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A FRAMEWORK FOR RETHINKING THE CONCEPT
OF APPROPRIATE TECHNOLOGY FOR DEVELOPMENT *

by

Ponna Wignaraja**

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** United Nations, Asian and Pacific Development Institute, Bangkok, Thailand.

1. The problematique

At no previous juncture in history have mankind been more aware of the potential resources, scientific knowledge, technological capabilities and unprecedented opportunities available for the satisfaction of their needs, not only in narrower economic terms but in wider social and human terms. And yet, the strategies that are being pursued by developed and developing nations alike seem to be leading to a dead-end, both from the point of view of national perspectives, as well as, global order.

The development process as it has been unfolding in the past quarter century has multiplied the problems of both, the developed and the developing countries, as well as those of individuals within each. Affluence and technological advancement have not resulted in the improvement of the quality of life for people in developed countries, on the contrary it has alienated them from their societies, polluted the environment, wasted resources and generated fear and uncertainty regarding their basic values. The inability to manage their economic systems and the frustrations of youth are the clearest manifestations that even in rich countries, some fundamental changes are required. In developing countries, not only have the larger masses who are poor got poorer, but they are increasingly becoming unfulfilled and restive without access to the elementary necessities for life such as nutrition, food, clothing, elementary medical facilities and even safe drinking water. In both groups of countries where the creativity and potential of people is unlimited, life still lacks a fullness, resources continue to be misused and major social and political contradictions remain unresolved.

Any attempt to do something about this through the use of scientific knowledge and its technological application requires as a starting point learning from the lessons of the past, formulating a vision for the future on the basis of the awareness of possibilities for all countries and peoples and setting in motion a new process of development which can benefit all mankind. The vision of possibilities, though not identical for all countries in the immediate future, could provide for development of poor countries in harmony with the basic requirements of the majority of people in rich countries. The fundamental and long term interests of the world's people can be reconciled, ensuring that the immediate requirements of poor countries are also met.

This Consultative Meeting on Appropriate Technology for Development can help to rethink past experience and generate an in depth discussion on basic issues at the national and global level which relate to a relevant concept of Appropriate Technology. The issues discussed should help to clarify (i) what the development process is about and (ii) what the relationship is between science and technology and the development process, so that a consensus may be arrived on how science and technology could respond to the problems indicated above, influence future development, particularly in the next quarter century and benefit human beings everywhere. This then becomes Appropriate Technology.

II. Rethinking the old framework of development

The framework that has influenced the development process in the past quarter century assumed there were "develop" countries and "developing" countries and that development was a problem of "developing" countries and if the experience of the former, along-

with some resources, were transferred to the latter, the gap would be narrowed. The objectives and process were viewed in economic terms and great reliance was placed on economic factors. It assumed that rapid economic growth could take place if there was central planning and control of the economy as a "top down" process, with emphasis on industrialisation, modernisation and urbanisation. Capital, the factor in short supply, was conceived as the main input into the process. Internal capital accumulation would be assisted by inflows of foreign capital and technology. The cumulative benefits of this kind of growth in the modern sector were expected eventually either to "trickle down" automatically or at best be handed down in an administrative fashion to the large numbers who are in the rural areas. Material accumulation was expected to solve other human problems.

The "Widening Gap" between rich countries and poor countries and results of the "Green Revolution", in helping the rich get richer and making the poor get poorer within poor countries has led to a questioning of the relevance of the framework and indicated the limitations of this narrow "techno-economic" view and approach to development, even in its own terms.

Apart from the model's relevance for poor countries and its narrow orientation the "realities of the quantity and quality of foreign aid and transfer of technology to supplement indigenous capital, the factor in short supply and weak internal mobilisation efforts, made the assumptions regarding possibilities of rapid growth in the model of little operational value. There is sufficient evidence from World Bank, United Nations, and other studies to confirm that, by any standards, neither the quantum of aid nor its quality nor the kind of technology transferred from developed to developing countries were sufficient or appropriate. Apart from

the apathy towards aid in most developed countries today, a growing body of opinion supports the view that the earlier kind of aid giving and technology transfer is a thing of the past and may have helped to create "soft" societies and increased the poor countries' dependence. Further, the multi-national corporations who controlled the stock of "modern" technology and which were the main instruments for its transfer extracted high prices for their know-how and equipment, and the "borrowed", highly capital-intensive, import substituting technology which was implanted in developing countries had little relation either to real factor endowment, particularly labour or to the existing technological stock in poor countries or to the real needs of the masses of people. The entire process was wasteful and the contradictions too many.

