BIBLIOGRAPHIC DATA SHEET

1. CONTROL NUMBER	2. SUBJECT CLASSIFICATION (695)
PN-AAG-948	TA00-0000-0000

3. TITLE AND SUBTITLE (240)

Science, technology and development: views from the developing world. Report of a symposium

4. PERSONAL AUTHORS (100)

5. CORPORATE AUTHORS (101)

Committee on Science and Technology in Developing Countries; Sym. on Science, Technology and Development: Views from the Developing World, Kuala Lumpur, Malaysia, 1979

6. DOCUMENT DATE (110)	7. NUMBER OF PAGES (120)	8. ARC NUMBER (170)
1979	50p.	600.3092.C734

9. REFERENCE ORGANIZATION (130)

COSTED

10. SUPPLEMENTARY NOTES (500)

(Symposium organized as a contribution to the UN Conference on Science and Technology for Development) (Funded in part by AID)

11. ABSTRACT (950)

12. DESCRIPTORS (920)

Science and technology
Technology transfer
Development
Natural resources
Meetings
Science education
Resources

13. PROJECT NUMBER (150)

14. CONTRACT NO.(140)

DS/ST

15. CONTRACT TYPE (140)

16. TYPE OF DOCUMENT (160)

AID 590-7 (10-79)

600.3092
C734

PN-AAG-948

SCIENCE, TECHNOLOGY AND DEVELOPMENT

VIEWS FROM THE DEVELOPING WORLD

KUALA LUMPUR, MALAYSIA

April 27-30, 1979

SCIENCE, TECHNOLOGY AND DEVELOPMENT

VIEWS FROM THE DEVELOPING WORLD

Organised by
COSTED
in collaboration with MSA
with support from UNESCO

KUALA LUMPUR, MALAYSIA
April 27-30, 1979

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PREFACE

This is a brief report of the symposium on 'Science, Technology and Development — Views from the Developing World' held at Kuala Lumpur Malaysia during April 27–30, 1979.

The draft documents that were prepared earlier by groups of scientists were discussed in group meetings and in plenary sessions at Kuala Lumpur. The brief summaries presented here represent the wider opinion emerging from the discussions. Each section in this publication will also represent a summary of the detailed articles that are being published as the book. In addition to the eight sections dealt with here an article entitled 'Strategies for development' written by Dr. Bhagavantam President — COSTED will also be published in the final document.

Martin del Campo (Mexico) J. R. Chowdari (Bangladesh), Edmund Cole (Ghana), N. Kodagoda (Sri Lanka), J. W. McGowan (Canada), M. Moravcsik (USA), T. Ramasarma (India), and Yuthavong (Thailand), helped in the preparation of this report and we are grateful to them.

S. RADHAKRISHNA
Scientific Secretary
COSTED.

INTRODUCTION

The symposium "Science, Technology and Development — Views from the Developing World" was organised by the Committee on Science and Technology in Developing Countries (COSTED) in collaboration with Malaysian Scientific Association (MSA) with support from UNESCO. The meeting was sponsored by the UN Advisory Committee on the Application of Science and Technology to Development (ACAST) and the International Council of Scientific Unions (ICSU). The US Agency for International Development (US-AID), through the US National Academy of Sciences, has also provided support for the meeting.

The symposium has been organised essentially to focus attention on the urgent problems of the developing countries and the role which science and technology can play in solving these problems. The proceedings are envisaged as an input from the scientific community of the developing countries into the forthcoming UN Conference on Science and Technology for Development (UNCSTD) and the International Colloquium on 'Science, Technology and Society — Needs, Challenges and Limitations', A special feature of the symposium is that a large number of scientists from the developing countries had participated in a collective programme. It is therefore, expected that this representative symposium and its documentation will help many International organisations give a direction to their policies in a manner which will help developing countries solve many of their pressing problems urgently.

The forthcoming UN Conference on 'Science and Technology for Development' (UNCSTD) is an important world event. It has an immediate potential in chalking out a course of action in

the application of science and technology for development. The widespread pessimism about the outcome of the conference can be countered by vigorous and concentrated action by the scientific community. The people and the governments in the developing countries are looking for new strategies for development to overcome the frustration of poor results of the past attempts to apply science and technology for development. Massive international programmes in the past have not been able to face the challenge of alleviating the poverty of vast sections of people in developing countries. Views have been forthcoming from the developed world on the methods of improving the situation. In order to provide an opportunity for scientists from the developing countries to express their views on these important issues COSTED, the Committee on Science and Technology in Developing Countries, formed working groups of over a hundred scientists from nearly thirty countries. Their views, gathered as a series of draft documents under the title 'Science, Technology and Development — Views from the Developing World', form the basis of the discussions at Kuala Lumpur. These scientists were invited in their individual capacity and the views expressed are representative of non-governmental effort of scientists in developing countries. We, however, recognise the important role which governments have to play in giving shape to the recommendations and implementation programmes. It is in this context that senior scientists occupying important government or advisory positions in developing countries have been invited to participate in the Kuala Lumpur meeting. Their views have been integrated with the document.

The draft documents were distributed widely, comments obtained and discussed at special meetings convened under the joint auspices of COSTED and different national academies at Hyderabad in India, on January 4, 1979; at Colombo in Sri Lanka February 16, 1979 and at Warsaw in Poland on March 14-17, 1979. Valuable inputs from these and several other formal and

informal meetings were utilised in making the volume representative of the widest cross section possible. A final discussion meeting at Kuala Lumpur, Malaysia during April 27–30, 1979 with fairly large participation enabled the finalisation of the document.

After the inauguration of the Symposium by Encik Clarence Mansul, Deputy Minister of Science, Technology and Environment, Government of Malaysia, group meetings and plenary sessions were held in eight subject areas under the chairmanship of distinguished scientists. The groups and the respective Chairmen were

a.	Concept of Development	Dr. Hassan	(Syria)
b.	Science Education	Dr. Virasai	(Singapore)
c.	Scientific Research	Dr. Ramasarma	(India)
d.	Scientific Information Services	Dr. Sahade	(Argentina)
e.	Agricultural Development Programmes	Dr. Ani Arope	(Malaysia)
f.	Health Services and Medical Education	Dr. Kodagoda	(Sri Lanka)
g.	Technology Transfer	Dr. D. Sastrapradja	(Indonesia)
h.	Natural Resources	Dr. A. A. Ashour	(Egypt)

Speaking at the Inaugural function Dr. Bhagavantam, President — COSTED stressed on the potential which Science and Technology have in solving the problems of developing countries. He said that many International agencies should work in a co-ordinated manner to retrieve the declining confidence of people in the developing countries. He urged the participants to use the opportunity to express their opinions as to the direction which Science and Technology should be taking in their countries in order to obtain maximum benefit to the maximum number of people. Dr Prakash, Director, UNESCO Regional Office Jakarta, spoke about the role of UNESCO and the manner in which it has contributed to the forthcoming UNCSTD. Dr. B. C Sekhar,

President, Malaysian Scientific Association welcomed the participants and spoke about the crucial issues confronting the developing countries.

