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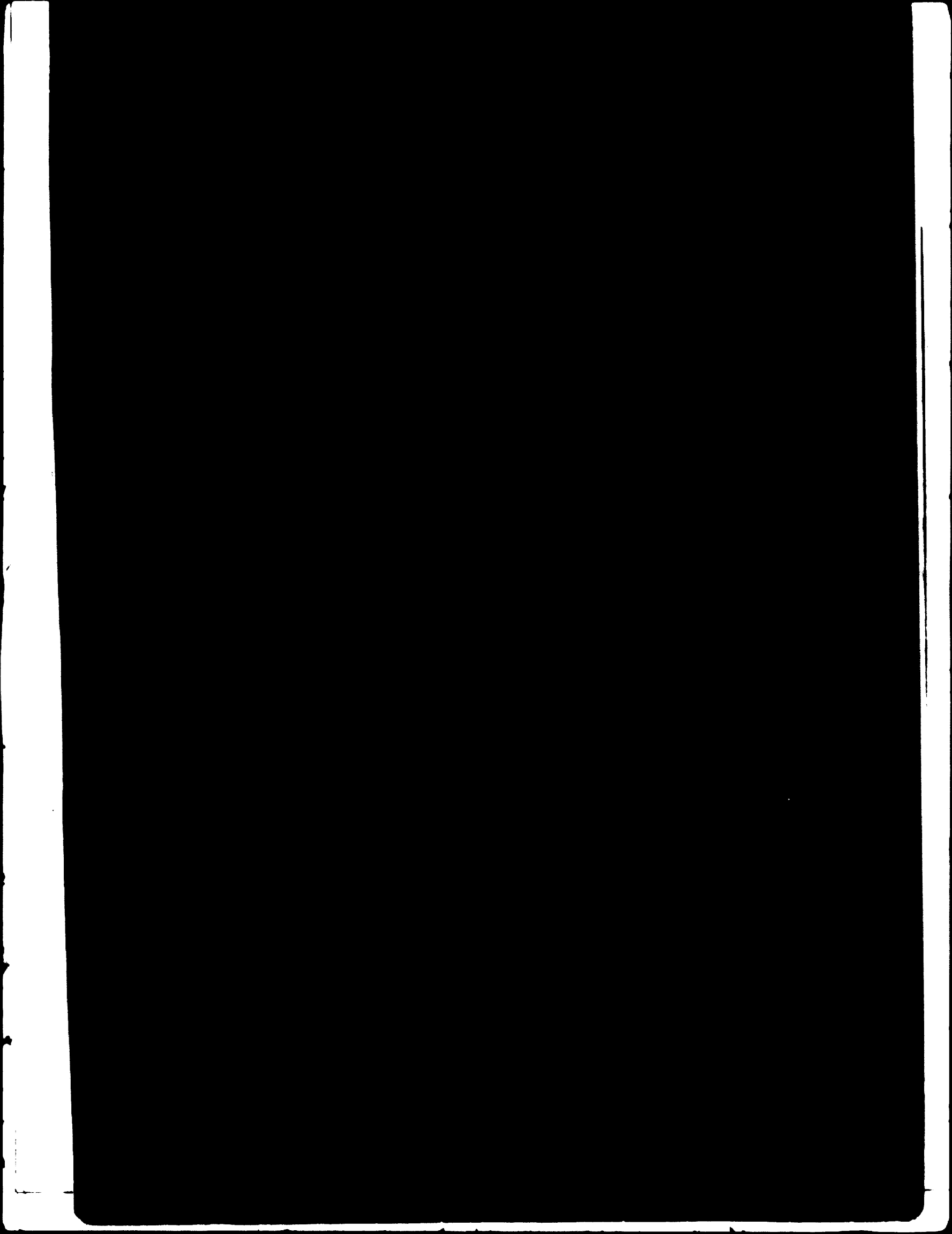
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DEVELOPMENT OF TECHNOLOGICAL CAPABILITIES  
IN THE ESCAP REGION\*

Note prepared by the secretariat of UNIDO

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I. MAJOR ELEMENTS OF THE CHALLENGE

A. Implications of the present pattern of technology transfer

1. In their efforts to industrialise, developing countries including those of the ESCAP region, have been relying heavily on imports of technology almost wholly from developed countries. The implications of such imports extend far beyond those of the discrete individual transactions that occur between the enterprises concerned. These implications have a direct bearing on the formulation of a strategy for the industrial and technological development of developing countries. The implications themselves are likely to increase in magnitude and intensity when we take into account the rapid rate of industrial growth envisaged by the Lima target.

2. What are these implications and how does the current scene of transfer of technology from the developed to the developing countries look like? These issues could be dealt with under three heads - the problem of selection, the problem of acquisition and the problem of development of technology. Common to all these problems and paramount in its implications is the problem of dependence.

3. The problem of dependence is briefly that developed countries are the source of almost all industrial technologies that are currently applied. Their enterprises and governments are significant sources of finance for setting up industries in many developing countries. Almost all industrial equipment is manufactured by them and almost all consultants come from them. Something like 97 per cent of the world's research and development is carried out in them and, except occasionally, for them.

4. These are a formidable array of circumstances which feed upon each other to aggravate the technological dependence of developing countries. This dependence is further compounded by a variety of factors. Not least of them is the absence of capabilities on the part of the developing countries to select, acquire, adapt or develop technologies. Clearly a game between unequal partners, but a game which has nevertheless to be played. But if the game has to be an equitable game between unequal partners, the question is what the rules of the game should be and how the weaker partner should be equipped to play better. For, the results are not going to be as transient as the results of a game but fundamental to the development of the developing countries.

