# Science and Technology for Development

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Report
on the United Nations
Conference
on the Application
of Science and Technology
for the Benefit of
the Less Developed Areas

## Volume VIII. Plenary Proceedings, List of Papers and Index

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# Prefatory note

This eight-volume Report gives a narrative account of the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas. It is an official report of the Secretary-General of the United Nations, enlarging upon his summary report on that Conference presented to the United Nations Economic and Social Council at its thirty-sixth session (E/3772 and Add. 1). In substance it is comprehensive, embodying both the oral discussions and the contributors' papers. In style it is non-technical: the aim has been to make this permanent record a readable one which will be widely studied and used.

The Report was prepared in the English language with the counsel of an Editorial Advisory Committee, under the Chairmanship of Sir Benjamin Lockspeiser, former Director of the United Kingdom Department of Scientific and Industrial Research, and composed of Ritchie Calder, Professor of International Relations, University of Edinburgh, V. Kovda, Director, Department of Natural Sciences, United Nations Educational, Scientific and Cultural Organization, Georges Laclavère, Secretary-General of the International Union of Geodesy and Geophysics, José Mayobré, United Nations Commissioner for Industrial Development, and J. V. A. Nehemiah, Director, Programme Liaison Division, Food and Agriculture Organization of the United Nations. The editorial staff comprised Gerald Wendt, Editor-in-chief; Leonard Berry, Assistant Editor; Georges Laclavère and Ritchie Calder, Consultant-Editors; Lee Ambrose, Robert Brittain, Peter Collins, J. Avery Joyce, Margaret Stewart and George Symeonides, Writers; John R. Conway, George Goodman, Anila Graham, Sophia Podolsky and Chandler Whipple, Assistant-Writers.

The volumes of the series are entitled as follows:

I. World of opportunity
II. Natural resources
III. Agriculture
IV. Industry

V. People and living—Population: Health, Nutrition, Rural Development, Urbanization
VI. Education and training
VII. Science and Planning
VIII. Plenary proceedings, list of reports and papers and index.

As suggested by its title, Volume VIII includes a complete subject index of the series as well as a complete list of Conference papers and of the reports of the Conference Secretary-General and Rapporteurs for each session. Each of the other volumes includes a subject index and (except Volume I) a list of papers and reports related to its own contents.

Code Numbers, e.g. A/100, are used in the text when referring to Conference papers. The full titles of these papers, together with the names of the authors and of the countries of origin, can be found for each volume in its "List of Papers" and for all volumes in the complete list published in Volume VIII.

The individual papers forming the documentation presented to the Conference are not bound in volumes but are available, until the end of 1964, as photo-offset copies of the papers as submitted by the contributors. They comprise the following:

(*a*) Papers submitted to General Sessions and the reports of the Conference Secretary-General and of the Rapporteur covering these papers and proceedings in English, French, Spanish and Russian;

(*b*) Papers contributed to Specialized Sessions. These papers have been reproduced in the original language of submission. A summary of each such paper, averaging two pages in length, has also been produced in each of the four languages used by the Conference. The report of the Conference Secretary-General on the papers contributed to the Specialized Sessions and the reports of the Rapporteurs on the proceedings of these sessions are also available in all four languages.

The charge for each of these papers is $US0.25, but they will normally be available in folders covering each session of the Conference. The price of the folders will, of course, vary according to the number of papers presented to any given session. Thus, for a folder containing eight submitted papers and two reports, the price will be $US2.50. A fully indexed list of papers, bearing the symbol E/CONF.39/INF.3, which gives an indexed reference to authorship, is available at a cost of $US1.50, in English, French, Spanish and Russian.

Purchases may be made through The Sales Section, United Nations, Palais des Nations, Geneva, Switzerland.

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# Foreword

The United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas had been long under discussion and for more than a year in active preparation when it opened in Geneva, Switzerland on 4 February 1963. Other scientific conferences under United Nations auspices had preceded it, notably one on New Sources of Energy in 1961, the two which were convened to discuss the Peaceful Uses of Atomic Energy in 1955 and 1958, and, as early as 1948, the United Nations Scientific Conference on the Conservation and Utilization of Resources. There was also the survey of "Current Trends in Scientific Research" which was undertaken under the joint auspices of the United Nations and of UNESCO in the years 1958 to 1960. In breadth of scope, however, the Conference on Science and Technology was unique. It touched on all the scientific disciplines and almost all aspects of modern society. More than 2,000 papers were submitted. The participants numbered 1,665 and 96 Governments were represented.

There is reason to think that this Conference will go down as an important landmark. In the words of Professor M. S. Thacker, President of the Conference, "The story of how man is remaking his world by a more effective use of human and natural resources would open even reluctant eyes." The United Nations Development Decade will, surely, reflect an ever growing awareness of the practical importance of science and technology for economic and social development. The destructive tendencies of science need not take over nor need its constructive triumphs remain aloof from daily life. Applied science can be the most powerful force in the world for raising living standards if action can be taken to harness it for that purpose—if the Governments and people of the world can find the means and the will.

In its resolution 834 (XXXII) by which it authorized the holding of the Conference, the Economic and Social Council requested me "to circulate for information a report on the Conference to all Members of the United Nations and of the specialized agencies, to the related agencies, and to the non-governmental

organizations in consultative status". At an earlier stage I have given a summary report to the Council itself (E/3772 and Add. 1), and now present in this eight-volume report a full and definitive account, written for wide distribution.

U THANT
*Secretary-General*

# Plenary proceedings

## AGENDA OF PLENARY SESSIONS

### OPENING PLENARY SESSION, 4 FEBRUARY 1963

Opening of the Conference by the President of the Conference, Professor M. S. Thacker[1]

Address of welcome by the President of the Swiss Confederation

Address by the Secretary-General of the United Nations, Chairman of the Scientific Advisory Committee, read by Mr. Philippe de Seynes, Under-Secretary, Department of Economic and Social Affairs, United Nations

Address by the President of the Conference

Address by His Excellency Salah El-Din Hedayat, Vice-President of the Conference, Chairman of the Scientific Advisory Panel

Messages from Heads of State or Heads of Government:

Oral presentation of messages by representatives of Heads of State or Heads of Government who have provided members to serve on the Scientific Advisory Panel

Brazil
Canada
Czechoslovakia
France
India
Indonesia
Mexico
Nigeria
Union of Soviet Socialist Republics
United Arab Republic
United Kingdom of Great Britain and Northern Ireland
United States of America

Circulation of messages addressed to the Conference by other Heads of State or Heads of Government

Addresses by the executive heads of specialized and related agencies:

Mr. David A. Morse, Director-General, International Labour Office

Mr. Binay R. Sen, Director-General, Food and Agriculture Organization

Mr. René Maheu, Director-General, United Nations Educational, Scientific and Cultural Organization

Dr. Marcolino G. Candau, Director-General, World Health Organization

[1] The President also read messages exchanged with the Secretary-General of the United Nations, who was indisposed and unable to attend.

Mr. Gerald C. Gross, Secretary-General, International Telecommunication Union
Mr. David A. Davies, Secretary-General, World Meteorological Organization
Dr. S. Eklund, Director-General, International Atomic Energy Agency

SECOND PLENARY SESSION, 4 FEBRUARY 1963

Opening address by the Right Honourable Lord Casey (Australia), Vice-President of the Conference

*Speakers:*

Professor A. Maréchal (France)
Professor H. J. Bhabha (India)
Professor P. M. S. Blackett (United Kingdom of Great Britain and Northern Ireland)
Professor D. Bovet (Italy)
Professor B. A. Houssay (Argentina)
Professor O. Lange (Poland)
Academician E. K. Fedorov (Union of Soviet Socialist Republics)
Dr. J. B. Wiesner (United States of America)

CLOSING PLENARY SESSION, 20 FEBRUARY 1963

Opening of Plenary Session by the President of the Conference

*Speakers:*

The Right Honourable Lord Casey (Australia)
Dr. J. W. T. Spinks (Canada)
H.E. Fernando García Oldini (Chile)
Professor Josef Lukas (Czechoslovakia)
Professor Henri Laugier (France)
Professor S. D. Pusponegoro (Indonesia)
H.E. Jean Forquet (Ivory Coast)
Professor Shigenori Hamada (Japan)
H.E. Emilio Calderón Puig (Mexico)
Professor J. C. Edozien (Nigeria)
Academician E. K. Fedorov (Union of Soviet Socialist Republics)
Mr. Salah El-Din Hedayat (United Arab Republic)
Sir William Slater (United Kingdom of Great Britain and Northern Ireland)
Dr. Walsh McDermott (United States of America)
Address by Dr. Carlos Chagas, Conference Secretary-General
Address by Mr. Paul Hoffman on behalf of the Secretary-General of the United Nations

*Speakers:*

Mr. Abba Eban (Israel)
Professor Abdus Salam (Pakistan)
Dr. F. T. Sai (Ghana)
Closing address by Professor M. S. Thacker, President of the Conference

# MESSAGES TO THE CONFERENCE FROM HEADS OF STATE OR HEADS OF GOVERNMENT

*Brazil*

MESSAGE FROM H.E. THE PRESIDENT OF THE REPUBLIC OF BRAZIL, MR. JOAO GOULART, PRESENTED BY H.E. JOSUE DE CASTRO, AMBASSADOR, HEAD OF THE PERMANENT DELEGATION OF BRAZIL AT GENEVA. BY WAY OF INTRODUCTION, AMBASSADOR DE CASTRO MADE THE FOLLOWING SUBSTANTIVE STATEMENT:

Mr. President:

We are living through a period of history which is undoubtedly revolutionary, a period of transformation, of transmutations, of historical crisis, a period best characterized by the great hopes and terrible threats which together lie on man's horizon. Because of this situation, the present generation of our world faces a very difficult task in deciding the fate of mankind. I think you will agree that no other generation has had such a difficult task as ours, for while all other generations have had to build the world in their own fashion, our generation has not only the task of building the world, but of preventing the world from being destroyed. Brazil, the country which I have the honour to represent, is aware of the situation: that is why my Government and my people attach the greatest importance to this Conference and keenly desire its success. The President of the Republic of Brazil, Mr. João Goulart, has been kind enough to send a message to the representatives participating in this Conference, a message which I now have the great honour to read for those present in this Assembly.

MESSAGE OF PRESIDENT GOULART

Because science and technology are of fundamental importance in the effort to secure the economic and social advancement of mankind, this Conference marks a decisive stage in international co-operation and constitutes one of the most significant events of the Development Decade.

For the under-developed countries, which account for the bulk of the world's population, imports of superior techniques and their adaptation to local conditions are as important as any other factor of production. In the case of several of these countries, including Brazil, the cultural and material evolution has reached a point at which they can profitably undertake scientific research and create their own technology, in keeping with the means at their disposal. In any case, the satisfactory solution of the problem of the communication of the science and technology of the more advanced countries is of the utmost interest for the development of all, and particularly for industrial development.

The Government and people of Brazil are looking to this high-level Conference, attended by scientists, technicians and experts in national economic planning, for the dissemination of ideas and experience for the benefit of all and for a general survey of scientific and technological knowledge with a view to satisfying the special needs of the under-developed countries. They also expect the Conference to make suggestions for more intensive and systematic international co-operation, under the auspices of the United Nations, in this fundamental form of activity.

Please transmit to those participating in the Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas my sincerest good wishes for the success of their deliberations and my firm hope that their conclusions will signify a step forward towards the advancement of the backward areas by bringing to the poor peoples of the world the advantages and facilities which human genius has already placed at the disposal of a minority, for the well-being and peace of the nations.

*Canada*

MESSAGE FROM THE RT. HON. JOHN DIEFENBAKER, PRIME MINISTER OF CANADA, PRESENTED BY DR. J. W. T. SPINKS, VICE-PRESIDENT OF THE CONFERENCE:

Mr. President:

In the course of the next few weeks, scientists and technicians will meet at the call of the United Nations Conference in Geneva to consider the application of processes worked out in developed countries to conditions prevailing in the less developed areas of the world. This Conference should be a valuable contribution to progress in the "Decade of Development" proclaimed by the General Assembly of the United Nations.

It will be the task of the Conference to assess the impact of the application of science and technology on the processes of development; to scrutinize opportunities for practical research; to analyse the best utilization of new advances for the acceleration of industrial development and to consider lines of future advance.

Canada supported resolution 1710 (XVI) of the General Assembly designating the 1960's as the United Nations Decade of Development in the hope that world attention would thereby be focused on the pressing economic and social needs of the less developed areas of the world, and on the co-operative efforts being made to raise living standards in the developing countries. Canada's efforts to assist these countries demonstrate the determination of the Canadian people to play a full part in the concerted effort to accelerate economic and social development in the coming decade.

It is my hope that as a result of the endeavours of the Conference practical expression will be given to those important aims of the Charter which call for the promotion of economic and social progress and the realization of increasing higher standards of life in larger freedom. I extend to you, Mr. President, and through you to all who are present at the Conference, my warm wishes for a most successful session.

*Ethiopia:*

MESSAGE FROM H.I.M. HAILE SELASSIE I, EMPEROR OF ETHIOPIA, CIRCULATED TO THE CONFERENCE:

Mr. President:

On the occasion of the opening of the United Nations Scientific and Technological Conference, we wish you and all participants most successful deliberations. In this era of scientific civilization it has become to all, and especially to those among the developing areas, an imperative to capture more and more the secrets of nature in order to better living conditions. We especially call upon the Conference to exploit to the maximum those avenues by which scientific and technological advance lead only toward the betterment of mankind.

*Czechoslovakia:*

MESSAGE FROM H.E. ANTONIN NOVOTNY, THE PRESIDENT OF THE CZECHOSLOVAK SOCIALIST REPUBLIC, PRESENTED BY PROFESSOR JOSEF LUKÁS, VICE-PRESIDENT OF THE CONFERENCE:

Mr. Chairman, distinguished delegates:

Today, you are commencing the deliberations of one of the most important conferences in the field of science and technology ever held by the United Nations. The idea of a meeting of scientists and experts from all over the world to consider the possibilities of employing science and technology for the acceleration of the economic, social and cultural development of the developing countries commands, in my view, our maximum attention.

We are living in a century of an unprecedented advancement of science and technology. The human genius has already to a considerable extent influenced the forces of nature and succeeded in harnessing them for his own good. Man is penetrating ever deeper into the cosmic space which, until recently, was inaccessible to him. However, many pressing world problems of prime importance are still outstanding, of which, apart from the conclusion of a treaty on general and complete disarmament, most important is the postulate of a speedy liquidation of the considerably different levels of development of the industrially advanced countries and those that only recently acquired their political independence. Both these problems are closely interdependent. Materialization of general and complete disarmament would release vast resources which could be channelled to accelerate the economic development of the developing countries and would also release large numbers of qualified scientists and experts for genuinely creative scientific work.

As an industrial country which attained remarkable successes in many fields of science and technology, the Czechoslovak Socialist Republic has for a number of years been granting economic and technical assistance to economically less developed countries. I may assure you, Mr. Chairman, that nothing gives greater satisfaction to our scientists and experts than the feeling that by their efforts and

their active participation in the deliberations of this Conference, they themselves will contribute to a speedy solution of the serious problems attendant upon an all-round development of the economically less developed countries.

Permit me, Mr. President, on behalf of the Government of the Czechoslovak Socialist Republic, the Czechoslovak people and myself, to extend to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas best wishes for a full success of its deliberations.

*France:*

MESSAGE FROM GENERAL DE GAULLE, PRESIDENT OF THE FRENCH REPUBLIC, PRESENTED BY M. G. PALEWSKI, HEAD OF THE DELEGATION OF FRANCE TO THE CONFERENCE. BY WAY OF INTRODUCTION, M. PALEWSKI MADE THE FOLLOWING SUBSTANTIVE STATEMENT:

Mr. President:

My country is one of those which from the outset has taken the very keenest interest in the tremendous problem presented by the unevenness of economic development around the world. We know that balanced development, which will gradually remove differences in levels of living, is essential to all, for it will ensure the maintenance of peace. That is why we have endeavoured to prepare for this Conference with particular care, in the belief that our long experience might be of general value. The less developed countries can expect a great deal from scientific progress. Modern technology, which is much more refined and much less expensive than traditional technology, should provide a simple, effective and rapid solution to many of their problems. Thanks to the progress of economic science, the development of a nation can now be envisaged as a whole. We shall therefore stress the importance we attach to flexible planning which alone makes harmonious development possible through the simultaneous utilization of all resources with less risk of error or imbalance. But it will be for the developing countries themselves to make the necessary effort to apply the new techniques. They will not achieve true independence, to which they aspire with a will which we applaud, until they have their own teams of engineers and technicians. It is to the training of scientific and technical *élites* that young States should devote their efforts. They know that France is ready to help them in this, for of all nations France contributes the highest percentage of its national income to aid to the developing countries. We are convinced that this Conference, whose purpose is to assess the means which science and technology can make available for economic development, will hasten the progress we earnestly desire to see. It is in this conviction that General de Gaulle, the President of the French Republic, sends to the Conference the message which I shall now read.

MESSAGE OF GENERAL DE GAULLE

The Conference of the United Nations on the Application of Science and Technology for the Benefit of the Less Developed Areas is fully in keeping with the

wishes of the countries which, like France, place their experience and their assistance at the disposal of other peoples. Accordingly, I hope very sincerely that its deliberations may achieve complete success.

*India:*

MESSAGE FROM SRI S. RADHAKRISHNAN, PRESIDENT OF INDIA, PRESENTED BY DR. HOMI J. BHABHA, HEAD OF THE DELEGATION OF INDIA TO THE CONFERENCE:

Mr. President:

I send my greetings to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas. Many conferences have been held in past years under the auspices of the United Nations, but none has had greater importance for the happiness and well-being of millions throughout the world than the Conference which is opening today. I hope its deliberations will help in creating, for those millions, a future unclouded by misery, want and ignorance. Indeed the greatest safeguard for the peace of the world would lie in ensuring that the material benefits which science and technology have brought within the reach of mankind are made available to all countries and all peoples on an equitable basis. This goal cannot be achieved in a day or two, but if as a result of the labours of the Conference a beginning on sound lines can be made, the Conference will have achieved its purpose.

*Indonesia:*

MESSAGE FROM DR. SOEKARNO, PRESIDENT OF THE REPUBLIC OF INDONESIA, PRESENTED BY PROFESSOR DR. SUDJONO D. PUSPONEGORO, VICE-PRESIDENT OF THE CONFERENCE:

Mr. President:

It is, perhaps a truism to state that the historians of the future will record the twentieth century as an age of Great Human Revolutions. Never before has there been an historical event of such a dynamic magnitude as the one in which we all participate at this juncture of our human existence. Millions of peoples and whole societies are now united in their solid determination to wrestle and free themselves from every kind of physical and mental oppression, from hunger and from want. Indeed it is the human spirit rooted in the creed to restore human dignity in all its dimensions which animates and incites the historical process of the present era.

As in all impact-laden human movements the Great Human Revolutions of our times require, if they are to succeed, the boldest creative imagination and productive action directed at bringing to mankind the spiritual and material benefits of our universe. The sheer faith in human dignity is ineffectual if unaccompanied by the dedication to make available to humanity as a whole the blessings of our collective heritage and the known and hidden treasures of nature.

Hence, it is heartening to learn that the present Conference is dedicated to restoring human dignity through the application of science and technology to the needs of millions of peoples. I believe the Conference should provide a genuine

opportunity to reappraise our collective knowledge and values by means of blending the human creative qualities of all who belong to the Family of Man.

I wish the Conference, on behalf of the Republic of Indonesia and myself, success in its deliberations for the good of humanity.

*Liberia:*

MESSAGE FROM H.E. WILLIAM V. S. TUBMAN, PRESIDENT OF THE REPUBLIC OF LIBERIA, CIRCULATED TO THE CONFERENCE:

Mr. President:

The application of science and technology has brought untold wealth and happiness to millions. I am confident that this Conference, which is convened for the purpose of exploring the recent advances in the application of science and technology and assessing the impact of such applications on the economic and social development of the less developed countries, has through its deliberations arrived at ways to give millions in these countries a future unmarked by misery, poverty, hunger, disease and ignorance. When the people of these countries have been able to share equally in the material benefits of science and technology, the United Nations will then have achieved one of its greatest objectives of bringing happiness and prosperity to all men. On behalf of the Government and people of Liberia and myself I wish to congratulate the Conference upon its achievements.

*Mexico:*

MESSAGE FROM H.E. DR. ADOLPHO LOPEZ MATEOS, PRESIDENT OF THE UNITED MEXICAN STATES, PRESENTED BY AMBASSADOR EMILIO CALDERON PUIG, VICE-PRESIDENT OF THE CONFERENCE:

Mr. President:

Dr. Adolpho Lopez Mateos, President of the United Mexican States, has honoured me with the mission of conveying to the United Nations Conference on Science and Technology a message of good wishes from the people and Government of Mexico.

Mexico believes in this Conference, because it thinks that this is the right time for the peoples of the world to make their voices heard and to repeat the universal cry: we want science to produce atomic energy for the electrification of the remotest areas of the world, isotopes for agriculture and medicine; we want the exploration of outer space to be a joint undertaking of the great Powers for strictly peaceful purposes. We want the great Powers to acquire a sense of trust and, by reducing their military budgets which are such a burden upon all mankind and which hamper effective assistance to peoples wishing to help themselves, to give expression to the realization that the contest for the hegemony of the world is absurd and that truth resides in that social justice by means of which the peoples—and more especially the new States that have appeared on the international scene—can satisfy their everyday needs.

The facts as we see them in Mexico are clear: science and technology ought to serve mankind for construction, never for destruction. For this reason we applaud the progress achieved in the Washington talks on the ending of atomic tests. We hope that in the very near future these talks can be brought to a happy conclusion at Geneva, the radiant city of peace.

In our own America, some of the countries are backward, others under-developed and others developing, but all of them have faith in the future and an earnest desire to become active economic units in the shortest possible time.

We have witnessed the recovery of Europe, and for years we have been asking: when will Latin America's time come?

The programme of the Alliance for Progress, if it succeeds in America, may establish sound precedents.

In Mexico we are making progress because we have started to help ourselves by our own exertions. In this way we are facilitating the co-operation of our friends.

In conclusion, I should like to appeal to the more developed countries which have come here to give the benefit of their experience, their science and their technology to the countries which are still looking for the way. Genuine and effective collaboration between the two groups of nations is the only hope for the strengthening of internal and external peace, so that the peoples of the under-developed areas may find their way and carry out their reforms.

The peace of the world, as we in Mexico see it, is only to be attained through social justice and through full respect for the human rights of all men without distinction of political creed and without discrimination of any kind.

We are firmly convinced that science and technology can solve the problem of our epoch by ending the exploitation of man by man, or by the State.

This is the fundamental task of our Conference.

*Nigeria:*

MESSAGE FROM ALHAJI THE RT. HON. SIR ABUBAKAR TAFAWA BALEWA, K.B.E., M.P., PRIME MINISTER OF THE FEDERATION OF NIGERIA, PRESENTED BY PROFESSOR JOSEPH C. EDOZIEN, VICE-PRESIDENT OF THE CONFERENCE:

Mr. President:

I feel honoured to have this opportunity to address this message of goodwill to you and the Conference, on what promises to be an event of memorable significance, not only in the history of scientific thought and action but also in the history of the less developed countries. It is a measure of the quality of our thinking about world affairs today that we recognize not only the indivisibility of peace but also of science. It is a measure of our recognition that in the second half of the twentieth century the less developed regions of the world are for the first time becoming fully integrated into the concept of one world, and I honestly wish that your efforts will prove so fruitful that this Conference will mark the beginning of a new epoch in the history of science.

As you well know, one of the major preoccupations of the less developed

regions today is that of organizing the best of the available pool of knowledge of all kinds, and applying this to the rapid advancement of our peoples. Without such advancement it is improbable that world peace can be maintained, and this is why I have linked the indivisibility of peace with the efforts which you are now making.

I should like finally to offer my congratulations to those who conceived this vast project, to those who have worked so hard to bring it to this stage, either as organizers or as contributors of papers, and to the Secretary-General of the United Nations and those of his staff who have been directly concerned with the Conference.

*Pakistan:*

MESSAGE FROM FIELD MARSHAL MOHAMMAD AYUB KHAN, H.PK., PRESIDENT OF PAKISTAN, CIRCULATED TO THE CONFERENCE:

Mr. President:

With recent scientific and technological advances, for the first time in human history, it has become possible to visualize the elimination of want and deprivation for the whole of human society.

The developing world, therefore, greatly welcomes the initiative taken by the United Nations to hold this great Conference on the applications of scientific and technological methods to the problems of economic growth. I sincerely wish all success to the work of the scientists and technologists assembled at this Conference in their great ideological task and hope that their deliberations will bring the era of progress and prosperity nearer.

But having said this, I would also like to express the feeling that just one Conference on this vast and complex subject is surely not enough. Scientific and technological advances take place continually and with accelerated rapidity.

Surveying the scope and area of the existing United Nations agencies, there is no single agency at present dealing purely with the questions falling within the scope of this Conference. I would wish that the participants of this Conference may also deliberate seriously on the possibility of giving their work a permanence and a continuity by the establishment of a United Nations organ for dealing with applications of science and technology.

This could help in the training of technologists from less developed countries, and most important of all it could provide a much needed forum, a central clearing house, for technical consultation, and technical know-how.

The Government of Pakistan would certainly be happy to play their role in the task of continuing the work of this Conference in this manner.

*Tunisia:*

MESSAGE FROM H.E. HABIB BOURGUIBA, PRESIDENT OF THE REPUBLIC OF TUNISIA, CIRCULATED TO THE CONFERENCE:

I have pleasure in conveying to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, my

best wishes for its complete success. I would ask the President of the Conference to congratulate the United Nations most sincerely, on my behalf, on this auspicious initiative.

The variety and extent of the items on the Conference's agenda, which ranges over the whole of human activity, prove the growing importance attached by the United Nations to achieving true advancement throughout the world. The broad participation of the various countries in the Conference is an earnest of its success and augurs well for the strengthening of international co-operation in economic, social and cultural development. Tunisia, which ever since attaining its independence, has been engaged in the struggle for the well-being of its people, will draw on the work of the Conference for useful suggestions for speeding its progress towards prosperity.

*Union of Soviet Socialist Republics:*

MESSAGE FROM N. S. KHRUSHCHEV, CHAIRMAN OF THE COUNCIL OF MINISTERS OF THE UNION OF SOVIET SOCIALIST REPUBLICS, PRESENTED BY ACADEMICIAN E. K. FEDOROV, VICE-PRESIDENT OF THE CONFERENCE:

On behalf of the Government of the Soviet Union and myself I cordially greet the participants in the Conference.

Your Conference, in which representatives from almost all the countries of the world are taking part, has been convened in order to map out the most effective ways of utilizing the achievements of modern science and technology in the interests of the social and economic advancement of the countries of Asia, Africa, and Latin America, many of which have but recently cast off the yoke of colonialism and taken the path of independent development.

We are living in a wonderful epoch of momentous social transformations and of very great discoveries in science and technology, in an epoch of the conquest of outer space. Today mankind possesses unparalleled opportunities for the creation of an abundance of material wealth, for the development of culture and education, and for the complete elimination of hunger and disease in all the countries of the world within the lifetime of one generation.

However, the achievements of the human mind, of science and technology have so far been insufficiently utilized for the purpose of speeding up the economic and social progress of countries which have recently taken the path of independent development. The final elimination of colonialism, the ending of the "cold war", general and complete disarmament and the consolidation of international peace will tremendously accelerate mankind's development and release vast material resources for peaceful uses, for meeting the urgent needs of Asian, African, and Latin American countries.

It is the duty of all men of good will, the duty of every scientist, statesman and public figure to enable all countries and nations to share in the achievements of world science and technology.

I hope that the Conference will be an important event in the historic process of the pooling of mankind's efforts to speed up the economic and social advancement of the countries which have freed themselves from the oppression of imperialism. I should like to assure you that the peoples and the Government of the Soviet Union will contribute in every way to the accomplishment of these tasks.

I wholeheartedly wish the participants in the Conference success in their noble work.

*United Arab Republic:*

MESSAGE FROM H.E. PRESIDENT GAMAL ABDEL NASSER, PRESIDENT OF THE UNITED ARAB REPUBLIC, PRESENTED BY H.E. SALAH EL-DIN HEDAYAT, VICE-PRESIDENT OF THE CONFERENCE:

Fellow scientists and dear friends:

The people of the United Arab Republic take pleasure in conveying their best wishes to this Conference, in its orientation towards a positive and constructive purpose for progress and peace. Such orientation makes amends for the conditions of under-development, from which a great number of nations suffered under the impact of various historical and international factors beyond their control.

Gentlemen, these premises in which your Conference is presently held, for extending the application of science and technology to the benefit of less developed nations, has witnessed, a short time before, another Conference for disarmament and peace. Both Conferences are complementary to each other, and both symbolize the two big tasks laid on the United Nations—namely, safeguarding the humanity from war and its dangers, and raising its standards by all possible means, placing the full experience of science and technology to the service of this noble purpose.

Today, humanity is not only exposed to the danger of an atomic explosion, but also to that of a population explosion, and no other way is open to it except by considering the whole world as one big family, of which the United Nations is the brain and heart.

Gentlemen, peace will never become stabilized in a world in which extensive differences between the standards of peoples exist. The big challenge awaiting the less developed nations, engendered by the stupendous acquisitions of science, which tend to widen the gap between them and the more developed nations, can only be overcome by close co-operation in the fields of science and technology, mobilization of all moral and material resources, and by proper planning for production.

These developing nations are willing to accept unconditional aids, especially within the framework of the United Nations. In their conscious outlook towards development, they regard such co-operation as a duty on the more developed nations, who should assist them to achieve their objectives, and we bless the United Nations decision, in considering the present decade to be the "Development Decade."

Finally, I hope that your Conference will achieve its main goals which it has been held for.

*United Kingdom of Great Britain and Northern Ireland:*

MESSAGE FROM THE RT. HON. HAROLD MACMILLAN, P.C., M.P., PRIME MINISTER OF GREAT BRITAIN AND NORTHERN IRELAND, PRESENTED BY SIR WILLIAM SLATER, VICE-PRESIDENT OF THE CONFERENCE:

Mr. President:

We live in an Age of Conferences. There are so many of them that even the most important do not always attract the attention they deserve, but of the very real importance of this particular Conference I have not the slightest doubt. In the more highly developed countries, the scientific discoveries and technological advances of recent decades have revolutionized the life of the common man. But in many parts of the world these discoveries and advances have only just begun to make their impact. The problem that faces us is how to make the best possible use of the new techniques that the scientists have given us to set men free from the bondage of poverty and hunger, disease and misery.

Britain has every reason to be proud of her past achievement and present endeavours in this sphere. To give but one example, the Indian Agricultural Institute has some 60 years of splendid achievement behind it. Now that our relationship with the countries of the Commonwealth is one of free and equal partnership cemented by ties of particular friendship, Britain is in a position to make a unique contribution to the work of this Conference, and I am sure that this will become evident as the Conference proceeds. But I would not wish to dwell unduly on the British contribution. There can be no room for national rivalries in this field, and the Conference will fail of its purpose if these intrude themselves. The value of a discovery or a new technique is not increased by labelling it with its country of origin. It is not where an idea starts that matters, but where it ends.

Much hard work has gone to the preparation of the Conference, and a great many papers have been written for it. The discussions that are held on the basis of these papers over the next fortnight, and the contacts that are established as a result, should have far-reaching consequences for the whole of mankind. On behalf of the British Government, I wish the Conference every success in its labours.

*United States of America:*

MESSAGE FROM PRESIDENT JOHN F. KENNEDY, PRESIDENT OF THE UNITED STATES OF AMERICA, PRESENTED BY DR. WALSH MCDERMOTT, HEAD OF THE DELEGATION OF THE UNITED STATES TO THE CONFERENCE:

Mr. President:

I am delighted to have the opportunity to address my greetings to the Chairman and Officers of this historic Conference, and to all the delegations participating

in it. Your labours may well prove to be a milestone in the United Nations Decade of Development.

The United States delegation comes to Geneva to learn, to share experience, and to probe jointly with the other delegations the great opportunity which we all share to seize upon the technological achievements of the industrialized world and re-shape them for the benefit of the newly developing nations.

We come to this task with a sense of humility; for we know that this is a complex and sophisticated problem requiring the most intimate international co-operation, the blending of many branches of knowledge, the study of a great variety of practical experiences, and the intellectual discipline of the open mind.

But we also come to this task with a firm conviction that rapid and even radical progress can result if we join forces with vigour. We come with enthusiasm for a task that is the most constructive undertaking of this or any other age. And we come with a restless sense of urgency to get on quickly with a job that can mean so much to so many of the peoples of our interdependent world.

I salute all members of the United Nations staff—beginning with the Secretary-General—who have worked to bring about this pioneering event and all the scholars and officials who now share responsibility to prove once again that there is more to be gained in this world by co-operation than by aloofness or hostility.

I congratulate you and wish you all possible success.

# ADDRESSES DELIVERED AT THE OPENING PLENARY SESSION

H.E. MR. WILLY SPÜHLER, PRESIDENT OF THE SWISS CONFEDERATION:

Mr. Chairman, Mr. Secretary-General, your Excellencies, ladies and gentlemen:

The conference for which you are assembled at Geneva is an unprecedented event, and I therefore consider it a great honour for Switzerland that it is being held on Swiss soil. While it is true that ours is the age of international conferences, both in the field of science and in other spheres of human activity, the conference now beginning, more than many others, should attract the attention of the world. It deserves to do so, first of all, by the calibre of the distinguished persons taking part in it, since I have the honour to greet here U Thant, Secretary-General of the United Nations, some 30 members of Governments and an imposing array of scientists, all of whom are among the most eminent in their various fields. It deserves to do so, again, by its magnitude, since you number 1,500 and almost 1,300 scientific papers will be presented for your consideration. But it deserves to do so most of all by the breadth of its purpose. You have not come to Geneva to discuss the most recent problems of some particular science accessible only to a handful of specialists. You will endeavour, instead, to make the latest scientific advances the common property of all mankind and to enable all nations to share in their benefits.

Goethe, of course, wrote as early as the beginning of the last century that science, like art, belongs to mankind and that national boundaries vanish before it.

On the other hand, we are aware today of the power that science creates and of the temptation for those who hold that power to keep it for themselves, to exercise it solely for their own advantage. Fortunately, science, by its very nature, can be transmitted to others and almost always reduces itself to universal methods. While discoveries have a value in themselves at first, they very soon become a source of applications affecting many sectors of human life. There is a need for all nations, for the entire world, to benefit from these discoveries of science.

By investigating the methods of applying science for the benefit of the less developed areas of the globe—which is, ladies and gentlemen, the aim of your conference—you will contribute to raising the standard of living of those less fortunate peoples. Little by little, by making new techniques known everywhere, you will be able, like modern pioneers, to rescue areas of the world from ignorance and poverty. There is nothing more inspiring than to see men who yesterday were ignorant and therefore doomed to vegetate get on their feet under the impetus of science and its technical applications, take their own measure and finally achieve a standard of living compatible with human dignity. This human dignity, of course, does not consist merely in the exercise of the right to life and to scientific discoveries; it consists also in the performance of the obligations incumbent on everyone to understand these discoveries and their technical application, to respect

their forms, to ensure that they are passed on to others and to direct their use towards the common good.

Technical advancement and social advancement—that is your theme and we hail it proudly, for your goal is to improve the lot of mankind. In order to become familiar with the latest advances of science and to benefit fully from them, countries with modest means must find new forms of co-operation. Only they will make it possible to achieve a better distribution of knowledge on this earth, and hence a greater equality of access to the power which man holds over nature.

The conference opening today is of great political importance, although the subjects with which it will deal seem to be exclusively scientific and technical. It is a fact that, in the long run, aid in the development of certain countries is effective only if it is based on the obligations which human solidarity imposes. But such solidarity alone is no guarantee of success. The desire of the Governments or private organizations of the industrialized world to give the less developed countries the benefit of their knowledge is no guarantee that the highest hopes will be fulfilled, even if such action is accompanied by the necessary economic and financial assistance. Familiarization with the particular way of life of each country, the understanding of its manner of living, its traditions and its culture, and the adaptation of scientific and technical methods to the particular conditions of its cultural life are just as important as the actual aid contributed to the country's development. This appeal to a sense of responsibility is also addressed to the statesmen of the countries receiving assistance.

Their responsibility consists in adopting long-needed internal reforms and taking steps to ensure that the assistance offered is able to produce its maximum effect. Mankind's most important task today is the establishment of a genuine partnership with the developing countries. Of great importance also is the patience which must be demonstrated both by the countries possessing greater knowledge and by the young States which wish to reach the level of the highly industrialized countries as soon as possible. Impatience and lack of understanding are not the only difficulties; another is the tension created by international politics and rivalries of the great Powers in providing assistance for the development of certain countries.

The more experience the United Nations and its specialized organizations acquire in accomplishing their manifold tasks in connexion with the development of certain countries, the more hope there will be for substantial progress in eliminating the political content of those activities. The conference opening today will make an effective contribution to the attainment of that objective.

The Swiss people, for whom I speak here today, earnestly hope that the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas will achieve complete success and mark a turning point in the history of the dissemination of scientific and technical knowledge in the world. If that goal can be achieved, I am convinced that a great step will have been taken towards bringing about that more harmonious human community which is desired by all nations.

MR. PHILIPPE DE SEYNES, UNITED NATIONS UNDER-SECRETARY FOR ECONOMIC AND SOCIAL AFFAIRS ON BEHALF OF SECRETARY-GENERAL U THANT IN HIS CAPACITY AS CHAIRMAN OF THE UNITED NATIONS SCIENTIFIC ADVISORY COMMITTEE:

This vast gathering was first conceived in the winter of 1960, a period of acute tension within the United Nations itself, as an act of confidence in the fundamental solidarity of all peoples and nations. It is my first and pleasant duty to pay tribute to the vision and the wisdom of those who originated this undertaking and laid the ground for it: the members of the Scientific Advisory Committee, Dr. Homi Bhabha, Sir John Cockcroft (later replaced by Sir William Penney), Professor Vasili Emelyanov, Dr. Bertrand Goldschmidt, Dr. W. B. Lewis, Professor L. C. Prado and Dr. I. I. Rabi, together with my predecessor, the late Dag Hammarskjold. In preparing and working out the details of such a complex project, the international officials concerned and the members of the Scientific Advisory Committee were assisted by the Scientific Advisory Panel under the able chairmanship of Mr. Hedayat, and to them also I extend my gratitude.

No doubt neither the nearly 2,000 papers which have been prepared for the Conference nor the discussion which will take place in the course of the Conference sessions can claim to offer a complete account of the actual and potential benefits of applied science and technology for the less developed areas, a subject which touches on all scientific disciplines and almost all aspects of modern society. But each and every one of those here present, whether he be a scientist, a statesman, an economist, an administrator, an international official, or a representative of a non-governmental organization, will draw from this Conference an answer, or part of an answer, to some of the specific problems which are the fabric of his professional life.

The idea of holding the Conference was, of course, no sudden inspiration, but arose naturally out of two trends that have in recent years marked the efforts of the United Nations in the economic and social field. The first of these trends was the drive to promote and accelerate, by every means at our disposal, the economic and social development of the poorer countries—a drive that is epitomized in the United Nations Development Decade. The second trend was the increasing concern of the United Nations to stimulate scientific and technological investigation and exchanges. This concern had been reflected, for example, in the calling of the International Conferences on the Peaceful Uses of Atomic Energy in 1955 and 1958, the establishment of the International Atomic Energy Agency, the calling of the Conference on New Sources of Energy in 1961 and the survey of "Current Trends in Scientific Research" undertaken, under the auspices of the Economic and Social Council, in the years 1958 to 1960.

