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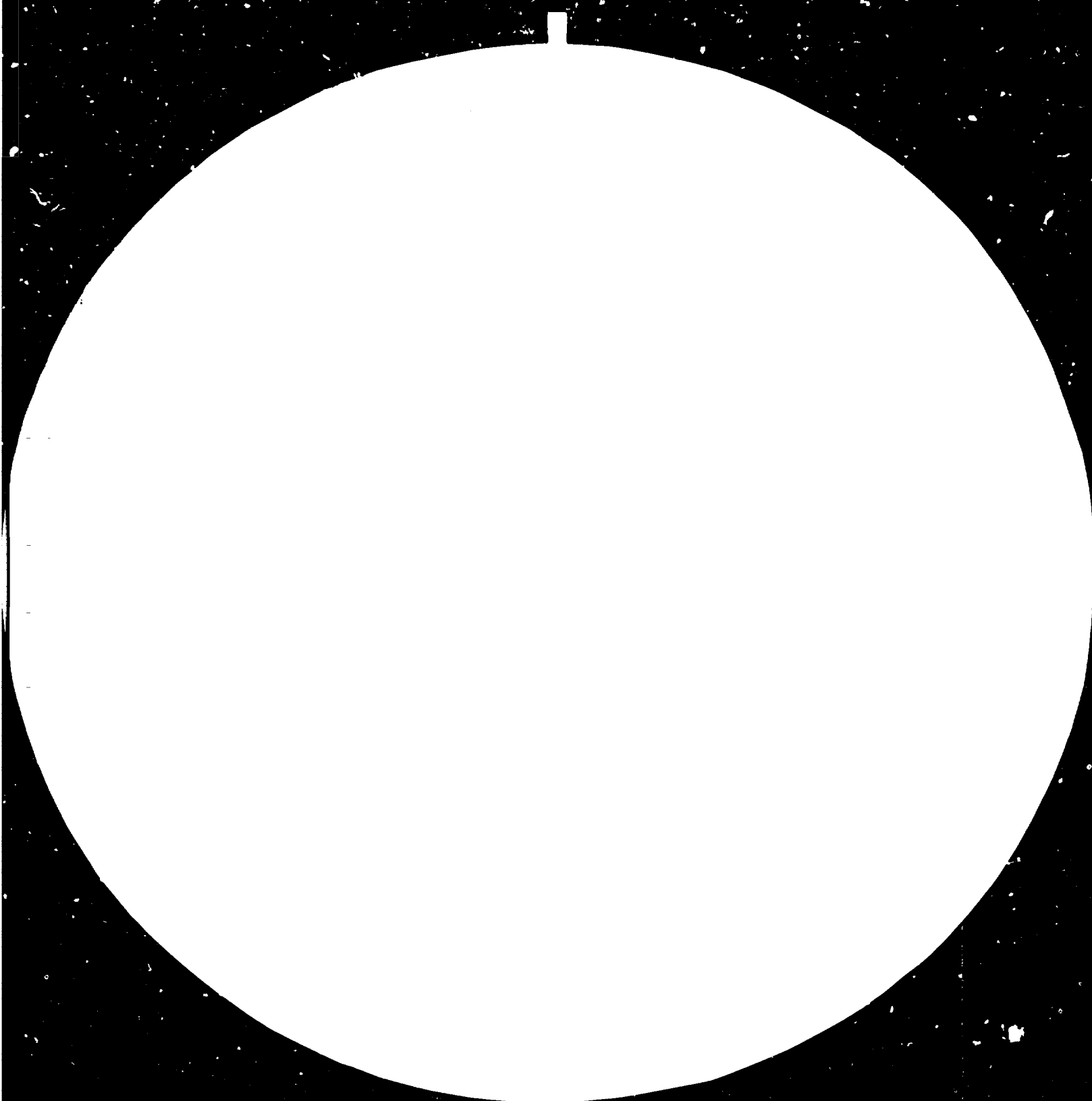
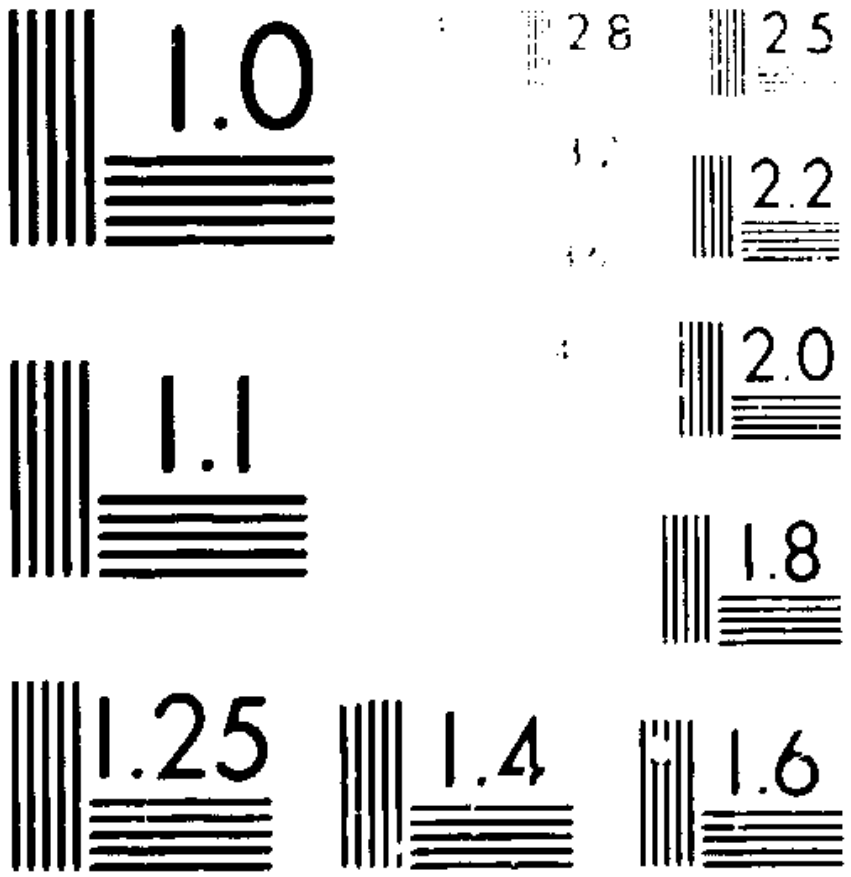
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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Y. Nayudamma

TENTH ROUND TABLE OF DEVELOPING COUNTRIES (DCs)

Zagreb, 15-17 September, 1982

THEME: Mutual Cooperation of Developing Countries in Technology and Human Resources Development for Industrial Development in Developing Countries.

