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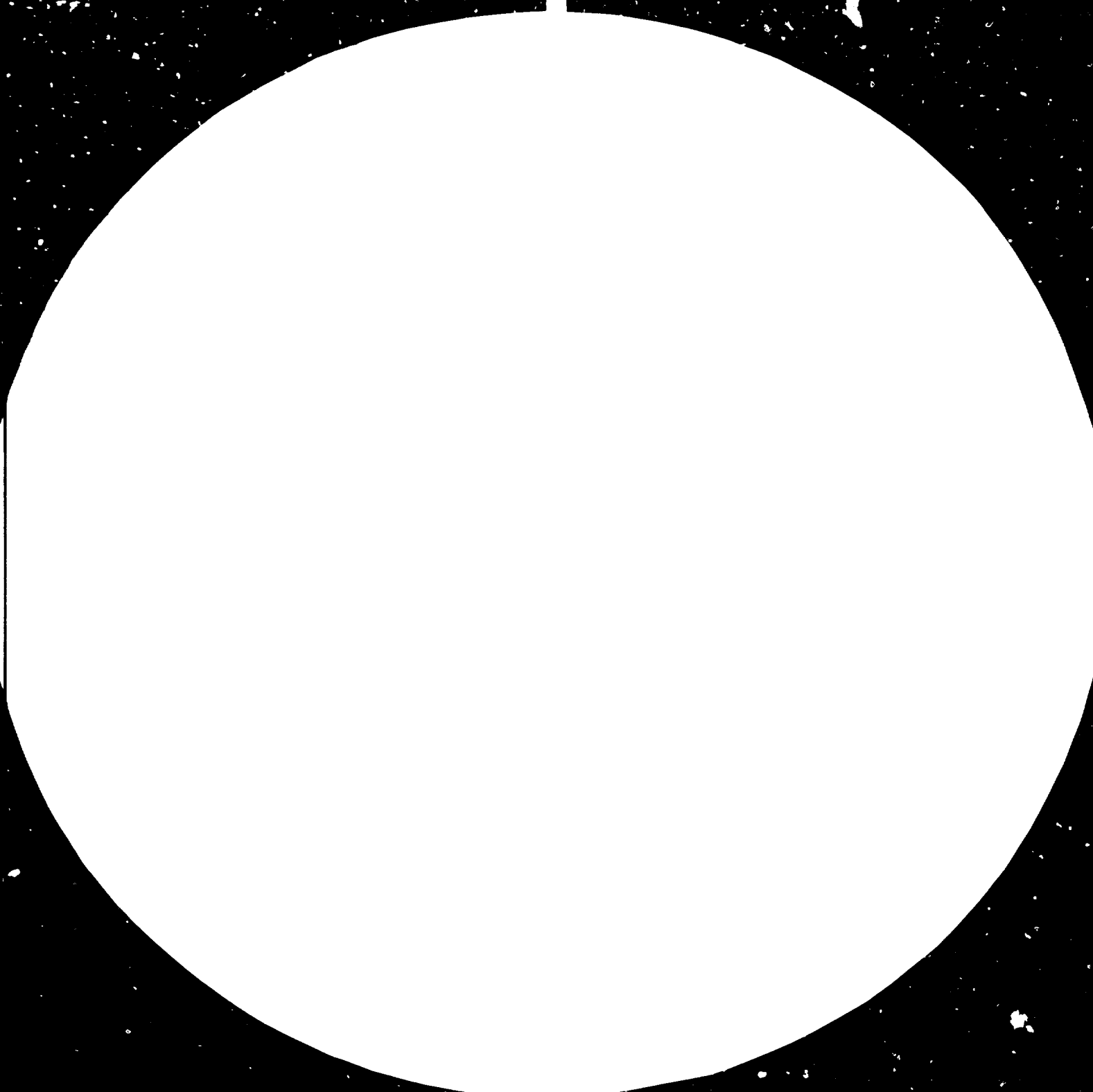
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PREPARATORY TO THE
FOURTH
GENERAL CONFERENCE
OF UNIDO**

*Accelerated Development of Human Resources
for Industrial Development
Yaoundé, United Republic of Cameroon,
30 May - 3 June 1983*

**ACTIONS FOR ACCELERATED DEVELOPMENT
AND UTILIZATION OF HUMAN RESOURCES
FOR INDUSTRIAL DEVELOPMENT**

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I. INTRODUCTION

1. In Document ID/WG.394/1 a general analysis of the past and current situations and future perspective related to the development of human resources for industrial development was presented with special emphasis on the developing countries. In Document ID/WG.394/3, an indication of the critical capabilities required for accelerated industrialization was given. In this Document, attention will be focussed on the actions to be considered by the developing countries in accelerating the development of the human resources required for their industrial development. These actions have been organized under four broad areas: viz strategies and policies; programme formulation and implementation; institutional infrastructure; and mobilization and optimization of financial resources.

II. STRATEGIES AND POLICIES

2. In order to formulate effective policies and strategies for the development of human resources for industrialization, it would be essential, first and foremost, to have a clear vision of the objectives of industrialization. This would facilitate the definition of industrial strategies and policies and in the elaboration of a meaningful industrial plan. The formulation of the above-mentioned policies and strategies would be meaningless unless it is based on reliable information and data. Thus, there would be a need to organize industrial manpower information covering industrial branches, sectors and sub-sectors, accorded priority in the industrial development plan, as well as the services sector. This, in turn, would facilitate the estimation of projected demand for industrial manpower, as well as the required institutional arrangements and programmes for its development. Industrial manpower policy is not only an integral part of industrial policy, but also of total manpower and educational policy which, in turn, are integrated within national economic, trade and external affairs policies to meet the national goals and priorities.

3. In formulating strategies and policies for the development of human resources for industrialization, considerable attention has to be paid as to how a developing country can take full advantage of the facilities that exist elsewhere, both in other friendly developing countries and developed countries as well as what the country should do to build its own infrastructure for education, training and research. Developed countries are, at present, undergoing a major technological revolution whose effect on life-styles, particularly on employment, has yet to be determined. This would be reflected not only in the training opportunities they provide for trainees from third world countries, but also in the design of training programmes and facilities within the third world countries themselves. Thus, a major policy decision confronting third world countries is the extent to which and the deliberateness with which the new technologies should be imported into their countries and hence the quality of trained manpower. Similarly, the industrial process involves, as a principal input, a combination of industrial raw materials in pre-determined proportions. It must be clear that the development of manpower concerned with the exploration, evaluation, extraction, transportation, marketing and general management of industrial raw materials is an important component of any policy for industrialization and for the development capabilities for this purpose. Past experience has shown that education systems borrowed from the advanced countries have given mixed, if not distorted results in developing countries. This calls for thinking of new forms of education like Development Education.

4. Policies for the development of human resources for industrialization cannot ignore the fact that the bulk of the population of third world countries lives in the rural area and are not frequently within the reach of the formal education system so that new techniques of mass education associated with

imaginatively designed demonstration effects and, where possible, with mobile educational training units would have to be extensively used. It must not be forgotten that, in general, women constitute a larger segment of the population than men and that policies for the development of industrial manpower must pay special attention to the need for the full development of the potentialities and effective utilization of women. At the other end of the spectrum is the education needed to face the challenges of "Information" society and bio-society with major revolutions happening because of emerging technologies such as biotechnology, genetic engineering, micro-processors, etc. As these emerging technologies offer new opportunities for revitalizing the development process, with an alternate pathway for industrialization and improving the quality of life, the manpower training and education should be geared to it. New types of institutions have to be evolved and the existing ones reoriented to meet the requirements of new technologies that are transdisciplinary in character. Existing educational and industrial training facilities have to be reviewed to take into account the changing profiles of skills required to operate industrial and other equipment. Both the public and policy-makers have also to be sensitized to create a milieu in which these new technologies could be applied.

