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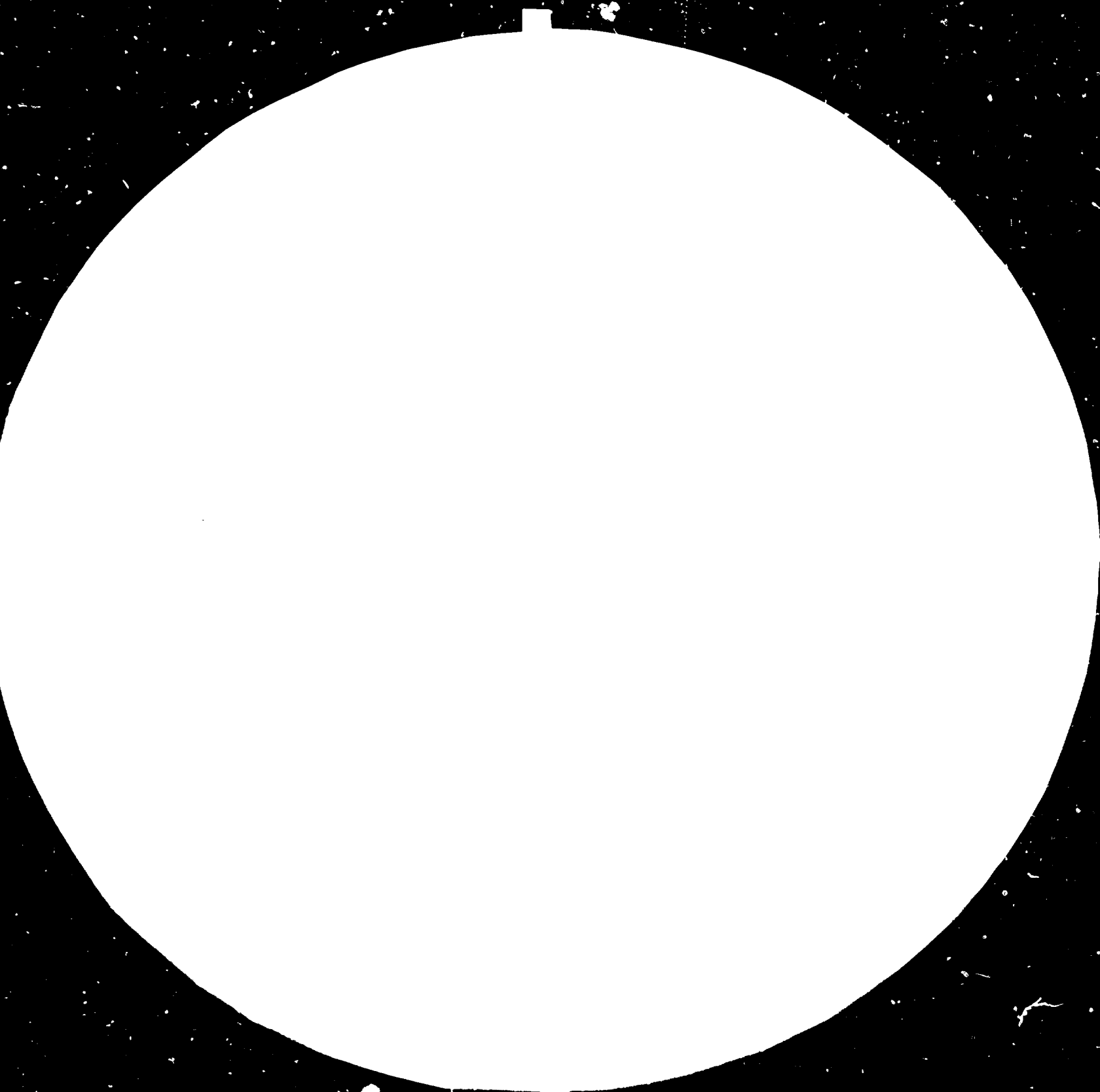

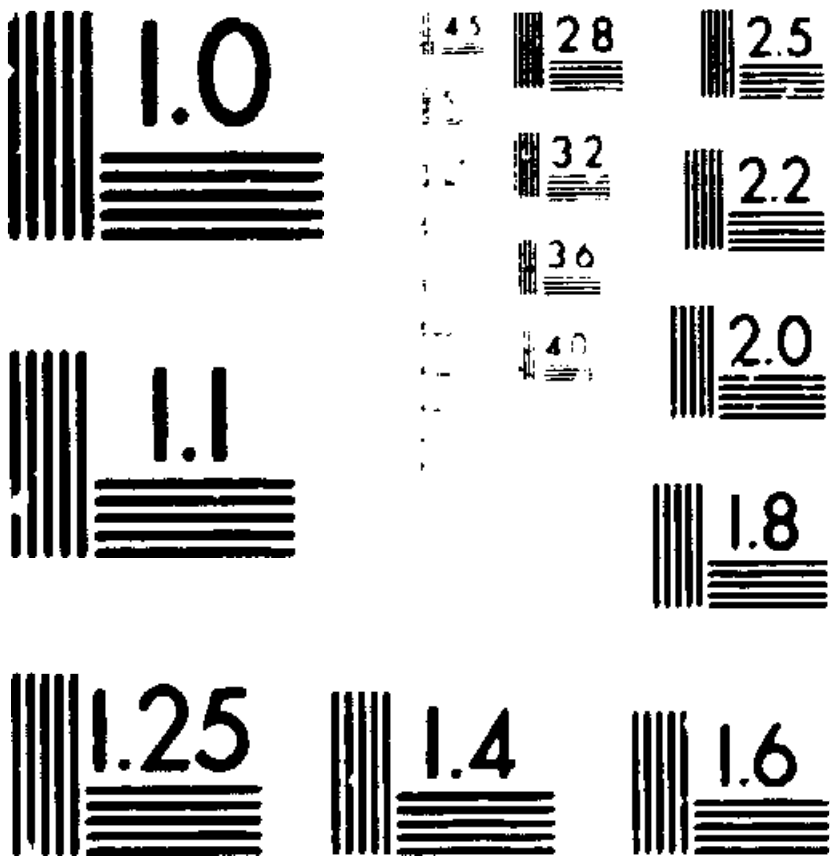

Item 5(a) of the provisional agenda

INTERNATIONAL CO-OPERATION, RELEVANT NATIONAL ACTIONS INCLUDING INDUSTRIAL POLICIES, AND UNIDO'S CONTRIBUTION IN CRITICAL AREAS OF INDUSTRIAL DEVELOPMENT 1985-2000:

Accelerated development of human resources for industrial development

Background paper prepared by the UNIDO secretariat

v.83-64419

CONTENTS

INTRODUCTION

1. When the Third General Conference of UNIDO was convened at New Delhi in 1980, the constraints in achieving the target set by the Second General Conference of a minimum share for developing countries of 25 per cent of world industrial production by the year 2000 1/ were realized and the need for substantially stepping up the annual industrial production growth rate of the developing countries was recognized.

2. With this in mind, the Conference emphasized the need to focus on human resource development. Training programmes, which had been high on the list of measures advocated at the Second General Conference, were seen to provide "the most effective vehicle for technology transfer and the creation of endogenous technological capability". 2/ The Conference stressed the importance of participation by youth and women in the development process, as well as the need to encourage their entrepreneurial ability. It also stressed the need to upgrade the skills of the rural population, so as to foster the development of small rural industries to meet the rural unemployment problem.