These trends have marked the recent efforts not only of the United Nations itself but of the whole United Nations family. At the staff level, the preparations for the Conference have been a joint enterprise of the United Nations, the International Labour Office, the Food and Agriculture Organization of the United Nations, the United Nations Educational, Scientific and Cultural Organization, the

World Health Organization, the International Telecommunication Union, the World Meteorological Organization and the International Atomic Energy Agency. These agencies have made a major contribution to thinking that underlies the planning and organization of the Conference's work; they have contributed moreover by preparing the agenda items within their fields, by providing technical and other staff and by the submission of papers. Their executive heads are on the platform with me this morning and to them I should like to pay a warm tribute. It is on their behalf as well as my own that I extend greetings to the Conference.

We might well begin our work in a spirit of humility. We suspect that science and its applications may be the major instrument of change in the contemporary world. We know at least that it is one of the principal agents of modern history. Yet we have not given sufficient thought to the relationship between science and society.

Moreover, with all its triumphs, science today is on trial. It is on trial in the first instance because of the vastly increased powers it has given to the forces of war and destruction, to the point that, for the first time, humanity may now be threatened with instant and total annihilation. Equally important, in my view, is the fact that in its boldest and most far reaching experiments, science seems to have lost contact with society. Its processes have at times become so involved in mathematical abstraction, and its preoccupations centred on areas so remote from daily life, that to the common man the scientists may appear today to live in a secluded world of their own. In some way, in the unfolding of its unavoidably complex processes, science must be made to remain aware of its human origin and its human destination.

The Conference may, I feel, contribute to this by focusing the attention of the scientific world on one of the most urgent needs of contemporary society, the need to combat poverty, chronic disease and illiteracy, the need to raise more than two-thirds of the world population to a condition compatible with human dignity. These are objectives which have now been clearly identified and which, for all of those entrusted with some responsibility in public affairs, have developed into a kind of "categorical imperative". But it is far from certain that the scientific world is as yet so concerned with those overriding objectives that it applies to the pursuit of them all the energy and resources that are potentially available.

It is also clear that those directly responsible for the progress of their nation are often not adequately informed of the advances that could be realized by the application of modern science and technology. The scientists of the world and the leaders of the developing nations together hold one of the keys to a better future. It is essential that they be enabled to meet, converse and help each other. Such closer contacts may assist the scientists to find their true place in society, by stimulating their concern for results of early and practical benefit to their fellowmen. It will also provide the leaders of the developing countries with fuller knowledge of the instruments which are at their disposal for overcoming

rapidly the obstacles to economic and social development and will thus help them in the great task of giving a maximum content to political freedom.

I hope that by the end of our meetings we shall all have a clearer view of some of the fundamental aspects of the question with which this Conference is concerned and be ready to chart new courses of action in the national and the international framework.

The first aspect which might, I suggest, be brought forward is the need for new research to deal successfully with some of the most pressing problems of the new nations. Many of these problems have either ceased to exist or perhaps have never existed in the very different environment of the countries which have now reached a high level of development. Scientific research is still a privilege of a minority of countries, and because it is so directly conditioned by the local environment obtaining in these countries, it tends to by-pass problems which are crucial in other parts of the world. As a result, the more advanced countries are as yet not adequately geared to certain of the tasks which are inherent in their act of solidarity with the developing nations. Scientific research is one of these tasks, and we should now seek to fill the gap at an early date. The first, and in my view the easiest, step is to identify the areas where new research specifically designed for the needs of the new nations should be undertaken and pushed forward. This requires only an effort of organization, of directing existing knowledge, talent and resources to certain neglected problems. I see no reason why it could not be carried forward successfully.

The second aspect of the broad problem before us which you may wish to ponder is how science and technology can be absorbed effectively by developing countries. This is a far more complicated and difficult matter, for it involves an organic process about which we know very little. It is often said that development may nowadays be telescoped by applying all the technological knowledge already acquired, that the trials and errors and the turmoil through which industrialization took place in the advanced countries during the nineteenth century may be avoided. There is some truth in this, and this is one of our reasons for hope. But let us not deceive ourselves with the illusion that what is at stake is just a simple transfer of technological devices. Let us be aware of the disruptions which may be caused by a superimposition of modern knowledge and techniques on a society whose habits and thinking, methods of work and way of life are entirely unprepared for them. And let us tackle the vast problem of education with more vigour, for a general rise in the standards of education is surely the most effective means of achieving—and maintaining—those social transformations that are necessary.

In the course of the preparation of this Conference, the title "Scientific independence as a corollary to political independence" was suggested for one of the general sessions. This title was not retained, because it was felt that it could be mistaken for an advocacy of self-sufficiency in science and technology as a proper objective for each and every one of the new nations. This, in a way, would have belied the great act of solidarity which this Conference represents. But the

suggested title embodied a fundamental truth. In my view, development of certain scientific institutions and the training of at least a small number of scientists in some of the advanced disciplines is by no means a luxury for any of the new nations. On the contrary, it is an immediate need in every country. When planning their own economic and social development, and in the practical day-to-day business of acquiring machines and equipment from abroad, or entering into long-term arrangements with foreign concerns and technicians for the development of their resources, or when concluding loan agreements, countries will need at least a small number of their own citizens who are conversant with the ways of science and technology. Without them, the minimum of self-confidence which is necessary to national life will be lacking.

It is clearly of the greatest importance that the momentum generated by this Conference should be maintained. One of the objectives we should undoubtedly set ourselves is the establishment of scientific programmes and institutions in the developing countries. This, it seems to me, might not be recognized and accepted as a new international responsibility, which our system of organizations could keep under review and help to promote through a variety of means. It would also represent a contribution to the process of "decolonization" and emancipation, which has emerged as a major objective of the world of today, inseparable from that of the maintenance of peace.

Finally, let me recall that the Conference has been conceived as a major event in the United Nations Development Decade, as likely to have a significant impact over the coming years in raising standards of living in the under-developed areas of the world. That it may achieve such an aim is my earnest hope, and in this spirit I wish you all success in the great task that lies before you.

THE PRESIDENT OF THE CONFERENCE, PROFESSOR M. S. THACKER:

I am keenly sensible of the great honour that vests in the Presidency of this Conference. No less great is the responsibility.

We are called upon to consider the applications of science and technology for the benefit of the under-developed areas of the world.

This is a vast theme, with many ramifications. Not one conference, but many will be required to discover and work out the possible applications. But, if I may say, it is fitting, however, that the first such conferences should be held under the auspices of the United Nations. For it cannot be denied that the United Nations is the most powerful international agency that has been fashioned by the will of free peoples. The authority of the United Nations, its prestige, and its effectiveness, will increase not only in proportion to its success in resolving conflicts, actual or potential, but in proportion to its achievements in the positive exercise of the arts of peace, its capacity to rid the world of the blight of poverty, famine and disease, and its ability to direct the world's energies towards a sustained and co-operative effort for the building up of a universally decent social order.

In this gigantic, and, may I say, never-ending task, science and technology have

a vital role to play. This Conference is thus historic. It symbolizes the revolutionary "winds of change" in the thinking and spirit of our times. It draws attention to growing disparities in standards of living in the different regions of the globe and to the dangers inherent if this trend continues.

The world today is at a cross-roads created by the mighty forces of science and technology—one road showing promise of leading up to peace and plenty and equal opportunities for all peoples; the other—one does not need to elaborate. And much will depend on the wisdom of our deliberations in this Conference to meet the challenge and opportunities of the future.

"For the poor, the economic is the spiritual; to them God can only appear as bread or a bowl of rice." These are words of the Father of my Nation, Mahatma Gandhi. And these words come appropriately to one's mind in a conference like this gathered to discuss an attack on the hunger, poverty, disease and squalor that affect nearly three-quarters of the world's population.

I am not attempting to define the terms "less developed areas", "under-privileged" and "under-developed". For one thing, many of these developing nations of the world may be poor in material and economic prosperity but are certainly not poor in thought, ideologies, art or culture. I am thinking now in economic terms. We have a few countries where, thanks to the harnessing of science and technology over several decades in various fields of human endeavour and to the combination of several fortuitous circumstances, an economy of affluence has been built up. Elsewhere, we find the rest of mankind struggling in different stages of development.

The wide, and in some cases, tragic gap can easily be gauged when one realizes that one-tenth of the peoples of the world enjoy 60 per cent of the world's income while 57 per cent of them have less than 10 per cent at their disposal. If the present trends are to continue, the gulf between the poor and the rich nations of the world will widen still further and this at a time when great continents have awoken to freedom and their populations are clamouring for certain minimum standards of life. These enormous disparities among the peoples of the world are a problem not only for the poorer nations, but for the world as a whole. Prosperity, like peace, is indivisible.

The most important feature of our world is perhaps that it is passing through a period of revolutionary change. Today we are in the midst not of one revolution, but of several. All of them are rapidly and visibly changing our ways of life, our sense of values and our attitudes in the political, social and economic fields.

Perhaps the most important of these various revolutions will prove to have been due to the upsurge of science and technology. In the last century, science was essentially the concern of a few private individuals and institutions. It has emerged as the most important implement of national development and economic uplift. And need I mention the widespread and almost ubiquitous influence of technology in all fields of human endeavour, whether public or private. Advances in nuclear science inspire hopes that mankind may have at his command before

very long, historically speaking, vast and cheap sources of energy. Radio astronomers and optical astronomers have extended estimates of the age of our galaxy and are striking farther and farther out into the boundaries of the universe. Man has encompassed his world with artificial satellites and has made challenges of reaching the "inviolate" moon. The arts of agriculture and medicine are vastly improved and the same can be said for almost every field of human endeavour. We have much deeper understanding of the biological processes. The sciences dealing with the earth and its environment are in an equally lively state. The air, the earth, the oceans and the sun contain riches which can support increases in population at higher and higher standards of living.

As I am talking, new entrants are being ushered into this world. It has taken man probably half a million years, perhaps longer, to reach his present status. He is now approaching 3,000 million in numbers.

By A.D. 2000, his numbers may well double. Here again he will face a problem of immense dimensions to find food, clothing and shelter for the newcomers, and, besides, all these people must be able to live in a world which preserves standards of human dignity and individual worth.

Today's advanced countries have absorbed the revolutionary discoveries of science and technology. In the less developed areas the deliberate adoption of science and technology as a means of progress has today to contend against various odds—lack of capital, social inhibitions, over-population, inadequate know-how.

What is the strategy of development to be adopted? In my thinking, a broad strategy must allow for three essential elements: (*a*) a survey of physical resources and their exploitation; (*b*) the encouragement of capital formation; and (*c*) the development of human resources. While all three elements are important for growth, I consider human resources as pivotal.

A problem of considerable importance which the leaders and planners face is the relative weight to be given to the development of physical, and of human, resources. There are multi-purpose river valley projects, and plans for roads, factories, airlines which are essential and which cannot be postponed. There are pressing and contending forces, within every country for early development of these facilities. But these are, as it were, symbols of a modernizing State. They constitute the external manifestation of the people's urge for action and for a higher standard of living. The planners in these countries have to relate such development in a balanced manner to other needs and priorities. In all this, I would give the highest priority to the development of human resources. Education, the training of scientists, technologists and engineers, technicians and craftsmen, managerial and administrative personnel and a host of professional and semi-professional workers of all kinds are perhaps still more of a "must".

Problems of education in the less developed areas are many. Generally, education is dealt with as a part of the social services. It has still not been adequately realized that investment in education and in the development of skills and capaci-

ties among the people is investment for economic growth and should really form an integral part of a country's economic plans. The building-up of an educational infrastructure is basic to all growth in any economy—advanced or less developed.

Education, however, is only one aspect—a very important one in my opinion—of the development process, but there are also others.

The provision of large-scale sources of low-cost energy will determine, more than any other single resource, the availability of such basic necessities as food, water and the materials of industry. Perhaps even more urgent is the need to improve levels of nutrition in many areas of the world in order to bring the people to the necessary state of health and physical and intellectual vigour. However that may be, one must face the fact that plans for development must aim at an integrated process. It is no use dealing with the problem in a piecemeal way. To offer one country a steel mill and to give another a nuclear reactor, however important these factors of development may be in themselves, will result only in unco-ordinated planning.

I would say, and readily accept, that totally imported science and technology may not be relevant to the needs of the less developed countries. I would also accept that the development of science in these areas should be such that it is suited to the material needs and genius of the people concerned and that such a development of science should gather momentum gradually. I would accept that view, but we must not make a fetish of it or find in the absence of such a science an excuse to delay action.

We know that help extended to the less developed areas takes the form both of capital aid and of technical assistance. Technical assistance well conceived and wisely administered will in the long run help the less developed areas to acquire the requisite skills and abilities to solve their problems themselves. I also realize that every developing country has before it a struggle against its limitations of social structure, natural environment, lack of capital and other deterrent factors. With the best effort they can put forward—and this effort is in itself a necessary condition—the developing countries will need both capital and technical assistance not only as a short measure or for short periods, but in conformity with the nature of the problems they require to face.

Capital for economic growth can be provided by the flow of external capital or by domestic savings. But available domestic savings in the under-developed countries are low. Many economists have dealt with the subject of capital formation. I do not propose to enlarge on it.

But I would like to point out that as development progresses, the countries themselves will be calling more and more upon their own financial resources. Could they not be aided in this process by import policies on the part of the advanced countries which would provide them with essential markets for the commodities and manufactures they must sell if their standard of living is to rise? The normal interplay of economic forces between the developed and less developed countries may otherwise contribute only to the progressive impoverishment of the weaker brethren.

It is indeed gratifying to know that the United Nations proposes to convene a conference similar to ours to consider the problems of international trade.

There is an associated problem which one has to consider. Do the best possible conditions exist in the receiving countries for deriving optimum benefits from such assistance? There are internal stresses and strains in the form of pressures, economic and sectarian. Public opinion in these countries has to make sure that all other interests are subordinated to the main task of development. In this important area, the scientists and technologists in the less developed areas should assume a more positive role in helping to form a public opinion adequate to the needs of our age.

Scientists and technologists may feel that they are not directly involved in political decisions; and perhaps this is so! But no one can deny that the scientist has become a man of power and influence in the twentieth century. Whether he likes it or not, he has attained a high place in decision-making.

Scientists and technologists must assume greater responsibility than hitherto in the planning process, both at the national and international levels. They are responsible for the efficiency and continuing operations of most of the attributes of modern living. They must surely play a fitting role in the direction of that modern world. I do not want it to be thought that I would like to see every scientist rush into politics. My view is simply that, in a world which is becoming increasingly dependent on science and technology, scientists must recognize their own significance in the political and social context, as they already realize it in the physical and mechanical worlds which they have taught us to know.

I believe also that scientists have an international role to play which is no less significant. These scientists, whose achievements are honoured and respected for the benefits they can confer on mankind are essentially international in outlook. I look forward to a time when their constantly growing network of scientific interests will be an important element in establishing the community of man.

For the world must become more than a world. It must become a community. Just as we cannot accept the existence of a slum at the end of our garden so we cannot, or should not, tolerate poverty next door to abundance. Can the rich nations of today turn a blind eye to the grinding poverty and misery in other parts of the world? Various societies have tried to evade their responsibilities when such situations arose within their own borders in the past, and history is replete with examples of what followed!

Is it enough if the rich nations of today were to help in improving conditions in the rest of the world? Are there not obligations and responsibilities on both sides? The generous help offered by such countries should be tendered without strings or conditions. The receiving countries must be allowed to develop in freedom, according to the genius of their own peoples. But, for their part, these nations must remember that progress cannot be merely handed to a people from outside. The soil must be prepared, so that the people themselves are determined to pursue the often difficult path of progress. Whole masses must be fired with enthusiasm for a different way of life. They must understand the choice they are

making. The quick transition from a primitive economy to a highly industrialized state cannot be accomplished without a gigantic effort.

During the last decade or so, technical assistance has come to play an important part in the international world. A great number of programmes are assisted by the United Nations, the specialized agencies, inter-governmental organizations, regional commissions, bilateral agreements and many semi-public and private agencies. The recipient countries are indeed grateful for all their excellent work. Nevertheless, I wonder whether the moment has not come to make a careful review of technical assistance programmes and to gauge how far they have been really effective or productive. A frank and objective discussion of the manner in which these programmes are functioning might be valuable.

I have in mind what I might call Master Plans or Regional Plans, aiming at the kind of balanced development I have stressed. This is merely a suggestion I offer for the consideration of experts who are meeting here today. I am keenly aware of the various difficulties which will have to be surmounted before such an idea can be translated into action. Nobody denies that the task is great but it is not beyond the realm of either human conception or human endeavour to fulfil. Astronomical figures are spent for purposes which have been the subject of discussion at several conferences held in the City of Geneva. Enormous resources could be released for diversion to the urgent needs of the under-developed countries. Given goodwill, imagination and foresight, coupled with the tools that science and technology have placed at our disposal, the task of human betterment, formidable though it may appear, is not beyond accomplishment.

It may be permissible for a President to dream of other possibilities on the frontier of challenge. The international organizations are demonstrating every day that it is possible for individuals to take an objective view even in the midst of controversy. They have given practical evidence of the way in which a man can outgrow narrow nationalism to consider the needs of the world as a whole. We have here perhaps the germ of a new idea. Is it fanciful to imagine that a kind of world committee of wise men—a brains trust—might draw upon all the vast fund of experience we are accumulating in the international organizations and agencies to help in preparing—and help in examining—development plans? Such a body might be of changing membership to include in turn the scientific disciplines of the nations of the world. It could meet in frequent sessions to observe, comment and advise. Perhaps at this moment the idea, as I suggest it to you, is somewhat vague, but I feel sure that could be further examined.

I have spoken of the great evolution of all peoples and races towards the ideal of one world. The road leading to this very desirable goal may be long, tortuous and difficult. Whatever the difficulties, this Conference symbolizes the fact that man is almost on the threshold of another important move forward in this age-long process of evolution towards a united world.

May I, Mr. Secretary-General, express to you my deep gratitude for inviting me to preside over this important Conference. I take it not only as a personal honour but as a tribute to the great country to which I belong. I bring greetings

and good wishes from my Prime Minister, Mr. Nehru, and the hope that this Conference will play an important part in helping the developing countries of the world in their struggle for higher living standards.

The United Nations has declared that the present should be designated as the United Nations Development Decade. All countries have pledged themselves to fight with renewed determination against poverty, hunger, disease and illiteracy in whatever part of the world they may occur.

This is indeed an uplifting ideal. I wonder, Mr. Secretary-General, if you could not find new ways to bring it home to the understanding of men and women everywhere, to light with its beacon the imagination even of a child at school. For there is not one of us who has not a part to play, however humble, in this great moment of history. With the weapons of victory newly forged for our use by science and technology, we can look with confidence across the threshold of tomorrow.

If our labours at this Conference make it possible for a step to be taken across that threshold on sound lines, this Conference will have achieved its purpose.

H.E. SALAH EL-DIN HEDAYAT, VICE-PRESIDENT OF THE CONFERENCE, IN HIS CAPACITY AS CHAIRMAN OF THE SCIENTIFIC ADVISORY PANEL:

Mr. President, your Excellencies, ladies and gentlemen,

It gives me great pleasure to address you in my capacity as the Chairman of the United Nations Scientific Advisory Panel and as a Vice-President of the Conference. The Panel was charged with the task of preparing for the Conference in co-operation with the United Nations Scientific Advisory Committee, the specialized agencies, the Secretary-General of the Conference and his staff. The Panel members represented both the highly developed as well as the developing countries on a fair geographical distribution. This adequate representation of developing countries has proved conducive to the orientation of the Conference towards their needs and problems. The incorporation of the various disciplines of science and technology was also observed in the composition of the Panel. This has also accounted for the breadth and balance of the Conference Agenda.

Mr. President, science and technology hold the greatest promise and potential for the success of the Development Decade. This international forum for discussion and exchange of experience is the very imbodiment of our response to the challenge of accelerating growth targets, through the application of science and technology, in the decade ahead. The rising expectations of the peoples of the developing member States, the inadequacy of progress made to date and the widening gap in *per caput* incomes between the developed and less developed areas, are indicative of the magnitude of the problem we have to cope with.

While the latest scientific feats have demonstrated the feasibility of effective solutions, the potentialities of modern science and technology are as yet only slightly utilized for the benefit of less developed countries.

Possible solutions can be achieved only through an international approach to scientific and technological development. Undoubtedly, the United Nations is the most appropriate framework through which the benefits of science and technology can be effectively channelled to the developing nations.

In devising an effective international approach to the utilization of science and technology for the benefit of less developed countries, I should like to stress the following considerations:

1. Undoubtedly, there is a widening gap between the highly developed and the developing areas of the world, in spite of the great efforts made in the fifties. Even a rate of growth of 5 per cent by the end of the decade, a target set up by the United Nations resolution on the Development Decade would only result in doubling the *per caput* income in less developed countries in a period of 35 to 50 years. In effect, this would mean, for many years to come an increase of only a few dollars per annum in the *per caput* income, a result which could hardly measure up to the expectations of the peoples of these lands.

Technological progress in the industrialized countries may still further widen this gap. In our times, science and technology present the effective outlet for development to proceed at a rate that does not fall short of these rising aspirations.

2. This paramount role of science and technology has called for the special attention of the United Nations. The General Assembly at its thirteenth session held in November 1958 adopted a resolution providing for a survey to be made on the main trends of scientific research, having regard to the needs of the various nations. The United Nations-UNESCO report on *Current Trends in Scientific Research* that has emanated from the above-mentioned resolution, acknowledged that "there is no agency in the United Nations family, concentrating on the international aspect of technology, applied research and industrial development, as distinct from technical assistance in the strict sense of the term. It may be thought that this deficiency is becoming more acute as technology advances and that specialized organizations set up in this field could not deal with the problems arising".

The working group established by the Economic and Social Council to study this report expressed, however, the view that before establishing a new international agency it was necessary to take full advantage of existing institutions. The Secretary-General of the United Nations, U Thant, however, rightly waved away any possibility for controversy over this issue when he aptly observed that the resources of the existing agencies "should be strengthened" and that "as new problems and new opportunities emerge, the instruments will evolve them, as has been the case in the past".

3. It has also been acknowledged that existing agencies "do not include such fields of technology like cartography, power and the various fields of engineering involved in modern industrial development". It is gratifying that the United Nations has recently given special attention to industrial development. An industrial development committee and an industrial centre were established. An expert

group has been appointed to examine the co-ordination of the United Nations efforts in the field of industry and the advisability of establishing a specialized agency for industrial development. We hope that similar attention will be devoted to other newer fields as well.

4. It is only fair to infer from any objective survey of current scientific and technological trends that technological progress has been fundamentally oriented to the resource pattern, needs and requirements of the already advanced countries. The fundamental developments in the fields of automation and space research are, among other trends, indicative of the current orientation of modern science and technology.

No parallel trends are equally observable in irrigation technology in arid regions, tropical agriculture, solar energy, implements and techniques of cultivation, crop processing, nutrition, small-scale industries and a host of related technological fields.

This Conference, I feel sure, will bring home these glaring contrasts. Measures to rectify these uneven trends present the major challenge in a "Development Decade". To correct these imbalances, the task ahead is no less than that of developing new technologies oriented to the development needs and limitations of less developed countries.

Indeed, this is a staggering job. It requires simultaneous breakthroughs on a broad front. With due regard to the dictates of specialization, the fundamental unity of science is more than ever called for. Equally important is the positive participation of all developing countries through establishing an adequate scientific and technological structure and acquiring the required basic skills. Along the same lines, successful formulae for pooling regional resources of Member States with common problems are to be evolved.

Mr. President, in this spirit, the Cairo Conference of July 1962 on the problems of economic development has conceived the shape of things to come in a Development Decade and within the framework of the United Nations. The participants in the Cairo Conference have emphasized the necessity of providing United Nations appropriate services in the field of science and technology by recommending that full advantage be taken of this Conference on Science and Technology "for the benefit of the developing countries including the possibility of establishing an agency for science and technology for the promotion of technological advancement and the building up of the scientific structure in the developing countries".

In a resolution adopted at its last session, the General Assembly of the United Nations recommended that Member States, the Economic and Social Council and other competent United Nations bodies and agencies should take into consideration the principles of the Cairo Declaration when dealing with the problems of economic development. In accordance with this resolution, we hope that the above-mentioned principle on technology will be seriously considered.

Mr. President, your Excellencies, ladies and gentlemen, may I allow myself to make some passing reference to the experience of the United Arab Republic

in organizing for scientific and technological development—a subject that I happen to be familiar with. Fortunately enough, we have made a comparatively early start in instituting a modern education system.

Mr. President, since our great national drive in 1952, the Government has paid full recognition to science and technology as an integral part of our development plan; a principle fully incorporated in our constitution. In terms of scientific and professional manpower, the United Arab Republic is one of the most advanced developing countries.

In a number of fields we have acquired original experience, namely: irrigation, river control, land reclamation, land reform, crop processing, rural industries, fine cotton textiles, telecommunications, economic planning, education and training. In other newer fields of technology such as pharmaceuticals, chemical industries, electrification schemes, metal industries, etc., we have gained marked experience. These experiences we have been sharing with many other developing countries. In fact the United Arab Republic is an aid-giver and an aid-receiver. Mutual technical co-operation which is nowadays widely advocated has been our actual practice. Indicative of our policy in this respect is the fact that 12 per cent of university enrolment is allocated to students from other countries. Almost 2 per cent of our national income is channelled into economic and technical assistance. Furthermore, the United Arab Republic has been making available her expert manpower, needed as it is, to fellow developing countries, to the extent of more than 6,000 experts in 1962. Many of our educational institutions are catering for these outside requirements on equal footing with our own.

It is worthy of note that the United Arab Republic scientific policy emanates from and corresponds with the accepted principles of the Cairo Declaration, namely:

That every developing community is a model unto itself. The appropriate technology would have to be evolved and oriented in response to its distinctive needs and its unique characteristics.

That the wide area of common problems requires co-operative regional efforts. That no technological progress can be attained without the maximum mobilization of indigenous domestic efforts.

That every developing nation is capable of positive participation in developing new technologies and in capitalizing on modern technological accomplishments.

That scientific and technological co-operation should be freed from political designs and power groupings, and should proceed within the framework of the United Nations.

Mr. President, your Excellencies, ladies and gentlemen, in my closing remarks, I would like on behalf of the developing countries to express our gratitude to the United Nations for adding a new successful endeavour by convening this Conference, which is the last of a long chain of studies, conferences and symposia organized by the United Nations and its bodies "for the benefit of the less developed areas". I would also like to point to the faithfulness, keenness and devotion of my dear colleagues, members of the Scientific Advisory Panel, as

well as to the laborious efforts of the staff of the Secretariat headed by the Secretary-General, a distinguished scientist with understanding, ability and wide scope of knowledge. Their close co-operation has resulted in the successful preparation of this Conference, a success which I am confident, Mr. President, will be assured by your wise guidance.

MR. DAVID A. MORSE, DIRECTOR-GENERAL OF THE INTERNATIONAL LABOUR OFFICE:*

I am happy to have this opportunity of associating the International Labour Organisation with the welcome which the Secretary-General has just extended to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas.

Having been associated with the preparations for the Conference since its inception, we set great store upon the important contribution which it can make to the work of the whole United Nations family in this vital field.

"The proper study of mankind is man." This is not a Conference for the advancement of science or the glorification of technology but a Conference designed to contribute to ensuring that scientific and technological progress is the loyal servant of human need and not the heartless master of an inhuman destiny. To promote human freedom, to preserve and enhance human dignity, to enlarge the horizons of economic security and equality of opportunity: these are the tasks to which the United Nations family of organizations have set their hand; these are the challenges which scientific and technological progress has made it possible for us to master.

The particular contribution which the International Labour Organisation is making and will continue to make in the matter is described in many of the papers before you and will become more fully apparent as the Conference proceeds to discuss such matters as the basic importance of human resources in development, manpower assessment, training, management development, conditions at the workplace, and the employment aspects of the application of science and technology. It would be premature for me to enlarge upon these questions now. But I would like to endorse wholeheartedly what Dr. Chagas has said in his report on human resources. "The core of human resource development is the planning and execution of a policy of education and training—two aspects of the same co-ordinated process designed to provide the trained manpower at all levels of skill required to achieve the objectives of the economic development plan. The parallel aims of such a policy are to achieve a balance between supply and demand such that, on the one hand, the various phases of the economic plan are not held up by shortages of the trained personnel required for them, and that, on the other hand, productive employment is available for the manpower resources of the nation, whether skilled or unskilled." That is, of course, primarily an

* Mr. Morse limited himself at the session to brief extemporaneous remarks and asked that his prepared statement, which is reproduced here, be circulated to the Conference.

ILO responsibility which we discharge with the full co-operation of our colleagues within the United Nations family. I welcome this opportunity to pledge anew our determination to make the utmost contributions to this end which the resources placed at our disposal by Governments permit.

The central theme of this Conference is the transfer and adaptation of the new technology for the benefit of the developing countries on a scale and at a rate which matches the urgency of their needs, but without sacrifice of human values. The magnitude of this task is apparent from the detailed agenda of the Conference and the imposing and indeed inspiring documentation which has been prepared for it. Nothing less than the fullest use of the combined resources of the whole United Nations family will suffice to meet the challenge which it presents. The application of science and technology for the benefit of the less developed areas is not a segment of policy which can be entrusted to any one existing or imaginable international organization; it is a primary objective of the whole of international economic and social policy, one of the leading purposes which must guide the whole international effort to promote "social progress and better standards of life in larger freedom", a continuous preoccupation which interpenetrates and inspires the daily work of the whole United Nations family. We in the International Labour Organisation look upon this Conference as marking an epoch in the collective effort to which we are all pledged to unite our strength to harness the resources of science and technology to promote and secure the freedom and welfare of the common man throughout the world.

MR. B. R. SEN, DIRECTOR-GENERAL OF THE FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS:

It gives me great pleasure to bring to this distinguished assembly and all participants in this Conference the greetings and good wishes of the Food and Agriculture Organization of the United Nations.

This meeting takes place during a crucial phase in the history of human affairs. We are confronted today with problems which constitute a challenge to our willingness to live in peace and work in harmony, and to our desire to reduce the growing disparities in living conditions between countries that belong to the single family of the United Nations.

We are the heirs to great achievements as well as the victims of disturbing paradoxes. Curative and preventive medicine has made much progress, and more and more men and women are living longer than ever before, but economic development has not kept pace with medical progress. The techniques of increased agricultural production have made significant strides, but their application is still largely confined to what are known as the developed countries which cover less than one-fifth of the world population. Thus we witness the spectacle of increasing human longevity and worsening living conditions side by side. Indeed, the paradox is that in some countries the farmers have to be subsidized to grow less, and in others they have to be subsidized to grow more.

The responsibility for removing the barriers and facilitating the spread of knowledge falls on the statesmen of the world, but in this task scientists have also a great part to play. Their responsibility includes both the extension of scientific approach and the application of scientific techniques. The former involves objectivity and detachment in the study of phenomena, close and courageous reasoning from facts to conclusions, and the integrity to stand firm by the results obtained. There are many fields of our activity where the spirit of scientific inquiry needs to be extended and deepened to make possible the progress we want.

The application of scientific techniques has made remarkable progress in the recent past. Given the will to apply the results of research, prosperity has been demonstrated to be within the reach of every nation. It is our duty to study the nature of the obstacles to the application of scientific techniques and to formulate measures to overcome them. Our task in the immediate future is to base our plans on known technology rather than on new inventions.

This Conference has been convened for the purpose of bringing together the scientific knowledge that already exists and making it available to the less advanced economies of the world. The Food and Agriculture Organization of the United Nations which has launched the world campaign against hunger and want needs all the support that science can give. I venture to hope that this Conference will prove to be a landmark in the great endeavour in which we are all engaged. I wish it every success.

MR. RENE MAHEU, DIRECTOR-GENERAL OF THE UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION:

This great Conference opening today is a timely one—both for those countries towards whose needs it is primarily directed and for those organizations whose task it is to stimulate and facilitate international co-operation and mutual assistance in the realms of science and technology.

After the great political emancipation movement which has occupied the foreground of history for the past 40 years (and which is now drawing to a close), it is clear for these countries that problems of administrative organization, economic growth and social progress will now become the dominant concerns of their peoples and their leaders.

Now, it is not enough to say that the application of science and technology is indispensable in reaching practical solutions to each of these problems. We must go further and declare that the essential factor in these problems is this: they all raise—and all at the same time—the question of the transition of society as a whole to scientific thinking and technological organization. Tomorrow, this intellectual promotion and this sociological mutation will shape the destinies of many young nations, depending upon the degree of mastery and efficiency with which they use their freedom. That, in UNESCO's view, is the question that lies at the root of this Conference and, for the organizations, in the United Nations family, which are now more and more engaged in aid to

developing countries and are assuming increasing duties in respect to these countries, this Conference should be an opportunity to re-examine their activities in a vital sector of development from the twofold viewpoint of the specific nature of their individual fields of competence and of the need for co-ordination—I would even say integration—of their common efforts.

It is in this spirit that UNESCO greets your meeting in this hall as an event of lofty meaning and great consequence. It is ready to participate in your work with an interest and a willingness to serve that befit the vast responsibilities assigned to it in the field of science by its constitution.

To many, aid to promote the technological development of countries lagging behind in varying degrees on the road to progress reduces to a problem of transferring knowledge and know-how, along with a problem of physical equipment.

But no matter how useful and necessary the transfer of knowledge for the achievement of specific goals in specific areas of economic growth and no matter how great a part it has come to play in modern international co-operation, it would be an illusion and a very serious one, in my opinion, to think that this transfer alone can solve the problem of helping to promote the technological progress of under-developed countries.

"Knowledge is power", said Bacon. Our entire technological civilization, of course, proceeds from this point. But knowledge is first and above all thought —thought focused upon nature in a certain manner. Knowledge is scientific only in so far as it is a product of the mind which alone gives it significance for man and determines its applicability to matter.

Science is not a body of formulae and recipes that in themselves—that is, without the intervention of the mind—can confer on man power over beings. This is the magical conception of knowledge. But science is the opposite of magic. Scientific knowledge is nothing but the crystallization of a certain activity of the mind. It is the scientific spirit, without which knowledge cannot bear fruit, that we must first implant and develop—and at all levels of thought and action.

Moreover, as science progresses and increases in scope and complexity, each day brings further verification of Auguste Comte's profound conclusion that science is not solely an intellectual reality but is equally, interdependently and even consubstantially a social reality.

Science is undoubtedly a social reality in its mechanisms and functioning. This is brought out by an analysis of its sub-structure, consisting of documentation and information services, unions and federations of scientists, congresses enabling them to compare ideas and, lastly, research institutions where work is more and more of a collective nature. Science is a society in itself, a society peculiar in that it aspires to universality and therefore prepares and foreshadows the mankind of tomorrow.

But this society would be unable to achieve its purposes and prosper in merely any context. Too often, it is forgotten that it is a certain type of society with its economic, social, administrative and intellectual characteristics that produces and maintains modern science. There is a sociology of science

about which neither Governments nor public opinion are always sufficiently enlightened and which, devoted to untangling the complex and profound interactions of science and society, informs us that the organization of one cannot be conceived independently of that of the other.

Recalling these essential truths leads us to an affirmation which is basic in our mind: over and above the immediate needs for practical specialization, the problem of the technological development of regions still under-developed cannot be fundamentally solved by the importing of foreign technology or by the hasty implanting of applied sciences in ready-made form. It can be solved only in a radical manner—and no doubt to an extent varying with the resources available —by creating and strengthening, through an indigenous process, in the very heart of the human reality of the societies concerned, the twofold intellectual and social reality of science.

As far as education is concerned, I will say that, no matter how badly we need specialists and technicians, we must not forget—without running the risk of serious miscalculations—that specialized technical training at any level implies a relatively more general technical education and that this technical education itself is based upon general scientific education, or simply on education. In education, the general always conditions and prepares the more specialized, and this holds true for the development of the community as well as for that of the individual.

As for the organization of the institutional structures and mechanisms which execute, and the planning of the programmes which direct, a country's scientific and technological efforts, I consider that these must be seen as one of the most authentic signs and one of the most certain causes of development and, in truth, of independence itself. Their increasingly systematic creation in the highly developed countries and the growth of government control over this whole apparatus must be considered one of the most important facts in the evolution of the modern State over the past 15 years.

Far from looking upon this organization and planning of science and technology as a luxury and a privilege reserved for the rich and powerful, the underdeveloped countries must understand that, along with a scientific inventory of their natural resources, there is no step more urgent and necessary to assure their growth methodically. They are less able than anyone else to remain ignorant of or waste their strength and go astray. Learning how to effect this rationalization immediately from those who have achieved it only after the grouping of long and costly empiricism—there, since there has been talk of short-cuts, is the decisive short-cut of history.

DR. M. G. CANDAU, DIRECTOR-GENERAL OF THE WORLD HEALTH ORGANIZATION:

It is a great pleasure for me to attend the opening session of this Conference, which gives rise to such great hopes. I am certain the Conference will yield tangible results of considerable value to all of us whose task it is to help improve social and economic conditions in the least privileged parts of our planet.

Today it is no longer necessary to insist that efforts to improve health in all countries cannot be effectively pursued in a social, economic and political vacuum. Whatever the social context, it is not possible to conceive of any general, harmonious progress without all the relevant factors being taken into account. Health is one of those factors.

We well understand that success in the fight against diseases is not by itself sufficient to ensure the social advancement of the nations. In the long run, our activities will lead to no enduring success if they but multiply the number of unemployed, increase the army of malcontents, or swell the ranks of the undernourished. Man liberated from disease must have shelter, means of education, land to cultivate, factories to work in. For us in WHO, health regained is only one of the conditions that enable man to lead a satisfying existence.

I am convinced that this Conference, by bringing together so brilliant an array of scientists from the four corners of the earth, will do much to help the common cause that it is the duty of all of us to defend.

May your endeavour prosper. You have my sincerest wishes for the success of your deliberations.

MR. GERALD C. GROSS, SECRETARY-GENERAL OF THE INTERNATIONAL TELECOMMUNICATION UNION:

Mr. President, Mr. President of the Swiss Confederation, Mr. Secretary-General, Excellencies, distinguished guests, ladies and gentlemen:

The theme of this great Conference which is assembling here today is science and technology. Its application, however, extends to every branch of human enterprise and endeavour—that is to say, to humanity itself.

We can no longer be satisfied, Mr. President, with the well-known dictum of the nineteenth-century philosopher, Herbert Spencer, that "Science is organized knowledge". It is infinitely more than that. The great achievement of the twentieth century has been to realize that the benefits of being alive should be open to all those who are alive and that the wonderful tool which Spencer calls our "organized knowledge" can be pressed into service of this ideal. Far more important than the achievements of science—and of its hard-working younger brother, technology—are the human needs which they are designed to meet.

One of the most basic human needs is communication, and, in a world whose population is increasing at a tremendous rate where its distances are becoming relatively smaller, science and technology have had to be called on to supply the means of satisfying that need. Our existing international telecommunication network is, I believe, ample proof that science and technology have responded well to this call, especially if one considers the financial limits imposed by the other demands of life. But it is clear that Governments in the future must be prepared to allow all possible scope for the development of a service which has repeatedly shown that it can both save human life and enrich it. People all

over the world are coming to regard telecommunications as both a necessity and a right due to them in this modern age. In this connexion, Mr. President, may I say how gratifying it is to me that the distinguished President of the Swiss Confederation, who has honoured us with his presence here today, is also the member of the Swiss Federal Council who is responsible for his country's telecommunications department and operations.

Similarly other distinguished heads of state, including Chairman Khrushchev and President Kennedy, are now devoting their special and personal attention to telecommunications—which they jointly agree should be available to the whole world on a non-discriminatory and universal basis. These channels must be kept open.