Throughout the 1960's and early 1970's some token attempts have been made to modify the narrower techno-economic notions of development and effect some reforms. The Reformists argued that a modified framework of economic development can still be made to work "efficiently" if (i) distributive or social justice is built into the objectives, (ii) there is an element of popular participation in an essentially top down planning process and (iii) the UN's New International Economic Order would ensure a continuous process of transfer of an appropriate proportion of the income and technology from rich countries to poor countries.

The Reformist position continues to be based essentially on conventional development thinking. Even with social justice built into it they still consider the development process as mainly an economic exercise, subject to allocation of scarce resources. Further, it assumes a conflict free social framework for change.

Despite evidence to the contrary, there is an assumption of "One World", which will permit under existing conditions, an orderly and continuous process of income and technology transfers from rich countries to poor and that the technology transferred would be appropriate. Underlying all this is the further assumption that the problem of development is still mainly in the developing countries and that a consistent set of "policy packages" based on technocratic considerations can be evolved, ranging from structural changes to investment decisions to employment opportunities, which can be carried out from "the top" with good will and assistance of developed countries and the international community.

Several conferences and studies done within the United Nations system and in academic circles have analysed the change in the nature of the problems that confront the world today and the magnitude of the "crisis" in development in both developed and developing countries and its national and international dimensions. There is now a great deal of consensus on the causes of failure, even in its own terms, of the development strategy of the past quarter century and the depth and nature of the social and political problems that confront developed and developing countries which, if left unresolved, would result in unmanageable disorder by the year 2,000 A.D. There is also an acceptance that causal factors for the crisis which has reached global dimensions are to be found not merely in the developing countries, but also in the policies and strategies of developed countries and in the actual workings of the global system.

Looking at the picture in positive terms there is increasing consensus on the following propositions:

- (a) Development is fundamentally about human beings and they must participate in decisions that affect them.

- (b) Development is now the concern of rich and poor countries alike and it has to be viewed in its totality.
- (c) The world's resource potential and present and future technological capabilities are sufficient to meet the reasonable felt needs of men and women everywhere, if properly mobilised through the release of their creative energies.
- (d) Development is not an imitative exercise, borrowing a ready made package but an endogenous process which each country would need to operationalise in keeping with its own values, political systems and resource endowment.
- (e) A flexible global system can be evolved to supplement national efforts and be mutually reinforcing.

What this measure of agreement implies is that instead of prolonging the debate on whether the old framework can work and continued a priori theorising in terms of values and processes of the past, a new vision of development can be attempted on the basis of the actual historical experiences of rich and poor countries, the current realities and the future potential and an appropriate processes can be set in motion within the "space" that is available at the national and international level for bringing about meaningful social change.

III. Towards a new strategy of development

The new conceptual framework which is beginning to emerge on the basis of the above consensus not only responds to the new driving forces for change that are in evidence all over the world but also permits a linking of the critical interrelated phenomena affecting development everywhere. It also demonstrates that the

response to these driving forces for change cannot come from marginal reform of the old framework of economic development, functioning more "efficiently" with distributive or social justice built into the process, but requires a redefinition of the philosophy and objectives of development in human terms and a total mobilisation effort suitable to the ecological and technological reality, as well as, the potential. Redistributive justice is simply not the issue. The new framework must reflect an integration of available knowledge and a sense of purpose which go beyond the narrow view of development in the old framework.

Country specific sub-models would evolve, when attempting to operationalise the new framework. An overview consisting of a new set of broad objectives and a new process is, however, a necessary precondition if the sub-models themselves are to be relevant and operationally valid. A supportive international dimension, on new terms, with new institutions would also have to evolve in the proper sequence. It would not be a mere quantitative extension of existing international economic relations, but would be one which emerges as the new process of national development is set in motion.