5. It is the conviction of many developing countries that the rules of the game are weighted in favour of the stronger partner. The concern of developing countries has been on the access to technology without discrimination and the supply of technology on equitable terms and conditions. Many of them have found by experience that the terms of supply of the technology have been financially onerous and its use circumscribed by restrictive conditions. The current initiatives to formulate a Code of Conduct and to revise the Paris Convention arise from this basic need to look at the rules of the game

6. It is estimated that technology imports of developing countries, in terms of fees, royalties and other payments for technical know-how and specialised services would increase from around 1,000 million in 1975 to over 6,000 million by 1985. This would constitute about 15 per cent of the total trade in technology, which is likely to be of the order of 40,000 million by 1985, if the growth in the volume of such trade during 1975-85 is maintained at the same level as took place during the decade 1965-75. Most of such payments by developing countries would be for technology and know-how imported from developed countries and would represent payment outflows by developing countries as a whole. Though these payments for technology would represent only a small proportion of the additional goods and services produced over a period of time as a result of imports of technology, the physical magnitude of the resource outflows from developing countries necessitate contractual terms of such transfer to be improved as significantly as possible and that appropriate international mechanisms are created and developed to assist developing countries to effectively acquire and utilise imported technology.

B. Need for indigenous technological capability

7. No less important is to see how the weaker partner can be strengthened. In the absence of an indigenous technological capability, the transfer of technology is a house built on sand. Looked at from any viewpoint, the growth of indigenous technological capabilities in developing countries has become a major consideration. Such capabilities are needed even to select and absorb imported technologies that will increase in number as well as complexity. Besides, foreign exchange costs could be saved not only by lessening the number of external technology contracts through the utilisation of technologies developed indigenously, but also by ensuring

that in the utilization of imported technology, local raw materials, equipment and capabilities are put to use. Thus the appropriate choice of imported technologies is likely to be better served by the growth of indigenous technological capabilities.

8. Besides, the order of industrial growth envisaged by the Lima Target cannot be reached by manufacture for export alone. This means not only increased indigenous consumption, but also a limit to which production can be increased through imports of raw materials, equipment and technologies. Hence the utilization of indigenous raw materials for indigenous consumption by the adoption of appropriate technologies can be expected to be an important component in any effort for achieving substantial increases in production.

9. What is more, when we consider the vast rural population of Asia, their betterment can hardly be expected to be served by the indiscriminate application of imported technology unrelated to their conditions by the application of technologies suitable to local conditions by persons who know such conditions. Hence, for any country aspiring to promote rural development, an indigenous technological capability is a sine qua non.

#### Selection of technology

10. The process of selection requires two basic prerequisites, namely information on alternatives and the capability for choice among alternatives. It is only with the help of information on alternatives that a viable choice could be made and the bargaining position of the buyer of technology strengthened. The trouble for the developing countries starts from basic lack of information itself. It is compounded by the inability to utilize whatever information is available and make an evaluation of the technology. There is a need to upgrade project evaluation capabilities in general and technology and equipment evaluation in particular. The ability for evaluation should also extend to the ability to separate the various elements of a technological package, such as the "core" and "peripheral" technologies, equipment and services. This will not only reduce the cost of the package but also help the utilization as well as growth of indigenous capabilities. The creation and stimulation of national consultancy and design engineering capabilities are of particular relevance in this respect.

11. Deeper issues are involved in the selection of technology beyond those of information and evaluation. These pertain to the appropriate choice of industrial technology. Experience in selection of technology has shown that wrong choices are possible not only from the point of view of enterprises but also, and more often, from the point of view of the national economy and society. The appropriate choice of technology from the techno-economic as well as the social viewpoints which is already a problem of concern, is likely to become more formidable and challenging in the years to come. The problem basically stems from the fact that products and plants designed for the industrialized world are sought to be adopted in developing countries with a totally different environment. It is becoming increasingly clear that the inappropriate choice of technologies will steadily lead the developing countries away from their development objectives. They can ignore this problem only at their peril.

#### Acquisition of technology

12. The acquisition of technology is an important stage in the whole process of transfer. At the enterprise level, the commercial, legal and contractual aspects have to be taken into account in addition to the purely technical aspects. The extent of the capability of enterprises in developing countries to negotiate contracts varies considerably. Sometimes direct investment may also be involved alongside the purchase of technology and this adds to the extent of negotiation, besides of course restricting technological options. Though each enterprise is expected to know best what its own interests are, a measure of regulation by the government has been found to be necessary. This is not only to avoid excessively payments through royalties, and lumpsum payments, or through indirect means, all of which entail scarce foreign exchange, but also to see that technology is really transferred to indigenous enterprises and without restrictions and that, at the expiry of the technology contract, they will have the technical capability and the legal right to be able to carry on and increase production on their own. Not all developing countries have however established regulatory mechanisms for the import of technology.<sup>1/</sup>

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<sup>1/</sup> For the variety of national approaches, see National Approaches to the Acquisition of Technology (UNIDO, Development and Transfer of Technology Series No. 1)