UC/INT/82/120

1. INTRODUCTION

.1 Today, S/T is mankind's main enterprises. The greater the capacity to generate and utilise S/T, the faster the progress of a country.

.2 Almost all advanced technology originates in industrialised countries (ICs) which accounts for 96% world's scientists and R & D expenditure of which 51% go for defense and around 25% by TNCs for private gains and only 1% for research on problems related to developing countries. It is the height of obscenity that half of world's research is for devising measures for destruction of man and nature. World's most patents are in industrialised countries and TNCs. The patents granted in developing countries are only to create monopolies. Technology knowledge is power and this power is held by few, who dictate the terms and choose

the people to give. Technology import has not proved to be the quickest route either; neither the development model of industrialised countries is the only model for developing countries to follow. In fact, technology developed in industrialised countries is designed for conspicuous consumption, for destruction of nature and domination of people and these are not suited to meet the basic needs of the poor people in developing countries. For developing countries' specific problems, there are no specific technologies developed in industrialised countries. The indiscriminate import and utilising it without adaptation have also created distortions in the socio-economic fabric of developing countries. Such technologies are also given under unfavourable conditions and developing countries do not have the capacity to adapt and absorb. Further the synthesis between traditional and modern values create conflicts in developing countries.

.3 There is therefore no choice for developing countries except to develop local competence and self-reliance in S/T. Self-reliance is not self-sufficiency It is the ability to 'discern' - ability to collect information, analyse, choose and implement. It is the

freedom to make and implement decisions. The concept of self-reliance demands national commitment and political will.

.4 Collective self-reliance among developing countries is to complement and supplement competence of each country, to reduce time and money taken to build local S/T capacity, to improve bargaining capacity, to examine implications of emerging technologies and to take collectivep policy action and to respond readily to social changes brought about by technology.

.5 Self reliance in S/T would mean building up structures, institutions and competence in local S/T spectrum covering

* Basic and applied R & D Institutions
* Educational and Training institutions
* S/T policy integrated with national development policy
* Identifying S/T gaps, set priorities, assign tasks, to S/T teams
* Set up and strengthen registration, deposit, review, evaluate and approval of technology transfer agreements in public and private enterprises.
* Information, technical assessment, evaluation negotiation, legal contracts
* Unpackage the technology package
* Analyse, arrive at alternatives and choose

* Adaptation, improvement, absorption and utilisation of technology

* Technology transfer and delivery systems

* S/T and Future

* S/T and Social Values

* S/T and Involvment of the generators/users, people policy makers, scientists, industrialists, bankers.

2. PRESENT STATUS AND GAPS IN S/T CAPABILITIES IN DCs

.1 A brief survey of the present status of S/T capabilities may give a clue to the gaps that exist and the steps to be taken for achieving national and collective self-reliance in the different components of S/T spectrum.

.2 The gaps are:

Lack of

* Access to information and awareness intelligence; ability to assess and arrive at choices; and choose; adapt; assimilate and utilise imported or indegenous technologies

* Ability to unpackage a package; bargaining capability; knowledge and experience in detailed engineering, designing and consultancy service;

* venture capital

* Optimal infrastructure for R & D and trained personnel for generating indigenous technology.

* Proper technology policy, linkages between industry, university and R&D institutions, limited markets; concern for traditional technologies; scientific attitude and ability to absorb technology by the majority of the people.

3 BASIC POLICY ISSUES FOR COOPERATION

.1 It is good to distinguish between Cooperation, Assistance and Aid: Aid is given by one country to another to set up an institute, factory, etc. Assistance is given to strengthen and effective use of the existing facility e.g. equipment, experts, etc. Cooperation is based on the concept of equality and equity. Cooperation is best between equals.

.2 Cooperation among developing countries must differ qualitatively in concept and pattern and should be distinct from the cooperation between industrialised countries and developing countries. The concept of donor-acceptor must be replaced by the concept of equality, equity, shared values, ideals, mutual interest and non-exploitative character, bearing in mind the stage of development and overall capacities of each country.

.3 Cooperation should be to supplement and compliment the local competence and for national and collective self-reliance, by pooling, sharing, and utilizing resources, skills, expertise, etc. Cooperation is to develop local competence to identify problems, generate technologies, design solutions, determine policies and bring about self-sustaining solutions to relevant local

problems and be responsive to local political, social sensitivities.

.4 Political will and commitment is a pre-requisite for such cooperation. The spirit of partnership; mutual understanding and working together harmoniously as a team are essential ingredients. Buthow to bring about these equations is not easily answered.

.5 Cooperation should be not only technical or commercial cooperation but it should be cooperation for overall growth and development of each developing countr'.

.6 The contemporary development should be linked with that of the past tradition and make it a part of national culture.

.7 The most urgent and crucial issue is for each country to redefine its national socio-economic goals not patterned on the models of industrialised countries but in terms of the real welfare of the people. It is important to recognise that we can ill-afford the patterns of conspicuous consumption and culture of consumerism.

.8 Development goals must be related to social values. It is the social values that decide our life-styles and

the life-styles dictate the demands and needs which in turn decide the type of technologies to produce the required goods and services.

.9 Choice of technology - labour or capital intensive simple or sophisticated, traditional or emerging technology.- will depend upon the development goals and priorities based on focal social values of the society. Alternative development styles require alternative technologies. If technology is an instrument of domination and disparity between 'have' and 'have not' countries, it is equally true between haves and have-nots within a country.