The elements to be included in such a conceptual framework could be tested against the following criteria:

- (a) The statement of the objectives of development in terms of fundamental humanistic values rather than in narrow techno-economic terms.
- (b) The setting in motion of an accumulation process, within a realistic assessment of the natural resources endowment and the available technological potential which meets the felt needs of the people.
- (c) The ability to mobilise communities - national and international - to tackle their respective problems.

1. New objectives

The main objectives of an alternative approach to development can be briefly summarised. People are the world's greatest asset. Bringing out their creativity and potential is the means, as well as, the end of development. A strategy of development which does not look upon people as an asset in development can only lead to a dead-end.

People must be de-alienated and must feel at home with whatever process is initiated, it must progressively satisfy their needs and they must actively participate in decisions that affect them.

Self-reliance and the development of the collective personality of men and women so that they can contribute to nation building naturally is a basic element of this new strategy which is characterised by the innovative genius of the people in shaping their development. It is an expression of their faith in their own abilities. This implies elimination of "dependency" relationships irrespective of whether they are of a national or international character and developing through a country's own effort and recognising the value of mutual assistance. Self-reliance is not to be confused with a narrow concept of self-sufficiency or autarky and elements of necessary interdependence can be expected to flow from the process as it unfolds.

2. New process

To achieve these objectives, the conditions for social and economic progress are simply those which release the energies and creativity of the people and mobilises these for the all round development of their lives.

A continuous process of social transformation of enormous magnitude has to be envisaged with meaningful transitional strategies yet to be worked out. A "big bang" type of revolution would not be the answer. There is in this sense no easy way to bring about the structural changes required which themselves have to be supported by an integrated process of total mobilisation involving raising people's consciousness and the inculcation of democratic values, the transformation of labour power into the means of production, fullest utilisation of local natural resources and the systematic development of appropriate technology. For most countries this is also the only viable method of accumulation leading to faster economic growth. There is now sufficient historical validity for this process of mobilisation. Further, this process of mobilisation flows from the consensus relating to development that is now emerging and can be consonant with the objectives stated above. It implies a new man, nature, technology mix.

Further elaboration on these four elements of the total mobilisation process is in order.

- (a) For this process of mobilisation to be effective it implies raising mass consciousness, a committed leadership that trust the people, participatory democracy, decentralisation of decision making and a continuous self-correcting mechanism which the people themselves will devise. This is the essence of a democratic ideal. Except those decisions which involve the vision of the society and matters relating to the larger issues of social transformation, all other decisions of a detailed nature can be taken with direct involvement of those affected. It implies a system which differentiates between the larger issues of planning that can meaningfully harness the potential energies of the people and give shape to their initiatives and those of a smaller detailed nature.

- (b) Transformation of labour into the means of production cannot be achieved by the mere offering of employment contracts. People have to be stimulated to work through collective participation in production and a range of other activities within their own communities. The capital fetishism of the past must give way to the fullest utilisation of labour power and creativity.
- (c) A new definition of resources is called for - where sunlight, wind and every blade of grass becomes a renewable resource. Local resources would not be allocated and distributed through the dictates of the "market-mechanism", but in response to satisfaction of the felt needs of the people which become "effective demand" as a result of new institutional changes. This implies a new product mix and the satisfaction of local needs as far as possible by optimal use of local resources, with gaps being filled by surpluses exchanged first with neighbouring areas, thereafter with more distant areas and so on.
- (d) The technology involved would not be an outright transplantation from other environments, but one which integrates human development with available local resources. In other words, the strategy of technological choice would be related to the basic social philosophy and the resource position. While the process would start from the existing level of technology and improve upon it, sophisticated technology and newly created technology would also be used and would reinforce the linkage between the two to achieve the objectives. The flow would not be in one direction, rich countries would also borrow appropriate technology from poor countries on equitable terms. The technology used should also be non-alienating in that it makes for greater dignity of man and itself bring about environmental and psychological states, which are natural.

