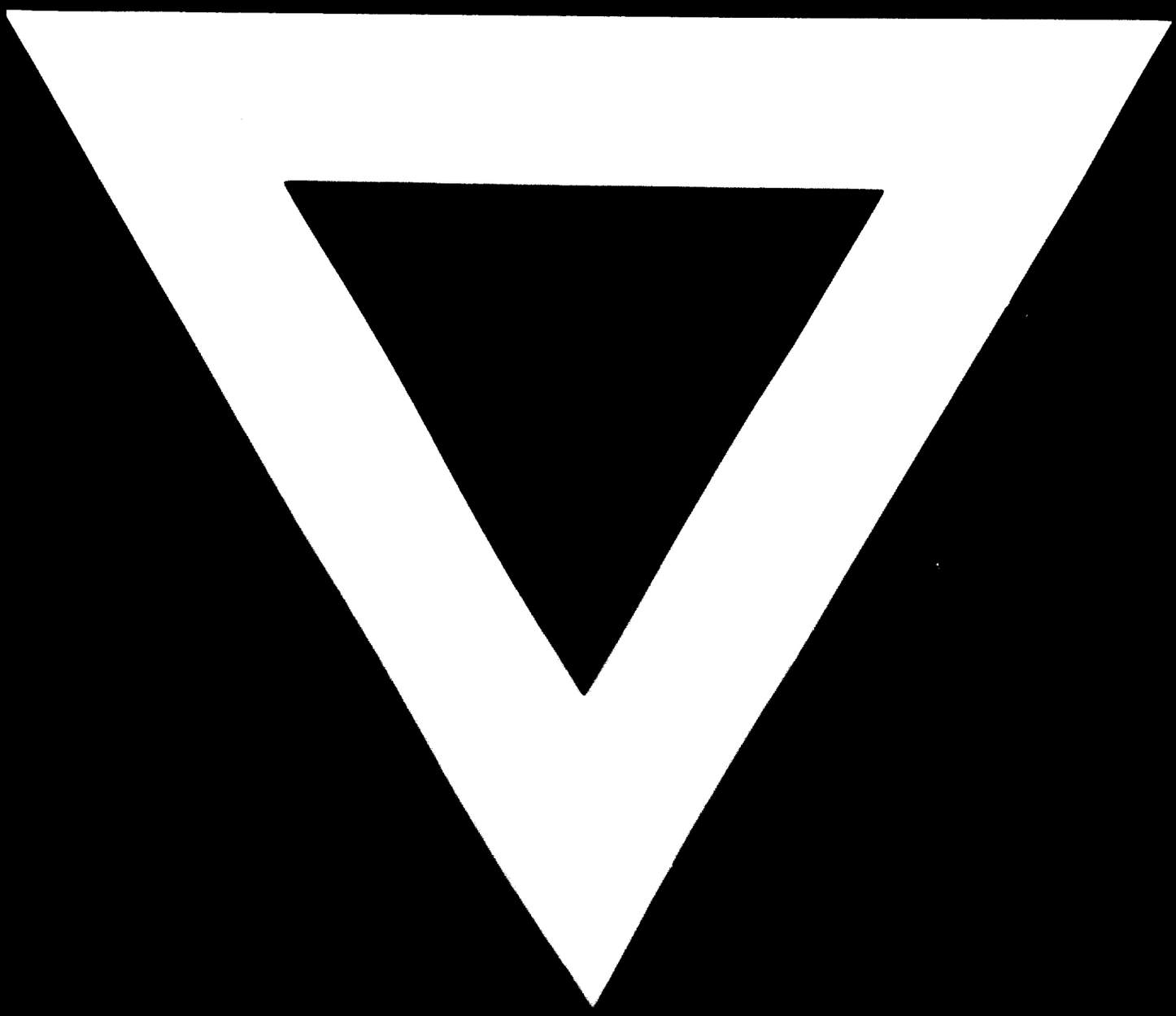
20. Mr. Kontos SOTIRIOS,
Architect-Urbanist (a specialist),
Daskalaki 36 - Ambelokipi,
Athens, GREECE

21. Mr. Sevas TAOUKIS
Chemical Engineer,
Hellenic Industrial Research Institute,
80 Academias Street,
Athens, GREECE

22. Mr. Dematrios VAKATATSIS
Chemist,
Hellenic Industrial Research Institute,
80 Academias Street,
Athens, GREECE

23. Mr. Lambros VOLIOTES,
Chemist-Mechanical Engineer,
Hellenic Industrial Research Institute,
80 Academias Street,
Athens, GREECE

24. Mr. John YANOUKAKOS,
Acting as Director Administration Services,
Hellenic Industrial Research Institute,
80 Academias Street,
Athens, GREECE



29. 6. 72