Telecommunications are now in the process of launching humanity into a totally new dimension—outer space. The science-fiction dreams of former years have become the urgent reality of today. Never before has the world as a whole embarked on such an adventure. It is science and technology which are taking it along the way.

But, Mr. President, let us never forget, in all the splendour and excitement that the Space Age offers us, that humanity must first be served by this latest spectacular achievement of the human mind. History is only too full of tragedies occurring when men have allowed their sense of glory to obscure their sense of responsibility.

I have stressed the human imperatives which must guide the use of our scientific and technological achievements. I do so as an engineer myself. I do so because I believe that no scientist, no engineer, no technical expert should ever allow himself to forget that he is at best an interpreter of what used to be called the "mysteries of nature". In this endeavour, Mr. President, I feel sure that this Conference will go down as a most important historical landmark.

Thank you, Mr. President.

MR. D. A. DAVIES, SECRETARY-GENERAL OF THE WORLD METEOROLOGICAL ORGANIZATION:

I am very happy to convey to you on this occasion the good wishes of the World Meteorological Organization and to express the confident hope that your Conference will be a complete success. I would like also to stress the Organization's great interest in, and full support for, the aims and purposes of this bold and timely venture.

It will, I think, be accepted, *a priori*, that the weather and climate of any country have a direct and important bearing on the economic potential of that country—the crops grown; the availability of water for human consumption, for industry, for irrigation, for hydro-electric power; transportation by air and sea; the effects of the ever-increasing pollution of the atmosphere; even the health of the people, the clothes they wear, the buildings they construct—*all* are affected to a greater or less extent by the weather and climate.

Thus, a full knowledge of the weather and climate of any country and the correct application of such knowledge are essential to full economic development. Many of the papers to be studied in the coming weeks deal in some detail with the various aspects of such applications. I need hardly add that WMO is anxious to be of every possible service to the countries of the world to that end.

It is indeed fortunate that the science of meteorology is at present in a stage where important advances are being made. To take but one of the many important developments in this field on which papers have been submitted, I may mention that the use of artificial earth satellites to observe the earth's atmosphere from outer space has given a tremendous stimulus to the atmospheric sciences as a whole. Already limited satellite meteorological data are being distributed as a daily routine on a world-wide basis and the prospects of further important developments in this field which will benefit all countries of the world seem most promising.

In the light of such considerations, it may seem strange that there is no section of the agenda of the Conference devoted to meteorology. This, of course, is not because the subject has been forgotten or overlooked—on the contrary, the papers I have mentioned and many others which have been presented to the Conference, show clearly that much attention has been given to this subject. The reason, of course, for the absence of such a section is that meteorology has a bearing on the subject-matter of many of the sections into which the Conference agenda has been divided and meteorological papers have therefore been scattered in these different sections. It is, I think, important to bear in mind that in considering any one section—and most delegates will individually tend to concentrate on one section—one is dealing with only a *part* of meteorology and that in planning national meteorological activities, the application of this science as a whole must be taken into account.

To conclude my remarks, Mr. President, may I, on behalf of WMO, acknowledge the unfailing help and courtesy which Professor Chagas and his staff have shown in all matters relating to WMO's participation in the Conference. WMO is very appreciative of the spirit of co-operation which has at all times prevailed.

DR. SIGVARD EKLUND, DIRECTOR-GENERAL OF THE INTERNATIONAL ATOMIC ENERGY AGENCY: *

The International Atomic Energy Agency is concerned with the youngest of the sciences and technologies your Conference will consider. Atomic energy, constructively used, is a potential tool of a capacity the limits of which we still cannot foresee: it will broaden the scope, quicken the pace and increase the rate of industrialization with all the resulting benefits for people everywhere. These benefits should come to the developing countries as part of a planned

* Mr. Eklund's statement could not be delivered at the session owing to delay in arrival of his plane, but was circulated to the Conference subsequently.

general progress in some of the fields with which this Conference will deal. I shall confine myself to alluding to only one of them: abundant and cheap power as a key to hastening progress of industrialization. You will agree with me if I say therefore that the Agency has a particular interest in the success of this Conference and the concrete proposals which should emerge and be integrated in the programmes for the Development Decade.

My congratulations to the Secretary-General of the United Nations and to the Secretary-General of the Conference for their timely initiative and massive labours in preparing this event. I would like to add my thanks to the President of the Government of Switzerland for serving as host.

# ADDRESSES DELIVERED AT THE SECOND PLENARY SESSION

THE RIGHT HONOURABLE LORD CASEY (AUSTRALIA), VICE-PRESIDENT OF THE CONFERENCE:

This gathering of delegates from many countries has come together to discuss how science and technology can be applied more effectively and more quickly to help the advancement of the developing areas of the world. Both the developed and the developing countries are represented. The more developed countries want to help, and the less developed want such help. It might be thought that all that was necessary was to bring them together. But it is not nearly as easy as that, as we have all learned in the last ten years or so.

We are here to help each other. In science and technology, international interdependence—what one might call the cross-fertilization of ideas—is perhaps more necessary and more possible than in most other human activities. It is, indeed, an obligation in the interests of mankind. Its end point is economic and social—to achieve a fuller and better life for mankind. Our discussions here have nothing to do with ideology or politics. They are confined to the practical questions of science and technology and their economic implications.

I am glad to have had some association with the chain of events that has culminated in this great Conference, in that on behalf of Australia I moved a resolution in the General Assembly of the United Nations in 1958 seeking to direct the attention of the United Nations to the special contributions which science can make to the promotion of human welfare. I stressed the need for the *application*, and the wider and quicker dissemination, of scientific knowledge. It is my firm belief that only in this way can the goals of development be attained. It is therefore a matter of particular satisfaction to me to find, four years later, a Conference of this magnitude discussing these very problems.

People are inclined to speak of developed and developing countries, whereas in fact the situation is not as simple as this. It is misleading to speak merely of developed, partially developed and under-developed countries, since in many lands all three stages are represented. Nor should it be thought that only the highly developed countries can help in solving the scientific problems of the developing world. Very often the particular experience of one developing country is very relevant to the needs of another. This comes out clearly in many of the papers before us at this meeting.

If I may speak for my own country, Australia provides one example of a country in an intermediate stage of development. We are scientifically fairly well advanced, we are rapidly developing our agriculture and industry, but we are still struggling with the problems of developing our natural resources. We thus feel that we have a foot in both camps. Moreover our development has

been relatively recent, so that the problems associated with it are still fresh in our minds.

We have not only given considerable attention to scientific research over the past generation, but have also been vigorous in its practical application. For example, in one governmental research organization, the CSIRO, we have in money terms spent about $US220 million on scientific research in this period. The application of this research has increased the national income each year by an amount which is double this total outlay over the whole period. I am convinced that the best investment which any country can make is intelligently directed scientific research.

There is nothing peculiar in our Australian situation that has made this result possible. Comparable results are possible in any developing country providing the scientists are given adequate scope and opportunity, and as long as there is a national determination to apply modern technology to production. The less developed the country the more spectacular the results are likely to be.

It seems to us that there are two main aspects of this Conference. We have of course to consider the specific technical problems discussed in the papers which have been prepared. We have before us nearly 2,000 papers prepared by leading experts in different countries. It is for each delegation to distil out of this mass of papers and the discussions which will accompany them, information of practical value in coping with the particular development problems of each of our countries.

But if we just do this and go home, the meeting, useful though it may be, will fail to achieve its full potential. The experience of the more developed countries emphasizes that there must be an appreciation at the national level of the vital role of science and technology in promoting human welfare and economic progress. This Conference must demonstrate to Governments that this is so. But it must do more; it must also consider what practical *machinery* is necessary for transferring the experience of one country to another.

The experience of many countries shows the great value of the creation by developing countries of suitable national scientific and technical organizations of their own. From our own experience in Australia we know that it is not enough for such countries to rely on the temporary palliative of taking knowledge from the developed countries. To do this for ever would mean remaining in a position of scientific and technological dependence. A national research organization can act as a channel for receiving and adapting existing knowledge from other countries. It must also develop its own research programmes directed to the particular national needs. It must play its part in influencing national policies concerned with economic development, including the encouragement of an educational system attuned to the possibilities of science and technical progress. It can also, in co-operation with similar organizations in other countries, exert some influence in directing the interest of developed countries to the problems of developing ones. In the absence of some such national scientific organization, even the most advanced countries face problems in using scientific knowledge

to the best advantage. An essential part of a national science policy should in our view be to provide such a national research organization. This involves the provision of trained scientific and technological manpower, and funds on an adequate scale. We believe that the developing countries can receive help from the more scientifically advanced countries in achieving this important objective.

This will mean a close re-examination of the existing arrangements for providing and receiving scientific help at the international level. There will be many informal opportunities during this meeting to discuss this question, although the Conference itself is not called upon to make formal recommendations. My own delegation looks forward to exchanging views on this matter with other delegations. It may be that all that is needed is to improve the effectiveness of existing machinery. On the other hand there may be merit in proposals which have been advanced for some new arrangements. The Australian delegation is anxious to discuss the whole problem with an open mind, and I am sure that this is the intention of every delegation here. I hope that by the end of the Conference some generally acceptable ideas will emerge and that the Economic and Social Council, and the General Assembly, will take appropriate follow-up action, so that the seeds sown by this meeting will grow and bear fruit.

Whatever the international machinery that is evolved, individual nations must themselves take appropriate action. Together with other nations we in Australia will be prepared to play our part, to the extent which our resources make possible. Such experience as we have gained is at the disposal of our friends in other countries, and we believe that we ourselves have much to gain from their experience also.

In this way this Conference can make a very significant contribution to furthering the objectives of the Development Decade which we are now entering. It will be axiomatic to those attending the meeting that science must play a vital part in development. If this Conference succeeds in achieving wider recognition of this concept at the national as well as the international level it will indeed have justified the hopes of the many people who have already contributed to its work.

PROFESSOR PIERRE AUGER (FRANCE): *

Science and technology are at present making remarkable strides. Spectacular progress is being recorded in a number of fields: space exploration, telecommunications, electronics, chemistry, biology, surgical techniques, etc.

An ever-increasing proportion of the population of the developed countries, moreover, is taking an active part in this scientific advance and it is estimated that the number of scientists alive today is ten times as many as the sum total of their predecessors who, from the time of Archimedes to Einstein, have opened the way to modern knowledge.

* Professor Auger's address was delivered in his absence by Professor A. Maréchal (France).

This scientific advance poses two questions: What are the basic processes of this rapid progress? How can the less developed countries progressively benefit from modern techniques, share in the scientific knowledge and, also, take an active part in research work? I would now like to provide some answers to these questions.

Man is capable of launching satellites around the earth, sending exploratory rockets towards the planets, navigating a submarine beneath the polar ice-cap and very soon he will attempt to pierce the upper crust of the earth's surface. These realizations of the dreams of Jules Verne might give the impression that technology has surpassed the basic sciences, whose prestige could appear somewhat threatened. In fact, however, an analysis of many examples shows that the role of the basic sciences is still of crucial importance: the remarkable achievements of modern science have been made possible only through the support which the scientists have constantly provided to the technicians; the greatest progress has been due more often than not to the employment of processes whose principles pertain to the basic sciences: thus, transistors result directly from the work carried out in the field of solid body physics, the discovery first of masers and then of lasers is the work of physicists who made subtle use of knowledge derived from various fields: wave mechanics, the work of Einstein on emissions from the induced circuit, classical optical physics, etc. The public can readily admire the power of laser light rays which are capable of transmitting light from the earth to the moon and of detecting the feeble light which reaches us in return, but it is difficult for it to assess the magnitude and complexity of the theoretical and experimental work undertaken on a world-wide scale which has brought about the development of our knowledge on the mechanisms of the emissions of light rays, the processes of the excitation of atoms, the properties of optical resonators which have been crowned recently by the invention of lasers.

Modern calculating machines owe their existence, largely, to the joint research work carried out by mathematicians and by biologists engaged in investigating the basic processes of human thought.

In quite another field, the selection of new varieties of plants well adapted to certain climates has been made possible only by applying the knowledge of modern genetics in carrying out the cross-breeding of plants, which has created the possibility of combining in a single species qualities previously found in several. This is the case of a number of varieties of cotton now widely cultivated in Central Africa, which show remarkable resistance to parasites and bacteria.

Thus, in very widely divergent fields, the basic sciences are found to be the source of outstanding progress; they constitute the guide-line which enables, through profound and comprehensive knowledge of the mechanisms of natural phenomena, progress to be made both in a widening of our knowledge and in the improvement of technology ranging from telecommunications to mining research or agronomy. Inversely, technological developments often pose new problems to the scientists which are sometimes the origin of fruitful research: finally, it may

be considered that one of the predominating factors in the present rapid scientific development is probably the existence of permanent contacts between basic science and its application.

In the nineteenth century the sciences could be easily classified according to a logical order starting with mathematics and ending with sociology. Such a classification, "a single parameter classification", as the mathematicians say, is now becoming more and more complex. In fact, science comprises disciplines seemingly remote but closely linked with the results that the methods of exact science have to be used in cases which seemingly belong to the natural sciences: biology and geology now benefit from the development of physico-chemistry or mathematical methods. The secrets of the giant molecules responsible for heredity are being progressively revealed by physical methods (diffraction of X-rays for example); of primary importance are messenger molecules, which provide structural information on the cell's nucleus regarding its protoplasm, and which are therefore responsible for the development of characteristics of the cells of a given individual. It may quite soon be possible for us to understand how the seemingly innumerable recollections which constitute our memory register in the extremely complex human brain; this will be the joint work of mathematicians, electronic experts, physiochemists and biologists. Thus, new scientific fields are being created such as biophysics and biochemistry, the development of which may perhaps be the most significant scientific event in the decades to come. In fact, what we are observing is the phenomenon of a proliferation of new scientific disciplines due to the establishment of multiple links between the traditional disciplines.

This situation may appear discouraging for the less developed countries: confronted by the day-to-day extension of the sphere of science they are obliged to decide which development policy should be adopted, and to choose the most effective means to obtain, within a reasonable time, a satisfactory level of living. It is obvious that imperative economic and human needs may most frequently dictate the choice of priorities: the natural resources of a country, its traditions or the aspirations of its people may lead the planners to choose the best methods of developing communications, energy, industries, agriculture, etc. These questions will be studied in detail in the course of the present Conference. I do not wish to dwell on them now. I would like to make only one recommendation: having chosen the priority sectors and the short-term development policy, it seems to me indispensable that the training of a scientific *élite* should be initiated immediately: among all the peoples of the world there are persons naturally gifted for higher scientific studies; it is absolutely essential to select and train such people as soon as possible and thus to form in the shortest possible time national cadres which will be able progressively to take responsibility in guiding the scientific, industrial, agricultural and economic policy of the country. It is these who will decide how the new techniques are to be applied, who will specify the research work to be undertaken and who will perhaps begin to participate in the advance of international science. It is these who will really assure the

creation of the scientific life of the country by constituting a nucleus around which teams of scientific workers will gradually be formed.

Thus, the less developed countries will be able to determine for themselves which are the problems to be solved, and which are the appropriate methods for their solution; in other words, they will become the masters of their own destiny.

DR. H. J. BHABHA, HEAD OF THE DELEGATION OF INDIA TO THE CONFERENCE: *

I shall deal with the problems of energy in the under-developed areas, because an adequate supply of energy is the primary requisite for all modern industrialization and for supporting a high standard of living. For the under-developed countries of the world, it is therefore of prime importance to ensure that adequate amounts of energy and power are harnessed at all stages of their development. A sound policy with regard to energy development can be formulated properly only by taking a long view of the broad energy requirements for quite a long time into the future.

In planning for the supply of electricity, it is important to remember that the capital investment in plants and industries required to consume a unit of electricity is on the average roughly seven times the capital investment in plant required to produce a unit of electricity. Thus, in any industrial complex the investment in power-producing industries is only about 10 per cent to 15 per cent of the total investment. A conclusion to be drawn from this important fact is that when making large investments in power production it must be assured that several times this amount, say five to seven times, is available for investment in new industries to utilize this power. Otherwise, some of the investment made in producing new power will lie unutilized. A second and equally important conclusion to be drawn is that while the investment in power has to be roughly one-seventh of the total industrial investment, one should always ensure that the investment in power-producing industries is somewhat more rather than less than the optimum figure of about one-seventh. Under-supply of power has a much more adverse effect than an over-supply.

*Present levels of energy and power consumption*

When discussing the economics of utilizing alternative energy resources, the present levels of energy consumption, the growth in demands for energy and the availability of the different energy resources have to be taken into account. For an examination of these factors, it is convenient to divide the world into nine groups of countries as follows: (1) North America, comprising essentially the United States and Canada; (2) Oceania, consisting of Australia and the Pacific Ocean Islands; (3) USSR; (4) Western and Eastern Europe; (5) Africa excluding Egypt; (6) Latin America including Mexico and countries south of it; (7) South Asia and the Far East (SAFE), including all countries of Asia excluding the

* The annexes referred to in Dr. Bhabha's address are contained in document E/CONF.39/INF. 34/Add.1.

Middle East and China; (8) the Middle East, including Iran, Turkey, Egypt and other Arab countries; and (9) China.

A tabulation of the *per caput* consumption of commercial energy, electricity production and installed electrical capacity for these regions (Annexure I) shows that the *per caput* energy consumption for North America is about 7.8 tons coal equivalent per annum, and that for Europe, Oceania, and the USSR is about three tons. These areas comprise the industrially advanced countries of the world today. On the other hand, Latin America, Africa, SAFE, the Middle East and China, which comprise areas that may be termed as "under-developed", have a *per caput* consumption of less than 0.7 tons coal equivalent. The disparity in these figures points to the enormous increases in energy production that will be required as the under-developed regions industrialize themselves. Moreover, the under-developed regions contain the bulk of the world's population—some 2,139 million out of a total of roughly 3,000 million.

*Resources available and growth in demands*

According to a recent survey by the World Power Conference, it is estimated that the total reserves of fossil fuel in the world that could be economically recovered are about $3\frac{1}{2}$ million million tons (1). On the other hand, the total consumption of commercial sources of energy in the world in 1960 was about 4,200 million tons of coal equivalent (2). The world consumption of energy increased at a rate of about 5 per cent per annum in the 1955-1960 period, and the rate has increased above this figure in 1959 and 1960 (3). On this basis (Annexure II) the estimated reserves of economically recoverable fossil fuel would be exhausted in about 75 years.

So far as water power is concerned, it is estimated that if all the sites in the world that have been surveyed are utilized, it should be possible to generate about 5 million million kW hours of electricity per annum (1). This forms a small portion of even the present total world energy consumption and would be less than 3 per cent of the likely consumption 30 years hence (Annexure II). It therefore appears that within the foreseeable future, the world will have to go in for a massive utilization of nuclear energy or other non-conventional resources.

*Regional distribution of world reserves*

A tabulation (Annexure III) of the total reserves of conventional resources, both measured and inferred, for different regions of the world, reveals the striking fact that the under-developed areas of the world are also those with the least *per caput* resources of conventional energy. The reserves are under 400 tons of coal equivalent *per caput* for the under-developed areas, 1,400 tons for Europe, over 8,000 tons for North America and over 25,000 tons for the USSR.

We may assume that the under-developed areas will aim at achieving as rapidly as possible a stage of development corresponding to that prevailing in Europe today, which would mean a *per caput* annual energy consumption of about three tons of coal equivalent. With a consumption of three tons *per caput*

for these regions annually the entire reserves would be exhausted in less than 40 years in Latin America, less than 65 years in the Middle East, less than 30 years in the SAFE region and less than 133 years in Africa. This does not, of course, take into account the steadily rising population. It is clear therefore that in the under-developed areas, the conventional reserves will not be sufficient to support a developed economy for any significant length of time and that recourse will have to be made either to nuclear energy or to imports of fuel on a massive scale in the near future.

The area which is worst endowed with conventional resources is the South Asia and Far East region, as can be seen from Annexure III. This region with a present population of 925 million will therefore require the use of nuclear energy at the earliest date of all.

*Relative costs of energy from different fuels*

The cost of commercial energy depends on two factors; first, the intrinsic cost of the energy in the fuel used and, secondly, the cost of the plant necessary for extracting this energy from the fuel and converting it into a commercially useful form, such as electricity. If the cost of coal is $US4 a ton, the cost of energy in it comes to $US0.2 per million British Thermal Units. Transport may more than double the cost of energy. For furnace oil at $US16 per ton, the cost of energy contained in it is $US0.4 per million BTU. The cost of nuclear fuel is higher, for we have to include the cost of bringing the ore to the surface, of extracting the uranium content in it, and then fabricating this uranium into fuel elements of the desired type. This may result in fuel elements costing anything from $US30,000 to $US60,000 per ton. On the other hand, the amount of energy that can be extracted from each ton, even with today's technology, is so enormous that the cost of energy from uranium may vary between eight and 20 cents per million BTU. In other words, the intrinsic cost of energy from nuclear fuel is almost invariably lower than the cost of energy from conventional fuel, and may in many cases be less than half the cost of energy from coal even at the pit heads (Appendix IV).

This general situation could have an important bearing on fuel policy. If fuel has to be imported in any case, then it is much cheaper in terms of the energy obtained to import nuclear fuel rather than conventional fuel. The known reserves of conventional fuels in most of the under-developed areas are relatively so small that the full industrialization of these areas will have to depend either on a large-scale import of fuel or on using nuclear energy. In view of the markedly low cost of energy in nuclear fuel the necessity to import fuel in very big amounts will itself tip the balance in favour of going in for nuclear energy. Thus, we come to the conclusion that the full industrialization of the under-developed areas will in the long run take place only on the basis of atomic energy, whether the fuel is imported or obtained indigenously.

If the generation of electricity from nuclear energy is not already much cheaper than from conventional fuels it is entirely because the technology is still in its

infancy and the cost of plant required to utilize nuclear fuel is greater than the cost of plant required to use conventional fuel. However, the cost of nuclear power stations has been coming down rapidly, so much so that in many areas of the world electricity from atomic energy has already become competitive with electricity from conventional fuels. A major portion of India, which is remote from the coal-fields, falls within this category, and certain high-fuel-cost regions of the United States are probably also in the same class.

In conclusion it is necessary to make a few general observations. Should a study of the economics of the situation in a particular under-developed area show that it would be expedient to go in for nuclear production, this could be done initially on the basis of imported equipment. It is neither necessary nor desirable for every such country to go in immediately for the design and manufacture of nuclear equipment, as the necessary technical effort may well take away scarce personnel from more urgent problems. On the other hand, every new industrial project, whether in the nuclear field or otherwise, should be made the starting point for the training of personnel, not only for operating such plants but for wider purposes. Each industry should be used to make its contribution directly and indirectly towards the development of technical personnel in a wider context than merely required for its operation, for unless an adequate cadre of technologists is built up, not only with the know-how for operating and producing plants, but finally also for designing them, the country will continue to depend for its development, especially on the basis of new techniques, on imported know-how and will always be faced with the problem of adverse balance of payments. It is not necessary for every country, especially a small one, to produce everything, but it must be able to produce some things containing a high technological content which can be sold in return for other things which may be needed. A balance cannot be maintained only by trading raw materials for industrial equipment. In the last analysis, the most important asset of the highly industrialized countries is their educated and trained manpower in all fields, in particular their large number of scientists, technologists and skilled labour. It is this resource which the under-developed countries must build for themselves as quickly as possible, if they are to cease lagging behind, and to pull their own weight in the forward march of humanity.

PROFESSOR P. M. S. BLACKETT (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND):

Mr. President,

I intend to speak about the problems of formulating practical and realistic plans for the application of science and technology by the Government of a newly emerging country. I will specifically have in mind the new African nations, since, for various historic reasons, they are very short of trained manpower.

The first thing which must strike, say, the Prime Minister or Minister of Finance of such a young nation, is that science and scientists are expensive and

that their financial demands clash with the innumerable other demands on a country's very limited financial resources, and still more limited foreign currency. Even in the field of scientific and technical education alone, there will be the choice to be made of the proper allocation of finance between primary, secondary and higher education; or between training science teachers, scientifically trained administrators, research workers in pure and applied science, and engineers and technologists. Then there are, of course, the essential problems as to what the scientist and technologist should be used for. It is important to note that these main decisions have to be made by the Government. For the Government alone, in general has the financial resources to carry out any worthwhile programme. Even when financial aid from other countries is available for specific educational and scientific projects, government assessment and approval will generally be necessary.

So it comes about that today a great deal of very detailed decision-making in the scientific and technical field will fall on the Governments of these newly emerging countries, and just at a time when vital political, economic, and social problems have to be solved. It is evident that a high priority for the educational system of an emerging country is the training of an adequate number of scientifically and technologically minded executives, able to make these complex and difficult decisions.

Any minister or other high official from an emerging country who is attending this great Conference will, no doubt, be in two minds about the vast display of scientific and technological developments which are dealt with in the hundreds of communications. On the one hand, the Conference will make clear the great possibilities, inherent in modern scientific industrialization and agriculture, for the raising of the material standards of life of the emerging countries. On the other hand, it will confront such a statesman or official with a frightening number of decisions which must be taken. For, even leaving new research and development out of account, the sheer bulk of advanced technology which is available to be bought in the world today, by a nation with the cash, is staggering. Even rich countries like the United Kingdom do not buy every process, plant, machine tool or vehicle on sale. How much more must this be true of the newly emerging countries, with their very limited resources both of finance and of trained manpower? Their representatives here today may feel like window-shoppers, admiring the riches of modern technology through the plate glass window of their limited resources in money and men. Moreover, when they have some money in their pockets they must clearly be very discriminating purchasers.

In considering the formulation of national policy in relation to the application of science and technology to the increase of material wealth, it is useful here to distinguish three main aspects.

The first is that of known and available technology. Most of the more urgent needs of the emerging countries in the early stages of development come into this category. To set up a motor-bus service, it is necessary to have the foreign exchange to buy the vehicles and fuel, and the technical schools to train the

drivers and repair personnel, but no research or development at all is needed. Nor is new research and development required to set up an airline, or a television system, or an electricity supply, or a sewage system and piped water supply, or the majority of normal manufacturing plants. Though such projects do not involve any appreciable research and development, they do require a large supply of technically and scientifically trained personnel to run them. A big increase of indigenous-trained scientific, technological and administrative personnel will be needed before a country can make full use of the known technologies without undue and expensive reliance on foreign personnel. A major task of a new nation's educational system must be to provide as soon as possible the necessary technological intelligentsia to make use of all the known and available technology which the country can afford to buy. Prominent among the vital tasks, which such trained people will have to tackle, is the formulation of a sensible "shopping list"—I mean by this homely phrase the decision as to what to buy and what not to buy in the world's well-stocked supermarket for production goods and processes. In one sense this great Conference is a catalogue of what is available, and so should be of great value to the citizens of the emerging countries who have the responsibility for making these decisions. One cannot over-emphasize the importance of recognizing the necessity for wise choice of what to buy. Incidentally, the mere reading and digesting of the mountainous mass of the Conference documents will provide a major task for the scientists and engineers of the emerging countries.

The second most important aspect of the application of science and technology to a less developed country is that concerned with problems which are related to the special conditions of the country, and the solution of which must be done on the spot. Prominent among these, of course, are those special aspects of agriculture and medicine which have specific local significance and so cannot be studied elsewhere. Then there are many problems in meteorology, geology, geophysical surveying, road building and housing, where original research and development related to local conditions is required. In addition, many new technological problems arise in the setting up of local industries, due to the special properties of the local fuels, raw materials, textiles, foodstuffs, etc.

In relation to these problems, the importance of a first-rate information service is vital. It must be made as easy as possible for the research and development personnel to be kept continuously aware of the state of general world knowledge on a particular subject, so as not to be led by ignorance into expensive researches to find out what is already well known. The opposite danger is to assume too easily that some process, technique or method, which has long been in successful use in some other country, can be transferred without modification to new surroundings. Some of the most valuable research projects in the early stages of a country's development will surely lie in the imaginative adaptation of known methods to local conditions.

There is one ever-imminent danger in such fields as medicine and agriculture. This is, that the policy-makers may become so impressed by the latest triumphs

of science that the more humdrum requirements of public health and good husbandry may get too little emphasis. The danger of relying on wonder drugs and neglecting the plumbing is very real. Historians of the future may be amazed that our present epoch had the genius to discover penicillin, but had not the wit to give the majority of mankind a sewage system up to the technological level of River Valley civilization 5,000 years ago.

The third aspect of the agenda of this Conference is the group of new technologies which are not yet in general use but are still under development, mainly in the technologically advanced countries. I refer, for instance, to such things as solar heat, fuel cells, desalination of water, and hosts of improved processes and manufactured goods. Though a close watch must be kept on these developments, I am convinced that the national economic and technological planning of a new country's development, over the next decade or so, should be based on what is now known. Useful technological innovation, when it arises, should be welcomed as a windfall profit: it should not be relied on for planning purposes. In fact, most of the now emerging new technologies are likely to be of only marginal economic importance to those countries, which are in the early stages of development, compared with the possible gains from fully utilizing existing technologies. For often, but not always, new development like nuclear power, desalination of water, etc., are expensive in capital cost—and it is capital, particularly in the form of foreign exchange, that emerging countries tend to be most short of.

It is essential that the applied scientists and technologists of the emerging countries develop a sound sense of the economic realities of the related phases of *research, development* and *production.* The first two stages are expensive. Only when the last stage of production is reached is there any increase in material wealth. Though no one would admit to believing that modern science is a magic wand to be waved over a poor country to convert it into a rich one, not a few seem to act as if it were true. In fact the advance of scientific technology can be only a part of a concerted national programme of educational, economic, industrial and social change. Only when integrated into such a plan will the full fruits of scientific technology be reaped.

PROFESSOR D. BOVET (ITALY):

In considering the position occupied by scientific and technological research in the modern world, the substantial investments and the number of scientists whose efforts are entirely directed towards widening our knowledge, the question occurs both to scientific workers and to the general public as to what are the aims of their endeavours and what, from the human point of view, are the objectives of science.

What is science? What is the aim of our research work? What is the object of the work being undertaken in the laboratories? The reply to these questions brings to the fore the two complementary aspects of the problem: on the

one hand the value of science considered from the aspect of the development of rational thought and knowledge, on the other hand its economic and social significance and the technologies to which it will give birth in the fields of industry, agriculture and communications.

Although the classical antimony between the two sciences, the pure, the other applied, has today largely been surpassed by events, science in its aims and achievements nevertheless still appears in these two aspects.

The expression of a universal harmony which, according to some, constitutes scientific knowledge, appears in the eyes of others hardly more than an instrument to be put to practical use.

Whereas Henri Poincaré affirmed that "thought is nothing more than a flash of light in the darkness in the middle of a long night, but it is this flash of light which is everything", Bouasse holds, not without a trace of humour, the pragmatic point of view when he writes "the scientist is looking for a form in which facts can find a good billet. Science has only one excuse for its hopeless monotony: to serve an end."

From the economic aspect, which is the most in evidence, the reply to this question is a relatively easy one: the multiplicity of sources of energy, the perfecting of telecommunications and means of transport, the automation of factories, and in the field of health, the prolongation of the duration of life and the almost complete disappearance of infectious diseases are the consequences, among a hundred examples of the progress engendered by the second industrial revolution.

But this perhaps is not the point and if we wish to avoid the risk of by-passing what is probably the nub of the problem, it is fitting that we should pause here to consider the fact that the moral, social and perhaps political revolution caused by the recent development of science takes on an importance equal or greater than the technological achievements themselves.

Clouzet wrote, "the theme of the theoretical and practical value of science is now inseparable from that of the destiny of man and of his intelligence".

Scientific research has become in the contemporary world as much capable of being conducted and exploited as are mineral and agricultural resources and an endeavour must be made to make people realize that this capital asset represents in its origin, the thoughts and the culture, the creative ability—I am tempted to add the fruit of fantasy—of many men.

Today, the vision of the detached savant, misunderstood, ridiculed, brooding over an often abstruse task, if it has not entirely disappeared, is gradually giving way to the picture of the "scientific personnel", always more numerous, of richly endowed institutions, soundly organized but always more and more closely dependent on powerful economic elements and Governments.

One of the most important consequences of the new planning of research is the role which it is consciously or unconsciously called upon to play in maintaining a balance between the research work carried out by the different branches of science.

Whilst, in the nineteenth century, it was biology which was the cradle of the most daring theories and the field where traditional and novel concepts confronted each other, it is in our century microphysics and cosmology which are producing the most dazzling accomplishments of rational thought.

The importance, as much theoretical as practical, of the contest in which contemporary science is engaged gives one the impression that the balance could incline in the long run towards the physical sciences.

In considering, moreover, the extent of the problems confronting biologists and the significance of their solution for the future of humanity itself, it is to be hoped that the balance will tip once more towards the side of the science of life.

With regards to the history of the trends of thought, I would like to recall here the hypothesis which I already formulated some years ago and which I have called "the hypothesis of the consistency of the grey matter".

This rests on strictly experimental bases: of 100 rats raised in my laboratory, ten only, or 15 at the most, are capable of learning anything a little complex. If I trained them to climb on to a perch at a given signal, it is unlikely that they will learn to open a door. If I teach them to press on a lever which will provide them with a drop of sugared water, they will often forget the other tricks.

I sometimes ask myself whether this does not also apply to our human society.

We are already aware that universities sometimes suffer from the inroads made upon them by industrial laboratories. What will happen if too strong a demand for physicists should suddenly deprive us of good biologists or good doctors?

Has it not already happened in the course of history that an excessive liking for philosophy has deprived the army of great leaders or that a town too rich in artists had neglected to choose good politicians? I leave this subject to your meditations.

It is not only a question of affirming that any field of activity accessible to knowledge would now be no longer neglected, but to acknowledge our relative ignorance on a number of problems which touch man himself very closely, notably in the field of the basic sciences, of molecular biology, of biophysics, of research into intermediary metabolism of the science of nutrition, of neuro-physiology, of the study of the informative processes of the central nervous system, of physiology, of psychology and of animal sociology in relation to the study of behaviour.

The study of the brain upon which depend the highest intellectual and cultural achievements, the organ which controls behaviour and thought and upon which our health and physical and mental well-being are largely dependent, must occupy a predominant place in research programmes and be the object of scientific co-operation both on an interdisciplinary and international level.

In the field of pharmacology, with which I am particularly familiar, I consider that now is the time that the impetus, which has carried research workers to discoveries which have improved physical conditions and have prolonged the duration of human life, should be similarly brought to bear upon problems concerning therapeutics and mental and social hygiene.

It is important to envisage the prevention and therapy of degenerative affections of the brain, of mental retardation and of the ills which are associated with old age. We are aware that chemotherapy, after having annihilated the army of pathogenous microbes, is today capable of attacking the fantasmas still more subtle of our obsessions and our hallucinations. A biologist appealed recently with all his heart for "a product which would induce virtue". I, for my part, think that humanity cannot stop in its evolution, that it will have, in the future, to resolve its own dilemmas and will have to choose between the "soma" of the best of all possible worlds of Huxley, which will plunge it into a stupefied state of beatitude, or the pill which will make it more intelligent by developing its faculties of initiation and memorization.

Pleading the cause of biology I would willingly support the paradox that the study of animal behaviour enables one to approach the study of human sciences and it is this, I think, in the field of biological research, which shows most clearly how the development of our own knowledge is capable of being modified and lends support to the idea that man is responsible for his own destiny.

On the human plane what will be the final balance of scientific research?

In contrast to Jean-Jacques Rosseau, who denounced the corruption of morals engendered by science, the encyclopaedists saw, in scientific progress, great hope for humanity and the *raison d'être* of all our endeavours.

The remarkable development of science and technology readily supports these emulators of Rousseau. Among our contemporaries there are still people who are ready to put science on trial. They denounce the narrowness of the intellectual field in which the scientist confines himself. They are ready to see in the machine and the robot a "universal conspiracy against all inner life" or to accuse the scientist to have made them lose their "soul".

And yet we see daily the formative value of science as much in the energy, enthusiasm and perseverance of the masters as in the effort and spirit of self-denial of our students and of our collaborators. We see it in the work of our colleagues in the universities and research institutes. We see it in the determination of many among them to infuse into the social reality, conscious that they are enhancing the ideal of human justice, their innermost faith in a supreme truth. We scientists believe that we have received a portion of the marvellous heritage left us by the great men who have been our forerunners and which can still enrich us, the living, with four centuries of long and lavish traditions.

Why is our epoch, which has hardly entered into the possession of new and vast sources of energy, suffering from a sentiment of powerlessness which leads it even to the borders of despair?

Disillusioned by the experiences and prolonged aftermath of two wars, troubled in its sense of security, afflicted by a sense of remorse to the uttermost depths of its social conscience, it would seem that our generation has lost the courage and the will to believe and the desire for peace.

Men of science, we must affirm as loudly as we can that science is not only

not responsible for all the ills of the age but has also provided many of the greatest achievements of the period since the war.

Speaking in this hall I would like to remind you that the great ethical revolutions now in being, the United Nations Charter, the World Health Organization's victorious struggle against disease, the Food and Agriculture Organization's campaign against hunger, the ending of colonialism, and the same principles of international collaboration which brought about and which now animate the work of this Conference, appear to me to be just as much the consequences of the transformations which have occurred on a global scale, the perfection of means of exchange and communications and which are, just as much, reasons for hope in the future.

The vast range of subjects which comprise the programme of the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas involve, besides a certain number of fields in which it can be considered that positive results have been achieved, other questions whose study is still being developed. This is particularly the case of problems relative to hydraulic resources, to agrarian structures and to the management of forest resources, to general problems relative to nutrition and the struggle against disease, to the better utilization of human resources and for matters bearing on the instruction and training of cadres.

To all of these problems each and every nation can, by reason of the diversity of their traditions and their culture, provide a contribution equally valuable for the community as a whole.

Humanity must now realize the determinate character of the part which the enrichment of its cultural patrimony is called upon to play in humanity's immediate development. The irreversible biological evolution which has continued its course on our planet for two million years, is followed today by the hope and the fruitful possibilities offered by a psycho-social or socio-genetic evolution.

Confident in a new humanism we consider that a serene and constructive vision of the future can be based only upon a rational elaboration of reality, on a recourse to science for the solution of all the problems to be confronted and on the search for an ideology and technology that are worthy of man.

PROFESSOR BERNARDO A. HOUSSAY (ARGENTINA):

The development of science and technology is the prime influence on the structure, economy and evolution of the modern world. Science and technology are nowadays the key to the progress of any nation, for on them depend its health, agricultural and industrial production, well-being and wealth, cultural development, rank and prestige, power and even independence.

This is particularly true of the under-developed countries, which are in that position because they have made inadequate use of science and technology.

They are compelled to choose between two courses—science or poverty. Either

they foster science and its practical applications, or they will be irretrievably condemned to low health standards and economic and cultural inferiority, in other words, a life of poverty and stagnation.

Other countries which, although more developed, are not yet sufficiently advanced, will in turn have to choose between science and mediocrity.

In order to raise living standards, science and technology must constantly be expanded and improved. We must never forget that in a century and a half, science and technology have wrought more changes in the world than the efforts of all the preceding centuries.

The growth of science has been so swift and immense that the great majority of the scientists that mankind has produced are still alive at the present day, and the bulk of the great discoveries have been made in the past hundred years.

The development and progress of the world have been due to the great scientific discoveries and their application, and not, as some mistakenly believe, to political debate or events.

It is wishful thinking to try to bring about economic expansion and progress without simultaneously or previously encouraging science and technology.

Science progresses by exploring the truth, using precise quantitative methods, by observation, experiment, demonstration and criticism. It does not accept dogmas, the principle of authority, empiricism, or routine. All knowledge is constantly scrutinized, revised and improved, using no criterion other than demonstrable fact.

