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Seminar for the Stimulation of Industrial
Research in Developing Countries

Singapore, 21 November - 2 December 1972

STATEMENTS ✓

presented by

His Excellency Dr. **TOH CHIN CHYE**
Minister for Science and Technology
Singapore

and

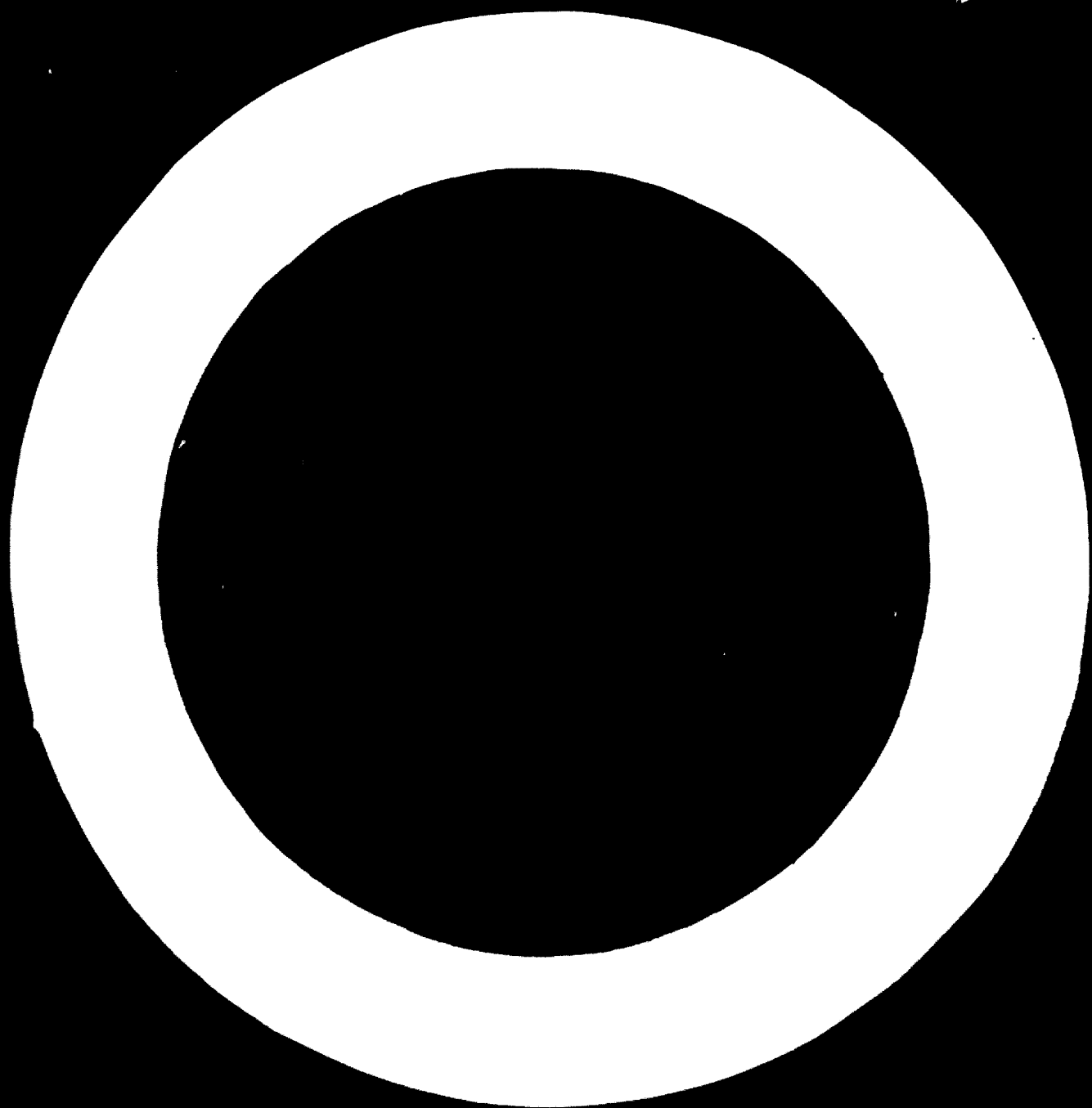
on behalf of

Mr. I. H. ABDEL-RAHMAN
Executive Director
UNIDO

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Opening Address by the Minister for Science
and Technology, Dr. Tan Chin Chye, at the UNIDO
Seminar on the Stimulation of Industrial Research
in Developing Countries on 21 November 1972 at
the Regional English Language Centre