13. What is the actual position of the developing countries in the acquisition of technology? The existing scene of transfer of technology to the developing world reveals by and large little or no bargaining strength on the part of the developing countries, lack of capabilities of their enterprises to select technology and negotiate equitable, still less favourable, terms and conditions, and a lack of national capabilities to channel and regulate the flow of technology to national advantage. The unrestricted inflow of foreign techniques and processes in all fields has significant techno-economic impact not only on recipient enterprises but also on the industry relating to the enterprise and on indigenous technological growth. Recipient enterprises tend to become highly dependent on the foreign technology supplier or licensor and there is little effort towards adaptation and even absorption. Where such unrestricted inflow has been permitted and technology supply arrangements allowed to be renewed successively without regulatory control, the dependence of recipient licensee enterprise continues over indefinite periods of time, even in respect of technical absorption and adaptation which could be developed with little effort. The inflow of foreign technology in any field also serves as a disincentive for other enterprises to use indigenously developed processes and products. Apart from the adverse effect on domestic technological development competition to import foreign know-how in the same field or for similar products becomes as much a question of the foreign brand name as the use of imported processes or techniques. These aspects have necessitated varying degrees of regulatory control to ensure that foreign technology inflow takes place primarily in sectors where this is necessary or desirable and that it continues only for such period as is necessary for effective absorption of the know-how in question.

#### Development of technology

14. With the problem of development of technology, one could include the problems of adaptation and absorption of technology. In regard to both adaptation and absorption, complementary action by the suppliers of technology is essential, if not obligatory; and training and skilled manpower are prerequisites. The development of technology requires R and D capabilities. For a number of reasons, including the size of enterprises and the lack of compelling circumstances, enterprises in developing countries have not established R and D units of their own. For this reason, as well as with a view to utilizing indigenous raw materials, developing countries have attached particular importance to the establishment of industrial research institutes. The problem is however how to make the institutes active and effective participants in the process of transfer of technology. In particular,



the links between industry and the institutes have to be strengthened and a close relationship established between the needs of industry and programmes of research. In most countries the institutes are not associated in any way with the process of import of technology.

15. There are also basic difficulties. In several developing countries, traditional indigenous technologies are being discarded without any examination. The application of modern science and technology to upgrade such indigenous technologies could be a major factor in the betterment of the rural population. The attitudes of the technological élite would need change no less than those of the political and administrative élite. Seen in this view, the research programmes and the methods of drawing up research programmes in developing countries may well need a fresh look. More information on the technologies available from the developing countries has to be obtained and disseminated. Innovative capacities in the developing countries have to be encouraged. Constraints other than the absence of capabilities no doubt contribute to the present situation. Even so both the building up of capabilities and the better utilization and reorientation of existing capabilities are matters of primary importance.

16. The cumulative impact of the problems of selection, acquisition and development of technology is such as to call for a vigorous effort on the part of the developing countries to build up their technological capabilities.

## II. MAIN LINES OF RESPONSE

### A. The instruments of action

17. The basic task of building up the technological capabilities is obviously that of the respective countries. International action, which can in any case play only a supplementary role would itself require as a prerequisite the careful identification by the respective countries of the requirements of international support.

18. What does it take to build up technological capabilities? The phrase "technological capabilities" means the capabilities for the choice, acquisition, adaptation, absorption and development of technology. It is on these lines that the national efforts should respond to the challenge of building up technological capabilities. International action in assisting developing countries should in turn correspond to the main lines of national response.

19. The task of building up the technological capabilities is obviously a task spread ver time and over many fronts.<sup>1/</sup> But the initiation of the process cannot be postponed. Ultimately the technological capabilities have to repose in individuals. That taken as axiomatic - which in turn emphasizes the crucial role of training - there are three main elements in the process, viz. the government, the technological institutions and the enterprises. The government takes the national decisions, the enterprises take their own individual decisions within the ambit of the national decisions, and the task of the technological institutions is to assist the government or the enterprise as required. Effective links among these three elements are essential for building up the technological capabilities.

20. Seen from the point of view of the instruments of national action for building up technological capabilities, the need is for national technology policies and plans, institutions, and training in its widest sense. These instruments could cover a part or the whole of the three broad problem areas viz. the selection, acquisition and development of technology.

21. The devising and application of these instruments have to be fused into a harmonious strategy. Such a strategy cannot overlook but should on the other hand be closely aligned to the varying requirements of individual industry sectors, the technological capabilities so far achieved in each of them and the national development objectives in respect of each. Basic to such a strategy are a technology plan and cogate technology policies.

The essential ingredients of a technology plan for each developing country comprise:

- (a) The identification of technological needs and objectives;
- (b) The development of an adequate technological infrastructure, including a comprehensive information system and the growth of technological service capability and specialized manpower skills;
- (c) The creation of institutional mechanisms for evaluation, selection and acquisition of technology considered most appropriate in a given set of circumstances;
- (d) The establishment and development of appropriate institutional mechanisms for monitoring the impact, absorption and adaptation of various processes and techniques;

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<sup>1/</sup> The overall situation in the ESCAP region is dealt with in ESCAP's Guidelines for the Acquisition of Industrial Technology in Asia and the Pacific

- (e) The growth of R and D activities in significant industrial sectors and in basic infrastructural fields such as energy, in close linkage with industrial activities;
- (f) The defining of policies and guidelines in terms of fiscal or regulatory instruments to encourage indigenous technological development and to ensure adequate inflow of appropriate foreign processes and techniques in critical priority sectors.

These aspects are closely interlinked and though the institutional and policy mechanisms may be covered by several institutions and instruments, an essential feature of technology programming is to effectively dovetail the functioning of such mechanisms so that the various basic issues receive adequate consideration.