5. Finally, it should be pointed out that the formulation of policies and the elaboration of a programme for the development of industrial manpower has to be undertaken, not in isolation, but as an integral part of national industrial and economic policy formulation and planning. There is thus a need to maintain a steady flow of information among the authorities responsible for economic, industrial and manpower policy formulation, planning and programme implementation (not only within the government but also in public and private enterprises), as well as educational, training and other institutions.

6. In formulating strategies and policies for the development of human resources for industrialization, the principle of selectivity should be adopted in choosing priority areas. In this regard, it would be desirable to accord particular priority to the development of human resources for the establishment of an industrial core, characterized by a potential for self-expansion and for promoting growth and diversification in other sectors and sub-sectors through linkages. As is well-known, core industries may be based on metals and engineering, or on chemicals or petrochemicals. They may take the form of backward integration by local mining companies to provide the technical inputs they require for mining. This engineering base is then extended to provide parts and components for railways, textile machinery, electric power generation and distribution, other modes of transport and so on. Cores may depend on the interaction of a set of leading edge or frontier technologies as micro-electronics, computers, outer space, ocean engineering, etc. Core industries may also take the form of a geographical concentration of growth potential such as a river valley. Education, training and research should thus include building capability and expertise for decision making, not only in formulating strategies and policies at the macro (national) level, but also at the micro level, i.e. at the sectoral, sub-sectoral, enterprize and institutional levels.

7. The formulation, implementation and monitoring of policies for the development of human resources for industrial development principally involve the people manning and operating the relevant governmental administrative system. It is therefore essential for most of these people to possess a technical background. It would also be imperative that they establish a working relationship with indigenous technological institutions as well as their counterparts in

industry in order to involve, as much as possible, national technical experts in this exercise.

III. PROGRAMME FORMULATION AND IMPLEMENTATION

8. Any action plan for the accelerated development of human resources for industrial development would have to consider both short-term and long-term programmes of a comprehensive nature including manpower planning for industrial development; the provision of adequate educational facilities; the re-orientation of education curricula and training programmes for the creation of specialized cadres of technicians, scientists and managers and specific training related to the selection, acquisition, adaptation, absorption and development of technology. In this regard, a number of suggestions are provided here.

A. Manpower Planning for Industrial Development

9. World-wide experience suggests that rigid manpower planning frequently fails to satisfy changes and unanticipated needs. On the other hand, the absence of planning of any kind may produce undesirable results, including increased foreign exchange payments to finance input of manpower from developed countries. Some kind of planning is therefore essential, but one which is associated, firstly, with mechanisms for monitoring divergencies between planning output and effective demand, and secondly, one which takes advantage of flexibilities of adjustment between planning output and actual demand, as well as changes in technological, manpower and natural resources development. Such flexibilities would include, for example, re-training; the full utilization of trans-disciplinary training; bridging courses which transfer students and trainees to new areas of specialization reflecting current needs; and building flexibility into the curricula of teaching/learning processes themselves.

10. In order to carry out appropriate planning for the development of human resources for industrialization, it would be essential to prepare manpower profiles and plans in industrial branches, sectors and sub-sectors accorded priority in the industrial development plan and programme. This, in turn, would facilitate the estimation of projected demand for industrial manpower. The next step in the above exercise involves the preparation of an inventory and evaluation of existing facilities, at the national level, for industrial manpower development. This would permit the identification of quantitative gaps and qualitative deficiencies, which would help to indicate specific lines of action to be taken to correct them. Included in such actions would be a determination of training needs that might be met by the optimum utilization, expansion and improvement of national facilities and/or the establishment of new ones; those that can be met through the utilization, under ECDC arrangements, of facilities in other third world countries; and finally training needs that can be met through international co-operation with developed countries.

11. The planning of human resources development for the development of a core industry, in particular, requires a good deal of manpower information: information on highly qualified engineers, technologists and managers and their location. This can sometimes be done with the aid of national professional associations. Data on outputs of the formal education system, on outputs of technical training institutions, on capacity utilization of these institutions, on drop-outs and so on, should be utilized. The supply side picture has then to be matched by calculations of manpower requirements, by realistic techniques, in co-operation and consultation with the industrial sector (both public and private). Location aspects of demand and supply have to be taken into account.

12. It is therefore not difficult to see that developing human resources for medium and small-scale industries (including their support services) may be the most difficult to estimate, especially where little existed before. In the planning process, industrial manpower profiles, more detailed than the simple model set out elsewhere, would be required. They must be related to specific requirements for different products by the most commonly used technologies. They must indicate the minimum entry requirements for obtaining diplomas and so on. This information, constituted in the form of a small information bank or service, would be of inestimable value to industrial manpower planners.

13. In the light of the above, urgent action needs to be taken towards the expansion and restructuring of existing facilities and programmes and the development of new ones. This would necessarily have to include the realignment of programmes in accordance with current and projected needs for industrial manpower and the massive introduction of suitable teaching/learning techniques and aids which would contribute towards the development of manpower for invention and adaptation rather than for stereotype imitation. Special consideration would also have to be given to the time and costs involved in the large-scale production of the wide range of human resources for the industrial development of the developing countries and to ensure large multiplier effects.

B. General Education and Training

14. An important measure which each developing country should undertake relates to a critical examination of the market from which industrial manpower needs to be developed. The present educational system in most developing countries is not oriented towards producing the right market of human resources from which industrial manpower could be developed and trained. There would therefore

be a need to undertake a re-evaluation of existing educational systems and the possible development of new ones with a view to ensuring that national education and training programmes are oriented towards more effectively meeting the needs of the country. Such reforms have to include primary, secondary and advanced education in order to imbue in the potential manpower at an early stage, a fundamental appreciation of technology. Emphasis would therefore need to be placed on science and practical education.

15. Intimately linked with the above is the need to also reform the educational and training programmes. Such programmes, especially at the university and post-university levels, need to be aligned with the priorities established in the national industrial development plans and programmes. The contents of the courses and the educational curricula also need to be re-examined. Advantage should be taken of new advances in educational processes and training methods as well as new training facilities and aids, such as courses in computers or on video tapes which would provide multiplier and demonstration effects. In this connection, research needs to be undertaken into technical learning processes and the practical application of their results. A close linkage also needs to be established between formal education and industry.

16. In re-structuring educational and training programmes, consideration also needs to be given to building greater flexibility into the programmes. This could be accomplished through the introduction of bridging courses and the provision of re-training and in-service training opportunities. Such flexibility should also help to produce a balance between manpower with general background training to allow for easy adaptation to undertake any industrial operations, as well as specialized skills. Vocational and technical education,

especially oriented towards producing skilled workers and technicians required for industrial operations, also needs to be emphasized along with management training for senior and middle level managers. Priority needs to be accorded to programmes of mass science and technical education in the rural areas and greater use made of the mass media, e.g. television, mobile training units and radio. Advanced technical training beyond the secondary school level also needs to be emphasized.