The production of goods, whether they are agricultural or industrial, involves a number of links. They begin with the purchase of raw materials, processing or manufacturing, marketing and sales. At every stage in this chain there must be technical competence for quality control of the raw material, managerial efficiency in production and the ability to size up potential markets for the product. Industrial research should, therefore, embrace not only the technical but also the economic problems of an industry. While the theme of this seminar is "The Stimulation of Industrial Research Activities in Developing Countries", it is necessary for us to inquire also into the factors which inhibit or deter investment in industrial research. It could well be that an analysis of these negative factors could provide an understanding why industrial research succeeds better in some countries and less in others.

In many developing countries, the research emphasis is on basic scientific work carried out by returned students who have studied overseas. Many continue working on the same research topics that they did abroad on returning to their home universities. Such scientific work for the greater part has little relevance to local economic needs. It is not surprising therefore to find in developing countries which are struggling to develop their industrial infrastructure that manufacturers and businessmen view research with scepticism, and even among government bureaucrats there is diffidence towards the ability of university research to contribute to economic development. For developing countries which do not have a substantial pool of qualified persons trained in research, and what qualified manpower they have are found mainly in colleges or universities, the problem of stimulating interest in industrial research and converting those involved in industry to the idea that their manufacturing operations can be improved by research is indeed a formidable one but not insuperable. In essence it amounts to

coupling university research with industrial requirements and making the most out of the little that developing countries have.

The factories of developing countries are all small or medium in size. Their resources in manpower, organization and marketing cannot match those that are available to their counterparts in the developed countries. For this reason, governments of many developing countries seek alternate ways and means of how to ensure the appropriate utilization of trained manpower so that their indigenous industries can remain viable. It is therefore not uncommon for developing countries to copy the patterns for the organization of research which exist in those countries in which their students have once studied. In the United Kingdom and European countries, there are Councils for Scientific and Industrial Research which maintain their own laboratories. In the United States, there are the National Science Foundation and the National Academy of Sciences but these do not have laboratories of their own. In the USSR, scientific research like industrial production is state organized. In the early stages of industrialization in the USSR, short-term problems and trouble shooting were dealt with by science academies, but with the development of more industries and the availability of scientists and engineers, industries took over short-term applied work while long-term applied work is performed in the research institutes and fundamental research in the universities. In Japan, in-house research accounts for more than two-thirds of the total national expenditure on research while the rest was distributed to research institutes, universities and colleges. This does not, however, imply that private industry in Japan is bearing the total cost of the in-house research. There are indirect subsidies provided by the Japanese Government in the form of tax reliefs as well as direct subsidies. It has also been pointed out, to the amazement of business management schools in North America, that Japanese firms are less worried about their financial liquidity than American firms, as Japanese firms receive loans from banks on generous terms. In the United States, in-house research is stimulated by federal contracts with the main contractors farming out research to smaller firms and even to universities. It is not, therefore, surprising to find presidents and vice-presidents of American firms flying to

Washington to lobby Senators and the civil administrators until they have developed a keen awareness that economics is also tied up with politics.

It is not for me to suggest in what form research should be organized in your countries. There are historical reasons why research institutes or agencies follow certain organisational patterns. The motivating impulses for their organization like nine-tenths of an iceberg are not seen. They differ from one country to another country but they must be understood and fathomed out otherwise developing countries will with naive copy the one-tenth of the research organization that is visible, only to find to their chagrin and great loss that what they have copied has not worked because the economic and social impulses motivating developing countries differ from those of the industrialized countries.

We need to realize that whatever pattern of management or organization of research each country chooses, cost-effectiveness should be the prime question in our minds and to understand that unless research results can be effectively used in any of the stages of production and marketing, such research will have little impact on economic growth. The United Kingdom itself has in recent years undertaken a study of the effectiveness of its own research laboratories financed from public expenditure. This study has been embodied in the well-known Rothschild Report, "A Framework for Government Research and Development". Its major recommendation is that applied research and development commissioned by the government should be performed on a customer/contractor principle. This of course has led to an inevitable furor among British scientists and academics who have lived on a long tradition of independence in scientific research. An article entitled "The Coherent Science Policy", published in the journal India in 1970, stated that the output of national laboratories run under the auspices of the Indian Council of Scientific and Industrial Research in 1966/67 was only 3% of the total outlay on these laboratories. I accept that it is not always possible to make an accurate accounting of the costs of research activities and assess their benefits. For this reason I do not believe that expressing the research effort of a country as a percentage of its GDP is meaningful for developing countries whose economies have yet to take off.

