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CHEMICAL INDUSTRY DEVELOPMENT PROGRAMME

REPORT OF THE CHEMICAL TASK FORCE

(5-23 November 1979)

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## Preface

The visit of the chemical field mission to six countries namely Tanzania, Gabon, Cameroon, Nigeria, Upper Volta and Egypt, to study the chemical industry sector, by a group of consultants and a staff member of ECA, took place from 20 May to 8 August 1978. Subsequently during August-October the mission prepared country reports and a regional report on their findings and recommendations.

The mission assessed the existing situations, identified opportunities for integrated development and formulated sectoral policies, programmes and targets for the development of chemical sector including fertilizers, basic chemicals, pesticides, petrochemicals and pharmaceuticals. The assessment was based on taking into account the peculiar characteristics, major problems, critical linkages, training needs, institutional requirements and modalities for co-operation between member States.

Although the field mission and its report covered only six countries, the countries represented least developed and most developed developing countries. It covered countries with practically no chemical industry to a country with diversified and dynamic chemical industry sector. Above all, the six countries covered had a population of about 138 million (1975) out of a total African population of 401 million (1975). This means on population basis the mission covered 35% of the African region. Again out of 49 independent countries of Africa, the mission covered six, which is 12% coverage. It covered countries with large natural resources like gas and oil, salt phosphates and countries with no such resources.

Thus although circumscribed by time and funds and difficulty in obtaining timely services of experienced experts, the regional report reflects the existing situation, constraints and future possibilities in the chemical sector.

The objective of the present Task Force and its report are to examine critically the regional report and express its views to the Expert Meeting on Chemicals. The Task Force was also requested to comment on the chemical sector work programme of ECA in the Industry Division for the period 1980-1986. The Task Force believes that the regional report represents a cross-section of the African situation and the conclusions to recommendations therefore could apply broadly to the entire African scenario.

The detailed findings of the regional report and the recommendations of the Task Force as contained in the respective documents are being presented in this meeting for consideration and discussion of the delegates.

## CHAPTER I

### CONCLUSIONS

#### A. General

##### (a) Present status, Policies, Strategies and Priorities

1. Present status: Chemical industries in most of the African countries manufacture consumer products from imported intermediates. Some countries have started to establish the second generation industries which manufacture intermediates and few countries have set up the third generation industries for manufacture of the basic chemical inputs. Thus starting from a purely import substitution base, the countries are going in for products which are inputs to other industries and which are for export to countries in Africa and outside. The first category of countries includes as examples: Gabon, Upper Volta, Ethiopia, etc; the second Kenya, Tanzania, Senegal, Ghana, Sudan etc. and the third Egypt, Algeria, Libya, Tunisia, Morocco, Nigeria, Zambia, etc.

2. Policies: When laying down the policy for development, the following special characteristics of the chemical industry must be taken into account:

- (i) Alternative processes and raw materials combinations for the production of the same product;
- (ii) High, complex and sophisticated technology involving multi-stage processing;
- (iii) Changing technology resulting in obsolescence in process, equipment and product in some cases;
- (iv) Capital intensity (highly subject to economies of scale);
- (v) High energy requirement for certain products;
- (vi) High proportion of highly qualified personnel requirement;
- (vii) Industry with effects on eco systems requiring incorporation of effluent treatment and safety measures;
- (viii) Heterogeneity of products;
- (ix) Products competing with traditional products;
- (x) Viability dependent on integrated approach and economic outlets for co- and by-products; and
- (xi) High linkage with industry and other sectors of the economy.

3. Availability of natural resources such as natural gas and oil, phosphates, potash, salt, botanical and animal resources is also a factor which must be taken into account while planning. It must also be determined in advance whether the projects are mainly for home consumption, export to the subregion or outside Africa. In most African countries the home markets are too small to sustain a viable production. Product costs have to be competitive with those of Transnational Companies.

4. Infrastructures in terms of road, water and railway transport etc., have to be developed by countries concerned and the chemical projects should not be saddled with the responsibility for creating the infrastructure outside battery limits. Supply of raw materials and distribution of products must be ensured.

5. Chemical industry development may be encouraged by governmental policies such as:

- Financial participation,
- Tax holiday,
- Tariff protection during initial phase,
- Export incentive,
- Adequate pricing to generate surpluses,
- Measures for investment safeguards, and
- Promotion of overall efficiency to compete in home, regional and world markets.

6. Training of skilled manpower is a policy of utmost importance. In-plant training in existing industries, participation of suitably qualified persons in seminars, symposia and workshops organized by the UN system, utilization of UN and bilateral fellowships should all be followed with vigour. A manpower development programme must be drawn up on a ten year basis by each country. Although national development plans exist in many of the African countries, clear-cut policies for development of the chemical sector is often lacking.

7. In some countries, elimination of poverty is the objective of industrial development whereas in some others, it is one, or a combination of the following:

- export,
- import-substitution,
- employment,
- development of industries based on local resources,
- diversification of industry,
- geographical distribution of industry,
- development of social and economic equality of the masses,
- providing minimum needs: food, clothing, housing for people, and
- increasing living standards.

8. Strategies: Clear-cut strategies for the chemical sector development are lacking in most of the African countries. In a few countries like Egypt, Algeria, Tunisia, Morocco, Nigeria, Kenya, etc., the strategies are spelt out in the national development plans. The strategies inter alia are the following:

- Meet the demand of the home market,
- Meet subregional and export demands,
- Develop the multiplier effect by making those chemical products which are inputs to other industries,
- Increase value added manufacture,
- Increase employment,

- Use of simple or complex technology,
- Small-scale versus large-scale projects,
- Compete in world markets, and
- Develop technical manpower infrastructures and institutions.

9. Priorities: Most of the African countries have established priorities mainly based on raw materials availability and needs of the people such as:

- priority to agricultural input industries such as fertilizers and pesticides so as to become self-sufficient in food,
- priority to industries such as pharmaceuticals to safeguard health of the people,
- priority to start with importing intermediates and back integrating when the basic chemicals are produced,
- industries based on local raw materials like natural gas and oil,
- export, and
- meet the requirements of the country, subregions or the regions

(b) General constraints

10. The main general constraints in the development of the chemical sectors are as follows:

- (i) The diversified nature of the industry making it virtually impossible for any country to be self-sufficient,
- (ii) The small and fragmented national markets,
- (iii) Economies of scale and the consequence of high investment particularly nowadays when plant investment have increased five to ten-fold,
- (iv) Lack of adequate trained manpower at all levels from inception to operation of chemical projects, and
- (v) Inadequate infrastructure and energy.

11. Before identifying the institutional framework required it is necessary to know the developing problems in Africa. According to the report of the chemical industry mission, they are as follows:

(c) Institutional constraints

- Small markets, land-locked situations, transport costs, raw materials and others are the constraints;
- Economies of scale employed by developed or large developing countries should not be used as such as a yardstick for small African countries;
- Subregional integration and pooling of natural resources, transport and manpower will provide larger markets.