22. Together with the framing of a technology plan, it is necessary to consider the various policy instruments which can play a significant role in technological change. These can take various forms including national laws and regulations for licensing of production capacity of industrial enterprises, or the defining of pioneer industries, controls over majority foreign equity holdings, employment of expatriates, controls over imports, incentives for experts and import substitution, regulatory control over foreign technology, regulations for use of domestic consultancy agencies and technical services, various forms of financial assistance and incentives for small-scale and rural industries and the like. Fiscal and regulatory instruments have often to be utilized in combination with one another.

23. Policies and instruments relating directly to technology have to be viewed within the framework of overall economic and industrial policies. By and large, however, such policies and mechanisms need to be defined in respect of (i) the role of private foreign investment, both existing and new; (ii) fields in which foreign technology is considered particularly necessary including measures designed to ensure adequate flows, including tax benefits; (iii) production and service sectors in which foreign technology should not be encouraged, including technical and management services, merchandizing and internal sales and sectors where domestic capability is either adequate or should be developed; (iv) the establishment and development of a regulatory mechanism to regulate such inflow in accordance with prescribed and well defined guidelines; (v) incentives and measures to encourage domestic technological growth, including tax rebates for R and D expenditure, limited duration of foreign technology agreements, etc.; (vi) incentives and measures to promote domestic technological services, particularly consultancy and engineering services

including tax relief and regulatory action such as insistence on local consultancy agencies being appointed as prime consultants in selected fields; and (vii) financial assistance and support to domestic technology agencies. Such a list of policy measures and instruments relating directly to technology can only be illustrative and not exhaustive and must be formulated in the context of each country or region.

24. Though the process of building up technological capabilities should essentially be a national effort, the co-operation of other countries is of considerable value. Inasmuch as developed countries are the predominant suppliers of technology to developing countries, the co-operation of developed countries is essential. Equally, since technological needs and experience in developing countries bear close affinity and follow a similar pattern, co-operation among developing countries can make a valuable contribution to collective building-up of technological capabilities. The collective building-up and utilization of technological capabilities of the developing countries is a matter that requires fresh approaches.

**B. Critical areas of action**

25. While many instruments have been applied in the past and with varying degrees of success, critical areas of action have to be carefully identified if there is to be a break-through. This is where the attention of the developing countries is needed at the highest policy-making level. It may be useful to recount in this connexion certain conclusions of the Round-table Ministerial Meeting on Industrial and Technological Co-operation among Developing Countries which was held in New Delhi from 4 to 8 January 1977. It was organized jointly by UNIDO in co-operation with the Government of the Republic of India, and was attended by 18 countries of which 16 were represented at the ministerial level. It identified the following specific areas of co-operation in all industrial sectors, large, medium and small, which may be pursued not only by the developing countries present at this meeting, but also by other developing countries:

- Co-operation in the field of industrial technology with a view to improving the identification and use of technologies already available in the developing countries including technical know-how and skills, machinery and equipment, design, consulting and construction capabilities;

- Technology Bank, to include considerations relating to joint purchase of technology and examination of contracts and agreements already concluded to provide guidance to others so as to avoid the mistakes concerning the experience of particular technologies by other countries;
- Industrial training to augment the skills which are considered basic to industrial development programmes;
- Establishment and strengthening of the institutional framework at the national and regional levels, to sustain industrial and technological development;
- The creation of programmes of co-operation concerning applied research and development activities in specific sectors, drawing upon machinery and capabilities already available in the developing countries concentrating specifically in the fields of engineering industries; electronics; fertilizers and agro-chemicals; pharmaceuticals; chemical industries; and energy;
- The development of concrete plans for the use of engineering and consultancy capabilities available within the developing countries;
- To promote collective action for negotiating and bargaining for more equitable economic relationships and for technology acquisition.

26. The importance and utility of expanding and improving certain reputed technical institutions in the developing countries so as to make them centres of excellence to provide services to more than one country was recognised by the Meeting, and it was agreed to explore the possibility of co-operative funding under the auspices of UNIDO to achieve this objective for the benefit of all developing countries.

27. These conclusions together with the considerations mentioned earlier provide a broad framework for further action at national, regional and international levels.

### III. A FRAMEWORK FOR ACTION

#### A. Improving the choice of technology

28. Attempts to improve the choice of technology should focus on the decision-making, the stage at which the decisions are made, and the support that is needed to make them. Decision-makers in enterprises, government agencies, and financing institutions have a role to play in the choice of

technology. There is often inadequate awareness at the stage of decision-making of the implications of the choice of one technology rather than the other. All too often, the alternatives are now known, let alone considered. The primary task is therefore to sensitize the decision-makers to the problems of choice of technology and to provide them the tools to facilitate such choice. The process of sensitization could be carried out through meetings and training programmes and by case studies conducted preferably within the country itself. The decision-makers have to be further supported by the supply of methodologies for evaluation of technology, and by information on alternative technologies. The role of consultants is important in major industries. The growth of indigenous consultancy services and the association of such services with foreign consultancy services where the latter have to be necessarily employed, are therefore matters of which action is needed.

29. The choice of technology occurs as part of the establishment of a factory or of a production programme within a factory. Technological choices are made, some times explicitly and often implicitly, as a part of other decisions. The stage of feasibility study is a crucial stage for technology choice. The choice can however get modified by the foreign investors, the views of financing agencies and the requirements for government approvals. The identification of the stage of actual technology choice is linked to the larger issue of the influence of government policies on technology choice. Industrial, trade, fiscal and monetary policies influence technology choice considerably. Besides, social objectives vary from private considerations of profit. Hence an examination of the effect of the government policies and the evolution of a consistent set of policies is basic to the improvement of the choice of technology.