During special plenary sessions representatives of Several International agencies like WHO, FAO, ICSU, UNESCO, ISTC, ESCAP/UNCSTD spoke.

The following statement was adopted by the delegates at the Kuala Lumpur meeting.

STATEMENT ADOPTED BY THE PARTICIPANTS

A Symposium on Science, Technology and Development — Views from the Developing World, was organised by COSTED in cooperation with the Malaysian Scientific Association, in response to the growing feeling that the views of the scientific community in the developing world should be presented as part of the ongoing global preparations for the UNCSTD scheduled to be held in Vienna in August this year.

1. *Stressing* the crucial need for making the UNCSTD a success, despite the widespread dissatisfaction, disillusionment and frustration amongst the people of the developing world regarding the generally poor results of attempts to apply Science and Technology
   for providing basic needs such as food, shelter, education and employment,
   for removing poverty and disease,
   and in contributing to the cultural and spiritual traditions of the developing countries,
   and affirming that Science and Technology have the potential to become powerful instruments for achieving appropriate developmental goals,
   having noted with approval the conclusions reached in the symposia held at Tallin and Singapore on the subject,
   the Symposium sought to identify the major issues relevant for urgent consideration at this time.

2. *Recalling* that, in the past, after conferences like the UNCSTD, there were serious lapses with regard to follow-up action, the Symposium recommends that suitable agencies be identified and follow-up mechanisms to implement the decisions

* The text of the statement adopted by the participants at the end of the four day discussions is reproduced here.

of the UNCSTD be speedily established and strongly supported.

3. *Accepting* the view that a strong national indigenous scientific and technological capability as well as a shared regional scientific and technological competence, is essential for the formulation and implementation of development programmes, with assistance from the International scientific community where necessary,
and recognising that, while there are wide variations at present in the level of indigenous scientific capabilities in many developing countries, the general level of such capabilities is distressingly low,
the symposium recommends that each developing country should acquire the capability to select its goals, formulate its plans and choose its own strategies so as to make it easier to relate development to its own culture and traditions.

4. *Observing* that the International bodies dealing with Science, Technology and Development have not been effective in the past in promoting development in the developing world,
and noting that such bodies often have very meagre and sometimes inadequate representation of scientists from the developing countries,
the Symposium suggests that suitable remedial measures be taken so that, in future, declarations regarding global aspects of development problems and the need for International collaboration for their solution will be more meaningful.

5. *Being* of the view that the deficiences noted earlier, such as isolation of the scientific community of the developing world, lack of opportunity for scientific collaboration and meagre representation on International scientific bodies, can be rectified to some extent, if suitable avenues for interaction are provided,
and noting that COSTED has been operating a travel fellowship programme, specifically for the benefit of younger scientists from developing countries,
the Symposium recommends that this and other similar programmes be implemented on a more extensive scale.

6. *Observing* that, for historical and other reasons, many International organisations concerned with development are funded by, work from and are located in developed countries,
the Symposium considers it desirable that such organisations should endeavour to promote a closer liaison with scientific communities in developing countries. In establishing new institutions to promote development, the International agencies should consider the desirability of locating such institutions in the developing world.

7. *Noting* that development is linked with the availability of good-quality education in general, and science education in particular,

the Symposium recommends International support for science education programmes and for the promotion of skills which are socially relevant.

8. *Recognising* that efficient dissemination of relevant scientific and technical information has an important role to play in harnessing Science and Technology for development,
the Symposium urges that such information systems be established as will promote development.

9. The Symposium discussed several specific programmes of action needing urgent attention, among which are the following:

* Formulation of development programmes to meet basic human needs, contributing at the same time to the cultural and spiritual values of a country.

* The integrated exploration, exploitation, conservation and management of natural resources.

* Extensive support for science education which is locally relevant, development of science teaching aids and technician training.

* Promotion of development oriented scientific research through a suitable reward system.

* Provision of primary health care for all people.

* Popularisation of diversified sources of food.

* Adequate support for efficient dissemination of scientific and technical information.

* The provision of an integrated plan of technology transfer covering all aspects of development, production and marketing.

SUMMARY AND RECOMMENDATIONS OF GROUPS

(a) CONCEPT OF DEVELOPMENT

The concept of development is very complex and depends on a large number of inter-related factors, difficult to identify and quantify. Development is a dynamic process and connotes different things to different societies depending on the prevailing conditions.

For a long time development was equated to economic affluence. The per capita Gross National Product (GNP) has been widely accepted as an indicator of development. The per capita GNP describes total productivity of a society and is a measure of its overall economic affluence. However, this does not reflect the quality of life which is of importance. The quality of life of a society includes factors such as happiness, equality of justice and state of mind.

Development strategies aimed at increasing per capita GNP alone have not produced the expected acceleration of their rates of development. The gap in the per capita GNP between some developing and some developed countries has continued to increase. The per capita GNP ranges from $ 100 in the poorest countries to around $ 6000 in the more affluent countries. The economic disparity between some nations has reached alarming proportions and is a threat to international stability.

The New International Economic Order, which the United Nations community is trying to usher in, aims at reducing this gap and calls on all the nations to participate in such a process. In particular, the New International Economic Order is concerned with policies that enable the developing nations, with cooperation from the developed countries, to provide a new basis for achieving higher living standards through both domestic effort and international solidarity. It has been widely accepted that one of the

objectives of the New International Economic Order would be to reduce and, if possible, remove the disparities between economically affluent and economically weak countries.

Any attempt directed only towards the reduction of the gap in per capita GNP between countries would be inadequate. The strategies should be aimed at overall development in terms of meeting basic needs: health, food, clothing and housing.

In any event there will still be some disparity within a country and between countries.

A basic needs strategy should concentrate on providing minimum standards of living. As a corollary, such a strategy also aims at an equitable distribution of the benefits of economic growth. It has to be noted that the principles of providing basic needs and of reducing disparities are not necessarily contradictory to each other. Developing countries should be aware that in the introduction of science based technology, particularly through the establishment of industry, certain undesirable features such as pollution may be introduced, and necessary precautions should be taken in advance.

The following goals for the year 2000 A.D. can be used as typical examples:

1. Life expectancy of 65 years or more
2. Literacy rate of 75% of population
3. Infant mortality of not more than 50 per thousand births.

It should be noted that these goals are difficult to achieve with the existing conditions in the poorer countries.