.10 The kind of development, technology, directions and priorities must be arrived at by a national consensus involving all the people representing the relevant sectors like government, industry, research and development, banking and labour and the people at large who are to be the beneficiaries. Full involvement of the concerned people in the planning process from the very beginning and arriving at an agreed plan is an assurance for its successful implementation. Otherwise plans remain paper plans.

.11 The policy for cooperation is not to superimpose an organisational structure but to let it evolve from

the concrete programs and projects.

.12 Transfer or mutual sharing of resources among developing countries include natural, financial, S/T resources, human skills and resources transfer should be compensated. The organisational and financial mechanisms should be seen in this light.

.13 The concept of collective self-reliance between developing countries is to find means to expand the total resources flow, not simply change their proportions. It is not substitute or a competitor but complimentary to bilateral and multi-lateral and global programmes.

.14 The identification of complimentarities is the real basis of development planning and collective self-reliance.

.15 Thus cooperation between developing countries for national and collective self-reliance is imperative to (a) pool the resources and share the experience and expertise; (b) share the power and responsibility among the countries of the world; (c) bring about new international economic order, changing the present international system loaded in favour of industrialised countries in regard to access to information and flow of technology, credit and control of markets, commodity prices, etc.

Developing countries cannot continue to be recipients of technologies that are often unsuitable, supplied at inflated prices and under restrictive conditions.

.16 Ability to Discern: The first concern of developing countries is to develop the autonomous decision making capability. This would entail developing indigenous capabilities in getting an access to knowledge; ability to assess, analyse and the wisdom to choose. Both information intelligence are necessary. The fact that development process is transdisciplinary in character, only a transdisciplinary team consisting of economists, scientists, technologists, social scientists, etc., can study and arrive at development alternatives and choices and the ability to integrate insights of S/T with that of economic, political social system.

.17 If S/T has to be responsive to local cultural social sensitivities, the relation between technology and culture has to be analysed from several alternative perspectives. Technology tends to homogenise culture and 'modernisation' through technology becomes 'westernization'. The influence of the combination of technology policies and cultural heritage as well as appropriate cultural conditions for technological development have to be examined carefully.

.18 Technology policy for what and for who?

It is necessary t. integrate S/T with national development goals and priorities. Technology tasks and technology policy instruments should be clearly defined to serve the specific priority needs of the majority of the people.

The cluster of technology policy instruments c cover:

* Industrial programs and policies
* Legal, administrative, institutional structure to shape industry to grow
* Incentives, controls
* Venture oriented banks, Risk Capital; Capital for adaptation and improvement
* Promoting S/T in State Enterprises
* Support services such as standards, engineering consultancy, information, technology q acquisition, adaptation, diffusion, delivery extension, etc.
* Linkages S/T with industry, education, user.

.19 S/T policies should aim location, situation, resources and culture specific to arrive at local solutions to local problems. S/T decisions should by andlarge relate to Environment, Ecology, Energy, Economics, Equity, Employment, Efficiency and more particularly for integrated Rural Development.

.20 If technology is for the good of the people, people should be involved in development process and should have a social control over technology. This also means that all the actors in the play, namely decision makers, administrators, financiers, technology generators should be sensitized to the cause and use of science, with scientific attitude as a way of life.

.21 The growth of effective S/T planning management and implementation organisations is a task of utmost priority to developing countries.

.22 A Careful look at S/T to be an effective tool for development calls for a three tier system of organization -

(1) High Level Intellectual Inputs: Centres for Development Altematives (CDA) may be set up where transdisciplinary groups work out development alternatives, provide alternative choices for the decision makers for taking an autonomous decision making. Such a group may also help to arrive at technology choices integrated with national needs and priorities with the capabilities of technology assessment, acquisition, adaptation, generation, relevance, etc.

(2) Development/Technology Delivery System: It is not enough to generate or acquire technology. It is necessary to deliver it at the doors of the people that need it. For this purpose voluntary agencies that have the desired S/T competence on one hand and confidence of the people on the other may be utilized. Voluntary agencies have the added advantage of getting things done efficiently at less cost and time as compared to bureaucratic governmental machinery. An umbrella agency also may be set up to look into the needs of the various voluntary agencies.

(3) Each agency may take advantage of unemployed uneducated/educated youth technology transfer agents. The youth may form National Youth Resources Corps. This would not only give them jobs or self-employment but also the feeling of participation and pride of achievement.

4. BASIC CONSTRAINTS:

What comes in the way of national and collective self-reliance in practical terms needs a closer examination.

.1 Joint action between countries is no substitute for determined action at national level. At the national level, some of the countries feel that they have not reached a stage of development for self-reliance. Some lack in financial, human and management resources. Some feel that climate for foreign investment may be blocked.

.2 Cooperation in basic research is simpler and easier but in case of technology which may be put to commercial use an initial, deeper understanding on who shares the benefits to what extent is essential.

.3 The 30th Pugwash Conference, August 1980 (Pugwash Newsletter Vol.18, 1 & 2 1980, p.9) identifies the obstacles to S/T development which are to be overcome and which require continued attention and investigation regarding their causes and consequences in developing countries. These are:

(1) lack of an effective science and technology policy

(2) obstructions to self-reliant development

(3) lack of research and development in industrial sector

(4) absence of linkages between R & D laboratories and industry

(5) Scarcity of technical staff at the intermediate level

(6) inadequacies of the education system

(7) absence of S/T in economic sectors

(8) lack of S/T information systems

(9) inappropriate administrative machinery in S/T institutions

(10) lack of a code of conduct for the operation of TNCs

(11) lack of cooperation between developing countries having problems of similar nature

(12) failures of industrialised countries to set up appropriate mechanisms and positions for S/T personnel of developing countries

(13) failure of developing countries and industrialised countries to counteract brain-drain both internal and external, etc.

.5 The countries that have a colonial past also suffer from other constraints.

(1) The legacy colonial administration is based on mistrust. Horizontal transfer of industrial technology from one industrial firm to another within a country and from one developing country to another has not found favour. Instead all of them go to the same western firm for the same technology.