30. The supply of information is a vital prerequisite for choice of technology. Such information has to be furnished to the decision-makers by national information institutions which may themselves require establishment or strengthening. Information has to be evaluated and packaged suitably if it is to be of use to the decision-makers. Since technology is available on a world-wide scale, national institutions require a constant flow of outside information and support. Herein lies the rationale of UNIDO's Industrial and Technological Information Bank (INTIB) whose pilot operation has commenced.

31. Special attention needs to be given to filling the deficiencies in information on technologies in use in developing countries themselves. Existing services such as UNIDO's compilations in this regard, will need strengthening. The supply of such information could be at two levels, one at the level of information without any evaluation serving primarily for current awareness; and the other at the level of information based on an assessment of the experience.

32. The exchange of information among developing countries needs to be promoted in this respect. The system to be adopted for this purpose could include, as envisaged by the New Delhi Round-table Ministerial Meeting, information on technical know-how and skills, machinery and equipment, design, consulting and construction capabilities. The Industrial and Technological Information Bank would need to be suitably supported and strengthened for this purpose.

B. Improving the acquisition of technology

33. It must be recognized that, as the manufacturing activities of the developing countries grow and diversify, the inflow of foreign technology is bound to increase rather than decrease, at least in the short run, with a progressive shift to more sophisticated technologies. Hence, the acquisition of foreign technology is a problem for immediate and practical action. The major objective of action in this field will be to strengthen the bargaining position of the developing countries, so that the right technology may be chosen on equitable terms and conditions, and the transferrer performs his due obligations. Here again, the question is one of sensitizing the decision-makers both at the enterprise and government levels, and of providing them the necessary tools and training for the negotiating and drafting of technology contracts. At the enterprise level guidelines for the acquisition of technology need to be provided and the entrepreneurs helped by the provision of model contracts as well as by the supply of information on sources of technology. At the level of the government, where regulatory mechanisms for industrial approvals and/or for technology acquisition exist, the government officials concerned have to be trained to examine the issues of technology acquisition. Guidelines for screening and evaluation of technology contracts would need to be evolved and applied as individual country conditions would require.

34. In the acquisition of technology the private and national considerations do not often coincide. Each country has therefore to examine the need for adopting a policy for technology acquisition and for setting up regulatory mechanisms as appropriate. Broad policy guidelines on the terms and sectors in which technology inflow would help both the buyer of technology as well as its seller. Over a period such policies and mechanisms, properly applied, would help rather than hinder the flow of technology.

35. The exchange of information and experience among developing countries is of great value in this field. New initiatives have to be taken in this respect. The New Delhi Round-table Ministerial Meeting recommended the exchange of information on contracts as of major importance. Such exchange among developing countries would greatly strengthen their bargaining power because of the greater knowledge and information at their disposal, apart from extending the area of technological choice. There is generally a tacit understanding between licensors and licensees that the terms of technology agreement should be kept confidential and this implicit confidentiality is sought to be extended to regulatory agencies also. Technology contracts, however, are purely commercial arrangements and so long as proprietary or confidential technical information is not divulged, there is no legitimate objection to the sharing of information among national regulatory institutions. The disclosure of commercial terms by one national regulatory agency to another would not normally injure the interests of licensors or licensees but would rather enable regulatory agencies to take decisions in the light of wider experience of other developing countries.

36. The willingness of the governments to provide information on the contracts they have entered into to an international organisation like UNIDO to evaluate the experience is basic to this exercise. A system of exchange of information on the details of the contracts concluded could then be established among national technology transfer registries and other organisations having access to information in this respect. INTIB of UNIDO has initiated steps whereby it could act as the focal point of reference and at the same time initiate co-operative programmes among interested developing countries.

37. A significant field of technological co-operation among developing countries relates to the joint acquisition of technology and know-how through a process of collective bargaining. Though seemingly difficult, this holds out considerable possibilities, both for technology suppliers, as also for recipients and licensees in developing countries. There is considerable



commonality in industrial programming in countries in comparable stages of development and projects in the same field may be undertaken in more than one country at around the same time. Such projects can range from large-scale industries such as steel, petroleum, fertilizers and chemicals, machine building and the like, to medium-size plants for textiles, sugar, cement and agro-industries and small-scale units covering a wide range of intermediate and consumer products. In a number of these cases, the acquisition of foreign know-how on a collective basis for more than one project can be considered. This would enable more detailed evaluation and consideration of technological alternatives and would reduce technology costs, apart from securing better contractual terms. Significant collective action has not so far been initiated in acquisition of technology primarily because this issue has been viewed in national terms and left to the initiative of individual enterprises. With growing realization of the interrelationships in technological growth, a joint or collective approach in technology acquisition has dynamic possibilities for developing countries in the future.

38. The institutional arrangements for joint acquisition of technology also need to be considered. These can either take the form of joint negotiations by a group of developing countries for identified sectors in which the country groups are interested or the establishment of an international mechanism through which technology can be acquired and transferred to projects in more than one country. The former approach necessitates close collaboration and co-ordination between country groups and the identification of common technological needs in specific industrial sectors, after which a joint body can be constituted for evaluating, negotiating and acquiring selected technology in the identified fields. The second alternative requires the creation of an appropriate international mechanism through which such joint technology transactions can be channelled.

