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Seminar for the Stimulation of Industrial Research in Developing Countries

Singapore, 21 November - 2 December 1972

FINAL REPORT[1/]

1/ This document has been reproduced without formal editing.

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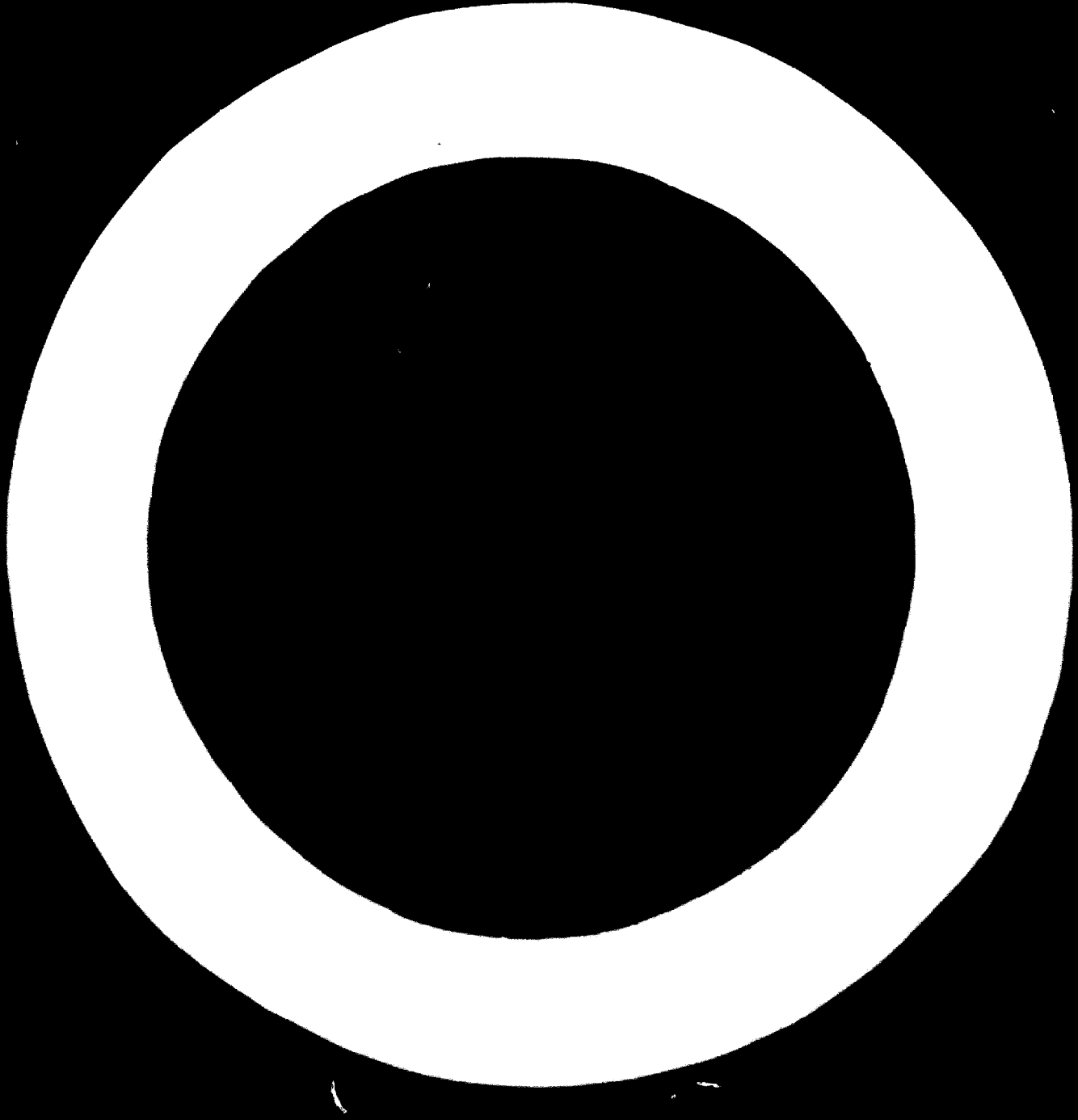
ABBREVIATIONS

CICS	International Council for Scientific Management
CODATA	Committee on Data for Science and Technology
Dm	German Marks
EIDA	Engineering Industries Development Agency
FAO	Food and Agriculture Organization of the United Nations
FID	International Federation for Documentation
IBRD	International Bank for Reconstruction and Development
ICSU	International Council for Scientific Unions
LIS	Light Industries Service
MRFB	Malayan Rubber Fund Board
NISIR	National Institute of Scientific and Industrial Research
NPB	National Productivity Board
OECD	Organization for Economic Co-operation and Development
R and D	Research and Development
RRIM	Rubber Research Institute of Malaya
SISIR	Singapore Institute of Standards and Industrial Research
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNISIST	World Science Information System (of ICSU and UNESCO)
WAITRO	World Association of Industrial and Technological Research Organizations
WFEO	World Federation of Engineering Organizations



I. LETTER OF TRANSMITTAL TO THE EXECUTIVE DIRECTOR OF UNIDO

The Seminar for the Stimula'ion of Industrial Research in Developing Countries held in Singapore from 21 November to 2 December, 1972, attended by senior executives from nineteen countries and UNIDO-appointed consultants and observers from CIOS, FAO, OECD, UNDP, UNESCO and Singapore, was broad-based with the participants drawn from governments, government researoh institutes, public sector industries, co-operative organizations, autonomous research institutes and private industries.

The deliberations of the Seminar were based, for purposeful and streamlined discussion, on seven broad themes, namely, Recent Trends and Developments in Industrial Research in the Developing Countries of Asia and the Far East; Role of Industrial Research in Industrial and Economic Development; Mobilization of National Resources and Planning of Industrial Research and Development; Development of Suitable Skills for Industrial Research; Planning and Implementation of Research Projects; Commercialization of Industrial Research Results; and International Co-operation for Industrial and Technological Research and Development. Field visits to Industrial Research and Development Establishments and industrial enterprises in Singapore and in Kuala Lumpur interspersed during the period of the Seminar not only exposed the participants to the situations prevailing in this part of the Far East but also provided further opportunities for discussions on specific issues relating to the subject of the Seminar.

Instead of labouring on generalities of Industrial Research and Development, which have already been discussed time and again in several forums on various occasions, the Seminar direoted its attention towards formulating concrete steps for effective implementation and unanimously adopted the resolution inoluded in Chapter II of this report covering the salient conclusions and recommendations which I respectfuily submit for your consideration and neoessary follow up action.

The report aleo embodies a summary of the Seminar's discussions and recommendations on action to be taken by Industrial Research Institutes, Industry, UNIDO and the Governments of the countries.

We wish to aooord our appreciation to the staff of the Industrial Services and Institutions Division of UNIDO for their aseistance during the Seminar and to UNIDO for making it possible for us to participate in it. We also wish to express our appreciation to the Government of Singapore and ite local organising oommittee for putting its time and facilities freely at our disposal. Finally we should like to thank His Excellency Dr. Toh Chin Chye, the Chairman and membere of Prosperity through Quality and Reliability (PQR) Campaign Organising Committee, the Chairman and members of the Singapore Manufacturere' Assooiation, Port of Singapore Authority and the Rubber Researoh Inetitute of Malaysia for extending dinner or lunch invitations to us as well as to the Malaysian authoritiee for making it possible for partioipants to undertake study tours in Malaysia.

Yours sincerely

Lee Kum Tatt
Chairman

R E S O L U T I O N

adopted by the Seminar covering the
salient conclusions and recommendations

Preamble

1. The Seminar for the Stimulation of Industrial Research in Developing Countries held in Singapore from 21 November to 2 December 1972, attended by senior executives from nineteen countries, by UNIDO appointed consultants, and by observers from CIOS, FAO, OECD, UNDP, UNESCO and Singapore, was broad-based with the participants drawn from governments, government research institutes, public sector industries, cooperative organizations, autonomous research institutes and private industries. For purposeful and streamlined discussion, the deliberations of the Seminar were based on seven broad themes:-

(a) Recent Trends and Developments in Industrial Research in the Developing Countries of Asia, Middle East and the Far East;

(b) Role of Industrial Research in Industrial and Economic Development;

(c) Mobilization of National Resources and Planning of Industrial Research and Development;

(d) Development of Suitable Skills for Industrial Research;

(e) Planning and Implementation of Research Projects;

(f) Commercialization of Industrial Research Results; and

(g) International Co-operation for Industrial and Technological Research and Development.