12. Lack of experience in project planning and contract negotiations: Choice of appropriate technology and its transfer. It is recommended that experts from other countries in Africa, Asia and Latin America be freely used. In addition expertise

provided by UN organizations like UNIDO and ECA must be welcomed. Symposia, seminars and workshops should be organized on these subjects subregionally and regionally and fullest participation in those organized by international institutions must be ensured.

13. Contracts with unscrupulous foreign companies: When a country decides on a project after proper feasibility and investment studies, a project manager should be invariably appointed with a Board of Directors to direct him. The capacity and broad process routes should be determined and a short list made of reputable companies who are capable and experienced in the world. The Companies should be requested to provide budget figures based on capacity, raw materials, infrastructure and process routes. Finally, tender specifications should be prepared and issued to 4 or 5 companies asking them to quote fixed lumpsum contract prices. The tenders should be analysed and orders placed on the lowest tenders provided he satisfies and guarantees production and other parameters in stipulated time. This procedure if followed will eliminate chances of unscrupulous foreign companies exploiting the situation in Africa.

14. Dealings with unscrupulous banks and foreign financing institutions: This should be avoided to prevent unfavourable terms and conditions being imposed. It is better to deal with banks and financial institutions of other governments and World Bank group.

15. Lack of co-operation between national fertilizers/chemical plant arrangements and government purchasing agencies: Although full utilization of national products should be ensured, quality and price should be comparable in international standards. For sometimes, protection or subsidies may help bring up an infant industry but eventually efficiency should not be sacrificed under the umbrella of protection.

16. Lack of experience in maintenance and operation: First of all, the organizations co-operating in setting up the project should train national experts both in foreign operating plants and during construction and erection of the project. After two years of operation, the project should be run by nationals if necessary with the help of foreign advisers. The project should set up training facilities for existing staff and for new recruits, set up a day-to-day as well as preventive maintenance system and a technology or R & D department for process and other problems.

17. High cost of expatriate personnel: The important point is to get suitable and experienced expatriates even at high cost and use them to train local experts to reduce the extent of their contracts. For this, appropriate job descriptions must be made, interviews conducted and most appropriate technical persons employed.

18. Infrastructure outside battery limits of a project should be the responsibility of the government. Railroad and water transport, electric power and water are some of essential infrastructure to be assured. Raw material supply and product distribution should also be assured either by project authorities or government or both.

19. Financial control: It is better for the government to have the controlling financial interest in any project even if technical day-to-day management is contracted or left to an autonomous corporation.

20. Import and other duties: Governments should allow duty drawback and other concessions to infant industries or when a product which is normally imported is to be made or there are export possibilities as in the case of pharmaceuticals and pesticides.
21. Manpower: Shortage of technical managerial and other high level and intermediate level manpower is the largest constraint in almost all African countries. Institutions for training should be built up nationally and for subregions not only in the well organized disciplines but also in contracting, marketing, maintenance, etc. In-plant training in existing units, fellowship training using UN fellowship funds and bilateral aids in similar enterprises in developing and developed countries with a stipulation and accompanying reasonable penalties for candidate to return to serve the country for a minimum period should be encouraged.
22. Policies of government, planning and development: Most countries have a 3 year or 5 year plan into which all chemical projects are integrated. Such planning is carried out by institutions and organizations such as designs, engineering and construction organizations, project executing and operating organizations and project monitoring organizations. It is advisable to have perspective plans on a ten year basis.
23. In many African countries, the planning and development systems and strategy generally suffers from lack of well-organized institutions as mentioned above and lack of expertise in implementation. One way to develop the institutional facilities and expertise is by seconding qualified nationals with UN organizations and experts and also with expatriate contract personnel.
24. There is also lack of expertise in choosing appropriate technology and not sufficient experience and knowledge of technology transfer and contract negotiations.
25. Technology transfer in its overall concept has to consider exclusiveness/non-exclusiveness of technology use, process and engineering guarantees and penalties, process patents, confidentiality, royalties, proprietary questions of improvements, access to improvements etc. Full familiarity with those matters as well as contract negotiations and types of contract to be entered into are essential. Type of contract depends on the level of development of the particular industry in the country. UNIDO has identified for the fertilizer industry four types of contracts, turnkey-lumpsum for countries with no experience in the fertilizer industry, cost reimbursable for countries which can intelligently control costs, semi-turnkey for those countries which can provide civil works, fabrication, erection etc. and supply of know-how and engineering for those countries which can carry out detailed design and engineering, fabrication, procurement, erection civil works, etc. African countries should also study and make use of the model forms of contract for construction of fertilizer plants drawn up by UNIDO. It is recommended that ECA/UNIDO organize a seminar on technology transfer and model contracts for countries contemplating construction of fertilizer plants. This may be held in ECA headquarters in 1990 and 15 countries or more could participate.



### Fertilizers, Basic Chemicals, Pesticides

26. To cite an example, more detailed and definitive information is required on the factors impeding the efficient use of fertilizers whether imported or locally produced. Without such information which should be systematically collected from all African countries and then processed and disseminated, it would be difficult to organize planning, production and distribution of fertilizers on a sub-regional network. Providing information, advisory and development services could meet the needs and aims of governments in the sub-regions serving as a basis for assured distribution and planning of production of fertilizers with maximum utilization of existing capacities and with establishment of new production units.

### Petrochemicals

27. Special attention should be given to promote, in advance, stable demand for intermediate petrochemical products by encouraging intra-regional trade and distribution of LDPE, HDPE, PVC, resins etc. among small-scale and medium-scale producers of final petrochemical goods, without relying on excessive expertise or sophisticated equipment and technology in moulding, extrusion and stamping processes. When demand has been developed and the intra-regional market has been established, further increase of petrochemical plants capacities could be planned.

28. Apart from the suggestions made in paragraphs 11-26 above, the following additional mechanisms may be used for follow-up to implement petrochemical projects:

- (i) periodic, regional and subregional meetings of planning, financial and technology experts from member countries along with ECA, OAU and UNIDO experts as advisers and consultants to study specific aspects of the petrochemical industry, to harmonize investment, fiscal, custom and other policies, to carry out necessary preparations and mobilize financing of projects.
- (ii) National Committees (to be established) for the development of the industry composed of planning, finance industry and technology experts to carry out preparatory work for the regional and subregional periodic meetings and to take the necessary follow-up actions at the national level as a result of decisions taken at the regional or subregional meetings.
- (iii) Centres for development of the petrochemical industry (to be established) at the subregional levels. (West, Central and East Africa): These centres should be staffed by a group of highly qualified local and international experts and equipped with tools for research, pilot plants and training facilities. The centres should collect, analyse and disseminate information; elaborate short-term and long-term programmes at regional and subregional levels; prepare trends of consumptions; prepare market studies, feasibility and pre-investment studies; research related to recent developments, standardizations of processes and equipment and manpower training and development.