The pursuance of such a strategy has far reaching implications: for the basic values and the life styles of the people in all societies, both developed and developing. It may be necessary for the countries to go through with a period of shared austerity, if required for ultimate good, until such time as the new process is underway. In a fundamental sense, it also calls for re-designing of institutions and process, their value premises and goal-set. In other words new man/man and man/nature relationships have to be established. Efforts towards self-reliant development, as the key orientation for the new strategy would require articulation of the felt needs of development by the people themselves, and a corresponding reorientation in the international relation system with a view to encouraging societies towards collective self-reliance whenever feasible in order that these provide the lead already initiated in support of a new international order.

Development should be looked at as a total process. The technocratic approach which has influenced thinking and action for the past quarter century, has fragmented the process into narrow specialisation. A reexamination of the total approach is urgent in order that the process could respond to the needs of the times. Transforming growth oriented societies into humanistic and self-reliant elements in a global community of nations would demand bold and imaginative steps, commitment and participation by all concerned. The overall framework identified above, however, should be viewed as a perspective to enable the national systems to relate to what they need for their future operations.

V. Issues for the development of science and appropriate technology

The full potential for scientific enquiry within this new development framework and the systematic application of the results of such enquiry to the task of transforming society and enhancing the dignity and creativity of man is yet to be realised.

In the old framework the concept of modernisation and the imitative process of developed country experience implied the existence of one stock of scientific knowledge and a technological pool which was to be transferred from the developed countries which had the stock to developing countries. The assumption also was that science and technology were technical issues and related mainly to the production process. Its wider political, social and environmental implications and the question of who controls technology were hardly raised. The existence for other stocks were ignored. Here were the roots of the concept of "Transferred Technology" and now being extended to cover a concept of "Appropriate Technology".

Today, with the known social^{|||} effects of technological developments on the lives of people in rich and poor countries and the failure of the development experience of the past to reach the masses in poor countries, the whole role of science and technology in development and its wider implications for the future of mankind and global order are assuming primary importance. Issues such as the inadequacy of the old transfer mechanism, the distortions introduced by the main actors in the process, and the possible improvements to the transfer process itself are of secondary importance.

The fundamental questions to which developmentalists and technologists alike must address themselves to are what kind of scientific knowledge and technological application are required to bring about the new kind of development; how can technology be better related to resource endowment; how can technological relations themselves be non-exploitative and improve social relations; are there other stocks of scientific knowledge and technology which already exist, even from unconventional sources, which can be immediately harnessed; does a new stock of scientific knowledge have to be created to deal with emerging problems of the large masses of people along with an appropriate technology; who should develop this

appropriate technology and how; what are the wider implications of the brain drain for developing countries; and should not the transfer mechanism itself be looked at first in terms of a two way flow from rich to poor countries and vice versa, where selective transfers from rich countries may help to overcome some economic problems of poor countries and in the reverse transfer of some technology from poorer countries on equitable terms may help alleviating rich country social problems, with a third flow between developing countries with similar problems and interests. All these issues are inter-related and must be looked at simultaneously.

The results of ad hoc development of technology can be illustrated. There is for instance growing concern about the long run implications to mankind of the rate and pattern of resource use currently, more particularly of non-renewable energy sources, by the rich countries. The concern relates to what the present pattern of consumption implies in terms of the environmental degradation that is already evident on the one hand and the long term supply demand balance of essential materials on the other. Further, recent experience among developing countries with the introduction of high yielding seeds and chemicals in an effort to increase cereal production, but within a traditional framework of rural institutions and land ownership, also show the distortions in terms of income differentials and social divisiveness of technological change when pushed through without reference to socio-political consequences.

In short, the problems of technology development can no longer be separated from the large political and social crisis that is confronting the world. As the new development process unfolds, sporadic and ad hoc changes in the present system of technology development and transfer will not be adequate. A systematic attempt has to be made to identify all available scientific knowledge and for each country to develop the kind of technology mix that will

be responsive to the needs. The needs of each country would be different and within a country a technological pluralism would give optimal results. A process would have to be initiated so that a very wide range of technologies would need to be developed to deal with immediate concerns, as well as, long range problems.

For purposes of this Consultative Meeting several strands of scientific and technological development may be identified. Some would respond to the immediate felt needs of the people in the two broad groups of countries - developed and developing - and build upon or adapt the existing technological stock in the particular country, taking into consideration the felt needs of the people and its resource endowment. Another strand would focus on newer problems areas. A greater part of this development would of necessity have to be undertaken by the countries themselves, though a part of it could be better undertaken by joint or collaborative efforts by both groups of countries at the international and global level. What would then be transferred would be a new kind of technology, which for most part does not exist now even in rich countries.