Field visits to industrial research and development establishments and Industrial Enterprises in Singapore and in Kuala Lumpur interspersed during the period of the Seminar, not only exposed the participants to the situations prevailing in this part of the Far East but also provided further opportunities for discussions on specific issues relating to the subject of the Seminar.

2. All aspects of industrial research and development - from policies and planning at the highest level to the attitude and skill of the technicians at the bench and plant levels - were discussed in depths. The Seminar provided an effective forum for exchange of views amongst the participants on the broad concept and the status of industrial R and D in each of the countries as well as on the special problems some of the countries were facing, and enabled closer attention to be given, in actual practice, to how the various ideas could be implemented in the best interest of the various countries.

3. The Seminar unanimously agreed that the task before a developing country is not merely to get better results within the existing framework of economic, social and industrial institutions, but to mould and refashion these so that they contribute effectively to the realization of wider and deeper socio-economic values for the societies concerned. The crux of economic development of countries, as a result of industrial progress, was recognized to lie, in particular, in achieving the specified industrial objectives while expending minimum resources within the shortest possible time. Industrial R and D was seen to be an important input to achieve the industrial objectives; hence the need to stimulate and promote industrial R and D activities where they exist and to establish new ones where they do not.

4. The Seminar also agreed that the object of planning in industrial R and D is to clearly identify the present and future industrial needs within the framework of the national perspectives, and to assign priorities on the basis of both the needs and the resources. The object of implementation is to ensure that all necessary inputs for effective R and D are made available and the R and D is pursued in the most appropriate manner, with the ultimate goal of translating the findings of research into productive streams in the industry with the least possible delay and at minimum cost.

5. Instead of labouring on generalities of industrial R and D which have already been discussed on previous occasions, the Seminar directed its attention towards formulating concrete steps for effective implementation and unanimously agreed as a first step on the following five lines of action:

(1) Establishment of an Industrial Information System with a view to promoting Industrial Research and Developmental Activities;

(2) Development of senior personnel for R and D Management;

(3) Training of technical personnel for Industrial Research and Development Activities;

(4) Strengthening of linkage amongst organizations engaged in Industrial Research and Development; and

(5) Creation of Appropriate Machinery for translation of R and D to Industrial practice.

Establishment of an Industrial Information System with a view to Promoting Industrial Research and Developmental Activities

6. While a great deal of effort has been expended worldwide in developing information systems and services geared to meeting the needs of scientific personnel, the lack of adequate "industrial" and "engineering" information and the inability to effectively utilize the available information are problems encountered in many of these systems. Improvement in the use of scarce research and development resources is possible only when the capacity to collect, store, retrieve, interpret and use the available knowledge - through information of the type needed by the engineers and technologists in the industry - the content of which is more than the type of information needed by pure researchers or scientists - has been created.

7. While a number of international organizations, such as, UNISIST, ICSU, FID, CODATA, are doing very useful work in the field of information services covering science and technology, and international organizations, such as, WFEO, in the field of engineering information services, there is still a need, specially in the developing countries, to develop a suitable industrial information system for promoting and servicing industrial research and developmental activities.

8. While the Seminar noted the efforts being made by UNIDO in this direction, it felt that such efforts must be intensified, co-ordinated and interacted with relevant national, regional and international organisations. It was therefore recommended that UNIDO should set up such a system whereby the wealth of industrial information at industrial R and D organizations as well as with others in any part of the world could be put readily at the service of organisations needing such information. To the extent possible, UNIDO should provide a direct central information service.

Development of Senior Personnel for R and D Management

9. The Seminar was convinced that, notwithstanding the amount of inputs that a country or an organisation may invest in its R and D, the R and D will remain ineffective unless it is properly managed. The concept of management at all levels, specially at the top level, was noted as a vital factor in the success of institutional research. Management of R and D establishments also need to be treated as a special skill since rules, procedures, and management systems designed for administrative services or for production services cannot be applied as such in the management of R and D establishments.

10. The Seminar was pleased to note that the Government of the Netherlands had already come forward to sponsor, in co-operation with UNIDO, a programme for the training of managers and senior executives of industrial research institutes in developing countries. As a

follow-up, the Seminar recommended that UNIDO, with the support of the concerned Governments and the UNDP should expand the above training programme. The Seminar urged the Governments of the various countries to sponsor and participate in these programmes. The Seminar also agreed that these management development programmes should be tailored to the needs of developing countries and should cover both governmental and non-governmental agencies.

Training of Technical Personnel for Industrial Research and Development Activities

11. The Seminar recognized that technical personnel in industrial research institutes need to have the required technical competence in their respective fields of speciality, as well as the ability to apply the basic intellectual faculties to the ever changing situations encountered in industrial work; they should be made to realize that the ultimate aim of all endeavours in an industrial research institute is to convert the abstract knowledge into concrete results. The Seminar stressed the importance of inter-disciplinary and multi-disciplinary approaches to work, the consequent need to work in teams, and the need for developing a cost and time consciousness in all work.

12. The important role technicians play in the implementation of R and D Activities was noted by the Seminar which also felt that the development of technician dexterity should receive special attention.

13. The Seminar consequently recommended that, in addition to the development programmes being planned for the management level, efforts should be made to provide training for technical personnel for industrial research institutes.

Strengthening of Linkage Amongst Organizations Engaged in Industrial Research and Development

14. With the rapid pace at which science and technology is changing and with the rapid rate of industrial development taking place in various countries, the Seminar noted that the establishment of close contact and linkage among organizations devoted to industrial R and D Activities should be dynamic. Bearing in mind the past efforts of the Economic Commission for Asia and the Far East (ECAFE) in the establishment of an Asian Research Advisory Council, the Seminar urged UNIDO to undertake activities, if necessary, in co-operation with other relevant organizations such as ECAFE, which would co-ordinate industrial research and development activities in the region including the implementation of the recommendations of this Seminar. Such a system could have liaison arrangements in each country for purposes of assistance, co-ordination and interaction within the region and thus contribute to the overall progress in industrial R and D Activities. The Seminar also agreed that within this system, there was scope for greater co-operation amongst the countries of the region where one could take advantage of the expertise, facilities and experience of each other. In strengthening the linkage, it should be ensured that both governmental, co-operative and non-governmental agencies and private industries are actively involved.

Creation of Appropriate Machinery for Translation of R and D to Industrial Practice

15. Industrial R and D results would, by themselves, be of no value unless they are effectively translated into productive streams in industrial practice. To achieve this, an effective machinery is necessary; the machinery could be integrated with the industrial research institution or with the industrial establishment or it may be an independent research development corporation such as those which exist in Japan and India. While the actual manner in which this machinery is brought into effect will depend on individual situations, the Seminar urged the various Governments to take all necessary steps

to ensure that such machinery exists and functions in consonance with the related industrial research organization(s).

Conclusion

16. The Seminar agreed that immediate concrete follow-up action should be taken. The Governments of the various countries should be urged to support, promote and co-operate in the implementation of these recommendations. Efforts should be made for obtaining assistance including financing from multi-lateral, bi-lateral and from other aid-providing agencies, and from industry.

17. The Seminar also noted the significant role UNIDO could play in the implementation of these recommendations. The Seminar recommended that UNIDO, in collaboration with other relevant organizations and experts, should develop strategy in order to ensure an effective implementation of these recommendations including assistance in the establishment of new Institutions on regional and/or national bases specially for the relatively less developed countries.

18. The support of Governments, the UNDP and other funding agencies would be necessary in the achievement of these tasks.

III. INTRODUCTION

Background

19. Industrial research institutes in developing countries aim at providing various services to the Government, industrial enterprises and to other industrial development agencies. Their effectiveness must be measured by their usefulness to the industrial community, and the extent to which various industrial undertakings make use of their services. This will not take place auto atically, nor can it be brought about by offering services at subsidized rates or even free. Such institutes must successfully "sell" their services to the business community; in other words they must be business-oriented.