Pharmaceuticals

29. Transfer of technology: This is an aspect of very great importance to the development of this sector. Accordingly,

- (i) ECA/UNIDO technical assistance must be obtained in the form of experts or advisers for:
  - planning, preparing and/or evaluating feasibility studies, rationalization of existing units and planning new units, and
  - preparing typical projects for formulation and packaging, intravenous fluids, extractive medicinal drugs, preparation of drugs from animal by-products;
- (ii) Licensing facilities should be obtained from outside experienced pharmaceutical companies for local production, training of nationals in production, quality control, technology etc., and
- (iii) Joint ventures with foreign pharmaceutical companies should be promoted.

30. Manpower problems: This should be overcome through the following:

- (i) Expand and utilize fully, existing possibilities of training in-plant, outside the country, etc.;
- (ii) Include a firm provision in all contracts for training of personnel on production technology, maintenance and quality control;
- (iii) Fully utilize possibilities offered by UNIDO in training pharmaceutical specialists e.g. at the University of Ghent, Belgium;
- (iv) Arrange that all faculties of pharmacy in African countries emphasize on industrial aspects;
- (v) ECA/UNIDO should organize training centres for individual subregions e.g. UNIDO and CEAO for East African subregions; and
- (vi) UNIDO/ECA should acquire and post qualified lecturers for training centres, faculties of pharmacy and research institutes

31. It is recommended that at least two multinational African pharmaceutical companies should be set up one in West and the other in East Africa, with financial and management participation from countries of the subregion.

32. Government policies must be oriented to pharmaceutical industry development leading to better health programme and should consider price subsidy, credit and tax and duty rebate as incentives. All governments should encourage inputs to the indigenous system of medicines.

(d) Natural Resources and Infrastructure

Natural Resources

34. The African region is endowed with raw materials and energy resources required as input for the development of the chemical industries. There are, except for sulphur, all major raw materials needed for the development of the sector. Oil and natural gas are exploited in North and West Africa, and good prospects have been identified in East and Central Africa; Coal and lignite deposits are in West and Southern Africa; Phosphate rock in North and West Africa; Potash in East and Central Africa; and Salt in North and East Africa. There are also deposits of limestone, baryte, trona, chromite, etc. in individual countries of the region.

(i) Oil and oil products are the inputs for the production of:-

- Ammonia and nitrogenous fertilizers,
- Ethylene, propylene, butadiene, aromatics, etc. for the manufacture of VC and PVC, polyethylene, polypropylene, synthetic rubbers, synthetic fibres (polyamide, polyester and polyacrylonitrile), etc., and
- Organic basic chemicals: methanol, acetic acid, phthalic anhydride, etc.

Deposits under exploitation as well as those expected to be worked out soon include those in Algeria, Libya, Egypt, Nigeria, Congo, Gabon, Angola, Tunisia, Cameroon, Zaire, Ghana, Benin, Ivory Coast. Hopeful prospects include those in Togo, Senegal, Chad, Gambia, Guinea, Guinea-Bissau, Liberia, Sierra Leone, Tanzania.

(ii) Natural gas is the requisite input for the manufacture of:

- Ammonia and nitrogenous fertilizers,
- Basic chemicals: methanol, acetic acid etc., and
- Acetylene, VC and PVC.

Available in Algeria, Libya, Egypt, Tunisia, Morocco, Nigeria, Gabon, Congo, Rwanda, Zaire, Angola.

(iii) Coal, lignite for the manufacture of:

- Ammonia and nitrogenous fertilizers,
- Methanol and other basic chemicals, and
- Calcium carbide and acetylene, and thereby VC and PVC.

Deposits are available in Nigeria, Mali, Benin, Libya, Algeria, South Africa. Hopeful prospects in Zaire, Ethiopia, Madagascar, Malawi, Uganda, Zambia, Tanzania, Zimbabwe Rhodesia.

(iv) Phosphate rock for the production of phosphate fertilizers and basic inorganic chemicals, based on deposits in: Morocco, Western Sahara, Mali, Mauritania, Tunisia, Egypt, Senegal, Upper Volta, Algeria, Angola, Malawi, Mozambique, Madagascar, Uganda, Zimbabwe-Rhodesia, South Africa, Mauritius, Seychelles, Burundi.

- (v) Potash for potassium fertilizers and chemicals based on potassium deposits in Morocco, Tunisia, Libya, Central African Republic, Ethiopia, Congo.
- (vi) Salt for the production of chlorine and caustic soda, both essential inorganic chemicals for the chemical and affiliated industries - deposits are available in Mali, Mauritania, Niger, Senegal, Togo, Ethiopia, Tanzania, Morocco.
- (vii) Trona (natural sodium carbonate or soda ash), one of the basic inorganic chemicals based on deposits available in Kenya, Tanzania and Ethiopia.
- (viii) Limestone indispensable material for the manufacture of lime and carbon dioxide and consequently for soda ash, calcium carbide based on deposits in all subregions.
- (ix) Byrite for the production of barium salts (chloride, carbonate, nitrate etc.), for industrial use - deposits in Togo, Mali, Liberia, Morocco.
- (x) Chrome ores for the manufacture of chromium salts (bichromete, oxides) for industrial use in tanneries, paints and plastic processing etc. - deposits in Zaire, Zimbabwe-Rhodesia, Benin, Ghana, Senegal.
- (xi) Biomass based on sugar cane, manioc, bananas, sweet potatoes, etc., available in most African countries, particularly in West, South and East subregions, for conversion into ethyl alcohol and its utilization as:-
  - gasoline mixture or substitute in motor fuels, and
  - input material for the production of ethylene and derivatives.
- (xii) Other vegetable resources include:
  - a) Natural rubber,
  - b) Pyrethrum for the manufacture of pesticides in Rwanda, Tanzania and Kenya,
  - c) Quinchina, rauwolfia, vinca, digitalis for the manufacture of some pharmaceuticals, and
  - d) Essential oils as inputs in the cosmetic industry.
- (xiii) Other mineral resources: Deposits of copper, bauxite, titanium, manganese, rare metals and rare earth elements, mainly used in the metallurgical industry, also provide inputs for the production of various salts, oxides, other chemical compounds, etc. indispensable for industrial and other uses. Deposits in Zaire, Nigeria, Niger, Burundi, Rwanda, Zimbabwe-Rhodesia, South Africa, etc.
- (xiv) Non-fuel sources of energy: Hydro and geothermal power.

- (xv) Some of the natural resources have been under large scale exploitation for years (e.g. crude oil in North and West Africa, phosphates in North Africa, etc.). Large parts of the outputs are in crude form. Consequently, they hold considerable potential for forward integration and further industrial development.
- (xvi) A good number of the deposits are, however, not yet exploited. Inadequate geological information, lack of infrastructure and huge investment requirement are among the major reasons for this state of affairs. In view of the last constraint through raw material surveys and investigations and the opening of new mining facilities should be the subject for multinational co-operation.
- Infrastructure:

34. Africa, the least developed continent, suffers from inadequate infrastructures. As a result, goods and services cannot be moved from one country to another, or even within the same country, quickly and efficiently, and this severely handicaps intra-African co-operation.

