ECONOMIC COMMISSION FOR AFRICA

First ECA/UNIDO Meeting of Experts
on Basic Metals and Engineering

Addis Ababa, 3-8 December 1979

REPORT OF THE FIRST ECA/UNIDO BASIC METALS AND ENGINEERING INDUSTRIES DEVELOPMENT PROGRAMMES MISSION */

(July to December 1978)

(For discussion by the First ECA/UNIDO Meeting of Experts on Basic Metals and Engineering Industries, 3-8 December 1979)

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(a) Mission authority and terms of reference

1. United Nations General Assembly resolutions 2626 (XXV), 3201 (S-VI) and 3202 (S-VI); United Nations Economic Commission for Africa resolutions 218 (X), 256 (XII), 267 (XII) and 319 (XIII); Declaration on Industrialization in Africa: Principles and Guidelines for Co-operation and Development underlined the importance of developing basic industries in Africa. Basic metals and engineering industries development constitutes the part of the basic industries development programme which was:

- adopted by the Second Conference of African Ministers of Industry held in Cairo, December 1973 1/
- recalled in subsequent meeting of the Follow-up Committee on Industrialization in Africa in 1974 which stressed that African countries could no longer follow the policy of trying to meet their economic requirements by way of exports of raw materials 2/
- Further recommended at its second meeting in August 1975, when the Follow-up Committee proposed the promotion of a variety of basic industries as priority areas for action in the African region 3/
- reaffirmed on agreed conclusions of the Third Conference of African Ministers of Industry held in Nairobi, December 1975, also underlined the importance of developing basic industries in Africa 4/
- recognized in the Lima Declaration and Plan of Action on Industrial Development and particularly co-operation among developing countries adopted by UNIDO in March 1975 in Lima 5/

1/ Declaration on Industrialization in Africa: Principles and Guidelines for Co-operation and Development, 1974, E/CN.14/613 and E/CN.14/INR/208, Part II, para. A(iv) and (vii), p. 23.

2/ Report on the first meeting of the Follow-up Committee on Industrialization in Africa, October 1974 (E/CN.14/INR/211, Part III, para. G(xi), p. 11.

3/ Report of the second meeting of the Follow-up Committee, August 1975 (E/CN.14/INR/213), para. 31(a) (i), (ii) and (iii), p. 7.

4/ Report of the Third Conference of African Ministers of Industry, held in Nairobi, 1975 (E/CN.14/649), Part II, paras. 9, 20, 21, 24; p. 21.

5/ Lima Declaration and Plan of Action, March 1975, para. 58 (f, k, e), pp. 10 and 11.

- Further reaffirmed on agreed conclusions in the third meeting of the Follow-up Committee on Industrialization in Africa held in November 1976 6/

- Strongly recommended in the Agreed Conclusions of the Fourth Conference of African Ministers of Industry held in Kaduna in November 1977 which underlined the importance of developing basic industries in Africa 7/

2. Integrated development of basic metals and engineering industries are part of the basic industries development recommended for establishment in developing countries by the Lima Plan of Action 8/, and endorsed as a programme by the Follow-up Committee at its third meeting in Addis Ababa in November 1976 as agreed conclusion for Development of Basic Industries in the African Region with concrete industrial development projects. The Committee endorsed the following four programmes formulated by ECA as a basi for achieving integrated industrialization:

(i) Basic metals industry development programme;
(ii) Engineering industry development programme;
(iii) Chemical industry development programme; and
(iv) Building materials development programme.

3. It also approved the following action programmes:

(i) Comprehensive studies in each of the above area to establish the stage of development so far reached in Africa and to determine the linkages among these branches and with the rest of the economy, training needs and steps to be taken to meet these needs;

(ii) On the basis of the studies, preparation of an integrated comprehensive industrialization policy and programme of action for implementation;

(iii) Organization of an intergovernmental meeting of experts from ministries of industry and planning to consider the industrialization policy and the programme of action

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6/ Report of the third meeting of the Follow-up Committee on Industrialization in Africa, December 1976 (E/CN.14/INR/218), Part II, para. 9D), sections (a) and (b), p. 8.

7/ Report of the Fourth Conference of African Ministers of Industry in Kaduna, November 1977 (E/CN.14/689), Part II, para. 7(c), items (iii) and (v), p. 12.

8/ Lima Declaration and Plan of Action, March 1975, UNIDO PI/38, para. 58 (f), (i) and (ii), pp. 10 and 11.

(d) An invitation to experts from ECA member States and other developing regions to prepare projects, programmes and policy papers for national and multinational implementation within the framework of the agreed strategy and to provide advice on the rationalization of industrial development, for submission to the Fourth Conference of African Ministers of Industry and later to the OAU Summit. 9/

4. In line with above agreed resolution, terms of reference and a number of isolated projects in the ECA Work Programme for 1976-1981, the programmes for the development of basic metals and engineering industries in the African developing countries are being implemented within the ECA/UNIDO Joint Industry Division (JID).

Role of basic metals and engineering industries and their main characteristics in industrial development

(b) The role of basic metals and engineering industries 10/

5. The development of basic metals and engineering industries and their subsequent role in national industrialization process is of paramount importance to the developing countries economies in general and developing African countries in particular. Accelerated industrialization requires fuller exploitation of mineral resources to produce industrial basic metals. The engineering industries transform these basic metals into capital and intermediate goods, durable consumer goods and consumer goods for the improvement of the standard of living and welfare of people. It is an accepted fact that the basic metals and engineering industries play a significant role in the process of industrialization and particularly in the linkages with major subsectors of the manufacturing industries with wider linkages with other sectors of the economy.

6. The basic metals industries cover all metallurgical activities specifically responsible for the production of standard metals and their family of alloys and alloying elements - from ores to intermediate products of specific engineering requirements. Engineering industries on the other hand transform these metals and intermediate products into various engineering products required for human and industrial consumption.

7. The basic metals industries are therefore vital instruments for developing interlinkage and inter-sectoral activities among all branches of the manufacturing sector. The engineering industries are the processors of basic metals and transform them into engineering products.

8. The relatively low level of development of the basic metals and engineering industries has convinced the developing African nations to

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9/ African Declaration on Co-operation, Development and Economic Independence, CM/ST.12/XXI, 25 May 1973, Assembly of Heads of State and Government, Addis Ababa.

10/ See Annex I-A and Annex I-B.

include the manufacture of metals and engineering products in their national development plans, thus emphasizing their key role in the process of industrialization. In the least developed countries in Africa, the basic metals and engineering industries sector and particularly the heavy engineering industries should provide all the other sectors of industries with their productive machinery and equipment as well as the facilities for training of skilled labour. All these elements lead to the idea of an integrated development of these two important manufacturing subsectors, e.g. basic metals and engineering industries.

9. It is, therefore, essential for the African countries to promote and enlarge the basic metals and engineering industries sector which will provide four important development aspects at national and subregional levels, e.g.

(i) economic improvement for a better and higher standard of living,
(ii) integrated industrialization for larger employment opportunities,
(iii) defence and self-reliance.

(c) The characteristics of basic metals/engineering industries in the industrial development process

10. The main characteristics of the basic metals and engineering industries in industrial development process can be summarized below:

(i) the basic metals and engineering industries provide a greater integrated linkage with all industries particulary, transport, agro-industries, communications, food, building materials and construction, defence production, textile industries, etc.;

(ii) basic metals and engineering industries provide intermediate and capital inputs to the metalworking, building and construction, chemical and all inter-sectoral industries;

(iii) basic metals engineering industries provide all the needed basic machine tools, equipment, accessories, including raw materials for the manufacture of agricultural tools and implements;

(iv) the demand for industrial machinery from engineering industries which is regarded as a function of the level of development of a country, as well as its rate and pattern of sectoral growth;

(v) the integrated and interlinked development of basic metals and engineering industries play an important role in the transfer, adaptation, adoption, absorption of appropriate technology to different branches of industrial manufacturing activities;

(vi) the basic metals and engineering industries provide spare parts, components and equipment to all industries where machinery and plants exist for repair and maintenance are in operation

(vii) the development of the basic metals and engineering industries programme will create an integrated development of other industrial sectors, e.g. transport, power, water supply and communications where intermediate and capital goods which play an

(viii) the advancement of engineering industries provides diverse products for national defence;

(ix) the development of engineering industries will provide public utility products, e.g. hospital equipment, public transport, power and water supply facilities;

(x) the development and expansion of engineering industries will provide self-sufficiency and less dependence on the foreign countries;

(xi) the development of engineering industries will provide basic necessity for broader welfare of the citizen at national level;

(xii) the basic metals and engineering industries provide a launching pad for greater employment opportunities, not only for its own sector, but also for the allied sectors mentioned above to which it is closely linked;

(xiii) the basic metals industries exploit the maximum natural resources, e.g. raw materials, and transform these raw materials not only for its own consumption but also for the requirements of other industries mentioned above;

(xix) it provides greater area for the application of machinery and equipment which are standard and can be made flexible for diverse product operations;

(xx) it provides common services facilities, e.g. foundry, forging, machine shop for all the industries related to manufacturing operations;

(xxi) the engineering industries with back up basic metals industries support provide greater repair and maintenance facilities to all industrial activities;

(xxii) the engineering industries provide basic design and development facilities to all industrial operations particularly in textile, food processing and agricultural machinery manufacturing industries;

(xxiii) the enlargement of basic metals and engineering industries sectors provide greater market opportunities and larger capital formation not only in its own sector but the industry as a whole;

(xxiv) the enlargement of basic metals and engineering industries provide more skilled and professional personnel for all industrial activities.

11. The characteristics and the role of basic metals and engineering industries is a gateway for all industrial development and industrial activities of a country. It is necessary for the African policy-makers and planners to give utmost priority for the development and expansion of these two subsectors. The integrated development of these subsectors call for both institutional and technological integration at national level,

coupled with expansion and creation of basic supporting industries and facilities, e.g. foundry, forging, heat treatment machine shops, tool room design, and ancillary and supporting industries development.

(d) Objectives of the mission and future guidelines

12. The following were the main objectives of the mission:

- to bridge the existing institutional gaps that are being observed by the mission to facilitate the planners and programmers in each country visited to create harmonious institutional support for the integrated development and implementation of priority projects in basic metals and engineering industries sector within the framework of the physical and visible constraints existing in each country;

- to facilitate the planners and programmers with concrete plan for the development of managerial and technical skilled manpower programming;

- to design policy objectives for the planners and programmers for

  (a) possible expansion of existing industries through the utilization of internal natural resources in basic metals and engineering products;

  (b) identification of new products which the government is not aware of and those which can easily be manufactured within the capacity of the existing plant;

  (c) to improve the basic support industries, e.g. foundry, forging, heat treatment, machine shops, tool room, rapair, maintenance, spare parts, in order to improve manufacturing facilities for the balanced growth of this sector;

- to facilitate the planners and programmers for the creation of a priority programme based on:

  (a) the government's own identified priority projects;

  (b) the projects identified during the mission;

  (c) the projects to be recommended by the mission;

- to ascertain projects that are common for the subregional African countries and those projects that cannot be implemented without subregional co-operation in the priority sector;

- to advise the member Governments, ECA, UNIDO and OAU regarding the implementation of these projects for the accelerated development of basic metals and engineering industries highlighting the need for intra-regional and interregional co-operation among the developing countries in line with the Lima Declaration and resolution adopted by the Conferences of African Ministers of Industry.

(e) ECA/UNIDO field mission plan (November 1978 - January 1979

13. The mission mounted by ECA visited selected African developing countries from 5 November 1978 to 19 January 1979 which included land-locked, island, small countries and large countries in order to assess the status of these countries within the context of industrial development.

- Kenya, Ethiopia, Zambia, Nigeria, Ivory Coast, Mali and Senegal were visited by an ECA/UNIDO team consisting of Mr. A.K. Mitra (engineering industries), Mr. V. Ivanchenko (basic metals) and Mr.K.K. Peki (industrial economist);

- Kenya, Ethiopia, Tunisia, Egypt, Sudan, Mauritius and Lesotho were visited by an ECA/UNIDO team consisting of Mr.Y.K. Mazhar (Team Leader), Mr. M.K. Mwango (basic metals) and Mr. A. Afeta (industrial economist).

14. The mission has explored the existing status of the basic metals and engineering industries and prepared the country reports of each country visited by the mission team which are already submitted to the respective countries for examination and consideration. Within the context of the integrated development of basic metals and engineering industries it was planned that the respective team should assess the present performance and activities in the following areas of each country mentioned above. Due to lack of time the mission was unable to visit all these areas in every country visited.

- National institutions, e.g. ministries responsible for planning, finance, economic development, industry, research and development;
- Parastatal organizations, e.g. development corporations, development banks, credit institutions, productivity centres;
- Chambers of commerce and industry;
- Large-scale engineering establishments producing basic metals and engineering products (private and public sectors);
- Medium and small-scale industries producing various engineering products and agricultural implements;
- Industrial estates which included ancillary and common services facilities;
- Large repair and maintenance shops and railway workshops;
- Technical training institutions, polytechniques, technical colleges and universities;
- International organizations within the country, e.g. UNDP, UNIDO, etc.

f) Proposed follow-up of the mission report

15. The report of each country visited by the team together with the regional report, will be critically examined by a high level expert working group from African countries, who will meet in Addis Ababa from 3-8 December 1979. This expert group will be the selected planners, programmers and engineers from African States. The final findings and recommendations thereafter will be discussed and submitted to the Follow-up Committee and to the African Ministers of Industry for future implementation.

16. The purpose of this expert group meeting will be to bring the African planners and programmers to discuss and pinpoint the actual priority projects, identify the major constraints and workout a formula for actual implementation of basic metal and engineering industries development programme as suggested in the regional report.

g) Members of the mission

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h) The report

17. The report of the first ECA/UNIDO mission for the basic metals and engineering industries development programmes comprises five chapters and a number of annexes.

18. The report starts with an introduction which states the mission's authority and terms of reference; explains the role of the basic metals and engineering industries and points out the characteristics of these industries in the industrial development process. Later in the introduction the objectives are pointed out and the mission members' names and background presented with a listing of the countries visited.

19. Chapter I, Conclusions and Recommendations, discusses the findings of the mission presenting them in a logical order, drawing conclusions and making recommendations throughout the chapter. Policies and strategies are presented first and the report covers national development policies, policies on capital formation, entrepreneurship, incentive schemes, manpower development and technology policies.

20. Institutional requirements are handled next and national institutions for industrialization as well as institutes for regional co-operation are discussed. Recommendations on the role of ECA, UNIDO and OAU are also presented.

21. The next parts of chapter I deal with specific conclusions and recommendations for basic metals as restructuring of trade, consumptions of metals and the recommended specialization of African countries. Specific priority recommendations are also given for this industrial subsector.

22. Chapter I then considers the engineering industries, recommending integrated development, needed institutions, national technology plans and the elements of the plans.

23. A summary of recommendations is given for both the subsectors as well as some proposals for multinational African industries in basic metals and engineering industries.

24. Chapter II deals with general economic and industrial conditions in Africa giving figures for growth of GDP, savings, fixed capital formation, as well as, trade and balance of payments. The latter part of the chapter discusses the manufacturing industry in detail presenting growth, employment, structure of the sector, industrial policies as well as industrial development institutions. Attention is also given to training and manpower development.

25. Chapter III presents the present status of the basic metals industries as far as the mission could identify it, due to constraints of time, the limited number of countries visited, and available up-to-date data. Here the different industries are reviewed: iron and steel, copper, lead and zinc, tin and the aluminium industry. The pattern followed for each industry is to review end-uses, organization of the industry, technology, economics and future outlook.

26. Chapter IV reviews the engineering industry, studying the import structure, trends in national development plans, objectives and priorities and strategies. Engineering industries are then grouped for the purpose of this chapter into capital goods as machine tools, transport equipment, engineering products for agriculture, durable and consumer goods.

27. Since repair and maintenance is of vital importance for Africa, this chapter also considers repair and maintenance workshops, spare parts manufacture, metalworking centres, railway workshops and maintenance shops in industry.

28. An important prerequisite for engineering industries development is design and research. The role of design centres, research and development centres is extensively discussed with due reference to the ECA African Regional Centres.

29. Chapter IV concludes by presenting the prerequisites for the development of engineering industries as institutional structure, planning institutions, ministries and parastatal organizations, etc.

30. The report also includes a number of annexes providing additional information mostly of statistical nature.

31. It should be noted that the information gathered was restricted by the limited amount of time in each country which was around seven days for smaller countries and ten days for the larger ones. The information is therefore valid for end November 1978/early January 1979. Statistical information was compiled during the first half of 1979 from references available at ECA.

32. From this, it is evident that the value of this regional report lies in the country reports prepared for the countries visited and the possibility of updating the report by further visits to the same countries, as well as attempting to cover the other countries in the region.

CHAPTER I

CONCLUSIONS AND RECOMMENDATIONS

33. Industrialization is perceived on the basis of activities relating to final goods and services produced by the industrial branches. Manufacturing branches are discussed traditionally as: consumer goods, intermediates, capital goods, light and heavy industries.

34. Discussion of basic metals and engineering industries requires a perspective focused on processing stages and processing chains involved in transforming raw materials from their crude form through primary, semi-finished, finished and final demand goods. The yard-stick against which countries covered by the mission were judged in respect of their successes in the basic metals and engineering industries is the extent and pattern of the processing chains achieved in these industries.

35. Processing chains are ascertained by means of transformation achieved on the inputs in comparison to the output after passing through the production line. On this basis the following basic metals and engineering industries outputs have been segregated: raw materials, processed raw materials, semi-manufactures, and manufactured finished products for final demand end-use.

36. The majority of African countries engaged in basic metals industries produce outputs with a low degree of processing before exporting to the developed markets. These exports, as a result of this, contain a low proportion of semi-processed and final demand products.

37. In the case of engineering industries, the majority of African countries import all the capital goods needs including equipment, spare parts, tools and implements. The few countries which have established their own engineering industries are predominantly engaged into assembly work based on imported components.

38. In order to strengthen the role of basic metals and engineering industries within the overall context of other industrial activities in Africa with a view to achieving internally self-sustaining development, diversification, and collective self-reliance, several measures are needed at policy and strategy levels.

A. POLICIES AND STRATEGIES

(a) National development policy

39. A national development policy includes the creation of conducive atmospheres for overall development in general and industrial development in particular. This, inter alia, involves political, social and economic conditions which have to be viable for long term industrial development, especially of basic metals and engineering. Apart from this, there must also be adequate physical and institutional infrastructures. This has to be accompanied by a broad policy framework usually expressed in a form of long, medium and short term plans with clear definitions of objectives (specific targets), priorities, strategies and policy measures including proper co-ordinative, control and regulating machinery.

40. All the African countries have already opted for development planning. In planning and programming national economic and industrial development there are some needs, however, for rationalization of objectives, priorities, strategies and policy measures. The major objectives of many African countries are to meet the basic needs of the masses (food, clean water, shelter, clothing, health care, education and employment) thus attaining greater economic independence. These objectives inevitably involve the increasing of agricultural production to feed their growing population and provide raw materials for domestic industries and export earnings, manufactures of basic consumers' goods to satisfy the needs of the masses, provision of infrastructures, local production of capital goods, managerial and technological capabilities, self-reliance and internally linked and self-sustained dynamic growth, as well as the control over the exploitation and development of natural resources. Attainment of the foregoing objectives requires an integrated approach in defining and selecting priorities and strategies.

(i) First strategy alternative

41. In most of the developing African countries priority is given to agricultural development. Then the strategy of implementation in such comparatively less populated subregions/regions may be through mechanization of farms including the use of irrigation works, piping, water pumps, etc. In heavily populated areas, the use of diversified handtools and light agricultural equipment and machinery would also be required. Thus the development of basic metals and engineering industries should be envisaged or accomodated in the national development plan as suppliers of the capital goods and maintenance services needed for the development of agriculture.

42. Secondly, transport and communications (land, water, air, port and terminal facilities and maintenance works thereof) facilities are creating tremendous bottlenecks everywhere including the development of new farming areas, mineral exploitation and development. The solutions to these bottlenecks are building new railway lines, wagons, locomotives, river steamers, coastal and ocean ships, airplanes, communication equipment and ports and other terminal facilities as well as modernization, replacement and extension of the existing ones. This includes a growing fleet of transport vehicles (trucks, buses, and passenger cars). Thirdly, all the economic and social developments of the countries particularly infrastructures, agriculture, industry and mining demand large construction works in the form of bridges, dams, irrigation works, roads, buildings which again require huge quantities of iron rods, steel structures - cables and wires. Fourthly, one should include the capital goods (machinery, equipment and accessories) needed by the fast growing manufacturing industries, mining and public utilities.

43. Thus, the first method to rationalize the development of basic metals and engineering is to have an integrated approach in planning and programming the developments and needs of agriculture, transport and communications, constructions, manufacturing industries themselves, mining and public utilities. Such perception would certainly bring into light the strategic need for the development of basic metals and engineering.

(ii) Second strategy alternative

44. Another approach is to take the development of basic metals and engineering as focal points of development, i.e. not only as suppliers and service rendering subsectors but also as leading and dynamic subsectors which can spearhead nationally/regionally integrated and self-sustained industrial development, create national/collective self-reliance, enhance control over national/regional resources, promote subregional/regional co-operation, and generate indigenous technical and managerial capabilities and innovation to transfer, adapt and develop technologies and skills.

(iii) Third strategy alternative

45. The development of basic metals and engineering could also be based on the strategies of import-substitution and/or export promotion. It must be ascertained, however, that projects thus selected could create greater value added and/or establish their roots in the national economies in the long run. These projects are usually found in industries (i) processing local raw materials mainly for domestic consumptions with supplementary exports, (ii) processing abundant local resources without large domestic market base but mainly for exports, (iii) processing imported raw materials and/or intermediate inputs for large domestic consumption but involving higher value added and deeper process technology, and (iv) processing imported raw materials and intermediate inputs for exports but with greater value added and deeper process technology.

(iv) Pros and cons of strategy alternatives

46. Strategies (i) and (iii) are limited, among other things, by the smallness of the national markets of most African countries (Nigeria and Egypt may be exceptions) as against the minimum required economic size of projects in basic metals and engineering. Strategy (ii) is of most developing African countries on the one hand, and the unwillingness of TNCs to co-operate in such ventures with the restrictions the advanced countries impose on the import of manufactures from developing countries on the other. Although Egypt and Nigeria may not be as much endowed with large well-known deposits of non-oil mineral resources as smaller countries like Liberia, Sierra Leone, Guinea, Gabon, Zambia and Mauritania, they both have embarked upon exploiting these strategies

47. One of the best solutions to overcome the smallness of the national markets (in smaller countries) and lack of well-known non-oil mineral deposits (in larger countries) is to form subregional/regional intra-corporation (among different national corporations of the region), co-operative arrangements in distribution of outputs and acquisition of inputs on a long term contractual basis. Such long term sales and purchase contracts could include co-production of components, and parts, subcontracting, joint ventures, cross-equity holdings, exchange of directorates and information. Some co-operations have already started to be based on such modalities. The recent co-operation on the iron ore development between Guinea, Nigeria and Algeria, the negotiation going on between ECOWAs member States, between Egypt and Sierra Leone on iron ore, Zambia with Nigeria and Egypt on copper, and Algerian, Nigerian and Kenyan moves to develop machine tool industries with India are good examples.

48. Strategy (iv) could be tried by smaller countries having cheap skilled labour but without abundant local resources. This could be possible especially in light engineering industries on he basis of subregional/regional market co-operation rather than on export processing zones to cater for the markets of developed countries. Some countries have been considering implementing this strategy through invitation of the traditional suppliers, private foreign companies or transnational corporations (TNCs) outside the region. The idea is mostly based on the assumptions that TNCs deploy their home based industries to developing areas merely to obtain a central point for market distribution. Prior reservations or allocations of the market (in the areas) for their home or elsewhere based industries, inter alia, may cancel out such advantages. Apart from this, the possible reactions of individual member States in the subregional/regional market co-operation should be properly analysed in perspective so as to avoid any future problems. In this view, careful attention should be paid to such things as rules of origin, ownership patterns, the origins of TNCs, level of value added, etc. Furthermore, the benefits the TNCs could give should also be evaluated in terms of all co-operating countries not only in terms of the country where the plant is located.

(b) Policies on capital formation

49. Some of the most important requirements for self-reliance are higher domestic savings and foreign exchange earnings to finance priority and strategic projects like basic metals and engineering which require heavy investments and have longer gestation and amortization periods, and from which foreign enterprises shy away. The increase in domestic savings and exchange earnings involves well prepared and administered fiscal, monetary and commercial policies.

50. Domestic savings come from government surplus budgets, the earnings of private and public enterprises, and individual household savings. Savings in the form of governments' surplus budget require efficient tax collection systems and proper control over current budgetary expenditures. The increase in the earnings of public and private enterprises demands material and cost controls and improvement in productivity while mobilization of household savings involves opening commercial and saving banks, compulsory insurance policies in certain areas, incentive saving rates, etc. This must be accompanied by well synchronized monetary and credit policies of the central saving, commercial and development banks so as to channel the saving thus obtained to investments in priority and strategic projects. In the absence of private local and foreign enterprises in the dynamic and strategic projects like basic metals and engineering these financial institutions should also take the lead in promoting projects by carrying out feasibility studies participating in equity, etc.

(c) Policies on entrepreneurship

51. Depending on ownership pattern, there should be enough room for pecuniary and non-pecuniary incentives and motivation for the development of indigenous entrepreneurship, innovation and management. In the case where private enterprises are stressed, there should be adequate and clear legal definitions with sufficient clauses to protect both the public and private interests,

rights and obligations including capable administrative machinery to enforce the laws. Where public ownership is preferred, the parastatal bodies and other public enterprises should be divorced from direct links to the political institutions or bodies (ministries) but should be managed by a board of directors in which relevant institutions are represented. That is, the management should be given adequate autonomy and stability so as to develop entrepreneurial and innovative talents and ambitions as well as managerial and technological capabilities and know-hows in public enterprises.

52. The government must also use deliberately and consciously public manufacturing enterprises, corporations and other parastatal bodies like the development and commercial banks, railway companies, etc. to develop the priority and strategic subsectors like basic metals and engineering. Apart from this, the public enterprises should be evaluated by their long-term performance, planning and programming their development projects within the given general broad policy framework, objectives and priorities. Last but not the least, selection, appointment and promotion of managers should be on merit basis; and the inputs and outputs of public enterprises must be properly priced.

53. Where mixed economies are practised, the States should not completely relegate the management of the joint venture manufacturing enterprises to the foreign collaborations. In many African countries, the interests of the States are assumed to be followed up through representation in the board of directors usually by senior officials on a part-time basis while the actual management activities are left to the foreign participants. Such practice has hampered the development of indigenous skills, and unnecessarily prolonged foreign controls over management. Thus the government participation should not be limited to equity subscription and representation in the board but also in the placement of indigenous personnel in top management posts, and as key technical department heads. This must include regular on-the-job training arrangements for indigenous personnel at all levels.

(d) Policies on incentive schemes

54. It has been mentioned that the policy measures or incentive schemes should be revised to favour priority and strategic subsectors like basic metals and engineering. In other words, the policy measures or incentive schemes should be re-arranged in such a way as to have multiple-stage inbuilt discriminative mechanisms in which each incentive scheme is bestowed to a specific type of national developments and benefits. The types of developments and benefits could be number of indigenous employeees and training arrangements for them; net foreign exchange earnings and savings to the economy as a whole; value added; net contribution to the government revenues; indigenization of ownership and management; location of plants in remote areas; development of managerial and technological capabilities and multiple product lines based on local tates; designs, satisfying the needs of the masses and requiring diversified skills; transfer, adaptation and development of technology; volume of investments the degree of internal/regional linkages and the promotion of self-reliance and control over natural resources.

55. There is a need for some rationalization in the existing system of incentives in order to remove the existing redundancies and over-generousities. Some of the incentive schemes which are unnecessarily over-generous or redundant are: (i) subsidized rates for freights, power, water and port facilities in the light of critical bottlenecks in these facilities and the financial strains they are facing; (ii) exemption of the products of new factories from the local excise and sales taxes at the expense of the existing enterprises, (iii) provision of land and building premises at very low rents to foreign enterprises in export processing zones, (iv) preferential treatment to foreigners in acquiring loans from local banks. Such incentive schemes have already reduced the capital amortisation period resulting in capital flights. Apart from this, the incentive schemes, including licensing and bank loan procedures should not discriminate against the small-scale and cottage industries and handicrafts.

(e) Policies on manpower development

56. Many African countries have already established a number of universities, technical colleges and institutes. In order to meet the existing critical shortages of managers, engineers and technicians and training institutes should increase technical and business graduates. The curriculum must be revised so as to meet the needs of industries rather than theoretical perfections. There should also be appropriate allocation and placement of graduate engineers and technicians in manufacturing industries with proper follow up to ensure that engineers and technicians are given full opportunities to learn practical experiences in operations of equipment, plants and machinery and should be exposed to techniques of managing factories through proper coaching under the supervisions of senior engineers and technicians. One mechanism that could be introduced to facilitate this approach is the idea of teaching companies modelled on the concept of the university teaching hospitals.

(f) Technology policies

57. The African region could learn a lot from the early experience of the Japanese industrialization policy on technology. The Japanese major strategic policies were, inter alia, (i) machinery, equipment and accessories were imported and installed for the purposes of producing goods and serving as models to be studies and reproduced, (ii) indigenous technicians, engineers and students were sent abroad not only to acquire theoretical and scientific knowledge but also to imitate and copy foreign technologies, and (iii) expatriates or foreign technicians and engineers were employed not only to operate factories and produce goods but also to teach their

local counterparts to operate and maintain factories and show the Japanese how to produce goods. Such technology policy could be followed by African countries particularly with the provision that any renewals of contracts for expatriates would depend mostly on the recommendations of their counterparts and local management.

58. The future integrated development of basic metals and engineering industries in the African region needs appropriate attention to the transfer, adaptation and development of technology and know-how. One approach to the successful pursuit of such a policy would require the introduction of new laws and regulations, (and the revision of the existing ones) on patent, trade names and marks, designs, franchise, royalty fees and industrial properties so as to give indigenous firms, technicians and engineers freedom to imitate and a free hand to copy foreign technologies, know-how and adapt them to local needs. Some developing countries in Asia and Latin America have gone as far as refusing registration and publication of notices on official papers of any patents, trade names and marks, designs and other restrictions on industrial property rights unless the proprietors have invested in local plants using the process technologies in question. Other countries have banned the use of imported or foreign trade names and marks, frachise and packing designs on locally consumed goods to reduce foreign exchange payments and establish a national product identity.

59. Another approach to promote transfer, adaptation and development of technology is to establish technology centres with the responsibilities and authorities to screen the types, levels, appropriateness, costs, terms and conditions as well as adequate arrangements for the transfer, adaptation and development of technology. If there are many competing foreign investors or if investors are mostly local businessmen or public enterprises with local funds or loans from transnational and multinational institutions, the technology centre should be empowered to review terms and conditions governing the technology transactions in order to forestall cartelization and monopoly of technology. If an investor is a single foreign company possessing its own technology, or if the technology is under a cartel or monopoly, the government may not have enough options. But even in this case, the government should negotiate the contracts striving to find suitable comparisons or alternatives.

B. INSTITUTIONAL REQUIREMENTS

(a) National institutions for industrialization

60. As a result of the experiences of other developing countries, a planning and development strategy with emphasis on the implementational phase of development projects has evolved. This development strategy calls for a well organized institutional framework for planning and implementing development projects. The institutional framework normally consists of organizations like, the economic planning bodies, industrial studies institutes, industrial promotion organizations, designs, engineering and construction organizations, project executing and operating organizations and project monitoring organizations.

61. The functional role of economic planning bodies is to formulate development programmes, the industrial study institutes to undertake identification and feasibility evaluation of projects, for industrial promotion organizations (industrial development corporations) to organize implementation of projects through project planning and contract supervision, for design and engineering institutes to do actual design, engineering, procurement and construction of projects for project executing and operating organizations to execute the projects and operate industrial plants, and for the monitoring bodies to monitor government projects and report on them to the highest levels of the government.

62. The present development machinery and strategy in African countries, suffers from two main weaknesses which are (i) lack of a well organized institutional framework consisting of institutions as defined above for handling development functions and (ii) lack of expertise in respect of activities involved in development planning and specially implementation of projects.

63. Another important area in which there is great need for expertise and knowledge in African countries is that of technology transfer and contract negotiations. Technology transfer has its technicalities such as exclusiveness/non-exclusiveness of technology use, process and engineering guarantees, process patents etc. which call for full familiarity with those matters, and similarly several different types of design-engineering project contracts - turnkey lumpsum, cost reimburseable, semi-turnkey, supply of know-how and engineering - involving also their legal aspects, are currently in practice. A proper knowledge of this specialized field is very necessary for countries in Africa to enable them to safeguard their interests and purchase technology and technical services on reasonable terms and conditions for the development of expertise in this area.

(b) Institutions for regional co-operation

64. While the need for regional co-operation has been stressed by all international as well as regional organizations in Africa, and even the formation of subregional economic communities like UDEAC and ECOWAS has taken place, yet the real economic integration based on the real spirit of co-operation between member States has still to come.

65. In order to achieve this objective, co-operation must be organized at four different levels (i) the political level through OAU, (ii) the subregional level through organizations such as UDEAC and ECOWAS, (iii) the country level through member States and (iv) the United Nations level through UN agencies such as ECA, UNIDO and UNDP. Co-operation on a subregional basis must be stressed at all these levels and the organizations concerned must play their role with sincerity of purpose to bring about the success of the subregional economic communities in Africa.

66. In addition, there is imperative need for the development of an institutional framework for co-operation for different economic activities in the subregions, and the subregional secretariats must undertake this important activity. For instance, an institutional framework must be developed for joint industrial ventures, in which each member State can have its financial participation and also proportional representation at the management level of the enterprise. Similarly institutional mechanisms for co-operation for other economic activities should also be developed as precursors to the actual establishment of these organizations.

(c) Mechanism for regional investments

67. A mechani m for translating political aspirations f r regional co-operation into economic realities at production level is urgently needed. A concept of African Multinational Industrial Corporations (AMICs) has been put forward as one such mechanism to deal with co-operation effort at enterprise level. 11/ AMICs could be modelled on the lines of transnational corporations which have demonstrated their ability and flexib lity to sustain a varying degree of quite exacting social, political, cultural and economic envir nments.

68 In order to avoid the past problems and obstacles in subregional and regional economic co-operation, AMICs should make a complete departure from the past concepts of co-operation, That is, AMICs should concentrate more on new objectives, strategies and modalities of co-operation. As far as possible, AMICs have to avoid high level politics and ideologies, an put more stress on business approaches, indeed, taking into consideration the special needs, interests and stages of growth of member States. Thus objectives of AMICs, inter alia, should be

(i) Acquisition of basic raw materials, intermediate and capital goods for the existing and/or potential national, subregional and regional factories over a long-term basis a reasonably stable prices

(ii) Distribution and marketing of the existing and/or potential raw materials, intermediate inputs, and finished and capital goods, guaranteed for long term periods at reasonably stable prices

(iii) Development and exploitation of new cheap resources, such as mineral wealth, agro-industries (multi-purpose river basins) with cheap power and labour

(iv) Meeting the demand and need to diversify investment location source of inputs and foreign markets

(v) Meeting the need to expand and grow, keep up with oligopolistic competition, and adjust structural imbalance both at national and regional levels

(vi) Developing and longer perspectives, to pioneer joint ventures and spearhead the establishment of basic, leading dynamic and nationally and regionally integrated industries requiring large-scale production and investment;

(vii) Acting as holding companies in different industrial activities without competing with national factories or companies but complementing and rendering technical, financial and managerial assistance to national factories or companies.