Scientific inquiry is carried out in a number of stages:

(*a*) *Pure or disinterested fundamental (or basic) research,* which seeks new knowledge about man and the universe without being concerned with whether the knowledge will be applied or not.

(*b*) *Directed fundamental (or basic) research,* which is systematically carried out in certain special fields, is a variation on the foregoing.

(*c*) *Applied research,* which seeks to meet immediate needs or to devise useful or essential products, e.g., agricultural, health and medical, or industrial research.

(*d*) *Development or technical implementation,* involving applied research and empirical knowledge in the use or improvement of new methods or materials in industry, agriculture or medicine.

But while the value and uses of applied research can readily be grasped and promoted, some effort is necessary to realize the importance of fundamental or basic research.

Nevertheless, it is basic or fundamental research which provides the constant flow of knowledge required for applied research in industry, agriculture and medicine. Whenever basic research is checked or reduced, applied science, technology, agriculture and medicine cease to progress and either stagnate or decline. This is made even more apparent by the fact that other countries continue to progress because of their reliance on basic research.

Fundamental scientific research is mainly carried out in the universities and national councils for scientific and technical research. It is also conducted in

official, private or philanthropic institutions, and sometimes in industrial laboratories as well.

The largest modern countries devote between 1 per cent and 2.5 per cent of their gross national income or budget to scientific research and development. Not less than 8 per cent to 10 per cent of these sums is earmarked for pure or basic research.

But it is essential that research projects should be drawn up by genuine scientists. The State must decide how much money can be made available, but the disposal of the funds must be a matter for the scientists themselves, and not the politicians or bureaucrats to decide.

Capable research workers and technicians constitute one of the main sources of wealth (or strength) of a modern country, for the success of either basic or applied research depends on their quality and numbers. This makes it essential that they should be properly trained.

It is desirable that talent should be detected at an early age, so that the most gifted students can be given a suitable training. The teaching of science at the secondary and advanced levels must be up to date, practical, individual, logical and should foster initiative and the ability to learn in such a way that they are never forgotten.

The standard reached by the students will depend on the teachers, the general approach, and the facilities available. If teaching, research and science as a whole are to progress, it is essential to train teachers of the highest calibre. It may also be helpful, if not essential, to import them from other countries.

Scholarships are an invaluable means of enabling students to find abroad the atmosphere and facilities they need, together with teachers who can provide them with an example, stimulus and guidance. But scholarship-holders must return home to strive for the progress of their own country, which formed, educated and assisted them. Countries which keep the best scholarship-holders from the under-developed countries are doing them a disservice which can only be condemned.

It has been reckoned that in some cases the expenditure incurred by the under-developed countries in training these men who later go elsewhere, greatly exceeds the amounts received by these countries in the form of co-operation or aid.

It is advisable that scholarship-holders from the less advanced countries, in addition to acquiring a basic training, should endeavour to fit themselves to put into practice what they have learned for the benefit of their country.

The social role of science is manifold. At the intellectual level, it provides us with increasingly detailed knowledge about man and the world. It also makes for sounder judgement and a loftier moral sense, as Pasteur put it.

At the cultural level, it makes it possible to hasten the spread of information and art throughout the world (printing, audio-visual devices, etc.) and to preserve them for transmission to later generations.

In the technical field, discoveries by physicists and chemists have been prodigious: electricity, aviation, space flight, communications, thermal (oil, coal), nuclear, solar, photochemical energy, etc., automation, plastics, petrochemicals, etc.

Technical progress has made industrial development possible, and has revolutionized economic and social conditions.

Improvements in health have been remarkable. Biological and medical research have in this century lengthened man's expectation of life by over 20 years. Many epidemics have been contained, while others are being stamped out.

Man has been able to engage in aviation, space flight, submarine nagivation, and to survive in both the coldest and the hottest climates. Scientists have discovered pathogenic germs, which can now be avoided or prevented (serotherapy, vaccinations, chemotherapy, antibiotics, pure water supplies, the treatment of sewage, etc.). Vitamins, hormones and the principles of sound nutrition have been discovered. Operations can be performed on the brain and the heart, and life can be maintained by extra-corporeal circulation.

But new problems are coming to the fore: the chemical contamination of the atmosphere, water supply and foodstuffs; the strain of modern city life on the human constitution; and the degenerative and chronic diseases which have become more widespread as a result of the increase in the expectation of life. Improvements in health, the sharp drop in infant mortality, the curbing of epidemics, etc., have caused an explosive increase in the world's population which raises serious and urgent problems.

Agriculture has made tremendous strides, but not all countries have benefited thereby. Such questions as soil conservation and fertility, the use of arid land and areas exhausted by erosion, salinity and alkalinity will all require a concentrated effort by science and technology, and the economic and social conditions which make them possible.

From the moral standpoint, the progress of science and technology must be used solely for the purpose of strengthening peace and brotherhood between the peoples and benefiting humanity, and never in order to oppress, harm or kill.

It is essential that these benefits should be brought as soon as possible to the greatest number of human beings.

Lastly, the more advanced countries have a moral duty to help the less developed countries. This is a universally accepted moral obligation. Moreover, in the long run, generosity of this kind ends by being beneficial and useful to the country that practises it.

The scientific and technical development of the United States, Japan and Latin America is due to the intellectual and technical co-operation they received from Europe.

There are many forms of aid, e.g., scholarships awarded by philanthropic foundations, especially in the United States; by official cultural bodies in Europe (the United Kingdom, France, etc.) and the United States (National Science Foundation, National Institutes of Health), the United Nations, the Organization of American States, UNESCO and others.

Exchanges of teachers are also invaluable, provided they are for a sufficiently long period to enable the teachers to work intensively with sufficient numbers of selected pupils, and with adequate equipment.

Economic aid is often indispensable, and many countries give it generously. The Alliance for Progress, which is due to the initiative of President Kennedy, has aroused great hopes in Latin America, which is relying upon it to help in fighting illiteracy, promoting general and technical education, and improving agriculture, health, and housing.

The Latin American countries are also anxious that the European Common Market should link itself with them, because any division or undue competition would cut western civilization in two.

Science is a supranational activity, for its truths recognize no political boundaries. Fortunately, there are close links and a genuine brotherhood between men of science in all countries. It is to be hoped that it will go on increasing and will serve as an example and a foundation for fellowship between all sections of humanity.

It is essential, therefore, that the economically less developed countries should foster and apply science and technology. Any plans for economic betterment will be futile and inefficient unless they are based on scientific and technical development, education and work. It is essential that all nations, Governments, newspapers, schools and centres of education and business should firmly grasp the fact that the only road to progress for their countries, especially the less developed among them, is to apply constantly the steady flow of discoveries produced by research, science and technology. International co-operation is essential for this purpose, and in turn it strengthens and consolidates brotherhood between the peoples.

PROFESSOR O. LANGE (POLAND):

It is the common aspiration of the less developed countries to promote their economic, social and cultural progress. This aspiration has become the major problem of present-day world economics and politics. It is generally recognized that the present division of the world into highly developed and under-developed areas and the deepening of this cleavage is fraught with great dangers. Thus the problem of development is an international issue and has to be solved with international co-operation.

The most important aspects of the problem are those of economics, science and technology. Of these three I want to concentrate on that of economics which —in a way—is the key problem. Before the First World War few economists were interested in development.

Their chief interest was that of economic equilibrium, development being thought of as taking care of itself spontaneously.

The emergence of a socialist economic system, first in Russia and recently in a number of other countries of Europe and Asia (among them in China), resulted in a new method of economic development based on conscious planning. This method proved very efficient in promoting rapid progress of previously less developed or even backward countries. In recent times planning as an instru-

ment of promoting economic development gets world-wide attention as is witnessed, among others, by the agenda of the present Conference.

This attention is not limited to countries with a socialist economic system. The countries of Asia, Africa and Latin America which have liberated themselves from colonial, semi-colonial or other forms of dependence, or are in process of doing so, look hopefully towards planning as an instrument of rapid progress. A major part of these countries has actually formulated economic development plans which serve as a basis of the economic policy of their Governments. While the type of economic and social system they wish to evolve is in many of these countries still an open question, it is commonly thought that planning as an instrument of development and progress has to be incorporated into their system, whatever it finally will be.

Also highly developed capitalist industrial countries, particularly in western Europe, are increasingly interested in planning. In some of them a certain measure of planning has been incorporated into the official structure of activity of the State, like in France, Norway, Sweden and the Netherlands. In others, like Great Britain or Italy, it is contemplated to do so. In all countries, including the United States of America, the problem of planning becomes an important part of economic and political thought. This is due to a number of causes. Needs of post-war reconstruction, of stabilization of employment and economic activity played their part in stimulating interest in planning. The greatest impact, however, seems to be that of the comparative rates of growth of the capitalist economy on the one hand and of the socialist economy on the other. The more the issue is faced in terms of peaceful coexistence and peaceful competition as well as co-operation of countries with different economic and social systems, the more economic planning will be an issue of world-wide interest.

In the less developed countries economic planning has become, at least in principle, the commonly accepted instrument of promoting economic and social progress. This is so because sufficient spontaneous forces of development are absent. Indeed, the spontaneous operation of economic forces produced stagnation and in many cases also retrogression. Planning is to achieve what the spontaneous forces fail to do. The key problem has two aspects: (1) accumulation of resources which can be transformed into means of production and means of subsistence for productively employed labour; and (2) the actual use of these resources for economic development, i.e., investment. The failure of the less developed countries to develop spontaneously is due to the absence of social conditions where sufficient private accumulation of capital could take place, and, what is even more important, due to the lack of proper incentives for large-scale productive investment. In addition to antiquated social structures, colonial and other forms of foreign economic dependence played here a major role. In consequence a situation has emerged where the accumulation of capital resources and their investment necessary to achieve a thorough "breakthrough" of the stagnant economic and social situation has to be undertaken by the State on the basis of a policy of planned economic development.

The first problem of planning economic development thus is the accumulation of capital resources. The resources accumulated derive essentially from the country's economic surplus, that means from the part of the national income above what is needed to maintain the population in good working conditions and customary living standards. This economic surplus must be carefully managed, in order not to be squandered in luxury consumption of unproductive upper classes or strata, appropriated by foreign monopoly capital or colonial and semi-colonial administrations. This is a matter of adapting the social structure to the needs of rapid economic development.

Foreign aid can play a part, provided it is used for productive investment. The less developed a country is, the greater is the importance of foreign aid. However, foreign aid cannot replace the internal accumulation effort of a country. For this it is usually too small, nor can it develop the internal incentives of economic growth which accompany the internal process of accumulation of capital resources. As experience has shown, foreign aid cannot serve to substitute for the social changes required by economic progress. Only in conjunction with a transformation of antiquated social structures hampering economic and social progress can foreign aid be really effective. Its role is chiefly that of overcoming certain bottlenecks which emerge in the process of economic growth.

The other problem of planning economic development is that of proper allocation of the investment of the accumulated capital resources (and of those provided by foreign aid). The effectiveness of the various investments is measured by the degree in which they contribute to the development of the economy. The crucial criterion is the contribution to the productive capacity of the economy. This determines the choice both of the fields of investment and the type of investments. Priority belongs to fields and types of investment which produce the greatest increase in productive power in the shortest possible time. This yields in the shortest time the greatest increase in a country's economic surplus out of which new capital resources can be accumulated. Thus the process of economic growth becomes self-sustaining and cumulative. It also allows for a gradual increase in the living standards of the population and stimulates the population's effort toward economic and social progress.

Economic development implies a technological and cultural revolution. The development of the productive power of the economy implies development of industry, where little of it was before; it implies modernization of agricultural production, where methods of cultivation were primitive and backward. All this implies a substantial development of various skills of the population; the cultural impact of it is obvious. The effectiveness of the investments made is the greater, the more appropriate the technology is to the needs of a developing country and the better adapted are the skills of the population to the requirements of the new technology. Planning the economic development, therefore, implies planning of technological development and of vocational education of the population. The cultural transformation of the country becomes an important factor in economic planning.

Economic planning thus becomes a complex task. It tends to develop into a separate science. The science is essentially economic in character. It is based on the principles of political economy which studies the economic activities of mankind in their social setting. But in addition to political economy, the science of economic planning draws upon sociology and geography, mathematics and statistics, technology and education, and many other sources.

Of particular importance are technology, scientific research and education. Economic planning, especially in the less developed countries, must be concerned with the transformation of technological conditions. Old ways of production in agriculture and handicraft are replaced by new ones, technologically more advanced. And what is more important, new branches of productive activity, particularly in industry and transportation, are opened which introduce new technologies hitherto unknown to the less developed country. The more effectively this can be done, the more rapid the economic progress, the greater the effect of a given accumulation of capital resources out of the country's economic surplus. The planning of technological development is an important part of economic planning, it is inseparable from the planning of investments.

Planning of technological development requires two things. One is scientific research on which technological development is based. Scientific research in the country's economic and technological potential is an indispensable instrument of economic planning. In particular, it is necessary to have a thorough survey of the country's natural resources: geological, agricultural, transport facilities, etc. Such survey is necessary for appraisal of the various economic potentialities and also for the proper choice of location of various economic activities. The other is scientific and technological education. This is an important aspect of the implementation of economic development plans. Such education, as already mentioned, is needed in order that investments provided for in the plan be properly utilized and also to stimulate the population's creative productive ability.

The promotion of economic, cultural and social progress of the less developed areas of the world is an international task. The world economy is a whole. The development plans of particular countries must take account of the international economic situation, particularly with regard to trade relations. Many endeavours to promote the economic growth of less developed countries have been defeated by a deterioration of the terms of trade; many capital investments made in such countries have been offset or even over-compensated by a fall of export prices. Thus the effort to raise the less developed areas economically must be accompanied by an effort to establish international trade relations on a basis which does not hinder the economic progress of the less developed countries.

Another field where international co-operation is necessary is that of economic and technical aid to the under-developed areas. If such aid is to be really effective and willingly accepted by the countries concerned, it cannot serve to maintain or establish, in new form, types of economic dependence and political

influence which broke down as a result of a disintegration of the colonial system or semi-colonial relationships. It is essential that the aid-receiving countries be able, directly and through their participation in international agencies, to ensure that the aid is used in accordance with their developmental needs and interests.

It must be kept in mind, too, that technical and scientific knowledge cannot be simply transferred from the more to the less developed countries. This has been emphasized by the Secretary-General of the United Nations in his address which has been read today. Technological and scientific knowledge has to be adapted to the specific conditions of Asia, Africa and Latin America. This cannot be done solely by foreign experts, however valuable their work might be. A decisive contribution is needed on the part of scholars, scientists and technicians of the countries concerned. In this context the cultural and intellectual advancement made possible by political and social emancipation acquires a direct practical importance.

Aid to the less developed areas is thus linked up to the world political situation. It will be the more effective, the more conform with the interests of the less developed areas, the more it can be taken out of the context of the "cold war", the less is international tension and the stronger are the forces of progress and peace in the world. At its last session, the General Assembly of the United Nations has called for general disarmament, indicating that a part of the economic resources at present used for armament purposes should be devoted to aid to the less developed countries. It is estimated that the world's total expenditure on armaments amounts to $US120,000 million per year. If of that sum, $US15,000 million annually would be devoted to aid to the less developed countries, the annual rate of growth of *per caput* income in these countries could be approximately trebled.

Disarmament would prove a major factor in solving, through international co-operation, the problem of under-development and backwardness. It would do so by setting free resources for economic aid. Not less important, however, are the indirect effects which disarmament would bring about. It would create a new climate in international relations, a climate of peaceful coexistence and co-operation, a climate in which the forces of progress would thrive in all fields. The less developed areas of the world would be the first to reap the benefits.

ACADEMICIAN E. K. FEDOROV (UNION OF SOVIET SOCIALIST REPUBLICS), VICE-PRESIDENT OF THE CONFERENCE: *

Ladies and gentlemen:

Allow me on behalf of the Soviet delegation to welcome representatives of many countries and nations present here, welcome many most prominent scientists whose works are well known throughout the world.

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* English translation supplied by the delegation of the USSR.

At the same time the Soviet delegation expresses its regret and disagreement with the fact that scientists from a number of countries have not been invited for political reasons to attend this scientific and technical conference—I refer to the scientists of the Chinese People's Republic, the Korean People's Democratic Republic, the Democratic Republic of Viet-Nam and the German Democratic Republic, the experience of rapid and successful development of which would be, undoubtedly, most valuable for our proceedings. We cannot and will not consider those people who do not actually represent anybody as representatives of the great Chinese people and its science.

We have gathered here to consider the possibilities and ways of using achievements in the field of science and technology in the interests of those countries and regions of the world which took the path of independent development.

It was a progress, a development of society on which the attention was recently concentrated. The manifestation of this attention is many-sided.

The rapid growth of knowledge strikes the imagination. The understanding of the surrounding world, of the substance structure, of our planet and universe and of the man himself is quickly changing.

The substance structure seemed to be clear for many decades. The stability of atom nuclei, being broken only as an exception by radio-active disintegration, seemed to be firm. Lenin's thesis of electron inexhaustibility seemed to many people rather a literary image. For the last 15 to 20 years there has been discovered an indefinitely more complicated picture of the matter structure.

A process of cognition of basic features of our planet lasting many thousands of years has not yet been completely finished, there are still white spots on the map of the globe. But the door to outer space has been already opened wide. For the last few years we have received a new idea of the earth's atmosphere and of the interplanetary space which is nearest to the globe. We began to understand the very complicated and original medium stretching for tens of millions of kilometres from the earth.

The approach to the surrounding nature has changed. Not long ago man used only an extremely limited number of natural resources. Some thousand years ago nobody was interested in iron-ore deposits, and only a few tens of years ago uranium was considered as an unnecessary worthless product during the process of radium extraction. Now almost all the elements of the crust are used in industry. Many types of natural resources have been used so intensively that one can see the exhaustion of their reserves.

The interference of man into the natural course of processes in nature is becoming more and more considerable. At present this interference is noticeable against natural fluctuations of the processes in nature, but the time is not far away when it will be comparable to and then will surpass natural changes.

Changes in every branch of technology are great. All of us present here are aware of them and they will be more than once described at our Conference.

And finally I want to refer to the progress of science itself. Any estimations of scientific researches show the growth in their volume by approximately ten

times for each 50 years. The very character of science changes. In the past, science progressed as a result of the unhurried and persistent work of individual scientists—talented people who did scientific work in small laboratories with the help of a small number of assistants. At present science is mainly being developed by large scientific institutions embracing hundreds and thousands of people. Huge installations—accelerators of high-energy particles, cosmic rockets and space vehicles—replaced retorts and flasks.

In the work of our Conference people from different nations and with different convictions, are taking part, but we all, I am sure, appraise identically the impetuous growth of natural sciences and their role in discovering gigantic perspectives of technological progress, gigantic possibilities of improving living conditions.

The same swift development of types of social system in the present world, maybe, is not so apparent to some part of the audience.

Some time in the past social structures were developing and replacing each other slowly. For many centuries social systems remained basically unchanged. Quite a contrary picture is observed nowadays.

A new socialist type of social relations has been developing at high rates. Less than 50 years have passed since the time when the foundation of a socialist system was laid down in Soviet Russia and about one-third of mankind has been already marching forward along this road. The socialist system is a new type of relations between people, a new type of economic and political co-operation between nations.

The socialist society has a definite, clearly determined aim and directs its development towards this aim (by the way, other social systems have no aims so precisely determined).

Socialism is striving for complete satisfaction of the growing material and cultural demands of the people by continuous development and perfection of socialist production.

The emergence of socialism has marked the beginning of the era of liberation of oppressed peoples. Tempestuous national liberation movement assumed particularly great importance after the Second World War.

This is a second significant feature of development of society in our epoch. Young sovereign States appeared in place of former colonial and semi-colonial countries. Their peoples have risen as creators of the new society and active participants in international politics, as the new revolutionary force in the world. Many of them while creating national States, continue to fight for their economic sovereignty and strengthening of their political independence. The States, which are organized in place of former colonial countries find step by step their own way of development which corresponds best of all to their interests and possibilities.

In many of these States peoples and Governments declared their intention to build socialist societies. What is the reason for this?

Evidently, the reason lies in the fact that the experience of history has proven that under socialism exploitation of man by man is liquidated, that unequality of people and unemployment disappear within the lifetime of one generation and not within the ages, and that a backward country turns into an industrially developed one. Every Republic of the Soviet Union, as well as many other countries, following the way of socialist development, give obvious examples of it.

Thus the Soviet Republics of central Asia which were once among the most backward countries in their development have now outstripped not only their foreign neighbours but also a lot of developed western European countries. For example, the production of energy in these Republics, with a population of 25 million, is four times higher than the production of energy in Turkey and Iran, with their population considerably above the figure of 100 million.

The number of students increased from 137,000 in 1918 to 8.9 million in 1962.

The rate of development of these Republics exceeded enormously the average rates all over the Soviet Union: for instance, the production of energy in Uzbekistan has increased 2,000 times while the average growth in the USSR is equal to 163 times.

Other socialist countries of the East, economically and culturally backward in the past, have achieved nowadays great progress in their industrial, agricultural and cultural development.

In the Mongolian People's Republic for instance there was in 1925 one hospital for the whole country. At present this socialist country has one physician per 930 inhabitants and 73 students per 10,000 of its population, i.e., more than in France, Japan, Italy or Austria.

What is the role of science in the development of social relations? There are various views on this subject. While some reject completely the existence of objective law in the development of social structure, the others consider the replacement of one social system by another as an unlawful and undesirable process. However, the correct understanding of the laws of history has gradually been paving its way.

Social sciences offer us the possibility to bring to light and comprehend the objective laws of historical development and realize its perspectives. They give the possibility to evaluate the role of the social phenomenon which may be small and weak at the moment of its origin but marking the beginning of a new epoch in the future. The deep understanding of the substance of social phenomena and the creation of the theory of these phenomena permitted to the great sociologists—Marx, Engels, Lenin—to evaluate in such a remarkable way the future progress of history.

At the same time in the society built on a rational basis—and such is the socialist society—science, or better to say the whole complex both of natural and social sciences, permits to calculate, plan and properly direct its development.

A good many years have elapsed since the Five Year Plans of the complex development of national economy of the Soviet Union were considered curiosities or propaganda statements. We know that at present in all States the plans of

our country and of other socialist countries are being regarded with interest and respect. Our scientists will be glad to share their experience in this respect at this Conference.

Science plays a big part in the long-term planning of the national economy. When one speaks about a plan for three to five years ahead, it is sufficient to take into account the present technical solutions: but when one considers perspective development of a country, it is necessary to take into consideration not only what is already known to science, but also, what will be discovered in the future. Our scientists faced this tremendous task while elaborating the perspective of the development of the national economy for 20 years ahead, which is an integrated part of the new programme of the Communist Party of the Soviet Union.

How was this plan elaborated? First of all the calculation was made of the development of the population in the Soviet Union. Then it was calculated how many various consumer goods, food, etc., would be needed for the full satisfaction of the demands of the population. Then the task for the development of the different branches of industry, agriculture, energetics, transport, etc., was determined. As it was stated, simultaneous evaluation of some possible results of future scientific achievements was made. Beside some key problems in the development of science, the solution of which will be especially needed for paving the way for technical progress were discovered. Thus the development of science was closely linked with the development of the society—science itself becoming a productive force.

The planning of the development of national economy is being carried out at present by many countries and especially by those which begin to build their national economy. The colonial oppression retarded their creative initiative and energy for a long time and now they have to begin from little. Therefore it is very important, it seems to us, that in the development of these countries there were applied the most progressive and effective methods of production, both large and small, and the progressive methods of the organization of the whole national economy. It is an obvious advantage to every country beginning its development at a later date. It should be used in full.

The Soviet Union stands on this principle in furnishing its equipment and technical experience to developing countries, and especially when organizing those 480 enterprises and other projects, which are being built in the countries of Asia and Africa with its assistance.

The use of advanced methods of production requires a rapid training of engineers and technicians and development of scientific and research work.

It is with sympathy and full understanding that Soviet scientists regard serious measures taken in this direction by young States. Cuba has liquidated illiteracy, greatly developed education and created a national academy of science. During the short period of existence of the Indonesian Republic the number of students in higher educational institutions has increased tenfold.

Other nations act in the same way while building their national independent States. The peoples who for ages were considered as an object of studies, as a certain material for scientific research, contribute more and more to a world science. They understand that in spite of many shortcomings and great difficulties resulting from long colonial oppression, it is necessary to provide for the development of scientific research and to form national scientific personnel, for it will help them to gain prosperity quicker than anything else. The Soviet Union renders and will continue to render assistance to the developing countries in training qualified specialists in various fields.

The progress of science and technology as well as the progress in development of social relations is directed towards speedy development of efficiency of man's labour and towards the improvement of the welfare of mankind. However, alongside the aforesaid it would be wrong to underestimate the dangerous trends of the development of the modern world—namely the trends which lead to destruction.

Modern weapons have now great destructive power.

Not long ago an arrow, spear or a bullet would kill one man and a gunshell would kill several men. Now, millions of people can at once become victims of "a shot" provoked by the intercontinental missile. The nuclear bomb is able to wipe out big towns.

The unwillingness of some Governments to agree with the real measures for disarmament and to give up the idea of war as a means to settling the outstanding problems leads to great danger for the whole of mankind.

Will it be able to overcome that danger?

We are sure that it will. The positive tendencies in the development of mankind will get the upper hand. We are sure that some time in the future a peaceful and lasting coexistence for the States with different social systems will be secured and that the competition between them will develop exclusively in a peaceful way. It is of importance not only because the other way means war and destruction.

It is also important because mankind can exist and develop only in this way. It is only on the basis of peaceful co-operation that it can successfully interact with nature and use the natural resources of our planet, which are rich but not inexhaustible.

The question which often arises is whether the main natural resources will be exhausted in the near future or not? Isn't there a serious danger for the population of the earth in this?

As it is known, some economists state that "the bomb of over-population" is a tremendous threat and may be the main one for the development of the whole of mankind at present. However we are not interested in oil, coal, certain kinds of animals or other natural resources by themselves—their amount may be larger or smaller and the moment may come when there will be no resources at all.

They don't count, but what is important is to what extent the vital needs of human society in power, food, materials, etc., are satisfied now and how they will be met in future.

Here again we see a rapid growth of *per caput* potential resources on the earth.

An example of this kind is a swift increase of the possibilities of energy production—connected with growing efficiency of energy transformers as well as due to the uninterrupted discovery of new resources.

The potential energy resources *per caput* on the earth are now some dozen times greater than 100 years ago.

The same applies to the productive potentialities of food and various materials and products.

And finally the striking progress in space research provides possibilities for an unlimited expansion of the sphere of human inhabitancy much faster than a critical situation may arise connected with the dimensions of the earth itself.

There is no danger of a scantiness of natural resources, but there does exist another danger—that is their spontaneous unorganized utilization.

It is high time for all of us to pass from the primitive "hunting" economy to a regulated cultivation of natural resources on the earth as a whole. Should we fail to do this in the circumstances of the growing influence upon nature we run the risk of wasting thriftlessly the earth's resources; we risk taking the whole complex of natural processes out of that state of mobile equilibrium in which it exists now, and to transform it into some other state that may be even undesirable for all of us.

The human society becomes such a mighty factor in the life of our planet, that already it cannot permit unorganized actions anywhere on the earth or outside it.

The beginning of the space era, which we are now going through, recalls, as it seems to me, some aspect of the so-called epoch of great discoveries.

There was, 400 to 500 years ago, a considerable acceleration in the rates of knowledge of development of the surrounding world. The ideas of the terrestrial globe changed significantly, people have learned about the existence of other continents, and about the people living in the remote areas. We now smile at naive ideas of the medieval scientists, disbelieved at that time, about the inhabitants of the Antipodes. However, will one not smile still in our life at our present ideas of forms of life on other planets?

The discovery of new continents and oceans, and the courageous cruises of seafarers represented a brilliant page in the history of human culture, but we remember that it was followed by the colonial enslavement, the capture of the territories inhabited by other peoples. No doubt it was at the same time a shameful page in the history of human society. It was at that time that the conditions were created for the forcible delay in the progress of many peoples—the conditions, the results of which we are willing to overcome.

There are some people who wish to repeat this page of history nowadays, some zealous military men dream about the establishment of military bases on the

moon, about the possibility of firing from the moon at the terrestrial targets, about the utilization of still modest successes in weather transformations in order "to direct" storms at the enemy, etc.

The scientists, however, work at the most important scientific problems not for this purpose. During 400 years the people have learned a lot.

There must not be military bases on the moon, there must not be and won't be colonial wars on the spaces of Venus and Mars, and the regulation of the courses of hurricanes, when it becomes possible, must be carried on, taking into account the common interest of all the nations.

There also cannot be success in our undertaking without peaceful coexistence of different political systems. Only with broad international co-operation will the application of any scientific and technical achievements provide rapid development of those areas of the world which are in need of it. The liquidation of the danger of a world war and general disarmament—these are undoubtedly the most essential conditions which are required for the development of any country of the world and in the first place for the countries which are behind in their development.

The past year was marked by one of the deepest international crises within the last period but at the same time it was marked by a remarkable example of peaceful settlement. Let this example open the way to the peaceful settlement of many other problems of international relations.

I believe that our Conference should be also considered as one of the elements in the struggle for peace and peaceful co-operation. Without this it has no sense.

The present state and the immediate prospects of science and technology are enough for the complete meeting of all the reasonable requirements of man in all the countries. As the head of the Soviet Government N. S. Khrushchev said in his greetings, mankind now has possibilities unseen before the creation of an abundance of material wealth, flourishment of culture, education, complete liquidation of hunger and disease in all the countries of the world within the life of one generation. It is up to us, the peoples of our countries, to put into life these wonderful possibilities.

Let those who will live dozens and hundreds of years later, with respect and love remember us—the people of the twentieth century who could have passed through with honour and wisdom one of the critical stages of human history; who could have directed all the power of the human genius to the creation and development of life on earth.

DR. JEROME B. WIESNER (UNITED STATES OF AMERICA):

Mr. Chairman, fellow delegates:

We have come here, to this Conference, drawn by a vision—a vision of what science and technology, scientific knowledge and its application, can do for mankind. Science and technology have made possible the elimination of ignorance and poverty. For the first time in history we have the opportunity to

create a much better world for all people. The great challenge of today is to see that this possibility is realized, that this promise is fulfilled. Viewed from this perspective, we are all developing countries, we are all less developed than we should be, we must all move forward.

We have come together—scientists, technologists, responsible leaders of Governments, educators, to share our knowledge and experience, to see how our store of accumulated knowledge can help all of us to move forward for the benefit of all of our peoples.

Ours is a unique period in the life of man. Other ages have produced their marvels; former eras have made great strides in science and technology. But none can approach our own in the pace of achievement, and none can approach our own in the pervasive application of the scientific method to the solution of our problems.

We are caught up in a vast process of change, for good or ill. The resolute will of our nations to direct the course of change to mankind's benefit was reflected in the Decade of Development resolution adopted by the sixteenth General Assembly of the United Nations. Our task here is to explore ways in which science and technology can contribute towards reaching that goal. Those of us who have come here from the United States realize that there is still much to learn about the development process, and development institutions. We approach these questions in the spirit of free inquiry and the scientific method. We come to explore and exchange ideas and experiences, to narrow our own areas of ignorance, and to find ways to reach the goals we share.

I am, however, convinced of one fact; that we do not fully appreciate the possibilities inherent in the application of present-day research techniques—the tools of science—to the problems of the less developed countries. Whether the problems be technical, economic, social, or political, we have today powerful and effective tools of analysis and study that have only begun to be used properly. We have powerful new techniques of analysis to assist planning and to help identify the factors limiting growth in a given region; and we have the scientific capacity to develop new techniques, new devices, new understanding to circumvent those limitations; we need the determination to apply modern techniques of research and development in this task with the intensity now being employed in the fields of atomic energy, space and electronics. We need to find the means to attract more of the world's best scientists and engineers to these challenging problems.

Secondly, I would say that of equal importance is the attitude and approach we take to economic and political development. Here, too, I believe we have a major lesson to learn from science, and it is found in the concept of experimentation. In the physical realm we have learned that it pays to conduct experiments, that the reward when a solution is obtained can be great, that it can return a thousandfold the cost of the experiments. It is man's ability to learn through experimentation that has made possible the advances of science and

technology and that makes possible the application of those advances to the needs of all societies.

More deliberate application of the experimental approach of scientific research to national development programmes would be very rewarding. We would learn to try more variants of a promising scheme. Most important of all, we would learn not to be dogmatic in defence of efforts in need of change; we would learn to be sensitive to possible improvements, and we would learn to keep the individual trials to the smallest size consistent with effective experimentation.

With this attitude toward experimentation in the development process, the efforts of many lands can be made to reinforce each other. Incidentally, the advantage that comes from large numbers of independent experiments comes rather automatically in our society. The recent increase in the family of independent nations will provide, for all, opportunities for national trial and error, which should be mutually stimulating and productive. Let us hope that this Conference serves to underscore the tremendous potential of such collaboration.

I want to use my opportunity here today to talk about the development of truly modern education and its importance in harnessing science and technology for development.

My thesis is a simple one: first, we must educate our peoples for modernization, for living productively and happily in the modern age; and second, to do this effectively, we must apply to education itself the tools of research, experimentation, and the team approach already applied so effectively in other fields.

One of the challenges of modern education is to realize the promise of science and technology, while avoiding the parallel opportunities for its abuse and misuse. If we are to succeed in doing so, not only our technical experts and our leaders, but the citizens of our countries, must be educated to understand the implications of modern technological advances for public policy towards the broad issues of security, peace, and welfare.

Society today is in an evolutionary state, in which each advance of our knowledge of the natural world has a series of consequences, frequently unforeseen and probably unforeseeable in detail. For example, one consequence of the automobile not written in the original specifications is the congested city. Improved health measures may mean a greatly reduced mortality rate, but without accompanying improvements in agricultural methods or the industrial base, they may result in greater impoverishment. Widespread use of nuclear energy for industrial purposes may provide an answer to some problems of development, but as we can already see, it may also pose the serious problem of contamination of our environment.

Each of these advances therefore poses new problems and new challenges, forcing man through science and technology to make hard choices as to how he will use his technical advances. The wiser and better informed these decisions, the more chance we have of moving towards better social conditions and of avoiding the fate of the dinosaur.

I do not want to minimize the problems of transfer and adaptation of technology from one culture to another. Indeed, as I have already indicated, the variety of cultures offers opportunity for experimentation in the application of science and technology to development. With the increasing number of independent countries, we can have a variety of experiments with new approaches to old and new problems.

The problem of transfer may indeed work both ways. I have not attempted to differentiate up to this point between the more and less developed countries for, in fact, all countries are faced with the same need for wise application of science and technology to solution of their problems. Many of the presently less developed countries have an opportunity to leap-frog the problems and patterns encountered in the economically advanced countries. This age is newer than many of us realize; we should not commit the error of copying old ways that are being replaced by new ones. Many new countries have the opportunity to experiment and produce something better; in the older countries we should like to be in the position of being able to copy their innovations. For example, the communication satellite will soon be available and in many situations will be superior to present techniques for internal communications.

It is obvious that an adequate level of education is an absolute prerequisite to enable any society to incorporate new ideas and attitudes into its development process. But a more subtle and exciting observation is that education itself can benefit from the application of research.

Here the needs are monumental in all countries and the field ripe for the kind of systematic research and development *on the educational process itself* that has only recently begun.

I have become convinced that if we pool our best efforts dramatic improvements in teaching and learning are possible. I can speak on this subject with some feeling. We in the United States have come to realize that our educational system has not kept pace in the way we feed necessary with the world created by scientific and technological advance. Accordingly, a number of the scientists and technologists in our universities, who heretofore have limited their efforts to traditional fields of research, are now applying the methods of organized research and development to education, not only in the universities, but also at primary and secondary levels. As a result of their initiative over the past few years it has been demonstrated, repeatedly and on a grand scale, that educational quality in our schools can be vastly improved. I am firmly convinced that the same methods can be applied, taking account of given variations, to greatly improve and speed the development of new educational systems.

One aspect of the effort to improve educational quality is the development of new aids for teaching. The blackboard and the textbook have done good service for half a millenium, but that does not mean that the presentation of information cannot profit from a little re-design. In these experimental programmes we are beginning to make new use of media that until recently have been the province principally of the entertainment industry—film, tape, records.

radio and television. And we are also experimenting with teaching devices of an entirely novel character—new methods of instruction and new types of apparatus, not to replace, but to enrich the work of the teacher, the indispensable human factor in education.

Our scientists and technologists also are working on curriculum structure and content. They are seeking to ensure that fundamentals are taught; that the information presented is up to date, accurate and in perspective; and that the method of teaching and the content impart the excitement and challenge of the subject to the student—whether he is a potential scientist or mathematician or technologist, or one who will pursue other occupations.

Although our experience has so far concentrated on science and mathematics and foreign languages, we are beginning to extend this approach—to the teaching of social studies, history, writing, literature, and also the practical arts, in order to develop the skills necessary for work in the new industries and in the new agricultural enterprises.

The preparation of first-rate curriculum materials in a subject is a complex operation in research and development. It requires the use of teams of workers from a wide variety of backgrounds. The teams comprise not only the outstanding masters of the field, but also outstanding teachers at the appropriate levels, specialists who have conducted significant research on the learning process, and technicians such as artists, photographers, laboratory and shop workers, who can help in devising new methods of presentation.

Like research and development in other fields, the creation of new educational techniques also requires a large and genuine testing component. New curriculum materials are not made generally available until they are demonstrated to work in the classroom, in an experimental process that can involve many schools over several years.

What are the implications for the less developed lands for this growing experience in improving educational quality? The spirit of innovation, the team approach, the development of new media and techniques, and classroom experimentation would appear applicable to new and old countries alike—with the added advantage for some countries that they are starting relatively fresh in facing their educational problems.

This new approach to education could make possible a massive attack on the problem of illiteracy, from which so many of our countries suffer. To attain basic literacy, as well as scientific literacy, true co-operation is in order. There is no rule saying that the citizens of one country—experts in subject-matter and experts in new teaching devices—cannot work with the citizens of another country in developing new materials. People with distinct kinds of special experience may also be necessary on the teams. There may be problems of special frames of reference, for example, exploiting local flora and fauna in a biology course or, to cite a more subtle problem, teaching experimental science in a culture that traditionally deprecates manual labour.

In some cases, especially in mathematics, some of the curriculum materials already developed might be useful directly in other lands. In fact, some efforts for such transfer are already under way, as are some efforts to use teams made up of people from many countries to develop new curriculum materials.

There is one aspect to improving educational quality which dwarfs all others: the preparation of teachers to teach the new courses—both the retraining of teachers now teaching traditional courses, and the education of new teachers. A large number of teachers is needed and so is a large number of teachers of teachers. But if we are willing to experiment a little in finding more efficient ways to prepare people for both tasks, it may not necessarily take generations to build up a large supply of skilled professionals. Many of our colleges and universities have set up special institutes to retrain teachers, both in short summer programmes and academic year programmes. In some schools we have tried establishing a kind of internship in education, an arrangement under which the new teacher works for a period of time under the supervision of a master teacher. We are also making use of local broadcasting facilities, using both taped and live programmes, to help teachers on a week-by-week basis in using new instructional materials.

To conclude, I believe that educational development must go hand in hand with scientific and technical developments. I venture to suggest that recognition of interrelationship—the wholeness of the development progress—will be the clearest perception we gain at these meetings. We will find that isolated technical projects, however worthy by themselves, do not add up to development unless they fit into an integrated national effort—that there is a role of the development process for all branches of science and technology, for all of the academic disciplines represented here today. And we should have, by the end of our meetings, a better sense of priorities—a closer identification of those problems most in need of technological attention.