35. The availability of roads, railways, ports, maritime and internal waterways transport, storage facilities and telecommunications is one of the essential prerequisites for the development of mining of chemical minerals, production and distribution of fertilizers, petrochemicals, basic chemicals, etc. Infrastructural network for sub-sectors like pesticides, pharmaceuticals, detergents, plastic processing products, paints and varnishes are not so important as for bulk products such as fertilizers, rubber products, etc. However efficient distribution of these products needs a speedy and regular transportation and communication.

36. In view of the above, intra-African co-operation should not be limited to industrial development only. It should include the development of fundamental infrastructures.

#### B. Specific to subsectors

##### (a) Fertilizers, Basic Chemicals and Pesticides

37. Fertilizers: Africa produces only 1.96 per cent of fertilizers ( $N + P_2O_5 + K_2O$ ) out of the total world production of 92.2 million tons in 1975/1976 and consumes 3.25 per cent. To achieve self-sufficiency in food and to improve the standard of living, fertilizer consumption has to be increased per capita from the present 5.0 kg. of nutrients to at least 20 kg. per capita to get the minimum efficiency of fertilizer application and cost benefit ratio. This means production and consumption has to increase from 2.40 million tonnes to at least 8 million tonnes in 1985. If the developing countries pattern of use of nitrogen and phosphates is taken into account, out of this 8 million tonnes, 5 million tonnes of nitrogen and 3 million tonnes of phosphates have to be produced and used assuming African soils are not deficient in potash. Thus the present production of 1.77 million tonnes have to be increased three times. Five million tonnes of nitrogen in built-up ammonia plants based on gas or naphtha will cost \$US 5,000 million including battery limit infrastructure.

38. From the raw materials point of view, it is possible to achieve this because many countries are rich in oil and natural gas and explorations are going on in several others and the prospects of new discoveries seem good.

39. In addition to the countries (e.g. Egypt, Algeria, Libya and Zambia) which are producing ammonia (the primary sources of nitrogen) at the present time from gas, oil, naphtha, coal, etc., there are excellent opportunities for putting up ammonia plants in Nigeria, Gabon, Tanzania, Sudan and Kenya utilizing gas, fuel oil or naphtha not only to meet internal demands of the country but also to meet subregional needs and for exports.

40. In the case of phosphates, production, consumption and exports are largely from Egypt, Tunisia, Algeria, Morocco, Western Sahara, Senegal, Togo, Nigeria, Uganda and Tanzania. Further expansion of phosphates are needed in the Western and Eastern sub-regions, especially in Togo, Nigeria, Uganda and Tanzania.

41. As regards potash, the existing unit in the Congo should be re-opened and raised to full capacity utilization. The Ethiopia project should be revived and followed up.

42. One conclusion which must be highlighted from the regional report of the field missions is the lessons to be learned from the discontinuation of the fertilizer project in Gabon presumably the economy of scale was not sufficient. But had market studies and proper feasibility studies been undertaken before launching the project and if International Organizations like UNIDO and Regional Organizations like ECA's expertise were to be associated with such projects, the waste of effort, time and money could have been avoided. Gabon is not an isolated case in Africa. It has happened in Sur'an, Kenya, Cameroon and other countries.

43. Another conclusion which should serve as a lesson in Africa is the under-utilization of capacities in fertilizer projects in Nigeria, Cameroon and Tanzania. The reasons are infrastructural problems, lack of raw materials, lack of demand, lack of trained manpower and lack of co-ordination between the projects and government authorities. Although under-utilization of capacities is a perennial problem of developing countries, the degree of under-utilization in Africa seems too high. To make a comparison, in India with 4 million tonnes of nitrogen capacity installed, the utilization of capacity on the whole is 70 per cent although more than 10 projects are achieving 90-110 per cent capacity utilization. It will be interesting to study the situation in Egypt, Tunisia, Libya, Algeria and Morocco.

44. Basic chemicals: In regard to basic chemicals like sulphuric acid, caustic soda, chlorine and soda ash, the region is still at its first steps in the direction of their development. Without basic chemicals, pulp and paper, food industries, forest industries, detergents, pesticides, etc. cannot develop. The large-scale soda ash production in Kenya from natural trona and the plans for expansion from 1 million tonnes to 2 million tonnes per year are praiseworthy. Tanzania should make urgent feasibility studies for the utilization of its own natural brines.

45. Of immediate interest to countries like Gabon, Cameroon and Tanzania which are going in for pulp and paper industries is the production of caustic soda and chlorine. In many countries non-availability of electric power at cheap rates will be a bottleneck (1 tonne of caustic soda needs 4000 kwh of electric power).

46. Pesticides: Pesticides are essential for human, animal and crop protection in Africa. Malaria eradication to protect the population, use of DDT or other more expensive and harmless pesticides, control and eradication of tsetse and other pests

affecting animals, use of powders and dips containing recommended ingredients are already in vogue. For crop protection and production, insecticides, fungicides and rodenticides are needed. Locusts and other insects, rats and other rodents are reported by FAO to destroy crops in the field and in storage up to 30 per cent. Most of the pesticides in most of the African countries are now imported in a formulated form. These formulations contain 3-5 per cent active ingredients and the balance are inerts in the form of solids or liquids. Hence the high cost of finished products imported into African countries reflect cost of inerts and transport. It is concluded that pesticides formulation plants to be set up in each and every African country. These are low cost plants and the technology is not complicated and technical manpower requirements are low. Each country should decide on the major insecticides, fungicides and rodenticides it needs every year to protect human, animals and crops and import active ingredients annually on worldwide tender basis. An advanced developing country like Egypt imports annually about \$60 million worth of finished pesticides. With Egypt's raw material, technology fabrication and manpower base it could formulate most of its requirements and proceed to make the active ingredients in the country itself.

(b) Petrochemicals

47. According to the UNIDO/ICIS worldwide study of the petrochemical industry, the world demand in 1985 for petrochemical building blocks or raw materials such as ethylene, propylene, butadiene and benzene will be 152 million tonnes of which Africa's share will be 4 million tonnes or 2.6 per cent. For the end products - plastics, synthetic fibres, synthetic rubbers and detergents - world demand in 1985 will be about 169 million tonnes of which Africa's share may be 5 million tonnes or about 3 per cent. Plastics will predominate the scene as it will replace many uses for which presently wood and metals are being used. Availability of raw materials exist in a number of countries with ethane/propane and naphtha as feed stocks; for ethylene the capacity which equates with market demand being 200 to 250,000 tonnes per year. Petrochemical complexes are very sensitive to scale and investment and developed and oil rich countries are going in, for capacities of 300,000 to 600,000 tonnes per year ethylene crackers costing \$1,000 million. However in countries with molasses or bio-mass and other renewable resources possibilities for 5000-15,000 tonnes per year of ethylene using ethanol exist.