Large sums of money can be spent on so-called big science projects as in high energy particle accelerators or in space exploration without bringing about a fall-out of visible economic benefit for the masses of people. Investment in such types of research more likely reflects either wealth that has already been accrued and which can be used for science culture or a compulsive concentration of resources to ensure military security.

Industrial research can be promoted or inhibited indirectly by other governmental policies. For instance, developing countries in the initial stages of industrialization promote import substitution. In order to make such indigenous manufacturing viable, it has to be protected from external competition by import tariffs. However, excessive protection makes these indigenous industries complacent and encourages a self-indulgent attitude that all is well so that initiative to improve and apply more modern technology to development is killed. There is little inclination towards innovation and industrial research. On the other hand, if such industries manufacture not only for the domestic market but are also export-oriented they will have to face international competition. Because of the sharpness and keenness of such competition, industries will be stimulated to develop skills for technical innovation and promotion of market research studies. Japan which probably has the world's largest balance of payments to-day recognizes that trade cannot be dissociated from research and its Ministry of International Trade and Industry undertakes the role of feeding industrial firms with technical information and expert advice on the multi-farious aspects of purchasing raw materials, machinery, or licensing rights, processing, manufacturing and marketing.

Developed countries whose political philosophy is based on private enterprises have vast complex patent offices to protect commercially useful research results. In addition some governments have development corporations which play an active role in assisting private enterprises to commercialize the results of research and development. The presence of these facilities encourages industrial innovation.

There is no doubt that developing countries face formidable challenges in their attempts to narrow the gap between themselves and the industrialized

countries. Copying research organizations which exist in industrial countries does not necessarily produce the results which developing countries hope for. Developing countries must, therefore, first cultivate an ability to adapt and secondly define what should be the priorities towards which their research efforts ought to be directed. Industrial research has been classified into the following three categories :

1. Those which bring about increases in productivity or improvements in the quality of products.
2. Those which are innovations to existing products or to methods of processing or manufacturing.
3. Those which bring about a growth of completely new industries. An example of this is the invention of the transistor which has brought about a new revolution in the electronics industry and given a new dimension in communications.

Developing countries on their own efforts are less likely to succeed by engaging themselves in this third type of research activity. This is not because they do not teach solid state physics but because they lack entrepreneurs among their scientists. However the area where industrial research will be productive and which will entail a lower cost will more likely be in the first category where short-term problems and trouble shooting can make an impact on industry by standardizing quality control and promoting productivity.

Singapore is a developing country even though in the last ten years, the contribution of manufacturing to GDP has increased by 13.8% while the contribution of agriculture and fishing has decreased by 4.2%. Although the main thrust of economic effort is in industrial manufacturing, I feel it would be a mistake to forget that we all live in an agro-industrial complex. How much of one's development effort should be directed at industrialization, how much at agriculture and the conversion of agricultural raw materials into industrial products must vary from one country to another. Whatever it may be, we in the developing countries can always console ourselves with the thought that astronauts can be surrounded by the most sophisticated equipment that has been made through R & D, they will still

want to come down to earth at the vision of eggs and bacon, beefsteak, mutton cutlets, good sea-food and a bottle of wine. It is only vegetarians who are resolute enough to wish to remain in space.

STATEMENT BY MR. I. H. ABDEL-RAHMAN
EXECUTIVE DIRECTOR OF UNIDO

Industrial research is recognized in both industrialized and developing countries as an effective tool of industrial development. Although the relatively new concept of industrial research dates from the first decade of this century, it has developed rapidly. Most developing and industrialized countries have defined their scientific and industrial research policies with varying degrees of comprehensiveness and have reached various levels in their implementation. However, there seems to be a general agreement that an important practical measure would be either to establish or to modify industrial research organizations in order that they may become the focal point of innovation and technological improvement.