(2) The colonial dependence extends to the thinking that "what is foreign is best; what

is urban is good and what is rural and traditional is bad". The craze for foreign goods is yet another indication.

(3) Further it suits the investor in developing countries to produce and sell with ease and quick profit the products with an international brand name and therefore only looks for foreign technology

(4) The selection of technology is also circumvented by such factors as foreign investment and credit facilities from suppliers of equipment.

(5) The decision makers have also additional attractions in foreign collaborations particularly from industrialised countries.

(6) Harmony, team work, cooperation are watch words of Japan. This cannot be said of all developing countries, particularly those with a colonial past whose policy is to divide and rule. How to inculcate the spirit of working together in harmony and cooperative endeavour is a major issue.

(7) There is an intellectual dependence. The elite in developing countries are more at home in industrialised countries than with their own people and the decisions are made by the elite as conditioned by the western training and temperament and not in consonance with the wishes, needs and priority of the majority of the people.

(8) Lack of local competence and innovative attitudes in developing countries is also partly due to colonial past.

* Education and training institutions are apparently replicas of overseas institute maintaining colonial heritage and intellectual dependence.

* Decisions in respect of universities, R & D design of programmes and priorities and deployment of resources were taken in the interests of the empire in the past and later that of TNCs.

* S/T policy of industrialised countries is to maintain the superiority of industrialised countries. Acceptance of such policies uncritically by developing countries only perpetuates the dependence. National capability should be developed both in traditional and emerging technologies and counter the moves of industrialised countries.

* Even a country like India with all its ~~its~~ large infrastructure for S/T industry and skilled S/T manpower is a classic example for continued dependence for new designs and techniques from industrialised countries. This is because of the fact that the initial wholesale absorption of unmodified techniques of production from industrialised countries is perpetuated without discernible improvement in the local capability. The dynamism to invent and innovate is curbed in this process.

* Industrialised countries have not only technologies but also control their transfer and use maintain their technology knowledge advantage by sustained R&D

effort and access to financial and managerial resources. As against this, developing countries have a weak bargaining position, without free access to technology information and ability to analyse, assess, acquire, adapt and absorb imported technologies and/or generate their own. Technology generaton requires money, long time lead and technology becomes obsolete fast and the inability to sustain all those make developing countries dependent on industrialised countries. Technologycal dependence breeds further technological dependence and the continued application of inappropriate technologies to distortion in the industrialisation process and cultural and social value systems. The benefits do not also flow to the masses of population.

.7 To repeat, development of indigenous technological capabilities thus becomes imperative to promote technological self-reliance, to promote cooperation between developing countries to share the know-how; to ensure the technological supplies inside and outside developing countries confirm to certain acceptable norms for technology flow and promote peaceful use of S/T for the betterment of the masses of people through development of economic sectors like industry, agriculture, transport, etc.

.8 Such a development should cover the total technology spectrum covering the selection, acquisition, adaptation, absorption and continuous improvement of technology and conducting R&D and generating technology. This include human resources and skill development at different levels from decision-making carrying out research, design and engineering, extension, dissemination and commercialisation of processes.

5. PRECONDITIONS FOR INCREASED SCIENCE AND TECHNOLOGY COOPERATION AMONG DEVELOPING COUNTRIES:

* Political will and commitment to national and collective self-reliance.

* Co-operation with a spirit of mutuality of interest, equity and mutual trust;

* Respect for cultural, political, social differences and respect for national sovereignty;

* Compatability, team work and willingness to share;

* Clear understanding of the tasks of a co-operative endeavour and who does what and who gets what benefits at the very beginning;

* Faith in and commitment to the cause and use of science and acceptance of science and technology as an essential instrument for socio-economic development.

* Developing national science and technology compatabilities and technical manpower for effective co-operation and collective self-reliance in science and technology.

* An annual expenditure at least one per cent of GNP by 1990 by each developing country on R & D.

* Economic co-operation among developing countries (ECDC) through technical co-operation (TCDC)

* Setting up of a nodal organizational and management structure/involving national and regional science and technology focal points to coordinate ECDC programme.

* Setting up of an appropriate national documentation and information system to facilitate exchange of information and matching the talents with the tasks of co-operative endeavours.

* Identifying national focal points to provide for a specific framework for concrete co-operative arrangements backed by financial allocations.

* Identify specific science and technology areas of mutual interest.

* An analysis of the reasons for lack of innovation in developing countries with a view to develop indigenous science and technology capabilities.

* Political will to resolve conflicts between developing countries without going to war and diverting the 30-40 per cent of national budgets spent on war to war on poverty.

* Display of vision and wisdom by not being attracted by short term benefits offered by the developed world;

* Not waiting for the outcome of North-South dialogue but to use South-South Co-operation;

* A clear understanding of the fact, the salvation for any country is only through local competence innovative attitudes and problem solving capabilities with an ability to identify problems, design solutions, determine policies and bring about self-sustaining solutions;

* Long term plans for co-operation for sustained industrial and technological growth.

* Continuous search for improved means, mechanisms, new avenues and methods of co-operation and to accelerate the tempo of co-operation.

* Common approaches for critical problems of mutual interest like population, food, etc.

* Willingness to utilise complementary industrial and technological capacity within the developing countries instead of running to industrialised countries.

* Common policies and measures for industrial processing of raw materials in developing countries and to achieve integrated rural development and self-sufficiency in food;

* Willingness to share resources, finances, technology and technical manpower and to compensate for resources transfer

* Coordination of educational and manpower planning

* A thorough survey of supply side and an indepth investigation revealing the full potentialities and complimentarities of existing institutions and resources.

6. COMMON AREAS FOR COOPERATION

6.1 Some specific areas for concrete action have been identified by the Advisory Committee of Inter-governmental Committee on Science and Technology for Development (ACSTD) to speed up the implementation of Vienna Program of Action at its recent meeting in February 1982. These are applicable to co-operation among developing countries

also.

These are:

* Policy making, financing and co-operation;

* Infrastructure, human resources and research and development linked to production;

* Choice, acquisition and transfer of technology and information;

* Activities promoting a more equal role by women in science and technology; and

* To promote science, technology and the future.