(viii) Acting as nuclei for collective self-reliance, control over the development and exploitation of natural resources, reduction of economic dependence on TNCs through interdependence between regional indigenous

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11/ Regional Industrial Co-operation, (ECA/CMI/FCIA.6/WP/3)/(ECA/CMI.5/IMP/WP/3), 18 July 1979.

(private and state) corporations, and gathering and dissemination of information and technical data on the activities of TNCs;

(ix) Transferring, adapting and developing technology and integrated research units within production plants (laboratories, quality and standard controls, workshops, R & D);

(x) Acting as focal points for technology acquisition and teaching companies in the development of managerial and technological capabilities, curtailing and/or reducing the 'brain drains', and unemployment and underemployment of the intellectuals through proper and regular channelling of graduates in engineering and business to industry and arranging for apprenticeship and in-plant or on-the-job training;

(xi) Developing and designing new product choices - multiple product lines - which meet the market needs and require diversified skills;

(xii) Collecting and disseminating economic information and technical data which could improve the transfer, adaptation and development of technology, upgrade the negotiative skills of each member State with TNCs and developed countries, provide alternative options and modalities for regional and interregional co-operation, sources of finance, technology, inputs, etc.

69. The formation of AMICs could be facilitated if promoted through the existing national industrial corporations, financial institutions, state holding companies and public utilities depending on the preference of member States as to which institutions and corporations they wish to delegate. Apart from avoiding high level politics and protocol, building on existing institutions and corporations will reduce the effort of establishing new administrative and organizational structures. The existing national corporations and institutions can easily draw upon their skilled personnel and experience for running the multinational organizations. Being non-political bodies, they will see to it that all co-operative arrangements are made on the basis of business interest and efficiency. But it would be much better if member States could delegate responsibility to national corporations operating in similar lines of activities or having interests either in production or marketing.

70. In addition, the amount of funds to be contributed or the ratios of shares should not be rigid, and the concept of equal contribution should be avoided. The ratio of equity participations could be based on individual members' capacities and interests, shares could be diversified as the need arises to stocks, short-term bonds, long-term securities, etc. Voluntary contributions over and above the required minimum could be acceptable.

71. Membership should not be obligatory but voluntary and large memberships should not be prerequisite at initial stage. Similarly subregional approaches in membership are not necessary. That is, AMICs could even be formed with two or three member States drawn from any parts of the region based on their interests and needs. It is also much better if decisions are made initially through consensus rather than unanimity or majority voting without involving vetoing, and at the same time withdrawals and new entrants should be allowed.

72. It should be clear that AMICs are not competing against any subregional and regional organizations, but supplementing the regional and subregional institutions, organizations and economic groupings. Thus AMICs should work with them, or in other words AMICs should act as an institutional machinery to translate their efforts into reality, and as a nucleus for further regional co-operation.

73. The modalities of forming AMICs should be as many as possible so as to provide greater flexibilities, multiple choices and characteristics to meet the differing needs, interests and objectives of member States. The following are examples of such modalities:

(i) To use as nuclei the existing multinational industrial corporations like: the iron ore project (between Guinea, Nigeria and Algeria) by expanding their scopes, objectives and operational functions so as to make them fulfill the objectives of AMICs, extend their features over as many industrial activities as feasible and meet the needs and interests of member States;

(ii) To call upon 'joint-pioneering countries' and 'growth initiative' national states to lead the establishment of AMICs on joint venture basis in the field of basic, dynamic and regionally integrated industrial projects

(iii) To promote cross-purchase of nominal shares or cross-equity investments or holdings among existing and new national corporations. This could extend to exchange of management among existing and potential national corporations (of the region) operating in similar lines of activities or vertically or horizontally integrated economic activities, e.g. corporations using the outputs of others as inputs. Such simple process would create much co-operation in distribution, marketing and financial arrangments. Thus existing national cement, sugar, petroleum fertilizer pulp and paper, metal, machine-tool and power generating corporations could practise these collaborative or mutually reciprocal arrangements;

(iv) To establish joint affiliates or subsidiaries to render joint or common services, production and supply of components and parts, maintenance and repair work e.g common shipping, transit and advertising agents, common management and engineering consultants, design and training centres, etc.

(v) To share jointly existing facilities - e.g. maintenance and repair workshops, laboratories, engineering design and research centres, in-plant training facilities, etc., on inter-corporation basis, etc.

(d) <u>ECA, UNIDO and OAU's role in implementation of the programme</u>

74. United Nations organizations will have to play a very active role in the development of the African region mainly through its principal agencies like ECA, UNIDO and UNDP. United Nations programmes will also have to be co-ordinated with OAU policies and programmes in Africa. In order to provide expertise for the satisfactory development of the basic metals and engineering industries, the following regional institutes are proposed to be set up with ECA/UNIDO assistance:

(i) African Centre for Repair and Maintenance

(ii) African Centre for Iron and Steel Industry

(iii) African Centre for Non-ferrous Metals Industry.

75. In addition to these three centres, the Economic Commission for Africa in close collaboration with UNIDO and OAU has launched several inter-country projects at regional level. In order to have accelerated industrial development in general and engineering industries development in particular the Economic Commission for Africa is executing the following regional projects to assist the African developing countries to succeed in their self-reliance and self-sustaining economic and industrial growth in accordance with Lima Declaration and Plan of Action.

- African Multinational Industrial Corporations will assist in implementing sectoral development programmes initiated by ECA, UNIDO and OAU are expected to yield an increasing number of activities and projects appropriate for multinational industrial co-operation among African countries. This will create multinational and African participation in greater industrialization of African countries

- The African Institute for Higher Technical Training and Research will be established in Kenya. The objectives of this Institute will be to assist the African countries in acquiring and developing adequate technical manpower capabilities. It will also collaborate with national, regional and international high technical training and research institutions in carrying out technical manpower development programmes;

- The African Regional Centre for Technology established in Senegal will provide assistance to African countries in institution building for transfer of technology, training of skilled manpower in the analytical and technical aspects of transfer of technology, establishment of technological information system and providing specialized advisory assistance in such areas as negotiations and legal aspects of transfer of technology

- The African Regional Centre for Engineering Design and Manufacturing has been established in Nigeria. The Centre will assist the African countries in engineering design of machinery and components, manufacture of machine parts and components and prepare studies for engineering design and manufacture of specific products

- The African Industrial Development Fund will assist the African developing countries to provide funds for prefeasibility and feasibility studies particularly for multinational industrial projects

- The African Regional Centre for Consulting Engineering and Management is now being studied and is a vital element in any African programme.

C. BASIC METALS INDUSTRIES 12/

76. The basic metals industries in Africa exist at different stages of development in the different subregions. In North Africa, the basic metals industry is relatively well developed. In West Africa, there are on-going projects to create the basic

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12/ See Annex I-A.

metals industries in Eastern Africa, the non-ferrous metals industry exists at raw materials processing stage. The iron and steel industry is non-integrated and usually based on imported inputs of scrap and billets.

(a) Restructuring of trade

77. Successful development of the basic metals industry in Africa requires considerable restructuring and change in the composition of trade within the region, shift in the product composition, and move towards processing of ores and concentrates into semi-manufactures. It is expected that the first move will need to be an attempt to substitute imported supplies by domestic production of local demand within the region.

73. The major policy issues to be resolved include pricing modalities, measures to stabilize exports and import prices between countries of Africa, removal of trade barriers, elimination of restrictive business practices, cartel policies and monopolies arising from manipulation of markets by transnational corporations operating in the African region.

79. In view of the narrowness of markets in individual African countries, development of basic metals industries requires concerted effort among countries in Africa with regard to restructuring the markets at national, subregional and regional levels. Mechanisms for achieving this objective require development of consumption, changes in geographical distribution of production, specialization in product mix among producers in the region, and design of a practical marketing mechanism among African countries.

(b) Relationships in industry

80. The basic characteristics of basic metals industry is the complex inter-play between producers, suppliers, merchants, manufacturers and final demand end-users. The relationships between these interested parties forms a business environemtn for transnactions in basic metals industries. In order to create this desirable environment, African countries must reorganize the flow of supplies, inputs and outputs with respect to volume, type, and quality across the receiving sectors of their respective economies in order that transactions within the basic metals industries may link and integrate with the economies of Africa as a whole.

81. Inter-industry transactions at subregional and regional levels are the essential pre-conditions for developing the basic metals industries. All the relevant factors relating to the market, (particularly mechanisms governing the demand, supply and consumption) require special investigation in each country of the African region with ultimate aim of setting up a stage for regional co operation. The basic metals industries of Africa are governed by exacting dynamic factors such as stages of economic development, structure of the economy and industry.

(c) Consumption of metals

82. The level of economic development of a given country is an important determinant of final demand for basic metals products. Closely related to the level of development is the structure and pattern of the economy particularly the branches most likely to consume metal end-products. In the early stages of development, metal consuming industries are insignificant. The sectors which do not consume metal products are predominant.

83. The next stage of development requires a large quantity of metal products needed for the physical infrastructure. The final stage of development creates metal transferring industries linked to engineering activities.

(d) Specialization

84. Individual African countries must draw up measures aimed at specializing in metal products: special steels, stainless steels, carbon steels, brasses, bronzes, refractory alloys, currency metal alloys, and other products. In addition to this effort, African countries within given subregions must agree on measures aimed at specializing on semi-manufactures: flat products, plates, sheets, skelp, strip long products bars, rods, sections, shapes, final demand products, tin plates, pipes, tubes, wire products engineering steels and others.

(e) Specific priorities

85. The following recommendations are made:

(i) African countries should strengthen their capabilities and bargaining position in respect of procurement, negotiating and contracting for metallurgical technology;

(ii) African countries should draw up measures aimed at restructuring of the markets, consumption and end-uses of metals and alloy products at national, subregional and regional levels;

(iii) African countries should explore the potential usefulness of African Multinational Corporations as an instrument and mechanism for co-operation in the basic metals industry with a view to overcoming the following constraints: markets, investment finance, manpower, economies of scale, external economies, cost structure of production, and bargaining position with transnational corporations;

(iv) In order that African countries may achieve internally self-sustaining development, diversification and collective self-reliance by the year 2000, measures are required aimed at drawing up short-term medium-term and long-term programmes aimed at shifting production emphasis from raw materials production to advanced processing in order to produce final demand metals and alloy products.

D. ENGINEERING INDUSTRIES 13/

(a) Role of engineering industries

86. The African developing countries so far have achieved different levels of industrialization except for a few African countries, e.g. Algeria, Egypt, Kenya, Nigeria, most of the countries industrialization levels can be considered to be in primary stages. It is an accepted fact that the engineering industries play a significant role in the process of industrialization, particularly in their interactions and linkages with major sectors of the manufacturing industries. So

13/ See Annex I-B.

far engineering industries have made a relatively small contribution to the economy of the individual countries in the region. The promotion and wide spread development of metalworking industries will no doubt put this share at a much higher level in African economy.

87. The relatively low level of development of the engineering industries has urged the developing African nations to include the manufacture of engineering products in their national development plans, thus emphasizing their key role in the process of industrialization. Particularly, in the least developed countries in Africa, the metal products sector and specifically the heavy engineering industries should provide all the other sectors of industries with their productive machinery and equipment, and also the facilities for training of skilled labour. 14/

(b) Integrated development

88. All these lead to the idea of an integrated development of this important sector of the economy. Therefore, this chapter will highlight the important parameters for the integrated development of engineering industries in Africa which require the following development aspects, e.g. -

- Institutional development aspects related to the engineering industries,
- Technological development aspects related to the engineering industries,
- Institutional and technological interlinkages for the engineering industries development aspects,
- Management and manpower development aspects for engineering industries,
- Integrated priority projects and systematic programming of these projects for interlinked development of engineering industries at national levels, subregional levels and regional levels,
- Greater co-operation among interregional developing countries to assist the integrated development aspects of engineering industries.

(c) Institutions

89. The institutions (governmental and non-governmental) play significant role in the development and maintenance of engineering industries. The institutional constraints can be overcome if the existing institutional structures can be re-oriented to suit the harmonious development of engineering industries whose role and characteristics are important milestone for Africa's self-reliance and self-sustaining economic growth. Policies, strategies and measures adopted for the development of engineering industries must be consonant with the prevailing institutional framework. Flow of relationships between various organs of government, industrial enterprises, parastatal organizations and industries involved in engineering activities must be ensured.

90. It is true that in many African countries such institutions do exist in some form or other. What is important is the creation of interlinking co-operation and co-ordination for effective planning, programming and implementation of integrated engineering industries development process.

14/ Role and place of engineering industries in national and world economies, Volume I, ECE/ENGIN/3.

91. In order to programme an integrated development of engineering industries at national level, it is essential that the institutional mechanism should comply with interlinked development process within the framework of African Governments' policies and strategies which are clearly outlined in the development plans. The proposed structural requirements and rationalization of existing institutions responsible for the engineering industries integrated development envisage the following important aspects:-

(i) development and reorientation of the institutional mechanisms;

(ii) identification and rationalization of institutional activities;

(iii) institutional responsibilities and identified work areas;

(iv) interlinkage of activities through horizontal and vertical integration of various institutions responsible for integrated development;

(v) integration of sectoral and subsectoral development programmes through the restructuring of existing institutions with minimum duplication and overlapping activities for specific engineering projects.

(d) National technology plans

92. The important criteria for the integrated development of engineering industries demand the development of technological aspects for specific engineering activities. The development of manufacturing technology is the recognized milestone for the industrial progress in general and self-reliance and self-sustaining economic development in particular. The whole structure of engineering activities greatly depends on technological innovation at manufacturing level. In order to achieve technological development, it is necessary to set realistic objectives through the national institutions to cater for the real technology needs best suited to local conditions. This can only be achieved through the creation of national technology plans for the integrated development of engineering industries development programmes in each African developing country. Such national technology plans must clearly spell out the modalities and appropriate policy instruments.

93. It is highly desirable that national technology plans should be formulated in a flexible manner in order to incorporate systematic technological interlinkage at various levels of manufacturing activities within inter-sectoral and subsectoral levels. Such technology plans must clearly spell out

(i) various manufacturing technology requirements in engineering industries with a view to maximize the utilization of natural resources best suited to local conditions;

(ii) the development of indigenous manufacturing technology through adoption, adaptation and innovation of basic engineering manufacturing processes so that maximum local employment can be achieved;

(iii) the requirements of machinery, equipment and facilities for engineering operations in such a manner that maximum employment can be guaranteed at industry level.

(iv) comprehensive survey of existing technologies being used in subsectoral engineering activities as corresponding to existing levels of technology of engineering industries in African countries,

(v) a definite time target for the development of indigenous technologies in priority engineering industries to control the foreign technologies which are inadequate or too sophisticated and if incorporated could bring mass unemployment and high drainage of foreign exchange,

(vi) the assessment of manufacturing technologies for iron and steel making, foundry forging heat-treatment, machine shop operations toolroom work, and major basic manufacturing and processing requirements for the engineering industries development programme,

(vii) adaptation of technologies for the accelerated manufacture of indigenous spare parts and components in vital sectors of engineering industries,

(viii) the definite technology criteria for the manufacture of engineering capital goods and engineering intermediate goods with special reference to the indigenous manufacture of machine tools.

(ix) a national plan and target for the requirement of managerial and skilled operatives for engineering industries, who will be responsible for the development and application of technologies at manufacturing level,

(x) a comprehensive and durable training programme to absorb the inidgenous and foreign technologies at management and skilled operatives level in engineering industries.

94. Therefore the national technology plans will regulate and control appropriate technologies during transfer process taking into account maximum development of indigenous technologies through the actual assessment of:

- the real need for basic manufacturing techniques
- the need for appropriate machinery and equipment best suited under local conditions
- maximum absorption of inidgenous and foreign technologies where the important parameter will be to organize effective training programmes for developing local skills and dexterity for engineering manufacturing operations at industry level.

E. SUMMARY OF RECOMMENDATIONS

95. It is recommended that the Joint ECA/UNIDO Industry Division in collaboration with the relevant substantive divisions of the ECA should organize seminars and workshops on technology transfer and contract negotiations in basic metals and engineering industries for the benefit of African countries. It is furtehr recommended that African countries should be encouraged to make use of the model forms of contract agreements for implementing basic metals and engineering industries projects. Further, till such time as expertise, know-how and experience are built up in this field in the African region, countries should be encouraged to associate experienced UN experts and consultants in their planning, negotiating and contracting for basic metals and engineering industries projects.

96. It is recommended that African countries should strengthen existing institutions (and build new ones where they do not exist) dealing with development planning, sectoral planning, preparation and implementation of basic metals and engineering industries projects, plans and programmes.

97. ECA, UNIDO and OAU should

(a) With respect to the basic metals industries

(i) provide concrete indications for possible subregional co-operation in the basic metals sector in the common interest of African countries with references to infrastructure, natural and financial resources, social needs, manpower needs, training and management, provision of services, manufacture of capital goods, etc.,

(ii) seek the co-operation of the countries with already established steel industries to provide training schemes including in-plant schemes for all categories of personnel from the countries just starting steel projects (could also be within the framework of UNIDO),

(iii) undertake the efforts for co-operation between the neighbouring countries with the aim of strengthening economic, financial and other types of collaboration between them in order to establish a unified strategy in the basic metals industries,

(iv) undertake the market study on structure of prices for raw materials and fuels in the region depending on kind of exploration and geological conditions of deposits,

(v) undertake the efforts in increasing of joint venture projects as forms of international and subregional co-operation in raw materials, coal and ore field development,

(vi) foster subregional and regional co-operation on research and development of all aspects of coal mines development and the utilization of coking coal because of its importance to the iron and steel industry,

(vii) establish the regional research and development centres in the field of utilization of coals, lignites and other fuels for reduction purpose in the metal production and pelletizing and provide information and services,

(viii) organize study tours to developed countries for representatives of all countries possessing fuel deposits to see practical examples of modern methods of economizing in the use of coking coal,

(ix) organize study tours to those developing countries that are working through their steel industry development programmes in order to set out the technical and other criteria to be assessed in establishing a steel industry, including the exploitation of ore and coal fields working out the plans and projects,

(x) maintain the contacts and co-operation between research and development institutes in developing and developed countries and provide the information as may be needed by developing countries from these institutes,

(xi) undertake the planning of the linkages of the basic metals industry to overall economic development of the countries and subregions,

(xii) undertake the study of possibilities of subregional markets to avoid any futher constraints in future development,

(xiii) recommend taking steps in the interchange of raw materials on a mutually advantageous basis the interchange of metallurgical know-how, of trained manpower and management and capital investment,

(xiv) to undertake efforts in establishing of refractory and ferro-alloy production in selected countries,

(xv) make the plans for the establishment of sponge iron plants in those countries that have high grade iron ore and natural gas resources charcoal and non-cokable coals,

(xvi) undertake the efforts in formulating the overall strategy for the growth of the basic metals industry,

(xvii) undertaking studies with the object of focusing attention on the main problems and factors which are of critical value for the development of basic metals production,

(xviii) to achieve rationalization of existing plants, full utilisation of existing capacities and their upgrading will give great benefit. This question should be studied by ECA,

(xix) industrial development is a complex phenomenon, the targets of internal development have to coincide with external global participation of Africa in the international linkages,

(xx) Poposed Project Implementation Plan (1982-1986 UNDP Cycle)

		m/m	US$ 1000
	1982		
	Studies and investment formation		
a)	Subregional integrated Basic Metal Development project (prefeasibility)	48	343
b)	Enrichment of iron ores (prefeasibility)	12	86
c)	Survey and scientific assessment of coals for iron and steel implementaion(regiona,subregional)	36	257
	Institutions and training		
a)	Technical working group on Basic Metal Development project (15 participants, 10 days)		52
b)	Training workshop of managerial level on planning and programming (25 participants, 20 days)		100
		115	836
	1983		
	Studies and investment promotion		
a)	Pelletizing(prefeasibility)	48	370
b)	Non-ferrous (prefeasibility)	48	370
c)	Enrichment of iron ores (promotion)	24	185
d)	Foundry (ferrous, non-ferrous centre (prefeasibility))	8	62
	Institutions and training		
a)	Training: Preparation and evaluation of contracts (25 participants, 20 days)		108
b)	Training: In-plant training (25 participants, 60 days - for enrichment of iron ores)		250
		134	1345

	m/m	US$ 1000
1984		
Studies and investment promotion		
a) Refractories (prefeasibility)	36	300
b) Non-ferrous (promotion)	24	200
c) Pelletizing (promotion)	24	200
d) Coals for iron and steel industry (prefeasibility)	8	67
Institutions and training		
a) Non-ferrous (meetings, establishment)		90
b) Pelletizing (meetings, establishment)		90
c) Training: In plant and training (25 participants, 60 days)		275
	102	1222
1985		
Studies and investment promotion		
a) Refractories (promotion)	24	216
b) Refinery of non-ferrous (prefeasiblity)	24	216
c) Refinery of non-ferrous (promotion)	24	216
d) Coke production (promotion)	24	216
e) Ferro-alloys (prefeasiblity)	48	432
Instituions and training		
a) Refractories (meetings, establishment)		100
b) Refinery (non-ferrous meetings establishment)		100
c) Coke production (meetings establishment)		100
d) Training: In-plant training for refractory and coke production (25 participants, 60 days)		300
	152	2096

	m/m	US$ 1000
1986		
Studies and investment promotion		
a) Form coke production(prefeasibility)	48	467
b) Subregional integrated Basic Metal Development project (promotion)	24	233
c) Ferro-alloys(promotion)	24	233
d) Hot and cold rolling(prefeasibility)	48	467
Institutions and training		
a) Subregional integrated Basic Metal Development project (meetings, establishment)		108
b) Ferro-alloys (meetings, establishment)		105
c) Training: In-plant training (30 participants, 60 days)		350
	150	2965

(b) With respect to engineering industries

(i) to formulate an integrated sequenced development programme for engineering industries;

(ii) to restructure the institutional arrangements of interlinked development of engineering industries at national level;

(iii) to create and establish a planning and programming unit under the ministry of planning at national level;

(iv) to create a development corporation if not in existence;

(v) to form engineering an/or metalworking industries development board;

(vi) install national cnetres for industrial research and development;

(vii) to formulate a national technology plans for engineering industries development;

(viii) to interlink the institutional and technological engineering activities;

(ix) to implement manpower development programme for engineering industries development;

(x) to introduce in every African iuniversity and technical institutions courses in industrial engineering;

(xi) to organize in-plant training courses and engineering courses in selected engineering disciplines;

(xii) to survey and conduct prefeasibility and feasiblity studies for the subregional and regional engineering sequenced projects;

(xiii) to undertake immediate studies at national and subregional levels for:

- expansion of existing foundries, forging, heat-treatment, machine shops, toolrooms, etc.,
- identification and manufacture of selected machines/ machine tools in existing railway workshops and in large repair and maintenance workshops,
- incorporation and expansion of industrial estates,
- expansion of ancillary engineering industries,

(xiv) to create institutional national linkages with ECA executed regional centres and institutions;

(xv) to utilise all United Nations agencies particularly the TCDC and ECDC programmes to implement African national and regional projects for integrated development of engineering industries;

(xvi) to discuss with UNIDO for the implementation of national and subregional engineering projects those projects which are identified and recommended to the African Governments.

F. PROPOSED AFRICAN MULTINATIONAL IRON AND STEEL INDUSTRIES

98. Integrated iron and steel industries at subregional levels are practical propositions in the African regionn. Major problems needing attention in this branch include economically sized plants and product specialization in order to cover the wide range of product mix.

99. Based on the vast iron ore, coal, natural gas, electrical energy, refractories and fluxing materials resources in Africa, this industry can be developed on the basis of subregionally integrated programmi g of production and end-uses of steel products. A subregional organization of mrkets is essential in order to achieve the degree of economic efficiency needed for

iron and steel production. The following projects are proposed bearing the above in mind:

(a) Conversion of national plants and projects into multinational/ subregional programmes 15/

(i) an integrated iron and steel industry for heavy sections, flat products and long products requiring a large output based on the Nigerian Ajaoukuta steel plant to serve the West African subregion in the heavy products market;

(ii) structural and specialized steel product plants (one for construction, one for engineering and one for special steels) within the West African subregion catering for subregional markets in specific product mixes with a view to achieving economies of scale in each product mix;

(iii) an integrated iron and steel industry in the East and Southern African subregions based on product specialization and flow of inputs and outputs with a view to achieving complementary economies and economies of scale within the subregions for specific product mixes;

(iv) a non-ferrous metals industry to produce brass and bronze, based on the mining industry ov Zambia and catering for the Eastern and Southern African subregions with another based on the Zaire mining industry for the West and Central African subregions.

9(b) New projects (regional/subregional)

(i) production of refractories for metallurgaical industries, one in the Eastern and another in the Westerns African subregions;

(ii) a joint venture project to produce ferro-alloys betwen the Sudan and Egypt;

(iii) African metallurgical consultancy services for metallurgical project development, implementation and training, which may eventually form part of the proposed African Centre for Consulting Engineering and Management.

G. PROPOSED MULTINATIONAL ENGINEERING INDUSTRIES PROJECTS IN THE AFRICAN REGION

100. The development of engineering industries based on further transformation of metals and alloy outputs of basic metals industries is a real possibility in Africa. Forward integration starting at the metals/engineering interface and

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15/ See Annex II-B.

ending with diversified finished products could enable the region to be self-sufficient to a large extent. This would inevitably mean organizing the regional markets on the basis of viable product groups of the engineering industry at subregional level. On this basis the following projects were identified:

(a) Conversion of existing national plants and projects into multinational/subregional programmes:

(i) Electrical products, accessoires and materials based on Zambian copper to serve Eastern and Southern African subregions and a similar project for West and Central Africa based on Zaire copper;

(ii) Components and spare parts manufacture for motor vehicles, railway equipment, agricultural equipment, etc. based on existing assembly plants at subregional level;

(iii) Production of machine tools, one in the Eastern and another in the Western African subregions;

(iv) Subregional maintenance and repair workshops for transport equipment based on existing facilities on the basis of specialization and complementarity with a view to fully utilizing existing capacities.

(b) New projects (regional/subregional)

(i) Regional maintenance, repair, services and training centre;

(ii) African Engineering Consultancy Services (for engineering project development, implementation and training) which may eventually form part of the proposed African Centre for Consulting Engineering and Management.

CHAPTER II

GENERAL ECONOMIC AND INDUSTRIAL CONDITIONS IN AFRICA

A. GENERAL ECONOMIC CONDITIONS 16/

(a) Introduction

101. The International Development Strategy (IDS) for the Second United Nations Development Decade has been aiming at an annual growth rate target of 6 per cent in real gross domestic product or 3.5 per cent per capita income for the developing countries as a whole. The annual average growth rate targets assumed for agriculture and manufacturing industry have been 4 and 8 per cent respectively, while for import somewhat lower than 7 per cent and for export somewhat higher than 7 per cent. For developing African countries the Lima Declaration has recommended 12 to 13 per cent annual growth rates in the manufacturing industry so as to attain the share of 2 per cent of the world industrial output set up for the region.

102. Although the developing countries have themselves the primary responsibilities for the development of their countries, their own efforts alone could not raise the level of their economic activities and standard of livings to the required level within the desired times. This has been already recognized by the IDS which states that the success of the Strategy would mostly depend on changes in international economic conditions and co-operation favourable to developing countries. The world recessions, oil and monetary crises, and the problems of demand management and stagflation have continued during the whole period of 1970s. The situation have had unfavourable impact particularly on the African exports and imports affecting their terms of trade, which again have adversely affected their investment expenditures and development plans.

103. A number of important export commodities like iron ores, copper and phosphate has had sluggish demand. The 1976/77 coffee and cocoa boom abruptly came to an end in the beginning of 1978. Only the petroleum demand which has been sluggish during 1977-78 has made substantial improvements starting in the late 1978, since start of the Iranian Revolution. The conditions in the developing Africa could have been worse had it not been for the increased foreign aid flows which have enabled to keep up a higher level of fixed investments. One could also add, the efforts made by some African countries in introducing stabilization measures to control inflation and deficits on their balance of payments through imposing a discipline on their fiscal and monetary policies.

(b) Growth in gross domestic products, savings and fixed capital formation (1960-1977)

104. Inspite of the continuation of the world economic problems, GDP for African countries as a whole increased by 5.8 per cent in 1977 compared to 6.3 per cent

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16/ See Annexes: II-A, II-B, II-C, II-D, II-E and II-F.

in 1976, and the estimated growth rate for 1978 was 5 per cent, i.e. an annual average of 5.7 per cent for 1976-1978, which is higher than the 4.6 per cent attained during the previous five years or 4.7 per cent achieved during 1960-1977. The trend for the 1979 may be less than what was attained during the previous three years. The over-all average growth rates for the last two decades (1960-1978) might not disclose, however, some disparities in the economic performance of developing African countries when grouped into oil exporters and non-oil exporters. The disparities could be even wider if countries are grouped according to per capita incomes.

105. For the total of developing Africa, the share of gross domestic saving in GDP declined to 16.5 per cent as compared to 18.6 per cent in 1970. The trend has continued in 1978. This means that marginal propensity to save has been reduced from 0.30 in the 1960s to 0.11 in the 1970s, which is completely contrary to the concept of self-reliance and self-sustained growth. On the other hand, the share of gross fixed capital formation to GDP increased from 23.2 per cent in 1970 to 26.0 per cent in 1977. This rise accompanied by a huge increase in consumption spending (fall in savings) has, however, created large resource gaps to be financed by reduction in foreign exchange resources and/or increased external borrowings. Another short coming of such huge investment is the rise in the capital output ratio from around 3 in the 1960s to around 4 in the 1970s showing reduction in the productivity of capital.

(c) External trade and balance of payments

106. The volume of exports of goods and services to the developing African countries increased at an average rate of 5.8 per cent in the 1960s while imports of goods and services in real terms rose at a rate of 3.9 per cent only. For the region as a whole import elasticity (to real GDP) was 0.83 (0.49 for oil exporters and 1 for non-oil exporters). But for the 1970s the situation has been reversed. Exports of goods and services increased at an annual average of 3.2 per cent while imports of goods and services at 9.5 per cent Thus the import elasticity rose from 0.83 in the 1960s to 1.98 in the 1970s. This implies that for every dollar increase in real GDP nearly two dollars more are required for imports.

107. Africa's trade in manufacture continues to be characterized by a large and increasing imbalance of imports over exports. Export of non-ferrous metal products, which constitute a large proportion of African manufactures exports has suffered a considerable decline largely due to unfavourable conditions affecting the major African exporting countries. Many new manufactured goods such as engineering products, are beginning to be exported, but their share in total export of manufactures is still small. Dependence on imports of oil and foodstuffs to meet domestic requirements due to slow growth of agricultural production and rapid growth in population increased the external debt and accentuated the inflationary pressures in the majority of countries. 17/

17/ ECA/CMI/FCIA-6/WP/7 Recommendations, suggestions and comments on the Provisional Agenda for the Third General Conference of UNIDO, 8-10-79, p.14.

B. MANUFACTURING INDUSTRY 18/

(a) Growth in manufacturing industry

108. A majority of developing African countries have been making considerable efforts to increase the rate of growth in the manufacturing industry. They have been allocating to it a substantial portion of their financial resources, especially foreign exchange, and providing fiscal, monetary and other incentives to promote investments in the manufacturing industry. In spite of these efforts, the 8 per cent annual rate of growth target set in the International Development Strategy (IDS) for manufacturing sector during the Second Development Decade has become unrealistic. Thus, in view of the general economic problems in the region and the restrictions imposed on the development of export manufactures, an annual growth rate of 6 per cent in manufacturing industry has been considered satisfactory in the 1970s.

Table 2.1: Growth of manufacturing value added by subregion of Africa 1970-1977

Growth rates in percentages

Subregion or area	1970-1977	Annual average 1970-1977
North Africa	56.1	6.6
West Africa	69.6	7.8
East Africa	30.9	3.9
Central Africa	26.6	3.4
Developing Africa	51.8	6.1

Source: ECA Statistics Division based on GDP value added at 1970 prices.

109. As shown in Table 2.1, West Africa has almost attained the yearly growth target of 8 per cent; and the annual growth rate of 6.6 per cent for North Africa would be considered fairly good. But the annual growth rates for East Africa (3.9 per cent) and Central Africa (3.4 per cent) are much lower than the target. Apart from this,

18/ See also Annexes II-D, II-E and II-F.

some individual countries have experienced stagnant or negative growth rates in the manufacturing industry. Nine countries registered declines in the value added of manufactures during 1970-1977 at 1970 constant prices, for 15 countries the growth rates were between zero and 5 per cent while 12 countries achieved 5.8 per cent growth rates and 13 countries managed to attain 8 per cent and over.

110. Countries which experienced negative growth rates during the decade include some least developed countries and those which attained independence from Portugal; while those which reached or exceeded 8 per cent target include the major oil-exporters and some whose growth in agriculture has been favourable. If countries are classified by per capita income, the least developed countries with per capita income below $US 100 registered the lowest growth rates in the manufacturing industry since 1975 while the major oil exporters registered the highest growth rates.

Table 2.2: Growth rates in value added in manufacturing industry by developing African countries grouped according to levels of GDP per capita, 1970-1977

	Growth rates in percentages		
Group of countries	1975-1976	1976-1977	1970-1977
Oil exporting countries (Africa)	17.1	10.1	11.2
Other developing countries	4.0	6.5	4.5
With per capita GDP in 1970 of $US 300 and over	10.5	5.3	8.7
$US 200 to 299	4.9	8.2	3.7
$US 100 to 199	4.8	5.2	4.5
Below $US 100	0.3	3.7	3.9
Developing Africa	8.1	7.6	6.1

Source: ECA Statistics Division

111. Generally the share of manufacturing has been rising in a number of developing African countries. But only for five countries did the share of manufacturing industry in the GDP exceed 15 per cent, and for the other 13 countries the share was 10-15 per cent while for the rest it was below 8 per cent.

112. Some rough estimation indicates that the capital formation in manufacturing has increased by 8 per cent a year. In terms of productivity of capital, there are favourable tendencies for the larger and more capital intensive projects with longer gestation periods, such as iron and steel works, petroleum refineries etc.

(b) Employment in manufacturing industry

113. During the period of 1971-1976 employment in manufacturing industry has increased by 5.8 per cent a year in North Africa, by 5.6 per cent in West Africa, but by only 2.7 per cent in East Africa. The relationship between growth in value added and employment, i.e. employment elasticity has been 0.6 for West Africa, 0.8 for North Africa and 0.9 for East Africa. If we look at individual countries, Egypt and Mauritius have shown 1.0 and 1.7 respectively. The Mauritius figure is attributed to the development of light industries, especially labour intensive clothing and garment industry during the 1970s. The share of employment by the basic metal and engineering sub-sectors in the total manufacturing industry for the whole developing Africa ranges between 2 to 8 per cent.

Table 2.3: Indexes of employment in manufacturing industry by subregion of Africa, 1971-1976

	Index of employment 1970 = 100		Annual rates of growth 1971 - 1976 (percentages)		
Subregion	1971	1976	Employment	GDP 19/	Employment Elasticity
North Africa	102.9	136.4	5.8	6.9	0.8
West Africa	107.4	141.2	5.6	9.4	0.6
East Africa	106.5	121.7	2.7	3.0	0.9
Central Africa	109.3	133.6	-	-	-

Source: ECA Statistics Division

(c) Structures and characteristics of manufacturing industries in Africa

114. Although some improvements have been made, most of the existing manufacturing industries are still characterized by light consumer industries like: food processing, beverages, tobacco, textiles, foot-wear, clothing, leather and shoes, sawmilling, paper cutting, printings and furniture. As shown in Table 2.4, the share of heavy industries (defined to include chemicals, petroleum products, non-metalic mineral products, basic metals and engineering) in manufacturing value added has increased from 32 per cent in 1970 to 39.3 per cent in 1976. Countries like Egypt, Tunisia, Nigeria, Kenya and Zambia have attained at least a 40 per cent share of the manufacturing value added attributable to heavy industry. The definition of heavy industries in the African context, however, is misleading or exaggerated as compared to heavy industries in developed countries. Whereas in developed countries industries regarded as heavy are iron-steel, chemicals, heavy mechanical fabrication, etc., in Africa, industries regarded as heavy are mining, cement, fertilizer construction and assembly work.