39. Technological co-operation among developing countries should also be extended in respect of consultancy and engineering services and development of manpower skills, including managerial expertise. Hitherto, linkages in these fields have been established primarily at enterprise level between licensees and foreign parent organizations and technology licensors from industrialized nations, though some joint training programmes have been undertaken in some ESCAP countries. The potential for greater co-operation

is particularly marked in respect of consultancy services and detailed engineering facilities, and there is considerable scope for setting up joint consultancy and engineering services. The first step in this direction is the greater use among themselves of consultancy and engineering services available in developing countries followed by the creation of appropriate national consultancy services in each country or in regional groups through such collaboration. The projected figure of \$6,000 million by 1985, by way of technology transactions in developing countries most of which will represent initial resource outflows from these countries, will itself constitute a significant constraint for the majority of them, unless joint efforts are initiated at the international level to cover such resource needs, at least partially. The widening of the field of technological choice, through the participation of a larger number of medium- and small-scale enterprises from both developed and developing countries in the technology-supply process, will also require resource mobilisation and support of significant magnitude if it is to be effectively achieved. It is also necessary, in order to ensure that technology supply to developing countries takes place on equitable terms acceptable to these countries that an institutional mechanism should be set up, through which a sizeable volume of technology transactions can be channelled on terms and conditions considered suitable and appropriate. For these reasons it would be useful to set up an international mechanism under the auspices of UNIDO with its principal aim being to assist and facilitate the flow of industrial technology to and from developing countries on equitable terms so as to accelerate their industrialisation.

40. The functions of such a mechanism could be to:

- (a) Assist in identifying technological needs of developing countries particularly in the specific technical needs in identified priority sectors of production and manufacture;
- (b) Assist enterprises, institutions and other bodies in developing countries in identifying technological alternatives, evaluating such alternatives and negotiating for the acquisition of selected technology on equitable terms and conditions;

- (c) Acquire licensing rights for technological processes, production techniques, trade secrets and know-how, both patented and unpatented for selected production branches and products, for the purpose of transferring such technology to developing country enterprises, other than wholly owned or majority owned foreign subsidiaries and affiliates on appropriate terms and conditions; and
- (d) Assist developing country enterprises in initial financing of the cost of acquisition of technology for selected production branches and products, either wholly or partially.

C. Improving the capability for development of technologies

41. The capability for adapting and improving existing technologies and developing new technologies suitable to individual country conditions is a major step towards reducing technological dependence and as such requires priority action. A strategy for this purpose if properly applied could release the innovative capacities in developing countries and benefit in particular the rural economy. A primary action, found wanting in most developing countries, is the systematic identification and improvement of technologies already used in a country. Particular attention needs to be given to measures directed at a reorientation of existing research in developing countries, the commercialization of the research results and the involvement of industry. The capacity for detailed engineering and design has to be built up. Though there are several reasons for lack of R and D work by private companies, measures have to be initiated by which there is increasing involvement of the private companies in indigenous research.

42. These measures again require a set of government policies and hence an examination of existing policies becomes a matter for national action.

43. The development of appropriate technologies is an area in which co-operation among developing countries can be highly productive. The exchange of information on available indigenous technologies and on the research programmes of their institutions can help to avoid wastage of scarce resources and the pooling together of experience.<sup>1/</sup> Co-operative research possibilities could be identified and promoted. The Round-table Ministerial Meeting has identified several sectors in which such co-operation may be promoted.

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<sup>1/</sup> See in this connexion "Report on the Meeting of Selected Heads of Research Institutes" (ID/WG.233/21).

44. While policies, institution building and training figure prominently in the above discussion on the framework for action, it would be inexpedient to apply uniform or preconceived solutions to the varying requirements of different countries. A careful examination of the present technological situation in the country in individual industry sectors and the steps to be taken to meet the foreseen needs in each sector is inescapable for each country. Effective use of and interlinkages between existing institutions and a national introspection on the policies needed are equally imperative.

#### ROLE OF UNIDO

45. The role of UNIDO in this respect is two-fold. On the one hand, it will stimulate and assist national action for the formulation of technology policies and plans and for building up national capabilities for the choice, acquisition, adaptation, absorption and development of technology. On the other hand, it will mobilize the co-operation of all organizations and individuals active in this field in a manner contributory to and complementary with the national actions. The former process of assisting developing countries will continue to be done through technical assistance projects, training programmes, workshops and publications. In addition increasing use will be made of short-term advisory services, since on many occasions what the countries may need by way of assistance is not technical projects but quick and short-term advisory services. Such services have been found to be specially useful for the choice and acquisition of technology particularly where large investments are involved. The process of mobilization of interest will be undertaken through the promotion of co-operation between developed and developing countries as well as among the developing countries themselves. In all these activities the existence of the ESCAP/UNIDO Joint Division of Industry including UNIDO regional advisers and the establishment of the ESCAP Regional Centre for Transfer of Technology provide an opportunity for concerted action in the ESCAP region.

46. While UNIDO has over the past decade been actively assisting developing countries in this field through technical assistance programmes, advisory services, meetings and studies, its approach has received a sharper focus through several recent mandates. As a result it has been possible to develop major programmes in the fields of technological information, the appropriate choice of technology and technology policy and planning. These mandates and activities are discussed below.

