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DEVELOPMENT OF HUMAN RESOURCES FOR
INDUSTRIALIZATION IN AFRICA^{1/}

Prepared by
the UNIDO Secretariat

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EXECUTIVE SUMMARY

1. The African Heads of State and Government, in adopting the Lagos Plan of Action for economic development, were unequivocal in agreeing upon measures to ensure the development of an adequate human resource base for its implementation. The rationale for such a move was quite evident in that, faced with a crisis situation, the preoccupation as to why a continent so well-endowed with natural resources continued to be the least developed region and more susceptible to changes in external and global economic environment, became more pronounced and urgent.

2. The Lagos Plan of Action therefore emphasizes the paramount importance of systematic and integrated development and the use of human resources by the countries of Africa in order to accelerate their self-reliant development process with a view to removing the above paradox and to making the standard of living of its peoples complementary with the resource endowments of the continent. In the contemporary society, the level of development of human resources is commensurate with its level of development. The underdevelopment of the African continent therefore reflects the underdevelopment of its human resource base.

3. An important outcome of this historic conference, therefore, would be to advance and recommend actions on the most appropriate manner in which the development of human resources in the Lagos Plan of Action could be translated into practical measures and programmes. In order to assist the conference in this task, UNIDO has prepared, for consideration by the conference, this paper on the "Development of human resources for industrialization in Africa". The paper is in five chapters, namely: introduction; the role of human resources in the industrialization of Africa; past experiences and current and future trends in human resource development for industrialization in African countries; critical areas and lines of action; and conclusion.

Major declarations adopted by the African
Heads of State and Government on Africa's economic and
social development

4. In the introduction, a brief description is provided of the present economic situation and the various factors which, over the past 25 years, have contributed to the present socio-economic situation of the African continent. On the basis of the above scenario, the paper goes on to give a detailed analysis of the major declarations and programmes adopted by African Heads of State and Government and the United Nations on the economic and social development of Africa. The main declarations considered are:

- (a) The Lagos Plan of Action (LPA) and the Final Act of Lagos (FAL): These advocate for an inward-looking economic development through the concept of self-reliant and self-sustaining development. The timeframe of the LPA is to the year 2000 and, at that period, the expectation is an Africa that is socio-economically integrated with a high level of intra-African trade in African manufactures, services and technologies and contributing at least 2 per cent of the world industrial output. They also advocate self-sufficiency in food production and ultimately the establishment of an African Economic Community and Common Market by the year 2000.

(iv)

- (b) Africa's Priority Programme for Economic Recovery (1986-1990) (APPER): This programme appreciates the fact that for reasons both internal and external to Africa, the objectives of the Lagos Plan of Action and the timeframe are slipping and Africa is moving deeper and deeper into the economic doldrums. Whilst according highest priority to the attainment of food self-sufficiency and agricultural development as well as to the alleviation of the external debt burden of the continent, the programme underlines the pivotal role of industry and other supporting sectors in the attainment of those priorities. The timeframe adopted for this programme, 1986-1990, coincides with the remaining period of the programme for the Industrial Development Decade for Africa (IDDA).
- (c) The United Nations Programme of Action for African Economic Recovery and Development (1986-1990) (UNPAAERD): This programme is complementary both in spirit and content to Africa's Priority Programme for Economic Recovery. It underlines the role of the international community in supporting the development efforts of the African continent and establishes priorities for Africa that are similar to those of APPER. The pivotal role of industry in the socio-economic recovery of the continent, particularly its linkage with food self-sufficiency and agricultural development, is again underscored. The timeframe is the same as that for APPER.

5. In essence, all these declarations attempt to redress Africa's economic situation. The factors such as adverse terms of trade, collapse in commodity prices, decline in real terms of official development assistance (ODA), and other serious external and internal constraints that aggravated the economic crisis in Africa are analysed and measures for immediate and long-term solutions proposed.

Industrial Development Decade for Africa (IDDA)

6. This special programme, also treated in the introduction, was conceived with a view to bringing into sharper focus and to creating a greater awareness both within Africa and without of the pivotal role of industry in the socio-economic development. Covering the period 1980-1990, the IDDA is designed to take urgent action towards the accelerated industrialization of the continent and, secondly, to mobilize greater international, technical and financial support for the African countries in their industrialization endeavours.

7. Following the proclamation of the IDDA by African Heads of State and Government and the United Nations General Assembly, a programme for the Decade was prepared. In this programme, the Decade is divided into two indicative planning phases: a preparatory phase (1982-1984) and the implementation phase (1985-1990). Various plans and activities have been developed to ensure the most appropriate implementation and adequate monitoring of the programme. Institutional arrangements ranging from National Co-ordinating Committees through a Joint OAU/ECA/UNIDO Intersecretariat Committee to the policy-making bodies, especially the Conference of African Ministers of Industry, have been established for directing and monitoring efforts in the implementation of that programme.

8. During the preparatory phase of the programme, a number of activities

were carried out at all levels in preparation for the implementation phase. On the basis of those activities, it is envisaged that activities during the implementation phase will focus on the establishment of priority core industries and related industrial manpower and technological capabilities, support institutional machinery and raw material base. Particular attention would be paid to the mobilization of financial resources and the promotion of greater intra-African co-operation in all the facets of industrial development.

The role of human resources in the industrialization of Africa

9. The role of human resources in the industrialization of Africa is treated in chapter II of the paper. It is recognized that the pace and direction of industrial growth and innovation as well as of economic and social development is determined by 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. Emphasis is placed on the fact that effective planning depends on a clear national vision, a precise definition of the objectives of industrialization, and a well-conceived industrial plan and strategy covering industrial branches, sectors, sub-sectors and service sectors. The critical capabilities required for industrial development are identified. The major ones consist of policy-makers and planners; industrial entrepreneurs; managerial capabilities; engineers, technologists and scientists; technicians and skilled workers; and repair and maintenance capabilities. The role of each of these categories of capabilities in the industrialization process is briefly analysed and cross-references are made to document ODG.5(SPEC.) entitled "Accelerated development of indigenous entrepreneurial capabilities for small- and medium-scale industries in Africa" and document ODG.3(SPEC.) entitled "Strengthening the scientific and technological capabilities in African countries for industrial development" prepared by the UNIDO secretariat.