If these things happen, then the United Nations specialized agencies will gain better guidelines for orienting their own programmes to the identified needs of the developing countries—for almost all of them already are deeply involved in technical assistance in support of the development process.

Furthermore, the members of the United Nations will discover in this Conference new ways to bring technology more directly to bear on the problems of the developing areas—and new requirements for additional research.

I hope that we will also, in the course of our discussions, think through our common needs for new institutions which can bring to bear the resources of research and education in the development process. We have a beginning in the resolution adopted by the last session of the General Assembly, which requested the Secretary-General to study the desirability and feasibility of establishing a United Nations institute, to be financed by public and private voluntary contributions, to undertake research and to assist in the training of personnel for United Nations operations. We have also noted with keen interest the proposed establishment of an educational planning institute in Paris which will be

supported by six sponsors including UNESCO, the World Bank, and the Ford Foundation. Surely these efforts should proceed in close relationship with each other: perhaps we should explore the need for and feasibility of an international institute concerned with all aspects of development, to work in close association with on-going efforts in the many existing outstanding centres around the world dedicated to education and research for development.

Through such institutions and programmes, through co-operative efforts, we can move forward toward the goals of the United Nations Decade of Development—surely the most challenging and constructive undertaking man has had the vision to begin. Here is a new dimension for international co-operation in which all can contribute to the solution of problems common to us all, old countries and new, all in process of development, all learning, experimenting, progressing together.

# ADDRESSES DELIVERED AT THE CLOSING PLENARY SESSION

THE RIGHT HONOURABLE LORD CASEY (AUSTRALIA), VICE-PRESIDENT OF THE CONFERENCE:

This Conference has been one of the greatest expositions of science and technology on a wide front that has ever taken place, and we must be most grateful to all those who have contributed to its success.

Many lessons have emerged for us all. Speaking in the briefest terms made necessary by the time factor, there must be increased co-operation between developed and less developed countries, in an effort more quickly to diminish the economic gap between them.

This calls for an effort on both sides, and by the United Nations and specialized agencies. First, the developing countries should be assisted where necessary, to establish their own scientific and technological organizations in close association with their national planning machinery. They must also be assisted to train their own scientists and technicians. Without this they are unable to take full advantage of what the more developed countries can offer. Secondly, the developed countries must be ready to do still more, and to make more sacrifices to spare highly qualified people. They must also gain a closer understanding of the true needs and special problems of the developing countries. They must avoid imposing preconceived ideas based on their own experience or their own interests. Thirdly, the United Nations and the specialized agencies must achieve a better co-ordination and rationalization of their technical assistance activities. It is clear that there should be some central machinery in the United Nations Secretariat to assist developing countries to decide which of a dozen instrumentalities is best suited to assist with a particular problem of development. We can be sure that increased funds will be provided only by Governments if they can be assured that competition and overlapping is reduced to a minimum; and this still has to be achieved. In considering the follow up of this Conference we look to ECOSOC to make a renewed attack on that problem.

Another relevant matter is the problem of financing more international aid which may well be called for as a result of this Conference. Even if the machinery is improved this problem will remain, and it is a formidable one under the present system of international payments. Many of the countries that provide the bulk of the cost of international aid are suffering from, or threatened with, balance-of-payments problems. Any country, however large and prosperous in its internal economy, has to watch carefully its international balance of payments. If its international outgo substantially and consistently exceeds its international income, there is trouble ahead, and the stability of its currency is threatened.

That part of international aid that is spent abroad is an important part of the international outgo of some of the great countries.

However, I ask the question whether some reform could be introduced under which the transfer of funds for strictly international aid purposes would not penalize the balance of payments of the giver and so menace its currency? I cannot believe that this problem is beyond the wit of man. Its solution would be greatly to the benefit of mankind, and would provide an impetus to the high purpose of this Conference.

In conclusion, Mr. President, let me say that this has been a very valuable Conference. Without a forum such as this, it would have been difficult to make the world aware of the highly important place of science and technology in the economy of every country, and the difficulties that stand in the way of the developing countries in this field.

My own country, Australia, will be glad to offer such co-operation as is within our resources to our friends in other countries to whom it may be thought to be of value.

At a later stage there should be a review of the progress made. Whether by holding another conference or otherwise, we must ensure that developing countries are more fully represented in that review.

And finally Mr. President this Conference has demonstrated a high degree of friendly co-operation between the more and the less developed countries. A number of personal friendships have been made that I am sure will be of lasting value to our respective countries in the future.

DR. J. W. T. SPINKS (CANADA), VICE-PRESIDENT OF THE CONFERENCE:

Mr. President, fellow delegates, ladies and gentlemen:

May I first of all express the pleasure of the Canadian delegates that they were able to take part in this unique and highly successful Conference. We have valued the opportunity of meeting with delegates from all over the world. We feel that they are now our friends.

Canada has participated actively in the many assistance programmes of the United Nations and its specialized agencies concerned with the problems of the developing countries. Our experience in the Colombo Plan has brought us into intimate touch with their problems and aspirations. In some areas at home we are ourselves still in the process of development, and our own history helps us to view with understanding the many and complicated problems facing the developing countries. Settlers arriving in my own province of Saskatchewan at the turn of the century saw only the windswept prairies grazed by herds of buffalo, but now we have farms, roads, towns, schools, hospitals and libraries, and even a large university which has attracted over 400 students from abroad: from the West Indies, India, Pakistan, Nigeria, Ghana and Indonesia.

The Canadian delegation feels that any programme will be of little permanent value if it is not accompanied by a strong system of scientific and technical

education in the recipient countries. This should be at all levels, from the early introduction of science in the elementary schools through the secondary and technical schools to universities and research institutes. There is often a great lack of science teachers. We feel that teacher training colleges should be set up as soon as possible in the countries themselves but that, in the meantime, dedicated teachers should be encouraged to help in the training programme. A number of students will continue to train in the more developed countries but this should be directed as much as possible to the higher levels of study.

Canadians are noted for their down-to-earth approach. They can therefore be of particular help in setting up surveys of soil, timber and fish, co-operatives, farm training programmes and the like. They can also be of assistance in fields where they have special experience, such as railroad transportation and nuclear technology. All this, of course, depends on the resources available and on constructive bilateral and multilateral arrangements. We would look forward to a strengthening of the present United Nations system, to improvements in the co-ordination between the various agencies which are now doing such useful work, and to a considered determination as to how the gaps in our existing structure of international co-operation may be filled.

Today the range and scope of problems arising out of the relationships of Governments and nations gives a new content and meaning to the traditional forms of diplomacy. The holding of our Conference is a mark that in the twentieth century these relationships encompass a far wider field than at any time in man's long history. The contribution that science and technology can make towards the creation of "one world" has been reflected in specific terms in the scope and depth of the subjects we have considered. We have learned at first hand of the many lines of action in which the United Nations and its family of institutions are playing an active part. We must now pause to assess and evaluate what has been done, what is possible, where the first priorities lie. We must then move ahead with all the means—including science and technology—available in this very imperfect but most exciting world where every sunrise is a challenge that, before the sun sets, each of us will have shared in solving what are clearly common problems. And in taking up the challenges that face us, let us remember that "It is not the beginning but the continuing of the same until it is truly finished that yieldeth the true glory".

H.E. FERNANDO GARCIA OLDINI (CHILE), VICE-PRESIDENT OF THE CONFERENCE:

Mr. President:

It would be premature today to attempt to make an inventory or balance-sheet of what the Conference has achieved in its 14 days of work.

In spite of the limitations of time it has been able, notwithstanding, to clarify, to complete and to develop the ideas expressed in a most impressive number of monographs, through *sui generis* discussion in which without going into polemics, various doctrines, ideas, suggestions and techniques have been raised, naturally,

with some points of disagreement, as also with areas of agreement. Undoubtedly the elimination of all references of a political nature from the discussion has contributed to this. Perhaps, the theme which has made itself most felt through all the points of the agenda has been the reference to the need for planning for the future and for making use of all available scientific and technical resources, and on this basis to work out gradually and systematically the economic, social and cultural development of the peoples and the happiness of the individual.

It is here that we have most clearly perceived the diversity of the thinking and the divergent appreciations of the values at stake—and which, sometimes, jump beyond the limits of ideologies and doctrines and go to the very roots of the matter.

Here, one speaker has stated that planning is more of an art than a science, while another has maintained that planning is, without any doubt, a science based on exact mathematical principles. Between these two extremes we can place all the other conceptions, possibilities, alternatives, and speculations which have all found their expression in the debates.

Looking back, it has been possible to appreciate that the situations which we are trying to remedy and which are included in the term "development" are extraordinarily varied and that each one of them represents a particular problem and should be considered separately.

The large number of scientists and technologists who are dealing with these problems and are trying to work out development plans seem to be concerned mainly with peoples which have just attained freedom, or which are maintaining their traditional primitive way of life, or which are still organized in feudal or tribal societies. In consequence, not enough attention has been given to the considerable group of insufficiently developed countries, which, as I said at one of the specialized sessions, do not possess any of these characteristics but which are not on the same level as the fully industrialized countries.

This is a defect which could be brought into proper focus by means of a more refined instrument. This would make it possible to deal with cases according to their particular characteristics; to decide, for example, how statistics should be used, when regional planning is appropriate, when recourse should be had to a central organization and when preference should be given to a particular sector.

The developing countries will then feel that their problems are being dealt with in a direct, concrete and practical way, and not as a part of a general scheme.

By its objectives, its complexity, the multiplicity of its fields of action and its procedures, the Conference which has just ended, cannot be compared to any other. Lack of precedents has forced it to make a road through unknown territory and this has exposed it, inevitably, to errors. But its mistakes have been small; they can be corrected and they will not be obstacles to the continuation of the endeavour that has been begun.

We must take into account that, as I said before, we are trying to open a new

road, which is an extremely difficult one and on which we have not yet learned how to drive. It is for the United Nations, in conformity with the wish of the developing countries to decide the best means of going forward without hesitation and without stopping until the final goal is reached.

PROFESSOR JOSEF LUKÁS (CZECHOSLOVAKIA), VICE-PRESIDENT OF THE CONFERENCE:

Mr. President, ladies and gentlemen:

It is a great honour and pleasure for me to speak at the closing session of this Conference. Sixteen days overfilled with discussions at more than 81 sessions and many informal meetings have proved that our endeavours were not in vain. I think we come once again to the conviction that science and technology are extraordinarily important factors in the development of human society. Therefore our opinion is that the application of science and technology has specific, essential and vital importance to the developing countries.

We have listened with great pleasure to a number of stimulating and interesting scientific and technical reports confirming the high level of science and technology of the present day. Human genius created an immense potential for economic, social and cultural progress. Our discussions have shown that the utilization and application of this knowledge depends on the present situation and future development of political and social conditions in each developing country and in the world as a whole.

There is no doubt that the developing countries are in need of tremendous financial and material means. We therefore take it as a logical result and real effect of our meeting that all the scientists taking part in this gathering have reached the conclusion during the meetings, that they must appeal to the Eighteen-Nation Committee on Disarmament to accelerate their deliberations in order to reach the positive conclusion of general and complete disarmament as fast as possible. Thus, huge resources would be made available for the sake of a fast and over-all development of the less developed parts of the world.

It has also been made clear that we cannot be satisfied with performance of the important task of international organizations which consists in assisting the developing coutries in their over-all development problems. We believe the respective United Nations bodies consider incentives and ideas presented by the delegates at conference meetings. We believe as well that they take appropriate measures towards a more efficient and better co-ordinated utilization of their means and potentialities. What we consider to be the most decisive effect of the Conference is that it was made sufficiently clear once again that the creative efforts of the developing nations themselves are the cornerstones for their future development. We are all aware that those developing nations are descendants of ancient and creative cultural traditions to which the brakes were applied by force in past centuries. We cordially welcome and fully support the efforts of developing nations in political, economic and cultural independency

to enable them to employ up-to-date scientific and technological knowledge and to contribute towards the over-all development of mankind as a whole through scientific work of their own.

Should the deliberations of the Conference help towards the desired consciousness and application of basic factors in the development of the developing nations, we may say with satisfaction that in both our roles as men and scientists we have made a sufficient contribution towards the efficient utilization of science and technology for the benefit of developing nations. In this difficult and highly responsible work, we, Czechoslovak scientists, have always devoted our efforts and will even multiply them in the future.

PROFESSOR HENRI LAUGIER (FRANCE), VICE-PRESIDENT OF THE CONFERENCE: Mr. Chairman, gentlemen:

As I had the honour of taking the Chair here at the General Session of this Conference on human resources, I hope you will not be surprised today at this closing session, if I draw your attention to the heart-searching the work of this Conference has forced on us and which has made us everywhere aware of present-day problems in a particularly acute and uncomfortable way.

In this heart-searching, the first point of which we become aware is this: I personally have always felt humiliated when representatives of prosperous, strong and wealthy countries have boasted of spending a few per cent of their national revenues on assistance for the rapid development of the outcast and destitute countries—assistance which is an act of mere human solidarity. We scientists who have each of us embarked on vessels over which we have no control, we at least have the right and, I believe, the duty of saying publicly that, in aiding the under-developed countries, the industrialized countries should not only give away their superfluity or their surpluses, but they should be ready to deprive themselves and give until it hurts. They should be ready to share with the outcast countries the last rags of St. Martin's cloak.

And the second point of which we have become aware is that if in this world, hundreds of millions of men, women and children are still living an existence which is unfit for the name of human, in a state of malnutrition which borders on famine, under abject conditions of housing and clothing, victims of diseases which we know to be avoidable, shut out from their fellow men by illiteracy, this is because the United Nations, after 18 years of growth, is not yet strong enough, nor powerful enough, to get all the Governments to work together for an effort of solidarity, to which all the peoples are ready to agree, for the relief of destitution everywhere and to hasten everywhere the development of a modern civilization in the service of mankind. That is to say that everywhere there should be an effort to increase the authority and the intellectual and material means at the disposal of the United Nations Organization.

And another point: circumstances have led to our Conference sitting practically side by side with a certain Disarmament Conference. I believe that all those who are here present are only too well aware that it is not possible

to talk about financial difficulties and reduce or limit material assistance for the under-developed countries when the great Powers, which, on every possible occasion, ask the international institutions to avoid overlapping and duplication —when these great Powers are spending, each of them, each year and at the same moment, for research on the same objects, billions of dollars. I believe that we scientists, we can and we must resolutely declare that among the problems of this Conference there can be no financial problems. There are only problems of opinion, of decision, of choices on the stormy summits on which the future of the world is being worked out.

And a fourth point: among all the problems which are being presented to all men everywhere for securing the progress of the developing countries, the one which has practically absolute priority is that of training. There will be no real independence for these young countries until they have set up themselves in their own country with all the assistance and good will available, an *élite*—a governing scientific, technical and administrative *élite*—capable of taking in hand patriotically and with all the risks implied, the destinies of their young countries. The old and ancient countries will not have fulfilled their duty to these young countries until they have done all they can, and with complete disinterestedness, to create these leading national *élites*. And finally, one last point. In the course of our general and specialized sessions and in meetings between individuals it has become evident, I believe for all, that a planned organization of the economic development of the world cannot be carried through by putting side by side in a crazy mosaic local nationalisms, in little countries, in small, middle sized, big, rich, poor, arid or wet, fertile or sterile countries, created by the hazards of geography or the chances of history over the land crust of the world. Planning, if it is to be at all effective, can be considered only through co-ordinating study and action at first on a regional and then on an international scale. And in conclusion, I should like to make to you the appeal, the appeal my successor at the Institute for Economic and Social Development is making to his international students. What is our task? Our task is to feed men, to care for men, to liberate the slaves.

PROFESSOR S. D. PUSPONEGORO (INDONESIA), VICE-PRESIDENT OF THE CONFERENCE:

Mr. President and honourable delegates:

It is exactly 16 days ago that we convened for the first time in this historical and palatial conference hall to discuss the role and the challenge of science and technology in our joint effort to provide a better living to all the peoples of the world. Out of the maze of new ideas, novel techniques and creative suggestions as presented to this august gathering there has emerged, I think, the principle that the human endeavours in science and technology and subsequent international co-operation will succeed only through an effective exchange of scientific knowledge and technological know-how. Therefore, it is essential to bear in mind that the pursuit in science and technology being an effort of all of

us belonging to the Family of Men cannot be but a two-way traffic between the economically advanced and the newly developing nations. If the theme of this timely Conference is to have any meaning at all, I submit, sir, that this principle should underlie all future deliberations and actions in making science and technology benefit the whole of mankind.

Furthermore, in all our searches towards the application of science and technology the present Conference has revealed that there are certain areas which the newly developing countries will have to decide for themselves. To take just one of the many examples at hand: it has been suggested that to obtain full utilization and optimum development of a country's natural resources it is mandatory to create a situation in which private, particularly foreign private, investment will have a maximum opportunity. On the other hand, it has also been indicated that a sustained growth of the national economy can be materialized only through a complete nationalization of all means of production.

These two recommendations, sir, we cannot accept as standard prescriptions for national development. I believe that this is one of the areas which we of the newly developing countries will have to determine for ourselves within the framework of our respective socio-cultural settings, national needs and objectives.

This Conference, sir, will become a milestone in men's creative endeavours to reveal the blessings of our universe if an effective follow-up is designed as expressed in the memorandum signed by newly developing countries. In this memorandum the delegations of these nations have called for "more ample United Nations services and an appropriate international machinery, including the possibility of establishing an agency . . . to ensure the permanence and continuity of United Nations efforts in the effective application of science and technology for the benefit of developing countries".

It is heartening to note that the Conference has been conducted in the spirit of the message of President Soekarno in which the pursuit in science and technology is viewed as a reflection of our common determination to restore human dignity.

In conclusion, may I have the privilege to express on behalf of the Republic of Indonesia our highest appreciation to all those who have made this Conference a success and to the Government and the people of the Swiss Confederation for their hospitality. In particular to you, Mr. President, I submit our highest regards and respect for your wisdom and intellectual integrity in bringing this Conference to a meaningful end.

Thank you.

H.E. JEAN PORQUET (IVORY COAST), VICE-PRESIDENT OF THE CONFERENCE:

Mr. Chairman:

I must ask you to let me read you a message from Mr. Houphouët Boigny, President of the Ivory Coast Republic, to the Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas.

This is the text:

"The Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas is about to come to an end and I do not want it to bring its meetings to a close without letting it know what great hopes it has raised in the developing nations, since it is becoming ever more obvious that human progress in every State is linked to the development of science and technology. The convening of this Conference was a particularly happy initiative and I very much hope that it has been able in its meetings to lay the basis for mutually advantageous technical co-operation between the nations of the world, on the basis of the respect for the sovereignty of States, and without indulging in fruitless political or institutional polemics which cast doubts on the work of the Governments they have chosen. In these conditions, the Republic of the Ivory Coast is ready to give every help in promoting efforts for improving the living standards of the peoples and closing the present gap between conditions of existence of the nations of the world. It is convinced that this Conference will not be forgotten in the history of mankind and that it cannot fail to have valuable results which will mark a new stage in the development of international co-operation."

After reading you this message from the President of the Republic of the Ivory Coast, I want to go on to say how valuable I feel this unique Conference has been. It has brought together scientists and technologists of the developed and developing countries and they have been able to compare and discuss their experience in a particularly friendly and constructive spirit.

The needs of the developing countries are undoubtedly considerable; but it is indispensable for the peace of the world that the disparities between the developed and developing countries should be brought to an end and only full and honest technical co-operation can remedy this state of affairs. By honest, I mean assistance given without political *arrières-pensées*, without any idea of interfering in a country's internal affairs and without unnecessary criticism or overhasty judgements on the acts of the leaders the country has chosen. I am alluding in particular to the remarks made in some of the papers presented to the Conference and likely to cast suspicion on a whole group of States which do not need to take lessons in patriotism from anyone. I will not labour this point but would prefer to turn to others more likely to be more useful for co-operation in science and technology.

It seems to me indispensable that we should think of some kind of reorganization of the present agencies or organs of the United Nations if they are to be in a position to cover all the fields of science and technology necessary for the development of the countries concerned. This reorganization should provide in particular for better representation of the developing countries on the integrated teams of specialists from different sciences which could work on multilateral plans of scientific and technological development. These bodies should work while respecting the independence of the State and integrating their plan with the general development plan of each country. It seems, moreover, desirable that

full consideration should be given to the existing regional inter-governmental organizations which should be able to assist the United Nations and its specialized institutions in making regional plans without unnecessary delays.

An important point should not be forgotten: I mean the development of the scientific and technological institutions of these countries and the training of the scientists and technicians who alone can make them able to take an active part in their own development.

I will end these brief remarks by saying how glad I am that this Conference has been so successful, not only in the useful exchange of opinion, but in showing the requirements of the developing countries and the possibilities of international technical co-operation.

I hope that in this field it marks the beginning of a new and important era—the era of the harmonious development of the human race. I would like, in conclusion, to congratulate the Chairman and the Secretariat for the perfect organization of this Conference which has so largely contributed to its success.

Thank you.

PROFESSOR SHIGENORI HAMADA (JAPAN), VICE-PRESIDENT OF THE CONFERENCE:

Mr. President, ladies and gentlemen:

It is my firm belief that the progress of science and technology is indispensable for the social and economic development of the modern world and that the past can be liquidated only through science and technology. This is very important in the establishment of new States and in the reconstruction and rehabilitation of less developed areas. Especially is it true in the case of a country like Japan where the land area is small, the natural resources poor and the population excessive. We often call the development of science and technology the development of the "initial process". Ever since the Second World War, and especially in the last decade, Japan has been making every effort to promote science and technology. In order to promote the cultural and natural sciences for the benefit of the whole nation, we have established the Japan Science Council, the Science and Technology Agency and other organizations which measure and promote basic research and its application in every field of science. Nowadays, in my country not only is a great deal of research undertaken by the Government but also resources for laboratories operated by industry have been incomparably more developed than before the war, and the number of colleges and universities, governmental, public or private is nearing five hundred.

As you all know, Japan is exporting transistor radios, tape recorders and so forth. Some people say that Japan is a highly developed country but you might rather say it is a country which is developing very rapidly. In my opinion Japan should not be content with the present circumstances and I am aware of the fact that many problems still remain to be solved and projects to be executed. In this sense I think Japan can be said to belong to the developing countries.

Mr. President, what I should like to point out here is the reason why Japan has made and is making such remarkable progress. First, there has been an

accumulation of various potential energies ever since the sixteenth century. Among them you can mention not only capital, but also the diligence, co-operative spirit, and management capacity, etc., of the Japanese people. Secondly, to this we must add the rapid expansion of our system of universal education which has been achieved since the beginning of the development of the country some 80 years ago. The percentage of illiterates in Japan is now one per cent of the whole nation. It cannot be denied that the spread of education became the cause of our high industrial level and contributed much to the implementation of modern science and technology.

Thirdly, we cannot overlook the assistance given us by certain advanced countries in the very difficult post-war years—without them the present development of Japan could not have been realized in such a short period of time and we are very appreciative of those foreign countries.

Mr. President, I feel it is a great honour for my country, as well as for myself, to have been selected to speak by the President of this historic Conference. At the same time, it is even more pleasing and encouraging that I was able, at formal and informal meetings or through private contacts, personally and directly, with representatives of both developed and developing countries, to obtain their open-minded opinions on the pressing problems of their respective countries. Thus, I became aware that all the countries of the world were a community aspiring to intensify international collaboration in order to overcome their inequalities through mutual assistance in science and technology.

In Japan there is a proverb: "seeing is believing". Whilst present at the Conference I realized the truth of this proverb. I am convinced that the countries providing technical assistance must send their representatives to the under-developed countries if they are to understand the magnitude of the task facing them.

In conclusion, ladies and gentlemen, I would like to add that if you come to Japan, you will be most welcome.

H.E. EMILIO CALDERÓN PUIG (MEXICO), VICE-PRESIDENT OF THE CONFERENCE: Mr. Chairman, ladies and gentlemen:

The Conference, which has kept us here in Geneva for the last two-and-a-half weeks, has gathered together the most eminent scientists and technological experts from all quarters of the world and enabled them to exchange views and discuss each other's opinions and experience.

We have been working very hard, with firm faith in the future of mankind, on a new form of international co-operation for the better organization of humanity: we want to give the under-developed or developing nations, who have come here convinced of the real and sincere co-operation of the powers which have preceded them in the development of, and the full enjoyment of, all the goods of this world, a sound basis for their future development. As far as the meeting and the discussions in Geneva are concerned, our Conference has

now reached its end, but the future is still open to us and the contacts we have made here, will help us to make an ever-growing reality of international co-operation.

The terms of the Conference do not allow us to put forward resolutions or recommendations. Perhaps this is just as well, for its views can then come unanimously to the controlling organs of the United Nations and we can make positive, properly co-ordinated plans about the task of future co-operation of science and technology for the benefit of the less developed regions.

My delegation, Mr. Chairman, would like to express its appreciation for the ease, the ability, the high sense of impartiality and humour with which you have directed the work of the present Conference.

We would like also to thank the eminent scientist from Brazil, Dr. Chagas, who has put all his talents and capacities into preparing the Conference and who has also been helping us in our work, and we would further like to thank all the members of the Secretariat who have helped to ensure the success of this meeting.

Before I sit down, Mr. Chairman, I would like to mention a particularly important event which has occurred in these last few days.

The scientists gathered here have sent an appeal to the Disarmament Conference, which the representatives of 17 nations are now attending in this very Palace, asking it to put an end to nuclear testing in order that we can carry out our own task satisfactorily. I am in full agreement with this appeal, Mr. Chairman, and, in fact, to be perfectly frank, I feel that this appeal is the *mea culpa* of science which has created these vast forces of destruction. I am convinced that if this appeal is to have its full effect, the scientists who have signed it must go back to their own countries and their own homes with the firm intention of working for a real and creative peace. If the scientists, who have helped to create this monster that menaces the whole of mankind, do not mobilize public opinion in their own countries, if they do not contribute to combating the attack on mankind constituted by the atomic tests of the great Powers, they will not have kept faith with the appeal to the Geneva Disarmament Conference. I sincerely hope, gentlemen, that this *mea culpa* is the starting point of an active campaign to mobilize public opinion in all the countries represented here to end, once and for all, all atomic testing and in consequence the armaments race which is at the present time preventing science and technology from being put at the service of the human race.

Thank you, Mr. Chairman.

PROFESSOR J. C. EDOZIEN (NIGERIA), VICE-PRESIDENT OF THE CONFERENCE:

Mr. President, your Excellencies, ladies and gentlemen:

When a journalist interviewed me in the course of this Conference, he asked me whether I had observed any revolutionary changes in my country during this decade. I had not thought of this before and so I briefly surveyed the changes which have taken place in my country during the last few years.

Many new buildings, better homes, more schools, many more cars, more electricity but nothing really very striking, only a gradual transformation as far as the physical outlook was concerned. But then I realized that there has been one truly revolutionary change in the people themselves. They have become conscious, they believe in individual worlds and they yearn to become part of that change.

The revolutions in agriculture and industrialization are the key processes which will bring about the change that my people expect. This Conference has become an important factor in the very close interrelated reactions, which can help to produce this change.

First, it has stimulated the scientist in the advanced countries to examine critically his relation to his community and to assess more clearly than ever before, his role in the rapidly changing world scene. He must integrate himself and his work more closely with his society—he must dedicate himself to the task of harnessing the full resources of his own country and of creating a more efficient organization, for the effective utilization of external scientific technical assistance.

Secondly, it has surveyed in broad perspective the needs of the developing countries and served to draw the attention of scientists from the more developed countries as to how they can help individually and collectively to close the widening gap between the standards of life of the two groups. This Conference has posed to scientists from the advanced countries the challenge and question: can a group, so obviously powerful and so obviously idealistic, continue as onlookers in the world scene? We know from our meeting that the answer is in the negative and we hope therefore, that as a result of this Conference they will consciously strive to become a more effective force in spreading the source of technological advance more uniformly throughout the world. This very important task can no longer be left entirely to the realm of international diplomacy.

Finally, while emphasizing that the United Nations agencies constitute the most effective system for channelling international technical assistance without "strings" and without infringing on human dignity to which the peoples of the developing countries have a legitimate claim. The Conference has shown clearly that the existing machinery is not only not fully effective but is inadequate in measuring the means of the developing countries. The machinery needs to be examined and to be completely overhauled and this Conference has acted as a catalyst to accelerate this internal change.

This Conference has therefore been a truly remarkable occasion. It has already had its repercussions on its three elements, the scientists in the developing countries, the scientists in the developed countries and the United Nations agencies, which are the three vital factors for technological progress in the less developed countries. Governments are the links between these three factors, and scientists, apart from technological development, have a moral duty to exert their influence on Governments for the benefit of all humanity. The peoples of the developing countries have become deeply conscious of their existence in a rapidly changing

world and earnestly desire to become part of that change. It is my hope, and indeed, my conviction that this Conference will prove to be a highly significant milestone in the history of international action towards the fulfilment of this natural desire.

In closing, ladies and gentlemen, I wish to add my personal thanks and those of my country to our President and our Secretary-General for their invaluable contribution towards the success of this historic Conference.

ACADEMICIAN E. K. FEDOROV (UNION OF SOVIET SOCIALIST REPUBLICS), VICE-PRESIDENT OF THE CONFERENCE:

Mr. President, fellow delegates:

It seems to me that our Conference has done a good job by the mere act of presenting to the entire world, by demonstrating to the entire world, yet again, all the importance and all the vast scope of the problems of the developing countries. The gulf between the level of production in different countries, the chasm between the level of prosperity in different countries, has not opened up overnight. Neither did it open up because some countries are poor in natural resources, nor because their peoples are somehow incapable of adapting themselves to science or technology. No, we know that many developing countries possess very rich natural resources, and the achievements of their ancient civilizations still fire the imagination. It is clear to us that the peoples of these countries are poor because their natural wealth, and the very labour of their people, have for a very long time been used to serve the interests of other countries, who built up their prosperity on this basis. And whereas, earlier, during the period of colonial domination they could not tell the world of their needs, today, when they have won their political independence, they will not and cannot tolerate any longer low standards of living or obsolete economic systems. The time has come to change the situation rapidly. And this, I think, is the main problem of the developing countries.

Can this problem be solved? Yes, it can. The potentialities of science and technology, which today stand at the disposal of the whole of mankind but did not exist earlier, here speak for themselves. In the many hundreds of papers submitted to our Conference all these possibilities have been examined. This can be seen from the experience, the practical experience, of the rapid development of backward regions in many countries, for example, the Soviet Union, particularly in Central Asia, and some of the socialist countries in the east and the west.

This, too, was propounded in hundreds of the papers submitted here by different scientists. This problem can and must be rapidly solved within the lifetime of a single generation. What is needed to solve the problem? Word has gone round of new institutions within the United Nations family, but I do not believe that another thousand international civil servants, who would begin to take up this work, would provide the solution to this problem. To my way of thinking, the main thing is that the peoples of the developing countries should have full control of their natural resources, and that they should be able to use their

own manpower to improve their well-being. It seems to me, that the achievement of full economic independence is extremely important. For this, it is essential that they apply the most advanced and most efficient methods in both small-scale and large-scale production. For this, it is equally necessary—and this has been shown in a large number of papers submitted to our Conference—that the training of their own resources of experts and scientists should be at all costs speeded up.

Of course, funds also are required; and alongside the total mobilization of the domestic resources available in each country, there is a need to attract resources from abroad. And those countries which, in the past, built their own prosperity on the exploitation of the natural resources and manpower of the less developed countries should be the first to provide such help. A different contribution to this work has been made, and will continue to be made, by other States; and the Soviet Union, which has never turned to its own advantage the resources of the developing countries, is providing, as everyone knows, considerable assistance in this field.

We scientists have gathered here in order to discuss the many questions of the application of science and technology. The time has long since passed when scientists lived secluded in the ivory towers of their laboratories, taking no interest in the outside world. Today, when science is exerting an enormous influence on life, scientists appreciate their responsibility for the ways in which their knowledge is being applied. No wonder that hundreds and thousands of eminent scientists throughout the world are fighting for peace, are fighting to remove the threat of a devastating war, are fighting for co-operation between the nations. And the Soviet scientists attending our Conference have enthusiastically supported the appeal, which originated in our midst, addressed to the Eighteen-Nation Committee for the speedy discontinuation of nuclear tests and the solution of the problem of universal and complete disarmament.

It seems to me, too, that the problem of the developing countries must become, not simply the professional concern of those scientists who are directly interested in it, but the great common task of all progressive scientists in the world. Soviet scientists have learned much at this Conference and are grateful to their colleagues for the experience they have gained here. We now understand the problems of the developing countries better. We deeply appreciate all the feelings which our colleagues in developing countries are experiencing, because we ourselves went through the same difficult times a few decades ago, times of backwardness, want and illiteracy for many of the peoples of the Soviet Union.

All that is now far behind us, and we are firmly convinced that these problems can be solved quickly in any country. I imagine that our colleagues from the developing countries who are present here, realize now that today nothing lies beyond man's reach, provided he makes intelligent use of his powers, and disposes intelligently of his own fate. We wish warmly all our colleagues success in their great and difficult endeavour and assure them that our knowledge and our experience will always be at their disposal.

H.E. SALAH EL-DIN HEDAYAT (UNITED ARAB REPUBLIC), VICE-PRESIDENT OF THE CONFERENCE:

Mr. President, your Excellencies, fellow delegates, ladies and gentlemen:

At the close of this undoubtedly successful Conference, I should like to hammer out some salient points. This Conference is only a beginning, and I would like to urge that many others follow. It has made possible a mutual exchange of experience in which the delegation of the United Arab Republic has honestly and objectively played its part respecting the two aims of national independence, and international co-operation, within the framework of the United Nations. Its deliberations have involved many principles which are in line with our national experience and which call for continued international action. The first is the principle of giving first priority to the development of human resources. The second is the principle of accelerated development, which can take place only through world-wide scientific co-operation. The third is the principle that every developing nation should participate positively in initiating this world-wide movement. Science and technology are no longer the concern of a few leading Powers. These principles today are more valid than ever before and, in particular, the principle that development is a total integrated process calling for continuous attacks on a broad front. The Conference has intensified our realization of the magnitude of the problems which remain to be solved, after adequate research carried out on the spot, by indigenous institutes, co-operating within the framework of the United Nations. Indeed, it would be fatal to belittle the size of the problems and the magnitude of the task that remains to be done. We cannot ignore the direct and varied repercussions of science and technology on the social and economic conditions and stability of the less developed countries.

Then there is the principle of effective international action within the framework of the United Nations. With the reorganization of the large number of existing agencies the Conference has expressed the need for a fresh approach to United Nations action in that field. This can be done only if you are open-minded enough to consider all possibilities for more effective international machinery, including that of establishing an agency for science and technology.

Mr. President, this was not meant to be an academic conference. Therefore, it is natural that it has given rise to a general consensus of opinion in favour of such action. The developing countries represent more than 40 per cent of the nations taking part in this Conference and more than 70 per cent of their population have been fully represented in the memorandum submitted to you, Mr. President, by their representatives including myself. In the name of these aspirations, and in the spirit of the United Nations Development Decade we are earnestly looking forward to an ever stronger United Nations machinery. The United Arab Republic is willing to put forward all its possible potentialities in order to realize this noble aim. This is in addition to the scientific, educational and economic aid that we are already exchanging with other developing countries until the idea achieves realization in the form of actual functioning machinery.

Needless to say, the United Arab Republic is willing to consider open-mindedly all possible measures for supplying international co-operation under the auspices of the United Nations. We have to take the measure of the past; no half-hearted measures are sufficient to meet the task of the United Nations Development Decade, we have to muster up enough courage and vision to convince the others of the proper action to be taken. History has proved how thoroughly we are in agreement with the spirit of the decade.

In conclusion, allow me, Mr. President to speak of my sincere admiration for your able leadership. I should also like to take the opportunity of thanking the Swiss Government, Mr. President, and the Secretary for the biggest conference ever to be held in Geneva, and lastly I would like to thank the Secretary-General and his staff for the work he has done.

SIR WILLIAM SLATER (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND), VICE-PRESIDENT OF THE CONFERENCE:

When I was told that I was to speak for a few minutes at this final plenary session, the task of giving my impressions of the Conference in so short a time seemed almost impossible, but as my mind travelled back over the events of the last 18 days, there emerged certain clear highlights against the general background.

The first amongst these was the change in the character of the Conference itself as it took shape in the hands of the delegates. Our President and Secretary-General wisely gave the necessary freedom for this self-expression, whilst retaining the essential control over the general proceedings. For this, amongst many other things, we all owe them our gratitude. There have been larger conferences, but there can have been few, if any, which covered as many widely diversified fields, linked only at a first glance through a common humanitarian and economic objective; the application of science and technology to alleviate the lot of the less fortunate.

Before we met, some might have claimed that a number of smaller conferences would have equally served the purpose, been easier to arrange and administer and more satisfying to the specialist. The wisdom of bringing together men of many interests has, however, in the result been more than amply justified. In no other way could the complexity of the problem facing a less developed country have been brought home to us so forcibly. In only such a conference could we have been made aware of the interactions between the diverse forms in which science and technology can be applied. The agriculturist attending sessions on road building, the industrialist on education, the health expert on the problems of urbanization, men with widely different interests drinking coffee together; such new contacts if they are followed up will in future make this Conference memorable as a landmark in the application of science in ordered development.

As the Conference has progressed, I have become more and more convinced that the originators of the Conference had this objective in mind. Wisely they

did not state it, but left it to grow as a natural outcome of bringing so many different interests together.

In some ways this Conference is the heir to that at Lake Success in 1948 called by Mr. Trygve Lie (UNSCCUR). The major differences lie in the wealth of experience which has been accumulated since then, in the better understanding of what is required for the orderly scientific development and in the active and often outstanding participation of the delegates of the developing countries at this Conference. They have been comparatively few in number but high of quality.

But perhaps for me the most valuable part of the Conference has been the chance it has offered to renew and enrich old and to make new friends. Long talks outside the formal meetings have enabled me to understand much better the difficulties which face the delegates from countries where there is much leeway to make up. Many of their difficulties might never have occurred to me. As a result, I shall return home better able to explain what the less developed countries are really needing. If, as I confidently hope, my country will be making more funds available both for bilateral and multilateral aid, this Conference will have helped the less developed countries to formulate their needs more precisely and my country to respond to these requests with a better understanding of the problems involved.

There is no doubt that this Conference has given a great impetus to the work before us. This impetus we must not lose, but equally we must take time to consider the best means of applying science and technology to the developing lands.

DR. WALSH MCDERMOTT (UNITED STATES OF AMERICA), HEAD OF UNITED STATES DELEGATION TO THE CONFERENCE:

Mr. President, members of the Conference:

Mr. President, my delegation congratulates you and Dr. Chagas on the grand job you have both done for this Conference. Today marks my first appearance as a listed speaker before this Conference and this is as it should be, for like all of us I came to this Conference to learn. To be sure I have not learned all the facts and all the papers of this Conference, but neither have I read all the books in my university library back home. In neither case does this dismay me, for I have long since found that I have much to learn, that I am still learning and that when I can know what I did not learn today, it is that much easier to get at it tomorrow.

This is true of the student in the university and it is true of would-be delegates of this Conference which in a very real sense has been a replica in miniature of a university. These are affairs of the mind and at the end of this Conference as on graduation day at the university, the faintly cynical question of: "What did you get out of it?" betrays an ignorance of what the learning process is all about. Thus, I cannot pretend to give a tightly reasoned analysis of the process or the relative values. This will have to await another day. But what I can do

is to report my immediate impressions—impressions largely based on what I have been told by the many delegates here—those from the highly developed and those from the less developed countries.