- (a) The formulation and implementation of a Co-operative Programme of Action in the field of Appropriate Industrial Technology has been undertaken in response to a Lima resolution on the selection of appropriate industrial technology<sup>1/</sup>. A report<sup>2/</sup> was submitted to the Industrial Development Board which adopted a decision<sup>3/</sup> welcoming the report, endorsing the means of implementation proposed therein and providing guidelines for the further delineation of the Programme of Action. The Economic and Social Council (ECOSOC) has taken note of this decision of the Board with satisfaction;
- (b) General Assembly resolution 3507(XXX) has called on UNIDO, inter alia, to establish an Industrial Technological Information Bank. UNIDO's proposal for a pilot operation<sup>4/</sup> of INTIB was endorsed<sup>5/</sup> by the IDB;
- (c) A resolution, initiated by the Lima Conference, was adopted by the IDB on the subject of International Co-operation in the Transfer of Technology<sup>6/</sup>. The resolution considers that UNIDO should continue to make an important contribution to the promotion of international co-operation in the development and transfer of industrial technology in order to promote the industrialization of the developing countries, and identifies a series of activities through which UNIDO could do so.
47. The aims of the activities undertaken on the basis of the above mandates are trained on those critical elements of the process of building up technological capabilities which have been identified earlier.

#### Industrial and Technological Information Bank (INTIB)

48. INTIB is intended as a direct support to the process of selection of technologies to developing countries. It is designed to add a qualitative dimension to the existing information activities of UNIDO by providing selectively processed information. Its pilot activities cover only four sectors, namely iron and steel; fertilizers; agro-industries; and agricultural machinery and implements. In its initial stages it will service institutions rather than enterprises in developing countries thus building up the capabilities of the institutions in assisting the process of the selection of technology.

<sup>1/</sup> Resolution ID/CONF.3/Res.2  
<sup>2/</sup> ID/B/188  
<sup>3/</sup> Decision ID/B/Dec.IV (XI)  
<sup>4/</sup> ID/B/183  
<sup>5/</sup> ID/B/Dec. V(XI)  
<sup>6/</sup> Resolution ID/B/47(XI)

Appropriate industrial technology

49. The Programme of Action on Appropriate Industrial Technology emphasizes the need for adoption of criteria for the selection of technology. Its ramifications however extend over the entire spectrum of activities crucial for indigenous technological development. The Programme of Action identifies the following framework of activities to be undertaken by national governments as well as by private agencies and regional and international organisations:

- (a) evaluation and comparison of alternative industrial technologies;
- (b) promotion of technological research; (c) collection and dissemination of practical experience; (d) application of technology to rural development;
- (e) technologies for alternative sources of energy; (f) national and international policies related to appropriate industrial technology; (g) institutional infrastructure for appropriate industrial technology; and
- (h) training programmes in appropriate industrial technology.

50. The important point, apart from implementing such activities, is the consolidation of effort in this field, and the mobilization of interest on a world-wide scale. This step will bring about a fuller use of existing resources and also place the concept of appropriate industrial technology in the main stream of existing activities and not apart from it. This goal can be achieved by stimulating policy and decision-makers, enterprises and research institutes in developing countries to promote the application of appropriate industrial technology; stimulating suppliers of technology and equipment in industrialized countries to undertake the necessary adaptation and redesign to suit the needs of developing countries; stimulating governments and donor agencies in industrialized countries and in developing countries with sufficient financial resources at their disposal to allocate more funds to co-operative programmes on appropriate technology; mobilising existing research capacity in developing and industrialized countries in research organizations, universities, private enterprises and particularly small companies and individual inventors, so as to promote the adaptation of available technologies and the development of new technologies where necessary.

51. For the mobilisation of interest, UNIDO proposes to organise a global meeting called the "Forum for Appropriate Industrial Technology (FAIT)". To this meeting would be invited government experts and selected institutions

from developing countries as well as interested organizations in the United Nations system, and donor and aid agencies that have shown active interest in the matter. This meeting would provide an opportunity to establish personal contacts and exchange information on the work being done and the problems encountered. In addition to this meeting a Consultative Group on Appropriate Industrial Technology consisting of highly qualified persons of international repute will be convened once a year. The first meeting of the Group takes place in November 1977.

52. A number of project concepts in the field of appropriate technology have also been developed. There is no consolidated fund specifically designed to implement such activities at present. However, the establishment of the United Nations Industrial Development Fund can be expected to provide a further impetus to activities in this field. Special contributions to this Fund could also be considered for this purpose.

#### Technology policies and plans

53. Projects are being implemented in this field in Algeria and Guatemala and planned in Turkey and Ghana. Common to all the projects is a field-level survey of the actual conditions in the country concerned, followed by an expert workshop with the local policy-makers. A major project on similar lines is envisaged in three sets of developing countries: 1. countries with no explicit technology policies or plans; 2. countries which have established mechanisms for regulation of imported technology; and 3. countries which have formulated technology plans. Integral to these studies would be the discussion of the results with the policy-makers of the respective countries. An international meeting of experts and policy-makers from developing countries will then be organized to discuss the experience and arrive at broad guidelines for national action. This project will form part of UNIDO's contribution to the UN Conference on Science and Technology for Development.

54. Other important activities, in addition to normal technical assistance activities, to be carried out in the next biennium include the preparation of guidelines for the evaluation and screening of transfer of technology agreements; compilation of training material for training courses in the acquisition of technology; a project for strengthening the collective bargaining position of developing countries in the IDCAS region for the

acquisition of technology; survey of indigenous technologies in use in Thailand and India in selected sectors of food preservation and processing; a pilot programme for the strengthening and modernization of technological performances of the medium and small industries in the Philippines; a system of exchange of information among research institutions of developing countries on the research programmes; and programmes in respect of application of technology for rural industrialization and alternative sources of energy.

