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PROGRESS REPORT ON IRON AND STEEL

I. INTRODUCTION

Activities in the field of the iron and steel industry involved the holding of an ECA/UNIDO workshop on manpower and technological development for basic industries Metals and Engineering Industries for the Central and West African Subregion (Ibadan (Nigeria), 16 October-6 November 1981). As a preparatory activity, a desk study was conducted covering a preliminary study on iron and steel industry for West Africa.

II. REPORT OF THE WORKSHOP

A. PLENARY SESSION

(a) Inaguration

The Deputy-Vice-Chancellor of the University of Ibadan declared the workshop open by welcoming the Hon. Minister for Steel Development and for Industry. He emphasised the importance of the Workshop and mentioned that it touched on a topic that was central to the Regions industrial development. It was impossible to achieve self-reliance in industrial development by relying on import of Technology. It was appropriate, he said, that this second Workshop was being held in Nigeria where efforts were being intensified to develop both the manpower and the technology to create iron and steel industries. He called upon the Minister for Steel Development to make a statement.

In his statement the Hon, Minister for Steel Development, Mamman Ali Makele draw attention to the importance of a Workshop of this kind not only to Nigeria but also other countries desirous of developing steel production, steel being the bed-rock of any meaningful technological take-off.

Since the 1960's, he said, Nigeria had been attempting to rise to this challenge by initiating programmes which would harness local resources with imported steel technology for the country's industrial take-off. These efforts he said had resulted, in the creation of five steel projects: two in Ajaokuta and Aladja and the others, which were rollers at Katsina, Oshogbo and Jos. He went on to explain what technologies had been chosen for these plants and why, and explained that even where for the sake of expediency technologies and other resources had been imported, there had been mixed to the greatest extent possible with local resources.

The Minister concluded by emphasising that current skill need of the on-going steel projects were at upwards of 40,000 skilled personnel and that as these projects developed and affected other sectors of the economy and of industry, Nigeria's needs in high-level skills was expected to grow significantly. The Minister's statement was followed by an address from the Minister of State in the Federal Ministry of Industries, Dr. Ishmael J. Igbani.

The Minister informed the gathering that the Federal Government of Nigeria saw the iron and steel Industry as basic and crucial for the development of engineering industries and specially for the industrialization of Nigeria. He explained how the linkage between iron and steel industries and engineering industries had hitherto not been properly established in Nigeria a situation that accounted for the low value-added in the vital industries sub-sector. Along with the development of the steel projects in Nigeria would have to come the development of engineering industries. He mentioned on-going vital projects in creation of machine tools, foundry, electronics assembly and automotive components parts industries. All these projects, he said, would have to rely mainly on iron and steel. He expressed the hope that the Workshop would contribute to Nigerians' knowledge of the linkage between iron and steel and other engineering industries. He predicted that because of the rapid expansion of the Nigerian economy and more specifically of the iron and steel and engineering industries, manpower shortages would increase. He said it was opportune for the workshop to address itself to the question of manpower for the development of these industries.

The Minister concluded by congratulating ECA for all its efforts to create institutions and structures which would enhance the region's capability to achieve the Lima target of industrial output of 2 per cent by the year 2000. He called for African Governments' support of ECA's efforts in every way possible be it by hosting workshops or by paying up subscriptions to regional or sub regional institutions. He wished the workshop fruitful deliberations. The Secretariat was then called upon to deliver the ECA statement.

In his statement, the ECA representative welcomed the Ministers and guests to the Workshop opening on behalf of the entire ECA Secretariat. He expressed ECA's thanks to the Nigerian Government, the Oyo State Government, the University of Ibadan and the various industrial enterprises for so generously providing facilities to the Workshop.

He said that the strategy for industrialization followed by African countries in the past had taught Africans that no meaningful industrialization could be achieved for the region through a vain pursuit of technology transfer. What was needed he said, was a new strategy which would establish linkages between the exploitation of the continent's abundant natural resources and its industrial development needs. In this, priority should be accorded to the development of basic integrated industries. For these industries to be developed, not only should technologies be developed along with them, but also skills. He showed that not only was African's industrial output extremely low, but its skills ratios for industry and technology were low as well. To achieve the Lima target, he said, both technology and skills would have to be developed.