Past experiences and current and future trends in human resource development for industrialization in African countries

10. The past experiences and current and future trends in human resource development for industrial development in the African countries is analysed in chapter III of the paper. The paper draws attention to the fact that many African 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. It analyses the weaknesses inherent in the past and current educational systems in most African countries due to the fact that most of those systems have been patterned on systems prevailing in industrialized countries or passed down from colonial times, and have not often been adjusted to respond to the prevailing manpower requirements of the countries. This has also brought with it attitudinal and social problems in some of the trained manpower. The paper also notes the weak links between educational and training projects and institutions and industry. This has diminished the practical aspect of industrial training.

11. The lack of adequate educational and training institutions and facilities is stressed. This has particularly adverse effects for the rural population and women as well as on science education. In this regard, the paper

highlights the fact that 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).

12. With regard to future trends, the paper recalls the priority attached to human resource development in the major United Nations and OAU declarations on Africa's economic and social development as well as in the programme for the IDDA. It indicates, on the basis of data available in UNIDO, that the percentage of the labour force in the industrial sector to the total labour force amounted to 7.6 per cent in 1960 and 11.9 per cent in 1975, and is estimated to reach 15.0 per cent by the year 2000. These figures show that the share of the industrial labour force will continue to increase as industrial development takes on greater significance in the African countries. The figures are also indicative of the magnitude of the task that lies ahead in regard to human resource development for accelerated industrialization. In view of the large number of capabilities, especially engineers and technicians 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 African countries to consider creating their own institutions.

13. The paper also stresses the fact that while 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. It accords particular emphasis to intra-African co-operation and advocates for greater international co-operation.

Critical areas and lines of action

14. In chapter IV of the paper, the critical areas and lines of action at the national, subregional/regional and international levels are identified. At the national level, emphasis is placed on policies, strategies and plans, institutional infrastructure, and mobilization of financial resources. With regard to policies, strategies and plans, the paper stresses the fact that such measures have to be taken as part of the total, integrated package of national action for educational, industrial and overall economic development. The need for representatives from relevant Government departments, industry, training and the educational system to be associated in the planning process right from the very start is necessary in order to enhance the level of co-ordination and to ensure that the programmes are coherently designed, the manpower priorities well-identified and the mechanisms for implementing the plan agreed upon.

15. While rigid planning for human resource development is unsuitable, 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. 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, particularly for "core" industries.

16. The need for a periodic review and restructuring of educational and training policies is stressed. In restructuring educational and training programmes, consideration needs to be given to building transdisciplinarity and greater flexibility into the programmes. Emphasis needs to be given to scientific and technical education; special programmes designed to train women to perform at all levels and stages of the entire industrialization process; and use of the mass media coupled with the introduction of microcomputers and computer education into educational programmes at the earliest level.

17. Furthermore, the need to strengthen or establish centres of excellence and teaching companies is stressed and emphasis is placed on the training of trainers. Countries are called upon to adopt appropriate measures to reduce and eventually eliminate "brain drain". They are also called upon to take deliberate steps to encourage and support indigenous industrial entrepreneurship, by providing suitable incentives and creating a stimulating environment.

18. A special call is made for financing policies to extend to the contracting and implementation of foreign-aided projects and for systematic efforts to be made to train nationals throughout the process of design, fabrication, testing, erection and commissioning of industrial plants, 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.

19. With regard to institutional infrastructure, each country is called upon to establish, if this does not already exist, a co-ordinating body for human resource development 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 specified areas of planning, programming, implementation and monitoring of human resource development and utilization for industrial development. It should have a very close working relationship with the other ministries, especially those responsible for industry, education and planning, and should have, under its ambit, the relevant departments of universities and other institutions of higher learning.

20. The paper also calls for the establishment of a national advisory body consisting of representatives from the various sectors of the economy, especially the business and industrial communities, chambers of commerce or industry, universities, research institutions and financial institutions, 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 at the micro- (sectoral, subsectoral and institute)

level.

21. It stresses the fact that for the effective operation of the national institutional infrastructure for human resource development for industrial development, the responsibilities and terms of reference of each institution should be clearly defined in order to avoid undue duplication, conflict of interest and wastage of limited resources. In this regard, the role of the business community and industry, especially in providing facilities for practical training, is stressed.
22. Concerning the mobilization of financial resources, it is noted that 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 1 per cent of GDP be earmarked specifically for the development of scientific and technological capabilities.
23. Alternative sources for financing human resource development programmes are proposed. These include financing by industry. In advanced countries, a sizeable portion of the costs for technical education and training is provided by industry. In most African 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.
24. As an incentive, Governments are called upon to consider reimbursing, in whole or in part, the cost of education and training by industrial enterprises and by making tax concessions or allowing a deduction of expenditure on education and training for purposes of determining profits tax. Similarly, individuals may be allowed to deduct expenditures on approved courses for the education or training of the income-earner or his or her children and other qualifying dependants.
25. It is recommended that Governments insert training provisions in contracts for the purchase of equipment and plants; finance the development of education and training facilities through soft loans, gifts and technical assistance from abroad; and establish industrial training funds which, initially, could be financed from a special taxation on industrial promotion, and the import and export of industrial products and raw materials, and from industrial and technology contracts.
26. 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. The training of manpower should be considered as an essential part of projects they finance rather than as an optional adjunct to a project contract.
27. Governments are also called upon to 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 the mass media; the restructuring of subjects so as to reflect higher skill priorities and needs; and a fuller use of existing facilities (including laboratories).

Actions at the regional and subregional levels

28. The paper notes that in order to attain the most effective intra-African co-operation in human resource development, attitudinal barriers would have to be overcome and countries would need to have growing confidence in each others' technical capabilities. Such co-operation is essential as the conditions, problems and obstacles encountered are similar, communication between trainers and trainees relatively simpler, and the cost of training generally lower.

29. A number of measures to concretize intra-African co-operation are identified. These include the selection and strengthening of national institutions which could become regional centres of excellence; establishment of appropriate machinery, especially at the regional and subregional levels, for initiating and co-ordinating co-operative activities; the establishment of an information system on training needs and facilities; provision of consultancy and extension services; joint establishment of teaching companies; joint production of educational materials; and research in industrial teaching and learning processes.