3. More recently, the First Consultation on the Training of Industrial Manpower, convened by UNIDO at Stuttgart in November 1982, in co-operation with the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Labour Organization (ILO), acknowledged the necessity for developing countries to carry out "integrated economic and human resource planning, including a clear national policy to develop the training of industrial manpower to meet present and foreseeable future needs. 3/ The Consultation concluded that developing countries should develop a system "whereby education and training requirements of industries of all sizes can be clearly identified and met, quantitatively and qualitatively". 4/

4. Human resources are recognized to be both the instrument for and object of development. At the same time, a trained labour force is an indispensable factor of production. Recognition of this fact is at the root of the so-called "human resources-led development strategy", in which human beings are the focus of development, both as producers and consumers.

5. A human resource-led development strategy would, therefore, involve a systematic effort to raise the skills, productive capacities, creative abilities and enterprising spirit of the nation's population through training, education and research. Ultimately, the self-reliance of the developing countries and the soundness of their production structures can only be achieved by developing their human resources. Indeed, as has been pointed out by Harbison and Myers, 5/ "if a country is unable to develop its human resources, it cannot build anything else, whether it be a modern political system, a sense of national unity, or a prosperous country".

6. The subject of human resource development cuts across all spheres of economic or industrial activity. The agenda of the Fourth General Conference accordingly reflects the emphasis on human resource development as a critical factor for economic and industrial development and a dynamic instrument of growth.

I. THE ROLE OF HUMAN RESOURCES IN INDUSTRIAL DEVELOPMENT

A. Human resources as a determinant of the pace of industrial development

7. It is the function of industry to serve as a main generator of national wealth required to achieve the objectives of a national development plan. The availability of an adequate supply of the right kind of trained manpower, in the right numbers, at the right time, in the right place and with the right balance of technical knowledge and practical skills will determine the pace and direction of industrial growth, industrial innovation and economic and social development.

8. An effective industrial manpower policy is thus of prime importance if industrial development is to be speeded up. It must form an integral part of the total manpower and education policy, which, in turn, should be integrated into national economic, trade, technical co-operation and other policies to meet national goals and priorities. In formulating such policies, it should be borne in mind that large numbers of the population of developing countries live in rural areas, frequently out of reach of the formal education system, so that new techniques of mass education will be needed, using imaginative educational tools and training kits.

9. Furthermore, it is important that manpower planning itself should not be carried out in a vacuum. There must be a clear national vision, a precise definition of the objectives of industrialization, and a well-conceived industrial plan and strategy covering industrial branches, sectors, subsectors and service sectors, which would, in turn, influence priorities in education and choices between training at home and abroad, and would determine the mix of occupations and critical skills required and the nature of the country's education and training.

B. Critical capabilities required for industrial development

10. The broad range of occupational categories that are essential to industrial development includes managers, industrial scientists, technologists and professional engineers, supervisors, technicians, craftsmen, skilled, semi-skilled and unskilled workers and support-service personnel trained in a variety of skills (engineering, design, production technology, testing and quality control, material management and value engineering, research and development, feasibility studies, industrial consultancy etc.). Similarly, one would need a core of personnel trained in the survey, exploration, extraction, development and processing of natural raw materials, as well as economists, accountants, information scientists, sociologists, material, marketing and financial experts, etc., needed in carrying out such functions as financial management, marketing, inventory control and other related services, which complement the engineering and technological component of industrial operations.

11. Some of these categories are considered to be particularly relevant to developing countries still at the initial stages of industrialization, the type and number depending upon the manpower profile required for each operation of the industrialization process and the choice of the particular technology.

12. To attain capabilities in the critical areas, not only will institutional structures for education, training, research and support services be required but also suitable instruments and mechanisms for co-ordinating, implementing and monitoring them and for ensuring effective consultation and co-operation between Government, industry and educational and training institutions. Moreover, these steps should be backed up by financial, material and other support.

13. The critical areas that would apply to most developing countries are described in the following paragraphs.

1. Capabilities in support of policy-making and planning

14. At the early stage of industrial development in which most developing countries find themselves, the most urgently needed critical capabilities would seem to be the ones directly related to autonomous policy-making, planning and implementation, involving access to information, and an ability to assess information for relevance and priorities and to choose from available alternatives.

15. Macro-economic data and techniques alone are of limited use and would have to be considerably supplemented by techniques based on actual inventories of existing industrial production capacities, including traditional technologies of industrial raw materials and natural resources, and other factor inputs, which must also include the identification of existing industrial growth nodes, institutional infrastructures, the mechanics of planning and creating linkages, measures for monetizing the rural economy, demand profiles derived from household budgets and expenditure surveys, and so on.

16. This information-gathering or socio-economic research activity could be carried out by local institutions concerned in one way or another with socio-economic research. It is important to have close working relations and a free flow of information between local institutions of social and economic research, the public administration and university departments working on similar topics.

2. Entrepreneurial capabilities

17. Entrepreneurship and entrepreneurial capabilities cannot, strictly speaking, be developed or taught. Governments can, however, provide the right environment and support services to promote and facilitate entrepreneurship.

18. It is now widely recognized that no industrial development plan and no process of industrialization, whether accelerated or not, can be successfully implemented or sustained without a very large number of entrepreneurs. They

depend not merely on the establishment of large-scale basic industries (metals, heavy engineering, basic chemicals and petrochemicals, pulp and so on) under the aegis of public or joint enterprises but on the availability of a large number of entrepreneurs operating on medium- or small-scale enterprises.

19. Support services and institutions set up to encourage indigenous entrepreneurs to enter industry should take into account their characteristics, strengths and weaknesses, sectoral and intrasectoral distribution, susceptibility to particular kinds of incentives etc. Government action should extend beyond providing financial resources and should include an analysis of the environmental factors that may encourage or hinder entrepreneurial activity. In fact, any action taken to increase the number of entrepreneurs, provide a more favourable environment for them to function in, and persuade them to transfer from well-entrenched or over-crowded areas of production to new ones where their presence and activities are essential for organizing the production of new product lines, should receive the fullest attention and support of policy-makers and planners.

3. Managerial capabilities

20. In any commercial enterprise, ultimate responsibility for success lies with the management. Expertise in such matters as manpower planning, recruitment, selection, induction, placement, technical education, vocational training and development is essential and the manager must work to ensure that expensively trained manpower is used efficiently and that industrial and human relations are maintained in a manner conducive to production and productivity. Moreover, although specialists may be available to carry out individual tasks, in the final analysis, the manager is responsible for co-ordinating product design, development, field tests, manufacture, quality control, inspection, distribution etc. and, of course, profits. Good management demands expertise, particularly in production, financial and materials management and marketing.

21. The importance of middle-level management supervisors and specialist services must not be neglected either. Procurement and control (including standardization and quality control), research and development, market research and marketing etc., are all critical considerations. This is the level at which a company's performance may well be decided and at which innovations are likely to be seen.

4. Engineering, technological and scientific capabilities

22. In addition to their traditional tasks, scientists, technologists and engineers nowadays need to be able to deal with people as much as with things, to use data from computers and from operational research, to apply techniques of critical analysis, to innovate, organize, plan, direct and manage, to solve problems of product development and of industrial relations. They also have to take note of the growth of knowledge, the speed and direction of technological advances, and possible social implications of such advances, especially in terms of employment, reallocation of the industrial work-force

to new jobs and the disappearance of certain human skills, effects on work habits etc. Flexibility and the ability to respond quickly to rapid changes are thus characteristics that have to be fostered. Self-sustaining and self-reliant industrialization depends on the development of this category of human resources.

23. The development of engineers, technologists and scientists applies to a very broad range of activities, encompassing employment in ministries and institutions, public and private industrial enterprises, educational institutions (especially universities and specialized institutions), research and development, consultancy services and standardization and other institutions providing technical and extension services to industry.