ECA and UNIDO had jointly responded to the call to initiate action towards this and by organising these workshops. It was hoped, he said, that the workshop would not be terminal, but that it would feed into action at the national level, and that through the participants, ECA would find a permanent source of contact with African efforts to change the direction of industrial development and achieve a faster pace in meaningful industrialization.

(b) Opening

The Plenary session was opened by professor S.O. Olayide, Vice-chancellor of the University of Ibadan.

In his address, the Vice-Chancellor said that he felt honoured to address high level skilled personnel in Management, planning and production in metals and engineering projects of the West and Central African sub-regions. The development of manpower and technology for the basic industries would go a long way towards removing some of the derogatory labels such as "Least Developed" "Underdeveloped" "Developing" "third world" etc. attached to these countries, he said.

The Vice-Chancellor then went on to explain how his University had, over the years evolved its programmes to have them streamlined with his country's needs for industrial and technological development. The present Faculty of Technology at Ibadan University which evolved from the 1972 Institute of Applied Technology had as its primary objective the generation of technology for national, industrial, and technological advancement. He observed that the nucleus that grew to the present day faculty of technology had been created in part by the Economic Commission for Africa.

The Vice-Chancellor gave a brief description of the curricula and programmes offered in the seven departments of the Faculty which are the following:

- Agricultural Engineering
- Petroleum Engineering
- Food Technology
- Civil Engineering
- Electrical Engineering
- Engineering Management/Industrial Engineering

The Vice-Chancellor concluded by re-iterating the importance of metals and engineering industries in the development of West and Central African Countries. He urged that whatever results, conclusions, and recommendations emerged from the Workshop, be carefully studied and implemented by African Countries.

(c) Metals and Metalworking Industries

The presentation of this topic by the Secretariat began with a synopsis of the Metals and Engineering Industries Mission report of 1979. This report summarized the findings of a mission that was mounted to twelve (12) African countries with the objective of assessing the status of Metals and Engineering Industries and was followed by a meeting of experts that drew up recommendations on the future development of Metals and Engineering Industries in African countries.

The Secretariat went on to discuss the importance of the seven metals: Iron, aluminium, copper, lead, zinc, tin and nickel. Statistical evidence was presented on production, consumption and trade in these metals and their ores. It was pointed out that iron resources of Africa were quite considerable and widely distributed particularly in Ivory Coast, Guinea, Liberia, Mauritania, Senegal, Ghana and Nigeria. It was further emphasized that Iron and Steel development in Africa had faced many problems. To date only Egypt, Zimbabwe, Morocco, Tunisia, Algeria and Nigeria had made significant efforts in developing the Iron and Steel Industry. The case of Swaziland was examined with the conclusion that the situation where iron ores were exploited to the point of exhausion leaving only a big hole and dumps should be avoided by African countries.

The Secretariat continued the presentation by discussing availability and supply of fuels and reducing agents for the Iron and Steel Industry. Botswana, Madagascar, Swaziland, Zimbabwe and Nigeria were mentioned as countries that possess coal.

The presentation was followed by an open discussion. The Ajaokuta project was summarized. The unique project development problems were discussed especially the availability of local iron ores and coal as a minimum condition for implementing the project. It was concluded that this requirement delayed the implementation of the project hence the decision to import coke for the Ajaokuta project. A brief discussion followed on the Warri Iron and Steel Project. It was pointed out that the rolling programme was similar to the Ajaokuta project.

(d) Technological Features of Metalworking Industries

The introduction of this topic by Secretariat began with a discussion of the Structure of Engineering industries. These industries, it was pointed out consisted, among others, of:

- Transport equipment industries
- Building construction materials industries
- Agricultural machineries industries
- Capital goods industries

Since these industries produced the goods that were necessary for the day-to-day run of life, to talk of engineering industries was to talk of all the production activities which were necessary to sustain life and the economy.

Fabrication technologies, the introduction noted, had improved over the years in Africa, although, between 1972 and 1978, the region imported US$ 82 billion worth of engineering goods.