Indeed, the most vivid impression of all is the truly extraordinary young men who have played such prominent roles here in virtually every delegation from the newly developing nations: these young men who have expressed themselves so well and with such great good sense in Spanish, French or English, although for many their public language is not their native tongue. You ask for hope. We have received here the finest hope of all in these young men and it is from what these young men have been saying here that I have gained most from my impressions.

They recognize that if the Conference has been broad, it is no broader than the problem and that this is something that cannot be avoided by immersing oneself in a single narrow technology.

Thus, if this Conference has done no other thing, it has totally demolished a notion that there is some single magic approach, be it capital transfer or education, that is the major answer to it all.

No industrialized country has the whole answer for the societies starting on the pathway to modernization. Science and technology are tools, useful tools, wonderful tools, but they are not absolute tools by which a nation can be built overnight.

The glamour of such instruments as atomic energy is giving way to realistic and knowledgeable judgement as to what science can do and what science cannot be expected to do. At least in the immediate future.

We have heard that science and technology cannot be transplanted ready made, and that there must be scientific and technological institutions in the receiving countries. We have heard that we must constantly review the existing international machinery for the application of science and technology in the development process and, what is more, we have heard that we must develop new systems, a multi-national effort to fulfil the needs that the United Nations can identify and define but which it cannot do itself for lack of funds.

To arrive at a consensus that development is whole, that the pattern of development is unique for each country, that science and technology are essential but have no inner magic, that national institutions are needed to receive international aid and that flexibility and adaptability are required even of our youngest national institutions. This is a formidable accomplishment of the intensive course we have been receiving here in the crowded days behind us. To me these are convincing truths from a welter of facts.

One final word. We must move fast and we have learned here that people can adapt to amazingly rapid change so long as they receive some human support in the process. Well, we are talking about human beings and let it never be said of any of us going forth from this Conference that we have used science and technology so clumsily, as might happen in any family anywhere, that a father's whole experience becomes totally without meaning for his son.

DR. CARLOS CHAGAS (BRAZIL), CONFERENCE SECRETARY-GENERAL:

We have come to the end of a journey, a journey in the course of which the hopes and expectations of the peoples of the world were united with the object of achieving the goal of comprehension and co-operation for which this Conference stands.

My first words must be words of gratitude towards my colleagues, scientific secretaries, executive and administrative associates, and all the personnel who have striven to make my task an easy one, and who have by their zealous and diligent work made possible this task which seemed to me at the outset an insurmountable one. Without their help I would not have been able to achieve anything. I would also like to thank especially, Dr. Thacker, our President, for his constant support and understanding.

During these days of the Conference we have come face to face with the problems with which development has to grapple; but we have also been able to measure what some countries and some international organizations have already achieved. These efforts are at times extremely moving, and if the results, regarded as a whole, are uneven, all that has been presented at this Conference strengthens the faith that we need to further our task.

At the present time, the problems which under-development brings into focus represent the most direct peril to our world, one might even say to our civilization proper; they constitute a universal preoccupation in which national rivalries, the antagonism of political systems and the egotism of certain privileged classes have no place.

We have concentrated our efforts on a free interchange of ideas, on the presentation of the most diverse views, and on the desire for achievement in such a way as to make this Conference a milestone not only in the Development Decade but also in the social evolution of mankind. What is the essential objective of this extraordinary initiative of the United Nations if not to free the largest part of the peoples of the world from the bondage of poverty?

There can no longer be any doubt—and the work of this Conference confirms our view—that this goal can be achieved only when science and technology are put to the service of man in order to enlarge and improve the methods whereby nature can be controlled and the world transformed. This will be to bring reality to the dreams of Francis Bacon who, more than 300 years ago, foresaw peace and prosperity reigning in a society where science would be applied to the service of men.

It was for this purpose that our Conference was brought into being. Its primary objective was to establish a record of achievements, failures, technical advantages and scientific short-cuts by which the nations of the world would be able to realize in the shortest possible time the progress they desire so ardently.

It has frequently been argued that this Conference was too vast in scope, in fact encyclopaedic. Surely, such an argument betrays a misconception of its aims. As a professional scientist I have so often heard the contrary argument

in criticism of the congresses and conferences which I have attended. How specialized they were. How could we reach an understanding in a world where economists are incapable of understanding economists, physicists incapable of understanding physicists, and one mathematician speaks a different language from another, and all are remote from the masses which represent 80 per cent of the world's population?

To inaugurate the Development Decade, the United Nations desired to organize a conference for the application of science and technology for the benefit of the developing countries; its purpose was clearly not to arrange a meeting for specialists but one in which competent men from various specialized fields might come together and pool their knowledge so that, in a cross-fertilized way, a better study might be made of the various problems which are encountered in the developing nations, and the solution of which is indispensable if the tempo of peace and prosperity is to be increased in the world.

It is proper to point out—if only to obviate a similar situation at future conferences of this kind—that unhappily the participation of the less developed countries was not as large as had been expected. Remedial measures are of course open to the ruling bodies of the United Nations. However, the quantity of scientific papers presented by developing countries and, as a matter of fact, their quality, as well as the active participation in our meetings of their delegates present in Geneva, have made a substantial contribution to our proceedings.

The mass of problems which were evoked in our sessions was truly immense. We might indeed have been overwhelmed had we not, at the same time, given heed to the voice of those assuring us that scientific solutions have in so many instances served to overcome obstacles which seemed insuperable and to point to solutions without which the future would indeed be sombre.

It is my firm belief that development is essentially an *état d'esprit*; I would even say it is a mystic conditioning of our people, and I feel that one of the goals achieved by our Conference was to establish this common aim within the international community. At the same time, every one of us coming from the less developed areas must try by persuasion, propaganda and constant effort to convince our fellow countrymen, and in particular the so-called ruling classes, that development is the *mot d'ordre* of our times, and that accordingly they must yield many of their privileges so that our nations may achieve the objectives which the masses have the right to attain.

This calls for an enormous effort, both at the national and the international level: bilateral and multilateral agreements must be urgently increased. Having heard the unanimous expression of the under-developed nations' desire for international aid free of political attachments, let us remember the words of Paul of Tarsus addressed directly to the more powerful countries: "Those who sow in parsimony, harvest in parsimony, but those who sow in abundance, harvest in abundance."

It was natural that the state of anxiety which haunts our days should have its repercussion in our Conference. This explains the impatience of many of

the participants who look upon development not as a far distant goal, but as something to be attained forthwith, a target of immediate action, even on the part of our Conference. We have to act and act fast. If we fail to do so our hopes and our dreams will vanish into thin air. Humanity risks being involved in the chaos represented by misery and destruction.

I am nevertheless convinced that this Conference establishes the first important step on the way to achieving the immense task we have set before us.

This is a great endeavour: to ensure a better distribution of riches, social justice and happiness for every inhabitant of the earth. This is indeed a noble task to which every citizen of every country of the world must contribute.

Before drawing conclusions from our debates, and noting some of our more important findings, I should like to suggest that faith and hope were born from our debates: it has been quite apparent that the problems set by development—even though they may present seeming differences when the time element of social evolution is disregarded in our appraisals—are quite similar in nature and that past experience can afford rational guidance.

We have seen that development is a complex and dynamic operation, which can be approached only through the mobilization of the total resources of every nation and through the co-ordination of many disciplines and activities. We understand clearly that none of us may consider his special field to have a greater significance than the furthering of development.

As an outcome of our discussions, it seems to me that one problem of the developing countries which has undoubtedly a very high priority is the problem of agriculture (including, in the foremost place, agrarian reform, in which the work of the Food and Agriculture Organization and its Freedom from Hunger Campaign is making itself felt) and health, for no individual can be employed to advantage, whatever the activity, unless he is physically prepared for it. Hence an equilibrium must be achieved between agricultural development and industrialization before we launch any large-scale programme of massive industrialization.

Looking back to the past, I may say, without any false pride—I am not speaking as a physician—that beyond any doubt one of the domains in which mankind can acclaim its scientific achievements is that of preventive medicine.

This is the lesson that stems from the campaigns for the eradication of malaria, for mass vaccination against yellow fever and poliomyelitis, from the fight against bilharziasis and the triumphs over tuberculosis, syphilis, leprosy, from the control of African and American trypanosomiasis: all the immense tasks to which the World Health Organization has contributed so largely and which I evoke here merely to cite a supreme example of the application of scientific methods for the benefit of mankind.

Global planification is seen to be the first step in development, and it follows that the question of priorities is one of the first each Government has to tackle. From this choice will depend the destiny of less developed nations; it will determine the fate of new countries confronted by the dilemma of true independence or subjection to what I may term technological colonialism.

One of the main conclusions emerging from our Conference is that the most urgent aspect of development is the increase of human resources, and thereby the adequate preparation of man to live a community life. Great efforts have already been made in this direction by nations and international organizations, but excellent though they have been, they have achieved only a small fraction of the appointed task. As in the case of Prometheus, this effort has to be renewed, if not enlarged, day by day.

To increase human resources is a hard and difficult task, but, as was stressed so often during the Conference, every such increment represents the finest investment for economic development. Clearly, one of its most important aspects must be the training of technical cadres. We have heard from the majority of representatives that this is a task to be undertaken on a national scale, organized and developed on the spot, and I wholeheartedly endorse their conclusions. I should in particular like to dwell upon certain salient aspects.

First of all, must we not voice our gravest anxiety when we hear that 700 million adults are illiterate? The alphabet has to be given to them, not only so that they may envisage a fuller participation in the social life of their countries but also, as a duty, to enable them to attain a status compatible with human dignity in the modern world.

Paraphrasing Mahatma Ghandi, who, by the humanity of his objectives and by the simplicity of his life, symbolizes all our hopes, I venture to say that men cannot be happy until the day when "every man has a bowl of milk in one hand and the alphabet in the other".

I am disturbed also by the inadequacy of the universities in the underdeveloped countries—and I am speaking particularly of those belonging to the region from where I come. They have failed to understand what is expected of them and instead have become enslaved by traditions and obsolete methods. Nevertheless, it is from these institutions that there should come the new synthesis of science and sociology so much needed in our present world, and it is for them to establish the lines on which the dynamic process of social and human evolution has to expand, a process which would stagnate if kept in the rigid hands of Governments, political parties and social cliques.

It is necessary constantly to emphasize that the nations should find the essential sources of the scientific and technological progress which is so much needed in the realm of the universities which are fully conscious of their social role. They must also help in creating the best conditions for development itself. This requires a transfer of information and "know-how", but this transfer will have no significance if it is not adapted to local conditions. The science and technology developed in the receiving country have an important role to play in this adaptation. They will command respect for local conditions and an understanding of the sociological, ethnic and historical problems which characterize the conditions of each country.

I need hardly state that I am not now speaking of the unjustifiable privileges maintained by the egotism of certain classes and clans which had, as its effect,

that in the renewal of the social structure, the pathways chosen, though not always the best, were the only possible ones. The introduction of scientific methods in new countries may present some difficulties because of the international character of science which often leads the scientist and the technologist to forget that culture, on the contrary, has a national character. This is an integral part of the life of a nation, and indeed virtually essential to its survival. Hence, in the introduction of new technical methods, it is necessary to adapt them to national conditions, and never to seek to apply an inverse procedure.

This would demand of the teaching centres a special attention to the social sciences so that the problems of international co-operation may be approached in a way permitting of the establishment, in the not too distant future, of the ethics of national involvement, already present to the minds of progressive and free people. Failing this, there is reason to fear that the mutual involvement of nations may serve rather to increase than to reduce tension.

Among the social sciences, I feel the lack of an important discipline, which might be called the discipline of development. In fact development responds to the co-ordination of so many different scientific activities that its progress depends on the elaboration of its own methodology, and of a doctrine whereby a balance may be struck between the different sciences. It seems to me that the creation of an international institute for development, a free forum where every opinion might be heard and every point of view debated would be a great step towards the achievement of our aims, and it is my opinion that this is a new task which could be carried out by UNESCO.

One of the most important problems connected with the training of cadres is the introduction of science at the lowest possible school level. It is indeed inconceivable that in many societies which, by their position, dominate the world, a purely classical education still prevails. However, in many developed countries new curricula have been established in which science has its normal place. From this experience, pilot projects have been experimentally undertaken in the developing countries. These trials may be the short cuts needed to increase the number of scientists and technologists. They have to be pursued notwithstanding the opposition of antiquated pedagogues. The cause of development demands a revolution in the methods of education. But the need for the training of personnel is also felt in the field of workmanship, and we must intensify in every way the policy of training skilled technicians. This is a task which should certainly be the responsibility of the International Labour Organisation. Another point which has been stressed repeatedly in our discussions is the need to integrate women fully in the social context of our life. They have to play a dual role: as much in a professional capacity as in their classical role. In my opinion, every woman should have a basic professional preparation at the same level as men. They are an asset essential to social development and the less developed countries should pay the greatest attention to this fact. The Director of ILO said that even development could be measured by the degree of woman's active participation in the national life of a country, or at

least by the degree of her emancipation. I would merely add that, in my view, this participation cannot be measured solely by economic indexes, for one should never forget the contribution of enthusiasm, understanding, and comprehension which a woman may bring to a man's life, and this is but another form of her contribution to the growth of a nation. However, I should add that the emphasis put on the *local* development of human resources should not make us renounce completely the exchange of research experts, a system which has hitherto represented the usual source of science and technology for under-developed countries. Notwithstanding the many problems which this interchange has produced, and which were frequently mentioned during our debates, I think that, if supported by the national policy which I have outlined, the system may become more fully effective.

There can be little doubt that the multiplication of regional centres, of which a large number have been established by UNESCO and other international agencies, represents a great step towards the improvement of technical cadres. These centres have the advantage of utilizing existing resources, and they are able to co-ordinate the efforts of various nations.

Another great task is to use more widely the mass communication media. Educational broadcasting and television are still at a formative stage in many countries where they could play a role of primary importance. Looking daily at the antennae reigning over the shacks in the slums of Rio, I wonder when the day will dawn when material progress will be truly devoted to the improvement of the human condition of our people. The programme which UNESCO has already initiated in this context is well worth developing.

Next, I would touch upon a related subject with which this Conference has dealt. It is one which, by reason of its gravity, cannot fail to preoccupy each one of us. The demographic expansion of the world has given rise and will continue to give rise to problems of a moral and social character. To these are added vexing economic problems and problems of agricultural production. This general subject has been freely discussed at our Conference, but none of us can be surprised that anything approaching a unanimous conclusion has proved possible. The drift from the countryside to the towns, which is a closely related matter, poses questions of extreme importance which the less developed countries must surely tackle without delay if they are not to be confronted with a situation in which the swamping of their towns by the mass exodus from the countryside leaves them face to face with a problem that will be wholly insoluble.

To conclude this part of my address, I would express the view that only intensive action in the training of technical cadres will enable us to produce the geologists and geophysicists capable of recognizing our natural resources; the engineers capable of providing us with transport, building new aircraft, designing new machines and furnishing new forms of energy resources; the specialists in electronics able to introduce into our activities the advantageous use of computers and new forms of telecommunication; the sociologists to cope with the problems of rural socialization and urbanization; the public health specialists,

the economists and all the scientists and technologists whose services we need. A short remark should be made here. It refers to the initiative mentioned by the representatives of UNESCO about the creation of an Institute for the Training of Scientific Administration, a laudable but hazardous undertaking, which deserves our attention in spite of the difficulties it will encounter before it can be properly carried out.

The problem of the increase of human resources is thus a major part of our preoccupations. Let me say that another problem concerns the transfer of information which, to be effective, needs to find a national structure capable of absorbing it, without risk of disturbing what I may call the national ecology.

And then one of the problems present in our minds relates to the financial implementation needed to achieve development. It is a truism that development implies huge investments. In this domain we have to unite all our efforts, if not to circumvent the danger, at least to understand the data which harass us and lead us to the border of despair. When we see that 80 per cent of mankind is in a condition of indigence if not of misery or starvation, the voice of free men must rise above any national pride and ask for peace based on disarmament, the only salvation for mankind in the atomic age. Thus the great resources of every nation, now unhappily devoted to the acquisition of weapons of destruction, would be used at the national as at the international level for the building of hospitals, scientific institutions, centres for technical training employed on the exploitation of national resources and the creation of new methods of production, used for the eradication of endemics, a rational industrialization, the elimination of illiteracy, leading towards all goals allowing man to enjoy his human condition without fear for the morrow.

This requires from every one of us, of every race, ideology, creed and nationality, a sustained effort, blended with persuasion, perseverance, humility and tolerance, which is not always easy to undertake but is nevertheless of extreme importance.

However, and this I say with utmost emphasis, let us not wait for disarmament before undertaking all the initiatives we have focused on development, because, and I say so in despair, disarmament may be long in coming, and I believe that any progress achieved in the way of development will be an effective step in favour of world understanding and thus towards disarmament.

Another point which emerges from our discussions is the desire not to see this immense effort crumble away but, on the contrary, to see it pursued and reinforced by a continuous and aggressive action able to transform into reality all the expectations and projects we have discussed during the past fortnight. Many opinions were heard on this during our debates. Many of them reflected ideas already expressed on other occasions by the less developed countries. Their sincerity, their desire for progress and their wish to expand certain programmes of international co-operation voiced the ideals of many of the less developed countries. For all those reasons, their suggestions cannot be ignored, they must

be explored and the solutions they propose should be carefully judged on their merits as well as in regard to their weak points.

This is what the United Nations certainly proposes to do. It will renew its efforts in favour of development by strengthening the activity of the specialized agencies, to whose work, in my personal capacity, I would like to pay a tribute of praise, and also by promoting the studies needed to emphasize their role in the field of development.

It has been suggested during our discussions that a committee should be established to study the implementation of the ideas emerging from our work. This might be achieved as a central organization or within one or more of the specialized agencies. It is not for me to pass judgement on the wisdom of this suggestion, but I cannot refrain from saying how much I have learnt in meeting with groups of experts. This was my privilege and my experience when I took part in the Scientific Committee to study the effects of atomic radiation, the World Health Organization's Advisory Committee for medical research, and, during the organization of this Conference, the Scientific Advisory Panel and the Scientific Advisory Committee of the United Nations. I have seen how these expert groups can really prove a source of important and collective scientific thought and thus perform an important scientific task for our days.

Let me elaborate on some thoughts expressed on the occasion of the birth of the atomic age by John McMurray: "Science is neither good nor bad; it is the men who apply it who are."

They tell us that our hopes and our aspirations would be valueless if in our task the moral and ethical values did not command the scientific and technological methods which are no more than instruments for use in furthering social progress, human justice, the liberty of the individual and a spirit of understanding among the peoples of the world.

Let us never forget that the real objective of development is the man; *l'homme tout entier*, in the words of François Perroux. That means, as many of the delegates have expressed it, other factors besides purely economic ones, for the human factor has to be considered and appraised in development. If we fail to do so, development may remain an abstract notion and all our efforts will bring only more power to the powerful and more riches to the rich.

The human being, it is true, has to eat, to work, and form an integral part of his community but, at the same time, he must defend those individual prerogatives which establish his human condition, in which his everyday worries equally with the dramatic moments of his existence, must be compensated by the fulfilment of happiness.

Centuries ago, before the anxieties of our modern days existed, and when we could not find dwelling under the same roof the illiterate and the man able to cope with the mysteries of quantum mechanics, a true human being, a poet and a philosopher gave us this advice which I quote from Sophocles:

"When men lose their joy, I do not believe they live: they are just animated bodies. You may store up in your house whatever pleases you, the most

splendid riches, live in the magnificence of a king: but if joy does not prevail, all this cannot buy you the shadow of smoke in comparison to true happiness."

In dealing with our unsparing task and trying to build up the ideal city of Thomas More, let us not forget the words of one of the great thinkers of the Hellenic civilization.

MR. PAUL HOFFMAN, MANAGING DIRECTOR OF THE SPECIAL FUND, ON BEHALF OF THE SECRETARY-GENERAL OF THE UNITED NATIONS:

## A VITAL DIMENSION OF CO-OPERATION FOR MANKIND

Mr. President, ladies and gentlemen:

One thousand eight hundred and thirty-eight papers ago, 95 meetings ago, 250 film showings ago and countless speeches ago, United Nations Secretary-General U Thant, regrettably unable to be with you, sent a message of greetings and good wishes to the participants in this great Conference. He has followed the proceedings of this Conference with the deepest interest, and he has asked me to express his congratulations on your very fruitful work. May I add, on behalf of the heads of all the agencies in the United Nations family, and on behalf of the Executive Chairman of the United Nations Technical Assistance Board as well as myself, our own thanks and deep appreciation. The Conference will undoubtedly be remembered as an important event in the unfolding of the United Nations Development Decade as well as in the history of the United Nations as a whole.

We are now living in the midst of the most revolutionary period ever known. Forty-five new countries have won their independence since the end of the Second World War. But the two revolutions which are likely to leave the greatest impress on this twentieth century are the "revolution of rising expectations", which is taking place throughout the less developed areas, and the revolution of modern technology and science. It is a fortunate coincidence that these last two revolutions are taking place concurrently, because if it were not for the revolution in technology and science there would be no hope that we could meet the rising expectations now filling the hearts of half the world's population.

The United Nations Special Fund, of which I have the honour to be the Managing Director, has the responsibility first of assisting the developing countries in finding out what physical resources they have, and second of helping them to establish training institutes of various kinds so that their own nationals may be taught to make effective use of those resources. The Special Fund to date has committed $US88 million for resource and industrial surveys and feasibility studies, $US53 million for applied research institutes, $US103 million for advanced training and technical education and $US7 million for development planning institutes.

We are well aware of the contributions science and technology have already made to the process of bringing to light the physical resources of the low-income

countries. I could give many examples from our experience in the Special Fund alone. One is that of aerial surveys where contemporary methods—steadily being improved—can already compress into one decade soil, mineral, water and transport investigations that, by methods that were standard a generation ago, would have taken a century. This is but one of the marvels of our age. Another exciting new instrument for discovery is the peaceful atom. Among the many applications of radio-active isotopes, medical diagnosis has been greatly aided, new accuracy is being brought to ground investigation and answers are being obtained to imponderables of plant breeding and fertilization, of animal husbandry and of insect control.

Nor is this the end. Electronic computers are being used for building mathematical models of river beds—showing where dams should be built, flood control barriers introduced, irrigation works installed. Computers are also proving their value in a host of other directions, not least in development planning. All this at less cost, with greater speed and higher efficiency than the older methods.

These incredible new tools are adding to the proof coming to the United Nations each day that the low-income countries are richly endowed with the physical resources required for their prosperity and sustained economic growth.

Potentially, these low-income countries are also rich in human abilities. Of the 1,300 million people living in the less developed countries for which the United Nations has some responsibility, almost half cannot read or write. Not over ten per cent of children from 14 to 18 are in secondary schools and only the thinnest layer are undergoing technical training or taking university work. Today everyone recognizes the intimate relationship that exists between the economic development of a country and the education of its people. Only by giving the highest priority to the development of education at all levels, with particular emphasis on the training of people to make effective use of their natural resources, can there be an adequate response to the revolution of rising expectations. Only through education can the benefits of the revolution of science and technology be realized. Making effective use of human resources is an entirely different task from that of speeding the discovery of physical resources. It is an area where there is need—desperate need—for innovation and change. I question whether this need can be met without fundamental change in teaching methods.

The United Nations Secretary-General and all of us concerned with helping to speed development are greatly encouraged by your evident recognition that, however spectacular the immediate results of this Confernce, its greatest achievement will be to set the stage for the vastly greater contribution that science and modern technology have yet to make to human progress. It is the follow-through that is all-important.

It seems to us that one of the first necessary steps in an expansion and reorientation of the scientific research and technological development now going on in the advanced countries, to make certain that adequate attention is given to the needs of the developing countries. I recall a conversation I had some 12 years ago with the late Dr. Carl Compton, who was then head of the Massachusetts

Institute of Technology. I asked this great physicist how soon it would be before the attention of the scientists could be diverted from research designed to blow man off the face of the earth to activities aimed at giving men a better living and a better life. Because I have spent part of my life on the American desert and know what a few drops of water can do to make land productive, I asked him specifically about the possibilities for desalinizing water. He replied that if only $US200 million, namely 10 per cent of what had been spent on developing the atomic bomb, has been given to the task, commercially feasible measures for the large-scale desalinization of water would already have been found. Need I tell you that that $US200 million has not been made available, although I am glad to report that a few million dollars are being spent annually for this purpose to very good effect, and that it may not be too long before vast arid zones of the earth can be turned into gardens.

Not only have the industrialized countries responsibilities for expanding and reorientating their research. They also have heavy responsibilities to assist in the introduction of new knowledge and techniques in the low-income countries and to support their wide-scale application.

If there are thus major responsibilities which rest with the more advanced countries, the action to be taken by the developing countries is no less crucial. The developing countries should give a more important place in their planning to the part that science and technology must play if development is to be speeded. Specifically, every developing country will need certain institutions for this purpose and need to have at its disposal, among its own citizens, at least some technologists and scientists. And those that are available must be regarded as the nucleus upon which to build. I will not dwell further on this point, which was discussed in the Secretary-General's introductory speech, delivered by Mr. de Seynes.

Further, in the low-income and industrialized countries alike there is the urgent need to bridge the gap between disciplines and activities, for instance to relate in a timely and essential manner the work of scientists and technologists with that of those who are planning and carrying out development programmes.

Finally, there is the role of the United Nations—a matter of especial concern to the Secretary-General, who is called upon to report on the Conference and its follow-up to the Economic and Social Council this summer. It is clear that the United Nations family will have to give greatly increased recognition, at all levels—headquarters, regional commissions and field offices—to science and technology. Many suggestions to this end have been made in the course of the Conference. They will be very carefully considered in the coming months by the Secretary-General as well as by the heads of the specialized agencies and the International Atomic Energy Agency. I do not wish in any way to prejudge the conclusions which may be reached as a result of such a study but I venture to think that the following elements will need to find a place among them:

(1) As was suggested in the Secretary-General's opening statement, help to developing countries in building up national scientific and technological

institutions and in arranging for the education and training of scientists and technologists should be recognized as an international responsibility and should to the greatest possible extent be made available on request by the United Nations and its related agencies.

(2) The provision of effective help will require a further strengthening of the growing network of joint field officers of the Special Fund and the Technical Assistance Board. It is the responsibility of all of us to see that these offices in nearly 70 low-income countries expand their services. Suitably supported by the various United Nations agencies, they could act as vital channels of information on scientific and technical developments of interest and value to the countries in which they are located; they could also gather and transmit to the appropriate United Nations agency information concerning new areas to which the attention of scientists and technologists might be directed.

(3) It may be necessary to seek ways of handling certain problems of the application of science and technology on a regional level and others—such as those of tropical areas—on an interregional level. Regional arrangements, in co-operation with the specialized agencies and linked, I would hope, with the regional economic commissions of the United Nations, might therefore also be envisaged. I believe that the Governing Council of the United Nations Special Fund would share my interest in supporting not only projects on a national level in this field, but also in supporting for soundly conceived regional projects such as autonomous institutes of science and technology related to the regional commissions.

(4) The gaps in international action, the researches that should be stimulated, the areas where the dissemination and application of new knowledge and processes are inadequate, all should be indentified and steps taken to fill them as soon as possible.

(5) What is needed is new programmes, new money and a new sense of collective responsibility. The existing organizations of the United Nations family provide a firm and adequate basis upon which to build. But the work of the United Nations family in the whole field of science and technology should be brought under continuing review so as to ensure an inter-disciplinary approach and a maximum of co-operation and co-ordination. The Secretary-General is proposing that this becomes a priority matter for continuous joint consideration by the executive heads of the specialized agencies and himself in the Administrative Committee on Co-ordination, at which he presides.

The formulation of a body of recommendations for international action is obviously a matter of very great importance not only to the United Nations family but also to each individual country here represented. In carrying out this task, the Secretary-General will rely heavily on the help of the heads of the specialized agencies and the International Atomic Energy Agency; but he is most anxious also to have the benefit of consultations with those Governments who were asked to provide the senior officers of this Conference. He therefore intends

to invite the President and the Secretary-General of the Conference and the countries which provided vice-presidents to continue to give him the benefit of their informal views through consultation with him within the next two or three months.

The Secretary-General believes that these consultations would enable him better to assist the Economic and Social Council in its consideration of practical programmes of international action to help carry forward most effectively the great task which this Conference has begun.

Finally, Secretary-General U Thant has asked me, now that your meetings are ending, to thank each and every one of the officers of this Conference for their assistance, and particularly the Secretary-General of the Conference and you, Mr. President, for your most valuable assistance.

If I may, I should like to conclude on a personal note. I firmly believe that if in this present United Nations Development Decade we can reach the goal set by the General Assembly, the momentum gained will ensure that, before this century ends, we will have won the war most worth winning—the war against chronic ill-health, mass poverty and ignorance.

MR. ABBA EBAN (ISRAEL), VICE-PRESIDENT OF THE CONFERENCE:

Sixteen days ago we began a dialogue of which the end is distant and the consequence still unknown. But there can be no uncertainty about the greatness of our theme. It is nothing less than the intersection of the two movements which dominate the life of our age. One of these is the growth of knowledge. Vast conceptual changes, new terms for the understanding and definition of nature, have gone in hand with spectacular technological results. Man is now clothed with a power which he never previously held—to generate and control energy; to fructify land; to conserve and utilize water; to combat disease; and to draw mankind together in close and constant accessibility.

Together with the growth of knowledge we have celebrated the growth of freedom. The movement of scientific progress has been accompanied by an intense movement of national liberation. More than 50 States, most of them in Africa, have added their flags to the international family within the past two decades.

Fifteen years ago a quarter of the world's population lived in colonies and dependent territories under the rule of imperial powers. Today the emancipation of Asia is almost complete. In Africa the family of independent States has grown from three to 33. All but a few of the 230 million Africans have achieved their sovereignty or are negotiating for its early attainment. Multitudes are newly embarked on the adventure of freedom with its pitfalls and hazards—but also with its deep, enduring satisfactions.

If constitutional freedom could itself guarantee welfare and equality we should now be celebrating mankind's golden age. But in the awakening continents political freedom has not been attended by a parallel liberation of peoples from

their social and economic ills. Behind the new emblems of sovereignty millions continue to languish in squalor, illiteracy and disease. Men awaken to learn that they may be free in every constitutional sense and yet lose the essence of their freedom in the throes of famine and want. As the political inequality between nations passes away, a new inequality comes to the fore. It is the inequality between those who inherit the new abundance and those who can only look in upon it from outside.

This Conference has sharply revealed the extent of the gulf separating those two worlds. In the advanced countries the average *per caput* income varies between $US900 in Europe and $US2,500 in North America. In most countries of Asia and Africa it is $US50 to $US100. In advanced western countries the average life expectancy has reached 68 to 71. In the undeveloped areas it stands between 29 and 39. In the West, industrialization goes forward with swift momentum. In most of the new States it is impeded by the lack of basic technical skills, of power and transport, and of the social and economic infrastructure necessary for a technological society. Natural resources are abundant but not developed. The lack of momentum in the educational movement prevents a wider acquisition of technical skills. Debilitating diseases continue to enfeeble the people and set a limit to production. At the same time the expansion of welfare in the advanced countries is swift and headlong. And the gap is becoming wider, with the science and technology of the advanced countries increasing it dynamically year by year.

Meanwhile the pressure of population on resources grows more intense. Since this Conference convened here on 4 February the world's population has increased by 1,600,000. It has grown by 10,000 since this morning's session began less than three hours ago. The resources available for development have not correspondingly increased.

The disparities in achievement between the advanced and the developing States do not arise from any inherent inequalities in moral and intellectual capacity. Nothing has been achieved by Europe and America of which Africa and Asia are intrinsically incapable. Indeed, if a conference similar to this had been convened some centuries ago, the East would have been defined as the advanced world, the West as the backward region. The truth is that since the scientific revolution began one part of humanity has been cut off from contact with processes of thought and action which have endowed another part of humanity with the elements of its power.

It might seem that all we need to do is to "export" science and technology from countries in which it is abundant to countries in which it is scarce. Such an easy formulation would distort the truth. Science is a plant which can grow only in certain conditions of social climate and economic soil. It cannot be transferred fully grown. Science is not a monopoly of any social system. It has flourished both in capitalist and in socialist societies. It has prospered in big States, but some of its most eminent representatives and institutions have arisen in small communities. Nevertheless, it is a tree that will grow only in a society which possesses a vision of development, which allows freedom for the creative

imagination, and in which education, the pursuit of scientific truth and the penetration of the spectacle of nature are held in profound respect.

Every State, however poor and small, can train enough of its citizens to ensure its own entry into the domain of scientific thought and action. Indeed, the prolonged exclusion of any State from that world is compatible neither with its national dignity nor with its economic and social progress. But the narrowing of the gap between advanced and developing States requires international action going far beyond scientific advice and technical training. I shall try to indicate some of the paths which this Conference has charted.

(1) There must be a vast increase in the flow of capital available for developing States. Some of us have joined in calling attention to the improbability of such an increase so long as $US150,000 million and untold efforts by scientists and technicians are spent annually on the arms race. Even if our hopes in this direction are not fulfilled, something can be achieved by a more logical system of human priorities in the world's scientific effort. How is it possible to justify the expenditure of tens of billions of dollars in prestige projects in outer space, when there is hunger, diseases and illiteracy on this planet where the human condition stands to be determined for good or ill? Is it our business to invade the moon or to save the earth for our common humanity?

(2) The advanced States and the international agencies should regard this problem as having a higher priority than it has hitherto enjoyed. If we cannot change the relationship between advanced and backward regions within two decades, the chances of a peaceful and ordered human society may be forever lost. By 2000, a world populated by 6,280 million people will not be able to endure the inequalities which now exist between States. The problem which has engaged the attention of this Conference should be solemnly considered by the heads of all Governments interested in international development. The problem is not less urgent than those on which other "summit conferences" have been held.

(3) It follows also that the United Nations should regard this Conference as a beginning, not a climax. The President of the Conference should be invited to summarize our experience not only at the ECOSOC but also at the next session of the General Assembly. The decisions required from Member Governments are policy decisions. I think that the President, the Secretary-General, the Chairman of the Scientific Advisory Committee and the Vice-Presidents should meet before the next session of the General Assembly to formulate alternative proposals for machinery designed to associate the scientific community more closely with the progress of developing areas and with the work of the existing specialized agencies.

(4) Nothing of value can be achieved without the initiative of the Governments of developing States. These Governments must be given a deepened confidence in the modern scientific movement as one of the sources of their progress. The course open to them is clear: draw up a survey of resources;

formulate a ten-year development plan; give the most urgent priority to human resources; establish an indigenous science through the training of a scientific *élite;* make maximal use of the United Nations specialized agencies, of bilateral agreements, and of the specialized assistance which is so patently available to Governments seeking accelerated development.

Let us hope and believe that the leaders of new nations will approach the problems of development and technical progress with the same ardour and perseverance which they have hitherto devoted to the struggle for national liberation.

(5) While I advocate a full use of international machinery, I do not believe that the United Nations should claim a monopoly of initiative and responsibility. The communion between the world of science and the world of national liberation should be sustained at every level. Individual States and scientific institutions should do what they can to stimulate the reciprocal flow of experience and knowledge. Bilateral programmes sometimes have an intimacy and speed which large international agencies cannot always achieve.

(6) Many of the new States have territories and populations too small to constitute viable units of development. Irrigation projects, universities and research institutes—except in such unusual conditions as those which affect my own country—require a broad demographic and territorial basis. There is a strong case for regional organization of planning and research, especially in Africa. It is not impossible to combine individual sovereignty with collective development.

(7) Future conferences held by the United Nations or in Member States should be of more limited scope and should address themselves to clearly defined fields. Believing that soil and water are still the main sources of life for millions in the awakening continents Israel proposes to hold a conference in 1963, bringing experts on agricultural planning and agrarian education together with ministers and officials of developing States concerned with these problems. I believe that similar specialized conferences could usefully consider problems of disease control, technical and scientific education, the use of new energies, initial industrialization and planning and survey techniques. The dialogue held here must be maintained and even intensified, but on an increasingly functional basis.

If we understand this Conference in its special context of history, we have no reason to be disappointed. We have been wisely led by our distinguished President, Professor Thacker, and ably organized by Secretary-General Dr. Chagas and his associates. There has never been such a concentration of scientific knowledge and responsibility in the service of humanity's submerged millions—those who have secured the outward form of liberty and now seek its inner content. There is evidence that the world's scientific conscience is being galvanized by the pathos and opportunity of the less developed regions. This is the first generation of mankind in which the elimination of poverty and disease has become objectively possible. Science is the father of this possibility. Scientists do not

wish to retreat into their laboratories in an effort to escape the challenge of human anguish and human hope. They have the will and the capacity to transform the human situation.

If we can only fertilize their will and organize their capacity we may yet inaugurate one of the great ages of history.

PROFESSOR ABDUS SALAM (PAKISTAN), CHIEF SCIENTIFIC ADVISER TO THE PRESIDENT OF PAKISTAN:

## WORLD DEVELOPMENT: A CRISIS FOR SCIENCE

Mr. President, your Excellencies, ladies and gentlemen:

I am deeply conscious of the great honour you, Mr. President, have done me and my country by asking me to speak at this concluding plenary session. Even apart from its lasting impact on world affairs, this will remain a memorable Conference for all those who attended it, first for its intense vitality coupled with refreshing plain speaking and secondly for the remarkable—truly remarkable—unanimity of development experience it has revealed. For its undoubted success, we all owe to you, Mr. President, to the Secretary-General and to his devoted Secretariat, the deepest debt of gratitude.

What have been the lessons of the Conference? Much of what I want to say has been highlighted by the distinguished delegates from France, USA, UAR, USSR and particularly Nigeria. For me the major lesson of the Conference is simply this: world development will come when the scientist and the technologist first begin truly to value their own potential. And when I say scientist and technologist let me be very clear. I do not mean only the distinguished representatives here, but also those outside this hall, those who constitute the whole body of science and technology. For far too long has the scientist lived in an ivory tower of his own creation. For far too long has he lived the captive life of the genie of Aladdin's lamp. He must change his own attitudes before he can ever hope to see the goal of world development fully realized.

Let me be more explicit. If there is one thing this Conference has focused for all of us, it is this. For the under-developed world there is absolutely no short cut to prosperity. Science and technology are almost like magic potions but not—certainly not—in the tiny doses that we at present can afford.

In saying this, I am fully conscious that it might indeed have been otherwise. After all, within our own generation we have seen the miracle of the antibiotic revolution. We have seen that science can conquer early death relatively inexpensively, that man can be made to linger longer if only to die eventually of starvation. It is perfectly possible that tomorrow may bring an inexpensive antidote to hunger but unfortunately our Conference did not hear any word of this.

Granted then, that we the scientists from the developing countries have been here to learn how best to equip ourselves for making the right choices, with the slender resources at our disposal, how likely is it that when we go back to our

countries we shall actually be asked to exercise these choices? Let us make no mistake about it. With rare and refreshing exceptions, *we* are hardly the men who run the development and planning councils in our countries. At present this is the prerogative of our civil administrators—men who are the finest products of the culture of the Arts, of the culture of Law, of the culture of War—but seldom if ever of the culture of Science. With unfortunate monotony this pattern repeats itself in Asia, in Africa, in Latin America. Quite often the priorities are set in practice by a distinguished scientist colleague from abroad; in Professor García's eloquent phrase "by someone with the ability to speak Spanish with a foreign accent".

Why does the scientist and the technologist carry so little responsibility for development in his own country? I could blame it on the legacy of our past. I could blame it on the acquiescence of our colleagues from some of the richer countries in accepting this pattern in their own conditions. But mostly the fault is with ourselves that we are underlings. Our own attitudes have been too academic. We have hardly equipped ourselves to fight for and take responsibility. If there is one thing this Conference has done, it has reawakened in us the resolve to fight and the willingness to accept all tasks of technological development.