24. The designing of industrial products, tools, fixtures and production aids, pre-planning, production technology, quality control, materials management and value engineering are facets of industrial engineering that are needed in any manufacturing industry. Systems analysis, operations research, design and development, socio-economic cost benefit analysis, prerequisition of feasibility studies, project reports etc., are other areas in which competence needs to be built up. It takes a long time and a great deal of money to develop these areas, necessitating careful planning.

25. Indigenous business consultancy groups, development banks and small industry service institutes etc. can also play a very important role, by guiding the development and expansion of middle-level and small-scale enterprises, which can rarely afford to employ foreign consultancy groups. In any case, so rapidly does the demand for services grow that foreign consultancy services, even if available at reasonable prices, simply could not cope with it. The development of indigenous consultancy services to supplement and replace foreign ones should be given every encouragement in government planning.

26. Another important set of critical capabilities in this category is related to industrial research and development, presenting at least four major challenges. The first is the adaptation and improvement of technologies acquired from developed or from other developing countries (transfer of technology), for example by applying a given technology to materials or processes for which it was not originally intended. The second challenge is the generation and transfer of technology from laboratory to industry. The third challenge (particularly in tropical agriculture and traditional medicine) is the role of traditional technology: how to upgrade traditional tools and technologies and how to weave modern methods into the traditional tapestry. The fourth challenge is the emergence of new technologies (e.g. micro-electronics, genetic engineering and biotechnology, remote sensing etc.) and their possible implications for scientific and technological developments in developing countries.

27. A further critical area relates to extraction, evaluation, transportation and trade in industrial raw materials. These activities may not be regarded as major parts of the process of industrialization but are nevertheless of fundamental importance to it, since the range of industrial production depends, in the first place, on the variety of local industrial raw materials available for conversion into industrial products and the degree of complementarity among them.

5. Technicians and skilled workers

28. Since most industrial operations, especially at the plant level, are carried out by technicians, vocational and trade-specific skilled personnel, technical and skilled labour must be accorded very high priority in national manpower development programmes.

29. Technicians function between technologists or professional engineers on the one hand, and craftsmen or skilled workers on the other. There is a tendency nowadays for professional engineers and technologists to engage in research and development, design and industrial engineering, so that technicians are having to take over some of the tasks they used to perform. As a result, more and more technicians are required to have a higher-level technical knowledge and the practical know-how and skills to build, install and service sophisticated equipment and operate complex processes. As such they are very much in demand for industrial development (according to some estimates, for every engineer, technologist or scientist, five skilled workers are needed).

30. Skilled workers can be divided into those with broad skills required by every industry, especially mechanical and electrical fitters, and those with specialized skills restricted to one industry or production process. In developing countries (as in industrialized countries), the latter are normally trained by the employers to their own exact requirements. Broadly skilled workers are, however, habitually in short supply, and it should be a prime concern of the national training system to ensure that this critical capability receives full attention, through, for example, a national apprenticeship scheme and the co-operation of major employers. Broadly skilled workers able to deal with a wide range of machinery and equipment are particularly important for repair and maintenance work.

6. Repair and maintenance capabilities

31. Developing countries must attach high priority to the repair, service and maintenance of industrial equipment. Human resources for this purpose form a category that may well overlap with others that have been discussed, but it is treated separately here in order to emphasize its importance to industrial development.

32. In the short term, for almost all developing countries, the critical objective for industrial development lies in the better use of the existing installed capacity, particularly rehabilitation and maintenance. The development or strengthening of maintenance and repair services has a marked impact on capacity utilization, reduction of operating costs and the need for replacement capital, as well as on employment.

33. The last critical capability that a country building up its industry must possess is the ability to ensure that new skills and knowledge gained are passed on and multiplied. This requires trainers of several distinct types: direct instructors teaching practical skills off or on the job, training managers who organize training within enterprises (while also carrying out

some training themselves), trainers of managers and supervisors and a further category who are too little known in developing countries. These are the training development advisers whose vital function is to link training institutions with the needs of industry.

II. PAST EXPERIENCES AND CURRENT AND FUTURE TRENDS IN HUMAN RESOURCE DEVELOPMENT IN DEVELOPING COUNTRIES

A. Past experiences and current trends

34. Many developing countries have recognized the need to develop their human resources and are allocating ever larger portions of their national budgets to education and its expansion. The fact remains, however, that educational expansion has not generated the manpower required for industrialization. This can be traced to certain strongly entrenched practices.

35. Education in most developing countries has been patterned on systems prevailing in Western industrialized countries or passed down from colonial times. But while the industrialized countries regularly review their own educational systems in response to changing industrial manpower requirements and changing industrial structures, many developing countries have not subjected their systems to review or, if they have done so, have failed to make effective changes.

36. It is no surprise, then, that many developing countries have been disappointed in the outcome of their educational programmes, in spite of heavy expenditure on expansion. The system has, in many cases, proved irrelevant and unresponsive to the changing needs of the country; it hinders initiative and creative talent and generally fails to meet the need for a better educated and more rounded, more versatile work-force. It is clear, therefore, that the educational system will have to undergo review, rationalization and qualitative improvement. It must change in form, content and method.

37. Where training has been received in advanced countries or in imitative institutes set up within developing countries, it has resulted in élitist, alien attitudes, values and life-styles not rooted in the soil of the developing countries. Foreign management courses, seminars and workshops often do not cover issues that are of prime importance for enterprises in developing countries. Also, while international experts admittedly play an important role, undue reliance on their advice should be avoided, since experience has shown that it may help to perpetuate intellectual dependence.

38. Because of the high cost of equipment for practical training, universities in developing countries have tended to establish humanities and social science departments rather than encouraging technical education. As a result, even though there has been an expansion in the number of universities, they are not meeting specific manpower requirements for industrial development, but instead are creating a mass of unemployed lawyers, accountants, economists, historians, sociologists and other social scientists. There is a mismatch between university products and industrial needs; between job opportunities and vocational training courses. This mismatch perpetuates a continued heavy reliance on costly expatriate technicians to support industry.

39. One important effect of the drive to secure a university degree as a credential is to reduce sharply, in the eyes of many prospective students, the value of technical training and of attendance at polytechnics or other types of vocational schools. Aversion to attendance at such schools is increased by the presumed superiority of work that does not dirty the hands over manual labour, which is viewed as degrading.

40. Although the educational infrastructure must continue to expand and to develop, major advances are more likely to be achieved by rationalization and qualitative improvement, with relatively little additional investment or assistance, by a strengthening of the linkages between industry and the educational system and by reorientation of the programmes. There are, fortunately, signs in many developing countries of a swing away from the humanities towards science and technology. These efforts, however, need to be redoubled.

41. Many schools and colleges, including polytechnics, do not have the necessary facilities for practical work, but theory without practice is of little use to industry. Similarly, there is a paucity of good teachers, instructors and educational materials.

42. The rapid evolution of the "knowledge industry" needs to be extended to all forms of education and to all age-groups and levels of the population, through the production and distribution of newspapers, journals, books, educational materials, fixed and mobile libraries and bookshops, radio, television, video, mobile science centres etc. In most developing countries, however, the necessary experience and funds are lacking, as are the hardware and software needed for systematic research to evaluate educational tools and techniques, teaching and learning processes and aids for accelerated education and training designed to reach larger segments of the population.

43. Second-level education is at present not designed to provide a well-rounded product with worthwhile skills for absorption in industry or for entry into professional courses. What it takes to enter into a technical or industrial civilization is generally missing. A reorientation of traditional approaches is needed to bridge the gap between learning and doing and to provide for continuous education (learning to learn), so that students are able to acquire new knowledge and capabilities and to adapt their knowledge to new skill requirements throughout their working lives.