These efforts may be made at the national level, joint national and international action effort through bilateral or multilateral programs through the UN agencies, regional and global collaborative action programs and a new international initiatives.

.2 The Interagency Task Force on Science and Technology for Development has set up four working groups to formulate specific and concrete proposals for joint activities of various UN agencies in the areas of:

* National Science and Technology policies and plans.

* Upgrading of traditional technologies.

* Science and Technology and the productive sector,

commercialisation of R & D and acquisition and transfer of technology.

3 Common Problems:

Developing countries face several common problems. These are:

* Population, poverty, employment, ecology, energy, efficiency, better utilisation of local resources; food sufficiency and food security; nutrition and eradication of tropical and water borne and related diseases, basic engineering industries like machine tools; fertilizers, drugs; these problems demand science and technology solutions.

* Utilisation of sunbelt resources and traditional skills e.g. biomass generation, utilization, biotechnologies, non-conventional energy systems, etc.

* Traditional tools, techniques and technologies

* Metereology

* Natural Resources Survey - Land and Ocean surveys

* Science Communication; Educational Satellites

.4 Science and technology capability building includes training of personnel, basic and applied research, finances for and management of research and development; industrial technology design, engineering and consultancy, execution of projects, joint research, development and production projects and setting up of joint ventures, etc.

7. AVENUES, MEANS, MECHANISMS & METHODS OF COOPERATION

1. CONCEPTS:

.1 Networks:

Setting Up and Networking of Independent and Yet Interdependent Institutions:

* Co-operation is to supplement and compliment each other's competence. Each country may build competence in area and scale the highest peak in that area. With each country having a peak, collectively in region would have several peaks and collective competence. Each country then is independent in one area and yet interdependent on other countries for collective self-reliance. Each country has then the pleasure and pride of sharing for mutual benefit and bring the countries together: Regional and international networks in Chemistry, Physics, Biosciences, etc, exist.

* Networks can also be with national educational and or research institutes dealing with the same subject, e.g. all the leather or food research institutes in the region and in the world.

* Network of professional/technical/organizations like Academies of Science and Engineering; Institution

of Engineers; Engineering and Consultancy firms, etc, national, subregional, regional and global may offer technological services, for flow of technology, consultancy, setting up pilot projects, plants, etc, particularly in high investment areas.

* Similarly other networks could be considered, e.g. Networks of (a) public industrial enterprises; (b) information systems, technology banks, technology registries, technology manpower banks; (c) product oriented R & D institutes like leather, paper, food, etc. (d) Training of S/T personnel at different levels; and (e) Centres for Development Alternatives; Technology Delivery Systems; Institutes for integrated Rural Development.

.2 National Centre acting as an International Centre:

* Yet another way is to have a National Centre of Excellence in basic or applied research acting as an international centre catering to the needs of the other developing and even developed countries. The existing centres may be upgraded and strengthened for this purpose. Even here the concept of each country being independent in one area and yet interdependent in another area still holds.

.3 Twining:

* An advanced centre in one country may be twined to a smaller centre in another country acting as an elder sister to it, transfering and building the competence of the smaller centre.

.4 Collaborative Specific Goal Oriented Projects:

* A common problem of mutual interest to a few countries is first identified, technological tasks dilenated and each task is assigned to a competent team in different countries.

2. JOINT VENTURES:

.1 Interested countries may jointly set up regional, sub-regional institutes to serve the common needs, e.g.

* Educational institutes
* R & D institutes - basic and applied
* Vocational training, polytechnics, etc.
* Information base
* Survey of natural resources

.2 Joint industrial projects and market sharing to stimulate industry, trade and market.

.3 Joint manufacturing facilities for small machine tools, agro-industries, fisheries, renewable energy,

equipment, educational aids, etc.

.4 Joint co-operative endeavours for popularisation of science, science communication and education, education satellite etc.

.5 Joint capability to monitor and evaluate technology perspectives and advances; their potential impact on society to suggest policy actions to respond to technology changes.

.6 Joint institutes in areas of innovation and research in advanced engineering and emerging technologies like biotechnology/genetic engineering, micro electronics, etc., to reduce time and costs.

.7 Joint industrial venture sharing capital, experience, labour, resources. One country may contribute to capital, another technology and technical manpower or labour and a third contributing natural resources.

3. GLOBAL/REGIONAL CENTRES

.1 Non-aligned Centre for S/T information is being set up for compilation and dissemination of information and existing capabilities in the different sectors of technology, availability of such technologies, conditions

of sharing and transfer of technologies, to maintain updated compendium of technicians and experts in diverse fields in developing countries and the terms of their availability, etc.

.2 TCDC - RCTT (Regional Centre for Technology Transfer) to undertake programme and projects on technologies that are beneficial to developing countries.

.3 Advanced International Centres for Biotechnology material sciences, electronics, space and renewable energy etc.

.4 Setting up regional multipurpose Training-cum-Demonstration, Pilot Project/Plant/Production Centres in selected areas like agro-industries.

.5 Setting up regional industrial estates and co-operative ventures in small and medium scale industries.

.6 Setting up institutes of technology and institutes of management, administration, financial management,etc.

4. ECDC/TCDC:

A close examination is needed to determine the effective functioning of ECDC/TCDC in or outside the

UN umbrella.

5. SHARING:

Sharing of experience, expertise may be done in the following areas to the best advantage of the co-operating countries.

* Formulation, orientation and sharing of experience in S/T policy integrated with national policy and S/T programs integrated with development goals and social values.

* Development alternatives and alternative technologies.

* Identification of technology needs and matching them with technology talents, facilities and funds.

* Methods and mechanisms of collection, retrieval, analysis of S/T information, evaluation and selection of technology; unpackaging of imported technology package; technology assessment, awareness intelligence of emerging technologies.

* To ensure technology supplies conform to agreed norms.

* Experience in R & D generating technology

* Experience in S/T institution building.
* Measures to check braindrain
* Product, process design; adaptation for indigenous production.