Within the region, textiles, assembly activities and agricultural machinery production predominated, and were increasing in importance in engineering industrial activities. The question to be considered was how to increase their value - added at the same time as dependence on out-of-region supply as decreased. It was noted that metal working industries had the following kind of structure:

- the primary sub-sector which consisted of core industries in which transformation activities occured
- the capital goods subsector in which activities were undertaken to produce goods which would in turn be used in the production of other goods and increase capital formation.

In Africa today, the presentation concluded, the core subsector of engineering industries was very undeveloped. This situation dictated the need for greater concentration on the development of the subsector. In this, the region needed to pay attention to rational choices of technology and to careful planning of technology development.

(e) Technological Features of Metal Industries

This topic was also introduced by the secretariat. The strategy to Industrialize on the basis of further processing of metallic raw materials was discussed. It was pointed out that new technologies offered new opportunities for African countries to enter into production of final goods and products in the steel, aluminium copper, lead, zinc, tin and nickel industries. The technological features considered covered.

- mineral processing
- treatment of processed minerals
- production of crude metal
- refining of crude metal
- production of semi-manufactures such as: alloys, billets, slabs and blooms.

It was emphasized that each of the above operations represent unique technologies for the metal Industry concerned. In the discussion that followed, an attempt was made to identify the real attributes of a technological capacity and capability in the metal industry was identified as one such attribute of a technological capacity and capability. Financing of equipment production was identified as another attribute. Raw materials and selection of equipment to process raw materials with given characteristics did not present insurmountable problems to the extent that equipment production did.

(f) New Philosophy of Manufacturing Control

This topic was introduced by the secretariat. In introducing the applications of the computer to engineering, it was pointed out that there was a requirement for extensive development of designers, manufacturing engineers, plants, machines and skills leading to a demand for more and more sophisticated information supply, processing and control systems which were all domains of computer application. The computer was currently used mainly for data processing in African countries. It was pointed out that not until its production processes were computerized a country could only with difficulty, accelerate its industrial development. Computerization could be considered as evidence of high engineering sophistication in an economy.

Computer applications are frequently identified with automation thereby removing manual work from engineers and technicians and ensuring short lead-time of project or production development. Computer applications in engineering could be considered for:

- analysis of structures, simultation, digitalization, numerical optimization and handling of multivariable problems
- mathematical modelling for processes, machines and equipment performance in computer aided design synthesis
- man-machine interaction
- research, design, prototype, testing production and maintenance applications.

In discussing the hierarchical structures of computer aided manufacturing systems it was pointed out that manufacturing shop control functions could be described as: process, data, and management levels. In this connection computer numerical control and direct numerical control were discussed in the context of control of process.

It was considered desirable to generally increase computer use and application in institutions and within the economy although it was necessary to guard against its use in industrial operation in Africa. This caveat was dictated by the fact that the biggest problems in the use of computers in Africa today, was the one shortages of skills a deterent, but also the capital outlays necessary to allow Africa to go into the use of computer in a big way was prohibitive.

The Workshop thought that it was inconsistent to advocate a greater concentration on the development of core sub-sectors of engineering industries and at at the same time suggest that Africa, with its low level of technological and skill development, should branch out into massive applications of computer technology. The Workshop thought that it was premature for the region to even consider this suggestion at this stage of its industrial and technological development.

B. MANPOWER DEVELOPMENT

(a) Planning Objectives

Secretariat noted that manpower Planning had emerged quite recently as being a central part of overall macro-economic development planning. Hitherto, it was though enough to leave manpower to the whims and fancies of market forces. Failure of implementation of development plans because of inadequate supplies of critical manpower underscored the need to more consciously plan the human input to development.

The major objective of manpower planning was the forecasting of manpower requirements. This was necessary to formulate rational manpower development and utilization policies. Manpower demand forecasting either at the macro-economic, the industry or the enterprise level, used a number of techniques to determine future requirements on a long-term (5 years), a medium-term (2 to 5 years) or on a short-term (up to two years) basis. A number of economic, social and political assumptions were used to guide forecasts. These forecasts were then matched with manpower supply forecasts in order to determine the magnitudes of shortages or oversupply in the industry, the enterprise or the entire economy.

Several forecasting techniques were discussed before the presentation moved on to consider supply mechanisms. These were seen within the context of education and training systems (formal and non-formal), and their strengths and weakness in respect of approaches and methodologies needed to optimize skill-acquisition in the various skill areas. Personnel mangement and general career development policies and programmes were also dealt with.