17. In the light of the above, urgent action needs to be taken towards the expansion and restructuring of existing facilities and programmes and the development of new ones. This would necessarily have to include the realignment of programmes in accordance with current and projected needs for industrial manpower and the massive introduction of suitable teaching/learning techniques and aids which would contribute towards the development of manpower for invention and adaptation rather than for stereotype imitation. Special consideration would also have to be given to the time and costs involved in the large-scale production of the wide range of human resources for the industrial development of the developing countries and to ensure large multiplier effects.

C. Special Programmes for the Development and Training of Critical Capabilities

18. In addition to the major exercise to be undertaken by the developing countries in carrying out a fundamental change in their educational systems, there would also be a need to develop special education and training programmes or to improve existing ones for the development or training of the various capabilities for industrial development identified in Document ID/WG.394/3.

(a) Strategy and Policy Formulation and Planning

19. Although people cannot, per se, be trained in policy and strategy formulation and management, there is, however, a great opportunity to bring

to the attention of those involved in such activities in the developing countries the experiences of other developing countries. Introduction of basic principles of management and organization of in-service training programmes, including study tours, would greatly enhance the capability of those involved in industrial strategy and policy formulation, planning and monitoring. Courses in this area also need to be included in the curricula of universities, management institutes and other relevant institutions of higher learning. Ultimately, however, the best way to learn is by doing. Developing countries must decide to shoulder the responsibility for strategies and policy formulation, planning and management of industrial economy rather than to solely depend on infinite advice from abroad.

(b) Entrepreneurial and Management Development

20. Again, while it is not possible to fully train an industrial entrepreneur, it is however necessary for the government of each developing country to adopt measures and incentives and provide short-term specialized courses that would stimulate and promote the development of local indigenous industrial entrepreneurs and people trained for self-employment. Such measures would include the development and provision of various technical and supporting services, especially information and data relating to raw materials, markets and technology; common services related to storage, marketing, training, repair and maintenance of equipment and social welfare; financial incentives such as the opening of credit lines and the granting of loans and tax reliefs as well as import restrictions on products which could be produced locally; and extension services related to feasibility studies, market research, assessment of alternative technologies, negotiations and purchase of equipment, etc.

21. In developed countries there is a considerable capacity in management training institutions and in many enterprizes that can be used by developing countries. Although efforts have been made to examine the needs of managers in developing countries and to adapt programmes, renewed attention should be paid to management related to the specific characteristics and production structure of different sectors of industry. More particularly, it is desirable to prepare training profiles related to the level of complexity of the management techniques required by different industrial sectors. Financial management is one of the critical areas that needs utmost attention. Market management becomes important particularly in international trade.

22. It is thus necessary that developing countries formulate policies designed to encourage and facilitate the training of managers in line with the specific needs of industry. The programmes of various Higher Technical Institutes constitute the basis for providing training of Managers and Engineers. Investigations have shown that the contribution of faculties of management and colleges of engineering to training in production engineering and plant management and to development of industrial managers at large is unsatisfactory and the young engineers and technicians are ill-prepared for supervisory and management functions which many of them will have to assume soon after graduation. In addition, management courses and seminars are arranged ad hoc in a fragmentary manner and individual managers are involved in various programmes without pursuing clear career objectives or selecting programmes that address priority issues faced by the enterprizes that employ them. Therefore, apart from formal education in schools of management, it is extremely desirable to institute well worked out programmes of in-service training for managers.

(c) Engineering, Science and Technology

23. An important capability for industrial development is the availability of trained engineers, technologists, scientists, and high-level technicians with specialized skills. Special programmes therefore need to be adopted to develop the massive amount of this category of personnel who are needed for designing industrial products and for carrying out such other activities as engineering design, production technology, testing and quality control, material management and value engineering, R and D, feasibility studies, industrial consultancy, etc., all of which are essential in industrial development. A well-developed core of such expertise would also play an important role in developing national capabilities for the exploration, extraction, development and processing of natural raw materials. Sight should not, however, be lost of the other important segments of this category of staff (economists), very much needed in carrying out such functions as financial management, marketing, materials and inventory control and other related services which complement the engineering and technological component of industrial operations.

24. Because of the dominant role of engineers in industry, their education and training is of crucial importance. This is well appreciated and high priority has been given to the establishment and expansion of engineering schools, often with the support of UNESCO and bilateral agreements. Nevertheless, problems of relevance and quality persist and a continuing effort should be made to ensure that curricula reflect advances in technologies, in their structure and content and that they are appropriate to the national situation. In addition, it is necessary to overcome the apparent contradiction between the fact that technologies are continuously changing and increasingly interrelated, and the fragmentary and partial way with which they are dealt with in university

curricula. It might, therefore, be desirable to regroup skills in order that an individual becomes "technically literate" in a variety of technologies common to a number of industrial sectors.

25. In connection with the above, the establishment of new Technical Universities, Science and Technology parks, teaching/training companies and centres of excellence would be particularly relevant.

(d) Technical, Vocational and Trade-Specific Training

26. In the Document on "Critical Capabilities for Industrial Development", it was noted that in some countries, for every engineer, technologist or scientist there are at least five technicians, vocational or trade-specific skilled personnel. The number of technicians and skilled personnel required for the industrialization process, therefore, has to be much larger than the number of engineers, technologists and scientists. Thus, in formulating a programme for the development and training of engineers, technologists and scientists, it has to be realized that an even larger programme would be required for the training of technicians and skilled personnel. Since the opportunity for children in the developing countries to obtain university education is very limited, a large number of those who obtain secondary school education should be trained, through special programmes, to become capable technicians for high level and skilled jobs in industry. Primary school graduates who do not have the opportunity to continue their education, as well as secondary school drop-outs, could also be trained through special programmes to handle certain low-level skilled jobs in industry.

(e) Special Programmes for Women

27. Since the traditional forms of education in most developing countries

have not provided equal opportunities for the education and training of women, who constitute a greater proportion of the population, any national education and training programme must necessarily pay particular attention to special programmes for women. As indicated earlier, such programmes must be oriented towards training women to contribute at all stages and levels in the entire process of industrial development.

(f) Training of Trainers, Teachers and Instructors

28 In restructuring educational programmes, special attention needs to be accorded to the training of trainers, teachers and instructors. This is extremely essential in order to bring about new types of teachers and instructors who can combine both formal and practical education in implementing the new forms of education. They should also be in a position to impart an education which will help the individual to be more innovative and creative rather than to be imitative, as has largely been the case in the past. As indicated earlier, the adoption of new technical learning processes and greater utilization of opportunities resulting from advances in the development of new technical training aids and facilities would greatly enhance the capabilities of teachers and instructors.

(g) Brain-Drain

29. The problem of "brain-drain" is one which has been receiving increased international attention. This problem is most acute in the technical fields such as science, engineering, management, medicine and economics, in which capabilities in developing countries are most needed and yet are limited. These are also fields in which national investment for training, largely abroad, are high and their loss to the nation also constitutes a loss of foreign exchange.