Actions at the international level

30. The paper recognizes the great scope provided by international co-operation in support of the efforts of African countries. Because the costs of technical education and industrial training tend to be rather high, a logical option would be the intensification of international co-operation, e.g. in the exchange of information, teachers and students, in the joint development, production and sharing of educational and training programmes and materials; and in the joint financing of expensive research and training facilities.

31. The Governments of developed countries are invited to adopt appropriate policy measures which would (a) facilitate greater access by students from the African countries to their education and training institutions and facilities; (b) help to reduce fees and training costs to African students; (c) expand scholarship and fellowship programmes to enable African students to study in African universities (whenever possible) or in other countries and regions; (d) provide information, training programmes and aids to African countries; (e) make available to African countries the results of research into newer approaches to the teaching and learning process, including suitable teaching and learning aids and curriculum development; and (f) help to finance industrial training programmes and facilities in African countries.

32. Those Governments are also invited to adopt policy and other measures to ensure that high priority is accorded to industrial training in bilateral and multilateral technical assistance and aid programmes to African countries as well as in contractual arrangements for joint ventures, direct investments and technology transfer projects between companies from their countries and Governments or enterprises in the African countries.

The role of UNIDO and other international organizations

33. The paper underlines the importance and relevance of the work of UNIDO and other international organizations concerned, notably the Economic Commission for Africa (ECA), UNESCO and ILO, which have an important role to play in helping the African 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. These organizations are called upon to intensify their assistance to the African 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; in promoting the exchange of teachers, instructors, students and experiences among African countries; and in the establishment of institutional linkages.

34. Other areas of assistance from the international organizations include the organization of fellowship programmes and study tours; promotion of intra-African co-operation, including the upgrading of national institutions to regional or subregional centres of excellence; carrying out assessments of Africa's industrial manpower needs, including the development of an appropriate information system; and the preparation of in-depth studies and analyses in order to rationalize and advance concrete proposals for improvements in national education and training systems. In view of the importance of industrial rehabilitation and maintenance, it is proposed to proclaim an "African Year for Repair and Maintenance" 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.

Conclusion

35. In the concluding chapter V, it is appreciated that the task facing the African countries in the development of its human resources for industrial development is tremendous. African countries and organizations are called upon to take concerted action in accelerating the development of their human resources. The role of intra-African co-operation is emphasized along with the need to intensify international co-operation not only with other developing countries but also with the developed countries. The role of the international community and organizations in assisting the African countries to develop their human resources for industrialization needs to be intensified. In this regard, the special critical role of UNIDO in assisting African countries and organizations in this important field is emphasized.

I. INTRODUCTION

A. Basic considerations

1. The question being posed repeatedly is why a continent that is so highly endowed with all the ingredients necessary for socio-economic development should be so under-developed. This question is a simple one but the answer is very complex. At the African level, it took up to 20 years of post-independence trial and many fora to identify the fundamental problems and to come up with a prescription for a remedy. One would have to go back to the scramble for Africa and the partition of the continent! This process divided Africa into innumerable fragments, the majority of resulting countries economically unviable with populations of less than 1 million. The economies of most countries are typified, inter alia, by vicious poverty and low levels of production in an environment marked by serious deficiencies in basic socio-economic infrastructure, most especially by a lack of physical capital, research capabilities, technological and human resource development that are indispensable to an integrated and dynamic community.

2. Despite some 25 years of independence during which Africa should, at least in principle, have been master of its own destiny, the present economic picture is still gloomy. As pointed out in the preamble to the Lagos Plan of Action (LPA), "Africa is unable to point to any significant growth rate. Whatever socio-economic indicator is used - be it per capita income, the share of primary activities in total production, school enrolment ratios, access to safe water, mortality or health - most African countries can be seen to be lagging behind other developing countries". The number of African countries listed as "least developed" by the United Nations recently increased to 27 out of a world total of 40, while 21 out of 34 countries classified by the World Bank as "low-income" developing countries are located in Africa.

3. Progress towards the achievement of the quantitative targets of the Lima Declaration has fallen short of expectation. The average annual growth of manufacturing value added for developing Africa has remained about the same as the average of 6 per cent obtained during the period 1970-1977. Although reasonable where internal problems of some countries and recent trends in world economic conditions are concerned, this rate is, nevertheless, well below the 8 per cent target set in the International Development Strategy and even less satisfactory when the requirements for achieving the regional contribution to the Lima target are considered. Africa's share in world production of manufactures has remained little changed since 1978 at less than 1.0 per cent of the total (in 1975 prices). This compares to a continued slight increase in the share of other developing regions which rose to about 9 per cent of the total, thus indicating a declining African production relative to other developing regions.

4. Most African countries are increasingly placing high priority on industrial development in order to facilitate the achievement of their social and economic goals, the existing industrial structure in most African countries, however, poses issues of considerable concern. The rate of growth of industry in African countries has been very slow, with industry accounting for only a small percentage of the gross national product (GNP). The process of industrialization which involves managerial, technological, economic, social and political considerations and parameters, dynamically composed,

orchestrated and performed by a changing cast of players, participants and decision-makers is also becoming more complex. This involves the building and management of enterprises which harmonize and integrate resources, technology and human effort for productive purposes.

5. The share of manufacturing in the region's gross domestic product (GDP) is still appreciably lower than the comparable average for all other developing countries, while agricultural performance has dropped rapidly. The economic activities in most countries of the region continue to be concentrated on the production of primary commodities for export to markets and at prices over which they have no control. The basic factor inputs for the production of those commodities are imported and paid for in much needed foreign exchange which exceeds by far their earnings from the exports. This has brought about another fundamental feature of Africa's sad economic condition, its high level of external debt. As a result of the worldwide economic crisis whose effect on Africa has been further compounded by natural disasters, several African countries are unable to service their external debt.

6. There is thus a growing disenchantment in several African countries with the present pattern of industrial growth and of development in general. While significant results have been achieved in some countries, the total impact of science and technology on the industrialization process has fallen considerably short of the socio-economic needs in most African countries. The economic benefits of industrial development have not seeped down to the poorer segments in these countries, which reside mostly in rural areas and which have remained largely unaffected by industrial development concentrated largely in urban areas. Industrial growth based on traditional western production and consumption patterns have not been oriented to meet the legitimate needs and aspirations of the larger rural community in the majority of African countries in terms of employment, income and basic socio-economic needs. Poverty and unemployment have, in fact, become intensified, not only in rural areas but also in the urban sector. Income disparities have tended to grow instead of being reduced and, above all, certain basic needs of the community, especially food security, remain unfulfilled, creating and accentuating a critical dichotomy in the development process.