(b) The Brain Drain

It was felt that one major source of brain drain was government wage policies. Another was the lack of training facilities locally. Most of the third world nationals now operating in developed economies were those who went there in the first place to study. If they had been kept at home for study they would possibly not have emigrated to developed countries. Thus developing local training facilities, it was felt, was a way of reversing this trend. A way of benefitting from the brain drain was, the workshop believed, to adopt an experiment tried out in Turkey whereby Turkish nationals working in high skill levels in developed economies were hired by their Government to run training and other manpower development programmes for the Government. In this way, part of the technology that had been transferred through the transfer of skills, was re-transferred to a needy homeland.

(c) Wastage

It was felt that another major constraint to full utilization of manpower was the one of high wastage rates. The workshop thought this was due to faulty macro-economic planning where plans for the creation of one industry were suddenly charged and redrawn to include several other industries without corresponding changes in plans to prepare the manpower necessary to man them. It was mentioned that in any case, in planning manpower supply,not only gross supplies, but also net supplies which would take full account of wastage and attrition rates, should be taken into account. Planning which created surpluses was by far better than planning which resulted in shortages.

Another constraint facing the provision of adequate manpower for the basic industries was the nature of training. Engineering training was considered to be too broad at the undergraduate level. This was probably the right kind of approach given the prevailing conditions and needs in Africa. However, there was a need to supplement this broad-based training with post-graduate industrial training. This was the only way to get generalist engineers to acquire much - needed specialization in areas relevant to industrial development needs.

It was revealed that so far the most critical skill shortages were to be found in the engineering, not the technician categories. In this, areas such as mechanical, chemical, electrical, industrial and production engineering were believed to be the most prominent.

(d) Training

It was revealed that African Countries had not as yet developed the capability to produce the type of data which would facilitate planning of manpower. It was agreed that efforts needed to be intensified to assist African Governments to develop this capability to create the data and other inputs necessary for planning.

On the question of existing training and general manpower preparation infrastructure, it was noted that the existing engineering institutions were not so structured in their curricula and programmes as to render them more functional in the provision of manpower of the right quality for Africa's development needs.

Although planning of manpower supply and demand was thought important, it was also considered vital even without any studies to determine magnitude of needs, to continue with the development of production and industrial engineers. However, in the present circumstances, it was believed expedient to begin producing industrial, metallurgical engineers and metallurgists by any short-custs possible. The situation within the region strongly indicated that there were no structures to produce these people. It might be possible to transfer mechanical engineering skills to industrial engineering skills. Similar arrangements, in view of the absence of facilities to train the skill cadres needed should be considered in respect of training of metallurgical engineers, metallurgists and other professionals critically needed.

This did not suggest that the data base, whose absence in Africa was constraining all efforts to plan, should continue to be neglected. Neither was it being suggested that manpower preparation should proceed without a rational plan. What was being suggested was some manpower development based on considered judgement while intensifying efforts to have a more rational and systematic approach to planning and development of m npower.

III. CONCLUSIONS AND RECOMMENDATIONS

A. METALS

(a) Specifically for Member States

(i) iron-making

1. For a steel plant with capacity of 1 million tonnes/year and above, it is preferable to use bigger sizes of blast furnaces (2,000m and above)

2. For charging large size blast furnaces the use of conveyor belts is recommended.

3. There is a need to adopt intensification methods when the Blast Furnace route is used such as: better burden preparation, sinter charging, high blast temperature, high top pressure, oxygen enrichment, oil steam and natural gas injection.

4. For countries where coking coal is a problem the Direct Reduction process should be given serious consideration.

5. countries with natural gas supply could adopt any commercially proven Direct Reduction process.

6. For non-oil producing countries, coal-based shaft furnace processes should be considered.

(ii) Steel Making:

7. oxygen steel making should be considered only in cases where the blast furnace route is adopted.

8. Electric steel making should be adopted for the Direct Reduction process.

9. All African countries should endeavour to establish some kind of steel making capabilities in view of the tremendous importance of iron and steel in industrialisation. Such steel production could be based on scrap, or scrap/sponge Iron.