6. EXCHANGE

* Exchange of information and experience in S/T competence building
* Established capability to give and receive
* Information about S/T capacity in industry, development experience, negotiating power for acquisition of technology, technology registrar etc., terms of licensing.
* Exchange or barter of technology, materials and funds.
* Exchange of scientific and medical equipment, prototypes, pilot plants, etc.
* Scientific journals, research reports, etc.
* Information regarding role of TNCs in developing countries.
* Exchange of experts and skills
* Exchange of technology profiles in areas of common interest like water management, power projects, natural resources survey, etc.

7. MECHANISMS:

* Organise meetings to exchange views and arrive at plans of co-operation - for Ministers in charge of S/T and industry; Heads of S/T institutions; Industrialists, etc.

* Each country may state one successful and not so successful experience in S/T co-operation in DCs to recognise weaknesses and strengths, opportunities and threats (SWOT Analysis) and to improve upon the present modes and mechanisms of co-operation.

* Each country may set up industrial and technology co-operation program

* Set up a clearing house for information and for matching the pairs for co-operation

* Bilateral/sub-regional/regional/global co-operative exchange programs

* Tri-party meetings with UNIDO and developing countries.

* Consultative meetings organized by UNIDO, UNCTAD, etc.

* Voluntary organizations assisting joint ventures in industry in R & D and indigenous S/T competence building efforts - like IDRC, COSTED and others -

which have greater efficiency, flexibility and speed.

* Industrialised countries supporting R & D projects in developing countries.

* Setting up a Third World Resource Centre to critically study and counter the intelligent moves of Industrialised countries against the interests of developing countries.

* Converting braindrain into brainbank utilising the nationals abroad and their expertise, talents. training and savings in the country's development process

* TNCs setting up R & D laboratories within developing countries. This is double edged weapon. TNCs exploit the cheap scientific labour within the developing countries; use them for developing processes in the areas that fetch high profits in the world at large and not necessarily related to the country's needs and finally patenting the results of research by the parent company and not within the developing country where the laboratory is located.

* Setting up national nodal/focal points for exchange of information, identification of needs

and established capacity to give and receive and to coordinate the various co-operative programs.

* Setting up venture oriented Finance Corporations with risk taking capacity.

* Setting up multinational Technology Generation and Transfer Corporations like TNC among the developing countries.

* Setting up of Co-operative Research Associations between industries and government

* Setting up S/T industrial parks individually and jointly by developing countries.

* Setting up joint facilities for natural resources, survey, resources development, etc.

* Promoting developing alternative technologies relevant to development goals of developing countries.

* Providing incentives/awards/rewards systems for S/T innovations that help developing countries development programs e.g. instituting prestigeous awards like, Third World Nobel Prizes for research related to basic needs, forestry, agriculture, fisheries, health; to reduce or remove pollution of poverty; to increase employment; to remove abnoxious, unhealthy professions like scavenging, etc.

8. MEASURES TO STRENGTHEN COOPERATION AMONG DEVELOPING COUNTRIES IN SCIENCE & TECHNOLOGY

Report of the meeting of Heads of S/T agencies of Developing Countries held in New Delhi 1982, ND/ST/82/DOC 1, give a detailed account of the measures to strengthen co-operation in the areas of:

* Compilation of dissemination of information;
* Formulation of Cooperative Arrangements through creation and strengthening of network of institutes in S/T including R & D institutes and through intensification of exchanges involving experts
* Flow of technology in areas such as setting up of demonstration pilot projects/plants, exchange of prototypes, scientific equipment consultancy service and assistance in manufacturing facilities.
* Co-operation in areas of technical innovation and Research in Advanced Technology.
* Co-operative efforts in enhancing negotiating power of developing countries in regard to industrialised coun ies technology supplies; and
* Organisational and financial matters for promotion of ECDC in S/T.

For full details, the document may be referred to. No useful purpose would be served to repeat the recommendations here.

HUMAN RESOURCES DEVELOPMENT

INTRODUCTION

Manpower is not only the most important resource for development but it is the objective of all development.

Manpower training, development, mobilization and utilization are thus considered crucial to the level and rate of industrial and economic growth.

The aim of education and more so S/T education should be to develop the person; to develop the creative, innovative urge; enterprising attitudes, problem solving capability and productive capacity of the person. A person so educated would have a sense of competence; a feeling of occupational identity, a satisfactory lifestyle and become an asset and not a liability to the society.

S/T education and training are needed at all levels to impart skills, specialist knowledge, quality and excellence, strengthen the ability of innovation, adaptation of optimisation in the matter of design and development; strengthen the perception of technological resources and needs of the country and develop competence to deal with real life problems.

It became imperative for each country to develop the necessary infrastructure for education, training and research and provide the opportunities to as large section of the population as possible to acquire knowledge, skills and technological competence.

Human Resources Development

Technology is generated and used by human resources: hence strengthening technological competence should be viewed within the overall context of human resources development (Page 71, UNIDO Doc. Part II ID/Conf/4/7). A balance has to be stuck between long term and short term educational and training progrmms for the acquisition of required knowledge and skills.

Education, training and research are to be distinguished and between them should cover the needs of extending from illiterate rural population upto high

level policy makers. Such a program should extend from skilled worker to ~~personnel~~ Professional such as scientists technologists, engineers and managers. The skills and knowledge to be created or upgraded will relate not only to the production process but also to the whole process of competence building in the total S/T spectrum that includes information, technology policy, planning, acquisition, adaptation, generation and utilization.

For knowledge base higher education and long term courses are the needs. Education could be formal and informal. For skill formation, short term courses may be run but training of personnel through their participation in actual execution of projects is more effective.

Long Term Courses would be dealt with by the universities, R & D institutions, Administrative and Management Institutes, Polytechnics, etc., giving degrees and diplomas.

Short Term Courses cover:

1. Training of information scientists and engineers.

2. A multidisciplinary task force consisting

of engineers, technologists, entrepreneurs, economists social scientists, administrators in the areas of:

* Technology awareness
* Technology assessment
* Technology and future
* Development alternatives and alternative technologies
* Emerging technologies and their likely impact
* Sensitising courses for policy makers
* Evaluation, negotiation, selection and acquisition of technology

3 Conduct of research; adaptation and generation of technologies; management of R & D institutions; evaluation of research projects and research results; commercialization, extension, liaison.