B. The Lagos Plan of Action (LPA) and the Final Act of Lagos (FAL)

7. It was against the above gloomy economic background that the African policy-makers resolved that, unless the fundamental factors underlying their economic and social crises are attacked at the root through durable and long-term structural transformation, Africa will perforce remain the sick child of the international community. This decision led to the convening of an extraordinary session of the OAU Summit in Lagos (Nigeria) in April 1980 devoted to the economic situation of the continent. At that meeting, they undertook a critical examination of the economic situation in their countries and the region as a whole, and adopted the Lagos Plan of Action for the economic development of the region for the period 1980-2000. The Plan deals with all sectors of African development and aims at promoting the development of indigenous African capabilities necessary for the achievement of the twin goals of collective self-reliance and self-sustained development.

8. In recognition of the pervasive and pivotal role which industry plays in economic development of the African countries, the OAU Heads of State and Government ranked industrialization second among the priorities in the African

strategy for the Lagos Plan of Action, first priority being accorded to self-sufficiency in food production. This high priority accorded to industrial development is fully reflected in the Lagos Plan of Action. Thus, paragraph 56 of the Plan asserts that "the industrialization of Africa in general, and of each individual Member State in particular, constitutes a fundamental option in the total range of activities aimed at freeing Africa from underdevelopment and economic dependence. The integrated economic and social development of Africa demands the creation, in each Member State, of an industrial base designed to meet the interests of the country and strengthened by complementary activities at the subregional and regional levels". Furthermore, in the Final Act of Lagos, industry was selected as one of the priority sectors for continental integration during the 1980s.

9. The long-term objectives for the industrial sector set for the region in the Lagos Plan of Action call for an increase to at least 2 per cent in the region's contribution to world industrial production by the year 2000, the corresponding share being 1.4 per cent by the end of the Decade. African countries are urged to do everything in their power to achieve self-sufficiency by 1990 in the food, building materials, clothing and energy sectors, while during the first half of the Decade the foundation will be laid for the phased development of the following basic industries essential to the achievement of self-reliance: food and agro-industries, building industries, metallurgical industries, mechanical industries, electrical and electronic industries, chemical industries, forest industries and energy industry.

C. Africa's Priority Programme for Economic Recovery (1986-1990) (APPER)

10. In view of the persistent deterioration of the economic crisis in Africa resulting in untold misery to the peoples of the continent, the OAU Heads of State and Government, during their twenty-first ordinary session at Addis Ababa (Ethiopia) in July 1985, decided to adopt Africa's Priority Programme for Economic Recovery (1986-1990) to cope with the emergency and to lay the foundation for absorbing the shock of future emergencies. The programme provides a framework for translating the broad principles and objectives of the Lagos Plan of Action and for the structural transformation of the African economies into a sharply focused series of operational activities to be implemented over the next five years (1986-1990). It is designed to pave the way towards the attainment of a lasting and durable structural change and an improved general level of productivity.

11. The Programme acknowledges the shortcomings in the current development policies of the African countries and represents an unambiguous statement of full commitment on the part of the African leaders to undertake a number of measures to remedy those shortcomings. Its implementation would help to bring about a radical change in the patterns of production and consumption, social and economic structural transformation, accelerated economic growth and development, as well as the economic integration of the region.

D. The United Nations Programme of Action for African Economic Recovery and Development (1986-1990) (UNPAAERD)

12. The African Governments, in adopting the various measures to redress Africa's economic situation, have often appreciated the fact that they cannot develop or implement those measures and the programmes they adopt in isolation since some of the constraints being encountered are exogenous to Africa. The

international recession, the collapse in commodity prices, the adverse terms of trade, the decline in real terms in official development assistance (ODA), increased protectionism, high interest rates and the heavy debt burden and debt servicing obligations of African countries are, e.g. among the more serious external constraints that aggravate the economic crisis in Africa.

13. It was against the above background that the African leaders requested for a special session of the United Nations General Assembly on the critical economic situation in Africa with a view to mobilizing international support for their efforts in abetting that situation. That special session adopted the United Nations Programme of Action for African Economic Recovery and Development (1986-1990) which is similar in content and spirit to Africa's Priority Programme for Economic Recovery (1986-1990). It calls upon the international community at various levels to lend support to the African countries, especially in mobilizing the \$40 billion estimated to be generated by the international community to finance the various economic recovery and development programmes and projects in Africa.

E. Industrial Development Decade for Africa (IDDA)

14. Although food and agricultural production is accorded the highest priority in the various political declarations adopted by the African countries and the international community on the economic situation in Africa, particular emphasis has always been given to other sectors that support agricultural and food production, especially the industrial sector. In this regard, it acknowledges and underscores the pivotal role which industry has to play in the overall socio-economic emancipation of Africa. It also underlines the fact that if Africa's agricultural resources are to be efficiently exploited, the linkages between agriculture and other sectors, notably industry, have to be strengthened. Accordingly, the programme envisages the establishment of strong structural linkages between agriculture and industry through the provision of, inter alia, agricultural implements and tools, fertilizers and pesticides as well as the processing of food and other agricultural products. Furthermore, a permanent solution to the external debt crisis on the continent would depend on the local production of industrial goods and services whose importation currently accounts for most of Africa's external debt and foreign exchange expenditure. The above substantiates the view advocated by UNIDO, and increasingly being accepted internationally, that a lasting solution to the food, agricultural, debt and, indeed, the economic crises in Africa lies in the accelerated development of the industrial sector.

15. In the light of the above and in order to accelerate and facilitate the implementation of the industry chapter of the Lagos Plan of Action, the OAU Heads of State and Government proclaimed the 1980s as the Industrial Development Decade for Africa (IDDA). The Decade was designed, firstly, to generate greater awareness in the African countries of the need to take urgent action towards the accelerated industrialization of the continent and, secondly, to mobilize greater international technical and financial support for the African countries in their industrialization endeavours. This proclamation subsequently received international support by the United Nations General Assembly which adopted, on the recommendation of the Third General Conference of UNIDO, resolution A/RES/35/66(B) proclaiming the Decade.