Studies made by the COSTED have indicated that one of the most important factors which could contribute to satisfactory development is the level of science education in a country. It is not a mere coincidence that development of a country is correlated with the education pattern and this leaves little doubt that proper science education would accelerate the rate of development.

The large population densities obtained in most of the developing countries is another important factor. A fair-sized family can be an advantage in some countries where manpower is an important asset. However, a much too large population which only counterbalances the benefits of modern science and technology to such an extent that they can hardly be felt is an unsatisfactory situation. The problem of population growth is a very complex and sensitive one and has to be tackled extremely carefully, because of the cultural overtones. Most developing countries have a large component of village-based population. Developmental strategies in such countries will necessarily have to respond imaginatively to the aspirations and needs of such sections of society.

A proper understanding and a personal involvement in the aspirations of the country as a whole is another basic ingredient for the successful culmination of development efforts. This leads us to the question of the social structure and its importance in development. Deep rooted inhibitions against the use of modern science and technology and grave misconceptions about what science and technology can do for a country can impede development.

Several developmental indicators have been evolved to replace the per capita GNP as a measure of the state of development. Of these, the Physical Quality of Life Index (PQLI), which has been developed by a group at the Overseas Development Council in U.S.A. takes into account three basic parameters. infant mortality, life expectancy and literacy. The first two sum up the factors of public health, income and general environment. Literacy is used as a general measure of well-being and skill. PQLI, while being a much better indicator than per capita GNP, still has a basic element of comparison between societies.

The ASHA Development Index (ADI) postulated by a group in India, uses employment, literacy. birth rate and infant mortality along with life expectancy and per capita GNP growth rate and attempts to quantify the goal which reflects the fulfilment of basic needs. In addition to the widely accepted parameters constituting

basic needs, the ASHA group has included the highly significant role of gainful employment in a society as a necessary factor contributing to development ADI provides a means by which each country can set a goal of its own by defining the minimum basic needs that it wishes to provide in a given time. This is a flexible indicator which can be adapted to the widely varying conditions existing in different countries and societies

If development strategies are based on the concept of meeting well-considered and carefully-planned basic needs, the path of such development will lead to a more satisfactory state of development. These paths need not necessarily be identical to the paths trod by other countries in earlier situations. A path for development which will initially seek to meet basic needs may be the desirable path.

(b) SCIENCE EDUCATION

Development is linked with the quality of education in general, and science education in particular. Improved science education can lead to material progress of a country.

In developing countries, secondary education is essentially serving the needs of higher education and it is desirable that a break is made in this traditional approach. In an attempt to catch up with developed countries, too many modern subjects are introduced in the curricula and inefficiently taught, leading consequently to wastage of effort. It is necessary that courses like management, engineering design, electronics, materials science, horticulture, nutrition, transportation, pollution control, house building and public hygiene are built into the curricula.

The objective of various educational levels and interfaces between them should be defined in the context of the needs of each country. Producing a large number of scientists and engineers with little links to the needs of a country leads to unemployment, which has become a grave problem in many developing countries. Teaching of science and technology should be blended in a coordinated way, since much of what is learnt in basic science seems to be of little use in the solution of immediate problems. An

integrated system of experience and experiments performed in fields, factories and laboratories is most beneficial. The developing countries need intelligent technicians with skill and interest in producing useful items. It will be an important reform if the kind of instruction imparted in polytechnics is absorbed in the secondary schools.

Creation of a mass science base in a society is possible only through the language of the region. Sending university teachers and students during vacations for massive rural education programmes is an effective method of eradicating illiteracy. It will also prevent alienation from rural problems. Good local text-books, modern in content and illustrated, to take into account special cultural and regional needs, are required. Adaptation of good text-books instead of total adoption is more appropriate.

The curriculum should be dynamic in nature, keeping up with the fast - changing socio-cultural, scientific, and technological, environment. To achieve this, the curriculum should be periodically and systematically reviewed.

The weakest part of science education in developing countries is in the area of practical experiments. There is an urgent need to develop instruments and apparatus with the locally available talent and materials. It is necessary to promote publication of journals devoted to science education to aid the teacher to keep up with the changing teaching methods. International programmes should aim at developing the indigenous capabilities, rather than making developing countries perpetually dependent.

Development is positively correlated with the quality and quantity of education in general and science education (including the applied aspects, of technology) in particular. International and national efforts should be made to improve the quality of science education as well as to augment the quantity so that it may reach an ever larger section of the population.

While no definite time frame is suggested, the international community should appreciate the sense of urgency to do away with

factors inhibiting the growth of science education and to act positively for its quick betterment. In this context it is suggested that each country should draw up both short-term and long-term plans indicating specific requirements and implementation strategies. International and regional co-operation for this purpose would be beneficial.

International support in the field of Science Education must be directed towards helping developing countries make their science education more socially relevant. In achieving this objective, there is a need for preparation of educational films and other audio-visual materials. These are expensive and can be done only with International support. Care must, however, be taken that the International support will be used to build local competence which can promote self reliance. All International collaborative programmes in Science Education must be directed to this end.

(c) SCIENTIFIC RESEARCH

The developing world is not homogeneous in the needs and capabilities of scientific research. These countries can be divided into a block of four: resources good or poor on the one side and science base good or poor on the other. It follows that each of these models responds differently in facing the issues. Thus, given the problem of obtaining a product the solution can be different: develop own methods, import technology, barter goods or be content with alternative poor sources.

1. Scientific Research is essential for the generation of indigenous technology and for absorption of imported technology. Most developing countries have little capability in scientific research required for their development, as seen from the number of scientists, laboratories, equipment, libraries, journals and publications. Even in those few countries with apparently large research output, its nature and quality are not likely to lead to development.

2. Scientific research capability of developing countries therefore, needs to be strengthened, especially in areas of immediate

relevance to socio-economic problems. Selectivity is needed in research areas because of limitation in manpower and supporting resources. Unique aspects of each country in terms of natural resources, agriculture and health problems should be given priority in research. However, some basic research in wider areas than those pertaining only to local problems is also desirable since this is a vital component for building up the scientific capability.

3. The choice of research problems appropriate to the country can best be generated through forums of scientists, industrialists and citizens. Professional societies, consumer unions and government organisations in developing countries should act as nuclei in formulating the activities of such forums. Private enterprises, in this way, will have an opportunity to interact in a mutually beneficial way with scientists and technologists.

4. It would be desirable to have resources made available by international agencies and developed countries for collaborative research programmes between scientists and technologists in developing and developed countries. The choice of the programmes should be made according to the research capability and needs of development of each developing country.

5. Training of researchers in developing countries should incorporate awareness of local problems. This is best achieved in a limited number of large, high-quality institutions within the region.. Exposure to research training in developed countries is useful, but should not be allowed to alienate the researcher from the development problems of his own country.