48. Capacities for olefins and aromatics exist in Algeria, Egypt, Libya, Nigeria (planned) and South Africa are as follows:

	Ethylene			B T %			In tons per year		
	Exist- ing	Under const- ruction	Planned	Exist- ing	Under const- ruction	Planned	Exist- ing	Under const- ruction	Planned
Algeria	120,000	600,000	500,000	-	33,000	-	-	-	500,000
Libya	-	330,000	-	-	-	-	330,000	-	-
Nigeria	-	-	-	-	-	-	-	-	250,000
Egypt	-	-	-	-	-	-	-	-	299,000
S.Africa	-	-	182,000	-	-	-	-	-	-

49. Thus, in Africa, the petrochemical raw materials or building blocks existing and under construction are as follows:

	<u>BTX</u>	<u>Planned</u>
	(in tonnes per year)	
Ethylene	1,050,000	682,000
BTX	23,000	-
Methanol	330,000	950,000

The conclusion is that the existing and under construction capacity is far short of the projected demand in 1935 namely 1 million tonnes.

50. The estimated end-products demand pattern for plastics for the subregions of Africa in 1974 and 1935 are as follows:

<u>Subregion</u>	<u>( ' 000 tonnes)</u>	
	<u>1974</u>	<u>1935</u>
North Africa	220	1,090
West Africa	102	575
East Africa	103	490
Central Africa	64	295
South Africa	230	305
T o t a l	724	3,255

Thus, the conclusion is that the projections for 1935 still falls short of demand projections of 3.3 million tonnes. Even this five-fold increase in demand in five years is ambitious. At the same time, it should be noted that the value of imports of plastics into the African region in 1975 was \$US 329 millions. If this modest figure continues for 10 years, Africa would pay 3290 million dollars for import of plastics whereas the additional capacity to meet the demand by 1985 of 2.5 million tonnes could have been established by spending this amount for capacity development.

51. Polyvinyl chloride in the form of bags, shoes, floor tiles, rigid pipes, sheets, etc. is most popular in Africa as well as in other regions. With large resources of forests in Africa, urea and phenol formaldehyde (U.F. & P.F.) resins should be manufactured for making particle boards, veneers, laminates etc. from wood. Many countries can start with vinyl chlorine monomer (VCM) at 50 per cent cost of the PVC and put up a suitable plant for polymerization. VCM is a world traded commodity and its F.O.B. price from European and American ports have stayed around \$500 per tonne, whereas PVC powder and granules cost \$1000 per tonne F.O.B. Regarding kettles for making U.F. and P.F. for a 5 to 10 tonne per day plant which is the size suitable for many African countries (the capital cost is low around \$2-3 millions). Urea, formaldehyde and phenol can be bought at competitive prices from world markets. When fertilizer plants to make urea fertilizer come into production, a part of the urea can be converted into resin grades. Similarly, once methanol is made in North Africa and West Africa, it can lead to production of formaldehyde. Thus a kettle for U.F. resin installed now gives for back integration later on to utilize African production of U.F. resin. Plants are now under construction in Algeria and Morocco and under planning in Nigeria and Egypt for V.C.M., PVC and U.F. and P.F. resins. Once PVC is available, every country can produce PVC rigid pipes by extrusion for drainage, drinking water and



irrigation purposes. Many other items like shoes, bags, floor tiles can be made by small-scale entrepreneurs. PVC and U.F. resins are materials which will give African entrepreneurs excellent chance to develop small-scale and medium-scale industries.

52. There is also scope for developing **industries**, based on ethylene or low density polyethylene (LDPE) and high density polyethylene (HDPE). The demand for LDPE and HDPE for packing and many other articles of everyday use is increasing and Africa will progress in its demands for such goods.

53. It is estimated that in the North African subregion, ethylene and BTX will be in surplus by 1985-1990 after meeting the subregion's demands the quantities for exports mainly to Europe will be about 500,000 tpy of ethylene and 300,000 tpy BTX. The demand for plastics in this region by 1985-1990 is estimated at 1.09 million tonnes compared to expected production of 0.337 million tonnes additional capacity to the tune of 0.7 million tonnes are needed. Synthetic fibres, synthetic rubbers and detergents will be in deficit. The estimates of deficit are 0.214 & 0.299 million tons respectively for synthetic fibres and synthetic rubbers.

54. In West and Central Africa, the deficits of ethylene, propylene, butadiene and benzene are relatively small and therefore the resources of Central and West Africa should be pooled and economically viable units set up to meet the expected demand and potential export markets. The deficit for plastics in both subregions will be about 750,000 tonnes per year. Capacities to take care of this demand should be planned urgently. Those countries which cannot have the primary plants should be provided with VCM to polymerize to PVC and PVC converted to end-products. There will be deficit by 1985-1990 in this combined subregion for synthetic fibres, synthetic rubbers and for detergents to the tune of 165,000 tpy, 131,000 tpy and 150,000 tpy respectively.

55. In the East African subregion, ethylene, propylene, butadiene and benzene will be in deficit by 235,000 tpy, 87,000 tpy, 70,000 tpy, 121,000 tpy and 121,000 tpy respectively in 1985-1990. The deficit for plastics by 1985 is estimated to be 430,000 tpy and two plants may be justified. Again synthetic fibres, synthetic rubbers and synthetic detergents will be in deficit to the extent of 75,000 tpy, 95,000 tpy and 90,000 tpy respectively.

#### (c) Pharmaceuticals

56. Based on the visits to the six countries, it is seen that Egypt is the only country where about 7 per cent output of pharmaceuticals is from locally produced bulk input and 93 per cent output from imported input. In Nigeria and Tanzania, 100 per cent output is from imported inputs. In Cameroon, Upper Volta and Gabon all pharmaceuticals are imported in the finished form. In Egypt, synthesis of salicylates and sulphamides has been established and production of anti-biotics by fermentation is under active consideration.

57. The above patterns reflect the entire African scene. The first group of countries import all their pharmaceutical requirements in finished form; the second group re-packs imported bulk pharmaceuticals; the third group carries out formulations using imported bulk ingredients and packing materials; the fourth group is emerging into production of drugs by simple chemical processes; and the fifth group is emerging into production by chemical synthesis and fermentation.

53. Standardization and quality control laboratories and trained manpower are essential in all the five groups of countries. Production of intravenous fluids, processing of medicinal plants and animal by-products are steps which should be taken by most of the African countries and production of anti-biotics and synthesis by a few countries.

59. It is a sad conclusion that in spite of efforts by international (UNIDO, WHO), national, subregional and regional organizations that none of the six countries visited have established a national list of selected essential drugs. This is the first step to be taken by all African countries. The second step by all countries is a forecast of drugs needed under each essential item for one or two years for bulk purchase. Whether the government (public sector) or private sector imports or distributes them is a secondary matter. The third step to be taken by all African countries is to either repack imported bulk drugs or to formulate them appropriately. In all cases, quality control and standardization centres should be set up and trained manpower developed. Another universal step to be taken is the adoption and use of generic names on packages. For some time the use of proprietary or brand names could be allowed along with generic names.

60. R.W. Trauter in his preliminary study for drug manufacturing industry in Nigeria lists, malaria, gastroenteritis and allied diseases, respiratory diseases, intestinal parasites and dermatological complaints as the first five of the major disease conditions. It is probable this order applies to many of the other African countries.