16. By the proclamation of the Decade, the African Governments reaffirmed their decision to accord, in their development plans, a major role to

industrialization with a view to enhancing its impact on meeting the basic needs of the population, ensuring the integration of the economy and the modernization of society as well as to achieving a greater share of world industrial production. They were also fully aware that such a proclamation would confer certain obligations on those who work for it and thus undertook a commitment to take all necessary steps and to make an appropriate contribution to the efforts required to ensure its success.

17. Following the proclamation of the Decade, the OAU, Economic Commission for Africa (ECA) and UNIDO jointly formulated proposals for the programme for the Decade which were adopted by the Sixth Conference of African Ministers of Industry in 1981 at Addis Ababa (Ethiopia). Those proposals (reproduced in document ID/287) were subsequently endorsed by the OAU Heads of State and Government and by the United Nations General Assembly. They provide a framework for the formulation and implementation of the programme for the Decade at the national, regional and international levels.

18. The programme for the Decade is based upon the broad guidelines, orientation, quantitative targets and subsectoral priorities provided in the Lagos Plan of Action. Its ultimate objective is to contribute to the attainment of self-sufficiency in food production in Africa. It is also directed towards the development and provision of a wide range of industrial inputs and services required for the development of the other sectors, especially agriculture, transport and communications and energy, as well as important factor inputs to the industrialization process, particularly manpower, technology, energy, raw materials, institutional infrastructure and financial resources. Implementation of the programme was divided into two indicative planning phases: a preparatory phase (1982-1984) and the implementation phase (1985-1990). Guidelines (document ID/310), outlining the priority activities to be carried out during the preparatory phase of the programme, were subsequently drawn up by the three secretariats and endorsed by the African Ministers of Industry.

19. During the preparatory phase of the programme a number of countries took steps in preparation for the implementation of the programme for the Decade. Many countries established national co-ordination committees and operational focal points, and others incorporated in their national industrial development plans and programmes the principles and ideas contained in the programme for the Decade. At the subregional level, steps were taken to strengthen subregional industrial co-operation. At the international level, assistance was provided, largely by UNIDO, to African countries and international organizations in the formulation and implementation of their programmes for the Decade. Special efforts were also made to popularize the Decade both within Africa and without. Investment promotion activities, including investment forums and solidarity meetings, were organized as a means of assisting African countries to mobilize financial resources for their Decade programmes and projects.

20. On the basis of the activities carried out during the preparatory phase of the Decade, it is envisaged that activities during the implementation phase will focus on the establishment of priority core industries and related industrial manpower and technological capabilities, support institutional machinery, raw materials base and financial resources. Special emphasis is also being accorded to the promotion and realization of intra-African industrial co-operation.

21. The role of the industrial sector in Africa's economic recovery has been clearly emphasized in the policy documents identified earlier, notably Africa's Priority Programme for Economic Recovery (1986-1990) and the United Nations Programme of Action for African Economic Recovery and Development (1986-1990). Although the implementation of the Decade programme has been slow, it has now been recognized, more than ever before, that it has a decisive role to play in the attainment of a long-term solution to the economic crisis affecting the African region. The African countries, international organizations, especially UNIDO, and the entire international community have therefore been called upon to take all necessary measures to ensure the successful implementation of the Decade programme. The African Ministers of Industry, meeting at their Eighth Conference in Bujumbura (Burundi), therefore decided to recommend the proclamation of a second Decade.

22. In the United Nations and the OAU programmes for Africa and the IDDA, the need for a more effective development and utilization of human resources and for ensuring a greater participation of the population in the development process is stressed. It would therefore be necessary to intensify measures for the development of human resources and technological capabilities with emphasis on the selection of national and regional/subregional training centres and institutions with a view to strengthening their capabilities for providing industrial training at the regional or subregional level. Intra-African co-operation in the area of human resource development also needs to be intensified through the elaboration of subregional training programmes with country specialization for promotion among potential donors. Emphasis also needs to be accorded to the organization of training seminars in such areas as project preparation and evaluation and technology acquisition as well as in-plant group training programmes in Africa in selected industrial branches such as metalworking, cement production, maintenance of agricultural machinery, etc.

II. THE ROLE OF HUMAN RESOURCES IN THE INDUSTRIALIZATION OF AFRICA

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

23. It is increasingly being recognized that the pace and direction of industrial growth and innovation as well as of economic and social development is determined by 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. 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 African 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.

24. 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. This would, in turn, influence priorities in education and choices between training at home and abroad. It would also 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

25. The broad range of occupational categories that are essential to industrial development includes managers, scientists, technologists and professional engineers; supervisors, technicians, craftsmen, skilled, semi-skilled and unskilled workers and support-service personnel trained in a variety of skills (e.g. engineering design, production technology, testing and quality control, material management and value engineering, research and development, feasibility studies and consultancy). Similarly, there is a need for a core of personnel trained in the survey, exploration, extraction, development and processing of natural raw materials as well as in such fields as economy, accountancy, information science, sociology, marketing and finance, 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.

26. Some of these categories are considered to be particularly relevant to African countries still at the initial stages of industrialization. The type and number would depend upon the manpower profile required for each operation of the industrialization process and the choice of the particular technology.

27. To develop the capabilities required to cover the broad range of occupational categories, there would be a need for institutional structures for education, training, research and support services. There would also be a need for suitable instruments and mechanisms for co-ordinating, implementing and monitoring the development of those capabilities as well as for ensuring effective consultation and co-operation between Government, industry and educational and training institutions. Moreover, these steps would need to be backed up by financial, material and other support. The critical occupational categories that would apply to most African countries are described in the following paragraphs.

1. Capabilities in support of policy-making and planning

28. At the early stage of industrial development in which most African countries find themselves, the most urgently needed critical capabilities would seem to be the ones directly related to policy-making, planning and implementation, including the collection, assessment and selection from available alternatives of information relevant to national priorities.

29. Macro-economic data and techniques alone are of limited use and would have to be considerably supplemented by information on existing industrial production capacities, including traditional technologies of industrial raw materials and natural resources, and other factor inputs. This would also involve 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.

30. 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

31. 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.

32. 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 only on the establishment of large-scale core industries (metals, heavy engineering, basic chemicals and petrochemicals, pulp and so on) under the aegis of public or joint enterprises, but also on the availability of a large number of entrepreneurs operating medium- or small-scale enterprises.