19/ Value added by the manufacturing sector.

Table 2.4: Distribution of manufacturing value added between heavy and light industries in a number of developing African countries, 1970 and 1976

Country and subregion	1970		1976	
	Light	Heavy	Light	Heavy
	Percentage		Percentage	
Egypt	57.4	42.6	50.7	49.3
Libyan Arab Jamahiriya	73.8	26.2	63.1	36.9
Sudan	79.2	20.8	78.3	21.7
Tunisia	56.4	43.6	47.7	51.3
North Africa	60.7	39.3	53.7	46.3
Ghana	74.7	25.3	68.5	31.5
Nigeria	69.3	30.7	57.8	42.2
Togo	91.6	8.4	81.9	18.1
West Africa	71.3	28.7	65.4	34.6
Ethiopia	85.2	14.8	80.8	19.2
Kenya	54.0	46.0	49.5	50.5
Mauritius	84.0	16.0	82.1	17.9
Somalia	97.7	2.3	94.7	5.3
United Republic of Tanzania	76.3	23.7	69.6	30.4
Zambia	68.7	31.3	60.6	39.4
East Africa	74.0	26.0	68.1	31.9
Central African Empire	88.4	11.6	82.0	18.0
Congo	78.4	21.6	79.2	20.8
United Republic of Cameroon	72.4	27.6	67.2	32.8
Zaire	55.8	44.2	65.0	35.0
Central Africa	67.1	32.9	67.6	32.4
Developing Africa	68.0	32.0	60.2	39.8

Source: ECA Statistics and Industry Division

115. Practically all developing African countries import nearly all their agricultural, industrial, mining transport and military equipment, machinery, accessories and installation requirements including the spare parts thereof. The export f.o.b. value of fabricated metals and engineering goods to Africa has increased. For engineering products alone (Section 7; Divisions 71, 72, 73) the export f.o.b. value destined to Africa increased from $US 6,011.5 million in 1972 to $US 19,100.5 million in 1976 at current prices.

116. The development of basic metals, with the exception of some non-oil mineral exporting countries and certain North Africa countries play a limited role in the economies of the developing Africa as a whole. Even in these non-oil mineral exporting countries, such as Zambia, Zaire, Angola, Gabon, Liberia, Sierra Leone, Guinea and Mauritania, the mining industries have substantially still remained as enclaves without

being integrated into the national economies. The mines are mostly owned and operated by Transnational Corporations (TNCs), and the minerals exploited are exported mainly in their crude forms. Even in the case of Zambian and Zairean copper, where nationalization and further processing of the ore were introduced, there are problems concerning indigenous managerial and technical capabilities to keep the mining and processing plants in proper operations and the lack of marketing know-how and out let markets which are under international cartels of TNCs in the electrical industry. 20/

117. Only some North African countries like Egypt and Tunisia and recently Algeria, Morocco and Libyan Jamahiriya have made some starts in the development of some basic metals and engineering industries. In West Africa, some initiative in the development of iron and steel works has now been made. In East and Central African subregions no substantial progress has been made in iron and steel industry with the exception of the recent Kenyan move to establish a machine tool industry in co-operation with the Hindustan Machine Tool Group (Government of India), and the proposed iron and steel projects in Kenya, Tanzania and Zambia.

118. Apart from this, the basic metals and engineering industries in developing Africa are characterized by a number of steel rolling mills producing steel rods and bars for reinforcing from scrap metals and imported billets; fabrication of different forms of steel structures, mills, metal furniture and household utensils, corrugated and galvanized steel for roofs all from imported steel bars and sheets. The number of foundries are very few and small in size usually with outdated technologies and limited scopes or restricted to a few types of castings. The maintenance workshops are also few and characterized by shortages of essential facilities and equipment. The modern and better ones are often restricted to railway companies, other public transport departments, mining companies, and some foreign owned big manufacturing enterprises. Even here the activities of the maintenance and repair workshop are limited mostly to fabrication of metals and repair, maintenace and servicing based on imported parts and components rather than modification or actual production of parts and components with foundries, heat treatment and forging, etc.

119. On the other hand, the assembly industry for agricultural tractors, trucks and motor vehicles, household electrical and eletronic equipment and appliances are being carried out in most of the developing African countries. These assembly industries have brought neither value added, net foreign exchange earnings, transfer, adaptation, development of technology, nor the development of skilled manpower (managerial and technical capabilities). In many cases, these assembly lines have resulted in negative value added and negative net foreign exchange earnings plus higher prices to the consumers and custom revenue losses to the treasuries. With the exception of a few developments in Egypt and to a minor extent in Tunisia and Algeria, many countries have invariably failed to move into the production of any major parts and components using domestic materials. Further more, basic development facilities for designs, products, materials, research, etc. are located abroad.

120. Indigenization in ownership and management is still restricted mainly to local trade, real estates, handicrafts, cottage and small-scale industries and services.

20/ For further details on international cartels in electrical materials and goods see Richards Newfarmer. "The International Market Power of Transnational Corporations, a case study of the electrical industry", UNCTAD/ST/MD/13, 1978.

Although these sectors are also important in employment and value added, they have little capacities to generate self-sustained dynamic industrial growth, national and collective self-reliance and to enhance control over natural resources. On the other hand, most of the big export-import trades, financial houses, tourist hotels, insurance companies, and large manufacturing enterprises are usually controlled either in terms of ownership or management by private foreign investors or TNCs. Thus a large number of the developing African countries are deprived of effective control over their dynamic economic sectors.

(f) Industrial policies and priorities

121. All developing African countries have industrial policy objectives and strategies as well as instruments with which they pursue their objective targets. In the 1960s and early 1970s the major strategy was import substitution. Starting from the mid-1970s export industries had been stressed while presently industries having or leading to greater internal linkages have begun to be emphasized.

122. With regard to ownership there have been different policies usually based on political alliance or ideologies. Some countries have been supporters and promotors of private enterprises (both local and foreign) while others have chosen public enterprises only. A few countries have also made policy shifts in introducing nationalization or denationalization. In between there are a large number of countries which prefer mixed-economies; i.e. a combination of private and public enterprises. Wherever public ownership of manufacturing activities are emphasized resource allocation management and promotion of growth are handled by central planning and control, but in the case of private enterprises resource allocation and control are practised through the indirect price mechanism and profit stimulant. In both cases, apart from political ideologies, there may not be substantial differences in as far as objective targets are concerned - increase in investments, GDP, employment, foreign exchange earnings, provision of basic need to the masses, self-reliance, diversification and structural transformation, control over natural resources, creation of self-sustained growth, etc.

123. Where large public manufacturing enterprises have been promoted, there are growing complaints against inefficiencies and mismanagement, mainly owing to, inter alia, lack of managerial and technical capabilities, poor planning and programming, instability of management and wrong pricing of products. When private sector has been promoted, overprotection, tax-holidays, exemption from indirect taxes, subsidized rates for the use of public services (infrastructure) have also led to inefficiencies, high costs and prices; and consequently it has been difficult to enter export markets and the income distribution have become more biased in favour of the few rich.

124. Practically every developing African country has effective tariffs for its local factories in the form of custom duties, import licensing, foreign exchange rationing, quantitative quota restriction, and priority in public procurements. In addition almost every country provides over-generous and sometimes redundant incentive schemes like five to ten years (in some cases twenty years) tax-holidays, duty free import of capital goods including construction materials and intermediate inputs, the right to remit expatriates, salaries, profits, capital and other funds. These incentive schemes are usually accompanied by subsidized rates for public services (power, water, transport, port dues, land purchase and bank loans). In many cases products are also exempted from local sales and excise taxes while financial bonus is awarded for quantities exported. Employment of expatriates have been relaxed or overextended under the pretext that local skills could not be available.

125. In spite of greater emphasis on the new priorities and strategies like industries leading to more internal linkages there have not been any substantial changes in the policy instruments or incentive schemes as they are all equally granted to almost all types of manufacturing investments. As a result, the simple and light industries, based on import-substitution and export oriented primary agricultural commodities and crude minerals or export processing zones based on imported intermediates, have flourished as against the more difficult and dynamic manufacturing enterprises such as heavy capital engineering industries, and basic metals and chemicals.

126. Surprisingly most of the policy instruments or incentive schemes and administrative procedures (particular licensing and bank lending) are biased against small-scale industries. This is despite the fact that the small-scale industries are more labour intensive and mostly owned and managed by indigenous firms and enterpreneurs, they use more local resources and provide goods to the consumers at much cheaper prices as compared to bigger ones. Only recently a few countries like Nigeria and Kenya have started to device some policy instruments which promote transfer of ownership in the small-scale industries and trade from expatriates to indigenous enterpreneurs and firms. But such transfer of ownership has to be accompanied by certain fiscal and monetary incentive schemes especially designed to assist small-scale industries.

127. The export promotion schemes or export processing zones have tended to repeat the same mistake made by import-substitution strategy, i.e. minimum or negative effects on domestic value added, net foreign exchange earnings, internal linkages, development of managerial and technological capabilities, self-reliance, control over natural resources and regional co-operation, etc.

128. Furthermore, lack of political will and policy commitment in regional/subregional economic co-operation has impeded some of the most dynamic and regionally integrated industrial development projects including basic metal and engineering industries. This is despite the fact that many developing African countries have long realized the problems of minimum economies of scale and, inter alia, the smallness of national markets of many individual countries. 21/

129. Thus it is in view of such lessons of experiences that there is a need for political and policy reconsideration to redefine the objective, priorities and strategies for the development of nationally and/or regionally integrated basic metal and engineering industries as opposed to import-substitution of consumers goods and export processing zones mostly based on imported intermediate inputs, foreign tastes and designs. Similarly the policy instruments or incentives schemes should be revised accordingly to favour the development of basic and dynamic industries like basic metals and engineering.

(e) Industrial development institutions

130. All developing African countries have institutional infrastructures for the general development of manufacturing industries. In most of the countries, the Ministry directly dealing with the development of manufacturing is named the Ministry of Commerce/ Industry, and in some countries it is a Ministry of Industry by itself. There is also a Ministry of Planning or Development mainly to coordinate the overall national

21/ For further details on regional industrial co-operation, please see ECA/CMI/FCIA.5/WP/3, "Possibilities for the Establishment of African Industrial Multinational Corporations", Addis Ababa, 10 October 1970.

development plans and programmes. In some countries the coordinating functions are handled by the Treasury or the Ministry of Finance. Apart from these Ministries, there is at least one development bank plus a host of commercial banks. Some countries have additional Investment Banks or National Development Corporations (usually to act as main holding companies), Agricultural Development Bank, Industrial Development Bank, Saving Bank, Housing and Construction Bank, etc. In some countries, where large public ownership is promoted, a large number of public manufacturing corporations and enterprises have been established on sub-sectoral basis.

131. With the exception in some North African and a few non-oil mineral exporting countries and recently in Nigeria, however, there are no particular institutions or Government Departments or Units specifically assigned or responsible for the integrated development of basic metals and engineering sub-sectors at the national levels. In some countries there are a few metal and engineering corporations or enterprises mainly engaged in day-to-day operations of existing plants while integrated development efforts in the form of planning, programming and promoting new and dynamic projects and expansions in their lines of activities are given minor attention.

132. Thus, with the exception of certain countries already mentioned, all the institutional infrastructures are mostly too general favouring, like the incentive schemes, all manufacturing projects and enterprises indiscriminatively. Apart from this, the coordination of the different institutions is not as strong as it can be expected. The reason is partly attributed to loose coordinative mechanisms, partly to an absence of a strong coordinative organizational body or lack of clear definition of the powers of the coordinative body, and party to the political powers of certain personalities heading certain institutions or organizations. As a result, two or three organizations are often independently studying or promoting the same project, while in some cases projects do not move forward because the co-operation of certain institutions or organizations is not obtained. There is a need, therefore, for the creation of a department specifically to deal with the promotion of basic metals and engineering industries in every country, and much improvement in the coordinative mechanisms among the different industrial institutions is of an immediate necessity.

(f) Training and manpower development

133. Many African countries have now established one or more universities, technical colleges, polytechnics, technical high schools and vocational training centres or institutes. Most of the national universities have faculties in business administration (management, accounting, marketing, etc.) and engineering (electrical, mechanical, civil, etc.) Some countries have even established specialized colleges like College of Technology, College of Geology, College of Metallurgy, etc. But there are some complaints of the courses in the curriculum i.e. most of the courses are not geared to the needs of manufacturing industries or essential courses like industrial engineering, production technology and management, and industrial designs are not either adequately taught or covered.

134. In some countries where ownership in key and modern sectors has been transferred to the public sector, managerial and technical capabilities, inter alia, have become big bottlenecks. There are wide shortages of skills at all levels. There are also some instabilities of management in public enterprises, and most of the time the changes in the top management are repeated down to the lower echelons. Thus most the public enterprises are deprived of the opportunities of building up capable and experienced staff. Consequently the development and dynamic impact of public

enterprises, through continuous planning and programming new projects and expansion and modernization of the existing ones, is minimum. Decision making on investments and implementation of public projects are unnecessarily delayed.

135. The problems of developing skilled manpower in the private manufacturing sector are still much worse. Engineering and business graduates are not properly channelled to the privately owned manufacturing enterprises. The reasons are mainly attributed, among others, to excessive preference for experienced engineers and managers by the private manufacturing enterprises, fear of bringing the local intellectuals near the workers and factory operations (enhancing politicization of the unions, indigenization of ownership and management), lack of compulsory apprenticeship or internership arrangements with in-built incentive mechanisms in the manufacturing enterprises, absence of teaching companies (like teaching hospitals for doctors and nurses) in manufacturing industries, and the absence of multiple product lines (requiring diversified skills) in most of the manufacturing plants.

CHAPTER III

PRESENT STATUS OF THE BASIC METALS INDUSTRIES IN THE AFRICAN REGION 22/

A. IRON AND STEEL INDUSTRY

(a) General review

136. It is said that steel consumption is somewhat characteristic of the standard of living in a country. In the future, as in the past, steel will be one of the most basic industrial materials. The iron and steel industry is notably capital-intensive, with an average, in 1978, specific investment cost requirements of about $US 1000 for each ton of steel-ingot production capacity per year. In addition, substantial infrastructure investment has to be made. The approximate cost of investment for establishment of an integrated iron and steel plant with a capacity of 1.0 million tons per year of ingots is about $US 500 million. A large portion of the capital invested in iron and steel plants is in a form of heavy industrial equipment and construction.

Table 3.1: Major world producers of crude steel (million tons)

Country	Production in 1976	Per cent share in 1976
USSR	147.0	21.5
USA	116.3	17.0
Japan	107.4	15.7
West Germany	42.4	6.2
China	26.0	3.8
Italy	23.4	3.4
France	23.2	3.4
U.K.	22.7	3.3
Poland	15.9	2.3
Czechoslovakia	14.7	2.2
Canada	13.2	1.9
Belgium	12.1	1.8
Spain	11.0	1.6
Romania	10.5	1.5
India	9.4	1.4
Brazil	9.2	1.3
Australia	7.8	1.1
South Africa	7.1	1.0
East Germany	6.6	1.0
Mexico	5.6	0.8
Netherlands	5.2	0.8
Sweden	5.1	0.7
Luxembourg	4.6	0.7
Austria	4.5	0.7
Others	32.9	4.9
Total world	683.5	100.0

Source: UN statistics 1976.

22/ See Annex I-A for definition of basic metals industry.

137. The per capita steel consumption in Africa is one of the lowest in the world, estimated at 8 kg compared to 300 to 500 kgs in developed countries. The consumption of steel in Africa is primarily characterized by steel rods, bars, sections, wire, rails, plates and sheets. The total steel consumption in Africa will amount to 60 to 180 million tons by the year 2000.

138. The world production of crude steel was 683.5 million tons in 1976.

139. As shown in table 3.1, the major steel producers in the world are: the USSR, USA and Japan which together produced more than 50 per cent of the world total in 1976.

140. Of the total 683.5 million tons of world's raw steel production, Africa's share for 1976 constituted only 1.24 per cent, i.e. 3.464 million tons (most of which are from South Africa and Rhodesia).

141. The growth of the Third World steel industries in another effect and is an important factor to be reckoned when discussing world steel production. The growth of steel production and consumption respectively in developing countries in the period 1950-1972 has been as follows

9.3 per cent and 6.0 per cent for Africa
11.9 per cent and 8.3 per cent for Latin America.

142. In 1973 the share of developing countries in world production was roughly 8 per cent or 55 million tons, while their share in consumption was roughly 12.0 per cent or 80 million tons.

143. Only a few developing countries in Africa Asia and Latin America have established integrated iron and steel plants.

144. The percentage of demand covered by local production attained in the last few years is roughly estimated as follows:

73 per cent for Latin America
56 per cent for Asia
12 per cent for the Middle East, and
7 per cent for Africa.

145. As a result, the African countries practically depend on imports of iron and steel as well as products therefrom. The total annual production capacity of iron and steel plants in Africa is about two million tons in 1977, and should be doubled in 1980.

146. At present, there is no large iron and steel industry in any of the countries visited, except the North African subregion (comprising Egypt, Tunisia, Algeria) where the conditions are more favourable for establishing integrated iron and steel plants. Such favourable conditions and major prerequisites exist in countries like Nigeria; some opportunities will probably develop in Libya, Uganda and Zambia.

(b) Availability of raw materials

147. Developing countries are major exporters of raw materials (iron ores) to developed countries. They supply about 125 million tons per year or 16 per cent of all iron ores consumed in the iron and steel industry (compare this with their share of 8 per cent of world steel production).

148. Since the ores they export are of a very high grade, the amount of iron contained from their ores comes to about 20 per cent of the world production.

Table 3.2: The total world's iron ore production (million tons)

1973	1974	1975	1976
853.8	901.6	897.9	877.4

Source: UNIDO Profiles No. 11 1978.

149. The iron ore deposits and extraction roughly can be shown in the table below.

Table 3.3: Iron ore resources and their exploitation in Africa

Subregions/ countries	Deposits, Mln tons Total	Reliable	Content Fe %	Extraction, mln tons 1974	1975	1976
Africa	26,576	6,300		64.327	63.114	59.305
1. Eastern and Southern African Subregion	1,513					
- Zambia	265	150	50	n.a.	n.a.	n.a.
- Madagascar	130	20	30-65			
- Mozambique	400	60	60			
- Swaziland	193	96	30-62	2.254	2.300	1.932
- Somalia	440	n.a.	30	n.a.	n.a.	n.a.
- Tanzania	45	45	42			
- Uganda	32	-	67			
- Kenya	35	-	32-55	-	-	-
2. Eastern African Subregion	18,470					
- Ivory Coast	3,500	-	40-46	-	-	-
- Ghana	1,090	-	40	-	-	-
- Guinea	3,500	500	52-64	-	-	-
- Liberia	3,700	600	30-66	25.000	26.700	23.000
- Mauritania	2,650	2,000	65	11.666	10.500	9.500
- Nigeria	300	90	40-50	n.a.	n.a.	n.a.
- Senegal	1,200	-	60	-	-	-
- Sierra Leone	200	100	45-60	2.000	1.400	-
- Togo	640	-	58	-	-	-
- Spanish Sahara	150	-	54	-	-	-
- Mali	510	-	40-65	-	-	-
- Upper Volta	60	-	40-58	-	-	-
- Niger	600	-	42-48	-	-	-
- Benin	290	-	47-51	-	-	-
3. North African Subregion	723					
- Algeria	1,350	600	55	3.200	3.300	3.260
- Morocco	170	170	45	0.531	0.620	0.350
- Tunisia	55	25	50	0.913	0.675	0.500
- Egypt	433	120	48-59	1.302	1.120	1.300
- Libya	1,755	720	48-59	-	-	-
- Sudan	70	-	-	-	-	-

Table 3.3 (cont'd)

Subregions/ countries	Deposits, mln tons Total	Reliable	Content Fe %	Extraction, mln tons 1974	1975	1976
4. Central African Subregion	4,650					
- Angola	2,000	230	40-60	5.500	3.600	3.300
- Gabon	1,000	860	62	-	-	-
- Zaire	1,300	-	45-65	-	-	-
- Cameroon	150		50	-	-	-
- Congo	200	-	43-65	-	-	-

Sources. (1) Statistics of the Institute of Foreign Geology of the USSR, 1978.
(2) UNECA estimates, NRD/MIN/1, 1976.

150. The world price was $US 19.0 per ton of ores (1976 figures), pellets (64 per cent Fe) - $US 32 per ton.

151. As one can see from the above table, the African region is very rich in iron ores. The grades of most of the iron ore deposits are very high and varies from 30 to 65 per cent (Fe). Almost all the ores mined are presently exported. Some countries have programmed expanding exploration.

152. For example Guinea began a big project for exploration of iron ore in 1975 with the assistance of the Swedish firm LKAB. The main deposits are magnetite and hematite types (Pierro-Risho deposits). Planned ore production is 15 million tons per annum. The total content of sulphur and phosphorous is 0.04 per cent; sangue content for 1 ton of ore was projected to be no more than 0.06 ton. For successful fulfilment of the project, the country has planned to build the Trans-Guinean Railway (length 709 km) from Mount Nima (location of main deposits) to Conakry port.

153. In Algeria there is proposal for exploiting deposits of Gara-Gebele. The expected extraction is between 10-12 million tons annually which will be useful for future expansion of the existing industry.

154. Gabon has been considering a project for the exploration of Belinga deposits (Fe 65 per cent - about 1.0 billion tons). In order to exploit these deposits the Government of Gabon established a joint venture with Sonifer (USA and West European Company) with 60 per cent (Gabon) equity participation.

155. Liberia's iron ore export to USA comes to 6 per cent of total USA import of the ore. In 1976 this export reached 12 million tons.

156. In 1975 the Association of Iron Ore Exporting Countries (AIOEC) was established. Some African countries are members of that body as Tunisia, Liberia, Mauritania, Algeria, etc.

157. In Egypt, iron ore is found on the west bank of the Nile in the Aswan area. Studies of this ore showed its suitability for the production of Thomas pig iron in the blast furnace as it is haematitic in nature with an average iron content of 44 per cent (Fe) and an average phosphorous content of about 1 per cent. Consequently, the Aswan ore was exploited and prepared to be used in the Helwan iron and steel blast furnaces.

158. The iron ore potentials of 70 million tons (with 50-60 per cent Fe) have already been identified in various areas of the Sudan. The country has planned to install an integrated steel complex with a yearly capacity of one million tons at LS 1,500* million but the feasibility study costs of $US 3 million could not be made available. USA and West Germany firms have been contacted. The country has no complete data on iron ore deposits, market study and skilled manpower.

159. The iron ore deposits have been discovered in a number of places, in the Red Sea hills and the Nuba mountains at Jebel Abu Tulu. Some of them are

(i) Karora-Red Sea hills near Ethiopian border, estimated at 20 to 25 million tons of 50 per cent Fe, magnetite with carbonate

(ii) Sofaya-Red Sea hills - 14 million tons of 40 to 50 per cent Fe, magnetite type

(iiii) Fodikwana-Red Sea hills - 4 million tons of 60 to 64 per cent Fe, magnetite type

(iv) Derudeb-Red Sea hills - more detail work is required

(v) Abu Tulu-Nuba mountains - initial reserve of 35 million tons of 61 per cent Fe.

160. For the moment Kenya has no exploitable ores and depends on import of steel. Several deposits of iron ores have been prospected. A pyritic deposits at Bukara is estimated to contain 17 million tons. The hematite ore body at Homa mountain is believed to contain as much as 10 million tons of ore at a depth of 30 metres. The main deposits of iron ore are identified and being considered for investment in the coastal province and Western Kenya.

161. Uganda has potential iron ore reserves. Those reserves consist of 30 million tons at Sukuru, 46 million tons at Bukusu (with 13 per cent TiO_2) and 4 million tons (60 per cent Fe) at Kigezi. In order to develop iron and steel industries Uganda needs:

(i) renovation and modernization of existing mines

(ii) provision of mining and quarrying equipment, spare parts, managerial and technical skills and sufficient transport facilities,

(iii) exploration of hematite deposits in Kigezi (iron ore), manganese ore in Toro, nickel ore in Mubende area.

162. The country possesses all metallic mineral deposits required for basic metals development especially those ones which are significant to produce the highest quality steels and precision metallic products.

163. Zambia's iron ore deposits at Kasumbalesa and Solwezi are estimated to be 30 million tons and 150 million tons respectively.

164. Nigeria has iron ore deposit (Itakpe hill) which is estimated to be 400 million tons. The country envisages to concentrate quartzites at the ore concentration plant to be constructed at the deposit area. The annual plant requirements for concentrates will be 2.1 million tons.

* LS = Sudanese pounds.

(c) Ore processing 23/

165. The ore processing varies depending on the type of raw materials, the techniques available to upgrade the metallic contents and to lower the impurity gangue. The reserves of iron ores in developing countries include both high and low grades.

166. Naturally occurring iron ores contain iron bearing minerals, gangue materials and other impurities. The value of a high grade iron ore is determined not only by its high iron content but also by its gangue and impurity contents the latter will exercise significant effects on the economics of iron and steel making.

167. In most iron and steel producing countries of the world, these aspects have received comprehensive study and practical action in terms of what is currently termed preparation, sizing and treatment of the iron ores with a view to charge prepared burdens in the blast furnance to obtain maximum iron productivity and low coke rates.

168. The preparation of the iron ore and its treatment outside the iron blast furnace will be reflected also in slag volumes, reduced flux rates and improved metal quality.

169. Depending upon the minerological and petrological characteristics, different methods of benefication are employed to suit a particular ore. The methods include crushing, grading, sizing, washing and wet screening, gravity treatment, magnetic separation, floatation, reduction, roasting and drying.

170. Blending of iron ore is one methods of the preparation. Highly siliceous ores may have to be wet ground fine followed by wet magnetic separation and agglomeration, etc., such as sintering, pelletizing and briqueting.

171. Sintering is one of the most widely adopted processes at present because of its economic and technological advantages. This process uses a wide variety of wastes such as coke breeze, mill scale, limestone and dolomite dust, lime fines, and blue dust. The sintering of iron ore fines is receiving universal recognition today. Sintering and pelletizing are complementary processes which provide the feed for modern iron smelting in the high capacity blast furnaces of today.

172. Pelletizing has also become universal as a means of achieving a higher value added in the exportable ores and in increasing productivity of the blast furnace and output in steel making (electrometallurgy).

173. Pelletizing of the ore fines to produce high grade oxide pellets is now universally accepted for iron and sponge production because of their high iron content, uniform size strength and reducibility characteristics. The pellets can also withstand long distance rail and ocean transportation.

174. Pelletizing is adopted where the ore particles are in a very fine form either as a beneficiated product or naturally occurring mineral like blue dust. Pelletizing is also an additional means of preparing feed stock for the production of sponge iron in modern direct reduction plants.

175. Pelletizing plants for using pellets are usually built close to the mine sites or near the steel plants for the local blast furnaces. The developed countries used the pelletizing process long time ago. Major ore producers in developing countries are mostly producing high grade ores for export, whilst the low grade ore is dumped at the mine sites.

23/ See Annexes III-D, III-E and III-F.

176. The world pellet production accounts now for over 20 per cent of the total usage of iron ore. The output of the pellets had reached about 175 million tons in 1975. The level of production in Africa was 4.85 million tons (1975 figure). 24/

177. In 1974 Mauritania nationalized a large company Miferma-property of International Consortium (50 per cent of French capital) and installed a unit for beneficiation of iron ores with capacity 10 to 12 million tons of relatively poor ores.

178. The ore preparation of Aswan ores in Egypt is achieved by crushing to suitable size. The ore is then transported to Helwan by rail or Nile barges. The expansion project for Helwan iron and steel plant will make use of the iron ore from the Bahariya region, which is about 350 km to the South West of Helwan. The iron ore of this region is much richer in iron (56 per cent Fe) than that of Aswan (42 per cent).

179. The Helwan sintering plant production at full expansion at the first stage is about 3,147 tons and 1,714 tons of blast furnace sinter respectively. The sintering plant consists of 4 units.

180. As regards the iron and steel industry of Sudan, it is being considered to process the chromites into ferro-chromium before export. At present the project is being studied by the People's Republic of China. The estimated capacity is 25,000 tons per annum with an investment cost of LS 50.0 million, and exportable quantitites of ferro-chromium amounted to 450 million annually. There are needs for detailed feasibility studies on types of alloys and market. Foreign collaboration is required to provide markets, power and technology. At present the Sudan is operating three chrome ore mines with the Japanese.

181. Tunisia has one pelletizing plant using local iron ore.

182. In Nigeria the iron ore deposit at Itakpe (near Ajaokuta) is now confirmed to be of average quality. Although it is intended to export this iron, which is quite plentiful. Arrangements have been made to import high quality ore from Liberia and Guinea for the Nigerian industry, at least in the initial period.

(d) Reducing agents and energy

183. The coal deposits in African countries are given in table 3.5.

184. Sometimes coking coals were being used in limited cases for non-metallurgical purposes such as generating power. Measures are needed to ensure that coking coal should be reserved for the production of iron and steel.

185. Formed coke had not yet been applied to large blast furnaces, but the process might perhaps already be suitable for small plants, and it would be useful to continue developing the process for use in large plants.

24/ Source: ECE, Steel/Ge.3/R.3/Add.1, p.9.

Table 3.4. World coal resources (by types of coal)

Continent	Type of coal	Resources (Billion metric tons unless otherwise indicated) measured	indicated	inferred	total	Percentage
Africa	H and A	30	61	138	229	
	B and L	-	1	-	1	
Per cent of total (distribution)	All	30	62	138	230	1.6%
		13%	27%	60%	100%	
World	H and A	759	1,757	6,455	8,971	63.6%
	B and L	296	637	4,207	5,140	36.4%
	All	1,055	2,394	10,662	14,111	100 %
Distribution		7.4%	17%	75.6%	100%	

H and A = Hard coal (bituminous, high-calorie, sub-bituminous) plus anthracite.
B and L = Brown coal and lignite.

Source: Institute of Foreign Geology of the USSR, 1974.

Table 3.5 Coal deposits in African countries (million tons)

Subregions and countries	Total coal reserves Total	Reliable	Coals and anthracites Total	Reliable	Brown coals Total	Reliable	Lignite Total	Reliable
AFRICA	59,380	29,535	59,220	29,515	160	20		
1. Eastern & Southern Subregions								
- Zambia	230	75	230	75	-	-	-	
- Botswana	1,000	400	1,000	400	-	-	-	
- Malawi	100	15	100	15	-	-	-	
- Madagascar	330	120	300	100	30	20		
- Mozambique	400	100	400	100	-	-		
- Swaziland	5,000	2,000	5,000	2,000	-	-		
- Tanzania	300	250	300	250	250*	-		
2. West African Subregion								
- Nigeria	1,300	450	450	450	-	-	60	n.a.
- Niger	4.5	n.a.	4,5	n.a.	-	-	n.a.	n.a.
- Mali	2.5	-	-	-	-	-	2.5	n.a.
- Benin							n.a.	n.a.
- Upper Volta							n.a.	n.a.
- Sierra Leone							n.a.	n.a.

* estimated.

Table 3.5 (cont'd)

Subregions and countries	Total coal reserves Total	Reliable	Coals and anthracites Total	Reliable	Brown coals Total	Reliable	Lignite Total	Reliable
3. North African Subregion								
- Algeria	[illegible]	10	100	10	-	-		
- Morocco (anthracites)	100	80*	100	80*	-	-		
- Egypt	190	-	190	-	-	-		
4. Central African Subregion								
- Zaire	200	50	100	50	100	-		

* Estimated.

Sources: (1) Statistics of the Institute of Foreign Geology of the USSR, 1978.
(2) UNECA estimates, NRD/MIN/1, 1976.

186. There are several countries with a significant potential for the expansion of coal production, not only for internal use but also in some cases for export.

187. The countries with known coal resources can be grouped into a few categories.

188. First group among the major oil-exporting countries, Algeria and Nigeria have fairly large coal potentials.

189. Nigeria possesses large deposits of sub-bituminous coal however, lack of adequate transport capacity has restricted their development. A newly discovered deposit at Lafia is stated to be of coking quality and consideration is being made to exploiting it to supply the planned iron and steel works.

190. Algeria possesses several coal-bearing basins, particularly in the south Oran region, where the coal is of coking quality.

191. To sum up, the above oil-exporting countries have the capacity to increase their internal use of coal, thus releasing more oil for export. Their oil revenues could be used to develop coal production, which can provide additional and useful local employment.

192. The second group of countries consists of those with a significant oil industry and in addition, a sizeable coal production capacity. The group includes Egypt. Egypt's known coal reserves are all in the Sinai Peninsula and as such have not been of benefit since 1967. Long-term efforts may result in the opening of new mines which would enable Egypt not only to become self-sufficient in coal but also to export some to other countries in the Middle East. The return of Sinai to Egypt will bring back the old coal mines.

193. A third group of countries which, while they do not possess a major coal industry, have significant coal deposits. Botswana and Swaziland have limited internal markets for coal and, therefore, could export their coal or electricity generated from coal. Morocco's coal reserve are anthracites in fine form, which could be used for power generation and in the form of briquettes as a smokeless fuel for domestic and industrial purposes. Mozambique possesses the only hard coking-coal resource in Southern Africa with an export potential. Very large coal resources are reported to exist in Zaire however their exploitation is limited because of location.

194. Zambia's present reserves are sufficient to meet domestic requirements the country is well-endowed with hydropower potential, which may reduce the opportunities for coal use in electricity generation. The coal potential of Zambia is 33 million tons at Sinazongwe 17 million tons at Maamba and 10 million tons in Monze area.

Table 3.6 The world and Africa coal production (1976) - million tons

	Million tonnes	Share %
World	2,462.55	100
Africa	78.89	3.2

195. From the above, the extraction of coals in the African region is very low.

196. In 1977, the total coal production in Zambia was 662,124 tons or 13 014 million kwacha by value. The coal is mainly mined by Maamba Colliery Ltd., from open cast near Sinazongwe, South-East of Choma.

197. The good quality coal during 1977 was $57 to $65 per ton in the United States of America. Lower quality which requires enrichment along with high percentage of sulphur content was $US 31 to 35 per ton.

198. In the Sudan, there are indications for natural gas and petroleum including favourable prerequisites for the development of basic metals and engineering.

199. Charcoal can be considered for iron smelting in countries which lack coal resources but possess good forests and forestry development programmes. For Kenya, the charcoal could be used as fuel in iron and steel production.

200. Coal production in Nigeria reached 59,310 tonnes in 1977. The Federal Government awarded a contract to a Polish firm for the mechanization of two Nigerian coal mines and the establishment of a coal washing plant at a cost of ₦ 13.5 million The purpose of the contract was to increase coal production and to bring the quality of Nigeria's coal up to international standards.

201. To meet the Ajaokuta iron and steel plant requirements for solid fuel a provision is made for the construction of a coke oven and by-product plant, which completely covers the requirements of the iron-making process and of the sintering plant for coke breeze. The coke will be produced from the coal blend prepared from the local (75 per cent) coals (Lafia and Enugu deposits) and partly imported (25 per cent) coking coals mixed in different nation.