44. The growing emphasis on science in current technological advances is one of the most significant trends in the development of human resources. The emerging technologies are converging and their continued impact is bringing about radical changes in social, economic and industrial structures. They affect society as a whole, encompassing skills, employment, work environment, leisure, family and social life. Several demand new or higher skills (though some might even have the opposite effect). To meet these needs, a trans-disciplinary orientation in education, research, training is required, as are new attitudes on the part of labour, management and government and changes in existing structures. Education, research and production have to foster a common culture and strong links, with particular emphasis on excellence and standards, guaranteed by a continuous upgrading of skills and acquisition of new ones at all levels, ranging from the worker to the manager.

45. A human resource development policy must ensure that new skill requirements are met, that economic development is not delayed through shortages of skills and that individuals have opportunities to adapt to the changing needs of the economy. Already, some changes in requirements can be seen in the clear demand for a range of higher-level technology-related skills, particularly in fields that cross traditional boundaries, for example design engineers, systems analysts and maintenance engineers.

46. There is still no clear consensus on how new technology will affect skills. As already noted, it could result in a strong trend towards "de-skilling", leaving unskilled workers who have no access to further training in a very vulnerable position in the labour market. Another possible trend is towards a polarization of skills, resulting in a relatively small highly qualified élite and a large number of unskilled workers. It is also possible that, as machines become more complex, there will be an up-market movement in skills at all levels. The possibilities are still open, and it should be noted that decisions about skill levels are determined exclusively by choice of technology, which can be influenced by political, managerial and social considerations.

47. Even in the industrialized countries, there has been a tendency in the last few years for Governments to intervene in order to encourage the vocational preparation of the national work-force, to stimulate the application of technology, to attack the rigidities and conservatism of the labour market, to make education, research and training more transdisciplinary and relevant, to introduce extension as a third dimension in addition to training and research, and to provide formal and non-formal continuous education. Changes are inherent in any industrial society. The fact that they have been seen to be necessary on such a large scale in the developed countries indicates that, in attempting to develop human resources, educational systems need to be dynamic, relevant, realistic, more open, more flexible and more coherent.

48. The priority given by industrialized countries to the intensive expansion of human capital formation over the formation of physical capital has often been credited with the success of their economic plans, in general, and their industrial growth and employment, in particular. The experience gained in these countries leads to the conclusion that the scientific and technological capacity of development, and as needed, the expansion of high-quality research institutes, are based on the development of highly-qualified scientific and technological manpower.

49. An awareness of previous deficiencies is now leading many developing countries to adopt measures to reform their educational and training systems. New methods and materials and new teaching aids in education technology are being introduced, for example, computer-based education even in primary and secondary schools. Governments are stimulating pilot schemes within the schools, designed to ensure that technical and vocational options are available within the curriculum and are given due weight in a balanced general and vocational education. Training to recognized standards is being made available for the broadest possible range of skills and the greatest possible number of people. Initial training on a broad basis is followed by a modular training structure aimed at increasing the adaptability and flexibility of the work-force.

B. Future trends

50. A UNIDO report on the training of national personnel for industrial development estimated that industry in the developing countries was expected to be able to absorb about 30 million new entrants into the labour force during the Second United Nations Development Decade (1970-1979) (ID/B/101, para.15). This meant that, on the average, about 3 million new entrants per annum should receive some form of industrial training. To those estimates it should be added the 100 million workers estimated to constitute the existing industrial labour force in developing countries, who would require continuing training during this period. For the Third United Nations Development Decade (1980-1989), UNIDO has formulated alternative scenarios, from which the magnitude of the labour force and training effort needed may be deduced.

51. The first scenario, depicting industrial growth for developing countries up to 1990, assumes that performance will be better than current trends but does not link it to the objective set out in the Lima Plan of Action. According to this scenario, the labour force in the manufacturing industry is likely to expand by 50 per cent over the 1975 level. Under a second scenario, relating to industry as a whole up to the year 2000 (and geared to the Lima objective), it is estimated that there will be an increase of approximately 150 million persons in the industrial labour force (excluding China) (see ID/WG.381/1, paras 14 and 15). The following table shows the industrial labour force in developing countries as a percentage of the total labour force, estimated on the basis of the Lima Development Objective (LIDO):

Industrial labour force in developing countries
as a percentage of the total labour force

Year	Africa	Asia	Latin America	Middle East
1960	7.6	10.2	20.0	14.5
1975	11.9	12.3	23.7	19.4
2000	15.0	17.1	27.6	23.3

52. The above figures show that the share of the industrial labour force will continue to increase as industrial development takes on greater significance in the developing countries. The figures are also indicative of the magnitude of the task that lies ahead in regard to human resources development for accelerated industrialization. Furthermore, the industrialization process will demand an increasing number of engineers and other qualified technical personnel. In view of the large numbers of engineers, technicians etc., to be trained, coupled with the strain that this requirement is already placing on engineering and technical or polytechnic institutions in industrialized countries, the only logical alternative is for the developing countries to consider creating their own institutions. There is great potential for technical and economic co-operation among developing countries in this area.

53. Ultimately, the nation's educational system will have to prepare future workers to function in a society characterized by increasing applications of electronics and biotechnology, and to meet the challenge of a changing economy. Computer literacy is becoming an important requirement for many jobs, a trend that is likely to become even more pronounced in years to come. The increasing technological complexity of the work-place is creating a need for a strong background in mathematics and science, even at the primary and secondary school levels. Some countries are already endeavouring to meet this need by retraining teachers and workers, changing curricula, setting up mathematics and science networks, introducing computers and computer software into the curriculum at an early stage, to augment text books and provide more challenging materials, encouraging collaborative programmes between secondary schools and higher institutes of learning and industry etc. This trend is likely to be followed by more and more countries as time goes by.

54. Another consequence of technological change is that some people may have to change their occupations one or more times during their lifetime, while others have to change their functions as their employment is upgraded. Educational systems should foster greater vocational adaptability, so that changes can be accepted and effected without undue social stress. There are indications that there will be a growing trend away from the concept of front-end loading, in which training in the first few years of work provides skills that can be drawn on until retirement, towards a system of periodic modular training undertaken whenever it becomes necessary. Initial training will, therefore, have to be more broadly based and less job-specific.

III. CRITICAL AREAS AND LINES OF ACTION

A. Actions at the national level

1. Policies, strategies and plans

55. Policies, plans and strategies for human resource development, taking into account the critical capabilities referred to in chapter I above, must be seen as part of the total, integrated package of national action for educational, industrial and overall economic development. Full involvement of representatives from relevant government departments, industry, training and the educational system from the very start of the planning process will go a long way towards raising the level of co-ordination and ensuring that the programmes are coherently designed, the manpower priorities identified, and the mechanisms for implementing the plan agreed upon.

56. World-wide experience suggests that while rigid planning for the development of human resources is unsuitable, since it frequently fails to take into account changes and unanticipated needs, the absence of planning of any kind may be worse, as it is likely, inter alia, to perpetuate the present dependence on manpower imported from developed countries. Some kind of planning is therefore essential, extending beyond the macro level to include the subsectoral and service sectors, with built-in mechanisms to monitor divergences between planned output and actual demand, as well as changes in technological, manpower and natural resource development.