61. Africa imported, in 1975/76, \$550 millions worth of pharmaceuticals and produced \$220 millions worth (per capita consumptions of drugs was 1.36). Both above figures are excluding South Africa. The conclusion is that to achieve \$US 12 per capita consumption target set by a UNIDO study which is about seven times the present consumption, efforts will be needed by governments, pharmaceutical companies and inter-regional organizations.

62. The series of steps in the development of an integrated self-sustaining pharmaceutical industry need the production of basic chemicals, solvents and petrochemicals as well as trained doctors, pharmacists, chemists and engineers, and facilities for equipment manufacture. The steps are as follows:

- (i) Import of all finished and packed pharmaceuticals,
- (ii) Bulk imports of finished drugs for repacking,
- (iii) Bulk imports of basic drugs for formulation and packaging,
- (iv) Production of simple drugs, injections, active ingredients from plants and animals, and
- (v) Production of anti-biotics, synthesis of sulpha and other drugs.

CHAPTER II

RECOMMENDATIONS

A. General

(a) Policies, strategies, priorities, targets

63. Policies: Clear-cut policies should be laid down regarding development of the chemical sub-sectors, whether they will be in public, private or mixed sector. The entitlements, if any, for the industry should be spelt out such as tax holidays, tariff protections, export incentives, adequate support prices to generate surpluses, safeguards against expropriations, promoting steps to compete internationally. It is recommended that any and more than one of the above entitlements be given to the chemical industry as the need exists and circumstances justify.

64. Strategies: It is recommended that national or subregional strategies be established in developing the chemical sector. Whether strategy is to export products or to use them for home consumption or both should be established. To make use of the multiplier affect of chemical industry products, other products should be planned. For example, if caustic soda and chlorine are produced, plans should be made to integrate it with the production possibilities for pulp and paper, insecticides, bleaching powder, detergents etc. for which caustic soda and chlorine are inputs, strategy whether complex or simple technology is to be used and where it should lead to from use of such technologies should be laid down. If the strategy is to increase employment, end-product fabrication such as goods using PVC, LDPE, etc. should be encouraged.

65. Priorities: Priority in planning certain products is of utmost importance. If cheap gas and oil are available, many exportable products or products for home use can be given priority. It is recommended as an example that priority be given to ammonia production than methanol production. Ammonia can be converted into solid fertilizer the use of which will increase food production. Whereas methanol is mainly for export for energy and for use in production of sophisticated products. It is recommended that in establishing priorities, the following criteria be used:-

- (i) Is the product for home market, subregional or regional market or is it for export outside the region?
- (ii) Is the manufacturing concern going to use local raw materials?
- (iii) Is there possibility of backward integration?
- (iv) Are the products to help in food production?
- (v) Will the production substitute imports and/or increase exports?
- (vi) Will the processes adopted enrich local "technological know-how"?
- (vii) Will the project and its products increase employment and improve standard of living?
- (viii) Is there an increase of added value?
- (ix) Will it contribute to the national economic profitability?

If some or many of these criteria are met, priority for development must be accorded.

66. Targets: Targets must be established by each and every country and each sub-region in Africa. This will not only avoid duplication and show clearly what each country and subregion are aiming at. It is recommended that targets and plans are not kept secret from fellow member countries of subregional groups for fear of being copied or one country being prevented from carrying out the plans.

- (i) It is recommended that targets at the country level satisfy firstly the local demand; secondly, subregional and finally regional demand. The target for whole of Africa should be co-ordinated at OAU or ECA level to attain the 2 per cent of world production allotted to Africa by the year 2000.
- (ii) Targets must take into account the division of activities among countries. While a country with hydro-electric resources may produce electric power and use it for caustic chlorine production, a neighbouring country with gas and oil resources may produce ethylene, PVC etc. The chlorine from one country can feed the project of the other country for PVC production. Thus targets are supplementary as well as complementary if transport costs justify.
- (iii) It is recommended that targets are made with a practical bias and in countries with no chemical sector, by importing intermediates. Imports are to be related to finished products which will be inputs to food and other areas of vital needs.

(b) Constraints

67. The general constraints existing in the case of the chemical sector which inhibit the development were discussed earlier. Recommendations as to how to remove or ease the constraints can be made only in a general way because of the peculiar circumstances existing in each country, and taking also into account the special nature of the chemical industry and its peculiar characteristics.

- (i) The small markets for chemical products and the low purchasing power in many African countries are constraints which can be overcome by subregional grouping of countries and by developing chemical industries suitable to the needs of the subregional requirements.
- (ii) The constraint of technical manpower should be solved by a systematic approach of manpower planning, institutions building, training in existing sectors, polytechnics and universities and availing of bilateral and UN fellowship schemes. The numbers in various disciplines required for each planned industry should be worked out like chemical, mechanical, electrical, civil, management, marketing etc. and provisions made for their basic training and then for the specialized jobs. Short-term training and updating of knowledge could be done through symposia, seminars and workshops in the various disciplines. Fellowships in other African and outside countries should be encouraged but trainees should be made to return and serve the industry within the respective countries in Africa for a minimum number of years. Governments should make sure that the stay and services of technical personnel are made attractive.

- (iii) The constraint of inadequate infrastructure cannot be solved in isolation. For example if a fertilizer plant of 1000 TPD ammonia has to be built at a railroad junction and the plant is based on natural gas and the product is urea, a gas pipeline has to be laid to take the gas to the battery unit, rail-cars to move 2000 TPD of urea which means about 100 railway wagons of 20 tonnes capacity each have to be provided. This means that when 100 cars are being loaded, 100 cars are on the way loaded, 100 cars are being discharged and 100 cars are on the way back. Thus 400 railway cars are tied up for that project alone. The impact of this heavy traffic on the railroad system has to be studied in advance. Similar circulations are needed for road and water transport, supply of water and electricity, markets, storage and distribution of product etc. In any case, the financing and responsibility of infrastructure development should be assumed by governments concerned.
- (iv) Finance is a constraint but need not be so if there is a viable project for which feasibility studies have been made, pre-investment and investment proposals have been completed and evaluated. A consulting firm of good reputation should be appointed and a project manager designated. A Board of Directors to guide and direct the project manager and oversee the progress of the project is essential. Sufficient land should be ear-marked, and raw materials and product distribution ensured. If such a proposal is submitted to international and other institutions and if the country or the subregion is creditworthy, financing on equitable terms should not be too difficult. Bilateral and/or multilateral finance may also be forthcoming on "buy-back" or some other suitable arrangements.
- (v) Non-co-ordination within the country or the subregions should not become a constraint. The line of authority should be clearly laid down and well understood by all concerned with the chemical project. A pyramidal type of organization must be set up and it should meet at least twice a year to review the progress of actions and correct and solve problems where needed. This kind of control becomes all the more difficult when more than one government is involved.
- (c) Institutional framework

68. Institutions for planning, for execution and sub-sectoral development institutions, such as Fertilizer Development Centre, Design Centres, Management, Consultancy and Technology Transfer Centres and above all Technical Training Centres are absolutely necessary. It is recommended that to start with Development Centres be set up with other disciplines as departments within such a Centre. The North African Fertilizer Development Centre which was proposed by UNIDO could be pursued by ECA for establishment.