In any education planning and reform, the problem of brain-drain must be given special attention and appropriate measures adopted to reduce or even completely eliminate it. Alternatively, the brain-drain may be converted into "brain bank", utilizing their talents wherever they may be to the advantage of the country of origin. It is therefore necessary for each developing country to adopt appropriate measures and programmes not only to develop the critical capabilities required for industrial development but also to use them efficiently and effectively as it becomes available.

IV. INSTITUTIONAL INFRASTRUCTURE

30. In Document ID/WG.394/1 the critical capabilities required for Industrial development were not only identified but some indication was also given of how they are to be developed. From that Document, it can be seen that the development of these critical capabilities is the result of institutional developments whilst institutional developments are themselves possible only as a result of the supply of critical capabilities. There is thus a close link between the subject of Document ID/WG.394/1 and the subject of this Chapter. As in Document ID/WG.394/1, attention will be concentrated on institutions which determine the output or improvement of the wide range of human resources required for industrial development.

A. Co-ordinating Machinery for Accelerated Development of Human Resources for Industrial Development

31. In order to accord the attention which human resources development for industrialization deserves, it would be necessary for each developing country to strengthen the existing or to adopt a suitable institutional infrastructure for this purpose. The structure should have an appropriate co-ordinating body with clearly defined functions. In order to ensure maximum

effectiveness, the body should be established by legislation, provided with adequate financial resources, and well-staffed with experts in the technicalities of planning, programming, implementation and monitoring of human resources development and utilization for industrial development. It should be placed with a well-trained and competent Head who should be able to make effective contacts with, and to secure the support of, all the relevant national decision makers and relevant institutions.

32. In some countries, such a co-ordinating body is located in the Ministry of Economic Planning whilst in others the Ministry of Industry performs the task. Irrespective of where the co-ordinating body is located within the governmental administrative machinery, it should have a very close working relationship with the other ministries, especially those responsible for education and planning. It would also be desirable to have some sort of a National Advisory Body consisting of representatives from the various sectors of economy, especially the business and industrial communities. Such a committee could advise the national co-ordinating body on the formulation of policies, the development of plans and programmes, as well as on the implementation and monitoring of such policies, plans and programmes, both at the macro (national) as well as at the micro (sectoral, sub-sectoral and institute) levels. The national institutional infrastructure should also have within its ambit the relevant departments of universities and other institutions of higher learning. While these would, by their nature, fall within the mandate of the Ministry of Education, their close working relationship with the national co-ordinating body for human resources development for industrialization would be essential.

33. Although institutions involved with middle-level education and training such as secondary grammar schools, vocational schools and trade-specific

schools, fall within the competence of the ministry responsible for national education, the national institutional infrastructure for human resources development for industrialization must also deal with these institutions since they produce the second level of the market for industrial manpower. In some countries, special vocational and trade-specific schools dealing with such skills as fitters, welders, electric and electronic technicians, machine operators, carpenters and sheet metal workers have been established under the direct responsibility of the national co-ordinating body.

34. In many developing countries, national efforts in human resources development for industrialization have failed to achieve the desired results due, among other reasons, to the lack of effective and close operational involvement of industry (public and private) and the business community in these efforts. It is therefore necessary that close links be established, within the national institutional infrastructure, between the national co-ordinating body and the business and industrial communities, such as the private sectors, public corporations, federations or associations of workers, employers and chambers of commerce/industry at all stages of policy formulation, planning, programming, implementation and monitoring of human resources development for industrial development. Such co-operation would facilitate the development of joint ventures in the implementation of new approaches for science and technology education and training. One such new approach worth special mention is the establishment of teaching companies, i.e. companies established and operated jointly by the government, industry and university as a business venture but with the main purpose of training industrial manpower. This point is further elaborated upon later in this paper.

35. Another important aspect for the effective operation of the national institutional infrastructure for human resources development for industrial development is the need to clearly define the responsibilities of each institution in order to avoid undue duplication, conflict of interest and wastage of limited resources. There is also a need to establish effective working links between the various institutions. With a suitable policy framework and effective national machinery which clearly defines, as mentioned above, the functions of each institution, links between the various training institutions in the country, particularly between multi-purpose and specialized training institutions, would be easier to establish and to implement. There would certainly be several situations whereby action would be required to develop working arrangements between institutions on joint training programmes and for complementing or supplementing each other's activities.

B. Formal Education and Training Institutions

36. It is the formal educational system, particularly at third and second level, that constitutes the central institutions affecting the development of human resources for accelerated industrialization. The weaknesses of universities in developing countries are well known. They include the lack of relevance of the range of subject offerings to national needs, so that many of the technologies required for the development of the industrial sector are missing. Others (the familiar mechanical and electrical engineering) produce graduates eminently suitable for planning, maintenance and administration but not for manufacturing. Even in respect of assembly and maintenance of industrial plants and machinery, dependence is often placed on manpower from the manufacturers, sometimes on a semi-permanent basis. This raises questions of the role played by the business sector (public and private) in consultative groups on the choice of subjects for university courses, content of curricula,

teaching methods as well as of the material contributions of the business sector (both public and private, indigenous and foreign) in the form of equipment, materials and teaching staff. Experience in developed countries shows that for full effectiveness tripartite arrangements linking government, industry and institutions of formal education are the best.

C. Universities and Engineering Education

37. The issue of subject offerings in universities goes beyond merely filling in gaps to provide theoretically qualified personnel in management and production technologies conventionally required by industry. There is also the question of incorporating new and emerging technologies (e.g. ocean science and engineering; climatology and other sciences and technologies related to desertification; the sciences and technologies related to renewable energy; biotechnology; outer space science and technology; micro-electronics) in university and polytechnics curricula. Among the more familiar post-war developments of great importance for developing countries is the science and technology of materials linked to design engineering. These, it will easily be recognized, are important also for the new technologies.

38. Attention must also be given to the question of whether the subjects offered in universities and polytechnics in developed countries will satisfy the important need for specialists in developing countries. Sometimes it is a question of orientation or emphasis as in the case of tropical agriculture or natural resources economics and management (particularly in connection with minerals, forests and energy) or geophysical exploration and mapping, or soil inventory and analysis, or plant taxonomy. It is not in every case a matter of providing for advanced technologies. It is equally important to provide for

new combinations of traditional technologies, conventional technologies and newly emerging technologies within the particular context of developing countries where the pattern of relative abundance or scarcity of factor inputs often differ very considerably from that of developed countries today.

39. In other cases, the needed area of specialization is latent and unrecognized. This point has been put forward in the following set of questions: "Where are the engineers with a Ph.D. in integrated development of arid areas? Where are the masters in the science of labor-intensive technologies? Where are the engineers in artisan craftsmanship? How many engineers do we have throughout the world working on solar energy, windmills or aquaculture in freshwater? Where are the Ph.Ds in development engineering? Where do we find experts in science and technology policy for development? These are some of the current problems posed by the inadequacies of engineering education in face of development problems.^{1/}

40. It must be obvious that the reform of university education in developing countries, if accelerated industrialization is contemplated, calls for far-reaching and urgent steps beginning with consultations among governments, universities and the industrial sector and touching particularly on the problem of teaching staff improvement and reorientation. However, reform goes beyond subject offerings and must cover the content and methods of teaching and learning. It must by now be clear that concern is with education for invention and innovation as much as (or perhaps more than) imitation. The central theme is illustrated by the following passages: "During his university years,

^{1/} Education and Engineering for World Development, American Society for Engineering Education.

the future engineer should be submitted to courses in economics and management. He should be aware of such things as possibilities and limits to planning, the meaning of economic and social indicators, the problems of organization, the techniques of project evaluation and cost analysis and many other indispensable instruments. He should be exposed to inter-disciplinary research methods, perhaps by working on particular research projects or even on his thesis with students of other professions."^{2/}

41. According to another commentator, engineering education should include:

- The entrepreneurship of new technologically based enterprises;
- the acquisition of venture capital;
- the relationships between large and small firms;
- the "selling" of ideas;
- the appraisal of inventions and technological opportunities;
- the analysis of markets;
- the management of the innovative process in a corporation;
- the role of competition in the advance of technology;
- the influence of such Federal policies as the tax anti-trust patent and regulatory laws;
- the allocation and effects of Federal funds for research and development;
- the protection of know-how, trade secrets and inventions;
- the long-term planning of corporate goals."