(iii) Preparation of iron ores, fuels and fluxes

10. For countries without cooking coal, it is preferable to import cooking coal and blend it with non-cooking coal to produce coke on site. Preliminary tests should be conducted to determine the optimum blending proportions.

(iv) Ingot and billet casting and rolling

11. Continuous casting is recommended for integrated steel plants. However, some capabilities for ingot casting should be provided if it is intended to produce rimming steel for rolling high quality steel sheets.

12. Countries intending to adopt the continuous casting process should send delegations to other countries already using the process to study the problems and requirements of continuous casting.

13. Standardisation of sizes, shapes and grades of structural products should be considered. This should facilitate national production programmes.

14. Measures should be taken by governments and professional institutions within the sub-region (i.e. ECOWAS) to standardise product range.

(v) Ancillary facilities

15. For integrated steel plants, a 100 per cent captive power generation capacity should be planned.

16. For mini-steel plants and re-rolling mills, having to take power solely from the national grid, a 5 per cent stand-by capacity should be provided for instrumentation. Furnace tilting, cooling and lighting

17. Off-peak operation of mini-steel plants and re-rolling mills should be seriously considered.

(vi) Water supply

18. The location of an integrated iron and steel works should ensure availability of large quantities of water.

(vii) Oxygen supply

19. The provision of a captive oxygen supply for a steel plant is essential in view of the inadequacy of supply on commercial basis in the sub-region.

20. For units providing oxygen, a fertilizer plant based on the Nitrogen by-product should be given serious consideration. Because of the hazards of the process, it is important that adequate training should be given to the personnel to ensure safety of operation.

(viii) Refractories

21. Integrated steel plants should endeavour to provide facilities for making their own refractories.

22. In steel producing countries, the governments should encourage the establishment of refractory industries.

23. Governments should sponsor research and development efforts to assess the suitability of local raw materials for refractory production.

24. A comprehensive geological survey of raw materials for refractories production should be carried out.

(ix) Materials handling and transport

25. In countries where iron and steel projects are being contemplated, measures should be taken to ensure that the national rail network service be constructed to link the existing lines. These should be considered as priority projects.

26. During the planning of iron and steel projects, serious attention should be given to the adequacy of existing road transport facilities to ensure that they met the needs for transporting heavy equipment for the steel project.

(x) Maintenance facilities

27. Iron and steel works should contemplate and plan for these three types of maintenance viz: capital, preventive and breakdown.

28. The use of sub-contractors can be considered for capital maintenance.

29. Maintenance (functions) should be given as equal importance as production functions; and chiefs should both report directly to the Chief Executive of the Enterprise.

30. It is recommended that Central Maintenance facilities should comprise the following fully equipped shops: Foundry, forge, tool room, machine shop, fabrication, pattern making, heat treatment and specialised shops to serve the needs of blast furnace, rolling mills, and coke ovens.

(xi) Metallurgical laboratories, instrumentation and control

31. A certain degree of automation and computerisation is inevitable in an integrated steel plant. In view of the situation in the sub-region remote control systems with facilities for human intervention should be adopted.

(xii) Manpower development for iron & steel plants

32. A curriculum development centre should be established to co-ordinate the technology and skills required in industry with the programmes and curriculum of training institutions.

33. There should be maximum indigenous participation in the design, manufacture, erection and commissioning of steel plant units to develop necessary skills and ensure transfer of technology.

34. In addition to the training of operating and maintenance personnel, special attention should be given to the training of process, equipment and plant designers. Additional measures should be taken to create a consultancy capability in the iron and steel industry. This will help to ensure that African countries are able to evaluate and select technological parameters and hence negotiate more effectively.

35. In accordance with the long term plans for the development of the steel industry, manpower requirements should be assessed and adequate provision made for training within the country and abroad.

(b) General considerations for member States

(i) Raw materials

36. The initial step in iron and steel development should be to undertake a comprehensive geological survey and assessment of the necessary raw materials required.

37. Characteristics of indigenous raw materials for the iron and steel industry should be evaluated and assessed prior to selection of iron and steel process technology.