33. Support services and institutions set up to encourage indigenous entrepreneurs to enter industry should take into account such considerations as their characteristics, strengths and weaknesses, sectoral and intrasectoral distribution and susceptibility to particular kinds of incentives. Government action therefore needs to 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.

34. Comprehensive proposals for promoting the development of industrial entrepreneurial capabilities in Africa are provided in document ODG.5(SPEC.) entitled "Accelerated development of indigenous entrepreneurial capabilities for small- and medium-scale industries in Africa" which has been prepared by the UNIDO secretariat.

3. Managerial capabilities

35. 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.

36. The importance of middle-level management, supervisors and specialists of services should not be neglected. Procurement and control (including standardization and quality control), research and development, market research and marketing are among the critical areas for consideration. This is the level at which a company's performance could be decided and at which innovations are likely to be seen.

4. Engineering, technological and scientific capabilities

37. 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; and to solve problems of product development and of industrial relations. They also have to cope with 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 and their effects on work habits. 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.

38. 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.

39. The designing of industrial products, the application of production technology, production and quality control, materials management and value engineering are among the many facets of industrial engineering that are needed in any manufacturing industry. Systems analysis, operations research, design and development, socio-economic cost benefit analysis, feasibility studies and project reporting are among 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.

40. Indigenous business consultancy groups, development banks and small industry service institutes could play a very important role by guiding the development and expansion of middle-level and small-scale enterprises which can hardly afford to employ foreign consultancy services. 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 therefore needs to be given every encouragement in Government planning.

41. 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. This involves, e.g. the application of 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 techniques 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 and remote sensing), and their possible implications for scientific and technological developments in African countries.

42. 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.

43. In view of the special importance of this category of human resources, comprehensive proposals are advanced in document ODG.3(SPEC.) entitled "Strengthening the scientific and technological capabilities in African countries for industrial development" which has been prepared by the UNIDO secretariat.

5. Technicians and skilled workers

44. 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 programme.

45. 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 UNIDO estimates, for every engineer, technologist or scientist, five skilled workers are needed.

46. 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 African countries (as in developed 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, e.g. 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

47. African 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.

48. In the short term, for almost all African 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.

49. An important 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. Another category which is too little known in African countries consists of training development advisers whose vital function is to link training institutions with the needs of industry.

III. PAST EXPERIENCES AND CURRENT AND FUTURE TRENDS IN HUMAN RESOURCE DEVELOPMENT FOR INDUSTRIALIZATION IN AFRICAN COUNTRIES

A. Past experiences and current trends

50. Many African 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.

51. Education in most African countries has been patterned on systems prevailing in 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 industrial structures, many African countries have not subjected their systems to review or, if they have done so, have failed to make effective changes.

52. It is no surprise, therefore, that many African countries have been disappointed in the outcome of their educational programmes in spite of heavy expenditures. The system has, in many cases, proved irrelevant and unresponsive to the changing needs of the country. In some countries, it tends to hinder initiative and creative talent and generally fails to meet the need for a better educated and more rounded and 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.

53. Where training has been received in advanced countries or in imitative

institutes set up within African countries, it has resulted in elitist, alien attitudes, values and life-styles not rooted in the soil of the African countries. Foreign management courses, seminars and workshops often do not cover issues that are of prime importance for enterprises in African countries. Also, while international experts admittedly play an important role, undue reliance on their advice needs to be avoided, since experience has shown that this has tended to perpetuate intellectual dependence.

54. Because of the high cost of equipment for practical training, universities in African 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. They are, instead, creating a mass of unemployed lawyers, accountants, economists, historians, sociologists and other social scientists. There is thus a mismatch between university products and industrial needs on the one hand, and between job opportunities and vocational training courses on the other. This mismatch has helped to perpetuate a heavy reliance on costly expatriate technicians to support industry.

55. 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.

56. 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 strengthening the linkages between industry and the educational system and by reorienting the programmes. There are, fortunately, signs in many African countries of a swing away from the humanities towards science and technology. These efforts, however, need to be redoubled.

57. 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.

58. 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, e.g. the production and distribution of newspapers, journals, books, educational materials, fixed and mobile libraries and bookshops, radio, television, video and mobile science centres. In most African 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.

59. 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 environment 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.

60. 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 transdisciplinary orientation in education, research and training is required, as are new attitudes on the part of labour, management and Government as well as 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.

61. 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, e.g. design engineers, systems analysts and maintenance engineers.

62. 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 elite 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.

63. 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.

64. 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.

65. An awareness of previous deficiencies is now leading some African 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, e.g. 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

66. The Lagos Plan of Action, the programme for the Industrial Development Decade for Africa, the OAU Africa's Priority Programme for Economic Recovery (1986-1990) and the United Nations Programme of Action for African Economic Recovery and Development (1986-1990) call for special measures to be taken to accelerate the development of human resources for industrialization. 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 27 of the 40 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.

67. 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 would have 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.

68. On the basis of data available in UNIDO, the percentage of the labour force in the industrial sector to the total labour force amounted to 7.6 per cent in 1960 and 11.9 per cent in 1975, and is estimated to reach 15.0 per cent by the year 2000. These figures show that the share of the industrial labour force will continue to increase as industrial development takes on greater significance in the African countries. The figures are also

indicative of the magnitude of the task that lies ahead in regard to human resource 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 number of capabilities, especially engineers and technicians 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 African countries to consider creating their own institutions.

69. Ultimately, the nation's educational system will have to prepare future workers to function in a society characterized by increasing applications of new technologies, 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 the 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, e.g. 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, and by encouraging collaborative programmes between secondary schools and higher institutes of learning and industry. This trend is likely to be followed by more and more countries as time goes by.

70. Another consequence of technological change is that some people may have to change their occupations one or more times during their lifetime, while others may have to change their functions as their employment is upgraded. Educational systems would need to 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 broad-based and less job-specific.

71. 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 would have to 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 resource development, including centres of excellence and institutes that have been initiated for technology, design and manufacture, technical training and research. Greater co-operation with other regions of the world would also be 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.