6. In order to motivate scientists and technologists in developing countries to do good-quality research, a system of "reward structure" for solving specific, identified problems within their countries should be established. Special funds should be given by UN agencies, professional societies and other organisations for this purpose.

7. Since it is impossible for most developing countries to develop their research infrastructures equally in all fields pertaining

to development, they should co-operate and form a small number of regional institutions, each specialising in selected fields of research. International agencies and developed countries could collaborate with developing countries, in supporting such institutions, so as to have measurable impact on identified common problems of a region of developing countries.

8. The acquisition and maintenance of research equipment must be given high priority. Pooling of equipment and maintenance facilities may be necessary especially in small developing countries. National or regional centres of expertise for servicing of complex equipment should be formed, but effort must be made to avoid long delays which might be involved. Developed countries and large instrument companies should make spare parts accessible to developing countries at a moderate cost.

9. The number and quality of technicians must be increased. Developing and developed countries should co-operate in schemes for training of technicians.

10. Schemes should be devised through international agencies, international scientific societies or otherwise, to make scientific literature more accessible to research workers in developing countries. These schemes should provide for acquisition of textbooks, journals, data banks, patent information, etc., by developing countries at a moderate cost. Sharing of library facilities within the same region and with the developed countries is encouraged.

11. Support should be given by international agencies and developed countries to a selected number of local scientific journals of high quality in developing countries. Existing journals should try to improve their quality by having suitable high-standard refereeing.

12. Developed and developing countries should co-operate in schemes for both short-term and long-term exchange for the purpose of furthering research in developing countries. International scientific societies and other organisations should hold

congresses, symposia, workshops and other activities more often in developing countries. More support should be made available to enable scientists and technologists in developing countries to participate in international meetings.

13. National and regional scientific societies should be strengthened in the developing countries.

14. Very few active scientists from developing countries are involved in International decision-making professional bodies. A conscious effort must be made to identify suitable scientists in developing countries and involve them in such bodies.

(d) SCIENTIFIC INFORMATION SERVICES

The developing countries do not form a homogeneous group. They could differ in their level of development, in their level of literacy, in the level and extent of their scientific and technical infrastructure, in their economic resources, or in their social and cultural background. As a consequence, the strategy for development should be different from country to country. Any strategy, however, will have to take into account that science and technology are essential instruments for the process.

A good infrastructure of basic science will allow a country to engage in applied science and in science oriented towards solving problems of national character. Such infrastructure needs to be founded on three fundamental elements: literacy, education and information. Moreover, the centers of learning should create an awareness of the country's problems and of the fact that science has a social function to perform.

The importance of scientific and technical information and the need for an international information network led ICSU and UNESCO to establish the UNISIST program which has provided some assistance to developing countries in the form of guidelines and suggestions. However, there are aspects of information services that have not been sufficiently implemented and are of particular importance to these countries. The aspects

that will meet their present needs refer to user-oriented and problem-oriented information services that would take into account the information policy of the country or countries concerned and, in particular, the information needs of the extension workers. Such services should be set up on a regional or subregional basis around existing facilities, whenever possible.

National information policies should give high priority to establishing extension services and to the use of mass media for communication of relevant scientific and technical information to the larger sections of the community, to overcome the barrier of high rate of illiteracy in many developing countries.

The establishment of information services of this kind requires funding that most of the developing countries are unable to bear. Therefore, it is essential that international organisations take an active role in the endeavour and provide the necessary funds. A number of International agencies, with considerable amount of funding, are now working in the area of information dissemination. A coordinated approach would be useful and must be evolved.

The extension workers should be selected carefully and trained properly through training schools and workshops. In this task the universities and other similar organisations should take a leading role. The extension workers should be able to give feedback to governments on the requirements of the rural community. Extension services ought to have an integrated character and this should be attained through teamwork of agents of the different relevant disciplines.

Skilled manpower is a pre-requisite to National, Regional and International information systems. The effectiveness and efficiency of such information systems largely depend on the quality of information personnel who man these systems. Hence, developing countries should give high priority for training programmes to train information officers, librarians, and communicators, particularly in scientific and technical information handling. Massive international support is required for such training pro-

grammes. Also, these programmes must be conducted in developing countries.

It is not necessary that the individual villager becomes familiar with the basic physics and chemistry of clean water, etc., but should have science-based technology introduced in his daily life through an upgrading of the services made available to him.

The Working Group stressed in their discussion the importance of a number of actions that ought to be taken. They are presented in what follows as a set of recommendations that are directed to Governments and international organizations for implementation:

1. Developing countries should formulate national science and technology information policies, as a significant component of the national development plans, and establish information systems that would cater to the needs of the various potential national users, namely: scientists, decision-makers, local entrepreneurs, journalists, science writers, extension workers, rural users, etc.

2. Developing countries should establish centres collecting indigenous information, in particular, related to the solution of specific problems.

3. High priority should be given to the establishment of a national system to communicate scientific and technical information of relevance to different sectors of the community.

4. High priority should be given to the selection and training of information extension agents and to the organization of national training programmes in the implementation of which the universities and other appropriate bodies should take a leading role.

5. National training programmes should include training in the handling and dissemination of scientific and technical information.

6. Cooperation and exchange of information between developing countries, particularly of their experience on specific problems of common interest should be urged and facilitated through the establishment of regional information networks and the implementation of joint projects (seminars, workshops, training courses, etc.).

7. Projects aimed at having the scientific and technical output from developing countries recorded in the international information systems should be drawn up and strongly supported.

8. International funding agencies and members of the United Nations family are urged to lend strong support, at national or regional level, for the implementation of the preceeding recommendations and of any project from developing countries aimed at improving access to scientific and technical information.

9. International organisations are also urged to help remove some of the obstacles that greatly hinder an efficient transfer of scientific information, like the high airmail postal rates, deficient communication systems, foreign exchange restrictions, etc., and in particular the high cost of the photocopies, microfilms, etc., that have to be procured from developed countries.

10. International organizations are further urged to help establish photocopying facilities in developing countries that find it difficult to finance and to establish regional documentation centres for the supplying of photocopies to the scientific and technical community of the region.

11. UNESCO is urged to tackle the problem of the high and increasing cost of scientific and technical books and journals that inhibit their use in developing countries, and to work out an arrangement by which microfiche editions of journals could be sold to developing countries at their basic cost of production and books be produced in low price editions.

12. Developing countries are urged to provide appropriate mechanisms for greater utilisation of already existing information systems like AGRIS, CARIS, etc.