4 Design, Production and Productivity

5 Standards, quality control

6 On the job, in plant training for engineers and skilled workers

7 Training of managers, entrepreneurs

8 Science communicators, popularisation of science.

PRESENT STATUS

The present S/T education and research system modelled on the industrialised countries pattern has produced neither the right type of manpower nor developed the innovative attitudes and local problems solving capabilities. Further utter neglect of traditional technologies and indigenous skills have undermined the confidence of the people and alienate technologies to tackle grassroot problems.

In a number of institutions, the physical facilities like workshops, space, library, equipments are far from satisfactory. Many equipments remain unrepaired and unutilized. Several of the courses are outdated and stereotyped. The faculty comes in for serious criticism for their indifference, incompetence, incorrect attitudes and inadequate aptitudes.

Even in countries where the good infrastructure facilities exist for S/T education, research and development, improvement in the economic well-being of people has not materialised: instead the gap has only widened between the urban and elite and the rural poor. Obviously, there is a mismatch between educational objectives and social needs.

Similarly employment opportunities commensurate with knowledge and skills of trained personnel are still quite limited resulting in unemployment and underemployment and braindrain. Much worse, posts remaining vacant on the one side and unemployment on the other coexist. There is thus a mismatch between the university products and industry's needs.

Add to it, about 25 per cent of the top S/T graduates produced by some of the best institutions in developing countries leave the country every year. Those that stay in the country are reluctant to make a career in S/T: insteady they go for management and administrative courses commanding higher salaries and status. The loss of the potential for innovative technology embodied in this sort of internal and external braindrain - not only has a great social cost but is to be taken as a defeat of the very purpose of education.

Today industry's involvement in higher education is limited and the total technical manpower employed by industry i mall. The major employer is the government where scientists and technologists are always kept on the tap, while civil servants are on the top.

The desirable ratio of technicians to professionals should be around 5 : 1; this ratio is seldome achieved and the link between them is also missing.

As regard engineers, technologists and scientists in most developing countries, there is both paucity in numbers and less than full utilization of their capabilities. The technicians do not get the necessary status and recognition.

There is a lack of adequate manpower planning. No doubt manpower planning is difficult since the date are unreliable and uncertain and since our understanding of the dynamics of socio-political economic system is meagre. Forecasting becomes an inexact exercise.

ISS-UES

The present system of education modelled as it is in the West with the concept of schooling, excellence and quality in many developing countries has neither produced the right type of manpower, nor has it increased the education of the masses. Colonial pattern of education has resulted in continued intellectual dependence ~~leading~~ lacking in innovative enterprising attitudes; independent decision making capacity

and self-employment capability; producing only white collared job seekers.

In the name of equality of opportunity, the educational apparatus gets congested with enrolment. No doubt, it is a laudable social objective but a screening is needed in respect of the ability, aptitude and requirement of the society. In the absence of this, we shall only be breeding an army of frustrated young men in search of elusive job opportunies which do not exist.

One important issue in traditional societies is that in the name of respect for the elders and teachers, the child's curiosity and questioning spirit is curbed. Fear of authority does not permit questioning even in research institutions. Without questioning and curiosity what is research? No wonder researcher's progress is slow in developing countries and the same researcher blooms when he goes to America.

The educational system today is churning stereotypes conformists and crammers and they get bored. Without the joy of creation, there is no freedom from boredom. This has to be changed.

Many a developing country gives mere respect for brains, clean white collar jobs and the skilled

worker gets little status, salary and social recog= nition. Dignity of labor has to be inculcated and this becomes difficult in a feudalistic society. What we need however are clean minds and dirty fingers and not clean fingers and dirty minds!

Although agriculture, forestry and fishers account for large employment in developing countries, fewest number of vocational courses are available in these areas. Similarly, very few courses are run relating to agro-forest-animal and their waste-based industries.

The patterns of education in developing countries prompt one to ask the following questions:

* Is the education relevant to the present or future needs of the developing countries?

* Are we training the right number in right areas where people are required? A cursory glance suggests that where as large number is being trained in areas where few people are required whereas in those areas where large numbers are needed, only a few trained people are available.

* Are we training people to be teachers? Researchers for industry or management? It appears we teach chess in the Universities and ask them to play checkers in life.

* Are we honoring our technicians, technocrats and scientists enough?

* A country gets great men in the areas where country recognises greatness.

* Where do the trained people go for employment - mainly for teaching, research - even all that, largely in government. In industrialised countries 70 per cent go to the industries. Why is this so?

* Is our education designed for entrepreneurship and selfemployment?

Technology change brings about social change. Thus technologists and engineers become change agents. You can not be an instrument of social change unless you are involved with the society and unless the curriculum of technical education covers a perspective of human behaviour, social environment, experience to cope with administrative and managerial demands of work environment, to get things done, in addition to professional skills and knowledge.

S/T institutions would do well to accept 'Public Service' as one of the major functions and Extension Service as a Third Dimension in addition to training and research. Extension service will help to get into the real world; to learn live problems; to get the feedback, to make public and industry aware of the technical institutions and its capabilities to build linkages, to help mobility of personnel in research, training, industry and field activities.

'Continuing Education' should similarly be accepted as an essential activity of S/T educational system and of the industry. It is said that engineering is a 'learning' profession rather than a 'learned' profession. It helps vertical, horizontal, occupational mobility, to improve job performance and to ensure against technological obsolescence.

Nonformal education: Human resources development should cover the needs of the illiterate rural population too. Where education and development are linked, formal and nonformal education, schools, colleges, mass media, radio, video, TV, satellite, cinema, library, science museums, etc, should form a total network of educational means and media to develop the 'complete' man. Popularisation of science is a must

to inculcate scientific temper. Education would then be related to real life problems and aspirations of rural people and linked with health, agriculture, food, family planning, rural industry, community living, etc.

The School would then become a hub of change

Industry - University Interaction: Technical education is primarily governed by the need of the industry. Close interaction of the two is mutually beneficial.