Perhaps I am somewhat hard on some of the scientists from the richer countries. Perhaps there are very good reasons why they should play no more than the advisory role of subordinate technicians, why they should not wish to shoulder eventual responsibility for development in their own countries. But when their acquiescence in the present scheme of things seriously affects the prospects of world development, we have a right to be terribly concerned. And unfortunately where this hurts most is in the provision of capital to acquire even those small but vital doses of the scientific and technological potion we so badly need.

To be quite blunt, whatever sacrifices we may make internally, there still is a quantum of capital we must depend on the developed world to provide. In this capital I include all reserves of skills and basic research. The decision whether or not such reserves will ever become available for world development is eventually a political and an administrative decision. But in campaigning for these resources, we do expect our scientific colleagues from the richer countries to be our greatest allies. For these same colleagues to turn round and tell us that no funds can be spared until general disarmament comes is the unkindest cut of all. Disarmament may be long in coming and quite candidly, I personally have the greatest fear that the funds presently going to armaments will never get directed towards the needs of the poorer countries—not unless we can all strive and fight for a fundamental change in world attitudes. After all, it is hardly the arms race which makes the richer countries exact the harsh subsidy of depressed commodity prices from us—a subsidy which Mr. Paul Hoffman will be the first to tell you runs into billions of dollars and which currently washes away almost all moneys received in aid.

The cautious timidity of the scientist from the under-developed country towards responsibility, and the cautious timidity of our scientist colleagues from richer countries towards capital are, to my mind, only symptoms of the deeper malaise which afflicts science and scientists in both developing as well as developed parts of the world.

For me, the real crisis of human affairs lies in this. Almost unthinkingly the scientist and the technologist have created this modern world. By eliminating distance the scientist has given a meaning to the concept of one world and reality to the concept of a single human family. By demonstrating that unlimited wealth can be created provided a base for it exists, he has invested humanity with the power to clear up all the slums on this earth. He has created something whose promise, whose scale the non-scientific and sometimes even the scientific mind barely comprehends. But after doing all this he turns his back, entrusting the task of world development to those who live and think in terms of an age of scarcity. His personal ideal still remains that of a recluse at the Institute for Advanced Study. I do not know how relevant Plato's message in the Republic was to the conditions of his day. But its aptness today is beyond the slightest doubt. Plato said, "Until philosophers are kings or the kings and princes of this world have the spirit and power of philosophy, and political greatness and wisdom meet in one, and those commoner natures who pursue either to the exclusion of the other are compelled to stand aside, cities will never rest, nay nor the human race." This to my mind is the real message of this Conference.

There is really nothing new about this message. Just after Hiroshima, the physicist was the first to feel the impact of what Plato had said. In the Pugwash Conferences he has been trying to atone for this ever since. What we need first and foremost is the crusading, the fighting spirit of a new Pugwash for world development among the scientists and technologists of the world.

I am quite clear in my mind what we from the developing countries must do as top priority. Not until all those who administer acquire the spirit of science, should we rest content. My colleagues from the developed world can help, not only by building anew the international avenues of co-operation, but also much more in a personal way. If I may respectfully suggest so, come and make frequent visits to us to encounter our problems first hand. If you are a university dean, take one department in one university in one poor country as your personal problem. If you are an expert, make it your duty when you next visit us to find out if there is also a local expert. Very often you will find that the doors which readily open to you are all but shut to him. He perhaps gave the same advice you tender today, years ago. You may find he was never listened to. It is crucial to build him up. Science knows no frontiers; in world development it needs solidarity, it needs forging and fusing of newer and vital personal links. We have started doing this at the Conference. Let this movement gather strength, let its message reach every scientific worker in every land.

Nine hundred years ago the great physician of Islam, Al Asuli, writing in distant Bokhara divided his pharmacopoeia into two parts: "diseases of the rich" and "diseases of the poor". If Al Asuli were alive today and could write about the afflictions of mankind I am sure he would again plan to divide his pharmacopoeia into the same two parts. Half his treatise would speak of the one affliction of rich humanity—the psychosis of nuclear annihilation. The other half would be concerned with the one affliction of the poor, their hunger and near starvation. In diagnosis he might perhaps add that the two afflictions spring from a common cause—the excess of science in one case and the lack of science in the other. I wish, in prognosis, he may not have to add that it is the faltering will of the scientist physician which needs building up much more than that of the patient.

DR. F. T. SAI (GHANA), HEAD OF THE DELEGATION OF GHANA TO THE CONFERENCE:

Mr. President, Mr. Secretary-General, your Excellencies, ladies and gentlemen:

Every so often the human race is called upon to take stock of itself, of its achievements and of its goals.

During this period of self-evaluation mankind is able to come out with ideas which look excellent and receive universal acclaim. The old League of Nations, in whose home we are today, arose out of such an evaluation. So did the United Nations under whose auspices we are met here today.

But whereas both of these great institutions arose out of a period of destruction, a period of upheaval and a situation of fear and near desperation, the present Conference has grown out of hope rather than fear. We have been looking at our world, at ourselves and at our future, and what have we seen?

We have seen that the two ends of the world's spectrum of wealth are very far apart. We have used the term developed and less developed to apply to these two ends and we have tried to discuss the causes of these differences. There are nations with a *per caput* income of $US50 or less whilst others enjoy $US1,000 or more. These differences are not due to national laziness or apathy, they are not due to contentment with their poor lot on the one hand as opposed to initiative and hard work on the other. These are differences which have been brought about by cruel climatic and physical conditions and have been accentuated by the tremendous advance of science and technology.

For the past two-and-half weeks, sir, we have been busy examining firstly the problems of the less developed areas in the light of current development all round the world. On some issues a considerable amount of knowledge exists, on others, hardly any. It has been made abundantly clear that practically every area described as less developed has got some people—however small their numbers—who are aware of their problems and in some cases, have ideas on how to tackle them.

It is to the lasting credit and glory of this great Conference that this small band has been given a good hearing. The developed nations have listened to

the problems of the developing and less developed areas and have together examined possible solutions. It has emerged quite clearly that the problem of education and training is the biggest single hindrance to progress in many of the countries we have been discussing—that there is a need to tackle this on a scale never before envisaged at an international level. Even where general education has made strides, scientific and technological education and training have so lagged behind as to slow down the best programmes of development. The general shortage of technicians and technologists of all grades has been clearly demonstrated. Then the various vicious circles that hinder capital formation in the less developed areas and the consequently slow growth of the gross national product have been discussed.

However, throughout this Conference there has been a justifiable optimism. The general feeling is that the know-how is either already available or can be developed. Examples of countries which have bridged the gap quickly through mobilizing the useful forces of science and technology have been put before us. In all these, however, the warning has been given that measures which have worked in one area need not work in another area, however superficially comparable. The complex ecology of man needs to be constantly studied. The reward is there.

Mr. President, mankind has been called upon to demonstrate its faith and confidence in itself, to accept the challenge that this is one world, that, however great the dangers of atomic destruction, there is the even greater danger of an unequal divided world that keeps on merely rolling along, some of its areas riddled with ignorance, poverty and disease. As a physician, I should like to ask what good it will do a mother to develop one half of a pair of Siamese twins and leave the other half. When the time of reckoning comes she is sure to lose both.

I have been encouraged to find that although mother nature has been selective in her feeding, the developed twin is now ready and willing to help the other. This is the beautiful feeling I have got out of this Conference and this is why I am sure we from the less developed areas will go back home with renewed energy knowing that we have friends and brothers able and willing to back us up in this era of scientific and technological advance.

PROFESSOR M. S. THACKER (INDIA), PRESIDENT OF THE CONFERENCE:

I speak to you at this last hour of UNCSAT. But is it the last? It is not. The work which has begun at Geneva in our labours, I feel sure, will see the beginning of a new world.

A little over two weeks ago, I spoke to you from this chair of my feelings, both of pride and humility, at being called upon to preside over your deliberations. Since then, we have seen quite a lot of one another, formally and informally. As we set out for our scattered homelands it remains for me not only to wish you a happy return, but to share with you briefly, before we part, some of the impressions which I, as your President, will be taking away from Geneva.

But may I first express to you my gratitude for the contribution you have made, individually and collectively, to the success of our meetings. I have drawn inspiration from you all in my difficult task.

I know you would wish me to place on record our appreciation of the discreet messages brought to the Conference by Mr. Philippe de Seynes and Mr. Paul Hoffman on behalf of U Thant, who has been unfortunately prevented from being with us.

Our gratitude also goes out to Mr. Spinelli, our host in the Palais.

All of us remember the gracious presence of the President of the Swiss Confederation at our opening plenary session. We have been fully conscious of this honour. We are also grateful to the authorities of the City and Canton of Geneva.

We had distinguished guest speakers and they brought to our deliberations the wisdom born of a vast experience and, I am sure, their words will not be forgotten.

I know you would wish me to place on record our appreciation of the discreet and patient labours of our secretariat, which go back over all the months of preparation for UNCSAT. I am thinking of the team assembled here under the direction of my distinguished colleague, the Secretary-General of the Conference, Dr. Chagas, the Deputy-Secretary-General, Mr. Laclavère, and the Executive Secretary, Mr. Katzin. Various other members of the United Nations Secretariat have helped us. I hope they will forgive me if I say I extend to them all collectively our thanks.

Our interpreters we have heard, but not seen. There are others who have been both unseen and unheard, but all of them made smooth our path with skill and often in difficult conditions.

Dr. Tavares de Sà, Under-Secretary of the United Nations in charge of Public Information, came over from New York to help us. He and his staff have served us well, but, may I say, that perhaps their biggest task on our behalf lies ahead—to present and project the results of our labours in an imaginative way to the world. And we can help him in this task. We can act as his ambassadors when we return to our respective countries and tell our people what UNCSAT has meant, what UNCSAT has achieved.

I would reproach myself if I omitted our friends of the press and other information media. They have been following highly technical discussions, by no means easy to explain to the man in the street. And it is our friends in the information media who know the secret way to his heart.

Our Conference has been unparalleled in its scope, in its diversity. It has been a demonstration of the role which the scientist and the technologist are called upon to play in our world. We started this Conference in some doubt, but may I say in all humility our doubts have been dispelled and we go to our respective lands with a feeling in our hearts that the Conference has not only brought home to us its meaning and philosophy, but has achieved the purpose for which it was convened.

The Conference discussed many aspects of science and technology: agriculture, health and nutrition, communications, transport, international co-operation, social problems, industrial development, organization and planning for economic development, training of men, etc.

Ladies and gentlemen, I am sure you do not expect me to try to summarize all these discussions, but let me say that our exchange of views, which has touched on a vast variety of problems, has drawn attention to the immensity of our task. The Conference has had a dynamic impact on men and women who have gathered here, and this great meeting of minds has had something of the effect of administering a shock therapy. It has confronted scientists, technologists and planners, and representatives of countries at various stages of development. Their meetings have resulted in a great enrichment of our understanding. Our minds have started to work along new lines because of what we were able to tell each other. And countless other minds must be made somehow to profit from our meetings, as we have profited.

The reason which brought together so many of us within these walls was a very simple one: that of human suffering. We have been, as it were, ambassadors of the needy, spokesmen of the tongue-tied, and I have myself seen how eager all nations are to share what they have and what they know for the benefit of each other. Our task is immense, but the world has the resources it needs to change the life potential of hundreds of millions and, in that way, the scientists and technologists can be the most powerful instrument of acceleration.

Acceleration might be taken as a keyword for everything we have been talking about and seeking to promote. There has been universal agreement that something must be done to speed up the developing process for the benefit of the majority of mankind. We have at this Conference realized, perhaps more clearly than before, the problems and our limitations.

Would I be wrong in saying that this Conference shows man really coming to grips with the problem of how his newly acquired skills can help in the process of economic and social development? The number of scientists alive today is equal to 90 per cent of all the scientists and research workers who have existed since the beginning of history and scientific knowledge, with all its technical and economic consequences, is growing more rapidly now than other human activities. May I emphasize what I said from this chair, in opening UNCSAT, about the scientist's role in decision-making. If he grasps this magnificent opportunity he can change the whole outlook for man.

The tremendous growth which we have witnessed in science and technology is a result of one thing—a better use by man of his mental capacities. No aspect of the development process has been more stressed here than this one—human resources. Developing human resources, training of men, training of minds, has emerged as the most pivotal aspect and, as your President, I stressed this at the opening of the Conference. I would like to say again, with the utmost conviction, that it is human resources, still largely untapped, which constitute man's real hope for the future. For all his inventions and calculating machines, man

remains the principal tool of economic development, as his welfare should be its only objective.

I spoke on an earlier occasion of regional plans and master plans. The meeting of minds in Geneva has shown us afresh the need for rational and integrated planning. The Conference has gone out of its way to emphasize this need, a need which has found eloquent spokesmen even among representatives of the so-called free economies. We have heard of the developing countries evolving along the lines of a mixed economy, allowing for both centralized control and private enterprise. There has been a rich diversity of opinion expressed regarding the planning of national economies. But please don't plan in isolation from social and cultural values.

Communication is another keyword which has emerged from our discussions. There is need for more and better communication between the developed and the developing countries, between all the international organizations, between the government and the private sector, between the various scientific and technical disciplines and between the world-wide network in every domain. I have gleaned from my discussions with various colleagues the feeling that for this purpose we need a clearing house or, it may be, several clearing houses, to assemble and distribute all the information available. Sometimes that information may be needed rapidly by industrialists, sometimes by the draftsmen of an economic plan, sometimes by specialists and experts. We have seen how vast is the area of experience from which all developing countries can profit and which can be drawn upon by every individual expert faced by a seemingly isolated problem. Somewhere and somehow, the rapidly accumulating fund of new research, new technology and new information must be made more readily available to the economic planner. In this connexion, some delegates have urged the setting up of an international information science centre.

We have heard several speakers tell us of the role of electronic computers in our modern society. It has been explained that they alone can break down and reassemble the vast quantities of data which are now involved in the decision-making process. UNCSAT has acted, in a sense, like a great human computer. We have fed into it the gleanings from many harvest fields of thought, experiment and experience. Now we are faced by the supreme question: what, in practical terms, can we contribute to the next stage? How can we be assured that what comes out of the computing machine can be brought to the help of those who need it—and all of us need it—in a form they can assimilate?

This Conference will publish a compendious analysis of the main trends of thought which have emerged here. I think it was a wise decision to concentrate on issuing an analysis of this kind, rather than a full record of everything which has been written and said, since that would have been very unwieldy, expensive and intolerably slow in production. And yet I feel that some of the essentials of our thinking might be circulated more rapidly. I think government planners and others would be reassured as to our practical intentions if they were to receive within a short time, say within a month, a handy work of reference

which might already begin to help in the process of decision-making. I have in mind a document of 25 pages or so, summarizing the proposals and ideas which have emerged here under our 12 agenda headings.

I also wonder if some very distinguished thinker with a world-wide reputation could be prevailed upon to compress in one volume the most essential lines of thought that have emerged here on the place of science and technology in the Development Decade. I would go still further: side by side with this volume by a world authority, may we not hope to see a popular booklet or a series of booklets designed for mass sale? It is up to us to show the public that there is emerging from a meeting of minds like ours a practical distillation of our knowledge in relation to the developing countries. The story of how man is remaking his world by a more effective use of human and natural resources would open even reluctant eyes. We have a duty to see that the story is told.

I have spoken of planning, of better communication and other necessities which have been stressed again and again at our meetings. But the problem of the practical follow-up is that on which we have all laid stress. It is on everyone's lips. There is a strong feeling amongst us all that this Conference must not be allowed to end in a vacuum—or, what would be equally deplorable—in an ocean of platitudinous goodwill. Although we do not make recommendations, I voice a hope that some definite steps will be taken, and taken without delay. There is widespread anxiety on this score. I fully share that anxiety and, as your President, I would like to stress that there must be a swift follow-up, or our deliberations will have been of no avail. We should not lose time. If we do, we shall incur, and rightly, the reproaches of our colleagues and the scorn of the public.

When I first spoke to you from this chair, I allowed myself to dream of a group or a committee of wise men, a kind of brains trust. If some such committee, or group of wise men, to include eminent scientists and technologists, as well as the heads of the international agencies concerned in development, were to be established, it might have a striking result. For the first time scientists and technologists could be publicly associated from the earliest stages and at a high international level with the discussion of development plans. This might be a step forward in our approach to these problems. Dr. B. R. Sen, Director-General of the Food and Agriculture Organization, followed up the suggestion and he spoke to us of a committee of scientists.

But, ladies and gentlemen, there have been other proposals.

We heard a suggestion to establish a world institute to develop natural resources by research, exchange of information, training of specialists and co-operation with the existing international organizations.

Some have felt the present inadequacy of the international agencies in the field of science and technology, and they have suggested the establishment of a new specialized agency. I received a memorandum from several representatives of the developing countries reflecting these views.

Suggestions have also been made to strengthen the existing agencies in appropriate ways, reinforcing them financially and expanding some of the departments

necessary to their work. It is widely felt that there should be a greater measure of co-ordination of their activities.

There has also been a plea to streamline all international aid procedures to make possible a speeding up of the process of development. Delays occur all too often on both sides. Perhaps responsibility for these delays does not lie at one door, but it is hard to escape the impression I have gathered that the international wheels do not always turn as swiftly as they could.

Whatever may be the decision, and a decision must be reached, the matter has to be studied, and studied soon. It is inconceivable that something practical will not emerge from all these ideas. U Thant himself has said that: "The potentialities of modern technology and new methods of research and development for attacking the problems of the developing countries are as yet only dimly perceived." Once they are better grasped, it will be seen that, huge as the task remains, it is not beyond the resources of man to find and implement solutions.

Every man and woman is concerned in this problem, but scientists and technologists have a major part to play and perhaps the greatest of opportunities. Could they not sustain and give life to the Decade of Development by uniting in a Decade of Dedication?

What I have in mind here would be the establishment of a new World Bank but, this time, a bank of human capital, of scientists and technologists bringing their knowledge and experience to the service of humanity. I see them, conscious of their new powers and responsibilities, uniting everywhere to form teams of volunteers to work in the developing countries. I see them as votaries of an ideal, men consecrating themselves, as devoted bands of men and women have done many times in the past, to help their less fortunate brethren. If you tell me that this is unrealistic or utopian, I would ask you why this spirit of dedication and sacrifice is no longer thought to be possible in our time, when we know that history is full of examples of it.

Indeed, I would say that without dedication, there can be no development on the scale we need. If this is a dream, can we not take some solace from the thought that the dreams of yesterday have a strange way of becoming the realities of today? What comments were made on the pioneers who turned into realities the electric light in this hall, the radio which carries our words across the world and the aircraft which will soon be transporting us? The difficulties are immense and too obvious for me to labour them. Nevertheless, let us not be dismayed. Problems, someone said, are only solutions looked at the wrong way round. Let us say goodbye to one another on a note of encouragement, remembering those words uttered 400 years ago by Hugh Latymer to his fellow martyr at the stake: "Be of good comfort, Dr. Ridley, and play the man: we shall this day light such a candle, by God's grace, in England, as I trust shall never be put out."

Latymer spoke of England only. Our task is to dispel the darkness that oppresses a great part of the world. And the torch which scientists of all the nations could uplift would be no uncertain candle.

I should be proud indeed to light it, in your name, here and now.

# PROGRAMME BY SESSIONS

## PLENARY SESSIONS

Opening Plenary Session
Second Plenary Session
Closing Plenary Session

## GENERAL AND SPECIALIZED SESSIONS

*Agenda item*

A: NATURAL RESOURCES

A.1: Mapping and surveying practices adapted to use in less developed areas
A.2: Integrated river basin development in less developed areas
A.3.1: Water development policies (*combined session*)
A.3.2: Surface water
A.3.3: Ground water
A.3.4: Particular problems in water-short areas
A.4.1: Energy development policies
A.4.2.1., A.5.2.2., A.5.2.3., A.5.2.4: Mining technology and mechanization
A.4.2.2., A.4.2.3., A.4.2.4: Upgrading of fuels and petroleum technology (*combined session*)
A.4.2.5., A.4.3.2: Non-conventional sources of energy and nuclear power (*combined session*)
A.4.3.1., A.4.3.3., A.4.3.4: Electrical power
A.5.1: Mineral development policy
A.5.1.2., A.5.2.1., A.5.3: Mineral exploration methods and concentration of ores and minerals (*combined session*)

B: HUMAN RESOURCES

B.1: Population trends
B.2.1., K.1.1: Forecasting requirements and priorities of numbers and types of scientists and technologists. Technique of manpower assessment (*joint session*)
B.2.2: New systems of vocational training and apprenticeship
B.3: Sound management and management development as a factor in technological progress
B.4: Employment implications of applications of science and technology in less developed areas
B.5: The application of science and technology to conditions at the work place

C: AGRICULTURE

C.1.1: Agrarian structures and land settlement
C.1.2: Agricultural credit, co-operatives and marketing
C.1.3., C.1.4: Agricultural extension and farm management and planned development
C.2.1., C.2.2: Nutrition and public health policies. General nutrition problems (*joint session with F*)
C.3.1: Soil science and soil surveys
C.3.2: Irrigation and water use

C.3.3., C.3.4., C.4.3: Soil management under low rainfalls. Shifting cultivation cropping practices
C.4.1: Plant breeding and improved varieties
C.4.2: The control of pests, diseases and deficiencies
C.5.1: Disease control
C.5.2: Animal breeding
C.5.3: Animal nutrition and management
C.6.1., C.6.2: Agricultural engineering and development of agricultural equipment
C.6.3., C.6.4., C.5.4: Handling, storage and processing of agricultural produce. Dairy technology
C.7.1., C.7.2., C.7.3: Forestry and forest products
C.8.1., C.8.2: Marine fisheries and inland fisheries

D: Industrial Development

D.1., D.3.1., D.3.2., D.3.4: Special factors affecting industrial development in less developed areas
D.2: Structural and locational problems of industry
D.3.3., D.9.1., J.2.2: Specifications and standards (*joint session*)
D.4: Food processing and preservation
D.5: Products of animal and vegetable origin and substitutes
D.6.1: Textiles
D.7., D.8: Iron and steel. Non-ferrous metals (*combined session*)
D.9., D.10.1: Engineering techniques and organization. Heavy engineering industries (*combined session*)
D.11., D.12: Fertilizers and heavy chemicals (*combined session*)
D.13., D.14: Building materials and building techniques (*combined session*)

E: Transport

E, L: Specialized training of personnel in the fields of transportation and communications (*joint session*)
E.1: Factors in the development of national transport policies (*combined session*)
E.2: Roads and road transport
E.3: Railways
E.4: Inland water transport and coastal shipping
E.5: Air transport and specialized uses of aircraft in less developed areas
E.6: New techniques in the transport of fuels and perishable goods

F: Health and Nutrition

F.1.1: Plan for health services and contribution of science and technology to its formulation and execution. Need for vital and health statistics
F.1.2., F.1.3: The principles of health service planning and the development of the health programme
F.1.4: Introduction of pharmaceuticals: problems of costs and quality
F.2., F.2.1., F.2.2: Control of communicable diseases in the light of developments in science and technology
F.2.3: The problem of mental disease in less developed areas
F.3.1., F.3.2., F.3.3: The need for various categories of health personnel. Changing responsibilities in health team
F.4: The role of medical research

G: Social Problems of Development and Urbanization

G.1: Problems of rural development
G.2: Urbanization problems
G.1., G.2: Rural development and urbanization (*combined session*)

H: Organization, Planning and Programming for Economic Development

H.1. (Part I): Methodology of planning for development. Part I: Planning: Aggregate, sectoral and priorities among sectors
H.1. (Part II): Methodology of planning for development. Part II: Regional planning
H.1. (Part III): Methodology of planning for development. Part III: Statistics, research requirements, other problems of planning
H.1., H.3: Common problems of methodology of planning for development and implementation
H.2: Organization arrangements for economic development including some reference to methodology
H.3: Implementation of economic development plans including some reference to organization

I: Organization and Planning of Scientific and Technological Policies

I.1.1., I.2.2., I.2.3: Special problems of scientific policy planning
I.2.1., I.1.2: Formulation of research policies and programmes (*combined session*)

J: International Co-operation and Problems of Transfer and Adaptation

J.1: Methods for stimulating technological change
J.2.1: Scientific and technological documentation, including the problems of language and terminology
J.2.2., D.3.3., D.9.1: Specifications and standards (*joint session*)
J.2.3., J.3.2: Technical exchange programmes. Technical co-operation programmes and co-ordination with national development policies
J.3., J.3.1: International co-operation. International scientific co-operation

K: Training of Scientific and Technical Personnel

K.1.1., B.2.1: Forecasting requirements and priorities of numbers and types of scientists and technologists. Technique of manpower assessment (*joint session*)
K.1.2: Specialized training at technical schools and means of accelerating formation of scientific and technological cadres including teaching staffs (*combined session*)
K.2.1., K.2.2: Scope and place of science and technology in general education. Specific new approaches to educational programming in primary and secondary education (*combined session*)
K.2.3: Specialized programming for training at higher technical institutes and universities
K.2.4., L.2.4: Communications as tool of education to meet specific problems of developing countries. Educational services (*joint session*)

L: Communications

L, E: Specialized training of personnel in the fields of transportation and communications (*joint session*)

L.1, L.2: Unification and expansion through telecommunications. Broadcasting and television in less developed areas (*combined session*)

L.3: Problems involved in the development of national and international telecommunications networks

L.4, L.5: Telecommunications in specialized fields. Recent major advances and current developments in the field of electronics of interest to developing areas (*combined session*)

# PRESIDENT AND VICE-PRESIDENTS OF THE CONFERENCE

*President:*
Professor M. S. Thacker (*India*).

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The Right Honourable Lord Casey, P.C., C.H., D.S.O., M.C. (*Australia*);
Dr. J. W. T. Spinks (*Canada*);
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Professor Henri Laugier (*France*);
Professor S. D. Pusponegoro (*Indonesia*);
Mr. Abba Eban (*Israel*);
H.E. Jean Porquet (*Ivory Coast*);
Professor Shigenori Hamada (*Japan*);
H.E. Emilio Calderón Puig (*Mexico*);
Professor J. C. Edozien (*Nigeria*);
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Academician E. K. Fedorov (*Union of Soviet Socialist Republics*);
Sir William Slater, K.B.E., D.Sc. (*United Kingdom of Great Britain and Northern Ireland*);
Mr. Jonathan B. Bingham (*United States of America*).

# OFFICERS OF THE CONFERENCE, INVITED SPEAKERS AND DISCUSSION LEADERS

## (*a*) GENERAL SESSIONS

*Agenda item A: Natural resources*

*Chairman:* Academician E. K. Fedorov (USSR) (Conference Vice-President).
*Guest Speakers:* Mr. David A. Davies, Secretary-General, World Meteorological Organization; Dr. S. Eklund, Director-General, International Atomic Energy Agency.
*Oral Presentations:* Mr. J. C. Chanmugam (Ceylon); Dr. Péter Lázár (Hungary); Mr. M. S. Randhawa (India); Mr. A. Wiener (Israel); Academician V. P. Gerasimov (USSR); Mr. A. Dorfman (Argentina).

*Agenda item B: Human resources*

*Chairman:* Professor Henri Laugier (France) (Conference Vice-President).
*Guest Speaker:* Mr. David A. Morse, Director-General, International Labour Office.
*Oral Presentations:* Dr. N. Keyfitz (Canada); Mr. G. Ardant (France); Mr. V. K. R. V. Rao (India); Dr. W. Nitisastro (Indonesia); Professor S. Taigar (Romania); Dr. A. Shoeb (United Arab Republic).

*Agenda item C: Agriculture*

*Chairman:* Sir William Slater (United Kingdom) (Conference Vice-President).
*Guest Speaker:* Mr. Binay R. Sen, Director-General, Food and Agriculture Organization.
*Oral Presentations:* Mr. C. S. Christian (Australia); Professor E. Saari (Finland); Dr. D. P. Cuthbertson (United Kingdom); Mr. C. E. Kellogg (United States of America); Mr. V. G. Bogorov (USSR).

*Agenda item D: Industrial development*

*Chairman:* Mr. Jonathan B. Bingham (United States of America) (Conference Vice-President).
*Guest Speaker:* Dr. J. Mayobré, Commissioner for Industrial Development, United Nations.
*Oral Presentations:* Mr. Z. Paikert (Czechoslovakia); Dr. J. Szita (Hungary); Mr. Soerjo-Sediono (Indonesia); Mr. J. Herbert Hollomon (United States of America); Mr. K. N. Plotnikov (USSR); Mr. A. Dorfman (Argentina).

*Agenda item E: Transport*

*Chairman:* Professor S. D. Pusponegoro (Indonesia) (Conference Vice-President).
*Oral Presentations:* Mr. J. J. Furniss (United Kingdom); Mr. Kent T. Healy (United States of America).

*Agenda item F: Health and nutrition*

*Chairman:* Professor Josef Lukás (Czechoslovakia) (Conference Vice-President).
*Guest Speaker:* Dr. Marcolino G. Candau, Director-General, World Health Organization.
*Oral Presentations:* Professor M. Magalhães de Silveira (Brazil); Dr. J. Sénécal (France); Professor J. C. Edozien (Nigeria); Dr. A. H. Mousa (United Arab Republic); Sir Harold Himsworth (United Kingdom); Dr. R. Dubos (United States of America).

*Agenda item G: Social problems of development and urbanization*

*Chairman:* Professor J. C. Edozien (Nigeria) (Conference Vice-President).
*Oral Presentations:* Professor R. Dumont (France); Dr. C. A. Doxiadis (Greece); Mr. K. Perczel (Hungary); Dr. Melvin M. Tumin (United States of America).

*Agenda item H: Organization, planning and programming for economic development*

*Chairman:* Ambassador García Oldini (Chile) (Conference Vice-President).
*Guest Speaker:* Mr. Philippe de Seynes, Under-Secretary, Department of Economic and Social Affairs, United Nations.
*Oral Presentations:* Professor E. Mateyev (Bulgaria); Mr. M. P. Massé (France); Rev. L. J. Lebret (Holy See); Dr. S. R. Sen (India); Professor E. S. Mason (United States of America); Mr. A. V. Korobov (USSR).

*Agenda item I: Organization and planning of scientific and technological policies*

*Chairman:* H.E. Jean Porquet (Ivory Coast).
*Guest Speaker:* Professor V. Kovda, Director, Department of Natural Sciences, UNESCO.
*Oral Presentations:* Mr. F. G. Nicholls (Australia); Dr. B. Starnovsky (Czechoslovakia); Dr. H. Seligman (IAEA); Dr. Max F. Millikan (United States of America); Dr. M. Roche (Venezuela).

*Agenda item J: International co-operation and problems of transfer and adaptation*

*Chairman:* Ambassador Emilio Calderón Puig (Mexico) (Conference Vice-President).
*Oral Presentations:* Professor H. Laugier (France); Mr. J. M. Otero Navascues (Spain); Dr. I. M. Romanov (USSR); Sir Gordon Sutherland (United Kingdom); Mr. F. M. Coffin (United States of America).

*Agenda item K: Training of scientific and technical personnel*

*Chairman:* Dr. J. W. T. Spinks (Canada) (Conference Vice-President).
*Guest Speaker:* Mr. René Maheu, Director-General, UNESCO.
*Oral Presentations:* Mr. I. Raw (Brazil); Professor B. Schwarz (France); Dr. A. B. Fafunwa (Nigeria); Professor S. V. Rumyantsev (USSR).

*Agenda item L: Communications*

*Chairman:* Professor Shigenori Hamada (Japan) (Conference Vice-President).
*Guest Speaker:* Mr. G. C. Gross, Secretary-General, International Telecommunication Union.
*Oral Presentations:* Mr. I. A. Newstead (Australia); Mr. J. Briend (France); Mr. S. Amer (United Arab Republic); Mr. Gerald F. Winfield (UNESCO).

## (*b*) SPECIALIZED SESSIONS

### A. Natural Resources

*Agenda item A.1: Mapping and surveying practices adapted to use in less developed areas*

*Chairman:* Lt.-Gen. Phya Salwidhan Nidhes (Thailand).
*Rapporteur:* Mr. R. Janicot (France).
*Discussion Leaders:* Dr. Knorr (Federal Republic of Germany); Mr. A. J. van der Weele (Netherlands); Professor Max Zeller (Switzerland); Academician U. P. Gerasimov (USSR); Rear Admiral H. Arnold Karo (United States of America).

*Agenda item A.2: Integrated river basin development in less developed areas*

*Chairman:* Professor Abel Wolman (United States of America).
*Rapporteur:* Mr. C. S. Christian (Australia).
*Discussion Leaders:* Dr. M. S. Randhawa (India); Mr. Y. M. Simaika (UAR); Mr. Eugene W. Weber (United States of America).

*Agenda item A.3.1: Water development policies (combined session)*

*Chairman:* Professor Emil Mozonyi (Hungary).
*Rapporteur:* Mr. M. M. Selim (United Arab Republic).
*Discussion Leaders:* Mr. E. F. Durrant (Canada); Mr. M. Berta (Italy); Mr. E. J. Davies (Sierra Leone); Mr. Korkut Özal (Turkey); Dr. Shunichi Kurosawa (Japan).

*Agenda item A.3.2: Surface water*

*Chairman:* Mr. E. F. Durrant (Canada).
*Rapporteur:* Professor L. J. Tison (Belgium).
*Discussion Leaders:* Professor E. Tongiorgi (Italy); Mr. J. Najjar (Lebanon); Mr. P. O. Wolf (United Kingdom).

*Agenda item A.3.3: Ground water*

*Chairman:* Dr. Mustafa Nuri Parlar (Turkey).
*Rapporteur:* Professor L. Picard (Israel).
*Discussion Leaders:* Mr. F. B. Haigh (Australia); Professor Theodor Sorgenfrei (Denmark); Mr. I. Chéret (France); Dr. Wolfgang Richter (Federal Republic of Germany); Dr. M. S. Randhawa (India).

*Agenda item A.3.4: Particular problems in water-short areas*

*Chairman:* Mr. Lassad Ben Osman (Tunisia).
*Rapporteur:* Dr. Asghar (Pakistan).
*Discussion Leaders:* Academician G. V. Bogomolov (Byelorussian SSR); Mr. A. Wiener (Israel); Dr. N. Stutterheim (South Africa).

*Agenda item A.4.1: Energy development policies*

*Chairman:* Mr. Celso Papadopulos (Argentina).
*Rapporteur:* Mr. G. Facca (Italy).
*Discussion Leaders:* Dr. I. H. Usmani (Pakistan); Mr. Walton Seymour (United States of America).

*Agenda items A.4.2.1., A.5.2.2., A.5.2.3., A.5.2.4: Mining technology and mechanization*

*Chairman:* Dr. R. W. Willett (New Zealand).
*Rapporteur:* Mr. J. M. Rayner (Australia).
*Discussion Leaders:* Mr. S. F. Yeh (China); Professor Marcin Borecki (Poland); Mr. T. L. Gibbs (South Africa); Mr. Antonio Caso (Spain); Dr. Kung-Ping Wang (United States of America).

*Agenda items A.4.2.2., A.4.2.3., A.4.2.4: Upgrading of fuels and petroleum technology (combined session)*

*Chairman:* Dr. D. T. A. Townend (United Kingdom).
*Rapporteur:* Dr. Humberto Peñaloza (Venezuela).
*Discussion Leaders:* Mr. Melo Franco (Brazil); Professor Remus Radulet (Romania); Dr. A. Moustaf (United Arab Republic); Mr. R. E. Bittner (United States of America).

*Agenda items A.4.2.5., A.4.3.2: Non-conventional sources of energy and nuclear power (combined session)*

*Chairman:* Professor Antonio Carrelli (Italy).
*Rapporteur:* Dr. Professor K. M. Koch (Austria).
*Discussion Leaders:* Mr. J. Apertet (France); Dr. H. J. Bhabha (India); Mr. D. Shimshoni (Israel); Dr. G. Facca (Italy); Academician G. V. Bogomolov (USSR); Mr. E. W. Golding (United Kingdom).

*Agenda items A.4.3.1., A.4.3.3., A.4.3.4: Electrical power*

*Chairman:* Mr. P. Ailleret (France).
*Rapporteur:* Dr. M. El Kosheiri (United Arab Republic).
*Discussion Leaders:* Mr. H. W. Bierkebo (Norway); Professor N. S. Kurbatova (Ukrainian SSR); Mr. E. W. Golding (United Kingdom); Mr. Stjepan Han (Yugoslavia).

*Agenda item A.5.1: Mineral development policy*

*Chairman:* Mr. A. Hamou (Morocco).
*Rapporteur:* Mr. Sutarjo Sigit (Indonesia).
*Discussion Leaders:* Mr. W. K. Buck (Canada); Dr. Hannfrid Putzer (Federal Republic of Germany); Mr. Joseph Richards (Liberia); Professor Marcin Borecki (Poland).

*Agenda items A.5.1.2., A.5.2.1., A.5.3: Mineral exploration methods and concentration of ores and minerals (combined session)*

*Chairman:* Dr. W. D. Johnston, Jr. (United States of America).
*Rapporteur:* Dr. S. H. U. Bowie (United Kingdom).
*Discussion Leaders:* Mr. J. M. Rayner (Australia); Mr. A. P. Marelle (France); Mr. F. Tonani (Italy); Mr. A. Benchekroun (Morocco); Dr. Humberto Peñaloza (Venezuela).

## B. Human Resources

*Agenda item B.1: Population trends*

*Chairman:* Mr. K. T. de Graft-Johnson (Ghana).
*Rapporteur:* Dr. M. Magalhães da Silveira (Brazil).
*Discussion Leaders:* Mr. N. Keyfitz (Canada); Mr. V. K. R. V. Rao (India); Professor Widjojo Nitisastro (Indonesia); Professor H. Hyrenius (Sweden); Dr. Milos Macura (Yugoslavia).

*Agenda items B.2.1., K.1.1: Forecasting requirements and priorities of numbers and types of scientists and technologists. Technique of manpower assessment (joint session)*

*Chairman:* Professor L. Massart (Belgium).
*Rapporteur:* Dr. Lucien Piché (Canada).
*Discussion Leaders:* Dr. R. D. Loken (Ghana); Professor Alves Martins (Portugal); Dr. B. I. Braginsky (USSR); Mr. Ewan Clague (United States of America); Dr. Milos Macura (Yugoslavia).

*Agenda item B.2.2: New systems of vocational training and apprenticeship*

*Chairman:* Major General C. Lloyd (United Kingdom).
*Rapporteur:* Professor Tiberiu Ionescu (Romania).
*Discussion Leaders:* Mr. Pedro Carriquiriborde (Argentina); Mr. F. Simon (France); Mr. Toshiyuki Noguchi (Japan); Dr. S. G. Korneyev (USSR).

*Agenda item B.3: Sound management and management development as a factor in technological progress*

*Chairman:* Dr. Milos Macura (Yugoslavia).
*Rapporteur:* Dr. Thomas E. Posey (United States of America).
*Discussion Leaders:* Professor J. Y. Tabb (Israel); Dr. Ahmed F. Sherif (United Arab Republic); Mr. Frederick H. Harbison (United States of America); Mr. Stepan Han (Yugoslavia).

*Agenda item B.4: Employment implications of applications of science and technology in less developed areas*

*Chairman:* Dr. Ewan Clague (United States of America).
*Rapporteur:* Dr. V. M. Kollontai (USSR).
*Discussion Leaders:* Dr. S. H. Zaheer (India); Mr. N. Abdourahim Ndiaye (Senegal); Dr. P. G. Podyachikh (USSR).