IV. CRITICAL AREAS AND LINES OF ACTION

A. Actions at the national level

1. Policies, strategies and plans

72. There is an urgent need for Governments to review and adjust existing policies, strategies and plans for human resource development and to adopt new ones, as need be, taking into account the critical capabilities identified in chapter II(B) above. The policies, strategies and plans for human resource development 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.

73. 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.

74. 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 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 with other developing countries, of facilities in those countries; and (c) needs that could be met through international co-operation with developed countries.

75. National education and training policies need 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.

76. 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.

77. 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 the mass media, especially television, mobile training units and radio. The establishment of science centres also needs to be considered.

78. Technical universities, science and technology parks, teaching and training companies, science clubs and centres of excellence are among the 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.

79. 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 African 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 dropouts, could also be trained through special programmes to handle certain low-level skilled jobs in industry.

80. In the past, traditional forms of education in most African countries have not provided equal opportunities for the education and training of women, so that any national education and training programme should 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.

81. Special attention needs to 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.

82. 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.

83. The important role of the entrepreneur in the industrialization process has already been stressed. The Government needs to 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 relief 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 for and purchase of equipment, etc.

84. 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 of industrial plants, 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.

85. 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 need to restructure their programmes, offering courses in such much-needed areas as production engineering and financial management, thus making their programmes more relevant. They should be encouraged to 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 decision-making and self-reliant development.

86. 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.

87. National planning also needs to 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

88. There is a need for each African country to establish, if this does not already exist, a co-ordinating body for human resource development 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 specified areas of planning, programming, implementation and monitoring of human resource development and utilization for industrial development.

89. In some countries such a co-ordinating body 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.

90. It would also be desirable to have some sort of a national advisory body consisting of representatives from the various sectors of the economy, especially the business and industrial communities, chambers of commerce or industry, universities, research institutions and financial institutions, 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) level.

91. 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 resource development for industrialization would be essential.

92. 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 such skilled labour 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.

93. It is important for the effective operation of the national institutional infrastructure for human resource development for industrial development that the responsibilities and terms of reference of each institution be clearly defined in order to avoid undue duplication, 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 and desirous of complementing or supplementing each other's activities.

94. The potential role of the business community (both public and private) in the academic programmes of universities and other technical institutions in the country needs to be fully explored. The contribution of the business sector, e.g. 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 and sponsorship of research work, will help to build up the training programmes offered, and to relieve some of the financial burden which, in most African 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.

95. In some African 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.

96. A teaching company is concerned, as a corporate institution, with the full range of manufacturing (e.g. procurement of raw materials and other factor inputs, production, marketing, research and development, extension and consultancy services). 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 for engineers and technologists) or as substitutes for formal education (especially at the level of the workshop operative). This would seem to be a useful means for African 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 or other developing countries) ought to receive serious consideration in programmes for the rapid development of human resources for industrial development.

97. The institutional infrastructure for the development of human resources for industrialization would also include centres of excellence. These are 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 African countries. It has been found useful 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.

98. 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 African 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 needs to be given particular consideration.

3. Mobilization and optimization of financial resources

99. In many African 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 1 per cent of GDP 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.

100. In advanced countries a sizeable portion of the costs for technical education and training is provided by industry. In most African 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

101. 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 African countries have begun to follow the example of developed countries in setting up industry training boards and industrial training funds.

102. 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.

103. 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, where this does not exist, 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.

104. 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 need to 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 the mass media; 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 and facilities and aids (such as films); 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 regional and subregional level

105. Perhaps the most effective means of facilitating intra-African co-operation is for the African countries themselves to recognize the need for greater collective 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.

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

107. Fortunately changing conditions are favouring this type of co-operative endeavour. These include: improved communication and a greater awareness of common problems; a knowledge of existing capacities, as well as wider access to training facilities available in other African countries; the establishment of regional and subregional training institutions; 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.

108. The considerable experience and expertise in the development of human resources for industrial development accumulated by some African countries could very usefully be shared with others. 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 African countries. Regional and subregional 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 African countries.

109. African 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.

110. The scope for co-operation among African 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 statesmanship 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.

C. Actions at the international level

111. 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 African countries themselves, there is nevertheless great scope for greater co-operation at the international level not only between the African and other developing countries, but also between the African and the developed countries. Because the costs of technical education and industrial training tend to be rather high, a logical option would be the intensification of international co-operation, e.g. in the exchange of information, teachers and students, in the joint development, production and sharing of educational and training programmes and materials and in the joint financing of expensive research and training facilities.

112. A great demand is emerging in the African 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 other developing and developed countries, through bilateral and multilateral co-operation arrangements and through commercial relations at the enterprise level, could be very useful.

113. The developed and advanced developing countries should also review their financial, technical and economic co-operation arrangements with the African countries with a view to according 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 greater access by students from the African countries to their education and training institutions and facilities; 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; the supply of information, training programmes and aids to African countries; making available to African countries the results of research into newer approaches to the teaching and learning process, including suitable teaching and learning aids and curriculum development; and the financing of industrial training programmes and facilities in African countries.

114. They need to adopt policy and other measures to ensure that high priority is accorded to industrial training in bilateral and multilateral technical assistance and aid programmes to African countries, as well as in contractual arrangements for joint ventures, direct investments and technology transfer projects between companies in the developed and other developing countries and Governments or enterprises in the African countries. Consideration should be given to strengthening existing focal points in the developed and other developing countries or establishing new ones to co-ordinate relevant programmes undertaken in co-operation with the African countries.

115. 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.

D. Role of UNIDO and other international organizations

116. 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 the ECA, UNESCO and ILO - have an important role to play in helping the African 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, there is a need to identify 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.

117. 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 African countries. Measures should be developed to ensure greater multiplier effects of the programmes. Above all, intensified efforts are needed to assist the African 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 African countries, and the establishment of institutional linkages.

118. UNIDO, in co-operation with the ECA, UNESCO, ILO and other relevant international organizations, needs to intensify assistance to the African countries, including the organization of study tours, familiarization courses and seminars for socio-economic researchers and policy-makers to the developed and 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.

119. Greater assistance also needs to 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.

120. Experience in the majority of the African countries suggests that most of them 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. International organizations, particularly the ECA, UNESCO and ILO, could intensify their assistance to African countries in reorienting their education and training programmes in order to respond more closely to the present and future needs of industrial development, taking into account the impact of technological innovations and advances.