(c) AGRICULTURAL DEVELOPMENT PROGRAMMES

Agriculture is one of the most important components of the economies of developing countries. It provides food to feed the growing millions of the population and also provides occupation and livelihood to the bulk of the population either directly or indirectly. It accounts from one-third to two-thirds of the gross national product of these countries and also the bulk of foreign exchange earnings through exports. The current agricultural productivity in these countries is very low and most countries are experiencing food deficits of varying magnitudes and these deficits are likely to increase as populations grow. According to the projections made by different agencies, the food deficits in these countries are likely to be in the order of around 100 million metric tons by 1990. The development and, indeed, the survival of the developing countries depends on how effectively and how soon their agriculture is galvanized into playing the key role that it should play in their economy.

The effort of the developing countries to improve their agriculture over the last two decades resulted only in marginal successes and, at any rate, does not meet even the present needs not to speak of the future. The growth rate in agriculture has generally been between 2 and 3 per cent. Over 50 per cent of this increase can be attributed to the expansion of the cultivated area. The land area being limited, sooner or later, additional land for agriculture ceases to be available. It is therefore very necessary to increase the productivity per hectare by increasing the intensity of cropping on the existing land.

Technology generation

Improved technology supported by an infrastructural institutional and socio-economic framework plays a key role in increasing productivity. The source for generation of technology is research and design. Agricultural research, being largely location - specific, has to be conducted in representative agroclimatic regions. Most developing countries have established National Agricultural Research Systems. But in some countries there is hardly any research capability. Even the existing systems suffer from serious inadequacies. The International agricultural research network

of the Consultative Group on International Agricultural Research (CGIAR), which is playing a critically important role, cannot substitute for strong national programmes. There is, therefore, a need to strengthen the agricultural research capabilities of the developing nations by establishing well-staffed and well-equipped research centres in various agroclimatic zones of the country to generate appropriate technology for accelerating the pace of agricultural and rural programmes. These national systems should establish close links with the relevant international institutes which, besides supporting the national programmes, should serve as training centres and pace setters for the national research centres.

Problem-solving research

The National Agricultural Research Centres should concentrate on problem-solving research — to seek solutions to the problems confronting production in the service area of the Centres. Besides commodity-oriented research, the farming systems including crops, livestock and fisheries wherever appropriate should receive research attention. Relevance and excellence should be the hallmarks for research at these centres. Some of the areas which should receive priority attention are: (*a*) Developing crop varieties with suitable agronomic traits pest and disease tolerance and consumer acceptability. Attention should be paid to the development of varieties suitable to unfavourable conditions like water congestion, drought, salinity, etc; (*b*) To generate technology suitable for semi-arid and arid areas in close cooperation with the international institutes established to work for these areas; (*c*) Management and use of irrigation water; (*d*) Soils, soil fertility and soil-plant interrelationships; (*e*) Efficient use of fertilizers; (*f*) Recycling of organic wastes; (*g*) Integrated and less expensive disease-and pest-control methods; (*h*) Post-harvest technology and (*i*) Simple animal-drawn and manually operated agricultural implements.

Adaptive Research

Adaptive research at the field level in the local environment, preferably in the farmers' fields, should be the terminal step in the development of technology. Besides testing the suitability

of the technology under the farmer's conditions, this would also enable the research worker to get a feedback on the field problems.

Agricultural education

With few exceptions, agricultural education in the developing countries suffers from serious deficiencies both quantitative and qualitative. Agricultural educational institutions need to be adequately staffed. Laboratory and field facilities require vast improvement. The curriculum should be relevant to the needs of the individual countries. A realistic assessment of manpower requirement has to be made to train adequate graduates and post-graduates.

The existing agricultural educational programmes are designed to train graduates and post-graduates to man the educational, research and administrative positions in the Government and private sector. Vocational agricultural training programmes are grossly inadequate, although agriculture is the main occupation in the developing countries. It is, therefore, necessary to institutionalize vocational agriculture in these countries to enable farmers, school dropouts and high school graduates to get adequate training in agriculture to acquire and upgrade the skills and knowledge required for farming.

Fisheries

Agriculture on a commercial scale could be carried out where conditions are favourable. Some developing countries have the expertise and the technology for mass production of seeds and the transfer of knowledge to private agencies. This expertise could be shared among developing nations.

There is a lack of scientific information on many aspects of aquaculture and this makes it difficult to formulate policy guidelines for the developing countries. Regional research consultative bodies could assist developing countries to establish research programmes according to the national needs and to facilitate collaboration and ensure effective utilisation of existing manpower and facilities.

Livestock

Livestock can help to diversify the economy, provide employment for the rural population and improve the diet of the population where it is culturally acceptable. Attention should therefore be paid to livestock improvement, management and health care.

Forestry

Conditions prevailing in developing countries have seldom been decisive for the implementation of sound forest management, production and maximum utilisation. Positive and sound forest management development and utilisation policies and strategy must be formulated by developing countries.

Technology Transfer

The weakest link in the chain of modern agriculture is the transfer of technology, or extension. The extension agents are often inadequate, ill-equipped, ill-trained and poorly motivated. There is a need to streamline the delivery system by increasing the efficiency of the extension agent to reap the full benefits of research.

Knowledge — practice gap

The knowledge - practice gap reflected in the difference in yields obtained at experimental stations and the farmers in their fields is a matter of concern and should require immediate attention of the developing countries. Attributing the gap to the inadequate transfer of technology tends to over-simplify the problem. Agricultural development is not a function of agricultural technology alone but involves a multi-pronged approach, including technological, institutional, socio-economic and infrastructural aspects.

Some of the areas which need immediate attention are: (*a*) Input supplies like seed, fertilizer and pesticides; (*b*) short, medium and long-term credit on reasonable rates of interest; (*c*) Land development including shaping, drainage, irrigation and reclamation; (*d*) Adequate rural roads and communications; (*e*) Pricing of both inputs and outputs and their meaningful relationship and (*f*) Storage and marketing facilities.

Agricultural Policy

It is imperative to have an integrated approach to agricultural development. Most developing countries being agrarian in character, should assign a higher priority to agriculture than to the more glamorous and prestigious projects. The uneducated and inarticulate peasantry should receive more attention than the educated and vocal urban elite. Developing countries should draw up comprehensive National Agricultural Policies to streamline their agricultural programmes, strengthen their effectiveness and realign objectives applicable to the practical requirements and national development goals consistent with the available manpower and natural resources.

Where national organisations are inhibited by budgetary and technical constraints, international funding of some of the programmes should be considered to enable them to function in the most effective manner compatible with their national needs.

A permanent international secretariat under the aegis of existing International agencies should be established to hold and coordinate periodic meetings among the developing nations and to study and discuss various problems and issues in the field of agriculture.