These are but elements of Development Education - education linked with the development process.

42. "New approaches and inter-disciplinary arrangements among the schools of engineering, law, business, and the social sciences - with important inputs from industry and government - are clearly necessary for the teaching of skills and subjects such as those described above."^{3/}

43. In order to promote the engineering profession in the developing countries, the following suggestions put forward by Daniel V. de Simone in his paper

^{2/} Gasas Gonzales, Education and Engineering for World Development, American Society for Engineering Education, Page 19.

^{3/} Daniel V. de Simone: Learning How to Swim: Education for Innovation, Pergamon Press, New York

on "Learning How to Swim: Education for Innovation" are worth consideration by national authorities :

- A specified number of the nation's outstanding inventors should be honoured annually and, through appropriate additional inducements brought to the universities as "masters" to work with students on special design projects.
- Case materials covering the history of major past innovations (the electronic computer and xerography are examples) should be prepared and disseminated by a suitable agency such as the Commission on Engineering Education or the National Society for Engineering Education. These should then be made available to universities for supplemented use in such courses as physics and chemistry.
- Travelling fellowships for teachers who have distinguished themselves in the teaching of invention and innovation should be established to enable them to demonstrate and introduce their techniques at universities throughout the country.
- Specialists in the use of creative problem-solving techniques should be retained by the engineering schools to give courses to teachers and selected students on the use of these techniques.
- At least one faculty member per campus should be free to devote a substantial part of his academic year to the organization and introduction of teaching programmes designed to stimulate creativity.
- Design laboratories and workshops should be established in the engineering schools to enable students to work on personally selected engineering problems thereby gaining experience in the planning, design, development, testing and evaluation of new products or processes.
- A mechanism should be established to bring promising inventions by students to the attention of potential users. Students would thus be given an opportunity to try to do something with their conceptions, and would learn that invention is merely a part of the innovative process". 4/

44. Critics of engineering education also draw attention to what has been described as a closed system: emphasis in courses and examinations on familiar problems and known solutions. An American commentator points

4/ Daniel V. de Simone: *ibid*

out: "What teacher ever says - you have now read about what is known so lets talk for an hour about what is not known" and explains his concern with the thinking than the learning student. For developing countries in which engineering courses are loaded with textbook problems and textbook solutions, distinction is of great importance.^{5/} Although these comments are related to engineering education, they can with equal force be directed at education in economics and management.

D. Polytechnics

45. The special role of polytechnics in producing the middle level range of specialists without which no process of accelerated industrialization will work is often inadequately appreciated in developing countries, yet it is here with direct involvement of educational institutions with industrial processes, that structures and dynamics are most essential. It is the polytechnic that is most likely to produce the bulk of technician entrepreneurs so that the inclusion of courses (optional or obligatory) on how to establish and run businesses ought to be given early consideration.

46. As with the university, the direction of development of polytechnics often followed a generally desirable path rather than one decided by meaningful calculation of anticipated needs. Many universities and polytechnics were established well before institutional mechanisms for, and techniques of manpower planning were locally developed. In any case, the broad shift in industrialization policy towards more far-reaching structural transformation, linkages, increased role of domestic and country group markets, is too recent for the data and information base to have been

^{5/} Ibid. See also Duncan and Weston-Smith. "The Encyclopedia of Ignorance" Pocket Books, New York 1977; Stephen Rosen: "Future Facts", Corgi Books, 1976

built up to enable new scenarios to be worked out to serve, at least, as one of the means of determining human resources needs. This recency cannot serve for much longer as an explanation. The same considerations that lead to proposals for university reform and the proposals put forward, also apply to polytechnics. What is clear is that in terms of numbers, the bulk of demand will be far larger at this level than at that of university graduates. There is thus a greater necessity to bring the pattern of output into line with the pattern of skill requirements, to expand and improve the quality of teachers and equipment and the orientation of courses towards manufacturing production with exact large costs in the future.

E. Secondary and Vocational Schools

47. The question of technical education as distinct from general education institutions is still for some countries and protagonists unsettled. For developing countries the relation of education to the world of work may be considered, in principle, settled. An illustration may help. In traditional rural society, the system of education is total and involves every aspect of the community's life. The break-up occurs with the advent of formal education when several aspects of work and life are moved offstage. In developed countries, the loss (in respect of familiarity with implements and tools, machines, new materials, processes, environments, etc.) is partly compensated for from birth. The pre-school child grows up with toys ranging from wooden blocks to complicated mechanical assembly units; acquires familiarity with materials, their uses and manipulation; with elementary uses of electric power and so on and graduates to bicycles and cars in adolescence. This is not an ambiance in which the bulk of children in developing countries are familiar with until adulthood and every means which can be used to compensate

for this lack ought to be employed where feasible. Moreover, the curricula, materials, equipment, teaching methods of secondary schools have, in developed countries, been very strongly influenced by the orientation of and requirements for entry into small-scale enterprises. It is therefore essential to critically examine the institutional means of developing these essential capabilities or the need for specialized manpower to constitute institutions fundamental to the process of accelerated industrialization.

48. Three considerations therefore immediately affect secondary level education: the fact that not every secondary level school graduate can gain entry into formal third level education and that graduates from secondary level education must be able to fit into the pattern of employment opportunities for skilled nations during the process of acceleration of industrialization. This applies with as much force to girls as to boys. Secondary level education requires its own autonomy and *raison d'être*. The second consideration affecting secondary level education is the impact of changes, improvements and advances of knowledge at the third level and their feed-back effects on secondary level education. This may at first appear contradictory to the argument for a certain amount of autonomy in secondary level education, but in fact the issue is much less so than about the way the knowledge industry is organized and how its different parts are linked to and enrich and stimulate each other.

F. Teaching/Training Companies

49. With conditions in developing countries, the education and training of nationals for industrial development requires the existence of some manufacturing enterprises operating in the areas of proposed expansion so as to constitute growth points for the practical side of education and training for industry. Where these do not exist and where access to industrial

enterprises in other countries is not available or is grossly insufficient, there is no alternative to creating such enterprises in situ. Thus, a very important part of institutional infrastructure would be teaching or training companies established in respect of each of the major industrial production activities for which rapid manpower expansion is needed.