20. In several countries industrial research is still at the conceptual and planning stages. These countries would need advice and assistance in their efforts, particularly to Government and industry, in setting up the appropriate structure, institution and/or laboratories for industrial research. These efforts require careful appraisal of the real needs and requirements of the country in this field, in order to guide the country in establishing research services that would give practical contribution to its industrial development.

Follow-up Action

21. In recognition of the above, UNIDO in co-operation with the Government of Singapore and the Singapore Institute of Standards and Industrial Research organised a Seminar on the Stimulation of Industrial Research in Developing Countries in Singapore from 21 November to 2 December, 1972.

Participants

22. The Seminar was attended by 30 delegates from 19 countries of Asia and the Middle East, six consultants selected by UNIDO, 10 observers representing CIOS, FAO, OECD, UNDP, UNESCO and UNIDO as

well as several observers from Singapore. The delegates and observers included senior executives of industrial research institutes and of industry as well as high government officials involved in planning industrial research activities. A list of the participants is given in UNIDO Document ID/WG.132/12 Rev.1, "List of Participants".

Inauguration of the Seminar

23. The inaugural ceremony of the Seminar was attended, in addition to the delegates and observers, by ambassadors and members of the diplomatic corps. After a brief courtesy address by Mr. Campbell, Regional Resident Representative of the United Nations Development Programme, Brunei, Malaysia, Singapore, Mr. Ndam, Associate Industrial Development Officer of UNIDO, presented the speech of Mr. I.H. Abdel-Rahman, Executive Director of UNIDO. This was followed by an address by His Excellency Dr. Toh Chin Chye, Minister for Science and Technology of Singapore. Dr. Lee Kum Tatt, Chairman, Singapore Institute of Standards and Industrial Research, was the Master of Ceremony. The texts of the speeches by Dr. Toh and by Mr. Abdel-Rahman are included in UNIDO Document ID/WG.132/15, "Statements Presented by His Excellency Dr. Toh Chin Chye, Minister for Science and Technology of Singapore, and on behalf of Mr. I.H. Abdel-Rahman, Executive Director of United Nations Industrial Development Organization (UNIDO), during the Inaugural Ceremony".

Opening of the Plenary Sessions

24. Mr. S. Ndam, Director of the Seminar, welcomed participants on behalf of UNIDO. In accordance with established practice in such seminars, where the head of the delegation of the host country assumes the office of Chairman, Dr. Lee Kum Tatt, Chairman of the Singapore Institute of Standards and Industrial Research, was nominated to the Chairmanship.

Election of Officers

25. The following were elected officers of the Seminar:

Vice Chairman: Mr. Jae Hyun Yang, Vice-President
Institute of Science and Technology,
Korea.

Rapporteur: Mr. Amin A. Sharif,
Principal Industrial Officer,
National Council for Scientific Research,
Lebanon.

Agenda and Programme of Work

26. The Provisional Agenda and Programme of Work were discussed and the latter amended. The Agenda and Programme of Work of the Seminar are given in Annexes 1 and 2, respectively.

Organization of Discussions

27. The organization of the discussions was briefly outlined. Participants were divided into groups comprising about 10 persons. Separate groups were formed for each topic under discussion.

Discussion Papers

28. Eight papers on the seven topics selected for discussion were presented by, or on behalf of, consultants as follows:-

"Recent Trends and Developments in Industrial Research in the Developing Countries of the Middle East."
Prepared and presented by Dr. El-Halfawy, UNDP/UNIDO Senior Industrial Development Field Adviser for the Middle East.

"Reflections on Industrial Research in the Developing Countries of Asia and the Far East." Prepared and presented by Dr. A. Sundralingam, Project Manager, National Institute of Scientific and Industrial Research of Malaysia.

"Role of Industrial Research in Industrial and Economic Development." Prepared by Dr. Thorkil Kristensen, Director, Institute for Development Research, Copenhagen, Denmark, presented by Dr. H. Chotani, Head, Research Section Pilot Plant Station, Pakistan Council for Scientific and Industrial Research.

"Mobilization of National Resources and Planning of Industrial Research and Development." Prepared and presented by Dr. S.R. Valluri, Director, National Aeronautical Laboratory of India.

"Development of Suitable Skills for Industrial Research." Prepared and presented by Dr. Lee Kum Tatt, Chairman, Singapore Institute of Standards and Industrial Research.

"Planning and Implementation of Research Projects." Prepared and presented by Dr. H.C. Visvesvaraya, Director, Cement Research Institute of India.

"Commercialization of Industrial Research Results in Japan." Prepared and presented by Dr. Kohei Susue, President, Research Development Corporation of Japan.

"International Co-operation for Industrial and Technological Research and Development." Prepared by Dr. P.C. Trussel, Secretary-General, World Association of Industrial and Technological Research Organizations, Vancouver, British Columbia, Canada, Presented by Dr. (Mrs.) Chan Beng See, Principal Research Fellow, Singapore Institute of Standards and Industrial Research.

29. The highlights of each paper were briefly presented by a UNIDO selected expert in about 10 minutes. Participants were allowed 15 minutes to ask questions calling for clarification. This was followed by a 1½ hour intensive discussion of the subject in the smaller group. Upon reconvening in the plenary session, representatives of groups briefly presented the salient points and recommendations issuing from their group discussions. The subject and recommendations were then opened for general discussion.

Working Group

30. The Seminar, in an effort to formulating concrete steps for effective implementation of its recommendations, set up a special working group comprising, in addition to the officers of the Seminar, Messrs. H.C. Visvesvaraya, Director, Cement Research Institute of India, Cecil S.O. Chan, Joint Director, Federation of Hong Kong Industries, and Anwar Haji Diab, Director General, Real Estate Industries Public Co., Ministry of Industry of Iraq.

31. The Working Group reviewed the records of the discussions of the Seminar and prepared a draft resolution covering the salient conclusions and recommendations. The resolution adopted by the Seminar is reproduced in Chapter II of this report.

Country Monographs

32. One of the sessions was devoted to the presentation of country monographs. Participants briefly highlighted the situation in their countries as regards industrial research and development. Some of these country monographs are reproduced in UNIDO Document ID/WG.132/13, "Country Monographs".

Study Tours

33. Study tours were undertaken to: the Jurong Industrial Estate; the Singapore Institute of Standards Industrial Research (SISIR); the Rollei Singapore (Pte) Ltd. in Singapore; the Colgate-Palmolive (Malaysia) Sdn. Bhd.; the National Institute of Scientific and Industrial Research (NISIR); and the Rubber Research Institute of Malaysia. Summaries of observations on these study tours are included in Annex 3 of this report.

Closing of the Seminar

34. At its closing session on 2 December, 1972, the report of the Rapporteur was unanimously approved and UNIDO was authorized to edit as necessary, the final report, to reproduce and circulate it.

35. The recommendations formulated by the participants were discussed and unanimously adopted by the Seminar.

IV. RECOMMENDATIONS

36. The Seminar, having duly considered and discussed the issues on the approved agenda, hereby recommended that:-

A. For the Attention of Governments

a. In planning for national economic development and for more effective utilization of available resources a close and active involvement be fostered between economic planners and scientists both at Government and industry levels, and such that scientists and technologists be included in effective national planning at decision-making levels;

b. More active support be given to industrial research through the establishment or designation of an official organ to implement the country's policy in scientific and industrial research, the said organ to be preferably set up as a co-operative endeavour between the Government and industry;

c. Appropriate industrial and patent information services be established and/or strengthened by developing countries on a national and/or regional level, with the assistance of international organizations such as UNIDO and UNESCO;

d. Greater emphasis be placed by universities on applied research;

e. Industrial research institutes be endowed with considerable financial and administrative autonomy;

f. Incentives be provided for commercialization of promising research results, and adequate steps be taken for protecting industrial property rights;

g. Emphasis be laid on the greater initial usefulness of multi-purpose research institutes in developing countries, without prejudice to single-purpose institutes when warranted by specific needs;

h. Appropriate machinery, such as research development corporations, be set up in developing countries, whenever necessary, in order to help translate research results into industrial undertakings.