*Agenda item B.5: The application of science and technology to conditions at the work place*

*Chairman:* Professor N. Tsamboulas (Greece).
*Rapporteur:* Professor Svend Aage Andersen (Denmark).
*Discussion Leaders:* Dr. Leo Noro (Finland); Dr. J. J. Gillon (France); Dr. Isador Lubin (United States of America).

## C. AGRICULTURE

*Agenda item C.1.1: Agrarian structures and land settlement*

*Chairman:* Mr. Roland Diziain (Cameroon).
*Rapporteur:* Professor Colin M. Donald (Australia).
*Discussion Leaders:* Mr. Adamandios Pepelassis (Greece); Dr. G. G. Kotovsky (USSR); Mr. S. Hegrass (United Arab Republic).

*Agenda item C.1.2: Agricultural credit, co-operatives and marketing*

*Chairman:* Mr. K. F. Svärdström (Sweden).
*Rapporteur:* Mr. Salvador Serrats Urquiza (Spain).
*Discussion Leaders:* Mr. Y. S. Landau (Israel); Professor Vasile Malinschi (Romania); Dr. N. I. Anisimov (USSR); Dr. Sherman E. Johnson (United States of America); Mr. Nguyen Huu Tan (Viet-Nam).

*Agenda items C.1.3., C.1.4: Agricultural extension and farm management and planned development*

*Chairman:* Professor Vasile Malinschi (Romania).
*Rapporteur:* Dr. K. van der Meer (Netherlands).
*Discussion Leaders:* Mr. Roland Diziain (Cameroon); Dr. J. C. Gilson (Canada); Mr. Carl Christian Thomsen (Denmark); Professor J. Tepicht (Poland); Mr. R. J. M. Swynnerton (United Kingdom).

*Agenda items C.2.1., C.2.2: Nutrition and public health policies. General nutrition problems (joint session with F)*

*Chairman:* Dr. Ali Hassan (United Arab Republic).
*Rapporteur:* Dr. Nelson Chaves (Brazil).
*Discussion Leaders:* Dr. J. F. McCreary (Canada); Dr. F. T. Sai (Ghana;) Mr. B. Hallgren (Sweden); Dr. Kamdhorn Suvarnakich (Thailand).

*Agenda item C.3.1: Soil science and soil surveys*

*Chairman:* Academician U. P. Gerasimov (USSR).
*Rapporteur:* Professor P. O. Ripley (Canada).
*Discussion Leaders:* Dr. István Szabolcs (Hungary); Mr. Sadikin Sumintawikarta (Indonesia); Mr. Sarot Montrakul (Thailand); Dr. E. W. Russell (United Kingdom).

*Agenda item C.3.2: Irrigation and water use*

*Chairman:* Mr. I. T. Kittani (Iraq).
*Rapporteur:* M. Ben Osman (Tunisia).
*Discussion Leaders:* Mr. E. J. Davies (Sierra Leone); Mr. A. Z. Zahidov (USSR); Mr. R. M. Hagan (United States of America).

*Agenda items C.3.3., C.3.4., C.4.3: Soil management under low rainfalls. Shifting cultivation cropping practices*

*Chairman:* Professor S. Hurwitz (Israel).
*Rapporteur:* M. Hélder Lains e Silva (Portugal).
*Discussion Leaders:* Mr. Jorge Molina (Argentina); Professor C. M. Donald (Australia); Dr. E. W. Russell (United Kingdom).

*Agenda item C.4.1: Plant breeding and improved varieties*

*Chairman:* Mr. Miguel Pereira Coutinho (Portugal).
*Rapporteur:* Professor Yuen-Liang Ku (China).
*Discussion Leaders:* Academician Pavel Popov (Bulgaria); Dr. H. A. Togby (United Arab Republic); Dr. Ryuji Ito (Japan).

*Agenda item C.4.2: The control of pests, diseases and deficiencies*

*Chairman:* Dr. C. J. P. Magee (Australia).
*Rapporteur:* Dr. E. C. Stakman (United States of America).
*Discussion Leaders:* Dr. M. O. Ghani (Pakistan); Dr. J. W. C. Geyer (South Africa); Professor C. W. Wardlaw (United Kingdom).

*Agenda item C.5.1: Disease control*

*Chairman:* Mr. G. Buck (Madagascar).
*Rapporteur:* Dr. Ralph C. Fish (United States of America).
*Discussion Leaders:* Professor S. G. Wilson (Netherlands); Dr. B. C. Jansen (South Africa); Professor B. G. Petrenko (Ukrainian SSR).

*Agenda item C.5.2: Animal breeding*

*Chairman:* Mr. Vicente Brunini (Argentina).
*Rappporteur:* Mr. Gonchig (Mongolia).
*Discussion Leaders:* Mr. R. M. Hutchinson (Ghana); Professor P. Hoekstra (Netherlands); Dr. J. L. Lush (United States of America).

*Agenda item C.5.3: Animal nutrition and management*

*Chairman:* Dr. P. Receveur (Niger).
*Rapporteur:* Professor B. G. Petrenko (Ukrainian SSR).
*Discussion Leaders:* Mr. W. Webster (Australia); Professor E. Jacobsen (Denmark); Dr. F. N. Bonsma (South Africa).

*Agenda items C.5.4., C.6.3., C.6.4: Handling, storage and processing of agricultural produce. Dairy technology*

*Chairman:* Professor Mogens Sode-Mogenson (Denmark).
*Rapporteur:* Professor Hermann Mohler (Switzerland).
*Discussion Leaders:* Mr. M. B. Rougé (France); Mr. A. Lloyd Ryall (United States of America).

*Agenda items C.6.1., C.6.2: Agricultural engineering and development of agricultural equipment*

*Chairman:* Professor W. M. Myers (United States of America).
*Rapporteur:* Professor B. G. Petrenko (Ukrainian SSR).
*Discussion Leaders:* Mr. Tosko Vanchev (Bulgaria); Mr. Miroslav Novak (Czechoslovakia); Asst. Professor Thomas Toogaard Pedersen (Denmark); Mr. M. Moberg (Sweden).

*Agenda items C.7.1., C.7.2., C.7.3: Forestry and forest products*

*Chairman:* Professor Eino Saari (Finland).
*Rapporteur:* Mr. Ange M'ba (Gabon).
*Discussion Leaders:* Dr. J. H. Jenkins (Canada); Dr. M. S. Randhawa (India); Mr. L. Birkner (Sweden).

*Agenda items C.8.1., C.8.2: Marine fisheries and inland fisheries*

*Chairman:* Dr. Victor Angelescu (Argentina).
*Rapporteur:* Dr. S. Laszyczynski (Poland).
*Discussion Leaders:* Dr. Atusushi Furukawa (Japan); Professor C. Boisson (Senegal); Mr. V. G. Bogorov (USSR).

## D. Industrial Development

*Agenda items D.1., D.3.1., D.3.2., D.3.4: Special factors affecting industrial development in less developed areas*

*Chairman:* Professor J. Pajestka (Poland).
*Rapporteur:* Mr. Guy B. Gresford (Australia).
*Discussion Leaders:* Mr. Parga Nina (Brazil); Mr. Filemon Rodriguez (Philippines); Academician A. A. Arakelian (USSR); Dr. Y. El Molla (United Arab Republic); Mr. William A. W. Krebs (United States of America).

*Agenda item D.2: Structural and locational problems of industry*

*Chairman:* Mr. J. E. Oberholtzer (Canada).
*Rapporteur:* Academician A. A. Arakelian (USSR).
*Discussion Leaders:* Mr. I. Anondo (Indonesia); Mr. José Marcelo (Philippines); Dr. K. N. Plotnikov (USSR); Dr. Eugene Staley (United States of America); Dr. B. Colanovic (Yugoslavia).

*Agenda items D.3.3., D.9.1., J.2.2: Specifications and standards (joint session)*

*Chairman:* Mr. Pedro Carriquiriborde (Argentina).
*Rapporteur:* Dr. V. Weidemann (Federal Republic of Germany).
*Discussion Leaders:* Mr. Jíří Nevřala (Czechoslovakia); Mr. P. Salmon (France); Dr. J. M. Romanov (USSR); Mr. G. Weston (United Kingdom); Dr. A. V. Astin (United States of America)

*Agenda item D.4: Food processing and preservation*

*Chairman:* Professor Svend Aage Andersen (Denmark).
*Rapporteur:* Professor Eugenio Tropa (Portugal).
*Discussion Leaders:* Professor A. Capart (Belgium); Mr. R. Nilsson (Sweden); Dr. L. Goldberg (United Kingdom); Mr. J. E. Wickersham (United States of America).

*Agenda item D.5: Products of animal and vegetable origin and substitutes*

*Chairman:* Mr. Hachemi Larabi (Algeria).
*Rapporteur:* Dr. T. Walsh (Ireland).
*Discussion Leaders:* Professor A. Capart (Belgium); Mr. R. Nilsson (Sweden); Dr. L. Goldberg (United Kingdom); Mr. J. E. Wickersham (United States of America).

*Agenda item D.6.1: Textiles*

*Chairman:* Professor Emil Honegger (Switzerland).
*Rapporteur:* Dr. A. Hogazy (United Arab Republic).
*Discussion Leaders:* Mr. M. Dollfuss (France); Dr. M. S. Randhawa (India); Professor G. Centola (Italy); Professor J. J. Vincent (United Kingdom).

*Agenda items D.7., D.8: Iron and steel. Non-ferrous metals (combined session)*

*Chairman:* Mr. J. R. D. Tata (India).
*Rapporteur:* Mr. Coheur (Belgium).
*Discussion Leaders:* Mr. W. K. Buck (Canada); Professor G. Scortecci (Italy); Dr. O. B. Djamalov (USSR); Mr. E. K. Sandbach (United States of America).

*Agenda items D.9., D.10.1: Engineering techniques and organization. Heavy engineering industries (combined session)*

*Chairman:* Professor K. N. Plotnikov (USSR).
*Rapporteur:* Dr. Federico Rivero (Venezuela).
*Discussion Leaders:* Mr. Václav Capek (Czechoslovakia); Mr. Antonio Portela (Portugal); Professor N. A. Dudley (United Kingdom).

*Agenda items D.11., D.12: Fertilizers and heavy chemicals (combined session)*

*Chairman:* Mr. Branko Colanovic (Yugoslavia).
*Rapporteur:* Mr. A. Benchekroun (Morocco).
*Discussion Leaders:* Professor M. Homes (Belgium); Professor Hans Sachsse (Federal Republic of Germany); Dr. S. H. Zaheer (India).

*Agenda items D.13., D.14: Building materials and building techniques (combined session)*

*Chairman:* Dr. F. M. Lea (United Kingdom).
*Rapporteur:* Mr. Sang Keun Chun (Korea).
*Discussion Leaders:* Professor Vladimir Lach (Czechoslovakia); Mr. A. Mayer (France); Professor Rachel Shalon (Israel); Professor Elio Giangreco (Italy); Mr. J. Van Ettinger (Netherlands).

## E. Transport

*Agenda item E.1: Factors in the development of national transport policies (combined session)*

*Chairman:* Mr. Wilfred Owen (United States of America).
*Rapporteur:* Mr. R. S. P. Bonney (United Kingdom).
*Discussion Leaders:* Mr. C. Brisson (France); Mr. José Ignacio Uriol Salcedo (Spain).

*Agenda item E.2: Roads and road transport*

*Chairman:* Mr. J. A. Gandilhon (France).
*Rapporteur:* Mr. D. F. Glynn (Australia).
*Discussion Leaders:* Professor J. Volmuller (Netherlands); Professor Jan Podoski (Poland); Dr. R. S. Millard (United Kingdom).

*Agenda item E.3: Railways*

*Chairman:* Mr. F. H. Fakiner (Federal Republic of Germany).
*Rapporteur:* Dr. M. S. Quraishy (Pakistan).
*Discussion Leaders:* Mr. K. A. Smith (Australia); Mr. Shigeru Fujishima (Japan); Mr. H. F. Dennison (United Kingdom).

*Agenda item E.4: Inland water transport and coastal shipping*

*Chairman:* Mr. P. Omtvedt (Norway).
*Rapporteur:* Professor A. Lederer (Belgium).
*Discussion Leaders:* Dr. H. C. Freiesleben (Federal Republic of Germany); Dr. M. S. Quraishy (Pakistan); Mr. Robert B. Keating (United States of America).

*Agenda item E.5: Air transport and specialized uses of aircraft in less developed areas*

*Chairman:* Mr. Louis Bonte (France).
*Rapporteur:* Mr. D. C. A. Rendel (United Kingdom).
*Discussion Leaders:* Mr. J. Mercier (France); Mr. J. R. D. Tata (India); Mr. M. S. El-Hakim (United Arab Republic).

*Agenda item E.6: New techniques in the transport of fuels and perishable goods*

*Chairman:* Mr. Mohammad Mohtadi (Iran).
*Rapporteur:* Mr. A. Assouline (Morocco).
*Discussion Leaders:* Mr. D. Durand (France); Mr. A. Lloyd Ryall (United States of America).

## F. Health and Nutrition

*Agenda item F.1.1: Plan for health services and contribution of science and technology to its formulation and execution. Need for vital and health statistics*

*Chairman:* Professor F. Widy-Wirski (Poland).
*Rapporteur:* Professor Armando Parodi (Argentina).
*Discussion Leaders:* Dr. Jean Claude Happi (Cameroon); Dr. F. T. Sai (Ghana); Dr. Y. Cohen (Israel); Dr. J. S. Tesch (Netherlands).

*Agenda items F.1.2., F.1.3: The principles of health service planning and the development of the health programme*

*Chairman:* Dr. P. Shupick (Ukrainian SSR).
*Rapporteur:* Dr. W. R. Aykroyd (United Kingdom).
*Discussion Leaders:* Professor Dante Costa (Brazil); Dr. Tibor Bákacs (Hungary); Dr. J. A. Höjer (Sweden); Dr. N. R. E. Fendall (United Kingdom); Dr. Leona Baumgartner (United States of America).

*Agenda item F.1.4: Introduction of pharmaceuticals: problems of costs and quality*

*Chairman:* Dr. Karl Evang (Norway).
*Rapporteur:* Dr. A. Héritier (Switzerland).
*Discussion Leaders:* Professor B. Babudieri (Italy); Dr. M. M. Motawi (United Arab Republic); Dr. H. Davis (United Kingdom).

*Agenda items F.2., F.2.1., F.2.2: Control of communicable diseases in the light of developments in science and technology*

*Chairman:* Dr. Marcel Roche (Venezuela).
*Rapporteur:* Professor M. Attisso (Senegal).
*Discussion Leaders:* Dr. T. W. Cameron (Canada); Professor B. Babudieri (Italy); Dr. N. I. Graschenkov (USSR); Dr. M. A. Attia (United Arab Republic); Dr. Albert B. Sabin (United States of America).

*Agenda item F.2.3: The problem of mental disease in less developed areas*

*Chairman:* Dr. T. A. Lambo (Nigeria).
*Rapporteur:* Professor Eduardo Faraco (Brazil).
*Discussion Leaders:* Dr. Rodrigo Fierro-Benitez (Ecuador); Mr. R. Gineste (France); Professor G. M. Carstairs (United Kingdom); Dr. Alexander H. Leighton (United States of America).

*Agenda items F.3.1., F.3.2., F.3.3: The need for various categories of health personnel. Changing responsibilities in health team*

*Chairman:* Dr. A. F. Tuboku-Metzger (Sierra Leone).
*Rapporteur:* Professor M. Prywes (Israel).
*Discussion Leaders:* Professor Georgi Galabov (Bulgaria); Dr. N. I. Grashchenkov (USSR); Dr. M. Talaat (United Arab Republic); Dr. John C. Snyder (United States of America).

*Agenda item F.4: The role of medical research*

*Chairman:* Dr. R. S. Morrison (United States of America).
*Rapporteur:* Dr. J. F. McCreary (Canada).
*Discussion Leaders:* Professor Armando Parodi (Argentina); Dr. F. T. Sai (Ghana); Dr. Dradjat D. Prawiranegara (Indonesia); Professor M. Rachmiliewitz (Israel); Mr. Conrado Dayrit (Philippines); Professor Tiberiu Ionescu (Romania).

## G. Social Problems of Development and Urbanization

*Agenda item G.1: Problems of rural development*

*Chairman:* Mr. Václav Eremiás (Czechoslovakia).
*Rapporteur:* Mr. Khaled Ben Ammar (Tunisia).
*Discussion Leaders:* Mr. L. Barberis (Italy); Dr. T. A. Zhdanko (USSR); Dr. Allan R. Holmberg (United States of America).

*Agenda items G.1., G.2: Rural development and urbanization (combined session)*

*Chairman:* Professor G. U. Papi (Italy).
*Rapporteur:* Mr. Václav Oplustil (Czechoslovakia).
*Discussion Leaders:* Mr. H. de Fraysseix (France); Professor V. K. R. V. Rao (India); Dr. R. Weitz (Israel); Dr. B. Palanova (USSR); Dr. G. Franklin Edwards (United States of America).

*Agenda item G.2: Urbanization problems*

*Chairman:* Dr. C. A. Doxiadis (Greece).
*Rapporteur:* Mr. Yilmaz Güven (Turkey).
*Discussion Leaders:* Professor L. Tonev (Bulgaria); Mrs. L. R. Polonskaya (Byelorussian SSR); Dr. A. J. Dakin (Canada); Mr. Karoly Perczel (Hungary); Mr. Aaron Milton (Liberia); Dr. A. Khalifa (United Arab Republic).

## H. Organization, Planning and Programming for Economic Development

*Agenda item H.1 (Part I): Methodology of planning for development. Part I: Planning: Aggregate, sectoral and priorities among sectors*

*Chairman:* Dr. Max F. Millikan (United States of America).
*Rapporteur:* Dr. S. R. Sen (India).
*Discussion Leaders:* Dr. Aldo Ferrer (Argentina); Miss Marie Vavrejnova (Czechoslovakia); Mr. Cazes (France); Professor Josef Pajestka (Poland); Dr. A. F. Sherif (United Arab Republic).

*Agenda item H.1 (Part II): Methodology of planning for development. Part II: Regional planning*

*Chairman:* Professor Macedo Soares Guimaraes (Brazil).
*Rapporteur:* Mr. Milan Franek (Czechoslovakia).
*Discussion Leaders:* Dr. F. Curato (Italy); Professor Roman Moldovan (Romania); Dr. I. V. Komar (USSR).

*Agenda item H.1 (Part III): Methodology of planning for development. Part III: Statistics, research requirements, other problems of planning*

*Chairman:* Professor J. Tinbergen (Netherlands).
*Rapporteur:* Mr. W. F. Searle (United Kingdom).
*Discussion Leaders:* Mr. Francisco Moura (Portugal); Dr. P. G. Podyachikh (USSR); Dr. Gerhard Colm (United States of America).

*Agenda items H.1., H.3: Common problems of methodology of planning for development and implementation*

*Chairman:* Professor V. K. V. Rao (India).
*Rapporteur:* Dr. V. M. Kollontai (USSR).
*Discussion Leaders:* Dr. E. R. Walker (Australia); Dr. J. Bognar (Hungary); Mr. Elias Gannagé (Lebanon); Mr. I. Sachs (Poland); Dr. Albin Orthaber (Yugoslavia).

*Agenda item H.2: Organization arrangements for economic development including some reference to methodology*

*Chairman:* Academician B. G. Gafurov (USSR).
*Rapporteur:* Mr. W. F. Searle (United Kingdom).
*Discussion Leaders:* Dr. Bruno Knall (Federal Republic of Germany); Mr. József Bognár (Hungary); Dr. A. C. Copisarow (United Kingdom).

*Agenda item H.3: Implementation of economic development plans including some reference to organization*

*Chairman:* Dr. I. H. Abdel Rahman (United Arab Republic).
*Rapporteur:* Dr. Shâpur Sharifi (Iran).
*Discussion Leaders:* Mr. Angel Gilo Muirraqui (Ecuador); Dr. D. Kochav (Israel); Professor Roman Moldovan (Romania); Dr. V. M. Kollontai (USSR); Mr. Kenneth R. Hansen (United States of America).

## I. Organization and Planning of Scientific and Technological Policies

*Agenda items I.1.1., I.2.2., I.2.3: Special problems of scientific policy planning*

*Chairman:* Dr. Salimuzzaman Siddiqui (Pakistan).
*Rapporteur:* Mr. Avakum Branitchev (Bulgaria).
*Discussion Leaders:* Professor Athos Silveira Ramos (Brazil); Academician V. F. Kuprevich (Byelorussian SSR); Dr. S. H. Zaheer (India); Professor I. Malecki (Poland); Mr. E. Martindale (United Kingdom).

*Agenda items I.2.1., I.1.2: Formulation of research policies and programmes (combined sesssion)*

*Chairman:* Professor R. M. Soemantri (Indonesia).
*Rapporteur:* Mr. Jaakko Iloniemi (Finland).
*Discussion Leaders:* Professor Leite Lopes (Brazil); Dr. W. B. Lewis (Canada); Professor F. Gatto (Italy); Professor Remus Radulet (Romania); Dr. N. Stutterheim (South Africa); Academician U. A. Arifov (USSR).

## J. International Co-operation and Problems of Transfer

*Agenda item J.1: Methods for stimulating technological change*

*Chairman:* Academician V. F. Kuprevich (Byelorussian SSR).
*Rapporteur:* Professor M. Destanne de Bernis (France).
*Discussion Leaders:* Professor E. Malavolta (Brazil); Professor Dr. J. van Baal (Netherlands); Academician U. A. Arifov (USSR); Mr. A. A. Sabet (United Arab Republic); Mr. G. H. McLaughlin (United Kingdom).

*Agenda item J.2.1: Scientific and technological documentation, including the problems of language and terminology*

*Chairman:* Professor Vicente Gómez Aranda (Spain).
*Rapporteur:* Sir Thomas Scrivenor (United Kingdom).
*Discussion Leaders:* Mr. J. Parga Nina (Brazil); Dr. P. R. Brygoo (France); Dr. S. H. Zaheer (India); Academician S. U. Umarov (USSR); Dr. Harold D. Lasswell (United States of America).

*Agenda items J.2.3., J.3.2: Technical exchange programme. Technical co-operation programmes and co-ordination with national development policies*

*Chairman:* Dr. E. R. Walker (Australia).
*Rapporteur:* Mr. Andrés Lara-Saenz (Spain).
*Discussion Leaders:* Mr. Eichler (Federal Republic of Germany); Dr. R. D. Loken (Ghana); Dr. A. D'Alessandro (Italy); Dr. Hollis W. Peter (United States of America); Mr. S. M. Del Carril (Argentina).

*Agenda items J.3., J.3.1: International co-operation. International scientific co-operation*

*Chairman:* Academician Evgeni Kamenov (Bulgaria).
*Rapporteur:* Mr. Raúl L. Cardon (Argentina).
*Discussion Leaders:* Mr. Crémieux Brilhac (France); Academician M. I. Agoshkov (USSR); Dr. Harrison S. Brown (United States of America).

## K. Training of Scientific and Technical Personnel

*Agenda items K.1.2., K.2.3: Specialized training at technical schools and means of accelerating formation of scientific and technological cadres including teaching staffs (combined session)*

*Chairman:* Dr. Tsung-Han Shen (China).
*Rapporteur:* Dr. Ewan Clague (United States of America).
*Discussion Leaders:* Mr. Bela Lengyel (Hungary); Dr. Hanoch Rinott (Israel); Professor L. J. Mostertman (Netherlands); Professor S. V. Rumiantsev (USSR); Dr. Harry C. Kelly (United States of America).

*Agenda items K.2.1., K.2.2: Scope and place of science and technology in general education. Specific new approaches to educational programming in primary and secondary education (combined session)*

*Chairman:* Dr. Raziuddin Siddiqui (Pakistan).
*Rapporteur:* Professor I. Raw (Brazil).
*Discussion Leaders:* Mr. Ascencio Carlos Lara (Argentina); Professor F. A. Kufour (Ghana); Professor Carlo A. Cavalli (Italy); Academician N. M. Zhavoronkov (USSR).

*Agenda item K.2.3: Specialized programming for training at higher technical institutes and universities*

*Chairman:* Academician N. M. Zhavoronkov (USSR).
*Rapporteur:* Mr. E. Gannagé (Lebanon).
*Discussion Leaders:* Mr. Victor Leinz (Brazil); Professor Antonin Bohác (Czechoslovakia); Professor Rachel Shalon (Israel); Dr. S. A. Huzayyin (United Arab Republic); Professor S. Mackey (United Kingdom).

*Agenda items K.2.4., L.2.4: Communications as tool of education to meet specific problems of developing countries. Educational services (joint session)*

*Chairman:* Dr. Albert Daguerre (Senegal).
*Rapporteur:* Dr. A. F. Tuboku-Metzger (Sierra Leone).
*Discussion Leaders:* Mr. E. R. Dawes (Australia); Professor Italo Neri (Italy); Dr. Murat Dikman (Turkey); Mr. Vernon Bronson (United States of America).

## L. COMMUNICATIONS

*Agenda items L and E: Specialized training of personnel in the fields of transportation and communication (joint session)*

*Chairman:* Mr. D. González Gómez (Mexico).
*Rapporteur:* Mr. M. A. Abdel Salam (United Arab Republic).
*Discussion Leaders:* Dr. W. Scholz (Federal Republic of Germany); Mr. R. S. Halsey (United Kingdom).

*Agenda items L.1, L.2: Unification and expansion through telecommunications. Broadcasting and television in less developed areas (combined session)*

*Chairman:* Mr. T. F. Rogers (United States of America).
*Rapporteur:* Mr. Alberto Ospina (Colombia).
*Discussion Leaders:* Mr. Jaroslav Beránek (Czechoslovakia); Mr. J. J. Matras (France); Mr. Salah Amer (United Arab Republic); Mr. E. W. Allen, Jr. (United States of America).

*Agenda item L.3: Problems involved in the development of national and international telecommunications networks*

*Chairman:* Dr. C. F. Boyce (South Africa).
*Rapporteur:* Mr. J. H. Merriman (United Kingdom).
*Discussion Leaders:* Mr. I. A. Newstead (Australia); Mr. J. Briend (France); Dr. M. M. Riad (United Arab Republic).

*Agenda items L.4., L.5: Telecommunications in specialized fields. Recent major advances and current developments in the field of electronics of interest to developing areas (combined session)*

*Chairman:* Mr. M. Ponte (France).
*Rapporteur:* Professor Michael Anastassiadis (Greece).
*Discussion Leaders:* Professor Humberto R. Ciancaglini (Argentina); Professor F. Carassa (Italy); Mrs. A. G. Masevitch (USSR); Mr. T. F. Rogers (United States of America).

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# SCIENTIFIC SECRETARIAT

## AGENDA ITEM A: NATURAL RESOURCES

| | *Sessions serviced* |
|---|---|
| Mr. M. K. Gopaliengar (in charge of agenda item) | General<br>A.4.3.1., 3. and 4. |
| Mr. A. J. Dilloway ... ... ... ... | A.2., A.3.1., A.3.2. |
| Mr. Z. Falecki ... ... ... ... ... | A.4.2.2., 3. and 4. |
| Professor A. Marussi ... ... ... ... | A.1., A.5.1. |
| Mr. G. van Rhyn ... ... ... ... ... | A.4.1. |
| Miss M. Richard ... ... ... ... ... | A.3.3., A.3.4. |
| Mr. J. C. Webb ... ... ... ... ... | A.5.1.2./5.2.1./5.3.<br>A.4.2.1./5.2.2., 3. and 4. |

## AGENDA ITEM B: HUMAN RESOURCES

| | |
|---|---|
| Mr. D. H. Hobden (in charge of agenda item) ... | General, B.4. |
| Mrs. A. Béguin ... ... ... ... ... | B.2.1./K.1.1. |
| Mr. N. Dufty ... ... ... ... ... | B.3. |
| Mr. B. Fortin ... ... ... ... ... | B.2.2. |
| Mr. E. Hellen ... ... ... ... ... | B.5. |
| Mr. K. J. Penniment ... ... ... ... | B.1. |

## AGENDA ITEM C: AGRICULTURE

| | |
|---|---|
| Dr. Ralph W. Phillips (in charge of agenda item) | General |
| Mr. J. H. Anderson ... ... ... ... | C.5.3. |
| Dr. J. Bengoa (Consultant) ... ... ... | C.2.1. and 2. |
| Dr. H. H. Brown ... ... ... ... ... | C.8.1. and 2. |
| Dr. A. B. Fagundes ... ... ... ... | C.3.3. and 4./C.4.3. |
| Mr. R. G. Fontaine ... ... ... ... | C.7.1., 2. and 3. |
| Mr. L. Garnier ... ... ... ... ... | C.3.2. |
| Mr. F. George ... ... ... ... ... | C.1.1. |
| Mr. R. N. Henry ... ... ... ... ... | C.1.2. |
| Dr. V. Ignatieff ... ... ... ... ... | C.3.1. |
| Dr. E. H. Jacoby ... ... ... ... ... | C.1.1. |
| Mr. N. R. Joshi ... ... ... ... ... | C.5.2. |
| Dr. K. V. L. Kesteven ... ... ... ... | C.5.1. |
| Dr. D. C. Kimmel ... ... ... ... ... | C.1.3. and 4. |
| Dr. Lee Ling ... ... ... ... ... | C.4.2. |
| Mr. J. Marley ... ... ... ... ... | C.1.3. and C.1.4. |
| Dr. B. M. Nicol ... ... ... ... ... | C.2.1. and 2. |
| Mr. K. Stenstrom ... ... ... ... ... | C.6.1. and 2. |
| Dr. M. Theilebein ... ... ... ... ... | C.4.1. |
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PART II

# Reports and papers considered by the Conference

# List of reports and papers considered by the Conference

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A/92 Surveying and mapping practices for use in under-developed countries (Liberia), Sawyer, J. L. F.

A/93 Local sources of energy, micro-hydroelectric stations, with particular emphasis on the electrification of agriculture (Hungary), Gádor, E.

A/94 The technique of photo-interpretation for mineral exploration (Netherlands), Verstappen, H. Th.

A/95 Appraisal of existing water resources, uses and requirements and allocation to different uses (Yugoslavia), Nesovic, B.

A/96 Contribution of the Corporacion de Fomento de la Produccion to the development of the underground water in Chile (Chile), Donoso, J., Dingman, R. J., Doyel, W. W.

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A/119 Evaluation of foreseeable energy requirements (Economic Commission for Europe), Energy Division

A/120 The geological education programme of the Government of Brazil and its relations to national scientific development (Brazil), Leonardos, O., Leinz, V., Bodenlos, A. J.

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B/69 Mobilization of manpower potential in Asia and Africa (Federal Republic of Germany), Billerbeck, K.
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B/74 The role of management in economic development (International Labour Office), International Labour Office
B/75 Training for management: a co-ordinated national management development programme (Ghana), Soloyanis, G.
B/76 Ergonomy in the countries in the process of development, possible applications and measures for assuring diffusion (France), Leplat, M.

## C. AGRICULTURE

C/1 Some aspects of wild and marginal land resources conservation (Invited Special Contribution), Watterson, G. G.
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C/3 The role of refrigerating techniques in the development of under-developed countries (Invited Special Contribution), Thevenot, R.
C/4 Schedule of seven years of trials on fertilization in Mali-M'Pesoba station (Mali), Richard, L.
C/5 The development of fishery resources (Ghana), Rawson, G. C., Adjetey, J. N. N.
C/6 Irrigation in Sierra Leone; possibilities and prospects (Sierra Leone), Mitchell, P. K.
C/7 Rinderpest Eradication Programme of Taiwan, Republic of China (China), Lee, R. C. T.

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C/9 Forage conservation and supplementary feeding of beef cattle (Argentina), Bignoli, D. P., Bravo, B. F., Forti, C.

C/10 Hog Cholera Control Programme of Taiwan, Republic of China (China), Young, S. S.

C/11 Home economics extension in Food for Health Programme in Taiwan, Republic of China (China), Colling, F., Li, A. H.

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C/14 Veterinary research and vaccine production under African conditions (South Africa), Jansen, B. C.

C/15 Agrarian structures and land settlement (South Africa), Pepler, L. A.

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C/23 Cattle production on the Ivory Coast (Ivory Coast), Chalumeau, P.

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H/34 Factors governing the capacity for absorbing foreign aid and the development of under-developed countries (France), Albertini, J. M.
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H/42 Planning in national economy of the USSR (USSR), Korobov, A.
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H/50 Statistical services in Africa (Cameroon), Ficatier, A.
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H/68 Planning as a continuing process (USA), Hansen, K. R.

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H/70 The organization of the planning bodies of the Byelorussian SSR (Byelorussian SSR), Pashkevich, O. N.

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I/2 Scientific research organization in United Arab Republic (United Arab Republic), Heydayat, S. El Din
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I/4 National policy for science in developing countries (Israel), Arnon, I., Keynan, A., Shimshoni, D.
I/5 Measurement of science in less developed countries (Sweden), Dedijer, S.
I/6 Growth and adaptation of radioisotope work in Ghana (Ghana), Ward, A. H.
I/7 Nuclear energy research and development in South Africa (South Africa), Roux, A. J. A.
I/8 The impact of scientific and technological policies on economic development (Indonesia), Makagiansar, M.
I/9 Research in biotechnology: a factor in advancing the technically under-developed countries (Sweden), Heden, C. G.
I/10 Research, and the training of university physics lecturers on a regional scale, Latin American Physics Centre (Brazil), De Almeida Fialho, G. E.
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I/13 The need for fundamental science in the less developed countries (Venezuela), Roche, M.
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I/16 The effect of scientific and technical policy on economic development (France), Cognard, P.
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I/22 Direction and organization of research in relation to natural resources (UNESCO), Batisse, M.

I/23 The financing of scientific and technical research and the appreciation of its results (France), Grasset, Y.

I/24 Organization and planning of scientific and technological policies (India), Thacker M. S.

I/25 The part played by scientific research in the oil industry: its importance for developing countries, the link with education (France), Favre, J.

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I/28 Science as a major factor in development: the special problems facing science in less developed countries (Australia), Nicholls, F. G.

I/29 Allocation of resources to scientific research and the assessment of results (Australia), Gresford, G. B.

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I/32 Scientific research and development in the Republic of Senegal (Senegal), Daguerre, A.

I/33 The ties between science and production as a factor of scientific and technical progress (Ukrainian SSR), Shukhardin, S.

I/34 Scientific policy and development of productive forces in the Georgian Soviet Socialist Republic (USSR), Andronikashvili, E. L.

I/35 Organization and planning of science in Uzbekistan (USSR), Arifov, U. A.

I/36 Considerations on personnel, dimensions, organization and geographic distribution of research centres in emerging nations (Italy), Quaranta, A. A.

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I/42 Agricultural and industrial extension services to diffuse technological knowledge (USA), Green, J. C., Ruttan, V. W.

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I/45 The research institute as a key industrial development instrument (USA), Godwin, F.

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J/4 Technical co-operation programmes and their co-ordination with national development policies (India), Jha, L. K. S.

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J/7 Machine retrieval of information on nutrition (United Kingdom), Leitch, I.

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J/14 Essential communication (United Kingdom), McLaughlin, G. H.

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J/16 Programme for the organization of documentation in less developed regions (Portugal), Paulo, Z.

J/17 Social obstacles to technical innovations (Sweden), Izikowitz, K. G.

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J/19 Indo-Swiss centre for training precision mechanics for scientific instruments industry: a case study of international co-operation (India/Switzerland), Mathur, K. N., Real, F.

J/20 The role of central documentation and information services in the national and international dissemination of knowledge (Netherlands), Maltha, D. J.

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J/22 Information services for research in under-developed countries (United Kingdom), Collins, P. B.

J/23 Social and cultural problems in the development of commercial aviation in Brazil (Brazil), Goldberg, K.

J/24 Changes in rural living conditions: a decade of technical co-operation in Taiwan, Republic of China, 1952-1962 (China), Chinese-American Joint Commission on Rural Construction

J/25 International training on seismology and earthquake engineering in Japan (Japan), Omote, S., Hisada, T.

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J/28 Scientific information organization and scientific and technological progress of countries in process of development (Brazil), De Queiroz Sambaquy, L., Leite Ribeiro, F. L., De Queiroz Grillo, S.

J/29 Proposal for the establishment of information centres serving different branches of science in order to render international scientific research more effective (Finland), Pesonen, N.

J/30 The Commonwealth and International Library as a new technique for diffusing scientific and technical knowledge (United Kingdom), Maxwell, R., Wood, C. W.

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J/32 Current trends in documentation and its problems in developing countries (United Arab Republic), Sabet, A. A.

J/33 Obstacles to educational planning in developing countries (Brazil), Abreu, J.

J/34 International co-operation in the field of technical documentation (Italy), D'Alessandro, A.

J/35 Professional training of documentation experts (Italy), Balbis, B.

J/36 Techniques for the production of a loose-leaf union catalogue of scientific serials (Australia), Doubleday, B., Hunter, T. R.

J/37 Application of new techniques of communication to broaden participation in scientific and technological development (India), Athalye, G. K.

J/38 Scientific and technical co-operation among the socialist countries and the co-operation between socialist and under-developed countries (Bulgaria), Kamenov, E. G.

J/39 The international standardization of theories, concepts, terminologies and notations pertaining to economic development (Belgium), Darchambeau, F. V.

J/40 Inducing changes in agriculture: the transmission of scientific information to farmers (Australia), Oeser. O. A.

J/41 Scientific co-operation, the main method for the rapid development of the under-developed regions (objectives, methods and means) (Belgium), Bernard, E. A.

J/42 Co-operation of Soviet and Afghan hydrometeorological services (USSR), Maslov, V. D.

J/43 Scientific and technical co-operation of the Soviet Union with the countries of Asia and Africa in the field of geology (USSR), Serguienko, M. N.

J/44 Experience in scientific and technical co-operation in the development of the coal-mining industry of the member countries of the Council for Mutual Economic Assistance (USSR), Kharchenko, A. K., Krasnikovsky, G. V., Kuznetsov, K. K., Klorikyan, S. K., Kozin, Y. V.

J/45 Irrigation and utilization of water resources of Ceylon (USSR), Ignatjuk, G. L.

J/46 The study of natural conditions and resources of the Mongolian People's Republic and their use (USSR), Morzaev, E., Tsegmid, S.

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J/48 International co-operation aimed at developing oil industry in under-developed countries (USSR), Fituny, L. A.

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J/50 The French contribution to technical documentation as regards the main tropical crops (France), Aries, P.

J/51 Diplomacy in the field of science (France), Dumesnil, Villecourt

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J/53 The transfer of scientific and technical knowledge and skills from industrialized to developing countries: a top priority (France), Laugier, H.

J/54 The USSR's assistance to under-developed countries in carrying out their national development programmes (Byelorussian SSR), Prokhorov, G. M.

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J/56 The adaptation of technical co-operation to national development schemes through operational teams (Belgium), Lefebvre, J.

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J/58 Dissemination of scientific and technical knowledge; Australian experience in exchange of persons programmes for developing countries (Australia), Dept. of Ext. Affairs

J/59 Scientific and technological documentation, including the problems of language and terminology (India), Parthasarathy, S.

J/60 Reform of development aid based on post-war experience (Federal Republic of Germany), Billerbeck, K.

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J/81 Guidelines in the process of change (USA), Peter, H. W.

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K/12 Training of medium technical staff (Czechoslovakia), Bohac, A.

K/13 Training of scientific and technical personnel: the affiliation between the Institute of Technology, Bandung, Indonesia and the University of Kentucky, Lexington, USA (under aid sponsorship) (Indonesia), Soemantri, R. M.

K/14 Manpower for science in a developing state: current trends and programmes in the Philippines (Philippines), Hermano, R. A. D.

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K/57 The orientation towards the promotion of higher technical studies at French Universities (France), Capdecomme, L.

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