50. A teaching company is concerned, as a corporate institution, with the full range of manufacturing (including procurement of raw materials and other factor inputs, production, marketing, R and D, extension and consultancy services). The only difference between it and other manufacturing companies is that its main output is large numbers of graduates (at high, middle and workshop levels) with readily usable skills. Teaching companies may be regarded as complementary to formal education (especially at engineer and technologist levels) or as substitutes for formal education (especially at the level of workshop operatives). Training companies are similar but may not possess the infrastructure of physical production assets. They, therefore, may be more concerned with management development, planning techniques, marketing, etc., or serving as agents for teaching companies. The concept of a teaching company may appear alarming but the matter is often one of emphasis. A manufacturing company involved in "thick sandwich" courses, i.e. one in which students in the formal education system spend considerable periods in the factory, is a prototype teaching company and is so regarded today in some developed countries.

51. Teaching or training companies would thus seem to be one of the best ways in which developing countries can produce not only the numbers, quality and range of manpower they need for core industries, but also

achieve the objectives of rapid and diversified industrial development without being tied down to manpower constraints exerted by limited education and training facilities abroad and at home. The establishment of teaching and training companies (national, multi-national, jointly with similar companies in developed countries) ought to receive high priority in UNIDO's programmes, especially assistance to developing countries in identifying suitable modes (such as local railway engineering departments) for development into teaching companies.

G. Centres of Excellence and Specialized Institutions

52. In the Document entitled "Critical Capabilities for Industrial Development", reference is made to centres of excellence, i.e. institutions engaged in high quality research, education or training (or all three) in a well defined field and recognized by other institutions and individuals as distinguished. Any consideration of the structure and quality of institutions for the accelerated acquisition, development and spread of specialized knowledge must naturally take centres of excellence into account. However, for developing countries, several considerations need to be borne in mind when the term is used.

53. The first consideration is that a centre of excellence must be seen as an operational force at work within a particular context and time. Centres of excellence engaged in frontier research in developed countries are still working within such a context - in developing countries they would not. This network of relationships not only serves as a feedback mechanism for keeping the centre on course, but also provides some guarantee that its research results will be subject to the test of needs and of use.

54. The second consideration is that the pattern of interests of centres of excellence in developed countries, whilst it may to a considerable extent coincide with what should be the pattern of interests in developing countries, cannot be fully so. For example, such subjects as traditional technology in tropical agriculture and medicine; desertification; tropical raw materials; mass communications; educational technology; all deserve centres of excellence in developing countries.

55. The third consideration is that it would be wrong for centres of excellence in developing countries to be seen as exclusively dealing with material things. Centres of excellence in, e.g. the analysis of factors which determine rates of social change or the social consequences of technical and economic change are of equal importance.

56. At the regional and sub-regional levels, consideration should be given to the subject so that areas of priority can be decided upon, existing institutions capable of development into regional or sub-regional centres of excellence identified, programmes for doing so agreed upon, and aid and technical assistance marshalled within a reasonable period of time.

57. It has also been found desirable in many developing countries to establish special institutions and higher institutes of technology and engineering under the direct responsibility of the national co-ordinating body in such sectors and sub-sectors as petroleum, iron and steel, aluminium, forest products, leather, textiles, rubber, copper, and solar energy, accorded high priority in the national industrial and economic development plan. In addition to

undertaking the total integrated vertical development and utilization of the specific nature resource, they would also have the major responsibility of training the wide range of technical and specialized skilled personnel required at each level over the entire spectrum of the above-mentioned development process.

H. Institutional Support to Local Entrepreneurs and Small-Scale Industry

58. Reference has been made elsewhere to the need to promote the development of local industrial entrepreneurship in small and medium-size industrial enterprises. This, in turn, calls for the setting up of special institutions to provide them with a host of support services. In many developing countries there has been a tendency to establish business information services, to provide investment incentives, etc. for foreign private entrepreneurs. There has also been a move towards the development of institutions to provide support services to local entrepreneurs (industrial development banks, industrial estates, rural technology institutes and organizations for promoting rural and village industries). Some countries have also established Small Industry Service Institutes and Rural Institutes, even Rural Universities providing not only support services but also offering special short and long-term courses. Similarly, quality circles and National Productivity Centres and Professional Associations, like Institutes of Engineering, offer short-term and refresher courses to small and medium sectors. The latter of these support institutions have, however, tended to be ad hoc rather than to be based on any solid research into the problems of medium and small-scale enterprises in a particular historical context. Other defects may abound - support service institutions tend to cluster in a few main towns and to ignore the potential of the very large hinterland. Where rural industrial extension service

organizations exist, their geographical coverage may be so large and the services spread so thin as to frustrate any impact in depth; the staffing may be sub-optimal in numbers as well as in composition; poor career prospects may blunt enthusiasm; and equipment and materials for training and advisory services may be virtually non-existent. The courses provided may be too theoretical or too sophisticated to meet the needs of most of the clientel, etc.

59. If the industrialization process is to be widespread, if it is to gather speed, if entrepreneurs at medium-scale and small-scale levels are to function in absorbing large and increasing quantities of metals, basic chemicals and petrochemicals, semi-processed fibres, pulp and so on, and convert them into finished products to meet rising local and national needs, then measures for strengthening institutional support services for entrepreneurs and managers at all levels becomes an important tactical requirement. This will mean extensive programmes and facilities for continuous training and retraining of staff and for expansion and orientation of these institutions. This will mean, firstly, recurrent surveys to determine actual, rather than imagined problems and needs; restructuring and expansion of institutions to meet local regional patterns of needs more exactly. For example, surveys often indicate the need for help in securing supplies of raw materials or in establishing standards or in quality control measures or in adequate storage and packaging or financial accounting and management and so on. These problems and needs are of considerable significance where such businesses are engaged in sub-contracted production of parts and components requiring strict adherence to tolerance specifications, or chemical products based on formulae that

must be maintained at all times, or food processing where stringent public health requirements must be met.

60. The volume and range of industrial production of goods and services by small and medium-scale industries involved in any concept of accelerated industrialization is far larger than policy-makers and planners, steeped in the economic theory of oligopolistic competition, tend to assume. Correspondingly, the institutional network of support services available to them in developed countries may easily escape notice. Indeed, at the present time, there has been a renewed recognition within the developing countries of the importance of medium and small-scale enterprises, particularly as sources of technological invention and innovation.

61. Discussions of support services for entrepreneurship leads to consideration of support services for management, especially at the medium to large-scale enterprises level and here the role of the consultancy company becomes most singular. In Document ID/WG.394/3 the role of the consultancy companies is discussed and attention drawn to ways in which the government can encourage the development of indigenous consultancy services. Here, consultancy groups are noted as one of the most critical institutional requirements of industrial growth and diversification, especially where acceleration is required. The justification for urgent action in promoting the growth of local consultancy companies rests not only on the role they will have to play but also on the significant foreign exchange costs of using foreign consultancy companies.

62. In addition to the above, there is a need to develop capabilities to carry out such activities as R and D, standardization and quality control, marketing industrial information, project identification and preparation,

selection and evaluation, and industrial and technological infrastructure. Many developing countries have established one or more institutions to undertake some or all of these activities. An important function of these institutions is the provision of training, not only for their staff, but also for staff from government departments and industrial enterprises engaged in carrying out these activities.