38. Representative sampling and analysis of available iron ore deposits prior to selection for exploitation is essential. High grade ores (more than 60 per cent Fe) can be charged directly into the blast furnace . Low grade ores (less than 60 per cent Fe) should be considered for exploitation with beneficiation.

(ii) Selection of technology

39. Countries with an iron and steel production of capacities greater than 2 million tonnes/year should endeavour to produce alloy steels and stainless steels whilst those with smaller production capacities could embark on re-rolling of stainless steel.

40. In countries where consumption of steel requires the production of steel under one million tonnes/year; direct reduction is recommended, (provided the vital inputs are locally available).

41. For steelmaking, oxygen steelmaking is recommended in cases where the blast furnace is employed. Electric steelmaking is recommended when direct reduction is employed.

42. Continuous casting is recommended for killed, semi-killed, and low alloyed steels.

43. Design philosophy adopted by equipment suppliers must be examined carefully in terms of the capability of equipment to withstand rigorous operational conditions.

44. Turnkey contracts should be discouraged. Contacts must take into account the need to involve indigenous expertise i all phases of the project cycle. Particular attention should be given to measures aimed at ensuring local participation in design, construction, erection, and commissioning. Full advantage should be taken of the training and full transfer of know-how associated with designs construction, erection, maintenance and operation of iron and steel plants.

45. Every effort should be made to establish local facilities for design and manufacture of equipment and spares in countries where iron and steel industries exist.

(iii) Development plan

46. It is recommended that every African country should formulate a 25-year national iron and steel development plan. This plan should cover the following elements: demand projection, raw material sources, technological options, manpower resources and institutional framework for implementing the plan. There should be a review of this plan every five years.

(iv) Economics and Finance

47. Governments should bear the cost of the infrastructure associated with iron and steel development while the steel companies should shoulder only the costs associated within the battery limits.

46. A comprehensive pricing policy should be evolved at the early stages of planning iron and steel projects.

(v) Programming of implementation:

49. The master schedule should be prepared on the basis of a bar chart. This can be followed by detailed netoc ammes of the specific items in the master schedule.

(vi) Institutional support

50. Governments should establish and co-ordinate relevant institutional supports required for the development of the iron

and steel industry. Among these are steel authority, financial, metallurgical, engineering, facilities and purchasing agencies.

(vii) Determination of manpower requirements

51. Determination of manpower requirements, based on a detailed study of the various functions involved, should be conducted during the planning stages of the project. This should be open to continuous review in light of operational experience. The overall requirement should also take account of the socio-cultural condition in the sub-region.

52. An organisational structure should be evolved during the planning stages with an in-built flexibility for modification with the changing needs of the enterprise.

53. Recruitment and placement should aim at achieving appropriate age profile which will facilitate career advancement and management succession.

(c) Sub-regional Co-operation

54. Measures should be taken by member states and professional institutions within the sub-region to standardise the sizes, shapes and grades of structural products to facilitate rational production programmes.

55. Within the spirit of the Lima Plan of Action and the desire for a new international division of labour, the possibility of establishing an iron and steel and coal community for the sub-region should be explored for the purpose of monitoring the markets for raw materials, intermediate and finished products, and trade in the iron and steel industry.

(d) ECA/UNIDO

56. ARCEDEM should design prototypes of mini steel plants for easy adoption by interested countries.

57. A compendium of iron making technologies available with respect to characteristics of raw materials should be compiled for use by the African countries for selecting technologies consistent with locally available raw materials.

58. For policy makers, exposure programmes should be organised on project initiation covering study tours and seminars aimed at sensitising them to intricacies of planning for iron and steel production.

59. Institutions set up by ECA such as ARCEDEM, AIHTTR and ARCT should formulate training programmes in contract negotiations, planning and programming, detailed engineering, construction techniques, operation and maintenance, and design and fabrication of spare parts.

60. Conferences involving experts working in the iron and steel industry in Africa should be organised regularly on specialised topics.

B. ENGINEERING

(a) General Recommendations

1. Universities and polytechniques in the member States should endeavour to offer courses in production engineering.

2. The African Regional Standard Organization (ARSO) should assist in establishing standards for metal and engineering products.

3. Traditional technology should be developed further.

4. Existing railway and large maintenance workshops should be fully utilized in order to meet national demand for skilled manpower.