202. The following table gives the structure of African energy. World prices for gas (1000 M) is $US 38 (Netherlands 1976) to 84.7 (Algeria liquid gas).

Table 3.7: Structure of African energy resources in 1976 in per cent

Oil	Natural gas	Coal	Hydro-energy	Nuclear	Total
42.4	5.1	45.6	6.9	-	100

(e) Availability of ferro-allyos, alloyed additives and other raw materials

The raw materials for the production of good quality steel exist in varying measures in many countries of the region as shown in table 3.8.

(i) Manganese

Table 3.8: Manganese deposits and extraction in Africa

	Deposits, mln tons			Extraction, thousand tons		
	Total	Reliable	content %	1974	1975	1976
AFRICA	3,317	231	n.a.	-	-	-
1. Eastern & Southern Subregions						
- Botswana	1*	n.a.	n.a.	-	-	-
- Zambia	1*	n.a.	50	-	-	-
2. West African Subregion						
- Ivory Coast	13	2	20-50	-	-	-
- Upper Volta	11	8	upto 52	-	-	-
- Ghana	10*	5*	25-50	246.6	408.7	311.9
- Mali	10	4	45	-	-	-
3. North African Subregion						
- Morocco	50	3	25-45	174.3	130.9	117.5
- Egypt	1	1	22	n.a.	n.a.	n.a.
- Sudan	n.a.					
4. Central African Subregion						
- Angola	5	n.a.	50	6*	n.a.	n.a.
- Gabon	200	200	50	2,138.0	2,245.2	2,216.3
- Zaire	10*	2	45	308.6	308.5	300.0

* Estimated.

Sources: (1) Statistics of Institute of Foreign Geology of the USSR, 1978.
(2) UNECA estimates. Present status in development of mineral resources, NRD/MIN/1, 1976.

204. As seen from table 3.8, Gabon extracts annually 2.0 million tons from the deposits at Moanda. At the beginning of 1977 prices for manganese were $US 69 per ton (c.i.f. Atlantic port, USA), ferro-manganese was $US 419 per ton.

(ii) Chromites

205. Deposits are available in the Senegal, the Sudan, Kenya and Madagascar. The investigations in Eastern part of the Sudan (Ingessana hills) revealed the deposits as not less than 1.0 million tons (Cr_2O_3=54 per cent) and some more million tons of ores with Cr_2O_3 = 35.40 per cent content. Kenya has the intention in preparing to extract deposits of chromites at West Pokot with foreign assistance. In 1976 Madagascar extracted some 169 thousand tons of chrome concentrates (Cr_2O_2 = 50 - 52 per cent).

206. Deposits of chromites can be estimated as follows

Madagascar - 5 million tons (Cr_2O_3 = 30 = 46 per cent)

Sierra Leone - 2 million tons (Cr_2O_3 - 45 per cent)

(iii) Nickel

207. Ninty per cent of this metal is used (as statistics show) in ferrous and non-ferrous metallurgy. In USA metal industry, for instance 44 per cent of nickel is used by ferrous metallurgical industry. 30 per cent of which is for the production of stainless steels. In non-ferrous alloys 20 per cent of nickel additives are used. Latest available figures indicate a price of $US 5.3 per kg of nickel.

208. Total African nickel deposits are estimated at 4,150 thousand tons (this includes proven deposits of 1,100 tons) in the following countries: Botswana, Madagascar and Morocco.

209. Botswana's total deposits are (500 thousand tons) Madagascar has about (370 thousand tons) with Ni content in the ores as from 0.7 to 1.5 per cent and 1.4 per cent respectively. Morocco's figure is not available. In Zambia, explorations are required at Munali, South of Kafue.

210. Production of this metal in Africa in mid-1970s can be indicated as follows:

Africa:	1974 - 37.7 thousand tons
	1975 - 36.7 thousand tons
Botswana:	1974 - 3.6 thousand tons
	1975 - 5.4 thousand tons
	1976 - 5.5 thousand tons
Morocco	1974 - 0.5 thousand tons
	1975 - 0.5 thousand tons
	1976 - 0.5 thousand tons

(iv) Cobalt

211. Cobalt is an important material used in the production of heat resisting and high strength steels. It is also used in the armament industries including the production of fire arms. Thirty per cent of its industrial use is in permalloys, sintered cutting tools, and 20 per cent is used in the production of gas turbine blades, used as prime movers in industry and aviation.

Table 3.9 Deposits and production of cobalt in Africa

	Deposits, thousand tons		Content	Production, thousand tons			
	Total	Reliable	Co in ore%	1974	1975	1976	1977
AFRICA	2,343	1,200		21.29	17.79	14.77	-
1. Eastern and Southern African Sub-regions							
- Botswana	26	26	0.06	0.03	0.08	0.27	-
- Zambia	370	250	0.05-0.25	1.96	2.11	1.80	2.7
- Uganda	700	11	0.1-1.3	n.a.	n.a.	0.071	0.069
2. North African Subregion							
- Morocco	13	13	1.6	1.75	1.96	2.0	
3. Central African Subregion							
- Zaire	1,920	200	0.1-1.0	17.55	13.64	10.70	

Sources: (1) UNECA estimates, NRD/MIN/1, 1976.
(2) Statistics of Institute of Foreign Geology of the USSR, 1973.

212. The table indicates that cobalt ores are available more abundantly in Africa and produced as a by-product in copper and nickel extraction. Zaire's cobalt production is by Gecamines Company in its copper-cobalt operations of Kamoto deposit in Kolwesi area. That company is also going to begin manufacturing two new deposits in Shaba area.

213. The main Zambia sources are copper-cobalt ores of Nkana and Chibuluma deposits. Baluba mines have been under exploitation since 1974. These deposits are estimated at 100 thousand tons (of cobalt) with assessments of cobalt in ore as 0.17 per cent.

214. Morocco's cobalt production is 3 thousand tons annually. Importers of African cobalt are USA and Belgium. For example, Zaire exports 47 per cent to USA and 28 per cent to Belgium.

(v) Wolfram and molibdenum

215. Both these metals are by-products of copper and uranium extraction. Wolfram is base for precision alloys, additive for the production of tool steels and wear resisting steels.

216. Production figures of wolfram (WO_3 in concentrate) in Africa have been given as 1.06 thousand tons in 1974, 1.10 thousand tons in 1975 and a reduced production of 0.93 thousand tons in 1976.

Table 3.10: Production of Wolfram in three African countries

Country	1974	1975	1976
Zaire	0.24	0.32	0.30
Rwanda	0.34	0.47	0.51
Uganda	0.14	0.13	0.12
Total	0.72	0.92	0.93

217. Price of Wolfram (WO_3 in concentrates) is somewhere around $US 12 per kg.

218. Molibdenum is an additive for production of stainless steels.

(f) Fluxing agents and metallurgical refractories

219. In Egypt after extensive research it was decided to exploit the limestone and from Beni-Khaled Quarries in Upper Egypt. The limestone in this area is a suitable flux for the production of high quality steel in the basic oxygen converters. Initial production capacity of the quarry was 600,000 tons annually. The exploitation of dolomite from El Adabia Quarry is reaching an annual capacity of 100,000 tons per annum.

220. In Kenya the fluxing materials are abundant in the form of limestone. There is a large deposits of magnesite of good quality and suitable for use as refractory raw materials. The country has also reserves of fluorspar, diatomite, and kaoline. The statistics below show the level of production of this group of mineral (1977 figures).

Table 3.11 Production of fluxing agents and refractories in Kenya

Minerals	Quantity (tons)	Value in K.Shs.
Diatomite	2,441	63,466
Fluorspar	124,000	1,462,000
Limestone products	77,826	523,366
Magnetite	3,575	39,302
Kaoline	495	12,476

Sources: (1) UNECA estimates, 1978.
(2) Mission estimates, 1979.

221. Most of the minerals extracted in Kenya are destined to foreign markets and only insignificant quantities are utilized locally, e.g. minerals produced and consumed in the country in 1976 consisted 173,376 tons valued at K.Shs. 3,173,000. Kenya's export is shown in table 3.12 (by value in K. Shs.).

Table 3.12: Exports of fluxing agents and refractories in Kenya

(in K.Shs.)

	1974	1975	1976
Lime	8	30.1	84.4
Magnesite	-	-	-

222. Uganda's limestone production and sales is given for 1977 figures with a production of 34,696 tons and sales of 2,761 tons.

223. Limestone is mined at the limestone deposits from Sukulu hills and Toroko Rock and near Kasense. The total production is shown above and estimated deposits are 18.20 million tons.

224. Zambia has lime and limestone near Lusaka, deposits estimated at 21 million tons (93.94 per cent $CaCO_3$), are now under exploitation.

225. Nigeria produced 4,831 tonnes of limestone in 1977, detailed figures are shown in table 3.13.

Table 3.13: Production of principal fluxing refractory minerals in Nigeria (in tonnes)

	1971	1972	1973	1974	1975	1976
Clay	-	9,207	2,047	16,867	12,322	21,036
Limestone	813,425	1,406,036	1,801,174	1,301,800	1,650,264	1,553,527

Source: Mission estimates.

226. For sintering and iron making at the Ajaokura iron and steel plant, supply of raw materials from the Jakura limestone deposit and Burum dolomite deposit could be made available.

(g) Iron production 25/

Table 3.14: African pig iron production ('000) tons and per cent world output

(Africa includes Southern Africa)

	1970	1973	1974	1975	1976	1970	1976
Egypt	220	220	200	250	250	0.05	0.05
Africa	4397	4845	5127	5757	6280	1.03	1.29
World	427400	494500	505600	470500	487900	100	100

Source: UN statistics.

25/ See also Annexes III-D, III-E and III-F.

African iron and steel per capita output

227. As can be seen from table 3.15, this per capita output is lower than world average.

Table 3.15: Output of steel per capita

(Africa includes Southern Africa)

	1970	1973	1974	1975	1976
Egypt	-	6	5	7	7
Africa	12	12	13	13	15
World	116	133	130	119	122

Source: UN statistics, 1977.

228. Only a few African countries have established iron and steel plants. Egypt is one of them. The main plant is the Helwan iron and steel complex. Algeria is another. The original capacity of the Helwan plant was 300,000 tons per annum. Later it was raised to near 500,000 tons. The present expansion scheme underway will be completed this year raising the capacity to 1.5 million tons per annum. This is a medium integrated iron and steel works, but there are also three other steel mills with a total capacity of of around 75,000 tons per annum (two near Cairo and one in Alexandria). There is also a company for forgings and castings.

229. The first blast furnace was blown in 1958 with an output of 250,000 tons of pig iron per year. The second blast furnace was blown in 1960 with another 250,000 tons of pig iron per year on the basis of the Aswan iron ores which are medium grade (42 per cent Fe). Lump ore is charged directly into the blast furnace.

230. In 1964, a decision was made to expand the plant to 1.5 million tons of steel, to utilize the Baharia Oasis ores about 300 km from Helwan. The ore is 52 per cent Fe. The third blast furnace of the first stage expansion was blown. The fourth blast furnace was blown in 1979 to complete the second stage expansion. The Helwan complex now consists of four blast furnaces with a total installed capacity of 4,600 tons per day of pig iron. The 1980/1982 steel requirements of Egypt are about 1 million tons per year. The iron making is done with self-fluxing sinter and the three furnaces under operation have 100 per cent sinter charge, thus reducing the operation cost due to the reduced coke consumption (nearly to 490 kg/t coke, and consumption reached 1,000 kg/t when the coarse iron are used).

231. The reducing agent used in this process is carbon delivered from the coke in the Helwan coke oven plant. Temperature of the air for blast furnace was about 800° C. But in order to increase the productivity and reduce the coke consumption (this is essential due to the scarcity of coking coals) the new blast furnaces use high temperature blast (1100° C), high top pressure and fuel oil injection into the blast furnaces.

232. Low coke consumption, grinding the different charge ingredients to the needed fineness / 10 mm is carried out before the process of aglomeration, introduction of advanced know-how (oil injection, high pressure blast, etc.), and installation

of two pig casting machines (capacity of each is 1,600 tons per day) have improved the blast furnace technology in this country. The daily production of blast furnace gas from each furnace is more than 1,600,000 m^3.

233. Sudan has two main foundries - modern foundry and Khartoum Central Foundry. The latter foundry equipped with a cupola has a capacity of 1,500 tons/year for grey cast iron. There are studies to establish an iron and steel complex with an annual capacity of one million tons at a cost of £S 1,500 million. The demand (in 1983) for 350,000 tons of steel products each year could be satisfied by utilizing indigenous iron ores, charcoals, natural gas, limestone and other outputs, electrical energy and the existing transport systems (rail, river, road). The Government is initially considering a mini-steel mill of 50,000 to 100,000 tons annual capacity costing £S 25-30 million as a pilot plant until the quantity of iron ore deposits and materials and market are assessed.

234. Tunisia: The Société Tunisienne de Sidérurgie Elfouladh is an integrated iron and steel plant. The plant consists of a pelletizing plant and high oven for iron-making. Some statistics on installed capacities and actual production are shown in table 3.16 below.

Table 3.16 Iron and steel industry and foundries in Tunisia

Establishments	Capacity	Actual production
1. Pig iron products at Elfouladh	180,000	136,000
2. Cast iron at Sofomeca	3,000	2,500
3. Cast iron at Reunis	4,500	2,500

Source: Mission estimates.

235. The local technology is not very complex. Tunisia, in so far as basic technology for the basic metals is concerned, has been dependent on turnkey plants delivered by a consortium.

236. In Kenya establishments producing cast iron are shown in the table below.

Table 17: Rolling mills and foundries in Kenya

Enterprises	Products	Capacity (tons)
1. Steel Rolling Mill Ltd. Nairobi	Malleable cast iron	n.a.
2. The railway foundry	Steel and iron castings	5,000
3. East Afircan Foundry	Cast iron	850

Source: Mission estimates.

237. The installed capacity in this country is based on scrap melting and imported billets.

238. In Nigeria the two direct reduction smelting plants using natural gas as reductant in Warri and Port Harcourt should be commissioned by 1981. The giatn project is under implementation. The unit for iron production in Uganda is Uoma Steel and Engineering Corporation Ltd. The company started in 1960. Products are ferrous and non-ferrous castings (cast iron, brass, aluminium). Two cupola furnaces 600 mm dia. with an installed capacity of 1.3 tons/hour for each furnace are installed. The present output of the foundry is very low, 40 to 70 tons/month, i.e. 480 to 840 tons/year.

239. Senegal To meet cast iron production requirements Senegal has two foundries with the railway workshop equipped with two cupolas for casting as well as two foundries in Dakar.

(h) Steel production 26/

240. Africa's present status of industrialization in terms of basic metals production can be said to be poor. The North African Subregion is the only area on the African continent where significant steel-making capacities are in operation (excluding Rhodesia and South Africa). In other parts of the region the levels of technology vary from country to country. No sophisticated technology is involved, plants operating with simple engineering and technological processes. Steel production in Africa was until recently less than one million tons. 1973 and 1974 figures are 0.76 and 0.791 million tons respectively. Africa is therefore a late starter in this field. The annual production capacity of iron and steel plants in Africa is now around three million tons this capacity is planned to rise to 15 million tons (of steel) by 1985. Most of the industries produce exclusively for their national markets. The ission observed that the plants installed are relatively small; they often produce under quasi monopolistic, inefficient and high cost conditions within the protected national markets.

241. Another characteristic of these industries is that, a good number of them, as is typical in most developing countries, operate below capacity (capacity utilization ranges from 35-84 per cent).

Table 3.18: Africa's raw steel production (output in '000 tons)

	1970	1973	1974	1975	1976
Algeria	330	395	450	450	450
Egypt	300	290	300	400	400
Tunisia	130	137	132	130	150
Uganda	20	14	12	15	15
Morocco	5	5	5	5	5
Total	735	841	899	1,000	1,020
Africa (W/Rhodesia and South Africa)	5,692	6,724	7,002	7,880	8,464
World	599,100	698,300	708,700	616,300	681,300

Source: Eisen und Stahl, Statistisches Bundesamt, Dusseldorf.

26/ See also Annexes III-A, III-B and III-C.

Africa raw steel output per capit

242. The low production figures and large population in some cases reflect on the figures.

Table 3.19: Africa output of steel per capita (kg)

	Years					Per cent of world output	
	1970	1973	1974	1975	1976	1970	1976
Algeria	23	25	25	27	26	0.06	0.07
Egypt	9	8	8	11	11	0.05	0.06
Tunisia	19	25	23	23	27	0.02	0.02
Uganda	2	1	1	1	1	0.00	0.00
Morocco	0	0	0	0	0	0.00	0.00
Africa (W/South Africa)	15	17	17	20	20	0.93	1.24
World	165	187	183	164	170	100	100

Source: Eisen und Stahl, Statistisches Bundesamt, Dusseldorf.

243. There is a fully integrated steel plant in Algeria (El Hajdar). Plans are afoot to raise Algerian steel production to over ten million tons by 1980.

244. In West African countries, present steel production is from small plants in Ghana and Nigeria. Scrap is used in small merchant steel rolling mills. Steel consumption in Nigeria has currently been of the order of 650,000 tons/year.

245. Kenya has the intention to establish a mini-integrated steel plant with a capacity of 200,000 tons/year of flat products (including 50,000 tons/year billets), to cover the demand for steel, which is estimated at 292,000 tons by 1985.

Helwan iron and steel plant in Egypt

246. The hot metal tapped from blast furnaces, numbers I and II is delivered to a mixer (500 tons), and afterwards to Thomas convertors. The Thomas convertors are used for phosphoric Aswan ores. The steel is cast into ingots and rolled into billets, blooms and finally into heavy sections. The Thomas shop comprises four convertors of 17 tons capacity each. Steel ingots from the moulds are delivered to rolling mills.

247. The steel-making shop comprises two electric furnaces of 13 tons capacity each, which are restricted to the production of quality steels with a 100 per cent scrap charge. Each of these three basic oxygen convertors has a capacity of 80 tons. At full capacity all three convertors will be installed with two of them in operation, and third one in reserve. The steel production is expected to reach 1,200,000 tons annually. The steel refining is done by oxygen. The average consumption of oxygen is somewhat less than 60 m^3/ton. In addition, there is continuous casting, slabing and blooming, cold and hot rolling mill, strip mill, sections mill and flat products.

248. Other iron and steel plants in Egypt are based on the melting of steel scrap in electric arc furnaces and basic open hearth furnaces (all cold charge); these plants have merchant rolling mills and steel foundries. The total capacity of the non-integrated small plants (Delta steel, the Egyptian Copper Works and the National Metal Industries Company) is the order of about 300,000 tons/year of liquid steel. Non-integrated small steel plants in Egypt using cold charges consisting of steel scrap/pig iron, are equipped with basic open hearth and electric arc furnaces. At the Delta steel, alloy and tool steels are mainly produced whilst the other plants mainly produce plain carbon mild steels for rolling into rods, bars, etc.

Table 3.20: Steel production in Egypt, technology and capacity (the table gives information of the main three establishments)

Establishment	Type of furnaces		Capacity, tons/ year crude steel	Product
National steel, Cairo	Open hearth	2x35 tons	100,000	Mild steel, rods, bars
Copper works, Alexandria	Open hearth	2x30 tons 1x50 tons	100,000	Mild steel rods, bars
	Electric arc furnaces	1x25 tons 1x25 tons		
Delta steel, Cairo	Electric arc furnaces	1x25 tons 1x18 tons 1x18 tons 3x3 tons	70,000	Alloy and tool steels, plain carbon steels

Source: Mission estimates.

Egypt - Helwan iron and steel works

249. Heavy section mill: The mill has a capacity of 80,000 t/annum, mainly channels, I-beams, angles, sheet piles, rail sleepers, fish plates.

250. Light section mill: The capacity of this mill is 80,000 tons of small angles, square and rods, which are mainly used for the reinforcement of concrete.

251. Plate and sheet rolling mills: The annual capacity is 30,000 tons with thickness up to 80 mm. The sheets produced from a new mill are 10,000 tons annually with thicknesses ranging from 1-5 mm.

252. Hot rolling mill: The products of this unit find their application in the automotive industry steel furniture, equipment, etc.

253. There are special units for galvanizing of the cold rolled sheets, for the production of tin plate by the hot dip process; strip mill units' present capacity is 600,000 tons annually. A new cold forming unit should be erected to produce 40,000 tons of cold formed products every year.

Table 3.21: Some figures show the structure of steel production (in tons) in Egypt

	1974	1975		1974	1975
Block	2,394	3,247	Cast iron Sanitary pipes	10,385	11,900
Heavy sections	54,164	63,138	Iron bars	261,742	258,140
Light sections	24,106	37,665	Wires	16,105	21,245
Hot rolling	17,892	55,864	Cast iron casting*	6,197	6,509
Cold rolling	65,561	94,826	Sheets & plates	39,017	52,437
Steel castings	7,750	9,469	Welded pipes	13,928	18,601
High pressure pipes	5,775	4,876	Spiral pipes	9,734	9,103

* L.E. '000.

Source: Mission estimates.

254. In Tunisia, the Elfouladh Integrated Iron and Steel Plant is equipped with:

(i) one shaft furnace with agglomeration ancillaries,
(ii) two top blown LD convertors, capacity 15 tons each,
(iii) electric arc furnaces.
(iv) three continuous casting stands
(v) rolling mills
(vi) oxygen plant

255. The total investment is 24,500 million Dinars. Fifteen per cent of the country's needs of steel is met by this plant. The continuous casting machines produce 310 kgs billets of 3 metres length, two are in operation with one standby. This arrangement appears to meet the 2-2.5 hours tapping schedule of the high ovens of 40-50 tons per tapping. Fumther extensions are foreseen (under study) to reach ultimately 330,000 tons by 1990. Figures shown below indicate the production schedule.

Table 3.22: Elfouladh integrated plant - Tunisia

	Product range	Installed capacity (tons)	Actual production (tons) 1976	1977	1978
1.	Billets casting	156,000	106,000	153,000	180,000
2.	Wire products	15,400	16,000	18,000	21,000
3.	Products laminates and RC bars	156,000	126,000	146,000	170,000
4.	Structural products (towers)	7,900	7,000	8,000	9,000

Source: Mission estimates.

256. The Sofomeca foundry has an installed capacity of 3,000 tons of steel per annum. Actual production is 2,000 tons per annum, using the electric furnace. The Foundries Reunies produces 150 tons of steel castings per year. These establishments use imported scrap. Proposals are underway to study the future development of foundry, forging and heat treatment facilities.

257. Kenya, EMCO Steel Works (K) Ltd. has a [illegible] tons per day electric arc furnace and makes billets for hot rolling. The outputs is 100 per cent scrap. Total annual output is estimated to be 15,000 tons of finished products.

258. The figures below reflect the present situation in Kenya.

Table 3.23· Kenya's main steel industries

Enterprise	Annual (tonnes)	
	Scrap requirement	Installed capacity (steel output)
Kenya United Steel	12,000	10,000
EMCO	18,000	15,000
Steel Rolling Mill	15,000	12 000
City Engineering Industries	8,000	7,000
Total	53,000	44,000

Source: Mission estimates.

259. The installed steel making capacity in Kenya is based on scrap melting. The total installed capacity of rolling mills in Kenya is about 20,000 tons per year. About 10,000 tons rolled steel products are imported every year. Fifteen per cent of steel output in Kenya is exported as finished products. The steel sector has shown a historic annual growth rate of 10 per cent over the years. Steel products cost about $US 420 per ton in Kenya, locally generated scrap costs $US 100 per ton.

260. In the case of Sudan, there are a few units for steel production (Sudanese Steel Products Ltd.). One of these products is galvanizing corrugated sheets. The installed capacity is 15,000 tons, actual production was 14,000 tons/year mainly because of problems of raw materials (rolls) which are imported. The production line consists of sheering, galvanizing and corrugating sections. Another unit is a steel rolling mill with annual capacity of 70,000 tons, but the actual production is 18,000 tons (in one shift).

261. The rolling mill consists of an oil preheating furnace of 16 tons per hour at 1200°C, two pass nine-stand, roughing mill reducing the billets from 80 x 80 to 22 x 22 mm. Intermediate four stands and four pass finishing mill and cooling bed for rolled products.

262. Raw material - imported billets are from Japan and India. The annual import of steel has reached about 250,000 tons and by 1980 it might rise to 300,000 tons. The metals industry represents only 0.2 per cent of the total needs and accounted for only 1.0 per cent of the total of industrial production value.

263. The Sudanese Mining Corporation (Ministry of Mines and Energy) is looking for foreign partners to build an integrated iron and steel plant of 600,000 tons annual capacity. But the amount allocated to basic metals from public sector investments is only LS 10.5 million which was allotted to the Geological Department.

Table 3.24: Mauritius: Import of basic metals (value in Rs. '000)

	1973	1974	1975	1976
Iron and steel	35,983	95,234	72,212	86,778

Source: Mission estimates.

264. The 1976 import figures for iron and steel (for Mauritius) amounted to 36,350 tons, the breakdown is given below.

Blooms, billets, slabs other than high carbon alloys	-	10,376 tons
Bars and rods, excluding wires other than high carbon alloys	-	10,209 tons
Angles, shapes and sections excluding rails other than high carabon alloys	-	4,251 tons
Tinned (excluding high carbon alloys)	-	844 tons
Galvanized (excluding high carbon alloys)	-	4,943 tons
Uncoated (excluding high carbon alloys)	-	1,669 tons
Iron and steel wire (excluding high carbon alloys)	-	1,233 tons
Tubes and pipes of cast iron	-	171 tons
Tubes and fittings of iron and steel	-	450 tons
Tubes and pipes of iron other than cast iron	-	3,437 tons

265. The share of basic metals and engineering industries in value added was 11.0 per cent (Rs 76 million) and share in number of establishment 13.0 per cent amounting to 55 during 1977.

266. In Nigeria the present import of metal products is significant and can be shown in table 3.26.

Table 3.25: Nigeria's import figures for steel products (in thousand tons)

Imports	1970	1971	1972	1973	1974	1975
Billets	15	16	20	79	137	167
Long products	178	122	219	243	401	496
Sheets and plates	221	207	129	140	201	233
Formed sections	-	-	13	9	25	29
Pipes (welded and seamless)	150	238	225	278	380	415
Total	564	583	606	749	1,144	1,340

Source: Mission estimates.

267. Long and flat products were consumed mainly for construction purposes, since any other of their application was practically non-existant. Demand for this kind of products will remain. In accordance with this it is envisaged to produce at the Adjaokuta Iron and Steel Plant 1.185 million tons of long products, the steel production capacity of the plant being 1.3 million tons per annum. More than half of Nigeria's requirements for flat products will be met by the Ajaokuta iron and steel plant. Nigeria has also plans which are under implementation for the establishment of an integrated iron and steel plant, using the direct reduction sponge iron - electric arc furnace route. It would produce 0.5 million tons/year of sponge for export and 0.5 million tons for the home market natural gas will be used for sponge making. This project will reportedly have the collaborations of C. Itoh (Japan) for marketing/financing and of Korf (FRG) for technology.

268. At present in Nigeria there are some small units producing steel rods, angle, sheets, bars, etc., mainly from imported billets.

269. Uganda: The biggest steel work in Uganda is the steel manufacturers of East Africa Ltd., Jinja. This company is capable of producing 30,000 tons of reinforced sections, round, square, angles and flat bars from ingots produced by refining ferrous scrap. The main input for manufacture is steel scrap melted in electrical furnace. The ingots are preheated and subsequently transformed into various sections by rolling mills.

270. The mill has 10 tons/charge electric arc furnace with a 3 MVA transformer, with a preheating furnace for ingots. The installed capacity is 24,000 tons of ingots/year as well as 30,000 tons of rolled steel bars/year. Present production is however only 8,000 to 10,000 tons per year.

271. The expansion of the company indicated: 20,000 tons/year steel foundry; and 30,000 tons/year steel producing plant.

272. The design of the furnaces will be as follows: 33,000 tons/year ore reduction furnace of steel/pig iron.

273. One 10-14 ton capacity electric arc furnace to produce 30,000 tons/year steel partly from liquid pig iron (carbon content not higher than 2 per cent) partly from solid steel scrap. Total cost of this plant including mining equipment will be in the order of $US 8 million. The technology and process involved in the Uganda iron and steel plant covers cast iron products from scrap generally for the spare parts manufactume. Qualities of cast iron castings are up to grade 14. Cupola furnaces is employed. Steel ingots are produced in the Jinja factory by the electric arc process of melting.

274. Senegal has one foundry run by Senemetallurgic producing steel and cast iron casting in Thies. This was a State-owned pilot plant originally designed to produce cast iron and steel and was set up in 1975. The foundry was installed with UNIDO assistance and capable of producing high quality steel with existing equipment. The plant is equipped with two induction furnace 0.5 ton/charge (1000 tons/year) and one rotary furnace 1.0 ton/charge (1000 tons/year). The production in 1978 was 140 tons of cast iron per annum.

B. COPPER INDUSTRY

(a) Principal end-uses of copper

275. Copper is one of man's most important metals. It has a number of valuable properties which either individually or in combination determine the end-uses. Copper is melleable, ductile, and a good conductor of heat and electricity.

276. The electrical industry consumes about 50 per cent of the total output of copper for the capital goods branch comprising heavy equipment used for the generation, transmission and distribution of electricity. Copper also finds uses in the capital goods for the manufacturing sector. Transportation and construction industries are the other most important users of copper. The consumer goods branch also uses copper in the manufacture of: household appliances, electronic equipment and many other products constituting the modern comforts of life.

277. Copper alloys, brass, bronze, used by mankind for over 5,000 years are still very important. Most currency coins, monel and gun metals also contain copper. Chemicals of copper, of which oxide and suplhate are the most important, are used extensively in agriculture and as algicide in water purification for town water supply.

(b) Production in Africa

278. Major world producers include: United States, Chile, Zambia, Zaire, Peru and Zimbabwe. Other producers of copper in Africa include: Botswana, Mauritania, Morocco, Namibia, Uganda, Algeria, and Mozambique.

279. In Botswana, copper production is from Selebi-Pikwe mine operated by the Bamangwato Concessions Ltd. This is a copper-nickel operation. In 1977, production of copper reached 11,700 tons. This operation has been beset by technical problems, capital cost overruns, and poor market conditions. 27/ Bamangwato Concessions Ltd. is owned 15 per cent by the Government of Botswana and 85 per cent by Botswana Roan Selection Trust.

Table 3.26: Copper production in Africa compared to the rest of the world (1977)

	World Total 27/	Africa Total 28/	Per cent to World Total 29/
Mine production	5,795.4	1,254.7	21.65
Smelter production	5,934.4	1,191.3	20.07
Refinery production	9,113.3	779.9	8.55
Scrap recovery	3,151.0	8.0	0.25

Source: 1979 World Metal Statistics.

27/ 1978 Mining Journal Annual Review.
28/ Excludes the Republic of South Africa.
29/ Includes the USSR and Planned Economies.

280. In Mauritania copper is produced from the operations at Akjoujt by Société Minière de Mauritanie (SNIM) who took over in 1976 from (SOMIMA) Société Minière du Mauritanie. The 1977 production was 7,700 tons. There are plans to establish a 33,000 tons per year refinery at Akjoujt. Other future plans involve the establishment of a copper metallurgical plant at Nouakchott. The copper reserves at Akjoujt are estimated at 23 million tons of 2 per cent copper. 30/

281. Zimbabwe produced 33,000 tons of copper in 1977 from the three major copper mines. The total copper capacity of Zimbabwe is 28,000 tons of metal per year. Copper operations are conducted by Messina (Transvaal) Development, Lomagundi Smelting and Mining operating the Alaska Mine, Schackleton Mine and Smelter; MTD (Mangula) operating the Mangula, Silverside and Norah Mines and Lonrho's Coronation Syndicate, operating the Inyati Copper Mine.

282. Namibia produced 32,000 tons of copper in 1977. The major copper operation is the Tsumeb mine which has 4.89 million tons of 4.4 per cent copper reserves. Asis West has 1.5 million tons of 7.78 per cent copper reserves. The largest copper reserve is at Falconbridge's Oamites copper/silver mine which is estimated at 3,534 million tons of 1.19 per cent copper.

283. Zaire copper operations constitute the highest grade copper ore in the world averaging at 3.83 per cent copper. The Government mining agency La Générale des carrières et mines du Zaire (Gécamines) operates 10 mines, 5 mills, 1 copper smelter and 2 copper-cobalt refineries. Gécamines is the successor to the Union Minière of Katanga. (Sodimiza) Société de Développement Industriel et Minière du Zaire is a joint venture between the Government (80 per cent) and Japanese interests (20 per cent). The third mining interest in copper operations is the SMTF) Société Minière de Tenke Fungurume Consortium comprising Charter consolidated, Amoco Minerals Co., Tempelsman and Sons, Mitsui, BRGM and Omnium Mines on one hand and the Zaire Government on the other. SMTF was formed to exploit the ore reserves at Tenke-Fungurume in the Shaba province. The reserves are estimated at 50 million tons of ore at 5.5 per cent copper. Initial capital requirements were estimated at $US 14 million. Already, some $280 million have been spent, and a further $500 million is needed to complete the project.

284. Mozambique produced 3,000 tons of copper in 1977 from the Edmundian Mine near Manica in the Manica province.

285. Zambian copper operations amounted to 565,000 tons per year in 1977. The copper industry in Zambia is a joint venture between the Government (51 per cent) Amax Inc. of USA and the Anglo-American Corporation of South Africa (49 per cent). Nchanga Consolidated and Roan Consolidated Mines are the two operating companies. Between them these two groups operate 6 copper mines. Major problems of the Zambian copper operations are: High production costs of up to UK £300-970/ton, transportation problems of getting the copper out of Zambia and the short supply of essential spare parts for mining equipment.

286. Production of copper from the Congo Republic has been declining from 2,500 tons per year in 1975 to 800 metric tons in 1977. Copper operations are conducted by Ste Minière de M'Passa.

287. Morocco produced 3,400 tons of copper in 1977 from its operations by the Arab Mining Company. A copper refinery is planned at Bleida in South-East of Morocco.

30/ 1975 Mineral Yearbook, vol.1, Metals, Minerals and Fuels, United States Department of the Interior.

Another copper smelter is being planned for at Agadir by (BRPM) Bureau de Recherches et Participations Minières.

(c) Organization of the industry

288. The copper industry is concentrated in the hands of a small number of integrated industrial giants. Despite state participation in the copper industries of the third world about 30 per cent of the industry is controlled by a few multinational corporations. The nationalizatin of mines and processing facilities has successfully reduced the control of transnational corporations over the markets. Although the industry is not integrated forward into fabrication there exists nevertheless close relationship between the copper industry and the electrical industry. By 1970 the eight largest copper corporations owned over one half of the copper capacity in the developed and developing countries operations. Three of these conglomerates were government-owned and accounted for 30 per cent of output. 31/

(d) Technology

289. Copper is profitably mined with a content as low as 0.5 per cent (Bougainville, Papua New Guinea) and as high as 6 per cent (Kisenda, Zaire). Pre-fabrication stages involve beneficiation, smelting and refining are conducted on site in most African countries. Over 94 per cent of copper exported from Zambia and Zaire is processed up to refining stage. Refining capacity at global level is distributed among approximately 30 corporations of which 13 largest ones control 66 per cent of the total capacity. Twenty-five per cent of electrolytic copper is supplied by 15 of the largest corporations. The processing stages of mining beneficiation, smelting and refining are thus integrated to a large extent. 32/

290. Finishing stages of copper fabrication are dispersed between developed and developing countries. Important developments in the technology of copper is continuous casting.