55. The establishment of the Regional Centre for Technology Transfer for the ESCAP region provides undoubtedly a forum through which developing countries in the ESCAP region could help each other in building up their technological capabilities. UNIDO will participate in the mission being organized by the Regional Centre to selected developing countries in the region. In addition, in collaboration with the Regional Centre, a workshop will be held with the national focal points in which, among other things, the linkages of the focal points and the Regional Centre with UNIDO programmes in appropriate technology and INTIB will be explored.

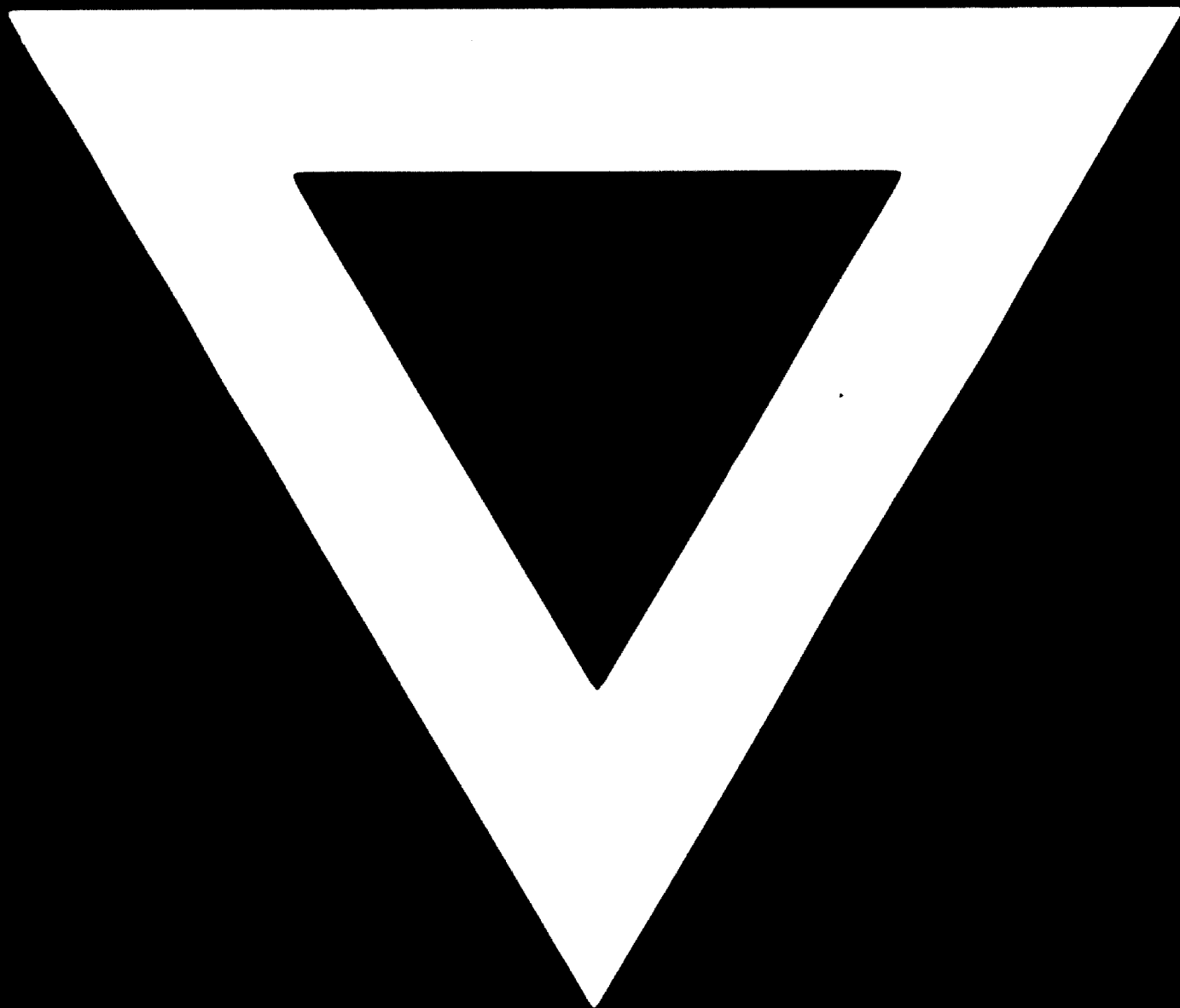
56. The guidelines provided by this Ministerial Meeting together with the conclusions of the New Delhi Round-table could well constitute a new dimension to action by developing countries to build up their technological capabilities. The core of this new dimension would be the concept of collective selfreliance on the basis of which new and practical approaches to the selection and acquisition of technologies as well as the development of technologies suitable to developing countries could be devised and applied. The ESCAP region is a suitable one in which such new approaches could be developed, tested and adopted widely.

57. In this process and in the light of the framework discussed above, action could be initiated by UNIDO particularly in the following areas, as an addition to its existing activities and in co-operation with ESCAP:

- (a) Establishing a system for the exchange and utilization of information on technical know-how and skills, machinery and equipment, design, consulting and construction capabilities in developing countries;
- (b) Establishing a system for exchange and utilization of information on technology contracts concluded by developing countries so as to strengthen their bargaining position;
- (c) The promotion of joint acquisition of technology and other measures for strengthening the collective bargaining position of developing countries;
- (d) Establishing an international mechanism under UNIDO auspices for direct assistance to developing countries in the acquisition of technology.



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