57. In order to carry out appropriate planning, manpower profiles and plans must be prepared for industrial branches, sectors and subsectors that have been accorded priority in the industrial development plan and programme, and particularly for "core" industries. This would make it easier to estimate projected demand for industrial manpower. The next step would involve the preparation of an inventory and evaluation of existing facilities, at the national level, for industrial manpower development, so as to permit the identification of quantitative gaps and qualitative deficiencies and help to indicate specific lines of action to be taken to correct them. Included in such actions would be the determination of: (a) training needs that might be met by the optimum utilization, expansion and improvement of national facilities or the establishment of new ones; (b) needs that could be met through the utilization, under economic co-operation among developing countries (ECDC) arrangements, of facilities in other developing countries; and (c) needs that could be met through international co-operation with developed countries.

58. National education and training policies will have to be re-examined to ensure that they reflect the national preoccupation with human resource development for industrialization. As already noted, in restructuring educational and training programmes, consideration needs to be given to building transdisciplinarity and greater flexibility into the programmes. This could be accomplished by introducing bridging courses and providing retraining and in-service opportunities. A balance could thus be struck between workers with a general background training, whose skills could readily be adapted to any industrial operations, and workers with specialized skills. Vocational education especially geared to the supply of skilled workers and technicians for industrial operations also needs to be emphasized, along with management training for senior and middle-level managers.

59. Policies should reflect the need to upgrade schooling at the primary and secondary levels in order to take account of the rapidly growing technological advances. In addition to the introduction of microcomputers and computer education into educational programmes at the earliest level, special teaching and learning aids for the young will need to be introduced.

60. A major concern of Governments should be to increase the overall productivity of the population as a whole by improving the productive capacity of each individual, particularly in rural areas. Among several possible measures are the large-scale training of artisans, the improvement of traditional tools, techniques and skills, mass introduction of educational and training aids, including do-it-yourself kits, popularization of science and technology and the setting up of extension services, especially in rural areas. For this purpose, priority must be given to programmes of scientific and technical education for the masses in rural areas and to the wider use of television, mobile training units and radio etc; science centres may also be established.

61. Technical universities, science and technology parks, teaching and training companies, science clubs, centres of excellence (see para. 81 below) etc. are all possible new approaches to a restructuring of the educational and training system. The open university and satellite education are two further potentially useful means of providing mass technical education.

62. In formulating a programme for the development and training of engineers, technologists and scientists, it has to be realized that an even larger programme will be required for the training of technicians and skilled personnel. Since the opportunity for children in developing countries to obtain a university education is very limited, a large number of those with a secondary school education should be trained, through special programmes, to become capable technicians able to take up high-level, skilled jobs in industry. Children with a primary school education 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.

63. In the past, traditional forms of education in most developing countries have not provided equal opportunities for the education and training of women, so that any national education and training programmes must necessarily pay particular attention to special programmes designed to train women to perform at all stages and levels in the entire process of industrial development.

64. Special attention must be paid to the training of trainers, teachers and instructors in order to meet the urgent need for new types of teachers and instructors who can combine both formal and practical education in implementing the new forms of education, fostering innovation and creativity, rather than the imitativeness of earlier systems. As indicated earlier, the adoption of new technological learning processes and greater use of opportunities resulting from advances in the development of new training aids and facilities would greatly enhance the capabilities of teachers and instructors.

65. Any educational reform process must take into account the problems posed by the brain drain, which often occurs in fields where national investment in training, largely abroad, is high and the loss to the nation also constitutes a loss of foreign exchange. Appropriate measures should thus be adopted to reduce or even completely eliminate the brain drain, alternatively using the talents and expertise of nationals, to the advantage of the country of origin.

66. The important role of the entrepreneur in the industrialization process has already been stressed. The Government must take deliberate steps to encourage and support indigenous industrial entrepreneurship, by providing suitable incentives and creating a stimulating environment. Such measures might include the development and provision of various technical support services, especially information and data relating to raw materials, markets and technology; common services for the storage, marketing, training, repair and maintenance of equipment and for 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; extension services related to feasibility studies, market research, assessment of alternative technologies, negotiations for, and purchase of equipment etc.

67. Training policies should also extend to the contracting and implementation of foreign-aided projects, and systematic efforts made to train nationals throughout the process of design, fabrication, testing, erection and commissioning, in addition to the normal operation, maintenance and repair of the plant and associated equipment. Such training could also cover the whole

range of activities in industrial investment projects from feasibility studies and the selection of technology through plant design and construction, production and management to marketing of final products. In fact, it should be a standing principle that a training component for the training of nationals be included in all capital projects.

68. With this in mind, the high-level expert group on accelerated development of human resources for industrial development, at the meeting held at Yaoundé, from 30 May to 3 June 1983 in preparation for the Fourth General Conference of UNIDO, has requested UNIDO to submit for the consideration of the Conference a proposal that funds for training should be considered as an essential part of the capital cost of a project (ID/WG.394/8, para. 81).

69. Considerable progress could be made in upgrading and reorienting manpower skills in relatively short periods of time by using an integrated approach with a multidisciplinary training team drawn from existing institutions. Universities could restructure their programmes, offering courses in such much-needed areas as production engineering, financial management etc., thus making their research more relevant, and could accept extension and consultancy work as a third dimension of their normal training and research activities. Similarly, management institutions, polytechnics, and vocational training institutes could gear their practical classroom problems to the immediate needs of an industry. Another possible approach is to train a core group of economists, social scientists, technologists, planners, administrators, bankers and industrialists for autonomous decision-making and self-reliant development.

70. Similarly, professional groups, such as national engineering associations, could organize workshops or seminars to upgrade the knowledge and skills of teachers, administrators, managers, directors etc., in subjects of interest and priority. These could be supplemented by short periods of training abroad.

71. Lastly, national planning should take into account the importance of mobility of personnel between industry, research, government and educational institutions in building competence and establishing working links between industry, government and the educational system.

2. Institutional infrastructure

72. There should be a co-ordinating body for human resource development, with clearly defined functions, in each developing country. 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 specified areas of planning, programming, implementation and monitoring of human resources development and utilization for industrial development.

73. In some countries, a co-ordinating body of this type is located in the Ministry of Economic Planning, while in others the Ministry of Industry or Ministry of Education 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 industry, education and planning.

74. It would also be desirable to have some sort of national advisory body consisting of representatives from the various sectors of the economy, especially the business and industrial communities, chambers of commerce or industry etc., which could advise the national co-ordinating body on the formulation of policies and the development of plans and programmes, both at the macro (national), as well as the micro (sectoral, subsectoral and institute) levels.

75. 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, a close working relationship with the national co-ordinating body for human resources development for industrialization would be essential.

76. Although institutions involved in middle-level education and training, such as secondary grammar schools, vocational schools and trade-specific schools, are within the competence of the ministry responsible for national education, the national institutional infrastructure for developing human resources for industrialization must also deal with these institutions, since they constitute the second level of the market for industrial manpower. In some countries, special vocational and trade-specific schools for training fitters, welders, electric and electronic technicians, machine operators, carpenters, sheet metal workers etc. have been established under the direct responsibility of the national co-ordinating body.

77. It is important for the effective operation of the national institutional infrastructure for human resources development for industrial development that the responsibilities and terms of reference of each institution be clearly defined in order to avoid undue overlapping, conflict of interest and wastage of limited resources. With a suitable policy framework and an effective national machinery that clearly defines 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. Situations would certainly arise in which working arrangements would need to be developed between institutions engaged in joint training programmes or desirous of complementing or supplementing each other's activities.

78. The potential role of the business community (both public and private) in the academic programmes of universities and other technical institutions in developing countries needs to be fully explored. The contribution of the business sector, in the form of advice on courses and curriculum design, facilities for the practical training for students, provision of equipment, materials and even some teaching staff, sponsorship of research work etc. will help to build up the training programmes offered, and to relieve some of the financial burden which, in most developing countries, is carried almost exclusively by the Government. Experience in developed countries has shown that arrangements linking government, industry and institutions of formal education can be very beneficial.