In many developing countries the industry is yet to be set up in many sectors. Even where it exists, it has its technology roots abroad largely and its interaction with education sector is limited.

* It is time for industry to realise the need for its greater involvement in education particularly higher education and to recognize that "to bring less than the most-up-to-date and powerful engineering skills to bear on the problems of emerging countries is to restrict severely the rate of its technological development. The problem may be old but they deserve most modern solutions".

* Polite persuasion and concealed compulsion may be needed to ensure industry's involvement in technical education and research. Tax on industry may be imposed for education and research purposes.

* All developmental projects and industrial expansion projects should be linked up with an induction of competent trained technologists and engineers.

* Both public and private enterprises may be asked to institute technical manpower audit to ensure proper development and utilization of technical manpower.

* All possible avenues should be explored to obtain firm linkages between research and industry. These may include setting up Science and Technology Parks, industry sponsored or owned Research Centres in and around the University campuses; sponsor research projects, exchange of trained personnel; joint development of curriculam and educational programs; in employment and manpower planning, etc.

* Universities must also give up their ambivalent attitudes and take up socially relevant research which may call for a multi-disciplinary group acti-

vity. There is a need for change in value system, recognition pattern of academic work and legitimization of developmental work. There is also a dire need for curiculum review and for redesigning the courses to include relevant and emerging areas with an inter-disciplinary approach with an emphasis on relevance and excellence, . . biotechnology, genetic engineering, micro-electronics, natural sciences, life sciences, environmental sciences, etc.

It is becoming increasingly clear that the present education system patterned on the West is not relevant; responsive and sensitive to the changing needs of the people; lacks direction; hinders initiative and creative talent resulting elitist alien attitudes values and life-styles not rooted in the soil of the country. Presently neither 'private profit' nor 'public good' is enshrined in education. It should therefore change in content, form and method to bring about a social change and improvement of quality of life for the bulk of people. It is how accepted education should be linked to development: that higher education must be for the development of a 'full', 'complete', well balanced man and the University must provide development leadership, in addition to its traditional roles.

Human resources development should be viewed far beyond the confines of conventional manpower planning. Technological manpower should be viewed as technological improvement of a variety of occupations and need not simply as a set of specialised technical sources.

Technological competence has to be viewed and planned not merely as a matching input in a productive process but as an infrastructure asset or 'external economy' to be provided ahead of demand in all pervasive way.

A large population canbe a source of strength rather than a handicap if they possess the capabilities for improving their economic well being. A small increase in productivity of a large number of people is more important than a large increase of productivity of a small number of people. Technical education should be viewed in this light.

To improve productive capacity of each person, several setps may be taken, e.g. large scale training of artisans, improvement of traditional tools, techniques and technologies and occupations promotion of selfemployment, vocational orientation to school curricula, rural orientation to engineering and diploma

courses, problem oriented approach of research institutes to traditional technologies and rural development problems, etc.

Growth points for technological capabilities reside in certain sectors like agriculture, transport, agro processing industries, engineering industries, electric power, etc. On the job training in these areas in the schools, in the field and in the industry establish the very essential skill base for technical progress.

Mobility of technical manpower and skills is important for the diffusion and growth of technological skills.

Education Policy: - should be ~~detailed~~ dovetailed to industrial, S/T and other national policies. Such a policy should include introduction of vocational content in the school curicula to reach the largest number of students, development oriented technical education at University level linkages with industry and user, together with measures to mobilise and utilise scientists and technicians in the development problem of the country raising technological capabilities from identification of a problem to solving the problem. Policy measures like using local engineering and

consultancy firms have a key role in the creation of technological capabilities and human resoursce development.

ROLE OF ACADEMIC AND PROFESSIONAL SOCIETIES

Academiees and professional societies may play an important role in human resources development. Their role could be:

* T promote relevance and excellence in its profession.

* To protect and promote the best interests of its members.

* To make their presence felt in decision/policy making providing dispassionate effective and objective analysis of important issues and express them freely and frankly.

* To work towards the creation of indigenous competence and infrastructure and create an environment conducive to the relevant research and utilization of research results.

* To transform value system so that work on development programs get importance, prestige and financial support.

* To help in curiculum development, to develop new educational programs; in employment and manpower planning; organizing study circles, quality circles; identifying technology gaps; in evaluation and accredition of institutes; departments and programs; in publishing journals; in setting up consultancy firms, etc.

* To form interdisciplinary groups to make an objective in depth study in technology assessment, technology and the future and for identifying technology tasks; generation, acquiring, adapting, improving and i utilizing technologies.

* To study the work conditions of engineers, academics

* To provide challenging opportunities, social recognition, better atmosphere.

* To provide facilities for free flow and mobility of people between teaching, research and industry.

* To disseminate information in an accurate enlighten the public opinion; popularise science.

* To sensitize its own members and others in industry and government to development problems

* To promote regional and international cooperation, looking for and opening up new opportunities for joint endeavours with other developing countries.

* To ensure work ethics and professional ethics.

COOPERATION AMONG DEVELOPING COUNTRIES

The philosophy, methods, means and mechanisms of cooperation between developing countries have been discussed earlier. This applies to the sector of education, training and research.

But special mention should, however, be made is the continuing intellectual dependence on advanced countries is detrimental to developing countries. In this regard cooperation in developing countries is of paramount importance.

Developing countries would have also to get away from their traditional inherent defects like (a) feudalistic way of life; (b) importance to clean jobs and lack of dignity for work done by hands and (c) lack of innovative and entrepreneural attitudes.

Education should be conceived as development education increasing the productive capacity of the large number of people than increased productivity of a small number of people.

The network concept of each country having a peak point centre of excellence and making it open to other countries applies equally to education and training. Such networks help exchange of ideas, sharing of experience, talents, facilities, etc, effective interaction, better communication and working as a transnational team with a feeling of shared values, of participation, involvement and pride of joint achievement.

Countries that have built in competence may set up educational consultancy firms who may assist other countries in setting up educational, training and research institutions. India has recently set up such a firm Educational Consultants India Limited.