5. Industrial training programmes for student engineers/ technicians should be more effectively monitored and evaluated.

6. Efforts should be made to have R & D undertaken locally; results of R & D should be made easily available to interested parties.

7. As a matter of urgency a new and well defined industrial policy should emerge from member countries of the subregion for engineering industries with high level of local value added and usage of local raw materials.

8. An industrial monitoring system should be established to monitor the performance of companies in the African subregion.

(b) Specific Recommendations

(i) Casting

9. Every country of the subregion should have at least one foundry Countries that have foundries already should expand them depending on needs of their industries.

10. ECA/UNIDO is requested to carry out national surveys of foundries in the West and Central African countries.

(ii) Metal Forming

11. Adequate safety precautions should be provided in all basic engineering industries.

12. Factories of metals should be promoted in member States.

13. Centres for the manufacture of dies and special tools for forging and casting should be established.

14. There should be provisions for extension services in metals forming for the small/medium scale industries in the rural areas by setting up well equipped service centres.

15. Member States of the subregion should incorporate factories to produce small tools by hot forming.

(iii) Metrology

16. Each member State of the subregion should request ECA/UNIDO to give assistance in the establishment of a well-equipped metrology laboratories in the higher institutions of learning. Such laboratories when established can serve the industries.

17. ECA/UNIDO should be requested to increase their yearly quota of fellowships for the training of special skills to participating governments to include metrology skill.

(iv) Metal Coating

18. Each member country should have an electroplating plant as a basic service to the engineering industries.

19. ECA/UNIDO should be approached by member States to provide a training scheme for electroplating technology within and outside the African region.

(v) Manpower Development

20. As a strategy towards the development of manpower, member countries should evolve a planned programme of training locally and abroad in different trades and disciplines for the basic industries and the training facilities within the country should be developed or re-oriented within a training policy which should provide for the development of programmes most suited to the needs of the country.

(vi) Material Handling

21. As an effort towards manufacturing basic material handling equipments in the subregion, the African Regional Centre for Design and Manufacturing should be requested to provide standard designs for the manufacture of simpler conveyor systems, simpler cranes, simpler winches, etc.

(vii) Planning and Implementation of Metalworking Factories

22. In order to avoid duplication of work and to ensure effective project planning and implementation, feasibility study for any engineering project should and must be done by professionals (e.g. industrial engineers) that have capabilities and proven experiences that such a project demand. Efforts should be made towards making these competence available locally.

23. In ensuring provision of adequate and competent maintenance personnel in the operations of a newly completed project, efforts should be made in retaining some of the skilled personnel that were involved in the construction phase of the project by the company owning the project.

(viii) Programming of Implementation

24. Attempts should be made for the emergence of transfer of technology right from the construction phase of a project; by the involvements of indigenous contractors and engineers in the activities of this phase.

(ix) Institutional Support

25. Member States should set up industrial development banks where they do not exist to encourage setting up small, medium and large scale industries.

26. Governments of member States should take steps to restructure operating guidelines of commercial banks, so that they can be involved in the industrial development of the nation.

27. In order to promote the effectiveness of metal working industries, governments should provide adequate infrastructure and public utilities (e.g. roads, water, electricity, etc.) that are needed by these industries.

28. Member countries should have their own standard organizations for basic engineering products under the auspices of ARSO.

29. Member countries should set up consultancy services in relevant institution to provide consultancy services to entrepreneurs at nominal costs for the establishment of basic engineering. Establishment of private consultancy firms should also be encouraged.

30. Participating government must develop a performance monitoring system to ensure that companies that enjoy any form of governmental support in the form of tax relief, custom duties exemptions operate within their establishing framework and guidelines. The main objective of such a system is the derivement of maximum benefits by the governments in terms of cogent technological development of the nation.

31. Government ministries public corporations such as Planning, Agriculture and Industries should develop an interlinkage for dissemination of information relating to their activities to promote technological growth of the country.

32. Member States should promote industrial entrepreneurship.

33. All member countries should establish auxiliary metalworking factories for the production of components and spare parts for engineering industries.

34. A survey of manpower requirements for metalworking industries should be carried out by member countries and the cost of developing this manpower should be made known.