(f) HEALTH SERVICES AND MEDICAL EDUCATION

The commendable objective of the Director General of the World Health Organisation: "Health for all by the year 2000", may be an utopian dream. It is, however, worth striving for a situation where "Everybody, everywhere would benefit from all the experience and knowledge of health care accumulated down the ages".

Health should be seen as a positive concept and not as mere freedom from disease. It is a broad concept that is intimately related to a productive life, sharing benefits of economic growth, literacy, justice, political freedom, and cultural satisfaction. A state of good health is an important aspect of development.

The deficiencies in the field of health care in developing countries can be viewed as the following paradox of quarters. Three quarters of the population of these countries is rural; only a quarter is urban. Three quarters of the diseases that afflict people are preventable; only a quarter needs cure. Conflicting with these demands, three quarters of health care resources are urban-directed, and only a quarter goes to the rural population. Three quarters of the health budget is spent for curative medicine, and only one quarter is spent for prevention.

Most diseases in developing countries are caused by lack of calories, balanced diet, clean water, sanitation, and preventive measures. High population growth rates are an important contributing factor. The economic situation, on which housing and the state of hygiene are often dependent, is very important. This is most clearly seen with regard to services such as the supply of safe drinking water, and in the maintenance of hygiene. Most deaths in infants and young children are caused by water-borne diseases which can be easily prevented. Medicaments constitute only a part of the picture. Aspects of medical technology are important in this regard, but the application of such technology should be with a sense of relevance, and with awareness of ethical and cultural constraints. No form of medical procedure should be simply forced upon the people. An important problem in the delivery of health care is the efficient balance in the apportionment and use of the available resources. There is presently too much concentration on urban-centred, capital intensive, hospital oriented, oversophisticated and curative medicine. Mounting costs of medical care are related to the degree to which it is alienated from the real needs of the people. Such lop-sided developments are understandable, because they reflect the curative interests of the middle classes, and the interests of politicians and policy makers who want visible and immediate results.

Health care delivery demands self-reliance in health. This reliance necessitates health education for everybody. Self-reliance should be based on a community diagnosis, which takes into account the present state of knowledge and attitudes of the people. Attention should be paid to the voice of the common people,

to religion, culture and tradition. Self reliance asks for a realistic appraisal of the constraints on change. The use of traditional medicine and indigenous medical practitioners in health education and the delivery of primary health care needs serious consideration.

Medical and paramedical education should be restructured in keeping with the stated objectives drawn up according to the needs of a country. The present criteria for selection, methodology of instruction, and assessment of student performance have several deficiences, and need to be reviewed. Skills in communication should be imparted to all medical and paramedical personnel.

The prevalent system of post-graduate education in most developing countries is based on foreign models. This often results in undue stress on cure, and an urban bias in the health care delivery structure. It also leads to over-specialisation of medical personnel. A system of post-graduate education based locally and modelled in keeping with national needs and aspirations should be evolved.

The present method of training doctors involves a cost that developing countries can ill-afford. Neither would the increase in the number of doctors necessarily improve health care delivery in a directly proportional way. Auxiliary health cadres should therefore be developed with the objective function of delivering primary health care, with stress on the peripheral situation in countries. Available resources should be diverted to building more small peripheral health units, rather than more sophisticated, over-specialised, large, urban-based hospitals.

Voluntary organisations could play a vital role in complementing the State's health care delivery system. The "Sarvodaya" movement is one such concrete example where voluntary forces have been mobilised towards human development.

Some of the present ills in health care delivery in the developing world arise from "commercialism" in medicine. Practice for gain by doctors employed by the state and misleading advertise-

ments of 'magics and cures' are such situations. Governments should look into these aspects of health service, with a view to taking corrective steps appropriate to the locale.

The drug monopoly by multinational drug companies is an even more vicious aspect of this medical commercialism. Both national bodies as well as international agencies should take positive steps to rid the developing nations of the multinational grip. Bulk purchase by groups of developing countries, setting up of local drug industry, quality control, pooling of research and technology in this field and prescriptions by generic names are some of the remedies suggested.

Overcoming resistance to change in the field of health calls for governmental commitments. Politicians, planners and policy makers should use all methods of persuasion, pressures, and even direct orders, to channel policy, personnel, and available resources towards the needy, but relatively silent majority.

The international agencies should play a positive role by helping to set priorities, and aid and action should be based on such priorities. Self-reliance of nations towards health goals should be the objective of all international action.

The following essential points are emphasised for initiating action programmes:

1. Health needs of the developing countries should be rescrutinised in their local contexts. This and this alone should form the basis for formulating objectives for the health care delivery system in that particular country.

2. Steps should be taken to ensure that in health planning, those responsible view health as a positive process.

3. Rural masses form the bulk of the population of developing countries and should be the centre for most health care delivery activity.

4. Most diseases in the developing world are preventable ones. Health activities should therefore be directed towards prevention of disease with stress on crucial areas of nutrition, personal and environmental hygiene, control of communicable disease and population control.

5. Political commitment must be brought to bear on the health scene.

6. People should be actively involved in attaining higher health standards. Health education should be intensified at all levels and in all aspects.

7. Health educators should take into serious consideration the culture and religious susceptibilities of the people. Tradition must not be opposed directly. People should not be required to do what they cannot.

8. The process of medical education should be critically examined with a view to stating educational objectives drawn up in keeping with the needs of the country. Methodology in instruction should be altered to obtain preventive and community bias.

9. Post-graduate education should be restructured, steering away from alliance to models derived from the developed countries. Post-graduate training should be in keeping with health manpower requirements of the country.

10. Provision should be made for continuing education of medical and paramedical personnel.

11. Health research should be geared to emphasise problem-oriented research where findings could be of immediate use to the country; promoting programmes which include research into areas of behavioural science, health service research, recording and reporting and the development of appropriate technology for health.

12. Auxiliary health cadres appropriate to each country should be developed.

13. Steps should be taken to train medical and paramedical personnel to tell the patients of the nature, prevention and treatment of their disease.

14. The efficacy of indigenous medical systems should be investigated. Their best may be absorbed into the natural health care delivery system. Indigenous medical personnel should be used in preventive and health education work.

15. Health education as well as health care delivery wherever possible should be co-ordinated with extension work in other fields and other development activity.

16. The Primary Health Care Approach should be considered for expansion and improvement of health services to include the large number of the hitherto under-served populations living in rural areas and in the poor sections of the urban centres.

17. Volunteer forces must be mustered for participation in health education, and where possible for activities connected with prevention of disease.

18. Interests of multinational drug companies must be curtailed. Legal remedies must be sought by governments to reduce the impact of irresponsible advertising of 'magics and cures'.