(e) Economics of the copper industry

291. Copper is one of the principal commodities of world trade. It is also one of the most important vehicles for resource-based industrialization for copper-rich countries. The market structure of copper is however oligopolistic and dominated by two marketing institutions namely the London Metal Exchange and the Intergovernmental Council of Copper Exporting Countries (CIPEC). The pricing determinant is the fact that raw materials costs constitute a high proportion of the total costs. Prices are fixed by negotiation between buyers and sellers as well as trading on metal exchange markets. The growing scarcity of copper is pushing up the need for substitution of aluminium for copper in most end-uses.

292. Economies of scale play a relatively small role in determining smelting and refining. In the unique case of low grade copper beneficiation, economies of scale play an important part.

31/ World Industry Since 1960: Progress and Prospects, special issue of the Industrial Development Survey for UNIDO III ID/CONF.4/2.

32/ World Industry Since 1960: Progress and Prospects, UNIDO ID/CONF.4/2.

(f) Future outlook for the copper industry

293. The performance of the copper industry in Africa is influence by performance of economies of the developed countries. With anxieties about the health of the economies of the OECD countries, the prospects do not appear well in the immediate future. 33/

294. The copper industry offers the greatest opportunity for further processing of copper into cables, brass and bronze products in the African region. Sanitary ware, builders hardware and currency coins are possible products that can be locally produced. This is a case of import-substitution which can be combined with a resouce-based development strategy.

C. THE LEAD AND ZINC INDUSTRY

(a) Principal end-uses of lead and zinc

295. Lead is very soft, highly malleable ductile and a poor conductor of electricity but very resistant to corrosion. Lead in its unalloyed form is used for handling extremely corrosive liquids such as mineral acids (sulphuric acid). When small amounts of antimony is added, lead becomes very tough. Lead metal is a very effective absorber of sound, radiation (x-rays, reactor emissions) and vibrations. Principal end-uses of lead are: ammunition, bearings, brasses, bronzes, cable sheathing, caulking, collapsible tubes, sheets, foils, pipes, traps, solder, printers type for newspapers, storage batteries, pigments, and glassware.

296. Zinc is brittle but can be made ductile at certain temperatures. It is a poor conductor. Zinc is normally used as an alloying element in brass, nickel, silver, typewriter metal, commercial bronze, spring brass, German silver, soft solder and aluminium solder. The most important end-uses of zinc in capital goods is the production of die castings used extensively in the motor vehicles, electrical and hardware industries. Large quantities of zinc are used in producing galvanized sheets for the construction industry. Zinc oxide is an important technological material that finds its end-uses into paints, rubber, cosmetics, pharmaceuticals, floor tiles, plastics, printers inks, soap batteries, textiles and many other products.

(b) Prodiction in Africa

297. Major African producers of lead are Morocco, Namibia, Zambia, Tunisia and Algeria. Other producers of the African region are Zaire, Congo and Algeria.

298. Morocco produced 11,200 tons of zinc and 104,800 tons of lead in 1977. Morocco was the largest producer of lead in 1977 followed by Namibia, Zambia and Tunisia. Production was from the lead smelter at Oued Heimer. Further plants are planned at Mekues in central Morocco with a 25 per cent interest by the Arab Mining Company. This project has a capacity of 25,000 tons/year to process lead concentrates. The total investments are estimated at MD 200 million. 34/ (MD - Moroccan Dinar)

33/ Mining Journal, vol. 291, No. 7461.

34/ 1978 Mining Annual Review.

299. Namibia produced 38,200 tons of lead and 41,200 tons of zinc in 1977 from operations at the Tsumeb Mine. Ore reserves at Tsumeb are estimated at 4.39 million tons of 7.05 per cent lead and 1.92 per cent zinc. Development work at Asis West indicated reserves of 1.5 million tons of 4.33 per cent lead combined with 7.7 per cent copper. Other operations producing lead and zinc are Rosh Pinah, and Berg Aukas. 35/

300. Tunisia produced 7,100 tons of zinc and 10,200 tons of lead in 1977. Production was in the form of concentrates, all of which was exported.

301. Production from Algeria amounted to 3,100 tons of zinc and 900 tons of lead.

302. Congo Republic produced 5,200 tons of zinc in 1977, from operations by Ste. Minière de M'Passa. Product was in the form of concentrates for export.

303. Zaire zinc output in 1977 amounted to 73,000 tons from the operations of Gécamines.

304. Zambia produced 51,100 tons of zinc and 15,000 tons of lead from operations at the Broken Hill Division of the Nchanga Consolidated Mines Ltd. Production from this facility has been falling steadily and there are fears that the long-term operations of this facility face grim prospects. So far the prospects are uncertain and the shut down of underground operations would seem likely within the next eight years. 36/

(c) Organization of the industry

305. The lead industry is dominated by the London metal exchange marketing institution. The industry is pressurized by environmentalists calling for stringent controls on the use of lead in view of lead poisoning risks.

306. The International Lead and Zinc study group (ILZSG) monitors the demand/supply relationship at global level in order to estimate the long-term balance between consumption and production of lead and zinc. Several lead and zinc projects are scheduled to become operational in the early 1980s. These projects are mainly in the developed regions of the world: Tara (Ireland), Rubiales (Spain). Several new and expansion smelter projects for primary and secondary production are scheduled for operation in the early 1980s.

307. Ownership of lead and zinc operations is shared between Governments and private investors. In Zambia, the Government controls 51 per cent of interests in the lead and zinc operations. In Zaire the Government control 20 per cent of Sodimiza, 20 per cent of SMTF and owns the whole of Gécamines.

35/ 1978 Mining Annual Review.

36/ Ibid.

Table 3.27: Lead and zinc production in Africa compared to the rest of the world in 1977(in thousand metric tonnes of contained metal)

	World Total*	Africa Total**	Per cent of Africa to World Total
Lead			
Mine production	3,659.3	175.1	4.79
Refinery production	4,225.0	108.5	2.57
Zinc			
Mine production	6,591.2	189.0	2.87
Refinery production	5,945.3	111.2	1.87

Source: 1979 World Metal Statistics.

* World total includes the centrally planned economies countries.

** Africa total excludes the Republic of South Africa.

(d) Economics of the industry

308. Operations of the lead and zinc industry are in the hands of specialized firms. Operating know-how revolves around the lead and zinc blast furnace.

309. Over the last ten years the lead and zinc market has been generally depressed throughout the world due to decline of the major traditional markets for lead and zinc: galvanizing and die casting. Major problems for the future involve the decline of automobile production (which is a major end-user of galvanized steel). Die cast zinc is expected to decline due to substitution of die-cast zinc by plastics and aluminium components.

(e) Technology

310. Major research effort on lead and zinc is devoted towards the solution of environmental problems: control of toxic emissions, treatment of wastes and effluents rendering them harmless, to reduce health hazards. Unfortunately in Africa, this aspect has been neglected. This is an area of social responsibility by the State controlled lead and zinc mines in Africa. Several direct smelting processes are currently being investigated in an attempt to bypass the blast furnace.

D. THE TIN INDUSTRY

(a) Principal end-uses of tin

311. Tin is malleable, somewhat ductile, and crystalline. Alloys of tin find important application in the capital goods industry, soft solder, type metal, fusible metal, pewter, bronze, bell metal, babbitt metal, white metal, die casting alloy, and phosphor bronze. A novel use of tin is in super conducting niobium alloys. For energy sources of the future, tin-niobium supper conductors are expected to produce magnetic fields using minute batteries this is an alternative form of electric power generation with a better efficiency. Tinning end-uses cover tin plates, steel wire and other containers.

(b) Production

312. Producers of tin in the African region are: Zaire, Nigeria, Rwanda and Burundi.

313. Nigeria's tin production has continued to decline over the last eight years. In 1977 production was 3,300 tons compared to 5,300 tons in 1973.

314. Tin is produced from operations by the Amalgamated Tin Mines of Nigeria Holdings Ltd., (ATMN) in which the state-owned Nigerian Mining Corporation (NMC) has a 40 per cent interest with the rest held by Messers. Gold and Base Metal Mines of Nigeria. ATMN operates the Ririwai Mine. Makeri Tin Smelting Company is operated by the Amalgamated Metal Corporation of the U.K. The State holds a 20 per cent interest in this operation.

315. Zaire produced 3,600 tons of tin in 1977 compared to 5,400 tons in 1973. Syndicat Minière de l'Etain (Symetain) operates the tin mines in the Kivu province. The Government holds a 20 per cent interest in Symetain. Output of tin has shown a downward trend over the last ten years. The Manono deposit is estimated at 165,000 tons of tin and 30 million tons of spodumene containing 6 per cent lithium oxide. 37/ There are plans to expand the output of tin in Zaire and a programme of geological surveys and prospecting is currently underway at a cost of Z. 3.5 million.

316. Rwanda and Burundi together produced 1,600 tons of tin in 1977. Société Minière du Rwanda (SOMIRWA), a joint venture between the Government and private interests represented GEO MINES, plans to establish a smelter at Kigali at an estimated cost of Fr. B. 400 million to be financed partly by the European Investment Bank to a tune of Fr. B. 120 million. La Banque Arab de Développement (BADEA) will provide $US 6 million for the ancillary electrical generating utilities.

317. Namibia produced 800 tons of contained tin in 1,242 tons of concentrates in 1977 from operation at Vis.

37/ 1978 Mining Annual Review.

Table 3.28: Tin production in Africa compared to the rest of the world in 1977 (in thousand metric tonnes of contained metal)

	World Total*	Africa Total**	Per cent of Africa to World Total
Mine production	224.1	10.1	4.51
Refinery production	222.2	6.1	2.75

Source: 1979 World Metal Statistics.

* World total includes planned economies countries.
** Africa total excludes the Republic of South Africa.

(c) Organization of the industry

318. Major institutions that dominate the activities of the tin industry are: the International Tin Council, International Tin Agreement and the London Metal Exchange. The International Tin Council draws up and attempts to implement the floor and ceiling prices of tin on the market. The Economic and Price Review Panel of eight members has been set up to make a six-monthly assessment of data related to prices. The ITC also maintains buffer stocks.

319. The demand/supply situation was imbalanced in 1977 leading to a world market deficit of 15,000 tons. Export controls had been imposed on members of the International Tin Council. Currently, the Fifth International Tin Agreement is in force.

320. The price mechanism of tin consists of floor prices, lower sector prices, middle sector prices, upper sector prices and ceiling prices.

(d) Technology

321. Concentration of tin ores is usually done on site by relatively simple methods. The bulk of smelted tin is produced in the developing countries. Most tin mines do not possess their own smelting facilities. They tend to sell concentrates to others. As such, there is no integration in operations of tin processing.

322. Entry into fabricating industries which produce final demand products: tin plate, tin-copper alloy, gun metal, brass, coinage metal, bearing, pump bodies, high pressure steam plant and military hardware presents a difficult challenge for the African countries.

E. THE ALUMINIUM INDUSTRY

(a) Principal end-uses of aluminium

323. Pure aluminium is light, pleasant aesthetic, easily formable, machinable, and easy to cast. Aluminium possess several other desirable characteristics such as: electrical and thermal conductivity, corrosion resistance, non-magnetic, non-sparking properties and ductility. These are important technological properties that make aluminium suitable for industrial applications. Aluminium finds wide applications as kitchen utensils, decorative materials on buildings, aerospace and

aeronautical structural materials in alloyed form. Aluminium is usually alloyed with copper, magnesium, silicon, manganese and specific metals imparting given properties for aircraft and rocket applications. Outside the capital goods industry, aluminium is used in such products as telescope mirrors, decorative paper, packages, toys and many other end-uses. Chemicals of aluminium are applied in glass making, and artificial jewellery, saphire, abrassives corundum and emery) widely used in surface preparation.

(b) Production

324. Bauxite is produced in Africa by: Guinea, Sierra Leone, Ghana and Mozambique. Primary aluminium is produced by: Cameroon, Egypt and Ghana.

Table 3.29: Aluminium production in Africa compared to the rest of the world in 1977 (in thousand metric tonnes of buaxite, alumina and primary aluminium

	World Total*	Africa Total**	Per cent of Africa to World Total
Bauxite	84,605.2	11,863.2	14.02
Alumina	25,136.0	562.0	2.23
Primary aluminium	14,220.0	290.3	2.04

Source: 1979 World Metal Statistics.

* World total for bauxite includes centrally planned economies but excludes them for alumina and primary aluminium.

** Africa total excludes the Republic of South Africa.

325. There are large deposits of bauxite at Minim Martap and Ngaoundere in the Adamaoua area of north-central Cameroon. These reserves are estimated at 1,000 million tonnes at 44 per cent alumina. Another deposit at Fongo-Tongo near Dschang has reserves estimated at 50 million tonnes. Development of these deposits is being undertaken by Société des Etudes des Bauxite du Cameroon (SEBACAM) with a 40 per cent interest held by the Government, 10 per cent by VAW and 45 per cent by Pechiney - Ugine Kuhlman and 5 per cent by Kaiser Aluminium. 38/ Investments are quite substantial ($US 1,000 million). Cameroon has excellent hydro-electric potentials. Development effort involves the construction of a railway network and hydro-electric stations. The mining capacity that is planned is of an annual output of 10 million tonnes of bauxite. This is quite a sizeable operation. An alumina plant will be constructed at a new port. Presently there is a 60,000 tonnes/year aluminium reduction plant at Edea. A capacity of three times of the present output will be needed in due course. $US 3,000 million has been set aside for the alumina - aluminium project in the 1976-1981 Development Plan. In 1977, Cameroon produced 46,200 tonnes of primary aluminium.

326. Guinea produced 10.64 million tonnes of bauxite in 1977 from operations at Fria-Kumba and Boké - Sangaredi and at Kidia. The consortium behind Friguia involves Frialco, Noranda Pechiney, British Aluminium Alusisse and Vereinigte Aluminium Werke.

38/ 1978 Mining Annual Review.

The Government has a 49 per cent interest. Cie des Bauxites de Guinée operates the Boke-Sangaredi project (maximum output of 9 million tonnes/year). The state has a 49 per cent interest with the rest held by Alcoa, Alcan, Martin - Marietta, Pechiney, VAW and Montedison. Plans are afoot to exploit the reserves at Boké, Tougone and Dabala. A $US 700 million joint venture has been set up between Guinea and Nigeria to exploit the aluminium potential of Guinea by an arrangement where alumina will be produced in Guinea and aluminium produced in Nigeria.

327. Ghana produced 275,400 tonnes of bauxite, and 154,100 tonnes of primary aluminium in 1977 from operations of the Ghana Bauxite Company. Plans to develop the Nyinahin bauxite have been announced. Volta Aluminium Company Ltd. completed the expansion of the Tema Smelter to 220,000 tonnes/year. 39/ The Volta Aluminium Company Ltd., and Tema Smelter are owned 90 per cent by Kaiser and 10 per cent by Reynolds.

328. Sierra Leone produced 745,000 tonnes of bauxite in 1977 from operations of Sierra Leone Ore Metal Company Ltd. (Sieromco). All production was exported. Ahisuisse Alusuisse Aluminium (the parent company of Sieromco).is currently considering to open a new mine at Port Loko. The reserves at Port Loko are estimated at 100 million tonnes bauxite. An alumina plant of 1 million tonnes capacity is planned at Pepel. The Government is expected to opt for the 50 per cent interest offered by Alusuisse in this venture.

329. Egypt produced 90,000 tonnes of primary aluminium in 1977 from operations at the Nag Hammadi Aluminium Smelter. Production is based on imported alumina. The capacity is 100,000 tonnes/year. The output is primarily for export. The smelter also supplies the Ismailiya aluminium extrustion plant with pellets. Expansions are underway to reach 160,000 tonnes/year. There is considerable forward linkage for aluminium products.

Mozambique produced 2,000 tonnes of bauxite in 1977 from operations at Alumen Mine near Manica in Manica province.

(c) Organization of the industry

330. Aluminium industry is dominated by the International Bauxite Association and the International Primary Aluminium Institute (IPAI) which represents the bulk of inventories of primary aluminium held outside the centrally planned economies.

331. Bauxite exporters are faced with high tariff barriers to entry at the smelting and refining stages. The market of bauxite cannot be described as a free one. Most sales of bauxite and alumina are intra-company transactions and there are no world standard prices on these two commodities. For most of the International trade in bauxite and alumina, export prices consist of quotations within the transnational corporations. 40/

(d) Technology

332. The first stage of processing (the Bayer process) removes impurities and water to yield the pure oxide (alumina). The next stage of processing involves smelting by electro-thermic reduction in the Hall-Heroult process taking alumina as the raw material. Aluminium processing is an energy-intensive operation.

39/ 1976 Minerals Yearbook.

40/ World Industry since 1960: Progress and Prospects, UNIDO III, ID/CONF.4/2.

333. Research and development effort is aimed at reducing inputs needed to produce the metal. Direct recovery of aluminium from the abundant supply of clays is another area of effort. This research effort is aimed at bypassing the energy-intensive Hall-Heroult process altogether.

(e) Economics of the industry

334. Smelting dominates the cost structure of the aluminium industry. Mining accounts for only about 10 per cent of the cost of production production of alumina from bauxite accounts for 20 to 25 per cent and the rest of the production cost amounting to 60 to 65 per cent is represented by smelting of the alumina to produce the primary metal. This cost structure is basic to understanding of the pricing and negotiating practices of transnational corporations in the aluminium industry. A 10 per cent increase in raw material costs adds a mere 1 per cent to the cost of the metal.

335. Economies of scale in the production of alumina from bauxite by the Bayer process can be achieved up to 300,000 tonnes. For export production the scale is 100,000 to 150,000 tonnes of alumina. Smelters are usually of a capacity between 30,000 to 100,000 tonnes.

336. Fabrication plants tend to be capital intensive and require large mills particularly rolling facilities for plate, sheet, bars, rods. 41/

F. PREREQUISITES FOR THE DEVELOPMENT OF THE BASIC METALS INDUSTRIES

337. The previous exposition has endeavoured to survey the existing situation and status of this important industrial sector, as far as the mission could identify projects in the countries visited, which included only a sample number of countries, and on the basis of published literature and statistics. The exposition can only be considered indicative but by no means complete. As the programme develops, it will be possible to complete and update data on the metals industry in Africa. It is however possible to discuss the prerequisites for the development of the basic metals industry bearing in mind the unique characteristics of the industry and prevailing conditions in Africa. These prerequisites are significant in the design of an approach to the formulation of the strategy for the planning of the basic metals industry within the long-term context of the Lima target and plan of action as well as the short range objectives of developing the heavy industries in Africa.

(a) Markets and economies of scale

333. The first and foremost prerequisite for the growth and development of the metals industry is the existence of a market for its products. The size of this market must justify production at the minimum economically profitable scale of operation. By and large, operations of the metals industry are characterized by dictates of economies of scale. Mineral processing, hot and cold working operations to produce flat products sheets, plates, skelp, strip are highly sensitive to economies of scale.

339. It can be generalized that almost all industries based on natural resources are subject to economies of scale. For most of these natural resources based industries this scale can be achieved only by institutionalizing the market or by bringing several countries together in joint ventures.

41/ World Industry Since 1960: Progress and Prospects, UNIDO III, ID/CONF.4/2.

340. The market constraint can be very limiting in the development of integrated industries which are linked horizontally and vertically to end-user industries in respect to sources of raw materials.

(b) Raw materials and proven reserves

341. Availability of raw materials is the next important prerequisite for the development of metals industry. The assured availability, logistics and price are crucial factors. The proven reserves must be adequately quantified over the project life which is usually fifteen years and above. Characteristics of the raw materials must be carefully evaluated to ascertain whether or not they meet the specifications of processes available on the market. In the absence of this conformity then research and development effort is almost always needed to design processes which after adaptation or as a result of innovation can accept the local raw materials. This is one of the greatest weaknesses of the African situation.

342. Location of the raw materials determines the magnitude of development costs of the required inputs. Important factors are remoteness of the resource location, infrastructure available at the site, required services, logistics of moving the raw materials to the processing site and the price of the raw materials landed at the processing site.

(c) Infrastructure

343. Availability of the physical infrastructure and utilities is the next important prerequisite. Availability of water, power, energy, effluent disposal and waste dumping facilities must be assured. Transportation facilities and materials handling systems are expensive overheads on a project. Where the resources are located away from the market (which in fact is much to the chagrin of the industry, the more usual situation) large sums of money must be set aside for their development.

(d) Manpower and expertise

344. One of the most important prerequisites for the integrated development of the metals industry and its subsequent profitable operation is the availability of unskilled labour, qualified and skilled manpower and the presence of an inventory of entrepreneurial, managerial know-how and expertise. Some industries have taken decades or even a life time to acquire these attributes to a successful metals industry. Supporting skills are needed to cover other related areas: design-engineering, planning, construction, project management and many other skills as negotiation, process identification, contracting, etc.

345. The experience of most African countries with an existing metals industry is their dependence on expatriate manpower at all phases. Only in some countries has it been possible to implement some of the project stages with local manpower as project management, erection and basic construction.

(e) Financing

346. Availability of capital finance on reasonable terms is a basic prerequisite for the metals industry. Financial requirements are segregated into foreign exchange needed to cover the cost of imported portions of the project and the local currency needed for expenditure on infrastructural costs. Both currencies must be available at reasonable rates of interest with terms reasonable enough to ensure smooth financial transactions in the early life of the project. The problem of growing indebtedness of African countries is undermining the strength of their credit worthiness. There has been an all round escalation on capital input to the metals industry in recent years hence reducing financial resources available for conceived projects.

CHAPTER IV

PRESENT STATUS OF ENGINEERING INDUSTRIES IN THE AFRICAN REGION

A. THE ENGINEERING INDUSTRIES 42/

(a) General review

347. The general review of engineering industries in Africa is a rather mixed episode covering existance of various types of light metal and engineering industries primarily based on import substitution and the relative narrowness of their industrial activities due to limited market opportunity. It has now been firmly established that there is a positive abscence of large scale engineering industries in the majority of the African countries. The causes of this state of affairs have been attributed partly to the narrowness of the markets at national levels and economies of scale that are characteristics of these industries. Coupled with thes factors, there seems to be excessive external dependency of the African countries on procurement of capital, intermediate, and durable consumer goods, although a sizeable number of African countries have considerable quantities of deposits of basic minerals for industrial use, it is paradoxical that the majority of these countries depend on importation of substantial quantities of basid metals and a wide variety of intermediate engineering products from other developed and developing regions. In many cases African countries have had to use technology, machinery and equipment th are not consistent with their actual requirements. Very often large scale production technology continues to be employed in operations where concentration should have been on development of scaled down plants.

348. The general outlook for the development of engineering capital goods amnufacture in Africa is still in the primary stage. Out of 49 ECA member States, so far only Egypt has manufacturing plants for machine tools, lathes, drilling machines, grinding machines, milling machines, etc. While recently Nigeria, Kenya and Algeria have prepared feasibility studies and implementation programmes for machine tools manufacture The general tendency in the African countries is to import capital goods against the earnings from cash crops and minerals export. Capital goods manufacture is beyond the present capabilities of the majority of the African countries. Capital goods, particularly machine tools manufacture, require foundry, forging, heat treatment, machine shop, tool rooms and adequate facilities for ancillary industries development, in order to produce parts and accessories. Moreover, the development of the machine tools manufacturing industries requires the intensive development of intermediate engineering together with specific ancillary industries.

349. The main demand for engineering goods in Africa is still however being met by importation. The import structure of engineering industries in Africa therefore deserves a quick glance.

(b) The import structure of engineering industries in Africa

350. Africa imports major engineering commodities from the other developed regions which include engineering capital, intermediate and durable consumer goods in various

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42/ See also Annex I-B.

sector and sub-sectors of engineering industries. However, extremely important changes took place in the development of the engineering industries during the decolonization period 1960-1975. There has been a structural shift from traditional branches of engineering to the development and manufacture of selected intermediate products e.g. steel rods, pipes, improved foundries, and assembly of cars, trucks, lorry, buses, electrical equipment and even machine tools manufacture in limited number of African countries. So far except in Egypt and Nigeria there has been no integrated approach for developing the engineering industries sector in African countries. However the engineering industries structure in Africa can some how be highlighted from the indigenous development of the sector, as well as the trend of importation of engineering goods within the region as a whole. The ECE Bulletin of Statistics on World Trade in Engineering Products and their relative share of export to developing African countries show that during the period 1972 to 1976, the figures reveal that the total export of engineering products to the African region has increased from 4.9 per cent to 7.1 per cent. During the same period the total export of transport equipment to Africa has increased from 6.7 per cent to 9.9 per cent.

351. The above clearly indicates that the demand for engineering products in African region has played a significant role during 1972-1976. Therefore the main structural priority of engineering industry is inclined to be towards the import of transport equipment in African region which constitutes 50 per cent of the total imports of all engineering products in African region.

(c) Trends in national development plans for engineering industries in Africa

352. During this decade the general trends in national development plans prepared by the respective African countries can be arbitarly summarized into three broad categories e.g.:

(i) Development plans oriented to free market economy. (Limited participation of Public Sector and larger participation by Private Sector engineering industries).

(ii) Development plans oriented by mixed market economy. (Participation of both Public and Private Sector engineering industries).

(iii) Development plans oriented by a planned economy pattern based on predominant participation by the State in engineering activities.

(d) Objectives and priorities

353. Although the objectives and priorities in most of the African countries differ to some extent as far as engineering industries are concerned, the majority of the African countries above established objectives and priorities for their national development plans.

(e) Strategies

354. The overall strategies as reflected in national development plans can also be divided into two groups, because of the basic differences observed.

- strategies adopted by non-oil producing countries in Africa;
- strategies adopted by oil producing countries in Africa.

(i) Non-oil producing countries strategies for engineering industries development

355.Here strategies are adopted for the development of resourced based industries through the introduction of import substitution. The basic strategy is the development of commodity producing industries. Most of the strategies in non-oil producing African countries have allowed for engineering industries development e.g.

- Expansion and rehabilitation of existing engineering industries.
- Allocation of funds from cash crops or mineral exports for the installation of new engineering industries based primarily on import substitution.
- In stepping up training of skilled and managerial manpower and bridging the existing manpower gap through employing expatriate in the industry both in the public and private sector.

(ii) Oil producing countries strategies for the engineering industries development

356.In oil producing African countries the strategies for the engineering industries development are somewhat different. The overall strategies of plans in these countries are simple. Due to the development in the oil sector substantial resources are becoming available to these countries as Government revenue, income, foreign exchange, etc. Since oil is a wasting asset, it is the development strategy of the Governments to utilize the resources from oil to develop and maintain the productive capacity of the economy and thus permanently improve the standard of living of their people. The main strategies of these countries can be summerized below as far as the engineering industries sector is concerned.

- In relative short time the economy enjoys a surplus of investible resources which are directed to create large engineering infrastructure.
- In some major engineering projects investment appears to be in excess capacity with a view that demand may catch up much earlier than the trends indicated.
- Major engineering projects oriented towards the reduction of unemployment through large investment programmes.
- Large programmes of expansion of secondary technical and university education, generally included in these plans, aimed at overcoming the present shortage of high level manpower. Moreover, these plans include generous provisions for engineering training programmes in practically all the strategies sectors in general and engineering industries sector in particular.

(f) Policies of development plans for engineering industries

357.Many of the African countries fall under the second category (Category II) as outlined above, generally based on a mix d economy in which government, co-operatives, and private entrepreneurs are free to participate as far as the engineering sector is concerned.

358. The development plan period varies from two to five years of duration in most of the African States. Five years seem to be the general trend. In these development plans the following broad policy objectives are noticed for engineering industries development e.g.

(i) libralization of industrialization policy to encourage indigenous and foreign entrepreneurs in most of the sub-sectors of manufacturing activities in general and engineering industries in particular;

(ii) exploration and exploitation of major minerals resources when they are available;

(iii) increased use of National and local Banks as well as direct government participation as the main instruments of ownership in the following industries e.g. ores-exploration, iron and steel, machine tools, railways and railway workshops, electrical power generation, ship building and dock yard workshops, public transport workshops, large maintenance and repair workshops and various other engineering industries of public interest;

(iv) indigenization of engineering industries

(v) introduction of incentives (different types and levels) both for local and foreign investors;

(vi) introduction and incorporation of various permits, licences and approvals to control industrial investments and repatriation of foreign exchange;

(vii) encouragement of export oriented industries;

(viii) improvement of R & D and transfer of technology;

(ix) dispersal of industries and promotion of small-scale industries;

(x) introduction of local manpower development in order to bring African technical personnel into key positions in industry;

(xi) introduction of rules and regulations for the employment of expatriate technical personnel both for the private and public sector engineering industries, with a view to gradually replacing expatriate personnel.

359. As far as the development plans for the countries in Category I and III, the patterns of development plans are somewhat different.

(g) The Assessment of Existing Engineering and Technology Level in Engineering Industries in Africa

Level indicates the relative development of engineering and technology in Africa.

3 levels have been chosen in this study.

	Technology Level I	Technology Level II	Technology Level III
359/1. Foundry Summary(Ferrous)			
(a) Cast Iron Casting	Small foundry technology with cupola or pit type furnance in small scale sector.(10.5 ton to 1 ton capacity)	Large cupola inducation furnances,in Railway Workshops or large repair and maintenance Workshop(1 ton to 5 ton capacity)	-
(b) Steel ingots from	-	Arc-furnace technology in mini steel rolling plant (10,000 to 40,000 tons/year capacity)	-
(c) Steel and Alloy Castings including malleable and S.G. Iron Casting	Malleable and S.G. iron castings exist in very few African countries (Kenya,Nigeria and Egypt)	Arc furnace only in Egypt for alloy steel castings.	
359/2. Foundry(Non-ferrous)			
(a) Brass	Pit type crucible furnace. Mostly oil fired and floor moulding(50 to 200 kg capacity)	Gravity die cast in only selected country,e.g Egypt,Kenya	Smelting of copper (in Zambia Zaire and Uganda)
(b) Aluminium	Pit type crucible furnace.(50 kg.to 200 kg capacity)	-	-

	Technology Level I	Technology Level II	Technology Level III
359/3. Rolling(Ferrous)			
(a) Hot Rolling for Wire and Bar	Generally 2 high rolling mills for hot rolling. Diameter of finished section varie varies from $\frac{1}{8}$" to $1\frac{1}{4}$" plant capacity from 10,000 - 30,000 tons/year.	4 high rolling mills are used only in Egypt	-
(b) Cold Rolling for Wire and Bar	-	-	-
(c) Hot Rolling for Sheetmetal	-	-	-
359/4. Rolling(Non-ferrous)			
(a) Hot and Cold Rolling for Copper Wire	Only mills are available in Zambia and Zaire.	-	-
(b) Hot and Cold Rolling for Aluminium.	-	-	-
359/5. Forging			
(a) Manual Forging	Generally used in small scale sector for the manufacture of agricultural hand tools	-	-
(b) Manually Operated	-	Technology is used in selected forging operation in medium sized plants.	
(c) Mechanical or Pneumatic Forge	-	Technology is developed Railway Workshops and in large repair and in maintenance Workshops.	Technology is developed in Egypt in large industry.

	Technology Level I	Technology Level II	Technology Level III
359/6. Heat Treatment			
(a) Case Hardening	-	Technology exists in selected countries particularly in Rail-workshops and maintenance work-shops.	-
(b) Through Hardening	-	Technology exists in selected industries and in Railway workshops.	
(c) Induction Hardening	-	-	-
359/7. Machining (General)			
(a) Conventional machining with Lathe, Drilling Boring, Shaping, Milling machines etc.	Technology developed in small scale sector.	Technology developed in medium size plant	Technology developed in large workshops including railway workshops
(b) Semi-Automatic e.g. Capstan, Turret etc.	-	Technology exists in medium size plants.	-
(c) Automatic e.g. Bar and Chuck Auto, Special purpose machine and techniques.	-	Limited industries in Kenya, Nigeria, Egypt, Zambia, Uganda, Tanzania.	-
(d) Usage of Jig, Tools, Fixtures	Technology remotely exists in small scale industries	Limited application in medium sized mass scale industries and in railway work-shops.	-
359/8. Metal Fabrication			
(a) Bending, Roll-Bending Pressing	Limited techno-logy development in small scale sector	Technology developed in large and medium size fabrication shop and in railway workshops.	-

	Technology Level I	Technology Level II	Technology Level III
(b) Press Work and moulding Technology	Limited development in small scale sector	Technology has developed in selected African oountries e.g. Egypt, Kenya, Nigeria, Ethiopia Uganda, etc.	
359/9. Welding (Arc-Welding)			
(a) Electrode stick welding	Technology developed in small scale sector	Technology develoned in large and medium size plants	-
(b) Semi-Automatic sub-merge arc welding and CO_2 welding	-	Technology developed in railway workshops and in repair and maintenance workshops	-
(c) Automatic welding with CO2 and sub-merge arc processes	-	-	-
(d) Use of welding Jigs and Fixtures	Limited use in small scale sector.	Technology developed in industries manufacturing doors and windows.	-
(e) Stress relief of welded products	-	Few industries in Egypt	
359/10. Tool Room			
(a) Conventional maintenance and tool grinding	Technology developed in small scale sector	Technology development in medium and large engineering establishment	-
(b) Tool manufacture technology	-	Limited development in medium and large industries particularly in Egypt Kenya.	

	Technology Level I	Technology Level II	Technology Level III
(c) Simple Jigs and Fixture manufacturing technology	-	Technology developed in medium and large industries and in railway workshops.	-
(d) Complex Jigs, Tools and Fixture Technology	-	-	-
(e) Jig boring and precision machining technology	-	Technology developed in Egypt and in selected railway workshops.	-
359/11. Gauges, Gauge Tools and Inspection equipment	-	Technology developed in railway workshops and limited industries for the manufacture of selected gauges.	-
359/12. Metal Coating			
(a) Galvanizing technology	-	Technology has developed in corrugated steel and pipe manufacturing industries.	-
(b) Ni-Cr. Plating technology	-	Technology has developed in selected African countries e.g. Egypt, Nigeria, Kenya, Tanzania, Zambia, Ethiopia.	-
(c) Phosphating technology	-	Technology developed in railway workshops in selected countries.	
(d) Anodising technology	-	In very few African countries.	-

259/13. Source of Manufacturing Technology and Know How in African Countries for Engineering Industries

Item	Source of Technology	Observation
1	Through technical collaboration or joint venture with large or medium size companies from developed and developing countries with equity and management participation.	Out of 49 African developing countries only Egypt procudes machine tools.
2	Manufacture of engineering products or machine tools under licensing agreement where agreed royalities are paid on design used, parts manufacture, or on sales turnover.	Three other countries Nigeria, Algeria, Kenya will go for manufacture of machine tools.
3.	Manufacture of engineering and machine tools by adaptation and modification of well known products without any collaboration or legal approval.	No African countries produce by this method.
4.	Manufacture of engineering products and machine tools from indigenous development and effort.	This is a recent trend and future prospects for the growth of African industries. Assistance can be obtained from the Regional Centre for Engineering Design and Manufacture in Nigeria, and Regional Centre for Technology Senegal.

(h) Requirement of Raw Materials for Engineering Industries (Selected African Countries)

359/14. The demand for iron and steel for engineering industries in selected African countries during 1930 is illustrated below:

359/14. The demand for iron and steel for engineering industries in selected African countries during 1980 is illustrated below:

Countries visited by ECA/UNIDO Mission	Demand for Cast Iron 1980	Demand for Steel Rolled Sections 1980
Ethiopia	3,000 tons	93,000 tons
Egypt	18,409 tons 9,469 tons(stell castings)	619,142 tons *
Kenya	10,000 tons	100,000 tons
Lesotho	-	-
Mali	6,000 tons	10,000 tons
Mauritius	-	86,000 tons
Nigeria	-	2,776,000 tons
Sudan	1,000 tons	100,000 tons
Senegal	4,000 tons	20,000 tons
Tunisia	175,000 tons	380,000 tons
Uganda	10,000 tons	70,000 tons
Zambia	35,000 tons	70,000 tons
Gambia	-	3,000 tons

* Actual production in 1975.