79. In developing countries, manufacturing enterprises operating in areas where expansion is proposed can serve as growth points for the practical side of education and training for industry. If there are no such enterprises, and if access to industrial enterprises in other countries is not available or is

grossly insufficient, alternatives have to be explored. The search for such alternatives has led to the introduction of teaching or training companies established in respect of selected industrial production activities for which rapid manpower expansion is needed.

80. A teaching company is concerned, as a corporate institution, with the full range of manufacturing (procurement of raw materials and other factor inputs, production, marketing, research and development, extension and consultancy services etc.). The only difference between it and other manufacturing companies is that, in addition to the normal production of hardware or services, its output also includes a large number of trained persons (at the high, middle and workshop levels) with readily usable skills. Teaching companies may be regarded as complementary to formal education (especially at the engineer and technologist levels) or as substitutes for formal education (especially at the level of the workshop operative). This would seem to be a useful means for developing countries to produce not only the numbers, quality and range of manpower they need for core industries, but also to achieve a 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 or multinational, or in conjunction with similar companies in developed countries) ought to receive some consideration in programmes for the rapid development of human resources for industrial development.

81. The institutional infrastructure for the development of human resources for industrialization would also include centres of excellence. These are developing country institutions engaged in research, education or training (or all three) in a well-defined field, which are recognized by other institutions and individuals as distinguished in their particular field, and which are willing to open their training facilities, upgrading them as necessary, to trainees from other developing countries. It has been found useful, in some developing countries, to establish these centres in such industrial subsectors as petroleum, iron and steel, aluminium, forest products, leather, textiles, rubber, copper and solar energy, which have been given priority in the national industrial and economic development plan. In addition to undertaking the total integrated vertical development and utilization of a specific natural resource, they would also have the major responsibility of training the wide range of technical and specialized skilled personnel required at each level of the spectrum of the development process.

82. The special role of post-secondary technical institutions, such as polytechnics, in producing middle-level specialists, without which no process of accelerated industrialization will work, is often inadequately appreciated in developing countries. Because the polytechnic will most likely produce most of the country's technicians and entrepreneurs, the inclusion of optional or compulsory courses on how to establish and run businesses ought to be given early consideration.

3. Mobilization and optimization of financial resources

83. For many developing countries, the most common source of financing for the education and training of nationals for industrial development is through allocations within the national budget. On the basis of the experience of several countries, it is recommended that a minimum of 2 per cent of GNP be

earmarked specifically for the development of scientific and technological capabilities. Even then Governments would still need to examine other means of mobilizing additional financial resources to develop the wide range of specialized skills required for the industrialization process.

84. In the advanced countries, a sizeable portion of the costs for technical education and training is provided by industry. In most developing countries, industry is still in its infancy and is unlikely to make any significant contribution at the present time. However, industry should expect to accept an increasing measure of responsibility in financing the development of the skilled personnel that it requires. In certain countries, 1 per cent of the wage bill in industry is used for the training and retraining of workers and staff, and such training arrangements may be made within the industry or in co-operation with existing training institutes. The Government may then reimburse, in whole or in part, the costs of education and training by the industrial enterprise (where this has been undertaken as part of a planned expansion of supply of skills), e.g. by making tax concessions or allowing a deduction of expenditure on education and training for purposes of determining profits tax.

85. In some countries, personal income tax rules allow deductions for expenditure on approved courses for the education or training of the income-earner or his or her children and other qualifying dependants. Training provisions can also be inserted in contracts for the purchase of equipment and plants. Governments may finance the development of education and training facilities through soft loans, gifts and technical assistance from abroad. Non-governmental organizations have also made substantial contributions, as have wealthier nationals who assume responsibility for the education and training of relatives' children. Recently, governments in some developing countries have begun to follow the example of developed countries in setting up industry training boards and industrial training funds.

86. The development banks and other financing or credit institutions, which regularly finance the purchase of industrial plants and equipment, are an important link in the mobilization of financial resources for the development of human resources for industrial development. One major criterion for financing the purchase of industrial plants and equipment should be the existence of trained and qualified nationals to operate the equipment, including its repair and maintenance. In the absence of such competent manpower, a training component must be included in the project. As already noted in connection with national policies, strategies and plans, the training of manpower should be considered as an essential part of project financing, rather than as an optional adjunct to a project contract.

87. In addition, special mixed credit arrangements should be considered. Commercial and investment banks should be encouraged to grant special loans for industrial manpower training, which could help small- and medium-sized enterprises to meet their training needs. Consideration should also be given to the establishment of an industrial training fund, whose revenue could, initially, come from special taxation on industrial promotion, and the import and export of industrial products and raw materials, and from industrial and technology contracts.

88. While the preceding paragraphs deal exclusively with approaches to mobilizing financial resources for industrial manpower education and training, optimization of the use of existing resources is of equal importance. Governments should give the same priority to improvements in the quality of education and training as to the physical structures (buildings), namely: improvements in the quality of teachers and instructors; purchase of educational materials, equipment and literature; expansion of the use of radio, television etc.; the restructuring of subjects so as to reflect higher skill priorities and needs; a fuller use of existing facilities (including laboratories); the deliberate introduction of textbook writing as an adjunct to establishment of national or multinational enterprises for the production of textbooks and other educational books, films etc.; and the promotion of technical libraries and museums not only in the capital city and a few towns but also in rural areas.

B. Actions at the international level

89. The development of human resources for industrialization offers plenty of scope for co-operation at all levels - subregional, regional, interregional and global. There is scope for co-operation among the developing countries themselves, on the one hand, and between the developing and the developed countries, on the other. Because the costs of technical education and industrial training tend to be rather high, a logical option would seem to be co-operation among countries, for example in the exchange of information, teachers and students in the joint development, production and sharing of educational and training materials and in the joint financing of expensive research and training facilities.

1. Co-operation among developing countries

90. Perhaps the most effective means of facilitating co-operation among developing countries is for developing countries themselves to recognize the need for greater self-reliance and mutual assistance in the formulation of policies and for accelerating the development of human resources. For this to happen, attitudinal barriers would have to be overcome and countries would need to have growing confidence in each others' technical capabilities.

91. At least two additional factors could facilitate co-operation in industrial manpower development in the developing countries. First, all else being equal, industrial manpower training ought to be more appropriate and relevant in another developing country as the conditions, problems and obstacles encountered are likely to be similar and communication between trainers and trainees to be simpler. Secondly, in most cases it is less expensive.

92. Fortunately, changing conditions are favouring this type of co-operative endeavour. These include: improved communucation and a greater awareness of common problems; a knowledge of existing capacities, as well as wider access to training facilities available in other developing countries; increased recognition of the vital importance of industrial manpower training

for a balanced socio-economic development; the greater willingness to view training as an investment of at least the same importance as investment in physical facilities; and the political will to achieve individual, as well as collective, self-reliance.

93. The considerable experience and expertise in the development of human resources for industrial development accumulated by some countries could very usefully be shared with others. Within geographical regions, selected national institutions could become training centres or centres of excellence within the region or subregion. Consideration should be given to the establishment of appropriate machinery, especially at the regional and subregional levels, for initiating and co-ordinating co-operative activities. Advantage should be taken of intergovernmental organizations already established in the industrial and economic development fields. An information system on training needs and training facilities should be established as an integral part of the programme of centres of excellence, so as to provide, on a continuous basis, timely and relevant information on training needs and training opportunities in developing countries. Regional, subregional and international networks should be developed, inter alia, to provide channels of communication for professional exchanges, and establish possibilities for mutual assistance between training institutions and research centres in developing countries.