1. Developing countries

For poor countries pursuing a self reliant humanistic development strategy the main internal focus would be the development of an appropriate technology to suit the felt needs of the masses and be integrated with human development. This would imply for instance technology which would not be highly specialised and which would permit the large numbers to be involved in developing it as well as utilising it. The selective borrowing of technology from rich countries or those in a similar stage of development on fair terms would not be precluded. Specific criteria would need to be established on how to select and how to borrow. The lack of criteria has resulted in the past in importation of complex chemical fertiliser plants, using foreign technology and expertise and involving a major

foreign exchange commitment when more relevant re-cycling of waste may have been more appropriate. Short distance transportation by motor vehicles, rather than the bicycle has its own attendant adverse consequences and not helped to solve the particular kind of transport problem in poor countries.

Though the majority of the people in poor countries live in rural areas the technology that was sought and transferred under the old framework had five significant biases which had far reaching implications for them (i) It was capital intensive in a situation where capital was the scarce factor (ii) It influenced the location and organisation of production favouring urban industrial development to rural development (iii) It further distorted income distribution and the already skewed consumption patterns, which reflected the disparities in income within poor countries themselves (iv) It reinforced the existing distortion in the education system which catered mainly to an urban elite and alienated the educated youth from applying themselves to the real problems of development (v) Internationally, it intensified the country's balance of payments difficulties, partly through having to pay exorbitant prices for this imported technology, partly through the continued commitment to use imports to keep the imported technology functioning. Above all, this technology could not be absorbed by the large numbers of people and bore little relation to their needs or creative capacity.

As has been mentioned earlier, the process of development of appropriate technology which would include technologies of differing degrees of sophistication should start from the existing level of technology and systematically improve upon it, with highly sophisticated technology being used where it is in keeping with the new objectives of development. Four elements in the development of appropriate technology in poor countries may be identified:

- (a) In order to set this process in motion it is clear that the appropriate educational and research infrastructure has to be built. In the last twentyfive years there has been an expansion in the education systems of poor countries, but they need to be restructured to the new development objectives and process. The new education system should not concentrate merely on making people literate. It should also help in improving the technological base of agriculture, rural industrialisation and allied activities. An altogether new schooling system to release the creativity and innovativeness of the people and shake the age-old inertia may have to be launched. Students, administrators, technical experts should go out to the villages to bring out a scientific approach to life.
- (b) To operationalise this approach a new type of action-research projects would also have to be initiated. Researchers would need to be integrated with the daily lives of the people.

The infrastructure for R and D would have to be built and the R and D activities may also have to be an unconventional type. First, scientists and technologists from urban centers and even those nationals currently abroad could be mobilised and sent to the countryside. These people who have advanced scientific and technical knowledge should interact with local artisans and veteran peasants. That way, an inventory of locally available (and perhaps half forgotten) techniques of production, health care etc. can be made. Secondly, a resource survey using if necessary sophisticated methodologies could be made. Resources are not necessarily the items that are already familiar. Resources may be hidden in the jungles and valleys or they may be materials currently considered waste. The advanced scientists together with the local artisans, peasant veterans and other "barefoot experts" could

enter into a dialogue and improve on these indigenous techniques and make maximum use of local resources. In this process some weed or some waste may turn out to be a food item or a precious "import" substitute. The recent experience in developing bio-gas and fertilizer from waste is testimony to the potentialities of this kind of mobilisational approach to innovation. A process of this sort can also establish its own dynamism and momentum for becoming more sophisticated and inculcating a scientific temper among the masses within a reasonable time perspective and assist in creating an R and D infrastructure to develop it.