#### African Regional Chemical Industry Development Centre (ARCIDC)

69. Since several regional institutions have been decided upon for establishment or are under planning, and since at least one of them, the African Regional Centre for Engineering Design and Manufacturing, is specifically for the engineering and metal-

forming industries, the Task Force recommends that to begin with steps should be taken early to set up an **African Regional Chemical Industry Development Centre (ARCIDC)**.

70. The recommendation for this Centre is made because the chemical sector is not yet properly and adequately developed in the subregions and countries. Since it is believed that a proliferation of institutions is against the declared policy of the policy-making organs in Africa, initially it would be better to entrust a series of development functions to this institution.

71. The ARCIDC is to serve initially as a nucleus for the functions which may later become the basis of setting up other regional institutions. As the development in the subregions and countries increases, this nuclei can also be transformed into institutions on the same pattern as the regional institution, but catering to the special needs of the subregion or group of countries concerned.

72. The ARCIDC may be designed for the following functions and disciplines, among others:

- (i) Sectoral planning,
- (ii) Training,
- (iii) Technology transfer and process development,
- (iv) Consultancy and management,
- (v) Process and engineering design, and
- (vi) Information.

73. The inter-linkages and the feedback between the departments of ARCIDC and that of the other regional, subregional or national institutes will provide for constant touch with them to co-ordinate the efforts of the planning department and collect and co-ordinate plans. The Training Department will co-ordinate with the training counterpart institutions, countrywise and subregion-wise. In this way, the long-term trained manpower requirements for the chemical industry sector for the whole of the region will be evident and taken care of. The technology transfer and process development department would keep liaison with similar departments or institutions in the countries and in the subregions. The same can be the position relating to consultancy and management and the process and engineering design departments. The feedback from the other regional, subregional and country institutions and departments dealing with the same subjects are of the utmost importance. In any case, the information and data collected by the ARCIDC will be valuable and authentic for the whole of the African region.

74. The description of the regional institution required by the chemical industry or the nuclei which will be the starting point for subregional institutions are described in the following paragraphs.

### Subregional Institutes and Centres

75. In course of time, as the developmental functions handled by the different departments of the ARCPIC grow, the discussions of their growth could justify the creation of separate subregional institutes, each devoted to its own specialized functional areas, wherever such institutes are not already in existence and where no duplication of functions would be involved. Where such subregional institutes are already in existence, they would be expected to co-ordinate their work with the regional institute.

76. Planning institute: The most urgent and important institution required is a Planning Institute. Although each country has its Planning Ministry or Organization, if the plans of the subregion are to be synchronized and harmonized there must be a competent body at the subregional level also, duly authorized to draw on the plans of member countries and ensure that there is no duplication and that the plan is backed by resources and is practicable. The chemical sector should have a prominent place in the plan.

77. Institute for Higher Technical Training and Research: This Institute for training, co-ordinating and planning manpower requirements is absolutely necessary for each subregion. It should work out the manpower requirements for the subregion on a ten-year basis and necessarily cover all sectors. An institute for each sector to start with may be a premature step and it would be advisable to plan first for an institute for all sectors for the subregions.

78. Institute for Technology Transfer and Development: In addition to adaptation and development of technology in the region, such an institution may also deal with contracting procedures, acquisition and purchase of technology. Its functions will be dictated by the needs of the subregions. For example, a subregion rich in oil and natural gas resources may have a bias towards an institute with greater orientation to oil and gas exploration, development, drilling, transport, storage, refining and their conversion into petrochemicals, whereas a subregion rich in medicinal plants or animal by-products may be inclined to be geared towards a technology base required in developing and processing such resources.

79. Centre for Consultancy and Management: This Centre may not necessarily be required for each of the subregions. In some subregions, the functions of technology transfer, and consulting and management could be combined within a single institute. As and when the work justifies, a specialized new institute for Consultancy and Management could be planned.

80. Other related institutions: Centres for Industrial Design and Manufacturing are needed only in certain subregions. At the present stage of development, such of the designs and fabricated equipment may have to come from outside the subregions, but a nucleus to build up slowly all the required skills is necessary in all subregions.

81. The linkages among the above institutions which support industrial development activities at the various stages will have to be carefully worked out. For example, the Planning Institute will need to give the go ahead signal on any project on which the necessary preliminary work has been carried out; the Centre for Industrial Design and Manufacturing will assist in the design and fabrication of equipment; the Centre for Consultancy and Management would help or carry out or assist in the construction stage by preparing the organization chart, the job descriptions and assisting in preparation of construction, maintenance, operation and safety manuals; the Institute for Technology Transfer and Development would assist in choosing the most appropriate technology or sometimes adapt technology, purchases 'know-how' and help in contractual negotiations; the Institute for Higher Technical Training and Research would be concerned with the training of skilled workers, operators, foremen, superintendents and managers using facilities both outside and inside the project - it would grade them, prepare curricula and uses appropriate visual aids and simulators for training.

82. The linkages between the institutions have to be carefully worked out to get maximum benefit and prevent overlapping. The Consultancy and Technology organs have thus to work closely together. The training Institute has to be in day-to-day contact with all other institutions.

83. The chart which follows is self-explanatory, and shows the inputs of existing regional institutions as well as those in the various pipeline and under consideration in the process of development of a chemical project from the earlier stages of its inception to the final stages of plant start-up and regular operation. It should be noted that most of the institutions described under the umbrella of ARCIDC are expected to start initially as departments of ARCIDC and eventually converted into subregional institutes. Most of them correspond to the regional institutions shown in the chart.

#### National Institute

84. Besides the regional and subregional institute for chemical industry development and specialized functions suggested earlier, it is recommended that in course of time, similar institutes should also be established at the national level to take care of the planning and development of chemical industry in each African country.

85. For the development of the national institutes, it is expected that the regional and subregional institutes would provide necessary assistance specially in the matter of development of expertise in the specialized fields.