B. For the Attention of Industrial Research Institutes

a. Emphasis be put on the establishment of closer ties with industry in order to generate industry's confidence in the industrial research institutes' competence for assistance;

b. An active part be taken in standardization, testing, and quality control, by assisting the national standards body (NSB) in its technical work and, in cases where a NSB is non existent by helping to create it;

c. Services of industrial research institutes be made available to the totality of the industrial sector, with particular emphasis on small-scale and medium-size industries, taking into consideration the various environmental and human aspects relevant thereto;

d. Attempts be made to establish viable links with industry and universities;

e. Stress be put on the importance of management training for top executives in industrial research institutes;

f. Research project teams be headed by team leaders selected on the basis of competence rather than seniority, and given the authority necessary to execute the project;

g. Measures be taken to improve working conditions and remuneration of scientists, technologists and technicians according to a scale commensurate with managerial echelons, in order to attract and retain research talent within the country;

h. Stress be placed on the importance of pilot plants and training of personnel for obtaining proper design and operation data, and on the need to associate prospective entrepreneurs in the developmental mechanism thereof.

C. **For the Attention of International, Regional, and Other Funding Agencies:**

a. Steps be taken by UNIDO, in collaboration with funding and appropriate agencies, to assist developing countries in training professional personnel for industrial research, with particular emphasis on technologists that would be capable of translating industrial research results into eventual commercial exploitation;

b. A programme be adopted by UNIDO with UNDP and/or IBRD assistance for establishing links among developing and advanced industrial research institutes in both developing and industrialised countries with a view to fostering co-operation in such areas as industrial information, training, and joint projects;

c. UNIDO, in collaboration with WAITRO and other appropriate agencies, undertake on a regional level an appraisal of research programmes of industrial research institutes with a view to identifying areas of excellence and thus facilitating twinning, exchange of information, and training possibilities between institutes of the region.

V. SUMMARY OF DISCUSSION

Recent Trends and Development in Industrial Research in the Developing Countries of Asia and the Middle East

37. The phenomenal increase in the population of certain developing countries has aggravated the problem of unemployment. There appears to have been indiscriminate use of capital to maximize profit. This has created dualism in the economy of these countries. There is now a greater conviction that employment should be treated as a primary not a secondary objective of development because it is the most powerful means of distributing income. Hence, the necessity in these countries for adopting technologies that would be labour intensive. Technologists therefore need to be involved in industrial and economic planning.

38. The rate of growth of industry in developing countries before the Second World War was very slow, with industry contributing only a small percentage to the Gross National Product (GNP). Industrialization and the transfer of technology thereafter proceeded at a faster pace but without the involvement of local research institutes. Industrialization was realized mostly through foreign collaboration, involving importation of know-how and turn-key projects; thus control, direction and transfer of technology has largely remained with the sources of supply.

39. With some exceptions, industrial research institutes emerged in these countries only within the last two decades. A number of important regional organizations have been established to promote, co-operate and co-ordinate in their fields of competence, the activities of the relevant member countries.

40. The technological pattern adopted naturally depends on parameters peculiar to each country. Thus, Hong Kong and Singapore - city states, have a limitation on population and natural material resources. Their economies depend on the exportation of manufactured products. The intellectual resources and strength of the people, in industrial technology, aimed at raising the standard of living of the entire

population, is directed towards industrial production. On the other hand, countries like India and Pakistan which have low gross national products and per-capita incomes have more than 40% of the people living near the starvation level. In order to raise the standard of living, the trend in such countries is the creation of more jobs.

41. The role of indigenous industrial research is therefore to provide advice for undertaking research and developing the appropriate technology involving the maximum use of indigenous raw materials, know-how transfer, and type of training required.

42. In this new strategy of development, it is necessary to foster and develop engineering design capability for constructing and testing prototypes and scale models appropriate to the parameters at hand. This is especially significant when utilizing a raw material particular to a given country. In planning for development, it is important to recognize the role of industrial research and to establish a dialogue between planners and research scientists in the formulation, screening and final selection of projects.

43. Different approaches for the establishment of industrial research institutes have been adopted in various countries. It is clear that these approaches differ in type in accordance with the stage of economic and industrial development in the country. Many of the developing countries have adopted the multi-purpose approach towards the establishment of research institutes, i.e. institutes that carry out activities covering more than the field of specialization. In countries where a predominant industry exists, single-purpose institutes have been set up, where the national need and availability of trained manpower justified the measure. Thus we find a Metrology Research and Development Centre in Egypt, a Jute Research Institute in India, and a Rubber Research Institute in Malaysia.

44. The general trend at present is for both types of institutes of industrial research to concentrate their activities on industrial economic studies, surveys and feasibility studies, standardization and

quality control, investigation at pilot plants level, upgrading of the quality of raw materials, and the exploitation of natural resources, studies to raise productivity in existing industrial enterprises, design of processes and equipment, adaptation of existing technology, testing and analysis.

45. Some researchers have often started out with optimistic views that R and D will solve the problems of industrial development, and have set up large organizations with impressive buildings filled with sophisticated equipment. The immediate result, in many cases, has been disappointment and frustration. It would always be preferable to start on a modest scale and then gradually expand when the institute proved itself.

46. Some of the difficulties which industrial research institutes must face and overcome relate to problems of organisation, of competent staff recruitment and of awakening general consciousness to the purpose and purport of research. Research is a long-term investment which, if wisely undertaken, cannot fail to make meaningful contributions towards national development. There is on the whole a manifest shortage of competent professional staff. No matter what the physical facilities and range of equipment available, the accent remains on skilled personnel. This becomes more acute as some trained personnel get attracted by private industry which pays higher salaries or better prospects and facilities abroad. Some are also appointed to governmental administrative posts because of a shortage of trained personnel in the country or for political reasons.

47. To assist in solving the above problems, the trend is for most countries of the regions to seek technical assistance through various international organizations, such as UNIDO, in strengthening

their industrial research institutes. Emphasis in these assistance programmes is being placed on adaptation of foreign technologies and development of indigenous ones; the setting up of suitable industrial information and enquiry services; securing more funds from both Government and the private sector for industrial research; the stimulation of research consciousness among Government planning agencies and industry; and the reorientation of research operations towards practical ends.

48. Industrial research institutes recognise the need to work in co-operation with economic and industrial planning agencies, one of their important tasks being to forecast industrial development trends. They are also adopting a forward-looking policy for determining the type of research capabilities they want to establish and thinking ahead of Government industrial and technological policies.

Role of Industrial Research in Industrial and Economic Development.

49. According to World Bank statistics for the period 1961-1971, the average rate of industrialisation and agricultural growth in developing countries have both been higher than corresponding rates in developed countries. In developing countries this growth especially in large-scale industries has come about through adoption rather than adaptation of technology. In most cases the adoption was probably motivated by a desire to enter the export market.

50. In transplanting technology from the industrialised to developing countries, manufacturers generally desire to set up industries employing their own technologies, and managers. Consequently little opportunity is afforded to local talents to play their full role in the development of that industry. Indigenous industries, usually employ a greater percentage of the local skills and are concerned with the total economy of the country.

51. In so far as the industrial sector comprises industry of various sizes from micro to large-scale enterprises, the services of an industrial research institute in a developing country should be available to the totality of the industrial sector with special emphasis in small and medium-scale industries. The role of industrial research in developing countries is to work out appropriate techniques suitable to the human and material conditions of the country.

52. There is a sharp distinction between the industrial pattern in developed and developing countries. In developed countries, capital is available while the labour force is limited. The pattern of demand reflects the demand of a rich society; in developing countries the opposite situation exists in that there is generally a shortage of capital, abundance of labour and the pattern of demand a poor society.

53. Industrial research institutes, if they are to play a significant role in the industrial development of the country, must be integrated with the planning policy of that country. Planning of industrial research must be closely tied to the overall economic planning of the country. A viable dialogue must be instituted between development planning and industrial research.

54. The importance of extension service type activities of research institutes in building up industry in developing countries cannot be over emphasized. This is one of the most important functions of an industrial research institute in developing countries especially in those countries which are at the initial stage of industrial development. To be able to render efficient extension services to industry, institute staff should be knowledgeable of the problems of industry and frequent exchange of personnel between industrial research institutes and other relevant organizations should take place.

55. Another important element would include the establishment, within industrial research institutes, of the right type of technical information services which would require documentation, collection and dissemination of industrial and technological information, and industrial enquiry services.