Many developing countries have established such research institutes. They aim at undertaking research and development programmes and at developing technological and similar activities which could provide various services to the industrial enterprises and other industrial development agencies. Their effectiveness must be measured inter alia by their usefulness to the industrial community and to the extent to which various industrial undertakings make use of their services. This will not take place automatically,

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. While the institutes must, on the one hand, endeavour to make their services better known to the various industrial enterprises operating in their respective countries, it is, on the other hand, essential for the enterprises to encourage the research institutes by utilizing their available skills and facilities.

Since the inception and creation of UNIDO, emphasis has been placed on its programmes in industrial research. The assistance being rendered by UNIDO to the developing countries in this field concentrated on the establishment of the institutes mentioned above and the expansion and strengthening of existing ones in order to improve their usefulness and effectiveness to the industrial sector. Some institutes have become important sources of technological innovation, and the industrial community is availing itself increasingly of their services on a contractual basis. A number have advanced considerably and are undertaking the design of industrial processes and plants after having carried out techno-economic feasibilities and selected the appropriate technology. A great number also serve as the technical arm of the government for undertaking technical investigations required for making decisions.

With the constant rapid developments in technology, industrial research institutes need to adapt their structure and the scope of their activities in order to deal with such changes. In their industrialization efforts, the developing countries depend largely on foreign technologies, which are the results of intensive and painstaking research carried out for several years. They are, therefore, not always suitable for the developing countries, particularly those technologies that were not foreseen for labour-abundant economies. They would necessarily undergo adaptations at various degrees to suit the individual environment.

The adaptation of foreign technologies for local application is only one approach. More important, in the long run, is the development of local indigenous technologies most suited for local conditions. A number

of policies would have to be made at the national level to encourage and assist the research institutes in such new ventures. In this connexion, UNIDO is placing emphasis on its assistance to developing countries, on the organization of industrial research at a national level, and in drawing up suitable industrial research policies oriented towards practical objectives.

The implementation of such efforts would depend not only on the buildings and equipment available to research institutes but to a greater extent on the competence of research personnel available in the country. Major efforts at both the national and international level will have to be put in the development of such personnel. UNIDO has been developing a series of in-plant training programmes for this purpose. It is hoped that the programme will be initiated in 1973 in Holland for managers and/or senior executives of industrial research institutes. This would be in co-operation with the Government of the Netherlands which has kindly offered to finance the programme. UNIDO is continuing to work on plans to extend the programme to other levels of personnel such as liaison officers, project team leaders, project evaluators and technicians. When these arrangements are finalized, invitations would be extended to your governments to nominate participants.

In the light of the above and judging from UNIDO's experience in working with several developing countries, trends for future developments in industrial research indicate that major efforts would need to be directed towards :

- The development and use of indigenous technologies; setting up of pilot plants; choice of appropriate foreign technologies; and the improvement of the capacity for the assimilation of foreign technology and its adaptation for innovation under local conditions.
- Implementation of projects of both national and regional interest by a number of research institutes and relevant organizations. This would include, for example, an assessment of industrial technologies to identify the appropriate sectors of development of industrial research programmes, aiming at improving the export marketability of certain products such as textiles, food processing and construction materials and the development of local technologies and the selection of appropriate processes, equipment and machinery for industrialization; the initiation of applied research programmes, carried through the various

stages of development from the laboratory scale through the pilot stage to production in selected sectors; regional application of appropriate local or foreign results of research and development for industrial uses; determination of costs of technology, covering appropriate choice, installation, commissioning and sustained operation.

- The development of appropriate industrial information and inquiry services including collection and dissemination of information on results of research and development, and the organization of seminars on various aspects of research both on general and specific topics.
- The development of closer links between research institutes in the developed and the developing countries, as well as within the developing countries.
- Development of closer links between research institutes and the users of its results, particularly the industrial community.
- The training of local technologists, research managers, technicians and others capable of putting these efforts into operation.

UNIDO notes with satisfaction the efforts being made by the developing countries of your region in industrial research. There is no doubt that your region is among the most advanced in industrial research among the developing countries. Let me assure you that UNIDO is willing and always ready, within its limited resources, to assist you in your efforts in industrial research as well as in industrial development generally. I am convinced that co-operation at various levels between research organisations must break national and regional boundaries and establish international links if meaningful results are to be achieved. UNIDO is, therefore, working on a programme of pairing research institutes.