- (c) A third element in the strategy for developing appropriate technology in poor countries would be to use sophisticated technology. For instance, in most poor countries renewable sources of energy are lacking and have to be imported at high cost. Sophisticated technology could be used to develop such new sources of energy e.g. solar energy. Unlimited availability of sunlight, unlike the fossil based energy currently in use, can provide a continuing source of energy. Through the nitrogen fixation process, the Azola weed becomes a new source of fertiliser for the rice fields in poor countries. Initially, the cost of development may be high but gradually, simpler and less costly techniques could be evolved. Another example relates to natural resource surveys. Prior to embarking on rural development programmes, the full economic potential of an area may be ascertained using aerial photo techniques and the information made available to decentralised decision making groups.

Several poor countries have a limited supply of highly trained scientists who can work on this technology. There is a much

larger reservoir that can be mobilised for this task. This requires a re-orientation of national priorities to meet the needs of the new development.

- (d) The fourth element would be the selective use of "borrowed" technology. In the old framework it was the lack of selectivity and the paying high prices for it without securing any control over it or its reproduction and adaptation that caused the problems of transfer. As mentioned earlier before borrowing, a new technology may even have to be created to suit the concept of human development. Social control over transferred technology and careful negotiation of the terms of borrowing is an essential element in reducing the earlier shortcomings.

Technical co-operation among developing countries i.e. borrowing from countries with similar problems and at a similar stage of development is both a source of appropriate technology and also a safeguard against transfer of inappropriate technology on unfair terms.

2. Developed countries

For rich countries too there needs to be a basic re-orientation of technological development. The private appropriation of technology should be subjected to social control of technological development. Secondly, even in the public sector, while the pursuit of technological excellence for itself e.g. space exploration, is not precluded, the main focus of technological development should be to take care of the social problems which have been caused by the kind of technology adopted in the past. Problems of alienation, pollution and resource waste should receive highest priority. Another focus should be assistance to poor countries in developing appropriate technology in a relevant

and non-exploitative manner, where they seek it. Further, they should co-operate internationally in developing new areas of technology for the benefit of all mankind in collaboration with scientists all over the world, irrespective of nationality.

The above aspects may be further elaborated:

- (a) Some examples of attempts to resolve major social problems by adapting new techniques are already in evidence. For instance, some automobile manufacturers have moved from assembly line to "group" technology and work habits to improve social relations in factories. Environmental concerns such as pollution and waste of resources are beginning to be tackled, but they need to be systematically studied and solutions effected. In this process some older technologies may require to be dropped. The entire rich country industrial base is built on the use of non-renewable fossil fuel. As the depletion of the stocks of fuel are beginning to emerge, new sources of renewable fuel from unconventional sources would need to be found, along with methods of conserving existing sources through adaptation of existing technology. There may also be the need for a reverse transfer of certain technologies from poor country's stock to rich countries. For instance, there is a body of scientifically tested knowledge and techniques available in poor countries for preventing or curing psychosomatic and stress problems in urban industrialised societies. These techniques could be harnessed and built into systems of rich country health care practices. In areas of urban renewal, some poor country experiences and low cost solutions could be transferred to resolve rich country problems. This stock of technological know-how has not been explored by rich countries to reinforce a system of mutual assistance.

The unplanned brain drain, however, does reflect a reverse flow which has adverse effects on scientific and technological development in poor countries.