V. MOBILIZATION AND OPTIMIZATION OF FINANCIAL RESOURCES

63. In the general considerations on accelerated development of human resources for industrial development presented in Document ID/WG.394/1. it was indicated that the governments of the developing countries were already allocating large proportions of their national budget to education and training. It has, however, been noted that in spite of these large investments, the returns are often not commensurate with the needs and requirements of the countries. A closer examination of the reasons for this reveals, among other factors, that there has been an imbalance in the allocation of financial resources among the major components of manpower development programmes. In most developing countries, such financing has concentrated largely on the development of the physical infrastructure, i.e. buildings for various institutions. Only a small proportion of the resources is allocated to the development of education and training programmes, training of instructors, fellowships and student welfare, laboratory equipment and instruments, and new training aids.

64. In this chapter, therefore, the subject of financial resources for the accelerated development of human resources for industrial development is dealt with from the point of view of real resources (teachers and instructors, teaching/learning aids, equipment, educational materials, buildings). A cursory examination of the number of nationals of developing countries who

are likely to need education and training in general, and in some specific sectors in particular, reveals the fact that only a small percentage of them can be educated and trained in developed countries for, at least, the following reasons: First of all, there is a limited capacity in the developed countries, especially when account is taken of their own needs, particularly their efforts to upgrade the quality of graduates of universities and polytechnics and the demands imposed on existing resources by their need to develop manpower (including retraining) to handle new technologies.

65. The second reason is the rapidly mounting cost of education and training of non-nationals in developed countries. Even if, in some way, the capacity limitation were to be avoided, the cost factor could not be overcome.

A third reason is the problem of "brain drain" from the developing countries since highly qualified graduates and trainees opt to remain in the developed countries. A fourth reason relates to the rapid development of capital/labour substituting technologies in the developed countries necessitating the replacement of certain categories of human industrial skills by machines. This is a major break in the structure of skills which developing countries will have to cope with.

66. The reasons apply, to a greater extent, to industrial training and to a much lesser extent to university or polytechnic education. In the case of training in industry, there is an increasing reluctance by industry in developed countries to take in trainees at high levels due to the need to protect confidential information.

67. Finally, in spite of the very large numbers of students to be educated and skills to be trained in each developing country, they will only be a

small part of the population. Their impact will thus depend on the ways in which they are selected and the ways they are deployed and used. These considerations lead to the conclusion that if the needs of the developing countries, in respect of human resources for industrial development, are to be met, the bulk of the education and training of engineers, technologists, industrial managers, floor supervisors and workshop operatives, etc., will have to be carried out in the developing countries themselves, and that developing countries have no alternative but to consider how this can be done very rapidly at a low cost. Further, past experience clearly shows that the people trained abroad tend to become alienated from the very people they belong to and become the elite exploiting the ignorant and continue to be intellectually dependent. Even where such foreign training is envisaged, the priority areas of training have to be determined and countries chosen that have competence in these areas for training. Otherwise, the mismatch between foreign training and local needs continues, leading to further brain drain.

A. Optimization of Local Financial Resources

68. It has been recognized that investment in industrial manpower development is indeed investment in real terms for capital formation and for social infrastructural development. In this regard, it is essential for the developing countries to establish appropriate priority among the various components of manpower development programmes. Thus, rather than perpetuating the existing situation whereby a larger proportion of resources is allocated to the financing of buildings for training institutions, more emphasis should be given to financing of training programmes, especially those related to the development of instructors and new training processes, methods and aids, student programmes including fellowships, training facilities and equipment,

especially those possessing a demonstration effect, as well as programmes in favour of the rural masses. These points are further elaborated upon later in the paper.

69. The question of finance leads, in turn, to the consideration of the extent to which local production capacities, education and training materials, can be built up in substitution for imports. This itself would depend on the extent to which foreign exchange resources (including foreign aid and technical assistance) are deliberately allocated to the building up of these local education and training capacities on a national, sub-regional or even regional basis. For such allocation to take place, there must clearly exist some quantified calculation of requirements. It is not obvious from the records of international global negotiations that such data, however rough, exist or are employed to provide a realistic background to discussions. Even in global discussions on the redeployment of industrial capacity from developed to developing countries, it is not clear that priority is given to industrial capacity for the production of books, films, materials and other equipment for education and training, in spite of the size of requirements of developing countries to accelerate their process of industrialization and in spite of the steadily mounting costs and other difficulties of sending large numbers of students and trainees to developed countries.

70. It is therefore recommended that in their negotiations for foreign aid and technical assistance related to the financing of human resources development for industrialization, developing countries should give priority to the training of trainers, especially teachers and instructors required for accelerated development of human resources for industrial development. High priority should

particularly be given to the redeployment of industrial capacities for the local manufacture (on a national, sub-regional or regional basis) . books, films and other materials and equipment for science and technology education and training. Consideration should also be given to the possibility of setting up new production units or utilizing redeployed ones at the sub-regional or regional level for regional teaching or training companies whose principal function would be the replication of teaching and training capabilities. Foreign aid and technical assistance should also be sought for the establishment or strengthening of existing R and D capacities at the national, sub-regional and regional levels for the development, commercialization and marketing of educational materials and equipment, especially for science and technology, education and training.

71. One of the most effective means of coping with the sheer volume of education and training needs is the establishment of national or multi-national training or teaching companies. The teaching company, as already explained, is analogous to a teaching hospital and whilst it is engaged in every aspect of production (procurement of raw materials and other factor inputs, processing, marketing, standardization, quality control, R and D, etc.), it also engages in extension and consultancy services. Its main product, however, is the technical or managerial graduate with immediately usable skills.

72. UNIDO could assist governments in identifying existing modes or production units (e.g. railway engineering workshops) which could be developed as teaching companies. The co-operating governments could then be called upon to seek the active support and participation of international financial institutions (including regional ones). However, it appears that the pressing necessity of creating such production units or centres in the developing

countries and the role they should play in financing their establishment has not yet been fully recognized. It is not unreasonable to argue that the cost/benefit of such investment, taking into account the mounting costs of education and training of nationals from developing countries in developed countries, on the one hand, and the benefits to production, employment, linkages and general economic transformation forgone, on the other, would fully justify the high priority being given to financing the development of such education and training facilities in the developing countries.

73. As the papers and report of the Stuttgart Meeting clearly bring out, there is now emerging an international market for training taking shape under the leadership of training companies mainly in developed countries. UNIDO could prepare a model pre-feasibility study of training companies showing their organization; the scope of training services they offer; their mode of operation and of financing; the particular strengths of individual training companies, etc., and formally present the findings to governments and inter-governmental organizations concerned with ECDC with a view to giving them assistance in setting up their own training companies. So vast are the anticipated needs that existing companies need not fear being crowded out of the market. Indeed, they could initiate the establishment of joint training companies with public or private entrepreneurs in developing countries.

74. The problems identified, and steps to deal with them proposed above, are complementary to measures taken on other aspects or areas of human resources development for accelerated industrialization with a view to optimizing the use of existing resources. It is recommended that governments of the developing countries should emphasize the following measures when deciding on their financial allocations to the development of human resources for industrialization:

devoting a lesser portion of scarce foreign exchange and other resources to buildings and more to measures for the improvement of teachers and instructors, the acquisition of materials, equipment, literature and to the development or expansion of mass media; restructuring of subject offerings, especially in universities to reflect higher priorities for the development of the natural resources/raw material industries and the production of specialists for policy research, planning, management, manufacturing, R and D, marketing; fuller use of existing facilities, especially laboratories (including the introduction of two or three shift systems); the deliberate introduction of textbook writing, associated with the establishment of national or multinational enterprises for the production of textbooks and other educational literature, films, video-discs, the active promotion of technical libraries and museums, not only in the capital city and few towns but also in rural areas; expansion of the use of the mass media, especially radio and television programmes for broad general education in entrepreneurship and management, as well as for more concrete technical education programmes.