(i) Resource Based Import Subsitution

359.15. The development plans of most of the African developing countries outline the importance of import substitution for the gradual development of engineering industries. Most of the existing industries orginated from the import substitution measures are industries manufacturing selected intermediate goods and consumer goods in African countries. Today a majority of the African countries except Egypt are importing basic engineering raw materials and products e.g.

- pig iron ;
- hot and cold rolled machining quality steel sections;
- parts and accessories for all transport equipment;
- railway tracks, locomotives and coaches;
- good varieties of intermediate and durable consumer goods;
- consumer goods.

359/16. The development of above resource based industries those fall within the categories of import substituted industries are few in the African region. Today a majority of the African countries are exporting minerals and other cash crops in order to import essential engineering products. Moreover, the value of import content of parts and components of existing industries originally established on the basis of import sustitution, has gone upsubstantially and badly affecting the balance of payment situation of the African countries in general. Most of these industries require foreign exchange to satisfy their assembly lines. Therefore, unless there is a proper and consitent guidelines on import substitution policy on the part of African developing countries, it will be difficult even to expand and diversify the existing engineering industries in Africa. Only few countries in Africa e.g. Nigeria, Egypt, Uganda, Kenya, Algeria, Zaire, Tanzania have given priority for the development of engineering industries based on resource based import sustitution.

359/17. Generally the African countries formulate import substitution policy and implement specific project within this policy those are mainly for selected engineering intermediate products and durable engineering consumer products. An integrated engineering industries development approach based on resource based import substitution so far could not develop in the African region. This requires greater exploitation of subregional mineral resources, and closer economic and technical co-operation among the African countries in general and subregional countries in particular. Therefore, it is imparative to develop regional and subregional resource based engineering industries those are paramount importance to the African Economies. The following are the types of existing engineering industries primarily operating on import substitution basis in African region.

Item	Industries and Products	Local Value Added
1	Industries manufacturing building material steel rods and sections utilizing local scraps and import billets.	60% to 70%
2	Industries assembling cars, tractors, truck, lorry etc.	10% to 15% (mostly paints, tyres and limited fabricated items
3	Railway workshops assemblying coaches locomotives etc.	10% to 15%
4	Assembly of motorcycles, scooters, bicycles.	10%
5	Industries manufacturing hardwares, bolts, nuts, nails, screws, from imported raw materials.	20%
6	Industries manufacturing non electric house hold kitchen ware and domestic appliances.	20%

Item	Industries and Products	Local Value Added
7	Industries manufacturing corrugated galvanized sheets and galvanized pipes	10%
8	Industries manufacturing household furnitures and fixtrues	25%
9	Industries assembling durable engineering consumer products e.g. refrigerators, fans, water heaters etc.	10% in certain cases less than 5%

359/18. So the value of import content of these products varies from 70% to 95% of total manufacturing costs.

(j) Present Manpower situation in Engineering Industries in Africa

359/19. The informations available from Year Book of Industrial Statistics published by United Nations indicates the important status of manpower situation in developing and least developed African countries up to 1976 in the field of metal and engineering industries. These are:

- metal and engineering industries employees in all manufacturing activities in the African region;
- wages and salaries of metal and engineering industries constitute 1% to 17% of total wages and salaries paid in manufacturing sector in the African region.

B. CAPITAL GOODS MANUFACTURE 43/

360. The 1976 ECE Statistics reflects the world export of metal working machinery and machine tools to the African region

Sub-sector	SITC No.	Import in $US f.o.b
Metal working machinery	715	293.2 million
Machine tools	715.1	157.9 million

43/ See also Annexes IV-A and IV-E.

These figures certainly indicate the existence of a potential market for metal working machinery and machine tools in Africa. There is virtually no manufacture of capital goods in Africa.

361. So far only Egypt produces machinable steel rods for engineering industries. Nigeria has prepared a feasibility study and implementation programme for integrated manufacture of intermediate steel products for engineering industries. General situation in African countries for capital goods manufacture has been a continuted importation from other developing as well as developed regions. The potential goods in the form of equipment and machinery, machine tools etc. will expand as Africa puts up industrial plants, chemical plants, refineries, and engineering industry manufacturing plants.

(a) Machine tool manufacture

361. Egypt is the only country in Africa which produces machine tools at the moment. The following countries have planned for the manufacture of machine tools in Africa e.g.

Nigeria	–	A project for machine tools started in collaboration with HMT, India.
Kenya	–	Feasibility study completed for the manufacture of machine tools in collaboration with HMT, India.
Algeria	–	Negotiation has started for the establishment of machine tools manufacture in collaboration with HMT, India.

The team could not identify any other efforts in this area. In the case of Egypt a compensive production range exists including lathes, milling machines, etc.

Essential establishments for capital goods industry development

363. Most of the engineering establishments in African countries in recent years are originated within the context of import substitution. So far the pattern of development in engineering industries has not followed an integrated development approach. Many of the engineering industries are in metal working sector and are intended for the supply of products for the building industry. However, recently the pattern of development is changing rapidly and the Governments of African countries are now

giving more priorities to the development of intermediate and durable engineering consumer goods.

(b) Foundries

364. In most of the African countries small foundries up to 0.5 ton capacities are located in the urban areas and mainly in the cities. Generally a figure of more than six foundries have been identified in each of the countries visited. They produce small cast iron shape castings and in many case non-ferrous castings e.g. brass or aluminium. Larger foundries are located in railway workshops or in large repair maintenance workshops. Most of these foundries are cupola type with a capacity from 1 ton to 5 tons per hour.

Bars and structural materials

365. Selected African countries like Kenya, Uganda, Ethiopia, Zambia, Nigeria, Sudan, Algeria, Zaire, etc. have mini rolling plants which produce building material reinforcing rods ranging from 10,000 tons/year to 40,000 tons/year. Most of these rolling mills use scrap steel and produce ingots by melting the scrap in electric arc furnaces. So far no African countries except Egypt produce machining quality steel sections. Many of these rolling mills have facilities only to produce steel sections for doors and windows and their production is not an ideal input to the engineering industries which normally require better and special grade steels.

C. TRANSPORT EQUIPMENT 44/

366. The situation on transport equipment e.g. automobiles, lorries, trucks, buses, railway rolling stocks, etc. is a rather a mixed phenomena of engineering activities. The majority of African countries have plants for assembly and sub-assembly of automobiles, lorries and trucks in collaboration with multinational companies from developed world. In every country in Africa local fabrication of bus body or truck body has become a traditional activity with high import content of parts and components. The output of these plants is extremely low and there exists a greater trend to import all transport equipment in African region except Egypt, which produces about 80 per cent components for transport equipment within the country including engines. Many African countries have started assembly and manufacture of motor cycles and bicycles spare parts.

(a) Fabricated sheetmetal tankers, bus bodies, truck bodies, trailers, etc.

367. A number of African countries have the facilities for the manufacture of fabricated tankers, bus and truck bodies, trailers, etc. e.g. Ethiopia, Kenya, Nigeria, Tanzania, Sudan, Egypt, Mali, Senegal, Uganda, Zambia, etc. Many of these industries are at owner/worker small scale level. Medium size plant fabricating a number of units per day are existing in Nigeria, Kenya, Egypt and few selected countries. Some governments are however embarking on larger scale projects attached to truck manufacture. In Egypt and Algeria both private and governmental companies are active. Nigeria has recognized the large market potential and will expand production.

44/ See also Annexes IV-A and IV-C.

(b) Railway wagons and rolling stock

368. As far as the railway rolling stocks are concerned: locomotives shunting engines, passenger coaches, freight wagons, the majority of the African countries import these products from other region. Although some countries in Africa: Egypt, Kenya, Nigeria and Sudan manufacture railway wagons and few other railway rolling stocks, so far no countries in Africa have developed integrated railway manufacturing projects except Egypt. There are no facilities to manufacture rail track materials, supplies and consumables in most African countries.

(c) Automobiles and trucks

369. Many African countries are assembling cars and trucks under licence from multi-national companies from Europe and America. These countries are Kenya, Nigeria, Senegal, Ethiopia (Trucks and Landrovers), Zambia, Zaire, Algeria, etc. One country which produce cars indigenously is Egypt. Generally the indigenous contents of these assembly lines are tyres, paints and few fabricated items e.g. wooden portions of trucks fenders and small parts. Nigeria has a number of assembly plants with a very ambitious production programme.

Automotive spare parts (Exhaust Pipes, Filters, Radiators, etc.)

370. A number of African countries e.g. Kenya, Egypt, Tanzania, Nigeria, Senegal, Zaire, Mauritius, Uganda, Zambia have facilities for the manufacture of selected Automotive spare parts. Most of these manufacturing units are in the small scale sector. It was noted that exhaust pipes were one of the first items to be produced. Filters are being assembled in a limited number of countries. This is also the case of radiators which are more complicated to manufacture. In very remote cases, gaskets and shock absorbers have been attempted, but the main problem facing an African automotive spare parts industry is the enormous and continuously changing variety of types and models, and the limited market for each unless a local production is established with limited models and varieties.

(d) Bicycles and scooters

371. These are important means of transportation. They are low cost and easy to assemble at the first stages with an excellent potential for other small local supply industries for parts and components. They also, at least in the case of bicycles, provide a cheap non polluting means of transportation.

372. Many African countries have embarked on projects to manufacture bicycles on a large scale. Egypt and Tanzania are examples, but it would be an exhaustive process to list all countries as some have smaller production units.

373. Scooters, mopeds and motorcycles are also being assembled in some countries. The rickshaw type vehicle, very successfully produced in many Asian developing countries has however not been introduced to Africa. Success of introducing this cheap and practical means of transport seems to depend on transportation habits and the terrain. Hilly or mountainous terrain has also prevented the expansion of the bicycle.

D. ENGINEERING PRODUCTS FOR AGRICULTURE

(a) Tractors and implements

374. Egypt is one of the countries which manufacture tractors and related implements with some indigenous content. In recent years there are number of tractor and implement assembly plants in many African countries. e.g. Kenya, Nigeria, Senegal, Swaziland, Algeria, etc. Some of the countries e.g. Ethiopia, Sudan, Kenya, Tanzania are considering assembly and progressive manufacture of tractors. The area of implements is however the area where maximum adaptation of products can be achieved with a large local components to be manufactured. All countries visited by the mission had some form of production in this area.

(b) Agricultural machinery

375. Due to the existence of potential internal markets, the agricultural machinery industry in Africa is directed towards indigenous manufacture of simple agricultural implements and tools. In almost every country in the African region the simple implements and tools are manufactured at village blacksmith level or at small scale industry level. Only during recent years in selected African countries, has there been a tendency of manufacturing power-making combinations. e.g. tractors and implements either on a joint venture basic with multinational companies or indigenous development of agricultural machinery industries. Egypt is the only country in Africa which manufactures tractors and implements with some indigenous content. Other African countries, Algeria, Kenya, Nigeria, Senegal etc. which assemble tractors and selected implements in collaboration with reputable farm machinery manufactures from developed countries. However, the situation in developing African countries for the manufacture of simple and power operated indigenous agricultural machinery is gaining continued momentum.

E. ENGINEERING DURABLE AND CONSUMER GOODS

(a) Electrical machinery and equipment

376. The present status for the manufacture of electrical machinery: capital, consumer and industrial equipment is not a priority activity in most of the African countries. Egypt has a limited manufacturing range of small and medium size motors and generating sets. In many other African countries there are limited facilities for the manufacture of simple electrical accessories: panels, plugs and sockets etc. The manufacture of electrical prime movers, power generating sets, and accessories does not take place in most of the African countries. It is anticiapted that the majority of the African countries will have a continued dependence on other regions for substantial import of electrical machinery and equipment for many years to come, unless positive measures are taken to identify selected ranges of electrical machinery and equipment which can be produced progressively in African countries.

(b) Engineering consumer goods

377. Electrical consumer goods mostly household appliances as refrigerators, cookers, heaters, etc. are now being assembled and manufactured in a number of African countries. Egypt and the Sudan manufacture large numbers of refrigerators. Other countries as Algeria, Tunisia and Kenya also produce refrigerators. None however produce their own compressors except in Egypt. Production varies from assembly to local production

of parts and components. In all cases however sheet metal work and painting after assembly is made locally.

378. Cookers, stoves and ovens are locally made in a large number of African countries. Some are assembled with agreements with foreign manufacturers under license, others are a completely local effort. The later sometimes suffer from inferior quality and safety. Very often large license fees and royalties are paid to foreign companies whose components are sold to African countries at high prices, Instances have been cited where the total price of components exceeds the price of the complete appliance. The same agreements apply to such items as fans etc.

(c) Sheet metal work

379. Selected African countries e.g. Kenya, Ethiopia, Uganda, Zambia, Sudan, Zaire, Mali, Nigeria, Egypt, Algeria, etc. have facilities for the production of corrugated galvanized sheets from imported sheet metal of various gauges. Import content of these products is very high and local value added constitutes only 5 to 10 per cent.

Metal furniture

380. Majority of the African countries produce metal furniture based on steel pipes and sections. These industries are generally in small scale sectors and sometimes in medium industry level. Electro plating facilities are not generally available within these industries.

F. REPAIR AND MAINTENANCE FACILITIES

(a) Repair and maintenance workshops

381. Most of the African countries have the following facilities for repair and maintenance:

(i) small foundries generally for cast iron, brass and aluminium castings, mostly devoted to the manufacture of spare parts;

(ii) large and medium size repair and maintenance plants for road or river transport equipment;

(iii) large and medium size railway maintenance workshops;

(iv) ship repairing facilities and workshops in ports of the coastal countries in Africa.

Most of these workshops and plants are geared to breakdown and preventive maintenance.

(b) Spare parts manufacture

382. So far there is no organized approach on the part of the African countries to the manufacture of spare parts on a systematic basis. Unlimited product mix variations and lack of standardization facilities have created enormous problems to African repair and maintenance activities in general and the manufacture of indigenous spare parts in particular. Therefore, the general outlook of repair and maintenance in African countries in recent years has been a continued and conspicuous reliance on foreign countries for the supply of spare parts and maintenance supplies and materials. There

is a lack of an integrated development approach in the field of repair and maintenance for engineering industries at sectoral and sub-sectoral levels, as a result large financial losses occur due to stoppages in industry utilities.

383. The general trend for the manufacture of spare parts in Africa has been confined to four main areas e.g.

(i) railway workshops;

(ii) large repair and maintenance workshops;

(iii) dock-yard workshops;

(iv) private industries (mostly of large size)

So far there is no integrated approach for the manufacture of spare parts. In Zambia there are extensive facilities within the existing copper belt industries manufacturing facilities for the spare parts of mining equipment. In railway and dock yard workshops the spare parts are manufactured on a job order basis. Foreign companies in the African region do have facilities for the manufacture of spare parts and can also import special parts. These are however more cases of the exception than the rule.

(c) Metal working centres

384. Most of the existing repair and maintenance workshops for engineering industries do not have facilities for the development of products which require:

- close toleranced castings (ferrous and non-ferrous);
- intricate die castings (hot and cold);
- metal extrustion (hot and cold);
- metal forming (flow forming);
- precision inspection tools and equipment;
- simple tools and special purpose cutting tools;
- heat treatment of alloy steels;
- heat treatment for stress relief;
- jigs and fixture elements and components;
- moulding tools and press tools.

385. For this reason metal working centres should be encouraged in Africa. Some progress has been made especially in industrial estates as in Kenya and Nigeria for example.

386. Where there is an expanded industrial development, large numbers of metal working shops run by private entrepreneurs spring up to cater for the different engineering needs of industry and utilities, many develop small regular production of needed engineering parts and components.

387. However, it is necessary to develo and encourage such centres in areas which need their services. These services might be those to cover the lack of facilities presented above or to include welding, turning milling, shaping and basic engineering processes.

388. Existing metal working centres are equipped with conventional turning, boring, drilling, milling, grinding facilities and in specific cases heat treatment facilities are available. Bending, piercing and blanking facilities are available including gas and arc-welding and brazing. As far as tool making is concerned most of these centres have facilities for manufacture of simple press tools and bending tools. The centres are more geared for the manufacture of fabricated products including agricultural simple tools and implements.

(d) Railway workshops

389. With regard to the Railway Workshops, most of the African countries do have large and medium size railway workshops mostly engaged in:

- foundry for spare parts casting and machine shop for general purpose machining;
- repair and maintenance of track and railway rolling stocks body;
- repair, maintenance and testing of existing locomotives, diesel powered or steam powered;
- repair and maintenance of track equipment;
- repair of wheels and rims;
- engine overhauling and testing facilities.

390. The workshops are well equipped with large standard machine tools and equipment including foundry, forging, heat treatment and general machining of components and parts. It is therefore an urgent need to utilize and mobilize the training resources within the railway workshops in Africa.

(e) Repair and maintenance workshops in industry

391. Large repair and maintenance workshops in industrial companies are mostly geared to the repair and maintenance of machinery for sugar, wood, textile, coffee, tea and very many machinery for cash crops in Africa. Most of these workshops are also utilized for tractor, lorries,truck and agricultural equipment repair and maintenance. Many of these workshops are now engaged in manufacturing machinery e.g. in Uganda, the UGMA maintenance workshop produced sugar crushers, trailers, and agricultural hand tools besides its regular maintenance programme. The mission feels that a thorough assessment is required as to the possibility of manufacturing capital goods e.g. machinery or some machine tools in railway workshops and large repair and maintenance workshops in Africa.

392. The foundry facilities within these workshops always have surplus capacity and are cupola furnaces from 1 to 3 tons capacity for grey cast iron. Non-ferrous casting facilities are also available and are generally pit type crucible furnaces ranging forom 40 kg to 150 kg capacity for brass and aluminium castings. Railway workshops have surplus capacity and the majority have a machine utilization below 30 to 40 per cent of their rated capacity. Many of these workshops e.g. Kenya, Mali, Senegal, Nigeria, Sudan are eager to produce railway rolling stock. So much so that, Kenya railway workshop intends to assembly railway coaches with a progressive manufacturing plan.

393. The railway workshops in Africa are essential institution for establishing comprehensive training programme as they offer a wide range of mechanical and

metallurgical training possibilities for skills. For instance, Kenya railway workshops have facilities to train 1000 trainees within a given period of time. There is ample scope in Africa to train mechanical, electrical engineers and metallurgists provided a subregional training programme can be devised for fuller utilization of these workshops. Moreover these railway workshops have an excellent potential to develop capital goods machinery and equipment with the excess capacity available in each workshops.

G. ENGINEERING DESIGN AND RESEARCH AND DEVELOPMENT CENTERS

(a) Engineering design centres

394. Without establishing a design capability, African engineering industry will always lag behind and depend on the developed industrial countries. Not only that but African industry will continue to pay millions of dollars annually for the purchase of designs, technology, know-how and engineering. Moreover most of the know-how needed is relatively simple and can be developed or even adopted locally if Engineering Design Centres exist. The Engineering and Industrial Design Development Centre (EIDDC in Egypt has been set up 10 years ago in Cairo and has developed designs for capital equipment, transport equipment, consumer and durable goods. On the list of engineering products designed in that Centre and which could easily be duplicated by other national Centres in Africa are agricultural and high speed trailors, bus bodies, tippers, washing machines, stoves, heaters (electrical and gas, solar heaters and water destillination units, brick making machines as well as over 100 different medium technology engineering products.

395. The African Regional Centre for Engineering Design has been now set up in Nigeria and will concentrate on a number of areas including transportation equipment, agricultural implements and implements for the building industry.

(b) Research and development centres

396. In some developing African countries Research and Development Centres exist in some form or other, but their activities are somewhat obscured as far as engineering products development is concerned. However the R & D Centres in the majority of cases are not adequately linked with the engineering industries and the relevant national institution responsible for the promotion of engineering industries.

397. Again, in many cases R & D Centres are academic in nature and mostly geared to cater for agricultural and food industries problems. Very few R & D Centres are fully devoted to the development of engineering industries products and processes. In addition to this they have acute shortage of technical engineering staff in order to promote and foster research and development activities, producing useful prototypes or equipment as an end product to their work which can be introduced and manufactured in African countries.

(c) Educational and training institutions

398. In most of the African developing countries training courses in engineering and technology for engineering industries are carried out in educational and industrial institutions e.g.

- Engineering courses at graduate level at the Universities;
- Engineering courses at technical institutes or polytechnique level;

- Engineering training courses at trades schools and vocational training centres;
- Engineering training at industry level;
- Engineering courses in Industrial Design/Engineering Institutes.

399. Very little interlinkage is, however, observed between the educational institutions and industry at large. The development plans in many African countries do not significantly interlink demand and supply of engineering manpower to the broader context of industrial development. Most of the educational and training establishments pursue an imported syllabus from developed countries to produce professionals more of academic rather than practical nature.

400. Therefore, there is a widening gap between the industrial needs and the quality of engineering personnel graduating from academic centres and industrial institutions.

(d) Regional centres (ECA executed projects)

401. In order to promote the industrial activities in general and development of engineering industries in particular the Economic Commission for Africa is endeavouring to assist the African countries by creating the following institutions, e.g.

- The African Regional Centre for Transfer of Technology in Dakar, Senegal;
- The African Regional Centre for Engineering Design and Manufacturing (ARCEDEM) based in Ibadan, Nigeria;
- The African Regional Institute for Higher Technical Training and Research in Kenya;
- The African Industrial Development Fund (AIDF);
- The African Multinational Industrial Corporation;
- African Regional Centre for Consulting Engineering and Management.

402. These regional centres will be the main instruments for the promotion and development of an African industrial network and will contribute substantially to the African industries in various sectors of industrial activities.

H. PREREQUISITES FOR THE DEVELOPMENT OF ENGINEERING INDUSTRIES

(a) Institutional structure

403. Integrated development of engineering industries require the development of an institutional structure in order to ensure harmonious development of the engineering industries sub-sectors. The policies, strategies and measures are the instruments to establish guidelines for the development. The institutional structure is on the other hand an effective implementing tool in order to bring about sectoral and sub-sectoral development activities at project level.

404. The visible institutions observed in various African countries can be summarized below for the planning, development and expansion of the engineering industries sector and are important prerequisites.

(b) Planning institutions

405. In most of the African developing countries this type of institutions exist for all sectoral planning at national level. Very seldom however do these institutions participate and formulate any integrated engineering industries development projects. So far no countries (except Egypt and Nigeria) have formulated any detailed integrated development plans for engineering industries development. In many planning institutions in African countries the following activities needed for engineering industries development do not exist, to ensure an integrated development programme. These activities should comprise:

(i) sections responsible for policy, strategy and measures for engineering industries development;

(ii) sections for sectoral planning including programming units;

(iii) sectoral and inter-sectoral studies, research and development sections;

(iv) special sections to co-ordinate and co-operate with other Government institutions responsible for the implementation of engineering industries projects;

(v) sections for monitoring the implementation of the planned projects as scheduled in the development plan;

(vi) special sections for the manpower development plan for engineering industries sector.

(c) Responsible industries

406. The majority of the African countries do have a Ministry of Industry or Ministries for industrial, commercial and trade development. The functions of a Ministry of Industry, however, are not always clear in many African countries. In many instances the Ministry of Industry is often called upon to directly run the public sector or nationalized engineering industries. In many cases the performance of these industries under the direct Ministerial supervision is not satisfactory due to Governmental red tape and bureaucracy. In many cases the Ministry of Industry is asked to develop engineering industries at national level, and is often not geared both administratively and technologically to prepare pre-feasibility and feasibility studies of specific engineering projects nor do they have any engineering projects and technical manpower support services to execute priority engineering projects. The main functions of a Ministry of Industry, which are not significantly included in the present structure, can be summarized as follows:

(i) section for comprehensive monitoring of the performances of engineering industries (corporations, companies or projects);

(ii) section for the specific manpower training required for existing and proposed engineering industries;

(iii) testing facilities and laboratories for testing engineering products which are manufactured locally and those imported from abroad to conforms to international and local specifications;

(iv) section to set up Standards and a Board of Trade Mark to protect the consumers;

(v) section to control imports and to promote import substitution;

(vi) section for the institutional development of small-scale industries particularly for the engineering industries sector; including the development of Industrial estates.

(d) Parastatal organizations (Development Corporations, Development Banks and Financial Institutions)

407. Parastatal organizations for running and financing public sector industries are a common features in African countries. Most of the African countries either have many organizations (Ethiopia, Uganda, Zambia) or a very limited number of organizations to develop the industrial sectors. In many cases the corporations activities for the development of engineering industries are not clear and duplication of authority and development activities are often noticed among the corporations and other Government institutions. The main functions of the development corporations should be promotion of industrial activities, identification, implementation and follow-up of projects. Once the industry is formed it is necessary that the development corporations should withdraw its activities as far as the day to day running of the industry is concerned. According to conditions prevailing in each country, the existing development corporation should have the following important sections for engineering industries development etc.

(i) section for project identification, pre-feasibility and feasibility study for specific engineering projects;

(ii) section for technological negotiation and advisory services;

(iii) section for manpower training,

(iv) section for procurement, finance and marketing services;

(v) section for management development and management consultancy services for industries.

These structural requirements are essential for integrated development of engineering industries. They were not always existant in many of the countries visited.

407/1. Selected Existing Country Projects Identified and Recommended Projects by ECA/UNIDO Field Mission for Integrated Development of Engineering Industries in Africa

(a) At National Level (Engineering Industries)

407/2. All the existing Government projects which are in the pipe line, projects identified and recommended by the ECA/UNIDO field mission for engineering industries development programme, are listed in the Annex of this report in countries e.g. Ethiopia, Egypt, Kenya, Lesotho, Mauritius, Mali, Nigeria, Sudan, Senegal, Tunisia, Uganda and Zambia.

(b) At Subregional Level (Engineering Industries)

407/3. The following are the Subregional Projects:

Item	Description	Countries	Remarks
1.	Integrated Steel olling Mill Complex to produce Intermediate ngineering Products.	Nigeria Guinea	Project is under implementation
2.	Proposed Integrated Steel Rolling Complex.	Zambia Tanzania Kenya Uganda	Initial work had been carried out by East African Community. Pre-feasibility study is required.
3.	Proposed Integrated Rolling, Drawing and Extrusion of Cu+Zn alloys and Alluminium Alloys. Commercial Bars, Rods and Sheets.	Zambia, Zaire Burundi Rwanda Uganda	Prefeasiblity study is required.
4.	Proposed Integrated Steel Rolling Mill to produce Intermediate Engineering products.	Senegal Mali Ivory Coast Upper Volta Niger	Prefeasiblity study is required
5.	Assembly and gradual manufacture of Railway Wagon and Coaches in existing Railway Workshops.	Kenya Ethiopia Uganda Tanzania Zambia	Prefeasiblity study is required.
6.	Assembly and gradual Manufacture of Railway Wagon and Coaches in existing Railway Workshops.	Senegal Mali Upper Volta Ivory Coast	Prefeasiblity study is required,

Item	Description	Countries	Remarks
7.	Assembly and gradual manufacture of Railway Wagon and Coaches in existing Railway Workshops.	Nigeria Togo Benin Liberia	Prefeasibility study is required.
8.	Assembly and gradual Manufacture of Railway Wagon and Coaches in existing Railway Workshops.	Zaire Angola Mozambique Congo Cameroon	Prefeasiblity study is required.
9.	Manufacture of Railway Rails and Accessories.		To be included in item 1,2 and 3. Rolling mill should include increasing this production.
10.	Manufacture of Diesel and Petrol Engines from 3HP to 45HP.	Group I Kenya Uganda Zambia Tanzania Group II Nigeria Benin Niger Togo	Prefeasiblity study is required.
11.	Manufacture of Buses, Trucks, Lorries, Tankers and Cars.	Group I Kenya Uganda Tanzania Zambia	(a) Existing Assembly plants are to be expanded and inter-country sub-contracting manufacturing programme should be planned.
		Group II Egypt Sudan Tunisia Libya	(b) Prefeasiblity studies are required.

Item	Description	Countries	Remark
		Group III Nigeria, Benin Niger, Ivory Coast, Togo	
		Group IV Zaire, Angola Cameroon Congo, Burundi Rwanda	
12.	Manufacturing of Machine Tools- Lathes, Drilling Machine Milling Machines, Shapers, Grinding Machine, Presses and Planning Machine.	Group I Kenya (Project implementation) stage	Group I Sub-contracting (countries to manufacture parts in existing Railway workshops and large maintenance workshops. Zambia Tanzania, Ethiopia, Zaire, Uganda, Pre-feasiblity study is required)
		Group II Nigeria (Project implementation stage)	Group II Sub-contracting countries to manufacture parts in existing railway workshops and maintenance workshops Benin, Niger, Upper Volta, Mali, Senegal, Liberia, Togo, (Prefeasibility) study is required)
		Group III Algeria (Proposing to manufacture)	Group III Sub-contracting countries to manufacture parts in existing railway workshops and repair and maintenance shop Tunisia, Libya Morocco (Prefeasibility study is required)

Item	Description	Countries	Remark
		Group IV Egypt (Already manufacture machine tools)	Group IV Sub-contracting countries to manufacture parts in existing railways workshops and repair maintenance shop. Sudan, Ethiopia, Somalia (Pre-feasiblity study is required.
13.	Manufacture of Agricultural Tractors and Implements from 16 HP to 45 HP) (Project should be considered in conjundtion with project in item 10 above)	Group I Kenya Tanzania Uganda Zambia Ethiopia	Group I Pre-feasibility study is required
		Group II Nigeria Benin, Niger, Upper Volta	Group II Pre-feasibility study is required
		Group III Zaire Cameroon Angola Rwanda Burundi	Group III Pre-feasibility study is required
		Group IV Algeria Tunisia Libya Sudan	Group IV Pre-feasibility study is required
		Group V Senegal Mali Ivory Coast Togo Liberia	Group V Pre-feasibility study is required

Item	Description	Countries	Remarks
14.	Subregional Toolroom Comple for manufacture of Jigs,Tools, Fixtures,Mould, Dies and Press tools.	Group I Kenya Uganda Zambia Tanzania Ethiopia Somalia	Group I Pre-feasibility study is required.
		Group II Nigeria Benin Togo Niger	Group II Pre-feasibility study is required
		Group III Zaire Cameroon Angola Rwanda Burundi Mozambique	Group III Pre-feasibility study is required
		Group IV Sudan Tunisia Algeria Libya Morocco	Group IV Pre-feasibility study is required
		Group V Senegal Mali Upper Volta Ivory Coast Guinea Liberia	Group V Pre-feasibility study is required

(c) At Regional Level (Engineering Industries)

407/4. The following are the regional cooperation projects identified for engineering industries development.

1. Creation of Regional Bords for Engineering Industries Development. The Regional Board will comprise of member States and its head-quarters will be eigher within OAU or ECA Secretariat. Under the Regional Board, for engineering industries development e.g. sub-regional boards for East Africa, North Africa, West Africa and Central Africa could be established.

2. Integration of Regional Centre Organized by ECA e.g. Technology Centre, Design Centre, Higher Technical Institute, Multinational Corporation and African Industrial Development Fund.

3. Creating of specific projects for engineering production exchange scheme to utilize maximum resources.

4. Project for regional promotion of engineering sub-contracting arrangement.

5. Project for engineering training programme amongst African countries.

(b) At the Inter-regional Level (Engineering Industries) (among developing countries)

407/5. The following are the interregional projects identified for engineering industries development among developing countries.

1. Setting-up of machine tools and tool manufacture factories on a joint venture basis. (Three machine tools factories in Kenya, Nigeria and Algeria will be set-up on a joint venture basis.

2. Setting-up of engineering industries for the manufacture of Agricultural machinery, transport equipment, railways on a joint venture basis with other developing countries in Asia and Latin America.

3. Interregional engineering training programme between African countries and developing countries in other regions.

4. Specific engineering product development and prototype manufacture in close co-operation between African countries and countries in the other regions.

J. INTEGRATED PROGRAMME FOR ENGINEERING INDUSTRIES DEVELOPMENT IN AFRICA

(a) Integrated Programme at National Level for Engineering Industries Development

407/6 Programme for Institutional Development for Engineering Industries

		Time Period
(i)	Establishment of Proposed Planning and Programming Units	1980
(ii)	Rationalization of National Institutions responsible for engineering industries development as outlined in the flow chart	1980-81
(iii)	Study to establish Proposed National Centres for Industrial Research and Development and Design Centres (see flow chart)	1980-81

		Time Table
(iv)	Interlinkage of National Institutions with the ECA Executed Regional Centre for Engineering Industries Development.	1980-84
(v)	Establishment of Section for Pre-feasibility Study etc. under Development Corporations.	1980-81
(vi)	Continuous negotiations and consultations with Intra-African Countries and between African countries and other Developing Region in identifying specific National or Multi-national identified Engineering Projects.	1980-90
(vii)	Continous dialogue with the Development Banks and Financial Institutions to enhance investment for specific National or Multi-national identified Engineering Projects.	1980-90
(viii)	Organizing National Workshops and Regional Workshops, Seminars and Expert Group Meetings to set-out Policy, Strategy, Planning of identified Engineering Projects for Integrated Development of Engineering Industries at National and Subregional Levels.	1980-90

407/7. Programme for Identification and Pre-feasibility Studies of Engineering Priority Projects

(i)	Pre-feasibility and Feasibility Study for Integrated Foundry (Ferrous and non-ferrous)	1980-81
	Capacity - Castings up to 100kg/piece Castings up to 500kg/piece Castings up to 1000kg/piece	
(ii)	Pre-feasibility and Feasibility Studies for the Manufacture of Mild Steel Sections, Electrode quality Carbon Steel Hardening and Tempering quality Carbon Steel; Carbon, Carbon Manganese and Silicio-Manganese quality Spring-steel; Carbon Tool Steel; Case Hardening quality Carbon Sulphur Steel.	1980-81
	Capacity - 20000 tons/30,000 tons.	
(iii)	Pre-feasibility and Feasibility Study for Rolling, Drawing and Extrusion of Cu+Zn Allocy and Aluminium Alloys Commercial Sections (for Copper and Aluminium producing countries)	1981-82

		Time Period
(iv)	Prefeasibility and Feasibility Study for the Manufacture of Galvanized and Black Sheet Metal for Building Industries and Hot(cross) Rolled Sheets (average up to 5mm thick and 400 to 700mm width) for Agricultural Discs etc.	1980-81
(v)	Prefeasibility and Feasibility Study for the Manufacture of Machine Tools(simple and complex) in existing Railway Workshops or in large Repair and Maintenance Workshop under heading Product Development for Engineering Industries	1980-83
(vi)	Prefeasibility and Feasibility studies and expansion of existing Hand Tools(Mechanical and Agricultural), General Hardware, Construction and Building Materials based on Metal Products.	
(vii)	Prefeasibility and Feasibility Studies for the Manufacture of Primary Metal Products of Furniture and Fixtures.	1980-85
(viii)	Prefeasibility and Feasibility Studies for the Manufacture of Petrol and Diesel Engines from 3HP - 45HP.	1980-82
(ix)	Prefeasibility and Feasibility Studies for the Manufacture of Agricultural Tractors (up to 45HP) and Power Operated implements.	1980-85
(x)	Prefeasibility and Feasibility Studies for the Manufacture of Rail Tracks, Freight Wagon, Passenger Coaches, Rail and Equipment Assembly of Locomotives in existing Railway Workshops.	1980-85
(xi)	Prefeasibility and Feasibility Studies for the Manufacture of Machinery Equipment for Electrical Industries. (Transformers, Motors, Electrical accessories etc.)	1981-85
(xii)	Prefeasibility and Feasibility Studies for the Manufacture Buses, Lorries, Trucks Passenger Cars including the Studies to expand the existing Assembly Plants.	1981-86
(xiii)	Prefeasibility and Feasibility Studies for the Manufacture of Motor Cycles, Mopeds and Bicycles.	1980-81

	Time Period
(xiv) Prefeasibility and Feasibility Studies for the Manufacture of Electrical Domestic Appliances.	1983-86
(xv) Prefeasibllity and Feasibility Studies for the Manufacture of Domestic Electronic Equipment.	1985-90

407/E. Programme for Management and Manpower Development for Engineering Industries*

(i)	Programme for Higher and Middle Management Development.	2 years
	- Training Courses for Senior Executives	2 years
	- Training Courses for Young Managers	2 years
	- Training Courses for Industrial Engineers	2 years
	- Training Courses for Maintenance Engineers	2 years
	- Training Courses for Factory Planning	2 years
(ii)	Post Graduate Training Programme for Graduate Engineers/Dimploma holders	2 years
(iii)	In-plant Quality Control Inspection Courses	1 year
(iv)	In-plant Courses on Machine Shop Practice	3 years
(v)	In-plant Courses on Toolroom Work (Jigs, Fixtures, Moulds)	4 years
(vi)	Ad-hoc Courses on Preventive Maintenance	6 months
(vii)	Ad-hoc Courses on Industrial Design and Tool Design	6 months to 1 year
(viii)	Ad-hoc Courses on Material Handling	6 months
(ix)	Introduction of Industrial Engineering at University/Technical College Level	2 years
(x)	Introduction of special Courses for Engineering Design and Draughtsmanship	2 years
(xi)	Skilled Technician/Workers Training Courses	1 year to 2 years

* Existing African establishmants, Institutes and Centres should fully utilized and their existing programmes merged with above proposed programmes.