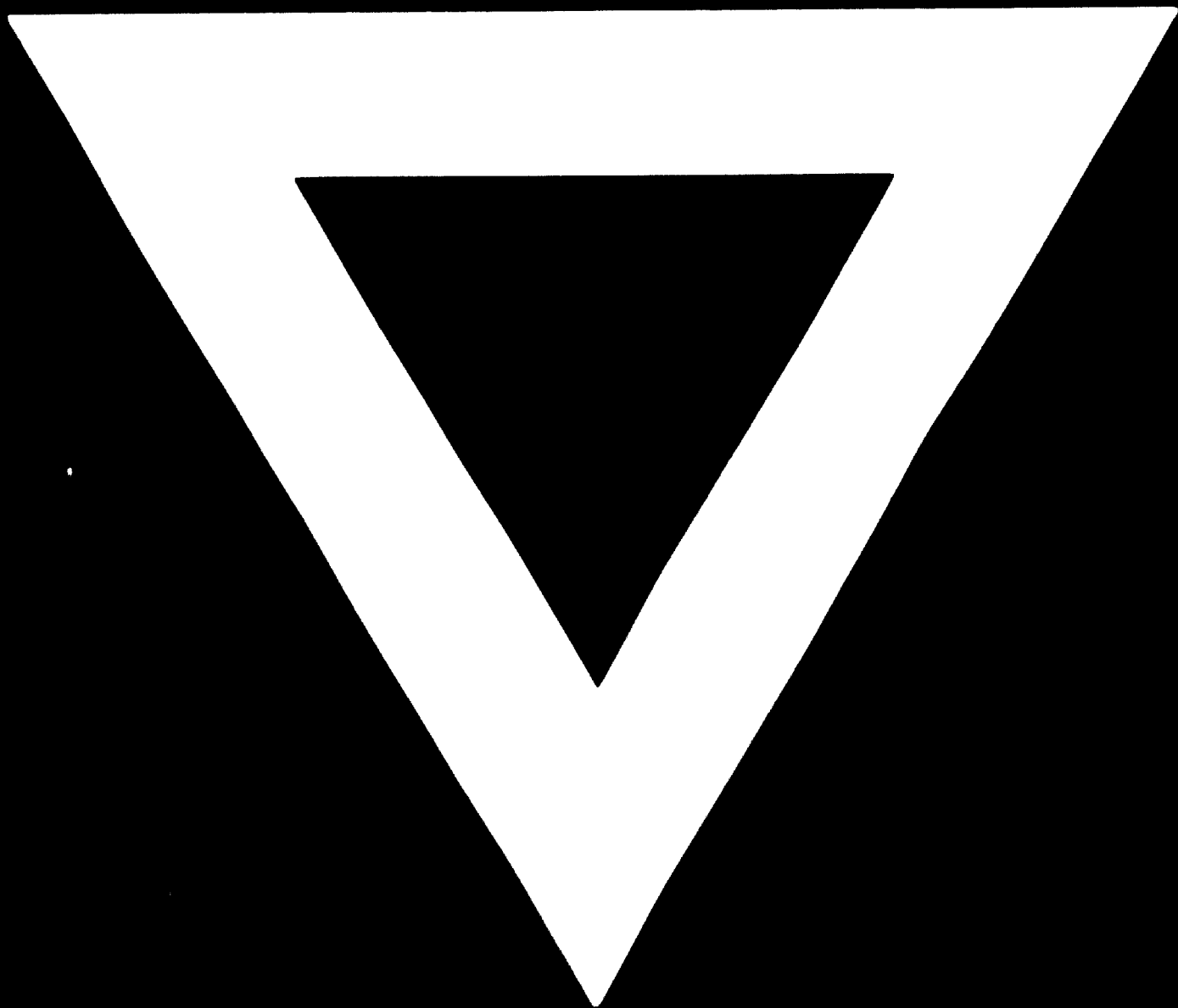
- (b) In assisting poor countries to develop relevant technology the old transfer mechanism must be brought under social control and negotiations conducted to ensure equity. Patent and copy right systems and codes of conduct would need to be reformulated so as to ensure greater equity. But apart from the improvement of the mechanism for selective transfer of technology from rich to poor countries, rich countries could assist poor countries in building their infrastructure for R and D and in facilitating the reverse flow of selected technology from poor countries to rich wherever it is mutually beneficial.
- (c) The third area of concentration for rich country technology should be to cooperate internationally in developing new areas of resources for the benefit of all mankind. The development of the sea-bed and new energy sources become examples of areas for major concern. To the extent that these have to be developed in the interest of future generations of people all over the world this effort should be internationalised so as to ensure that the benefits will be equitably spread.

This Consultative Meeting has an important role in focussing on the international action which could help to generate a new perspective in the development of science and technology; training and retraining developmentalists and technologists in understanding and operationalising these new ideas and values; assisting poor countries in building their R and D infrastructure for development of appropriate technology; organising and initiating action in

new areas of science and technology in rich and poor countries for the benefit of all mankind; and finally in supervising of the reformulation of a proper code of conduct for the two way transfer of technology from rich to poor and vice versa and the encouragement and organisation of technical cooperation among developing countries. All this to be done within a new conceptual framework at the macro/micro level which is just beginning to become clearer in response to a better understanding of the reality and compulsions for social change in rich and poor countries.



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