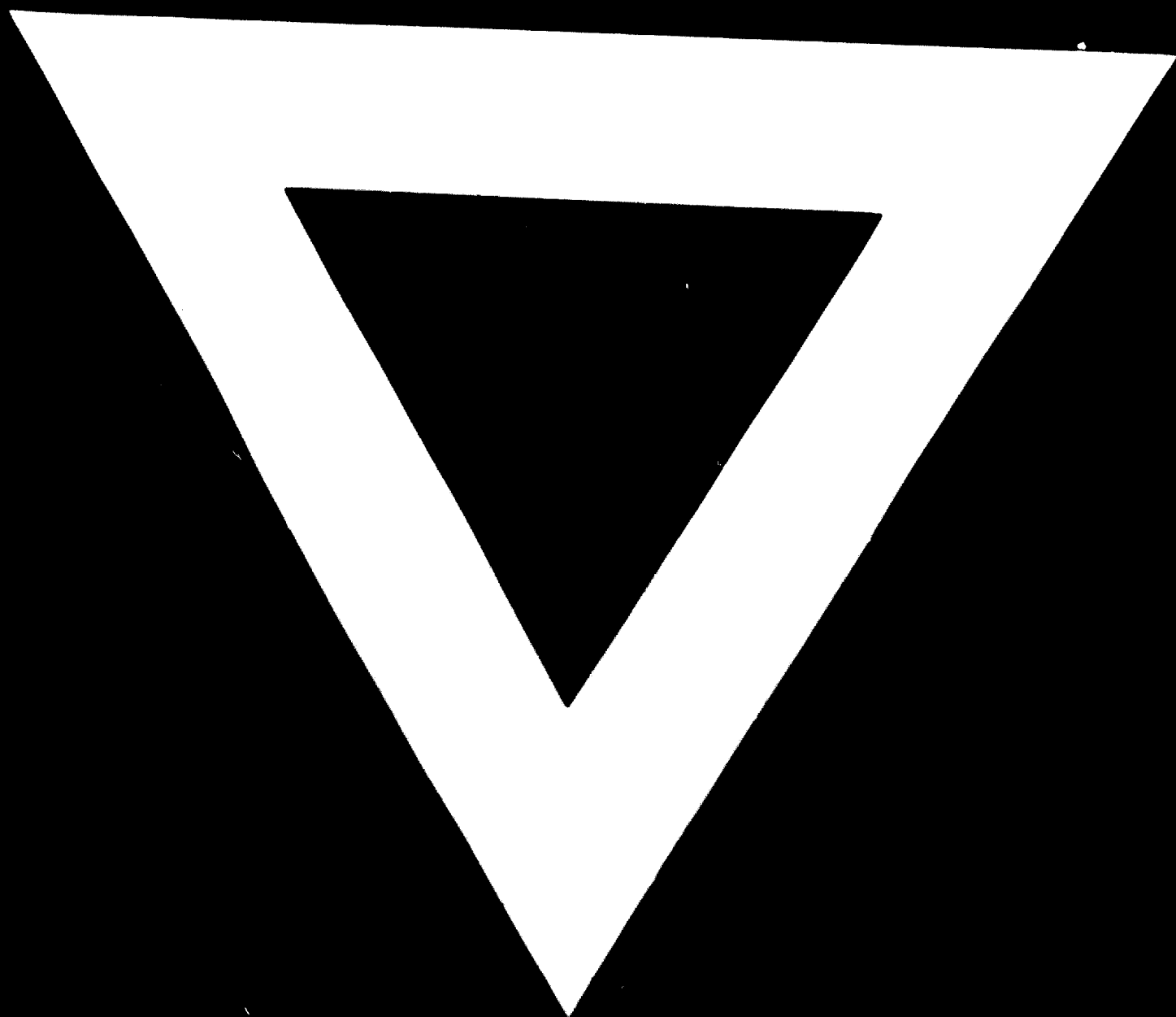
A quick glance at the Provisional Agenda for the Seminar reveals that discussions will be focused on major issues which will affect the level of development of industrial research in your countries. While UNIDO is assuming a catalytic role in convening this Seminar, the implementation of its recommendations would largely depend on you. UNIDO looks forward to receiving these recommendations and hopes to improve its programme of technical assistance to your countries in particular, and to all developing

countries as a whole.

I should like to express to the Singapore Authorities again, UNIDO's appreciation for its kind offer to host this Seminar. The efficiency of its organising committee has very much facilitated UNIDO's preparations.

I wish you all success in your deliberations.





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