- General machinist
- Fitters, welders, fabricators
- High skilled toolroom operatives
- Quality control-viewers/inspectors
- Skilled maintenance operators
- Skilled operatives for forging and heat treatment
- Maintenance technicians for heavy industries

407/9. Programme for the Development of Back-up Engineering Support Facilities

		Time Period
(i)	Establishment of Central Toolroom	1980-82
(ii)	Establishment or expansion of Central repair	1980-83
(iii)	Workshops establishment of Foundries for Ferrous and Non-ferrous Castings(refer item 2(i))	1982-86
(iv)	Establishment of Rolling Mills, Drawing and Extrusion Mills for Engineering Intermediate Goods, Manufacture(refer item 2(ii) and (iii) above)	1982-83
(v)	Establishment of Central Testing Laboratories	1983-85
(vi)	Establishment for the Manufacture of Ferrous and Non-ferrous Die Cast Components	1982-86

(b) Integrated Programme at Subregional Lever for:

407/10. Engineering Industries Development

(i)	Prefeasibility and Feasibility Study for Integrated Steel Rolling Mill complex (Zambia, Tanzania, Kenya, Uganda)	1980-82
(ii)	Prefeasibility and Feasibility Study for Integrated Rolling, Drawing and Extrusion of Cu+Zn Alloy and Aluminium Alloy Commercial Bars, Rods, etc.(Zambia, Zaire, Burundi, Rwanda, Uganda)	1980-82
(iii)	Prefeasibility and Feasibility Study for Integrated Steel Rolling Mill to Produce Intermediate Engineering Products,(Senegal Mali, Ivory Coast, Upper Volta, Niger).	1980-82

		Time Period
(iv)	Prefeasibility and Feasibility Study for Assembly and gradual Manufacture of Railway Wagon, Coaches in existing Railway Workshops.	1980-82
	(a) Kenya, Ethiopia, Uganda (Proposed) Tanzania, Zambia;	
	(b) Senegal, Mali, Upper Volta, Ivory Coast;	
	(c) Nigeria, Togo, Benin, Liberia;	
	(d) Zaire, Angola, Mozambique, Congo Cameroon.	
(v)	Prefeasibility and Feasibility Study for Manufacture of Diesel and Petroal Engines from 3HP to 45HP.	1981-83
(vi)	Prefeasibility and Feasibility Study for the Manufacture of Buses, Trucks, Lorries, Tankers, Cars.	1981-83
	(a) Kenya, Uganda, Tanzania, Zambia;	
	(b) Egypt, Sudan, Tunisia, Libya;	
	(c) Nigeria, Benin, Niger, Ivory Coast, Togo;	
	(d) Zaire, Angola, Cameroon, Congo, Burundi, Rwanda.	
(vii)	Prefeasibility and Feasibility Study for the Manufacture Machine Tools in existing Railway Workshops of large Repair and Maintenance Workshops.	1980-82
	(a) Kenya(parts suo-contracting to Zambia, Tanzania, Ethiopia,Zaire, Uganda)	
	(b) Nigeria (parts sub-contracting to Benin, Niger, Upper Volta, Mali, Senegal Liberia, Togo)	
	(c) Algeria(parts sub-contracting to Tunisia, Libya, Morocco)	
	(d) Egypt(parts sub-contracting to Sudan, Ethiopia, Somalia)	
(viii)	Prefeasibility and Feasibility Study for the Manufacture of Agricultural Tractors (16HP to 45HP) and Implements.	1980-82
	(a) Kenya, Tanzania, Uganda, Zambia, Ethiopia	

(b) Nigeria, Benin, Niger, Upper Volta

(c) Zaire, Cameroon, Angola, Rwanda, Burundi

(d) Algeria, Tunisia, Libya, Sudan

(e) Senegal, Mali, Ivory Coast, Togo, Liberia

	Time Period
(ix) Prefeasibility and Feasibility Study to set-up Subregional Toolroom Complex	1980-82

(a) Kenya, Uganda, Zambia, Tanzania, Ethiopia, Somalia

(b) Nigeria, Benin, Togo, Niger

(c) Zaire, Cameroon, Angola, Rwanda, Burunid, Mozambique

(d) Sudan, Tunisia, Algeria, Libya, Morocco

(e) Senegal, Mali, Upper Volta, Ivory Coast, Guinea, Liberia

CHAPTER V

MAJOR CONSTRAINTS TO THE DEVELOPMENT OF BASIC METALS AND ENGINEERING INDUSTRIES IN THE AFRICAN REGION

A. GENERAL CONSTRAINTS

408. The following typical constraints have been identified by the team to be of a general nature and of widespread occurrence in most African countries visited. They represent in essence the experiences of African countries in the metals and engineering industries. These problems have been imposing varying degrees of constraints on the planning and development process of the metals and engineering industries:

(a) Planning constraints

409. The fact that markets are too small for economically sized production units is one of the most common problems which planners in smaller sized developing countries face, the inadequacy of the domestic market for a particular product, which from other considerations like raw material resources may have a potential for development in the country is an important constraint. Basic metals and engineering products manufacturing plants generally are quite sensitive to economies of scale. Depending upon the cost of different inputs, there is a minimum scale of operations below which a plant is not likely to prove profitable in financial terms. Quite a few projects in developing countries get bogged down at the feasibility study stage, because the total market within the country is not large enough to justify the minimum economic size manufacturing unit. Export possibilities to neighbouring countries, although evidently there, can not be fully relied upon. It is not uncommon, particularly in the African region to come across situations, where a group of countries in a region, may individually not have a market large enough to set up a production unit and may therefore be importing their requirements from outside, while the region as a whole may have the required market potential, amounting to minimum production scale.

410. Lack of experience in the planning, design and implementation of large projects requiring huge capital. Generally the countries of the African region, are new to such areas as industrial project planning, purchase of technology, contract negotiation for purchase of technical services etc. This is a highly specialized field in the world of technology today, and for countries which are planning ambitious programmes of investment in major basic metals and engineering product projects, lack of experience in this critical fields, can make them vulnerable to all sorts of problems, including exploitation by unscrupulous firms plant suppliers, equipment vendors and project engineers firms. Highly unreasonable and unfavourable financial agreements have also often been signed with foreign financing companies by African countries for the supply of foreign credit. As a consequence of such unscrupulous practices, the industrial ventures concerned floundered either technically or financially and either never got off the ground or faced premature closure of operations.

411. An examination of the present institutional structure of most of the developing African countries reveals that most of the development activities in basic metals and engineering industries are related to and promoted by Ministries of Industries as well as Parastatal Organizations like Development Corporations, Development Banks etc. It seems there are considerable overlapping activities for the promotion of these industries in these institutions. Many promotional activities are duplicated and interlinked within the various Ministries and other institutions responsible for development. For

example, the identification of projects and the necessary feasibility studies are carried out by many different institutions within the countries. The appropriate decisions and implementations of various interlinked priority projects can not get off the group due to lack of co-ordination among the decision-making and executing institutions. There is an urgent need for the rationalization of institutional bodies procedural reformation and inter-linkage of Ministries and parastatal organizations for effective planning and programming priority projects within the broad context of industrial development.

B. MAIN INSTITUTIONAL CONSTRAINTS

412. The main institutional constraints in basic metals and engineering industries in African countries at national level are as follows:

(a) Constraints in planning and programming

- The shortage of planners and programmers and the lack of technical and engineering staff at planning level;
- The heavy dependency on foreign advisers who are experienced in planning methodologies and techniques that cannot be directly applied to the needs and demands of developing countries;
- Inadequate preparation of sectoral and sub-sectoral studies of projects and lack of consultations at industry level;
- Lack of techno-economic feasibility studies including site selection studies for the development of basic metals and engineering industries;
- Lack of constructive decisions on the development aspects of infrastructure provision of services, manpower needs, manpower training and management, natural and financial resources, social needs etc.;
- Lack of specific development and project evaluation criteria and absence of information relating to the linkages within the existing industries and their industrial capabilities;
- Lack of an integrated and interlinked development approach towards basic metals and engineering industries development.

(b) Constraints in management ability

- very few countries in African have organized basic metals and engineering management capability for the industries;
- level of managerial and technological personnel is low and can not cope with the operational problems of major industries;
- lack of qualified personnel for project identification, market survey and feasibility study preparation for individual and interlinked manufacturing projects;
- lack of managerial and technical training programmes;

- an uncoordinated implementation approach to specific industrial projects due to lack of trained managerial staff;

- lack of managers, supervisors, technicians, engineers, inspectors at industry level;

- heavy dependency on expatriate managerial staffs;

- lack of management consultants or institutions to assist the industries at project and plant level.

(c) Constraints in product development and design services

- lack of institutions for product adaptation, design and prototype manufacture of engineering products;

- lack of design offices for product development and design;

- lack of institutions for prototype design and manufacture;

- limited possibilities of facilities for the supply of working drawings.

(d) Constraints in procurement, finance and marketing services

- limitation of financial resources for undertaking massive capital intensive basic industries;

- lack of adequate foreign exchange for importation of essential raw materials and spare parts for machinery and equipment;

- procurement problems for cast iron and steel particularly scrap, pig and ingots due to acute transport problems (specially in land-locked countries);

- lack of staff for appropriate choice and procurement of specific plant and machinery;

- limited technical sales and marketing facilities for engineering products;

- little experience in international marketing which the establishment of basic metals industries calls for;

- reluctant government support in initiating and financing heavy industries (e.g. basic metals and engineering industries) whose gestation periods are long. The result of this is that there is stagnation of investment in the engineering and basic metals industries especially as foreign and local private entrepreneurs are reluctant to invest in these capital intensive industries in preference to quicker cash earning alternatives.

(e) Financial constraints

413. The unfavourable balance of payment situation has aggravated the natural and sustained industrial growth in the majority of African countries in general and non-oil producing countries in particular. Many important engineering projects of high priorities have been either put in abeyance or cancelled temporarily due to the financial difficulties. Most of the African metal and engineering industries are based on import substitution. The value of import content of the products imported by those industries adversely affected many countries' balance of payment situation. In addition to this, production levels in specific engineering industries have gone down due to various reasons such as:

- lack of working capital coupled with high interest rate imposed by the commercial banks;
- lack of foreign exchange to import important spare parts and raw materials;
- lack of transport facilities and high transport cost;
- narrowness of internal market;
- obscure export market opportunity;
- unrest of labour force;
- frequent breakdown of plant and machinery and obsolescent machine tools and equipment that are not replaceable due to financial difficulties.

414. Many financial institutions and commercial banks have reduced the credit and overdraft facilities on account of the uncertainities in external and internal economic depression. The increase in oil price has badly affected most of the African engineering activities at factory level. Many countries have reduced their foreign exchange allocation for industrial activities in general and engineering activities in particular. They have also reduced the import quantities of essential parts and components required for assembly and sub-assembly lines in many engineering industries in general and car industries in particular.

415. In addition to this, the majority of African countries do not have facilities for extended credit guarantee schemes for exportable engineering products those which have cheap labour content and could compete in the world market. In many instances, the commercial banks are reluctant to fund a number of sick establishments to come out from their temporary setbacks. Many large manufacturing projects are abandoned due to shortage in financial resources and non-availability of long-term investment loans. Moreover very few African countries have merchant banking facilities to provide ad hoc working capital for existing and feasible new engineering industries and projects.

416. The following are the major financial constraints:

- lack of funds for the prefeasibility studies and feasibility studies of priority and identified engineering projects;

- lack of foreign exchange and external credit lines for engineering projects;
- lack of merchant banking facilities in order to obtain ad hoc financial assistance.

C. TECHNOLOGICAL CONSTRAINTS

(a) Constraints in technological advisory service

- lack of ability for proper plant layout particularly in the small-scale sector based on engineering knowledge;
- absence of facilities for process planning particularly in engineering industries sector;
- lack of personnel for methods study (at present technical institutions do not produce Industrial Engineers or Methods Engineers Industries greatly depend on foreign technology through the ex-patriates);
- lack of facilities for the appropriate selection of machinery equipment, and materials;
- lack of facilities for the improvement of actual production techniques;
- total lack of possibilities for the design and manufacture of jigs, tools and fixtures (there is possibility to expand a number of engineering industries to manufacture jigs, tools and fixtures in the African region);
- relatively little knowledge work study (method study and work measurement do not exist in many large industries in Africa);
- inadequate facilities for quality control and particularly testing requirements in many African engineering industries.

(b) Constraints in common engineering services facilities

- limited foundry facilities particularly gray iron and steel castings including malleable and S.G. iron castings;
- limited facilities for brass and aluminium castings;
- lack of pattern making facilities;
- limited number of workshops for the manufacture of intermediate goods e.g. machining quality steel sections, steel sheets, plates and other commercial sections;
- lack of facilities for precision tool room work particularly the manufacture of jigs, tools and fixtures including gauges, etc.;
- serious lack of heat treatment facilities including galvanizing, electroplating, anodizing, etc.;

- absence of facilities for small tools manufacture e.g. drills, reamers, cutters, taps, etc.;
- inadequate maintenance facilities particularly the re-conditioning of machine tools, transport equipment, agricultural machinery, water supply equipment, power generating machinery etc.

(c) Constraints in ancillary industries

- lack of industrial estates and engineering infrastructure for the manufacture of wide range of components, parts and accessories for larger and medium size industries in Africa. Very few countries in Africa have manufacturing facilities for following selected products, e.g.
- manufacture of brass, phosphers bronze split or bush bearings;
- manufacture of selected hardware, e.g. bolts, nuts, springs, pints, etc.;
- manufacture of transmission gears and gear boxes for industrial machinery and transport equipment;
- manufacture of selected range of electrical components, e.g. plugs, sockets, panels, cabel boxes, switches, etc.;
- manufacture of selected range of automotive spare parts e.g. exhaust pipes, filters, gaskets, radiators, rubber bushings, spark plugs, etc.;
- manufacture of wheels and rims for bicycles, cars, etc.;
- manufacture of domestic and industrial taps, valves and water fittings;
- manufacture of agricultural machinery parts, e.g. discs, tines, etc.;
- manufacture of electrical motors and diesel engines up to 15/35 HP.

Constraints in maintenance and spare parts supply

- lack of manufacturing facilities for the manufacture of spare parts of existing machinery and equipment;
- lack of preventive maintenance schemes in industries;
- shortage of trained maintenance fitters and engineers;
- lack of maintenance workshops particularly in market towns and in the rural areas;
- absence of maintenance training programmes.

D. CONSTRAINTS IN MANPOWER DEVELOPMENT AND TRAINING

417. This is one of the major constraints most of the African countries are facing today, particularly in the metals and engineering industries sub-sectors. Difficulty in providing skilled manpower to the industries is a serious problem in the majority of the African countries. Considering the existing industries structure in Africa, the following shortage of manpower has become a serious setback in industrial operations. These shortages are in:

- Higher management level, e.g. managers, engineers, technologists, industrial and production engineers, quality control engineers, maintenance engineers, plant engineers, etc.;

- Middle management level, e.g. inspectors, process planners, estimators, technical supervisors, designers, draughtsman, foreman, toolmakers, production recorders, etc.;

- Skilled operative level, e.g. operators, turners, fitters, planners, borers, shapers, millers, pattern makers, etc..

E. CONSTRAINTS AT REGIONAL AND SUBREGIONAL LEVEL

(a) At regional level

418. The major constraints at regional level in Africa for basic metals and engineering industries development can be summarized below:

- lack of standardization of engineering products responsible for the import of a wide range of similar products within African countries creating enormous problems in spare parts and maintenance;

- lack of regional transport policy which is affecting the incoming and outgoing engineering products in terms of transport costs, diversity of product delivery schedules and transport maintenance;

- lack of regional policy to set up engineering capital goods industries which will assist the African countries in preserving their valuable foreign exchange and to utilize maximum African raw materials;

- lack of regional finance to assist priority large engineering projects that can not be implemented by single or group of African countries;

- lack of technology plan and unification of industrial training programmes in the African regions as a whole;

- lack of the interchange of metallurgical know-how of trained manpower management and capital investment;

- lack of market study (subregional, home and exports) on structure of prices for raw materials and fuels in the region depending on kind of exploration and geological conditions of deposits in a view of new requirements;

- lack of efforts in increasing of joint venture projects as forms of international and subregional and regional co-operation in raw materials, coal and ore field development on mutually advantageous basis;
- lack of coordination activity in economic evaluation and strategy for development of basic metals and engineering industries;
- lack of regionally co-ordinated infrastructures and manpower system;
- lack of regional policy and strategy for possible development of the iron and steel and engineering industries with the intermediate scenerios to be elaborated for the 1990 time horizon;
- increased rate of interest and inflation;
- lack of over-run finance for a project at the implementation stage which often proves inadequate as the project progresses;
- lack of institutional interlinkages between the financial bodies and the project planning divisions in most of the African countries.

(b) At subregional level

419. The identified constraints at subregional levels in Basic Metals and Engineering industries in Africa can be summarized below:

- lack of efforts for co-operation between the neighbouring countries with the aim of strengthening economic, financial and other types of collaboration between them in order to establish a unified strategy for the growth of basic metals and engineering industries;
- lack of exchange of studies and information on possibilities of subregional markets to avoid any duplication and further constraints on future development of basic metals and engineering industries including information on product development, R & D and transfer, adaptation and development of technology;
- lack of coordination activity in raw materials development, in the interchange of raw materials on a mutually advantageous basis, resources based industries that could be easily implemented with mobilization of internal subregional African countries resources;
- lack of subregional co-operation on research and development of all aspects of coal mining and utilization of cooking coals, lignites and other fuels for reduction purposes in pellebizing and metal production;
- lack of identification of possibilities for co-operation between neighbouring countries in the joint exploitation of ore deposits and seeking to promote constructive decisions;
- lack of initiatives and interlinkages of national planning and programming bodies in order to develop the infrastructure and manpower, to identify common projects of mutual interest in subregional African countries;

- lack of exchange of ideas and information for refractory and ferroalloy production on joint venture subregional basis;

- lack of interlinkages with other sectors of economy to achieve the desired impact in the industrialization;

- lack of subregional co-operation to set up multinational engineering industries with equity participation to manufacture and supply of engineering products that are of high priority and at present come from other regions;

- lack of interlinkage of national planning and programming bodies in order to identify common engineering projects of mutual interest in subregional African countries;

- lack of resource based engineering industries porjects that could be easily implemented if the subregional African countries can mobilize their internal resources i.e. existing unutilized plant and machinery, improvement of the labour force and financial investment within the subregion.

DEFINITION OF BASIC METALS INDUSTRY

The following definition of basic metals industry is based on the 1968 United Nations 4 Digit Code of International Standard Industrial Classification of all economic activities:

SITC 4 Digit Code	Related Economic Activities
3700	Basic Metals Industries.
3710	Iron and steel basic industries. Production and manufacture of primary iron and steel products, semi-manufactures and ancillary activities pertaining to the iron and steel industry: pig iron, ferro-alloys, steel ingots, blooms, slabs, and billets, semi-fabricated products, structural sections, wire, flat, hollow products, foundries and forging,
3720	Non-ferrous metal basic industries. Production and manufacture of primary non-ferrous metal products, covering operations from smelting, alloying and refining through forming operations: rolling, drawing founding and casting, semi-manufactures of metal, alloy, ingots, billets, slabs, flat, hallow, sections, extrusions, castings, and stampings.

Basic Metals Grouping

Basic Metals are grouped as follows:-

Ferrous Metals:

Iron	Chramium	Tungsten
Nickel	Cobalt	Vanadium
Manganese	Molybdenum	Tantalum

Non-ferrous Metals:

Copper	Aluminium	Uranium
Lead	Magnesium	Zirconium
Zinc	Titanium	Beryllium
Tin		

DEFINITION OF ENGINEERING INDUSTRIES

The following definition of engineering industries is based on the 1968 United Nation 4 Digit Code of International Standard Classification of all economic activities:

SITC 4 Digit Code	Related Economic Activities
3800	Engineering Industries.
3811	General hardware, hand tools, and cutlery
3812	Metal furniture and fixutres
3813	Structures, fixed facilities and fabricated metal products for structural, building and construction end-uses.
3819	Fabricated metal products for general engineering applications
3820	Prime movers: turbines, engines, generators
3822	Agricultural machinery and equipment for soil preparation, planting, harvesting and other farming processes and operations.
3823	Machinery and equipment for metal and woodworking
3824	Industrial plant-machinery for processing and manufacture of industrial products.
3825	Business and office machines and equipment
3829	Mechanical appliances such as: pumps, blowers, compressers, air conditioners, refrigeration units; power transmission equipment.
3831	Machinery and equipment for electrical industry Equipment and machinery for generation, transmission and distribution of electricity Electrical prime movers Switchgear and switchboards Transformers, rectifiers Motors, starters, electromagnetic clutches and brakes
3832	Domestic electronic equipment radio, television receivers, sound reproduction and video
3833	Domestic electric appiliances space heaters, heating pads, hot plates kitchen and catering electrical appliances

broilers, roasters, toasters, food mixers, cleaners, fans, waxers, polishers, hot water heaters, fridges, ranges, stoves, ovens

3841 Transportation equipment
Shipbuilding and repair
Railroad equipment, locomotives, rail track, freight cars
Passenger cars

3843 Motor vehicles, assembly, repair, rebuilding
Passenger cars, lorries, trucks
Trailers, coaches, tankers, sub-assemblies

3844 Motorcycles and bicycles
Assembly, rebuilding and repair
Motorcycles, scooters, bicycles, tricycles

SUMMARY OF POPULATION FOR AFRICAN IN 1975

Countries are listed with ones having the least population on top and those with largest population at the bottom of each column.

Below 1 million	1-4 million	5-10 million	11-24 million	25-50 million	Over 51 million
St Helena	Lesotho	Zambia	Uganda	Zaire	Nigeria
Seychelles	Congo Rep.	Mali	Kenya	Ethiopia	
W. Sahara	Mauritania	Tunisia	Tanzania	Egypt	
Sao Tome	Liberia	Upper Volta	Algeria		
Djibouti	Cent.Af.Rep.	Zimbabwe	Morocco		
Cape Verde	Togo	Angola	Sudan		
Comoros	Libya	Cameroon			
Eq. Guinea	Sierra Leone	Madagascar			
Swaziland	Somalia	Mozambique			
Reunion	Chad	Ghana			
Gambia	Rwanda				
Guinea-Bissau	Senegal				
Gabon	Guinea				
Botswana	Niger				
Namibia	Ivory Coast				
Mauritius	Malawi				

Source:- Concise Report on: The World Population situation in 1977
New Beginning and Uncertain Ends. ST/ESA/SER-A/63
Population Studies No. 63, United Nations, New York, 1979

COUNTRIES OF AFRICAN SUB-REGIONS

Central Africa	Eastern Africa	North Africa	Southern Africa	West Africa
Angola	Burundi	Algeria	Botswana	Benin
Cent. African Rep.	Comoros	Egypt	Lesotho	Cape Verde
Chad	Djibouti	Libya	Namibia	Gambia
Congo	Ethiopia	Morocco	Swaziland	Ghana
Eq. Guinea	Kenya	Sudan		Guinea
Gabon	Madagascar	Tunisia		Guinea-Bissau
Sao Tome	Malawi	West Sahara		Ivory Coast
Cameroon	Mauritius			Liberia
Zaire	Mozambique			Mali
	Reunion			Mauritania
	Rwanda			Niger
	Seychelles			Nigeria
	Somalia			Senegal
	Zimbabwe			St Helena
	Uganda			Sierra Leone
	Tanzania			Togo
	Zambia			Upper Volta

Source: Concise Report on: The World Population Situation in 1977: New beginnings and uncertain ends. ST/ESA/SER-A/63 Population Studies No. 63 United Nations, New York 1979

POPULATION OF AFRICAN SUB-REGIONS IN 1975 WITH PROJECTIONS TO 2000

(Figures exclude the Republic of South Africa)

Sub-regions	Population in Million		% Growth Rates
	1975	2000	1975-2000
Central Africa	45.310	87.732	2.64
Eastern Africa	114.498	239.861	2.96
North Africa	98.185	191.824	2.56
Southern Africa	3.190	6.280	2.80
West Africa	115.469	238.034	2.89
Africa Total	376.651	763.730	2.83

Source: Concise Report On: The World Population Situation in 1977; New Beginnings and Uncertain Ends. Population Studies No. 63 United Nations, New York 1979

Annex II-D

GENERAL ECONOMIC INDICATORS BY COUNTRY

Country	1976 Millions		At Constant 1970 Millions US Dollars				
	Population	Labour force	GDP	Manufacturing value added	Gross fixed capital formation	Exports of goods and services	Imports of goods and services
Algeria	17.3	3.7	6671.4	943.1	2582.9	908.6	1978.2
Angola	6.4	1.7	923.3	40.6	169.7	358.8	400.8
Benin	3.2	1.5	256.6	16.3	38.8	62.5	73.4
Botswana	0.7	0.3	226.9	14.7	50.0	80.7	139.0
Burundi	3.8	1.9	249.4	27.9	36.4	22.7	28.1
Cameroon Un. Rep.	6.5	3.1	1363.7	157.9	187.1	376.6	341.9
Cape Verde Isl.	0.3	0.1	24.8	....	...	...	...
Central Afr. Rep.	1.8	0.9	184.8	23.0	38.5	21.7	50.5
Chad	4.1	1.5	323.7	22.7	42.0	105.6	162.0
Comoro Isl.	0.3	0.1	29.6	...	...	...	...
Congo	1.4	0.5	382.1	55.4	48.7	56.5	146.0
Egypt	38.0	10.5	8206.9	1740.3	1303.0	2005.3	2483.2
Equatorial Guinea	0.3	0.1	58.5	2.8	10.2	35.1	33.2
Ethiopia	28.7	11.9	2016.1	182.1	121.9	278.2	250.7
Gabon	0.5	0.3	769.1	58.2	549.4	220.8	456.1
Gambia	0.5	0.3	64.1	0.9	6.4	44.4	52.9
Ghana	10.3	3.7	2309.2	167.0	451.7	762.9	608.1

Country	1976 Millions		At Constant 1970 Millions US Dollars				
	Population	Labour force	GDP	Manufacturing value added	Gross fixed capital formation	Exports of goods and services	Imports of goods and services
Guinea	4.5	2.0	368.9	22.9	32.8	55.2	107.3
Guinea-Bissau	0.5	0.2	107.9	...	...	...	...
Ivory Coast	5.0	2.5	2334.8	375.7	502.2	650.9	695.1
Kenya	13.8	5.2	2120.3	327.6	350.4	339.2	425.3
Lesotho	1.1	0.6	113.6	...	11.8	13.4	109.1
Liberia	1.7	0.7	461.4	23.4	120.1	212.0	201.8
Libyan Arab Rep.	2.5	0.6	6206.2	185.7	1233.6	2186.6	3218.8
Madagascar	8.3	4.0	889.8	121.1	113.3	155.2	129.1
Malawi	5.2	2.2	473.9	35.0	135.7	143.8	134.5
Mali	5.9	3.1	333.4	33.7	43.5	66.6	98.7
Mauritania	1.4	0.4	239.8	10.6	61.8	122.1	138.2
Mauritius	0.9	0.3	346.6	63.3	93.1	321.7	261.0
Morocco	17.8	4.6	4674.6	573.1	1242.5	719.8	1447.2
Mozambique	9.4	3.6	1470.6	113.5	129.0	260.1	194.1
Niger	4.7	1.4	3	26.1	42.6	91.4	122.5
Nigeria	64.8	24.7	12289.0	1192.8	5005.4	2287.7	5409.5
Rwanda	4.3	2.3	283.4	11.3	46.0	37.7	57.4
Sao Tomé + Princip	0.1	...	8.5	...	...	...	...
Senegal	5.1	1.9	1085.9	151.5	119.4	384.9	468.1

Country	1976 Millions		At Constant 1970 Millions US Dollars				
	Population	Labour force	GDP	Manufacturing value added	Gross fixed capital formation	Experts of goods and services 5	Imports of goods and services
Seychelles	0.1	...	18.3	...	...	...	...
Sierra Leone	3.1	1.2	433.5	53.6	46.9	96.0	104.6
Somalia	3.3	1.2	331.7	23.2	71.1	48.8	109.8
Southern Rhodesia	6.5	2.1	1985.4	299.1	314.1	325.0	350.2
Sudan	16.1	5.8	2261.8	240.7	307.5	526.7	551.0
Swaziland	0.5	0.2	215.4	40.8	51.3	141.5	123.3
Tanzania Un. Rep.	15.6	6.5	1659.6	173.4	308.3	403.6	323.1
Togo	2.3	1.0	270.9	18.7	67.5	55.7	111.3
Tunisia	5.7	1.4	2486.2	291.1	629.7	516.6	754.0
Uganda	11.9	4.8	1329.9	94.7	78.9	170.8	209.9
Upper Volta	6.1	3.3	359.6	50.4	36.3	38.7	85.6
Zaire	25.6	10.7	2218.0	196.1	638.4	1316.6	1058.4
Zambia	5.1	1.9	2213.2	243.7	456.1	1073.6	383.1
Africa, total	381.0	142.9	73826.4	8445.7	17914.2	17528.9	24477.0

Source: Recent Industrial Development in Africa, UNIDO/ICIS-117, 6 August 1979

Annex II-E

RELATIONSHIPS BETWEEN ECONOMIC INDICATORS BASED ON 1976 VALUES

Country	GDP per capita (constant 1970) US Dollars	Per cent				
		Labour Force/ Population	MVA/GDP	Gross fixed capital formation/GDP	Exports/GDP	Imports/GDP
Algeria	336	21.6	14.6	38.7	13.6	29.7
Angola	144	27.0	4.4	18.4	38.9	43.4
Benin	80	45.5	6.4	15.1	24.4	28.6
Botswana	324	47.1	6.5	22.0	35.6	61.3
Burundi	66	49.1	11.2	14.6	9.1	11.3
Cameroon Un. Rep.	210	47.5	11.6	13.7	27.6	25.1
Cape Verde Isl.	83	29.0	...	...	...	...
Central Afr. Emp.	103	54.6	12.4	20.8	11.7	27.3
Chad	79	37.2	7.0	13.0	32.6	50.0
Comoro Isl.	99	38.0	...	...	...	...
Congo	273	33.8	14.5	12.7	14.8	38.2
Egypt	216	27.7	21.2	15.9	24.4	30.3
Equatorial Guinea	195	31.3	4.8	17.4	60.0	56.8
Ethiopia	70	41.5	9.0	6.0	13.8	12.4
Gabon	1,538	51.0	7.6	71.4	28.7	59.3
Gambia	128	51.2	1.4	10.0	69.3	82.5
Ghana	224	36.0	7.2	19.6	33.0	26.3

Country	GDP per capita (constant 1970) US Dollars	Per cent				
		Labour Force/ Population	MVA/GDP	Gross fixed capital formation/GDP	Exports/GDP	Imports/GDP
Guinea	82	45.3	6.2	8.9	25.8	29.1
Guinea-Bissau	216	33.2	...	...	...	...
Ivory Coast	467	50.5	16.1	21.5	36.4	29.8
Kenya	154	37.7	15.5	16.5	25.4	20.1
Lesotho	103	56.6	...	10.4	11.8	96.0
Liberia	271	38.5	5.1	26.0	45.9	43.7
Libya Arab Jam.	2,482	23.4	3.0	19.9	19.1	51.9
Madagascar	107	48.8	13.6	12.7	18.6	14.5
Malawi	91	43.3	7.4	28.6	24.0	28.4
Mali	57	53.2	10.1	13.0	26.0	29.6
Mauritania	171	28.4	4.4	25.8	50.9	57.6
Mauritius	385	33.3	18.3	26.9	92.8	75.3
Morocco	263	25.7	12.3	26.6	15.4	31.0
Mozambique	156	38.8	7.7	8.8	17.7	13.2
Niger	101	30.8	5.5	8.9	19.2	25.7
Nigeria	190	38.1	9.7	40.7	18.6	44.0
Rwanda	66	52.4	4.0	16.2	13.3	20.3
São Tomé + Principe	85	...	...	...	...	...
Senegal	213	37.1	14.0	11.0	35.4	43.1
Seychelles	183	...	...	...	...	...