75. As already remarked, none of these proposals are new and many of them are in practice in several developing countries. What seems to be required is a mass movement in individual or groups of countries in the field of education and training for accelerated industrialization and this could perhaps begin by UNIDO organizing, in co-operation with UNESCO, ILO and agencies outside the United Nations system, forums where experiences in the adaptation and use of each of these ways of accelerating human resources development for industrialization can be exchanged, together with programmes of study visits and technical assistance. Policy makers, planners and

practitioners in one developing country need to be made aware of what is going on in other developing countries in order to judge the extent of their own advance or lag, and in order to enrich each others' understanding of the nature of particular obstacles and how to overcome them.

B. Mobilization of Financial Resources

76. At present, the most common forms of financing the education and training of nationals for industrial development are, firstly, budgetary; provisions for formal education in secondary and trade schools, poly-technics and universities, accompanied by scholarships and bursaries. Secondly, governments may reimburse in whole the costs of education and training by industrial enterprises where this has been undertaken as part of planned expansion of supply of skilled nationals or make tax concessions, e.g. allow deduction of expenditures on education and training for purposes of determining profits tax. In some countries, even personal income tax rules allow deductions for expenditure on proven courses for education or training of the income earner or his or her children and other qualifying dependents. A third method consists of training provisions in contracts for the purchase of equipment and plants. Governments have also financed the development of education and training facilities through gifts and technical assistance from abroad and soft loans. Non-governmental organizations have also made substantial contributions, and so have "better off" nationals assuming responsibility for the education and training of children of relatives. In recent times, governments have begun to set up, as in the developed countries, industry training boards and industrial training funds, mentioned earlier in this paper.

77. Several observations can be made about this mixture of methods and means of financing human resources development, in general. First, it is not easy to calculate the total volume of expenditures involved. Secondly, there is no way of knowing the distribution of these expenditures by area of specialization, nor has an easy means been found to bring private voluntary fellowship grants into balance with projected manpower needs, though several governments now insist that non-governmental awards should be offered to a central pool in which specialization is determined. Thirdly, it has become apparent that priorities for the financing of education and training have to be seen not merely in terms of the physical cash involved but also in terms of the foreign exchange requirements for the building-up, within the developing countries themselves, of possibilities for education. Indeed, this challenge requires that efforts be made to rationalize and upgrade many of the methods and sources of financing national programmes to accelerate industrialization, which, themselves, also have to be given high priority. Without such integration and rationalization, it will be difficult to decide on how to optimize the use of local funds, especially the foreign exchange resources (export earnings, aids, loans, technical assistance) so as to build up local capabilities. This is intensified partly by the shrinkage of some sources of funds and the hardening of the terms by which funds can be obtained from other sources and partly by the mounting costs of importing teachers, instructors, materials, equipment, building components, etc. Both factors raise fundamental questions relating to which sources of funds need to be enlarged to compensate for the decline of others; which ought to be re-directed to education and training of skilled nationals abroad for direct absorption into industry; and what means to adopt in obtaining external financing for the establishment, improvement or expansion of local facilities.

78. In the light of the above, the potential of increased contribution from industry and the business community has not been fully exploited. Thus, much remains to be done, notably by commercial banks and credit institutions whose prime objective is to finance the sale of industrial plants and equipment without according appropriate attention to the training requirements. Yet, an important criterion for financing the importation of industrial plants and equipment is the existence of trained managers, engineers, scientists and technicians. This vicious circle needs to be broken. Financial institutions, when they study projects, need to accord highest priority to the training of industrial manpower since it is only on the availability of competent manpower that viable projects can be identified and successfully implemented. In connection with the above, the training of manpower should be considered as an essential part of project financing rather than as a mere adjunct to a project contract. Consideration should be given to the provision of training and related training material on concessionary terms and in greater volume by suppliers.

79. In addition, special mixed credit arrangements should be considered. Commercial and investment banks should be encouraged to consider granting special loans for industrial manpower training which could greatly assist small and medium-size enterprises in meeting their training needs. Additionally, consideration should be given to the establishment of an industrial training fund whose revenue could, initially, come from special taxation on industrial promotion, import and export of industrial products and raw materials, and industrial and technology contracts.

C. General Aspects

80. In this Chapter, a slightly unorthodox approach has been adopted in discussing the ways to make the best use of existing resources, and how to ensure that additional resources obtained through foreign exchange earnings, aid, trade and even debt, are allocated to the skills revolution so urgently needed in developing countries, without reference to financial estimates or ways of mobilizing funds. The central point is that the availability of real and financial resources for later stages in the education and training revolution depend on the careful, imaginative and resolute ways in which such resources are used in earlier stages.

81. The main emphasis has therefore been on the substitution of adequately educated and trained indigenous manpower for current and prospective imported ones. It is this substitution that is seen as the principal means of overcoming the present and anticipated foreign exchange shortages. It is argued, in effect, that the larger the foreign exchange resources (whether obtained through earnings, technical assistance, debt) devoted now to building up or improving local capabilities (national, multi-national, regional) for education and training for industrial development, the less likely will be the industrial manpower and foreign exchange constraints on attempts to accelerate industrialization in the future. In other words, costs will, as time goes on, be expressed in terms of local currency and real resources rather than of foreign exchange and external facilities. Historically, there is no known case in which accelerated industrialization has been achieved by substantial dependence on imported human resources or externally located education and training facilities.

82. Emphasis is also placed on the optimum use of existing real and financial resources. One reason for this experience is the increasing harsh international climate for investment, aid and loan finance flows from developed to developing countries and the likely decline of petrodollar loan and aid funds. These developments mean that far closer definitions of priorities than in the 1970s will have to be undertaken, associated with far tighter control over the allocation and use of scarce resources. In addition, the quantitative basis and qualitative aspect of projects for which aid or loan is to be negotiated will have to be greatly re-examined and improved than in the past and so will the expertise required for the technical presentation of projects, as well as for negotiating the details of funding the investors, loan providers or technical assistance agencies.

VI. CONCLUSION

83. In this Document, a number of actions have been proposed for consideration by the developing countries in accelerating the development of human resources for industrial development. These actions cover both long, medium and short-term measures. They are neither exhaustive nor do they attempt to cover every possible action that needs to be undertaken. They however give the developing countries an insight into the type of actions they need to take and the alternative approaches and mechanisms they may wish to consider. It is thus expected that each developing country would use them as a spring-board for decisive actions towards the formulation and implementation of their national programmes while taking full advantage of co-operative arrangements at the sub-regional, regional and inter-regional levels.

84. In order to do this effectively, a suitable strategy and policy framework must be established along with a well-articulated institutional framework.

National requirements for critical skills must be carefully determined and their development well-planned. Concerted actions would also have to be taken, first to optimize the use of available local resources and, secondly, for mobilizing additional ones for the accelerated development of human resources for industrial development.