94. Developing countries could also co-operate in the provision of consultancy and other technical services, as well as in the development of these services. The education and training of middle-management and specialized staff can also be organized on a co-operative basis, e.g. in joint institutions or teaching and training companies, as can the production of educational materials and equipment. In training workshop operators, the most effective form of co-operation lies in the provision of teachers, instructors, facilities or technical opportunities to train them.

95. The scope for co-operation among developing countries thus covers a wide range of activities: exchange of information, organization of study tours, provision of technical assistance experts, education and training (especially of teachers), establishment of joint teaching and training companies, joint production of educational materials, research in industrial teaching and learning processes. It will require a considerable effort on the part of policy-makers and planners in their programming and planning, and considerable statemanship at the highest levels in negotiating mutual benefits and costs and foreign exchange implications. Long-term programmes of co-operation should be agreed upon taking into account the different educational and industrial structures and other conditions of the participating countries.

2. Co-operation between developing and developed countries

96. While emphasis on the development of human resources for industrial development has to be placed on action first at the national level and secondly among the developing countries, there is, nevertheless, great scope for co-operation between developing and developed countries. A great demand is emerging in the developing countries for the training of production, maintenance and management teams in connection with industrial projects and,

to some degree, for the establishment of technology and training centres to support specific sectors of industry. The assistance of developed countries, through bilateral and multilateral co-operation arrangements and through commercial relations at the enterprise level, could be very useful.

97. The adoption of appropriate policy measures by Governments of developed countries would facilitate such co-operation. Such measures could include greater access by students from the developing countries to training institutions in developed countries; the supply of information, training programmes and aids to developing countries and the financing of industrial training programmes and facilities in developing countries. High priority should be given to industrial training in bilateral and multilateral technical assistance and aid programmes to developing countries, as well as in contractual arrangements for industrial or technology transfer projects between companies in the developed countries and Governments or enterprises in the developing countries. Consideration should be given to strengthening existing focal points in developed countries or establishing new ones to co-ordinate relevant programmes undertaken in co-operation with the developing countries.

98. There is considerable scope for international co-operation at the enterprise level in the development of human resources for industrial development. In this regard it is important to determine, in concrete and quantitative terms, the specific training needs and the criteria for the selection of trainers, trainees and training opportunities in industrial enterprises. Actions to be taken to strengthen international co-operation at the enterprise level include improvement of financing terms for the training component of industrial projects, special programmes to strengthen the capabilities for mastering the mechanics of financing in both public and private sectors and the use of mixed credits (from public and private sources) for training to be undertaken that goes beyond the needs of a particular enterprise or contract.

C. Recommendations for further action at the international level

99. Experience in the majority of the developing countries suggests that most are not satisfied with the product of their educational and training institutions, particularly when it comes to meeting the manpower requirements of industry. An in-depth study and analysis of the problem is urgently needed in order to rationalize and make qualitative improvements in the educational system.

100. The Conference may, therefore, wish to consider a recommendation for UNIDO, jointly with the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Labour Organization (ILO) and other relevant international organizations, to organize a high-level meeting, preferably at the ministerial level, to identify the reorientations necessary in developing countries in the fields of education and training, in order to respond closely to the present and future needs of industrial development, taking into account the impact of technological innovations and advances. Such a meeting would also propose an action plan at the national and international levels. Such a meeting may be dovetailed, with any plans that may emerge for a world conference on training human resources for development being discussed elsewhere.

101. A major short-term task of industrialization in developing countries lies in the better use of existing installed capacity. The development and strengthening of maintenance and repair services is a particularly important activity, in terms of its impact on capacity utilization, reduction of operating costs and need for replacement capital etc. To help draw world-wide attention to this problem, the high-level expert group on accelerated development of human resources for industrial development has urged UNIDO to submit for the consideration of the Fourth General Conference a proposal that "the year 1986 be proclaimed as the International Year for Repair and Maintenance of Industrial Plant and Equipment, in order to focus national and international attention on the problems of maintenance of industrial plants and equipment with a view to developing appropriate capacities and capabilities in industrial maintenance" (ID/WG.394/^, para. 67). In view of the need for developing countries to increase productivity as part of their efforts to develop human resources, it is further proposed that integrated programmes in these fields be promoted at the national levels through international action.

D. Human resources implications for the Industrial Development Decade for Africa

102. The situation in Africa, particularly in the context of the Lagos Plan of Action for the Implementation of the Monrovia Strategy for the Economic Development of Africa (A/S-11/14, annex I) and the programme for the Industrial Development Decade for Africa, 6/ calls for special attention and special measures from the international community, the international organizations, and more so from the African countries themselves, for the accelerated development of human resources for industrialization.

103. In the industry component of the Lagos Plan of Action, a medium-term target of at least 1.4 per cent has been established as the region's contribution to world industrial production by the end of the Decade, if the region is to meet its share of 2 per cent established by the Lima Declaration and Plan of Action for the year 2000. Considering that most countries of Africa are still at the threshold of industrialization, and that the region contains 26 of the 36 least developed countries of the world, it may be concluded that attainment of the objective would require large-scale material, financial and other inputs. But more than material and financial inputs, it would require the accelerated development, full mobilization and effective utilization of its human resources.

104. Africa's problems in the development and utilization of human resources are well-known: the high rate of population growth, the growing level of both unemployment and underemployment, the shortage of different types and levels of trained manpower, the high level of adult illiteracy, deficiencies in the educational system etc. Clearly the priorities for Africa are the development of human resources with immediately usable skills at the high and middle levels of critical industrial sectors. The development of scientific and technological capabilities has to receive special priority - including the training of science and technology teachers and instructors, and the strengthening of existing industrial and technological institutions or the establishment of new ones.

105. While the emphasis will continue to be on national-level actions to build up national scientific and technological capabilities, there is plenty of potential and scope for co-operation to reinforce national actions. Particular importance should be attached to intra-African co-operation as an instrument for collective self-reliance and accelerated industrial development. There is a particular case for regional collaboration and support for regional programmes for human resources development, including centres of excellence and institutes that have been initiated for technology, design and manufacture, technical training and research.

106. Co-operation with other regions of the world is essential for the attainment of the industrial development objectives of Africa. International support for human resource development must, however, be seen as supplementary to, and reinforcing, national and regional efforts by the African countries themselves.

107. The role of the international community in the development of Africa's human resource capabilities for industrialization is crucial to the industrial development efforts of the region. The advanced countries need to review their financial, technical and economic co-operation arrangements with the African countries, and to accord high priority to the development of critical capabilities for industry. They need to expand education and training possibilities for African countries, inter alia, by providing more access to training and educational facilities in their own countries (if necessary, establishing a minimum yearly intake quota), making special arrangements for a reduction in fees and training costs to African students, expanding scholarship and fellowship programmes to enable African students to study in African universities (whenever possible) or in other countries and regions, and adopting policy and other measures to ensure that joint ventures and direct investments in African countries by companies from their own countries give high priority to training and include a training component in all contractual agreements. The advanced countries should also make available to African countries the results of research into newer approaches to the teaching and learning process, including suitable teaching and learning aids, curriculum development etc.

108. International organizations need to carry out a thorough review and reassessment of their programmes on human resource development in Africa, in the light of the programme of the Industrial Development Decade for Africa, and with special attention to the human resource requirements of industry in Africa. They should assist the African countries in reviewing the educational and training systems or programmes they now have, with a view to identifying inherent weaknesses and proposing action programmes for improving the quantity and quality of the manpower produced. Emphasis should be placed on the strengthening of existing institutional infrastructure, the mobilization of financial resources, the promotion of intra-African co-operation, particularly in the establishment of centres of excellence and teaching companies, the joint production of teaching and learning aids, the training of trainers etc.