Country	GDP per capita (constant 1970) US Dollars	Per cent				
		Labour Force/ Population	MVA/GDP	Gross fixed capital formation/GDP	Exports/GDP	Imports/GDP
Sierra Leone	140	37.2	12.4	10.8	22.1	24.1
Somalia	101	37.6	7.0	21.4	14.7	33.1
Southern Africa	305	32.9	15.1	15.8	16.4	17.6
Sudan	140	35.8	10.6	13.6	23.3	24.4
Swaziland	431	44.2	18.9	23.8	65.7	57.2
Tanzania Un. Rep.	106	41.6	10.4	18.6	24.3	19.5
Togo	118	41.4	6.9	24.9	20.6	41.1
Tunisia	436	23.9	11.7	25.3	20.8	30.3
Uganda	112	40.3	7.1	5.9	12.8	15.8
Upper Volta	59	53.7	14.0	10.1	10.8	23.8
Zaire	87	41.7	8.8	28.8	59.4	47.7
Zambia	434	36.9	11.0	20.6	48.5	17.3
Africa, total	194	37.5	11.4	24.3	23.7	33.2

Source: UNIDO, compiled from UNSO and ILO data. Recent Industrial Development in Africa UNIDO/ICIS-117 6 August 1979

Annex II-F

TREND OF AVERAGE ANNUAL GROWTH RATES OF ECONOMIC INDICATORS 1970 to 1976

Country	Annual Growth Rates in Per Cent						
	Population	Labour force	Gross domestic product	Manufacturing value added	Gross fixed capital formation	Exports of goods and services	Imports of goods and services
Algeria	3.22	2.84	7.22	11.09	11.13	-1.50	9.86
Angola	2.21	2.02	-8.95	-11.06	- 5.64	-3.96	0.99
Benin	2.75	2.04	3.14	7.90	1.32	-4.74	-4.03
Botswana	3.34	2.09	16.23	11.94	10.14	14.05	11.86
Burundi	2.28	1.70	1.62	5.64	12.03	-0.50	2.30
Cameroon Un. Rep.	1.85	1.37	4.30	3.66	5.90	9.58	4.11
Cape Verde Isl.	2.80	2.44	-4.35	...	...	...	...
Central Afr. Republic	2.14	1.79	-1.42	- 3.02	4.20	-9.91	0.53
Chad	2.08	1.48	3.32	- 2.16	5.08	5.55	5.56
Comoro Islands	2.21	1.81	-0.05	...	....	...	...
Congo	2.56	2.04	7.07	15.20	-3.85	-6.74	3.40
Egypt	2.21	2.45	1.55	1.94	9.34	10.24	11.54
Equatorial Guinea	1.64	1.52	-3.45	- 0.11	-5.33	-0.33	3.58
Ethiopia	2.47	1.95	2.11	2.08	-7.78	5.29	4.47
Gabon	1.01	0.36	18.72	28.65	41.14	5.28	26.91
Gambia	2.57	1.25	6.63	- 0.23	4.21	16.53	14.54
Ghana	2.93	2.06	0.95	- 5.11	7.19	5.95	3.26

Country	Annual Growth Rates in Per Cent						
	Population	Labour force	domestic product	Manufacturing value added	Gross fixed capital formation	Exports of goods and services	Imports of goods and services
Guinea	2.43	1.72	2.39	1.20	7.13	5.65	4.39
Guinea Bissau	1.54	1.02	3.02	...	...	...	...
Ivory Coast	2.58	1.86	7.33	9.66	8.63	6.61	5.59
Kenya	3.53	2.60	4.68	8.89	-0.62	1.80	-3.45
Lesotho	2.25	1.40	9.19	...	9.48	25.07	21.67
Liberia	2.30	1.54	1.64	7.55	6.26	-2.50	1.64
Libyan Arab Rep.	4.04	2.41	10.58	21.22	11.01	-12.76	23.07
Madagascar	2.98	2.26	-0.19	2,29	-2.45	2.46	-5.34
Malawi	2.49	1.91	5.90	0.25	12.70	7.47	3.89
Mali	2.66	1.96	2.75	1.98	0.80	7.34	10.14
Mauritania	2.63	1.80	3.88	10.95	10.89	5.12	10.22
Mauritius	1.31	3.26	10.71	14.41	24.48	24.09	18.23
Morocco	3.00	2.78	5.31	5.80	16.91	-0.54	10.71
Mozambique	2.42	1.53	-3.67	-10.50	-12.19	4.84	-10.13
Niger	2.86	2.51	1.94	1.27	8.57	4.82	7.16
Nigeria	2.73	2.06	7.48	15.78	25.85	6.35	26.53
Rwanda	2.61	2.54	4.08	5.26	20.75	5.53	7.84
Sao Tomé & Principe	1.97	...	-10.84	...	...	...	...
Senegal	2.80	1.69	3.31	3.24	4.62	17.35	19.33

Country	Annual Growth Rates in Per Cent						
	Population	Labour force	Gross National product	Manufacturing value added	Gross fixed capital formation	Exports of goods and services	Imports of goods and services
Seychelles	2.33	...	3.26	...	...	...	...
Sierra Leone	1.53	1.81	1.20	6.40	-1.70	-5.59	-5.16
Somalia	2.59	2.73	7.15	7.57	14.24	3.43	13.79
Southern Rhodesia	3.52	2.67	4.94	-1.03	6.65	-6.88	-3.84
Sudan	2.44	2.74	-1.31	2.82	9.11	7.32	8.38
Swaziland	2.96	2.18	11.68	19.56	15.48	12.30	9.52
Tanzania Un. Rep.	2.83	2.38	4.21	4.44	1.76	1.35	-2.85
Togo	2.49	2.10	0.17	-4.13	11.10	-8.56	0.03
Tunisia	2.43	2.30	9.07	12.74	13.20	7.08	11.86
Uganda	3.35	2.40	-0.10	-4.55	-12.59	-7.90	-3.85
Upper Volta	2.19	1.78	1.47	3.31	6.63	15.20	11.22
Zaire	2.77	1.87	2.78	3.10	5.15	7.28	2.56
Zambia	3.57	2.44	4.18	4.92	-0.90	1.96	-7.00
Africa, total	2.69	2.14	4.39	5.34	11.36	2.31	10.33

Source: UNIDO, compiled from UNSO and ILO data. Recent Industrial Development in Africa UNIDO/SCIS-117 6 August 1979.

IRON AND STEEL INDUSTRY

Product Groupings

Iron and steel products can be grouped according to the shape of the product as a result of the fabrication and manufacturing operations applied in obtaining the product:-

Structural sections	Other sections	Flat products	Round products
Hot-rolled sections	Standard rails	Hot rolled plate	Rods
Welded sections	Crane rails	Hot rolled sheets	Half rounds
Cold-formed sections	Joint bars	Hot rolled coils	Wire, wire fabric
Tubular sections	Squares	Cold rolled sheets	Wire rope, nails
Cold-drawn sections	Hexagonals	Cold rolled coils	Reinforcing rods
Press-formed sections	Octagonals		Tubes, pipes, hollows
	Triangulars	Strip, skelp,	
I-Beams, angles, tees,	Bars	Coated steel sheets	
Zees, channels, piling		Galvanized sheets	
		Tinning sheets	

IRON AND STEEL INDUSTRY

Classification of steels

There are many ways of classifying steels. Several national standards are applied in the classification and selection of steels for particular applications. Different terminologies are used such as: grade, properties, chemical composition and type of steel. Classification is important in respect of design of a production programme and choice of product mix for a project proposal to establish an iron and steel plant. Most African countries have adopted the standards of developed countries with whom they have been associated with historically. Some of the more widely used standards are: British Standards, West German DIN Standards, American Standards and French Standards.

Typical chemical specifications in weight percentages for common iron-steel materials

Alloy	Cast irons	Iron super alloyes	Carbon steels	Alloyed steels	Stainless steels
Al	-	0.25 - 0.35	-	-	0.10 - 2.0
B	—	0.03 - 0.45	-	-	-
C	0.4 - 3.8	0.03 - 0.45	0.06-1.03	0.08-0.64	0.03 - 0.75
Co	-	0.0 -20.0	-		13 - 15
Cr	0.5 - 35	13.5 -20.75	-	0.2 -1.75	11 - 30
Cu	3 - 7	0.0 - 7.0	-	-	1.5 - 3.5
Mg	0.02 - 0.07	-	-	-	-
Mn	0.20 - 1.50	0.25 - 2.00	0.25-1.65	0.25-1.90	0.30 -12.0
Mo	1 - 3	0.50 - 6.0	-	0.08-0.30	0.75 - 4.5
Ni	1.5 - 30	9.0 -38.0	-	0.20-3.25	1.0 -25.0
P	0.02 - 0.8	0.0 - 0.030	0.04-0.12	Max -0.04	0.040- 0.045
S	0.07 - 0.2	0.025- 1.0	0.05-0.35	Max 0.04	0.030- 0.15
Si	0.08 - 2.5	0.55 - 1.0	Max 0.06	0.20-0.35	0.20 - 2.0
Ti	-	0.25 - 3.0	-	-	0.2 - 1.20
V	-	0.02 - 5.0	-	-	0.1 - 0.30
W	-	1.35 - 2.50	-	-	-
Cb	-	-	-	-	0.2 - 1.0
(Cb+Ta)	-	-	-	-	0.15 -00.45

IRON AND STEEL INDUSTRY

Consumption of steel by sectoral final demand based on categories of products and destination with respect to world indirect trade in the iron and steel industry. Values in per cent share of trade (indirect) in steel as a whole:-

Product categories representing final demand	1962	1965	1970
Intermediate goods	8.4	8.4	6.8
Non-electrical machinery and equipment	24.7	24.3	24.5
Electrical machinery and equipment	5.0	4.9	5.1
Agricultural equipment and tractors	5.8	5.8	4.2
Railway rolling stock	4.5	2.9	2.2
Private (passenger) cars	18.7	18.4	19.7
Commercial Vehicles	8.1	6.3	8.1
Parts and spares for vehicles	4.2	5.8	8.2
Household equipment	2.6	2.8	2.7
Other products	18.0	20.3	18.5
Total percentage share of indirect trade	100.0	100.0	100.0

Source: Long-Term prospects for steel consumption until 1985 and outlook for 1990 and Past Trends in Production and Trade Economic Commission For Europe ECE/Steel/9 dated 1 October 1976

An example of steel products differentiation and demand (based on USA 197[illegible] shipments). Table gives the flow of products in the United States for [illegible] to illustrate sectoral demand pattern for products, based on tonnages.

Product grade	[illegible] total output
Carbon steel	90.00
Alloy steels	[illegible]
Stainless steels	1.00
Total	100.00

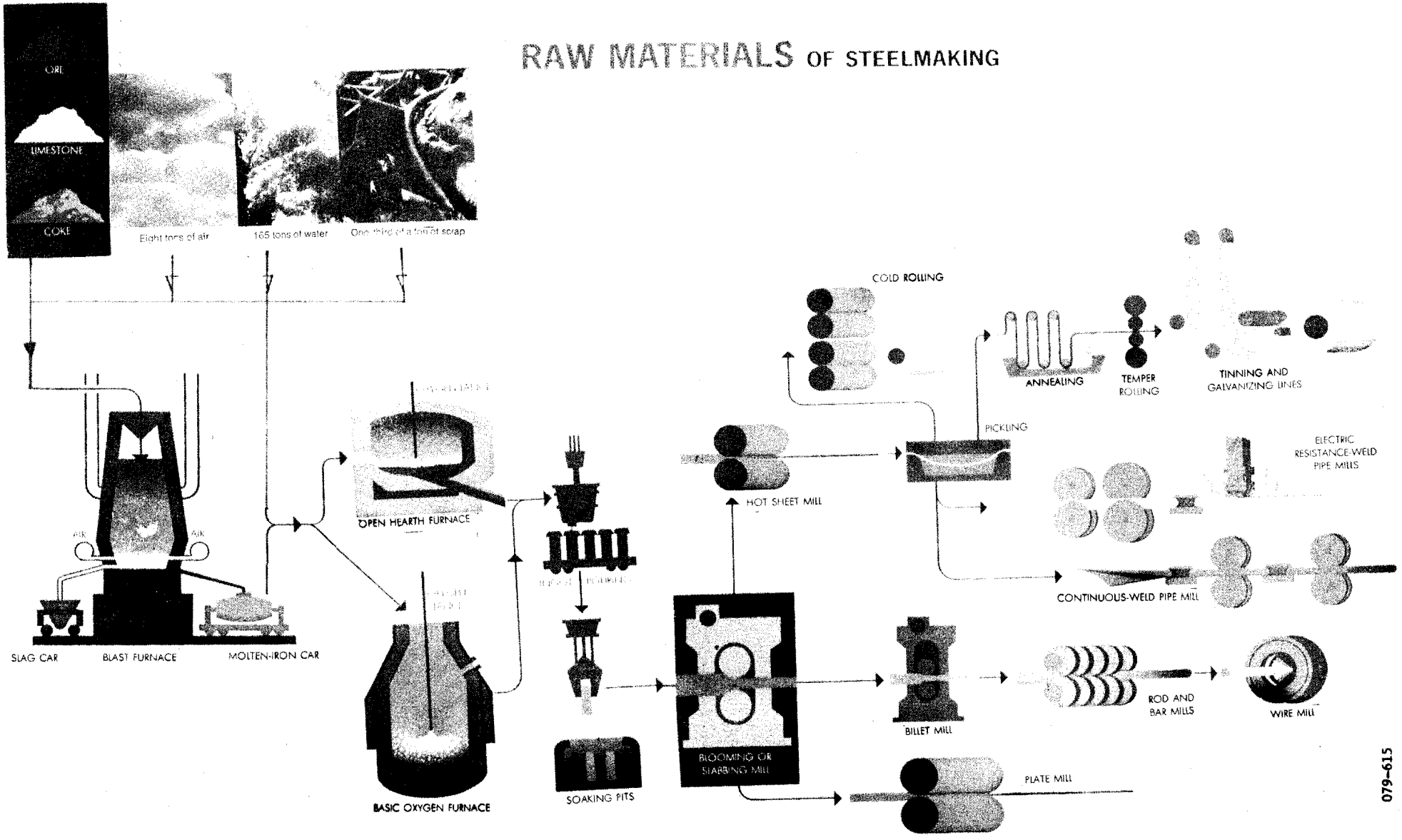
Sector of final [illegible]	Per cent of total output shipped to sector
[illegible]	42.00
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	100.00

Product	Per cent product of total o
[illegible] and plates	17
[illegible] and rail materials	2
[illegible] tool steel	[illegible]
Pi[illegible] and tubing	7
Wire and [illegible] products	3
Tin mill products	7
Sheet and strip	19.50
Total	100

Source:-

Source:- The World Iron and Steel Industry Second Study, UNIDO/ICIS-89 20 November 1978

RAW MATERIALS OF STEELMAKING



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IRON AND STEEL INDUSTRY

Techno-economic of integrated iron and steel plants, based on Federal Republic of Germany Deutschmarks (DM) in 1976 prices $US 1 is roughly 2 DM

Sintering plants

Installed plant capacity	1.7 - 3.9	million tonnes/year
Area of suction side	175.00 - 360.00	sq meters
Investment costs	65.00 - 100.00	million DM
Specific investments	38.25 - 25.6	DM/tonnes
Operating costs	17.82 - 10.71	DM/tonnes

Blast furnace plants

Hearth diameter	3.9 - 14.0	meters
Investment cost	upto 350	million DM
Specific investments	upto 100	DM/tonnes
Operating costs	64.00 - 35.00	DM/ tonns
Production capacity per year	upto 35	million tonnes/year

LD and OBM basic oxygen steel plants

Installed production capacity	600,000.00 - 1,000,000	tonnes/year
Converter tap weight	60.00 - 250.00	tonnes
Common tap weight	150.00	tonnes
Investment costs	117.00 - 186.00	million DM
Specific investment	180.00 - 195.00	DM/tonnes
Operating costs	67.00 - 50.00	DM/tonnes

Electric steel making furnace

UHP furnace tap weight	25.00 - 100.00	tonnes
Installed annual capacity	50,000.00 - 1,000,000	tonnes
Investment costs	50.00 - 180.00	million DM
Specific investment	1,000.00 - 180.00	DM/tonnes
Operating costs	234.00 - 137.00	DM/tonnes

Continuous casting plant

Installed plant capacity	0.36 - 5.0	million tonnes
Investment costs	20.5 - 304.0	million DM
Specific investments	59.50 - 60.80	DM/tonnes
Operating costs	32.87 - 21.55	DM/tonnes

Flat products hot rolling mill

Mill specifications

- Final rolling speed	about 30 m/s
- Specific coil weight	upto 40 kg/mm
- Total coil weight	upto 50 tonnes
- Installed drive power	upto 150,000 KW
- Slab length	upto 15 meters

Mill configuration options

- 56 ins 3/4 continuous train
- 66 ins continuous train
- 90 continous train

Investments

Mill capacity per year	2.5 - 5.5 million tonnes
Investment costs	509.00- 797.0 million DM
Specific investments	204.00- 145.0 DM/tonnes
Operating costs	101.0 - 69.0 DM/tonnes

Source:- Structural changes in the iron and steel industry, ECE/Steel/20 United Nations, New York 1979.

IRON AND STEEL INDUSTRY

Techno-economics of direct reduction and mini-steel plants.

Classification of plant sizes

Plant size	Installed steel output plant capacity (tonnes/year)
Scrap melting plants	20,000 - 200,000
Re-rolling mills	20,000 - 200,000
Non-integrated plants	100,000 - 500,000
Mini-integrated plants	200,000 - 600,000
Small-integrated plants	500,000 - 1,000,000
Medium-integrated plants	1,000,000 - 5,000,000
Large-integrated plants	5,000,000 - 16,000,000

Installed capacity of direct reduction plants, in the world in 1978

Process	Installed capacity (tonnes/year)
Hyl	8,635,000
Midrex	7,705,000
SL/RN	1,795,000
HIB	1,050,000
Purofer	830,000
Fios	400,000
Armco	330,000
Allis-chalmers	250,000
Kinglor mentor	40,000
Other processes	1,315,000
Total installed capacity	22,850,000

Geographical distribution of installed capacity direct reduction plants in 1978

Region	Installed capacity (tonnes/year)
Central, Eastern and North Africa	4,030,000
Rest of Africa (mainly South Africa)	370,000
South-east Asia	3,070,000
Western Europe	1,620,000
Eastern Europe	2,600,000
Latin America	7,790,000
North America	2,870,000
World Total	22,350,000

Investment costs for integrated mini-steel plants covering: Direct reduction, electric arc furnace, continuous casting, and mechant rolling mill in 1976 prices

Installed steel capacity	50,000 - 500,000	tonnes/year
Capital investment	17, 17 - 213	million $ US
Specific investment	240 - 475	$ US/tonnes
Operating cost	about 150	$ US/tonnes

Source: Draft World-wide Study of the Iron and Steel Industry 1975 - 2000, UNIDO/ICIS-25, 15 September 1976

ENGINEERING INDUSTRIES

Capital Goods Industry

classification of products as a function of final demand and production routes.

Final demand	Product group	Production routes
Custom built equipment	Metal structures, storage tanks, boilers Heat exchangers, furnaces.	Simple cutting, forming and welding
Equipment for the basic industries	Plant, equipment and machinery for:- cement, glass, chemicals, rolling mills industrial furnaces etc Prime movers: Turbines thermal engines Pumping stations compressors etc.	Complex cutting forming and welding including complex casting forging, heat treatment; machining and assembly
Standardised industrial equipment for production	Small tools, implements	Simple cutting froming and welding and simple casting forging, heat treatment, machining and assembly
	simple industrial plant and equipment eg:- Agricultural, building and construction power tools	
	Non-electrical equipment plant and machinery, trucks, cars, buses tractors, public utilities, infra-strucural facilities, machine tools	Complex Casting, forging heat heat treatment machining and assembly

Final Demand	Product group	Production group
Sophisticated equipment for industry, business, public utilities and infrastructure requiring advanced technology	Electrical systems Computer systems Precision equipment	Advanced methods and techniques for cutting, forming, welding casting, forging heat treatment machining and assembly

Source: Capital goods industry (preliminary study) UNIDO/ICIS-70 8 May 1978

ENGINEERING INDUSTRIES

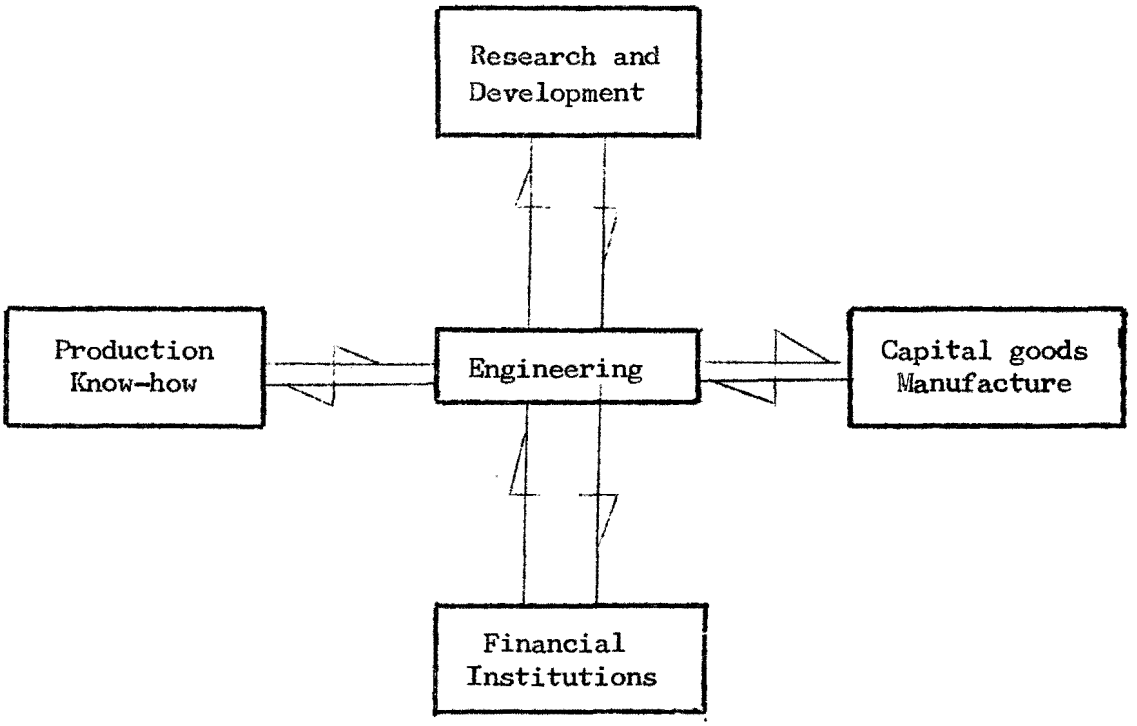
An example of the monopoly mechanisms of transnational corporations in capital goods industry in respect of global control of markets, based on the cartel modalities of the International Electrical Association (IEA) in maters relating to international tenders and procurement contracting.

Capital goods	Territorial exclusions based on market allocation	Mutual Notification of contracting transactions	Mutual safeguards on liabilities guarantees delivery time financial assistance	price control and regulations on tenders	Quota allocation in market areas	Number carte members
Steam turbines to drive generators	yes	yes	yes	yes	-	18
Steam turbine driven alternators	yes	yes	yes	yes	-	18
Water turbine driven AC generators	yes	yes	yes	yes	yes	10
Synchronous condesers	yes	yes	yes	-	-	-
Circuit breakers	yes	yes	yes	-	-	-
Transformers	yes	yes	yes	yes	yes	-
Rectifiers	yes	yes	yes	yes	yes	9
Rolling mill equipment	yes	yes	yes	-	yes	6
Water turbines	yes	yes	yes	-	-	-

Source: The International Market Power of Transnational Corporations: A case study of the electrical industry. UNCTAD/ST/MD/1 14 April 1978.

ENGINEERING INDUSTRIES

Interrelationships of engineering industries with other poles of the industrial system.



Transaction cycle

- Preliminary studies
- Implementation studies
- Project engineering studies
- Training of personnel

Source: Capital Goods Industry: (Preliminary Study) UNIDO/ICIS-70 3 May 1978.

ENGINEERING INDUSTRIES

Establishment and Employment structure of Engineering Industries in Selected African Countries

Countries visited by ECA/UNIDO Mission	Year	Number of Engineering establishments	Employment in engineering industries	Employment in manufacturing industries	%
Ethiopia	1970	8 state owned 19 private small scale	1,435 -	60,120 -	2.4
Egypt	1975	32 large****	1,175,106*	5,831,600*	20.0
Kenya	1975	104 (large establishment)	30,491	104,529	29.2
Lesotho	-	-	-	-	-
Mali	1978	7	1,258	9,000	13.9
Mauritius	1978	54	5,006	33,000	15
Nigeria	1974	1,054**	20,900	174,180	12
Sudan	1977	117	5,850	76,500	7.6
Senegal	1978	12	3,000	20,500	14.6
Tunisia	1976	49	6,200	60,600	10.2
Uganda	1976	29	1,945	24,534	7.9
Zambia	1973/74	155	8,611	43,130	19.9
Gambia ***	1977	10	375		
Algeria***	1975		44,695	103,460	43.2

* Industry as a whole
** Includes large number of repair and maintenance shop
*** Figures obtained from national paper
**** Large public sector with approximately 3,000 smaller ones and private sector

It is difficult to pinpoint the exact employment figures for engineering industries in Africa. However, there exists a critical shortage of trained and skilled manpower in most of the African engineering industries.

The existing main sources of technical manpower recruitment in African countries are as follows:

- from existing universities and technical colleges. Most of these personnel are graduates and diploma holders in engineering disciplines;
- from existing polytechnics;
- from trades schools and vocational training centres;
- from inplant training scheme in public and private sector industries.

The basic shortage of technical manpower in most of the African countries are in the following fields;

A. Management engineers

- Electrical, mechanical, metallurgical engineers;
- Industrial engineers;
- Production engineers;
- Engineering planning and feasibility study engineers;
- Procurement and technical sales engineers;
- Maintenance engineers;
- Industrial design engineers;
- Tool room engineers.

B. Supervising technical staffs

- Inspection and quality control engineers;
- Methods engineers;
- Designer, draughtsmen and estimators;
- Production recorders.

C. Skilled operatives

- Pattern makers and mould makers;
- Foundry operatives;
- Fitters, welders and forging operatives
- Turners, millers, berers, planners;
- Tool makers.

D. Maintenance operatives

- Mechanical technicians
- Electrical technicians
- Pneumatic and hydraulic technicians
- Plumbers, joiners and special skilled technicians.

Classification of engineering products on the basis of product composition of world engineering exports by economic categories.

A. Broad economic categories

Capital goods and consumer goods; for example:

- Research and development intensive equipment
- Investment goods
- Heavy transport equipment
- Passenger cars
- Consumer durables

B. SITC section 7 machinery and transport equipment

Division 71:- Non-electrical machinery
Division 72:- Electrical machinery
Division 73:- Transport equipment

Division 71

711:- Power generating machinery other than electrical
712:- Agricultural machinery and implements
714:- Office machines
715:- Metalworking machinery
717:- Textile and leather machinery
718:- Machines for special industries
719:- Other machinery and appliances

Division 72

722:- Electric power machinery and switch-gear
723:- Equipment for distributing electricity
724:- Telecommunications apparatus
725:- Domestic electrical equipment
726:- Electrical apparatus for medical and radiological purposes
729:- Other electrical machinery and apparatus

Division 73:

731:- Railway vehicles

732:- Road motor vehicles

733:- Road vehicles other than motor vehicles

734:- Aircraft

735:- Ships and boats

Research and development intensive equipment	SITC Rev.1 Code
1. Electronic office and business machines	714
2. Telecommunication equipment	724
3. Electronic equipment	729.3,7,95
4. Electro-medical apparatus	726
5. Electrical measuring equipment	729.5
6. Electrical machinery and equipment	729.91-729.9
7. Aircrafts and aero-engines	711.4 & 734

Investment goods	
1. Steam boilers and engines	711.1-711.3
2. Internal combustion engines	711.5
3. Miscellaneous engines	711.6-711.8
4. Electrical power machinery	722.1
5. Switch-gear and related equipment	722.2
6. Equipment for distributing electric power	723.
7. Agricultural tractors	712.5
8. Other agricultural machinery	712.1-712.3
9. Metalworking machine-tools	715.1
10. Other powered tools	719.5 & 729.6
11. Other metal working machinery	715.2
12. Textile machinery	717.1
13. Paper and pulp-mill machinery	718.1
14. Printing and book-binding machinery	718.2
15. Food processing machinery	718.3
16. Machinery for construction, mining and mineral processing	718.4 & 718
17. Heating and cooling equipment	719.1 & 729
18. Pumps and centrifuges	719.2
19. Mechanical handling equipment	719.3
20. Packing and weighing machinery	719.62-719

21.	Spraying, vending and other machinery	719.61-719
22.	Ball and roller bearings	719.7
23.	Other investment godds	717, 718

Heavy transport equipment

1.	Buses, lorries, trailers	732.2-732
2.	Railway vehicles	731
3.	Ships and boats	735

Passenger cars

	Cars	732.1-732.8
	Spareparts	

Consumer durables

1.	Typewriters	714.1
2.	Sewing machines	717.3
3.	Television receivers	724.1
4.	Radio receivers	724.2
5.	Other household equipment and appliances	719.4,725
6.	Batteries and accumulators	729.1
7.	Electric lamps	729.2
8.	Motorcycles and spareparts	732.9
9.	Bicycles and spareparts	733.1

Source: Standard International Trade Classification, Revised Statistical Papers, series M No. 34 United Nations New York 1961 (ST/STAT/Ser.M/34)

Structure of world trade in engineering products 1970 to 1975

(a) Value in billion US Dollars F.O.B

Engineering Products	1970	1971	1972	1973	1974	1975
Non-electrical machinery	37.609	42.958	50.926	66.225	84.627	101.811
Electrical machinery	16.911	18.909	23.101	31.085	41.296	46.398
Transport equipment	31.988	38.578	46.796	61.268	73.710	88.778
Other unspecified equipment	1.631	0.944	0.950	1.207	1.512	1.868
Total engineering products	88.139	101.389	121.773	159.785	201.145	238.855

(b) Percentages of the share of products in world trade

Engineering Products	1970	1971	1972	1973	1974	1975
Non-electrical machinery	42.7	42.4	41.8	41.4	42.1	42.6
Electrical machinery	19.2	18.7	19.0	19.5	20.5	19.4
Transportation equipment	36.3	38.0	38.4	38.3	36.6	37.2
Other unspecified equipment	1.8	0.9	0.8	0.8	0.8	0.8
Total engineering products	100.0	100.0	100.0	100.0	100.0	100.0

Source: Role and Place of Engineering Industries in National and World Economies: ECE/ENGIN/12/Vol-11; 28 December 1977; United Nations

Major exporting countries for engineering products and their share as individual countries in world export trade for engineering products (1970-1975), covering market economies and planned economies countries.

Percentage share of individual countries in world trade			
0.1 - 0.5	0.6 - 1.0	1.1 - 10.0	10.1 - 20.0
Argentina	Austria	All other exporters	West Germany
Australia	Bulgaria	Czechoslovakia	Japan
Brazil	Denmark	France	United States
Finland	Hungary	Germany D.R.	
Hong Kong	Norway	Italy	
India	Romania	Netherlands	
Ireland	Spain	Poland	
Israel		Sweden	
Korea; Rep.		Switzerland	
Mexico		U.S.S.R	
Portugal		United Kingdom	
Singapore			
Yugoslavia			

Source: Role and Place of Engineering Industries in National and, World Economies ECE/ENGIN/12/Vol-11; 28 December 1977 United Nations.

Major importers of engineering products in Africa giving volume of imports in millions US dollars f.o.b. for 1975 to 1977.

Less than 100 million $ F.O.B.	100-500 million $ F.O.B	500-1,000 million $ F.O.B	More than 1,000 million F.O.B
Burundi	Angola	Ceuc countries	Algeria
Rwanda	Ghana	East Africa	Egypt
Ethiopia	Sudan	Morocco	Liberia
Guinea	Zaire	Tunisia	Libya
Madagascar	Zambia		Nigeria
Malawi			
Mozambique			
Togo			

Source: Bulletin of Statistics on World Trade in Engineering Products (1977). Economic Commission for Europe United Nations New York 1979.

Total exports of engineering products to Africa showing value of imports in millions of $ US and showing the share of Africa as an export market for world trade in engineering products. (1970 to 1977) excludes South Africa

	Value in millions of $ US (F.O.B)				
	1970	1974	1975	1976	1977
Algeria	480.2	1,341.7	2,476.9	2,647.5	3,306.7
Angola	125.0	211.3	123.6	113.0	311.0
Burundi; Rwanda	7.9	19.3	30.6	33.6	36.0
Ceuca countries	187.8	382.0	570.8	689.7	686.5
East Africa	232.4	393.2	461.4	471.2	811.8
Egypt	495.9	701.3	1,233.7	1,720.5	2,023.2
Ethiopia	52.2	95.8	83.9	117.5	172.8
Ghana	100.5	204.9	198.6	267.1	342.4
Guinea	22.7	30.0	46.0	46.8	58.7
Liberia	914.9	3,159.0	3,946.2	4,147.4	4,029.9
Libya	183.8	1,259.5	1,738.9	1,885.0	2,126.2
Madagascar	45.9	59.2	74.7	62.0	81.8
Malawi	-	25.0	41.4	37.5	40.8
Morocco	221.8	428.5	733.2	1,030.9	1,247.4
Mozambique	105.1	176.0	89.3	80.7	132.0
Nigeria	338.9	873.5	2,179.0	3,061.8	4,334.9
Zimbabwe/Rhodesia	150.2	2.7	2.9	1.9	1.4
Sudan	85.2	190.2	349.2	449.5	455.5
Togo	15.8	28.4	62.5	91.6	85.2
Tunisia	80.1	293.2	459.2	512.5	638.8
Zaire	185.9	411.7	467.2	282.3	312.3
Zambia	-	266.9	337.8	256.3	228.6
All other African countries	373.9	856.4	999.1	1,134.5	1,549.6
Africa Total ($ US millions)	4,406.7	11,410.0	16,700.0	19,141.0	23,014.0
World Total ($ US millions)	89,454.0	203,082.0	240,537.0	271,904.0	211,463.0
Per cent share of Africa in world exports as an importing region (i.e export market of exporting nations)	4.9	5.6	6.9	2.0	7.4

Source: Bulletin of Statistics on World Trade in Engineering Products - 1977, Economic Commission for Europe, United Nations, New York 1979.

Composition of exports of engineering product to Africa in 1977 giving value in $ US F.O.B and percentage share of individual products in exports to Africa excluding South Africa.

		Value in million $ US F.O.B.	Per cent share of product
711	Power generating machinery	860.6	3.7
712	Agricultural machinery	536.3	2.3
714	Office machinery	150.6	0.7
715	Metal-working machinery	225.3	1.0
717	Textile-leather machinery	496.2	2.2
718	Industrial machinery	1,657.3	7.2
719	Other mechanical equipment	3,379.9	14.7
722	Electrical power machinery	1,140.1	5.0
723	Electric power distribution equipment	377.3	1.6
724	Telecommunication equipment	1,389.2	6.0
725	Household electrical appliances	176.1	0.8
726	Electro-medical apparatus	38.0	0.2
729	Other electrical machinery	694.0	3.0
731	Railway vehicles	415.4	1.8
732	Road motor vehicles	4,914.1	21.4
733	Other road vehicles	276.8	1.2
734	Aircraft	668.4	2.9
735	Ships and boats	4,926.7	21.4
	Other machinery and equipment	691.7	2.9
	Total exports to Africa	23,014.0	100.0
	Total world exports	311,463.0	
	Per cent share of exports to Africa	7.4	

Source: Bulletin of Statistics on World Trade in Engineering Products-1977, Economic Commission for Europe, United Nations, New York 1979.

Linkage between engineering and basic metals illustrated by the share (in percentages) in the indirect trade the world between engineering, iron and steel industries for 1962, 1965, 1970.

Engineering product category	Per cent share in world steel indirect trade		
	1962	1965	1970
Intermediate goods	8.4	8.4	6.8
Non-electrical machinery and equipment	24.7	24.3	24.5
Electrical machinery and equipment	5.0	4.9	5.1
Tractors and agricultural machinery	5.8	5.8	4.2
Railway rolling stock	4.5	2.9	2.2
Private passenger cars	18.7	18.4	19.7
Commercial vehicles	8.1	6.3	8.1
Spareparts for vehicles	4.2	5.8	8.2
Household appliances	2.6	2.8	2.7
Other products	18.0	20.3	18.5
Total	100.0	100.0	100.0

Source: Long-term prospects for steel consumption until 1985 and outlook for 1990 and past trends in production and trade. ECE/STEEL/9, 1 October 1976, Economic Commission for Europe, Steel Committee.

RESOLUTIONS OF THE GENERAL ASSEMBLY INCLUDING THE ECA

2626 (XXV)	International Development Strategy for the Second United Nations Development Decade.
3201 (S-VI)	Declaration on the Establishment of A New International Economic Order
3201 (S-VI)	Programme of Action on The Establishment of A New International Economic Order
218 (X)	Africa's Strategy for Development in the 1970s
256 (XII)	Implementation of the Programme of Action on the Establishment of a New International Economic Order.
267 (XII)	Investment Promotion and Industrialization
319 (XIII)	Accelerated Industrialization in Africa