19. Safe drinking water should be made available for household use.

20. Proper excreta disposal facilities should be a part of rural community settlements.

21. Appropriate measures including legislation should be taken to ensure the safe disposal of industrial and household wastes, and varieties of pollutants.

22. There should be appropriate national and regional mechanisms that could assesss problems, evaluate progress and

exchange ideas regarding health care delivery in the developing countries.

23. International agencies should indicate the right directions in health care approach, to the developing countries.

(g) TECHNOLOGY TRANSFER

Based on the experience of developed countries, developing countries recognised that the application of modern science and technology had contributed significantly to the affluence of one-third of the world. Consequently, they looked with hope for the same benefit through the utilisation of modern science and technology. The strategy adopted by these developing countries involved rapid urban industrialisation with the hope that the growing affluence of the urban community would trickle down to the large number of unskilled and semiskilled people within each country. There is now ample evidence to show that this strategy has failed in part because little attention had been paid to the social and cultural heritage of people, the political environment, local financial conditions, the production potential and the impact of industralisation on the ecology and the community. Although GNPs of developing nations have increased over the last decade they have fallen behind with respect to those in developed countries. More serious is the fact that the upper 10 to 20 per cent of the population within each country have become wealthier, while the mass of the people who primarily live in rural areas have remained unemployed or underemployed, are without proper housing and services, are illiterate and continue to suffer from malnutrition and disease. Furthermore, those who have left the villages and have moved to urban areas more often than not suffer from social disruption and loss of personal dignity.

If the New International Economic Order is to be realised, imaginative new industrial strategies must be developed and the old ones revamped. They should deal realistically with the rural as well as urban areas. More attention must be given to

* the transfer, adaptation and utilisation of technologies imported from developed countries

* the transfer of appropriate technologies from other developing countries with similar resources, and

* the transfer of indigenous technologies within the boundaries of the developing nation itself.

The technologies which can most readily be transferred, particularly to the rural areas, will be those which are low-cost, labour-intensive, consume little energy and are suitable for small and medium-scale production.

Considerable attention has already been given to industrial development in the urban centres while much less attention has been given to the rural setting where nearly 80 per cent of the population lives today. The two agencies which can most effectively contribute to rural industrial development are:

(*a*) government — which has a traditional role, and is responsible for establishing the necessary infrastructure needed,

and (*b*) universities, technical colleges and research centres — which perhaps hold the key to effective rural development in the near future.

As with all human ventures, success depends upon identifying leaders within the communities, who are sensitive to the needs of the community. More specifically, identifying, promoting and supporting large numbers of small-scale entrepreneurs can be a very powerful instrument of change.

It is impractical for government to be involved with the setting up of a large number of small rural industries. They will develop, provided help and encouragement can be given to them on matters like:

(*a*) identifying and estimating markets
(*b*) providing risk capital through private, governmental and cooperative sources

(*c*) necessary managerial, marketing and technical skills
(*d*) necessary plant, processing and manufacturing equipment
(*e*) availability of raw materials.

All of the skills necessary to help the entrepreneur are available within the universities. The question is how to tap these excellent resources.

There is a need for universities within developing countries to expand their traditional role of teaching and research to include rural development. This has been effectively brought about by a few imaginative university administrations which have encouraged the development of extension service involving university personnel and students. In other universities small interdisciplinary bands of dedicated staff, research workers and students have taken the lead and have offered themselves, and their talents towards establishing rural technology. It is important that these groups be encouraged through publicity and social recognition. It is also important that relevant multidisciplinary services and extension training be organised, that students be encouraged to undertake projects on and in the villages and that appropriate recognition be given to those members of staff who participate in extension activities. Motivation is a key determinant and the outcome is based upon (*a*) local, national and international recognition of his work and ability, (*b*) a reward structure within the university and (*c*) government support for his activities. The importance of student training cannot be overstressed — special multidisciplinary courses which stress not only the technical, but social and economic aspects as well, are required. Promotion in universities may depend on teaching, research and rural extension work as a necessary third component.

Universities, technical colleges, and research institutes have already brought together people from a multiplicity of disciplines and have established extensive technical support facilities to complement them. Universities must be encouraged to take a leadership role and make available staff and facilities needed to support entrepreneural growth at the village level. The concept of the

technology transfer centre or consultancy centre has gained some well-deserved prominence in a few developing countries. These centres function as part of university extension service and draw from within the university, personnel and services needed for industrial development. They should be encouraged and expanded by government as part of an infrastructure designed to encourage development in the rural and urban context as well. This network would include:

1. *Extension workers* who are given a broader multidisciplinary training for work in the villages.

2. *Technology Transfer or Consultancy centres* and other activities within research centres, technical colleges or universities.

3. *A National centre* concerned with the importation and distribution of imported and indigenous technologies.

4. *Regional centres* to facilitate the exchange of technologies and technical experts among developing countries.

It is to be expected that the character of these institutions will depend upon the social and political aspirations of each country as well as its level of development. Whether or not a particular technology will ' effectively transferred and industrialisation results will in the end depend upon the actions of the government and acceptance by the community.

From the deliberations of the groups of scientists, engineers and science administrators from developing and developed countries the following main recommendations emerged:

1. Small industries should be promoted and rural entrepreneurs supported by integrated services which will make their efforts profitable for them.

2. Local technology transfer centres should be established by universities, research centres and technical colleges supported by government to interact directly or through extension workers with entrepreneurs.

3. National centres should be established to be concerned with the importation of appropriate technologies as well as the development of indigenous technologies.

4. Regional centres should be established to facilitate the international transfer of technologies and experts between developing countries and from developed to developing countries.

5. Existing technology transfer centres at local, national and regional levels should be encouraged with sufficient support from governmental and international agencies.

6. Existing technology transfer centres and transfer agents should be encouraged to interact by all available means in order to facilitate the interchange of expertise and information and to strengthen the network.

7. An attempt should be made to determine the effectiveness of the network in transfering technology and establishing industries in the rural areas.

(h) NATURAL RESOURCES

Natural resources can be broadly classified under three heads: (i) non-renewable resources like mineral and fossil fuels; (ii) renewable resources like land, soil, water, forests wild life and (iii) human resources. The concept of resources, in relation to man's approach to equilibrium with his environment varies from place to place and from time to time. It is important to have a continuing assessment of the natural resources of a country and the technological capabilities to utilize the resources or to devise substitutes that modify the resources base without interfering with the ecological balance.

The exploration, assessment, exploitation, conservation and management of natural resources are an essential prerequisite for all agricultural and industrial planning and development. Developed countries have given a high priority to the survey, assessment and judicious utilization of their resources through application of science and technology which has enabled them

to attain a much higher rate of growth. They have also continued to import raw minerals, oil and other resources to protect this growth rate of their own economy.