Mobilization of National Resources and Planning of Industrial Research Development

56. There is a tendency in some developing countries for planners to aspire to standards of living beyond the practical reach of the country. They aim at attaining a standard of living similar to that of a more advanced society. With the limited resources available in these countries, such targets are meaningless. The optimal utilization of these resources can best be effected through the setting-up of appropriate integrating mechanism whereby a survey of all such resources becomes the basis on which realistic development plans can be drawn up.

57. It is also essential to set up an appropriate machinery to co-ordinate the country's efforts in industrial research and development. Such machinery should include ministries or departments of Technology and councils for industrial and technological research. Many countries are already moving towards this aim. As several useful research and development projects emerge and are carried out in private industry, greater dialogue should be established between industrial research institutes and corresponding departments in private industry.

58. Priority industrial sectors for development are usually identified in national industrial development plans. Such sectors should indicate the kind of industrial research and development that industrial research institutes undertake. The kind of research in such institutes would also depend on government policies vis-a-vis the exploitation of the natural resources of the country.

59. If the industrial research institutes are to make effective contributions to the economic well-being of a country and to increase

its productivity, a number of factors are to be considered. Since in most developing countries, agriculture provides more employment opportunities for large numbers of people, large government investments in this sector of the national economy are common. Industrial research institutes operating in such agriculture-based economies may consider gearing their activities towards developing agro-industries.

60. An important aspect of mobilisation of resources is reflected in the allocation of national funds for industrial research, the amount ultimately depending on the priority accorded to industrial research in the country.

Development of Suitable Skills for Industrial Research

61. A country without an indigenous scientific and technological capacity is unable to utilise science and technology to serve its developmental needs. Several requirements must be met before this capacity can begin to bear fruit. The most important of these requirements is manpower skilled in one or more of the three following categories: management ability; technological expertise; technical proficiency.

62. It is essential to develop good and pragmatic management for industrial research. While machinery can be replaced or scrapped, wrong choice of personnel, particularly at the management level, is much more difficult to correct. The important thing therefore is to develop the mental attitude necessary for good management. Management is important in so far as it plays a directive role in the establishment of priorities, the planning of programmes conforming to national development objectives, and the co-ordination of individual and team-work.

63. It is true that developing countries are short of skills highly competent in their fields and able to work in multi-

disciplinary teams required for industrial research. One reason for this may be that there is too much specialization in fields that are not immediately required by the developing countries. Another reason could be that too many people are specializing in the same field. Also to be considered are job satisfaction, good living and working conditions, salaries, and other incentives. Appropriate incentives should therefore be provided to attract and retain people with the required skills. This would help to reduce the "brain drain" and to provide job securities for such skilled personnel. It is to be noted that some developing countries are already adopting successful measures in this respect.

64. Industrial research institutes are not the only source of skilled personnel for industrial research. Through good management and national planning skilled personnel in universities and industries, working in collaboration with industrial research institutes, could contribute significantly to the solution of industrual research problems.

65. The development of industrial research personnel, technologically minded, cost-conscious and with entrepreneural talent, is most necessary. Some research workers consider public relations work as degrading. It is far easier to do test tube work and machinery work than to deal with human beings in industry. This isolated approach does not create confidence with industry.

66. The professionals of technology constitute the backbone of an industrial research institute and its vital link with industry. As such, they should be able to avail themselves of as wide an access as possible to sources of technical information in developed countries and to gain experience through training abroad and exchange schemes with educational institutions. Suitable orientation in universities

towards industrial research could contribute towards basic development of professional skills. Technicians and skilled workers constitute the supporting base of an industrial research institute and should therefore be chosen with due regard to the type of skill required. They should also be trained on the job and/or sent to Polytechnics to enhance their theoretical knowledge.

Planning and Implementation of Research Projects

67. Planning of industrial research on the national level brings into play the definition of aims and objectives, the technological possibilities with their socio-economic implications, and the projected duration of execution. Specific research projects can then be identified within a framework of relevant priorities.

68. Optimization of R and D efforts necessitates a judicious choice between innovative and adaptive technology, without losing sight of the compatibility involved in the transfer of technology.

69. Management systems for R and D, sadly lacking on the whole in developing countries, should be given serious consideration in order to develop research programmes in line with national socio-economic conditions and which would play a more dynamic role in development.

70. Effective implementation of research projects can best be arrived at through team work, the team-leader in each case being selected on the basis of his knowledge and competence in the chosen field rather than on his hierarchical position in the institution; the team members should also be selected bearing in mind the needs of the leader, the disciplines involved, and the resources of the institution. To ensure proper participation, the responsibilities of each team member should be clearly defined and a system elaborated whereby each member's contribution would be clearly recognized.

71. The degree of administrative and financial autonomy of an industrial research institute could affect the flexibility of its operation and, consequently, the value of its achievement.

72. A system needs to be evolved within industrial research institutes so that, the quality of work and the progress of a research project could be periodically evaluated. Such a system must necessarily be pragmatic and geared to ensure the introduction of corrective measures as needed. This can best be achieved by adopting project planning procedures made flexible to allow adaptation to changing situations.

73. Proper implementation of a research plan, once its duration and cost have been clearly defined, necessitates measures including, in particular, adequate finances, manpower and equipment; efficient management of these resources; and translation of research results into industrial practice.

74. Equipment procurement should be carefully planned to meet precise needs. Where large investments are involved ways to make multi-purpose or extensive use of this equipment as well as to share it with other institutions should be also considered.

75. The "modus operandi" of a national industrial research institution varies in its details and scope from one country to another, but all such institutions require certain functional levels in carrying out their programmes, the most important of which include planning, finance and co-ordination of scientific and technological research at the national level, including provision of a strong technical information service, as well as such communal scientific services as computer facilities and sophisticated and expensive scientific equipment; and execution of research projects either directly or through involvement in the team work.

Commercialization of Industrial Research Results

76. Eventual commercialization of industrial research results is perhaps one of the major goals of industrial research institutes. Development work including pilot plant operation cannot therefore be overemphasized. The function of an industrial research institute should not end where industrial production starts; institute personnel must feel they are involved in the totality of the industrial sector which translated their efforts into a tangible product. This dynamic interaction can only make for a harmonious relationship between industrial research institutes and industry, and both stand to benefit from it. This should help to minimize the time lag between the completion of development research and its industrial application.

77. The commercialization of industrial research results requires an appropriate mechanism within the country. Most developing countries do not have such a mechanism. In addition many research personnel, individually and collectively lack funds for bringing their development work to a level where it can be commercialized. Governments should therefore consider setting up an appropriate machinery such as an industrial research and development corporation in order to help translate research results in industrial undertakings.

International Co-operation for Industrial and Technological Research and Development.

78. From the preceding discussions, it has become evident that the capabilities of industrial research institutes must extend beyond scientific and engineering teohnology to management and entrepreneur skills to meet this wide spectrum of oapabilities. It therefore requires a broad range of information and experience, brought about through international co-operation.

79. In fact research in industrialized countries owes much of its success to co-operative efforts that manifest themselves through technical publications, symposia, and personal contacts. Research thrives on transmission of information and its application to specific problems.

80. Communication between R and D establishments in developing and developed countries could lead to similar advantages but is often not realised because of a "communication gap" rendered all the more acute by the great diversity of information and experience a developing R and D establishment needs to fulfill its functions.

81. It is precisely the need to fill this "communication gap" that brought into being in 1970, the World Association of Industrial and Technological Research Organizations (WAITRO). It aims, inter alia, at providing a clearing house of technical information and a means for assisting developing R and D establishments to contact other parties with similar interests and problems, particularly in industrialized countries. Projects of mutual interest could then be started, as well as training of technical and administrative personnel and the introduction of potential investors in such new or adopted technological applications as may have been developed through this co-operative effort.

82. It is essential to clearly define the areas where joint efforts are possible and desirable. One example might be environmental control which is a broad subject, covering water, noise, and air-pollution, each component with a technology of its own.

83. A recent study carried out by WAITRO[1/] evaluating the needs and problems confronting industrial research institutions in developing countries indicated that most of the needs were not for direct financial assistance but rather for the sharing of experience and information; training of technical personnel; training in industrial application of

1/ "Priority of Needs of Industrial Research Institutes in Developing Countries." WAITRO Publication No.3, 1972.