121. The above is another area requiring the assistance of UNIDO, in collaboration with the ECA, UNESCO, ILO and other relevant international organizations. Furthermore, these organizations need to increase their assistance to 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 increasing the quantity and improving the 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 and the training of trainers.

122. The above assessments need to include an estimate of the future manpower needs and critical capabilities for accelerated industrial development, taking into account the impact of technological innovations and advances. It should also include measures to enhance the active participation of industry in human resource 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 and materials; 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.

123. A major short-term task of industrialization in African 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, consideration might be given to the proclamation of an "African Year for Repair and Maintenance" 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. In view of the need for African 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.

124. UNIDO could also assist selected African 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 those African countries that may wish to establish such companies, either individually or as joint projects with foreign companies from the developed or other developing or African countries.

125. 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 upgrading national institutions to the regional or subregional level for research and development related to the adaptation and local production of implements, tools, instruments, and material for education and training. The feasibility of setting up multinational joint enterprises for the production of education and training materials and equipment, including "do-it-yourself" kits, 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) Development, at the national, subregional or regional levels, of the training programmes 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 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) The identification of potential centres of excellence and the strengthening of existing ones, including research and development institutes and selected university departments;
- (h) The development of an information system to deal with training needs and training facilities as an integral part of its programme on centres of excellence: UNIDO could make such information available to the African countries on a continuous basis;
- (i) The development of regional, subregional and international networks of communication for professional exchanges and the formulation of assistance programmes between training institutions (including research centres) in African countries;
- (j) The organization, as a special training activity in the area of technology development and acquisition, of special sensitization programmes (including meetings and workshops) to create awareness among the African 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 those 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, 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 industrial training facilities in the country concerned, and by giving information about suitable training available in other countries.

V. CONCLUSION

126. The most important factor input for industrialization in the African region is industrial manpower. The achievement of the strategy for self-reliant and self-sustaining industrial development enunciated in the programme for the Decade as well as in the various programmes adopted by the United Nations and the OAU depends, to a large extent, on the development of the requisite local industrial capabilities. This of course would be contingent upon the pattern of industrial production which determines the number and type of industrial skills required. Even now, after having passed the half-way mark in the Decade, the gap is still appreciable. This deficiency is very often related to existing educational policies and programmes, which are not equipped to cope qualitatively and quantitatively with the entire spectrum of industrial activities, especially those related to the development of core industries.

127. In the light of the above, there is a need to take concrete action for the accelerated development of human resources for industrialization. Any national action plan for the accelerated development of human resources for industrial development would necessitate long-term programmes of a comprehensive nature ranging from the provision of sound educational facilities and reorientation of curricula to vocational training, the creation of specialized cadres of technicians, scientists, managers and industrial entrepreneurs. Such programmes should, in addition, take note of the requirements of the decentralized sector and of the need for enhancing the involvement of women in industrial activities. The human being is indeed the centre of the innovation process. Experience has shown that innovations often sprang from groups of individuals working closely together and developing skills and experience in a specialized area.

128. The establishment and operation of training programmes for the development of the wide variety of competencies required for industrial development is therefore very basic if the African countries are to make a breakthrough in their social and economic development. Actions required in the area of training would need to be directed towards the development of personnel in technological institutions, personnel in a variety of institutions and technological staff of relevant departments of industrial enterprises. In each of these categories various levels of personnel ranging from top management to the technical level have to be developed. In this

connection it may be noted that the management of educational and financial institutions has been widely recognized as a profession for which special competence needs to be developed.

129. In view of the present situation in which Governments are already allocating large proportions of their budgets to education and training, it is necessary to explore better ways of utilizing these resources in order to produce the right types of skilled personnel needed for Africa's industrialization. In order to achieve this, Governments have to take measures to involve industry actively in all forms of training and resolve the problems of shortages and imbalances in manpower. In addition, the process of importing technical skills should be viewed in a much larger perspective than at present.

130. The actions required for developing appropriate personnel for industrial development need to start at the fundamental stages. The industrial and business communities need to be fundamentally oriented with the particularities of industrial development. Intensive action, initially at the national level and internationally assisted, needs to be undertaken in reforming the educational programmes at the university and pre-university educational institutions in the technical fields in order to imbed in potential technologists, at an early age, a fundamental appreciation of technology.

131. The establishment of special training institutions, centres of excellence and teaching companies, on a multi- or mono-sectoral basis, might be considered in some African countries. Such institutions could be developed to provide services to other countries of the region. In addition to the formal training programmes which need to be developed to meet specific needs, there is also a need to establish a systematic approach for in-service training.

132. Intimately linked with the programme for the development of national personnel for industrialization is the need to establish the status as well as appropriate salary and compensation schemes to encourage a greater proportion of the business community to take up technological activities. This would also help to reduce and ultimately eliminate "brain-drain".

133. The development of human resources for industrialization is an area which lends itself to intra-African co-operation. Such co-operation could be significantly supported by co-operation at the international level. In this regard, UNIDO and other relevant international organizations, especially the ECA, UNESCO and ILO, have a significant role to play. UNIDG, e.g. in intensifying its future technical co-operation activities in Africa, would need to accord special priority to the elaboration and implementation of industrial manpower development plans and programmes. That assistance could focus on the following priority activities:

- (a) Adopting a medium-term approach to the organization of training activities in the African region;
- (b) Identifying manpower needs, including the identification, analysis and evaluation of training needs, programmes and facilities; and formulating industrial manpower development policies and plans, including measures for the involvement of local experts in project design, planning, preparation, implementation and monitoring etc.;

- (c) Developing comprehensive and fully integrated programmes directed towards the accelerated development of industrial manpower, technological capabilities, local entrepreneurial capacities and industrial trainers;
- (d) Strengthening and/or establishing multi-purpose training institutions, as well as teaching companies, specialized institutions or centres of excellence, to provide training in specific core industrial subsectors and branches;
- (e) Strengthening training links between universities and industry;
- (f) Establishing "teaching companies", as well as facilities for the local production of textbooks, educational and training videos, kits and manuals;
- (g) Introducing special training programmes for industrial maintenance and rehabilitation, the integration of women in industrialization, and the development and promotion of small-scale industries, especially in rural areas;
- (h) Mobilizing financial resources for industrial training;
- (i) Promoting intra-African co-operation, TCDC and international co-operation in industrial training.