E. Role of UNIDO and other international organizations

109. The subject of human resource development for industrialization is of direct importance and relevance to the work of UNIDO. UNIDO and other international organizations concerned - notably UNESCO and ILO - have an important role to play in helping the developing countries, especially the least developed countries, to develop their industrial manpower. Such assistance has to cover the total spectrum of the development process but should be well-formulated and channelled to priority actions determined by Governments. The critical areas of such assistance should include the identification of manpower needs, the formulation of policies, plans and programmes and the strengthening of mechanisms to co-ordinate the collection and dissemination of information on industrial manpower development. In this regard, assistance would be required in the identification of all existing and relevant industrial training opportunities at the national, subregional, regional and global levels, and the assessment and dissemination of information on each of them.

110. In addition, the ongoing programmes of these organizations related to industrial manpower development need to be critically re-examined, expanded in scope and redirected towards meeting the actual needs and requirements of the developing countries. Measures should be developed to ensure greater multiplier effects of the programmes. Above all, intensified efforts are needed to assist the developing countries, especially the least developed countries, in acquiring more financial resources (and making better use of existing ones) for industrial training, in acquiring or sharing training programmes, facilities and equipment, and in promoting the exchange of teachers, instructors, students and experiences among developing countries.

111. UNIDO, in co-operation with UNESCO, ILO and other relevant international organizations, could assist the developing countries by organizing study tours, familiarization courses and seminars for socio-economic researchers and policy-makers to other developing countries, especially the newly industrializing countries, related to industrial structures and processes and to the use of technical and social accelerators, economizers and adaptors in the development of human resources for industrialization. The study tours should also include industry familiarization visits (including visits to training and teaching companies) for officials dealing with education and training in ministries of industry, education, labour and manpower planning, for central and local government development officials, and for trainers, teachers and instructors in universities, polytechnics and other advanced technical institutions, in order to enable them to exchange experiences with their counterparts and to benefit from successes achieved by the countries being visited.

112. Assistance should also be provided in training national staff in the organization of data and information bases pertinent to the accelerated development of human resources for industrialization. In this regard, special programmes should be developed for industrial and manpower planners, as well as programmes for the development and provision of support services to indigenous entrepreneurs and to medium-scale and small-scale enterprises. Programmes for assistance in the development of indigenous consultancy services should be intensified, with special emphasis on the improvement of existing, or the development of new, policy measures.

113. Another area requiring the assistance of UNIDO, in collaboration with UNESCO, ILO and other relevant international organizations, relates to the review of formal education and training arrangements in the developing countries and their relation to estimated manpower needs and critical capabilities for accelerated industrial development. Such a review should include consideration of arrangements for the active participation of industry in human resources development, with particular reference to the selection of courses and the development of curricula; the provision of part-time teaching personnel; the acquisition of equipment, materials etc.; the provision of facilities for industry familiarization visits and on-the-job training in industry. The review should also cover the national machinery for planning, co-ordinating and monitoring the implementation of programmes for the development of human resources for industrialization, including, in particular, the role of industry, education and training institutions and other relevant agencies.

114. UNIDO could also assist selected developing countries in establishing teaching or training companies, at the national, subregional or regional level, in core industrial sectors. The concept of teaching companies has precedents, not only in the United Kingdom and Canada, but also in China, where the "Tien tsing and Shanghai" (old-established manufacturing centres) have already existed for several years. First, UNIDO could prepare a short and simple basic paper on the design and functioning of such teaching companies as a service to developing countries that wish to and could set up joint projects with foreign companies from the developed or developing countries.

115. Other areas for possible assistance by UNIDO, in co-operation with other relevant international organizations, include:

(a) A review, at the national level, of the structure and functioning of the knowledge industry. Such a review should include the role of national youth services, supported by mobile units, in promoting mass vocational education and in transmitting improved techniques, tools, implements and equipment for small-scale production in the rural areas;

(b) An examination of the possibilities of establishing multinational institutions for research and development related to the adaptation and local production of implements, tools, instruments etc., for education and training. The feasibility of setting up multinational joint enterprises, for the production of such materials, equipment etc. including "do-it-yourself" movements, should also be studied;

(c) Elaboration of proposals for the development of capabilities for the exploration, evaluation, extraction, transportation and trade in industrial raw materials;

(d) A review, at the national level, of the curricula consistent with requirements to deal with technological breakthroughs;

(e) The preparation of guidelines, based on experience and practice elsewhere, for introducing bridging courses as part of the programme for accelerated development of human resources for industrialization;

(f) A thorough review (including field studies commissioned by Governments) of existing support services to industry in general, and local industrial entrepreneurs in particular, with a view to revising their structure and coverage; improving the quality of staff and their methods of operation; and ensuring proper geographical distribution. In this regard, consideration should be given to more effective ways of promoting local consultancy services and to the role of public enterprise in promoting medium and small-scale entrepreneurship and management;

(g) Increased efforts by UNIDO to identify potential centres of excellence and to strengthen existing ones, including research and development institutes and selected university departments;

(h) The development by UNIDO of an information system to deal with training needs and training facilities as an integral part of its programme on centres of excellence: UNIDO should make such information available to the developing countries on a continuous basis;

(i) The development by UNIDO of regional, subregional and international networks of communication for professional exchanges and the formulation of assistance programmes between training institutions (including research centres) in developing countries;

(j) The organization, as a special training activity in the area of technology development and transfer, of special sensitization programmes (including meetings and workshops) to create awareness among the developing countries of the direction and possible consequences of new technological innovations;

(k) Assisting national Governments to identify training needs for the development of industry, in terms of critical capabilities and the specific needs of each country for each level and type of critical capability, with a view to assisting the country in meeting needs from its own resources and, to the extent necessary, with international co-operation;

(l) Acting as a catalyst by helping national Governments and training authorities to obtain suitable industrial training, wherever this may be available:

(i) By advising on the national industrial training system (including links between this and the national education and other relevant systems) and on the best use of all industrial training facilities in the country concerned;
(ii) By giving information about suitable training available in other countries;

(m) The "critical capabilities" referred to in chapter I may include any of the following categories and possibly others, as required by the circumstances of the country concerned, the order of priority depending also on local circumstances:

Industrial project planners (whose work includes monitoring implementation)
Negotiators for technology contracts
Entrepreneurs
Managers and supervisors
Engineers and other technologists (for construction, production and technical support services)
Consultancy capabilities
Research and development services (both in industry itself and in national industrial research and service institutions)
Technicians (intermediate between technologists and skilled workers)
Broadly skilled workers (essential for maintenance of all industrial equipment)
Trainers to multiply skill and knowledge
Training development advisers to link training institutions with the needs of industry.

Notes

1/ Lima Declaration on Industrial Development and Co-operation (A/10112, chap. IV).

2/ See the report of the Third General Conference of the United Nations Industrial Development Organization (ID/CONF.4/22, para. 127).

3/ Report of the First Consultation on the Training of Industrial Manpower (ID/WG.381/3), para. 8(a).

4/ Ibid., para. 8(b).

5/ Frederick E. Harbison and Charles A. Myers, Manpower and Education: Country Studies in Economic Development (New York, McGraw-Hill Book Co. Inc., 1965).

6/ Official Records of the Economic and Social Council, 1982, Supplement No. 11 (E/1982/21), chap. V, p. 76.