R and D; industrial exploitation of R and D results; and promotion of research programmes.

84. Several projects such as the organization of training courses on quality control are most often limited to a particular country. It would be worth considering the desirability of organizing such projects on a regional basis so that the benefits may be shared by countries in the region. An added advantage is the establishment of contacts which, in turn, encourage co-operative interplay between the industrial research institutes. Another scheme that should be considered is pairing or twinning of industrial research institutes. This practice has proved beneficial to the institutes concerned.

85. Co-operation should not only be limited to interaction between research institutes but should include co-operation between research institutes and governmental, semi-governmental and other organizations engaged or interested in industrial research. In this connexion, Governments of the developing countries as well as international organizations such as UNDP and IDRB, should consider providing the necessary financial support to promote such co-operation.

Annex 1

A G E N D A

1. Registration and Administrative Matters

2. Inauguration of the Seminar

3. Organizational Work Session
   - Election of officers
   - Adoption of the agenda
   - Selection of working groups
   - Organization of work

4. Recent Trends and Developments in Industrial Research in the Developing Countries of Asia, the Middle and Far East

5. Role of Industrial Research in Industrial and Economic Development

6. Mobilization of National Resources and Planning of Industrial Research and Development

7. Development of Suitable Skills for Industrial Research

8. Planning and Implementation of Research Projects

9. Commercialization of Industrial Research Results

10. International Co-operation for Industrial and Technological Research and Development

11. General Discussion

12. Review of Draft Recommendations and Report of the Rapporteur

13. Finalization of Recommendations and Report of the Rapporteur

14. Closing Session

Annex 2

PROGRAMME OF WORK

Monday, 20 November 1972

14.30 -	Registration and Administrative Matters

Tuesday, 21 November 1972

Morning:

08.30	Registration and Administrative Matters
10.00	Inauguration of the Seminar
11.30	Organization Work Session

Afternoon:

14.00	Recent Trends and Development in Industrial Research in the Developing Countries of Asia, The Middle and Far East

Wednesday, 22 November 1972

Morning:

08.30	Role of Industrial Research in Industrial and Economic Development

Afternoon:

14.00	Mobilisation of National Resources and Planning of Industrial Research and Development

Thursday, 23 November 1972

Morning:

09.00	Ad hoc Group Discussions by Participants

Afternoon:

14.00	Tour of Jurong Industrial Estate and Shipyard

Friday, 24 November 1972

Morning:

08.30 Development of Suitable Skills for Industrial Research

Afternoon:

14.00 Visit to the Singapore Institute of Standards and Industrial Research

Saturday, 25 November 1972

08.30 Visit to Rollei Singapore (Pte.) Ltd.

Monday, 27 November 1972

14.00 Visit to Colgate-Palmolive (Malaysia) Sdn. Bhd.

16.00 Visit to National Institute of Scientific and Industrial Research, Malaysia

Tuesday, 28 November 1972

09.00 Visit to Rubber Research Institute of Malaysia

Wednesday, 29 November 1972

Morning:

08.30 Planning and Implementation of Research Projects

Afternoon:

14.00 Presentation of Country Briefs

Thursday, 30 November 1972

Morning:

08.30 Commercialisation of Industrial Research Results

Afternoon:

14.00 International Co-operation for Industrial and Technological Research and Development

Friday, 1 December 1972

Morning:

08.30	Review of Draft Recommendations and Report of the Rapporteur and General Discussions

Afternoon:

14.30	Review of Draft Resolution to be adopted by the Seminar covering the salient conclusions and recommendations

Saturday, 2 December 1972

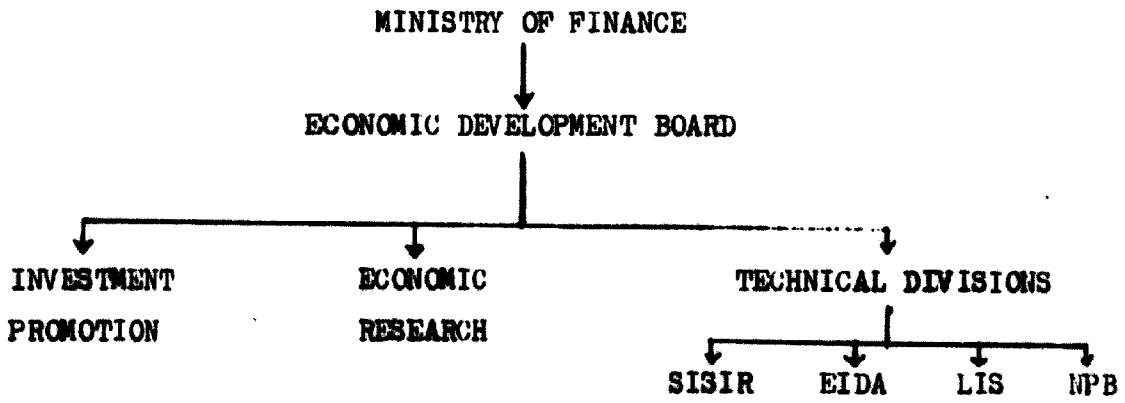
09.00	Finalization of Recommendations and Report of the Rapporteur Adoption of Resolution covering the salient conclusions and recommendations

Annex 3

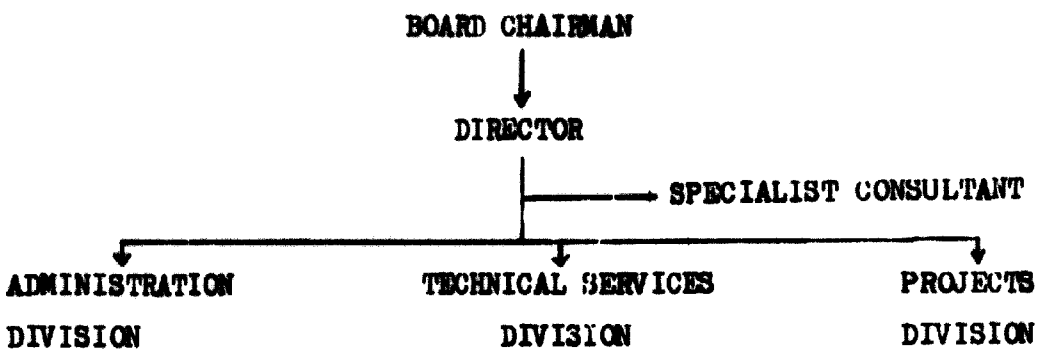
SUMMARY OF OBSERVATIONS ON STUDY TOURS

Singapore Institute of Standards and Industrial Research

The Singapore Institute of Standards and Industrial Research is attached to the Ministry of Finance according to the chart below:



SISIR's LINE OF OPERATION IS THUS:



SISIR will become an autonomous body by early 1973. Under the Projects Division are three sections namely, Standards, Technical Information Service and Industrial Research Sections. Started in 1963 with 15 staff, as the Industrial Research Unit it now runs with 200 people and a budget of $2.8 million.

COMMENTS

There are many other developing countries like Korea, India and the Philippines that have Industrial Research Laboratories better equipped and far more sophisticated than SISIR's facilities. These countries conduct scientific investigations that require trained personnel and high technology. SISIR, on the other hand, well-manned as it is by highly qualified men (Master's and Ph.D's) undertakes research topics that are - except for the waste disposal problem - modest, ranging from concrete mix formulations to shark fin canning. The bulk of SISIR's activities are concentrated on Materials Testing, Quality Control and solving production problems, perhaps in an unconscious effort to make the institute as self-sufficient as possible as these are quick money earning activities. At present SISIR earns more than 50% of its running cost from industry.

What is impressive is the pride that SISIR personnel take in their work and achievement. They have good reasons. Their work is immediately (even during the experiment) tied up to industry. Whatever success they will attain they will see the fruits of their labour in the commercial scale.

SISIR is founded only in 1969 and already it is infusing its activities into the private sector. Since the Singapore industry is in its early stages, SISIR and industry shall grow together, deriving strength from one another, taking care of each other.

Jurong Industrial Estate

In order to fully appreciate the success story of Singapore's phenomenal growth the participants to the UNIDO Seminar paid a visit to the Jurong Industrial Estate on 23rd November 1972.