The problems facing developing countries with regard to existing and potential resources are different from those of the affluent nations. The availability of know-how and financial aid from developed countries to developing countries are restricted to a few isolated areas with attached conditions which force these recipient countries to sell their raw materials at prices dictated by the developed countries. There have been a number of geographical, political, technological and social problems faced by the developing countries in the management of their natural resources.

Survey and assessment of natural resources has been recognised as a first priority area for developing countries and should be carried out by national efforts and with help from sister developing countries. Where necessary,the help of international agencies should be obtained. The developing countries should acquire the necessary expertise, if not already available, for carrying out such surveys which are of a continuous nature. There should be a suitable system to ensure the steady availability of man-power trained in the area of natural resources — international agencies can help in coordinating the activities among different countries (where it is needed) and by providing support to existing insitutions for research and training and establishing new ones. For survey and assessment of natural resources, the developing countries should take advantage of suitable known and proven advanced technologies.

Non-renewable resources

Minerals: If we examine the rate of consumption of some of the mineral resources, we find that in most cases the per capita consumption in the developed world and its continuing growth have posed serious threats to the global resources position. Once the ores of higher grades at shallow depths are consumed, we will have to extract and process ores of lower grades at greater

depths. The technological, financial and energy costs in such a case will be prohibitive.

Some of the developing countries which export raw ores to other countries and import processed metals at much higher costs, have started realising the dangers in such a situation. It has to be emphasised that the developing countries should not be merely concerned with earning foreign exchange by selling raw materials, but should formulate their own development and utilization strategies to meet the needs and aspirations of the people both on the basis of immediate and long term planning.

Energy resources: Fossil fuels. mainly oil, gas and coal will still be the main sources of energy until the turn of the century. With the gradual depletion of these resources, the world will have to depend on other sources of energy, such as hydroelectric, nuclear, solar, wind and geothermal energies. In the long run, it will be necessary to develop resources that are inexhaustible and pollution free and non-conventional resources offer such possibilities. The developing countries have to adopt appropriate measures to cope with present demands and future requirements. Some such measures are

* Judicious use and conservation of available fossil fuel resources.
* A review of regionwise hydel power resources where two or more countries could jointly exploit and utilize the energy and water resources.
* Large scale utilisation of solar energy for drying, heating and cooling purposes, as most of the developing countries are located in the equatorial region.
* Research and development efforts on nuclear fusion and high temperature reactors as individual or joint collaboration efforts in developing countries where necessary.
* Research and development efforts in utilization of non-conventional sources of energy like solar, biogas, wind, tidal and geothermal etc., wherever applicable.

The developing countries should exploit, conserve and manage their non-renewable resources particularly minerals and fossil fuels, taking into careful consideration the total reserves, ultimate recoverability and their demand growth rate. Recycling and substitution has to be practiced to the extent possible where known technologies are available.

Renewable Resources: Land, soil, water (both surface and ground) forest, etc., form very important renewable resouces for developing countries. Every effort should be made to complete the surveys to show the present land use pattern and prepare maps for geology, geomorphology, geohydrology, soil and forestry and integrate such information into land capability maps which will serve as an excellent guide for long term optimal land use planning.

Water: Water plays a very important role in agriculture, industry, transport and recreation in addition to what is required for human needs. Any water resources development programme should aim at a basin or sub-basin-wise approach, treating surface and ground water as components of the same system. There is considerable disparity in the use of water among the developed and developing countries. Even safe drinking water is not available presently in the rural areas of a large number of developing countries which has resulted in many diseases and higher mortality rate in children. With the increase in water requirements, developing nations need to implement conjunctive use of surface and ground water, adopt conservation measures by more effective management practices and introduce efficient irrigation practices.

The thin film on the surface of the globe, which is called soil, is a combination of minerals and organic matter with special particle size and texture ranging widely in chemical composition and organic content which is essential for agriculture and sustanance of life on earth. Soil is a renewable resource but it is regenerated at a very slow rate. Techniques like aerial photo-interpretation with limited ground control can provide quick and cheap means of preparation of resource maps.

Forests: Forests play a variety of roles in economic growth, ecological equilibrium, recreation, soil conservation, grazing, ground water flow and as a habitat for wild life. About one-third of total land area of the world is presently covered by forests, but there are large areas among developing countries where the percentage of forested area is considerably low. A recent World Bank study estimates that the existing forests in developing countries will disappear in less than 40 years, if population growth and wood consumption continue at current levels. A judicious approach to management of forests should aim at large scale afforestation, and energy farming for fire wood, to achieve 'multiple use' and 'sustained yield of forest product'.

Marine Resources: Vast deposits of minerals and fuels are expected to occur on the continental shelves and slopes of oceans, and investigations carried out mostly by advanced countries have revealed deposits of manganese, nickel, cobalt and copper in the form of nodules on ocean floors The dissolved salts, other chemicals and metals also offer immense potentialities for the future. Attention has to be given to the exploration of ocean resources (living and non-living) to meet future requirements. Till such time as developing countries are in a position to acquire and use technology to explore and exploit the marine resources, serious efforts must be made collectively and through international agencies to safeguard their immediate and long-term interests.

Human Resources: If we look at the global picture of population, about four billion people inhabit the earth and every year this number is increasing by about 70 million. Two-thirds of this population is living in developing countries. By the end of the century, the world population may be of the order of six billion. In developing countries where effective population control measures will take some years to come, it is necessary to actively pursue a policy whereby we utilise our population as a resource and train them and motivate them towards gainful employment through labour-intensive technologies to earn enough money to meet the basic needs.

For the past few decades, the philosophy for economic development of the under-developed countries has been "what is best for the rich must be best for the poor". However, large-scale industrialisation leading to increasing urbanisation cannot answer problems of developing countries where nearly 80 percent of the people live in rural areas. In most cases imported technology is capital intensive and may not match the natural resources of the country, where capital is scarce and labour is abundant. These countries may also not have the indigenous capacity to absorb sophisticated technology.

In this context, the concept of alternate appropriate technology plays a vital role. Developing countries must be helped to help themselves but only by making available to them technologies that recognise the economic constraints and limitations arising out of poverty. The economic prosperity of a country and of the entire world depends on how all the countries of the world adjust themselves individually and collectively to the constraints imposed by population growth, limited resources, international trade and ecological considerations. It is obvious that the exponential growth of resources consumption cannot go on for ever. There has to be an increasing realisation that research and developmental activities for substitution, recycling and alternate energy resources need to be intensified.

There is an urgent need for the developing countries to manage their natural resources judiciously and adopt management practices built around specific purposes and goals rather than piecemeal policies and their implementation in isolation. Developing countries have to safe-guard against big business households and multinational corporations who exploit them by under-pricing of the raw materials and overpricing of the processed products.

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