The Visitors were received by Mr. Wee Ban Bee, Public Relations Officer of the Corporation, who gave them a brief resume of the Corporation's activities and then conducted them on a tour of the Estate.

The basic measures taken by the Singapore Government to encourage new industries were the provision of infrastructure, tariff protection and fiscal incentives. Their objectives were to secure industrial peace, to increase the future supply of skilled labour and to increase the volume of national savings. Singapore external reserves have increased from $336.2 million in 1959 to $4,777.07 million in June this year. Since 1968 the average annual increase in GNP has been around 12 per cent. The share of gross investment in GNP has increased from 9.3 per cent in 1961 to 25.1 per cent in 1971. Employment in the manufacturing sector increased at such a rate that at present there is labour scarcity and labour has to be imported from Malaysia and elsewhere.

The Island's largest industrial estate is at Jurong Town, in the south-west corner of Singapore. Out of the barren hills and swamplands has grown a town which today is a landmark for industrialisation in Singapore. The project which is in its second and third phase of development, when completed will house 600 factories, employing about 75,000 workers in a township of 14,000 acres.

Jurong was chosen because of four factors:

(i) the barren land was owned by the State;
(ii) thinly populated;
(iii) had a natural harbour, and
(vi) land was cheap.

The land is leased to industrialists for 30 years at 6 per cent of the land value - $2.30-3.50/square ft

The value is reviewed every 6½ years but refixation cannot exceed 50 per cent of the original value.

As of today there are already 417 factories in production and 80 under construction. The number of workers employed is 48,000. The project is expected to be completed by 1980. The Estate is divided into various zones. The light industries are located in the north and the heavy industries to the south. A loan of Singapore $25 million from the Asian Development Bank is available for the modernization of the port. The port has a prepared storage area of about 22 acres and covered storage space of about 285,000 sq. ft.

The industries located represent light and small industries, building material industries, Electronics, a petrol chemical plant, two refineries, plastics, textiles, optics etc. Out of the total investment in industry, 40 per cent is local enterprises, and the rest from USA, Germany, UK, Japan, Hong Kong and Taiwan.

The zoning separates the housing area from "clear industries" and "duty industries". This is in line with the ambition of the Corporation to create a garden industrial town so that the workers living in it can enjoy the best social amenities.

Standard factory building designed and built by the Corporation are available for sale or rental to industrialists. Covered areas rank from 9,360 to 35,000 sq. ft.

Housing

The most impressive part of the estate are the blocks of multi-storied houses provided for the workers. The planners aim

to house 400,000 people by 1980.

At present there are 7,000 units of low-cost flats and 3,000 are under construction. These flats would continue to be built and improved until the needs of the workers and their families for accommodation is satisfied. Five types of flats are provided - one room tenement, two room tenement, three room tenement, four room tenement.

The shopping centres, teaching school and other social facilities are also provided.

The most interesting aspect of the whole project is that the responsibility of providing housing rests on the government and not on the industrial establishment.

Visit to Rollei Singapore, Chai Chee Road, Singapore

This visit to the Rollei Singapore factory in Chai Chee Road took place on 25th November 1972. This is Rollei's largest of its six installations in Singapore. This internationally well-known manufacturer of cameras and related photographic equipment started operations in Singapore in late 1970 and since then has established 4 large factories producing cameras, projectors and flash-guns.

The delegates were welcomed by Dr. Eder, the Financial Manager, who gave an introductory briefing on Rollei's activities in Singapore. In the last 2 years the major portion of production was transferred to Singapore from the parent company in Germany. In fact the production of componente has exceeded that in Germany to include such expensive and sophisticated components as lenses and shutters. Theee items are still being supplied to the parent company by an outside concern.

To give an idea of the scale of operations Dr. Eder revealed that sales of Singapore-made Rollei products amounted to $60 million

in 1972 and are expected to rise to $105 million next year. The local organization employs 3,400 staff. The local staff comprise middle management personnel drawn from universities, technicians from the Polytechnic and operators from schools. The Company at the initial stage selected 450 Singaporeans and sent them to Germany for training. At the present moment also there are 40-50 people in Germany. The Company has spent so far DM 8 million on this programme.

The group was taken round the factory to see the production of plastic components by injection moulding, metal part stamping and galvanising operations. The fully programmed electroplating processes were of particular interest to the chemists in the group. Throughout the tour one could notice that great emphasis was placed on quality-control in the various operations and numerous posters. It was therefore not surprising to learn that 20% of the staff are engaged in quality control work.

The tour ended with Mr. Riegel, the Production Manager, explaining the finer points of the range of Rollei's products manufactured in Singapore. Much interest was shown in the 3 types of cameras which were on display, in addition to the computer flash-guns. The group was also shown the newest camera model - the Rollei A26 - not yet available on the market. This is a compact instamatic camera with fully automatic setting and detachable flash-gun.

Rollei's successful operations are spear-headed by a research-conscious management and backed by an effective research and development programme in Germany.

The most impressive thing about the whole project was the detail planning which enabled the factory to go into production within five months from the time of start of construction of the buildings. Another interesting aspect was that 98 per cent of the product was exported to USA, UK, Germany and other countries including Japan. 35 per cent of these products went to West Germany.

The conditions conducive to the transfer of [illegible] to Singapore were the relatively low wages, the availability of dexterous skills in the local people, the ideal location of Singapore and the pragmatic and helpful attitude of the Government.

The total investment was estimated at M. 100 million.

National Institute of Scientific and Industrial Research

The National Institute for Scientific and Industrial Research was set up by Act 48 of Parliament in July 1971, with the provision of 35 million (Malaysian) development fund under the Second Malaysia Development Plan and $1.5 million as assistance from UNDP with UNIDO as Executive Agency. It is, therefore, still at the initial stage of development. A large portion of the equipment is still to be received.

While plans for construction of permanent buildings are under was, the nucleus of the Institute has been set up by acquiring 63,000 sq. ft. of constructed premises in the heart of an industrial area. The present strength of the staff is about 70 including the Director and about 15 scientific/technical officers, who have been recruited during the past one year. The ultimate strength envisaged on completion of the project is in addition to the director and 5 UN experts, 25 professional staff and 48 laboratory assistants and 22 auxiliary personnel. It is planned to spread the activities of the Institute over 4 sections comprising Electrical Engineering, Electronics and Physics; Chemistry and Chemical Technology including minerals processing; Mechanical Engineering and materials science; and Industrial Consultancy services.

It is expected that NISIR's activities will cover immediate as well as long term objectives. Priority will however, be accorded to the immediate objectives during the initial stages. These activities may be categorised as Technical Information and Documentation Services; Trouble shooting and Technical Consultancy Services to

industry; Adaption of foreign technology and machinery to local uses; Development of technological know-how and techniques for the utilization of Malaysian raw materials; and Training of research personnel.

The Institute has undertaken a few projects such as pelletization of tapioca for export, extraction of thorium and rare earths from monozite, and studies on the chemistry of medicinal plants. A machine for chipping tapioca for use by small investors has been developed and made available for industrial use. Four patent applications have resulted from initial work.

Rubber Research Institute of Malaysia

Malaysia is the world's largest producer of natural rubber today, accounting for over 40% of the world's total supply and 60% of the total agriculturally developed land. The Rubber Research Institute of Malaysia which was set up some 45 years ago has made a vital contribution towards making the rubber industry technologically sound and economically viable.

Every form of rubber exported from the States of Malaysia bears a research cess (currently one Malayan cent), to support the Malayan Rubber Fund. This Fund is managed and utilized by a Statutory Board (M.R.F.B.) in co-ordinating activities within and outside Malaysia relating to research, development, publicity and other matters affecting the natural rubber industry and in controlling the activities and policies of all research and development organizations wholly or mainly financed by the Fund.

The Rubber Research Institute is the largest of its kind in the world devoted to research and development concerning a single perennial crop. Presently it has a staff of nearly 1,250 including over 160 research officers. Apart from its laboratories located in the heart of Kuala Lumpur, the RRIM has also a sizeable experiment station at Sungei Buloh, 16 miles away, where some 3,100 acres of land are available for experiment and field trials.

The RRIM has made notable contributions to the science of rubber production, particularly in the fields of soil management, breeding of high yielding material, planting techniques, bud-grafting and crown budding, tapping methods, yield stimulation and disease control. With the induction of the Standard Malaysian Rubber Scheme in 1965, processing and packing methods have been greatly improved and today, Malaysian industry offers a quality guaranteed and technically graded natural rubber. The new process includes the manufacture of vicosity-stabilized rubber, oil-extended natural rubber and general purpose tyre rubber. This development has enabled the natural rubber industry to effectively combat the fierce competition from synthetic rubber. At the Experiment Station, facilities are provided for experiments concerning breeding and selection; commercial production on a plant of 10 tons capacity per day, training of small holders and estate personnel to update their information on all aspects of natural rubber planting and processing.

Separate areas are demarcated in the station for cultivation treatments and pathological research, experiments on tapping, yield stimulation, cover crops, budding, manuring, planting distances and density of planting.

Colgate-Palmolive Factory

Colgate-Palmolive (Malaysia) is a wholly owned subsidiary of the parent organization and commenced operations in 1962. At present it employs a labour force of 220, with four top management posts manned by personnel from the parent organization - Toilet Soaps, detergents and toothpaste are manufactured in this plant. While toilet soaps and toothpaste are marketed locally, detergents are marketed both locally and abroad. An expansion of production capacity is underway.

The technology as well as most of the raw materials are imported. Packing material is obtained locally. A fraction of this manufacture is accomplished by the importation of soap-chips

into the country by Colgate-Palmolive for processing instead of the conventional starting point for manufacture of soap which is the saponification of triglyceride with sodium hydroxide.

The chips are compounded with perfumes and other additives in the plodder with subsequent stamping and packaging of the products. The reasons for the elimination of the initial processing at this factory were not disclosed.

The ingredients for toothpaste and detergent are blended and processed in the plant. The products are marketed in packs of different sizes. Production figures as given by the tour leader to the participants are given below.

Detergent Powder

Production of this commodity is on a three shift basis while packaging is on a two shift basis. The production units have a capacity of 50,000 lbs/8 hours - the packaging units have a capacity of 4,000 cases/8 hours. Each case contains 24 (500 gm) cartons.

Soap

The unit weight of a cake of soap is 84 gm. On an 8 hours day production capacity is 500 cases of 144 pieces.

Toothpaste

Toothpaste is marketed in two sizes, large 135 gm and medium 49.5 gm. In terms of the large size package, the production capacity of this unit is 220,000 tubes per 8 hours.

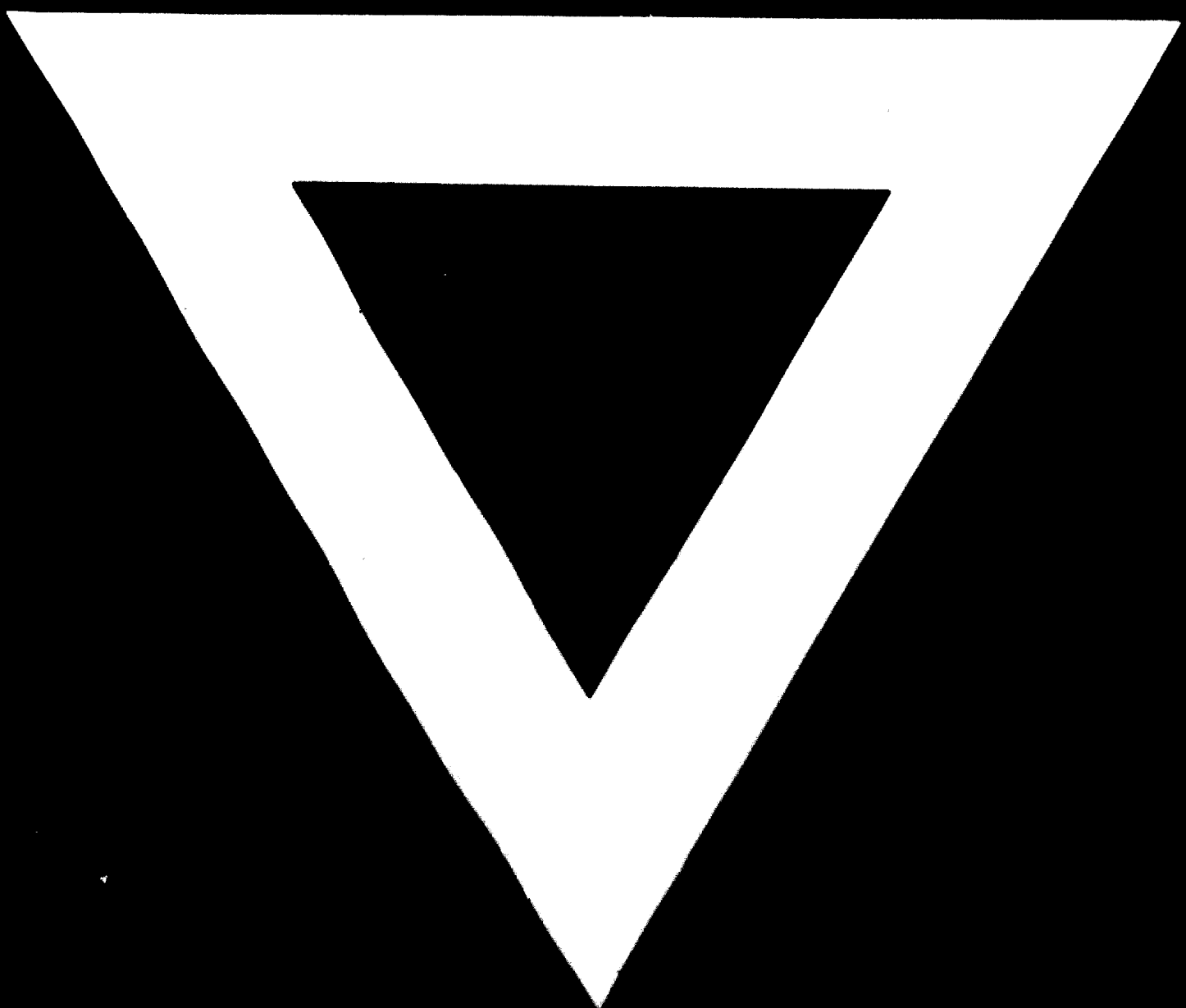
Annex 4

3

LIST OF DOCUMENTS

Agenda	- ID/WG.132/1
Annotated Agenda	- ID/WG.132/2
Programme of Work	- ID/WG.132/3 Rev 2
"International Co-operation for Industrial and Technological Research and Development" by P.C. Trussell, Secretary-General, World Association of Industrial and Technological Research Organisations (WAITRO)	- ID/WG.132/4
"Role of Industrial Research in Industrial and Economic Development" by Thorkil Kristensen, Director, Institute for Development Research of Denmark	- ID/WG.132/5
"Commercialisation of Industrial Research Results in Japan" by Kohei Susue, President, Research Development Corporation of Japan	- ID/WG.132/6
"Planning and Implementation of Research Projects" by H.C. Visvesvaraya, Director, Cement Research Institute of India	- ID/WG.132/7
"Recent Trends and Development in Industrial Research in the Developing Countries of the Middle East" by Mohamed El-Halfawy, UNDP/ UNIDO Senior Industrial Field Adviser for the Middle East	- ID/WG.132/8

"Development of Suitable Skills for Industrial Research" by Lee Kum Tatt, Chairman, Singapore Institute of Standards and Industrial Research and of the Science Council of Singapore	-	ID/WG.132/9
"Mobilization of National Resources and Planning of Industrial Research and Development" by S.R. Valluri, Director, National Aeronautical Laboratory of India	-	ID/WG.132/10
"Reflections on Industrial Research in the Developing Countries of Asia and the Far East" by A. Sindralingam, UN Project Manager National Institute of Scientific and Industrial Research of Malaysia	-	ID/WG.132/11
List of Participants	-	ID/WG.132/12 Rev 1
Country Monographs	-	ID/WG.132/13
Final Report	-	ID/WG.132/14 Rev 1
Statements Presented by His Excellency Dr. Tan Chin Chye, Minister for Science and Technology of Singapore, and on behalf of Mr. I.H. Abdel-Rahman, Executive Director of United Nations Industrial Development Organization (UNIDO), during the Inaugural Ceremony	-	ID/WG.132/15



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