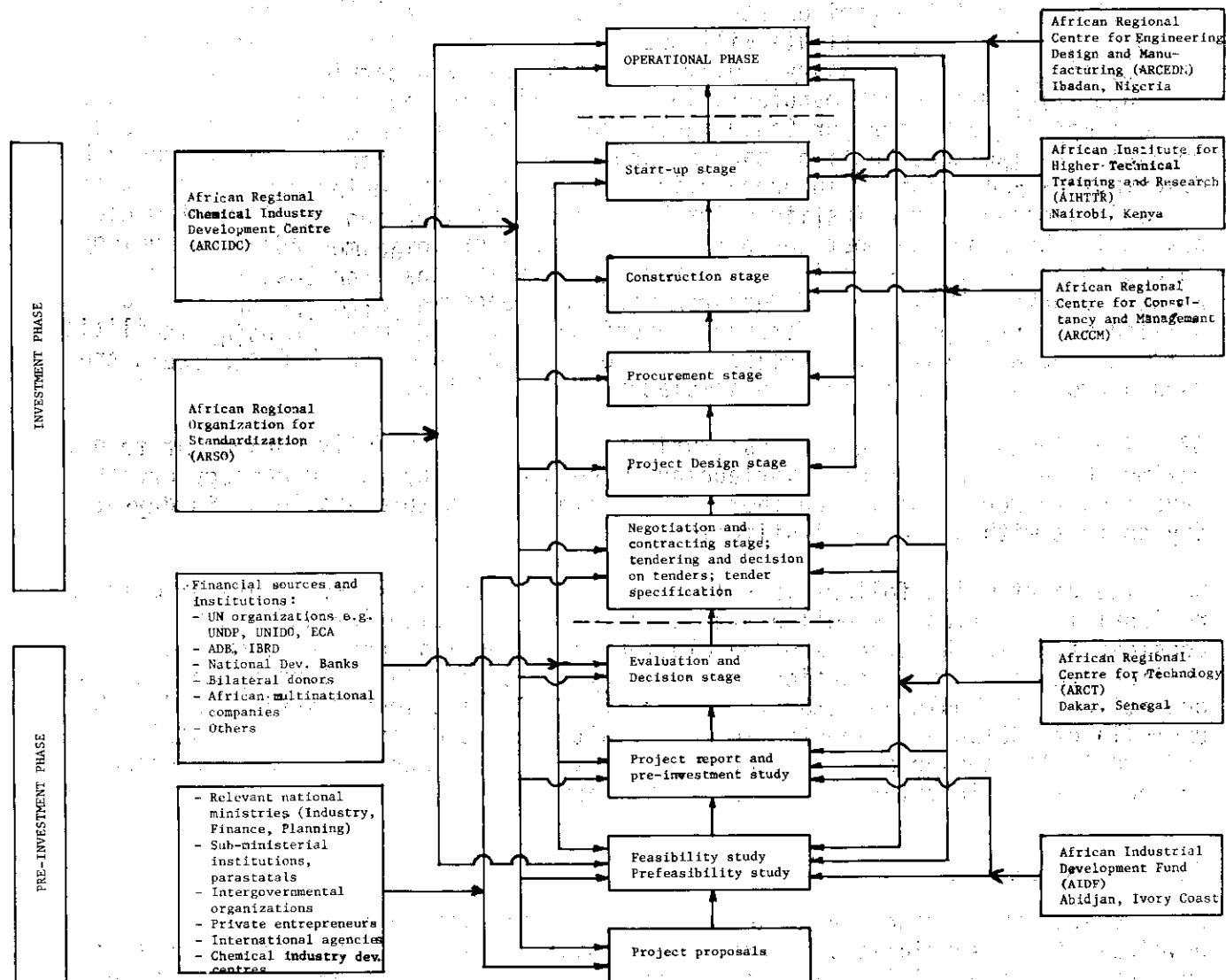
#### (d) Natural resources and infrastructures

86. It is recommended that further geological explorations, investigations and research for locating new deposits and better identification of explored deposits and programmes for their industrial exploitation should be carried out.



Chart I

The Development of Regional and Subregional Projects  
(Institutions and their linkages)



37. Increased forward integration and the gradual substitution of exported crude products by intermediates and/or end-products should constitute the main goal for the development of African natural resources and their better utilization. Forward integration should take into account the full and efficient utilization of all possible components of the ores and other resources.

38. In order to exploit natural resources and to process them into concentrates, fertilizers, petrochemicals, basic chemicals etc., it is essential to promote and to develop the requisite infrastructures, particularly energy, transport and communication facilities.

39. ECA should carry out detailed studies in each subregion to identify shortcomings and future development possibilities and needs of infrastructure.

#### B. Specific to the subsectors

90. It is recommended that seminars be organized in each subregion during 1982 and 1983 on the subject of chemical industries sector development. These seminars could culminate in a regional symposia at ECA headquarters in 1983 for co-ordination and integration to evolve the necessary pattern of development and set targets for the years 1985, 1990 and 2000 and a blueprint drawn up for the African region as a whole.

91. It is recommended that all chemical industries sector projects initiated in African countries be thoroughly scrutinized by suitable international experts provided by ECA/UNIDO from the points of view of economies of scale, processes, raw materials, end-products, markets, cost of projects, etc. to avoid abandonment of projects mid-way.

##### (a) Fertilizers, Basic chemicals and Pesticides

#### Meetings: Symposia, seminars and workshops

92. A seminar should urgently be convened for helping countries in the process of putting up chemical projects, particularly fertilizers, on technology transfer, contracting procedures and model contracts at ECA headquarters in 1980. UNIDO will have by then all necessary documents to familiarize about 15 participants from 15 countries on these subjects.

#### Studies: Feasibility, market, pre-investment and others

93. It is recommended that feasibility studies for setting up ammonia projects in countries such as Gabon, Tanzania, Sudan and Zaire and pesticides active ingredients in countries such as Egypt, be urgently carried out by ECA/UNIDO in 1980. ECA should take up the initiative without waiting for country requests to go to UNIDO. If necessary, ECA should develop and process such requests.

94. Similarly, to increase phosphate production in the southern subregion, feasibility studies should be undertaken with a view to increasing the existing capacities in Tanzania and Uganda. The possibilities for converting existing plants/projects in Senegal and Togo into multinational or subregional projects should be examined.

95. A feasibility study is urgently needed for Tanzania to set up a soda ash project using natural trona occurring in Lakes. There is a very old and successful on-going project in Kenya, the experience of which could be counted upon. The two countries can co-operate in a common programme of export of the product.

96. For countries entering into pulp and paper production, it is essential to set up caustic soda chlorine plants. Feasibility studies should be undertaken for caustic soda-chlorine plants in countries such as Gabon, Cameroon and Tanzania with particular emphasis on utilization of co-product chlorine for pesticides; electric power requirements, its availability and prices should be thoroughly studied.

#### Field projects

97. A team of experts should be sent to help bring existing fertilizer plants in countries such as Nigeria, Cameroon, Tanzania, Ivory Coast, Zambia and Senegal to better utilize their capacities. The team should include besides the leader, a chemical engineer and a maintenance engineer, and should give on-the-spot advice and prepare plans for longer range actions.

98. Utilization of existing fertilizer and other capacities be studied in countries such as Egypt, Tunisia, Libya, Algeria and Morocco to help other African countries to benefit from the lessons learnt and avoid difficulties experienced in North African countries. The team should advise and provide ways to improve the situation.

99. Information services comprising results of continuous monitoring of national, regional and world trends and prospects in the demand, supply, production and prices of fertilizers should be organized in the form of information network where ECA should be a focal point.

100. Within the frame of the network of the national bodies and institutions, there should be exchange of expertise and information and more ad hoc subregional arrangements on such issues as stock management and market development. Close contact should be maintained between appointed Governments' liaison correspondents who would participate at the expert group meeting reviewing activities of the network. These meetings should be organized by ECA. After the constant flow of information on the above issues is well processed and established, especially on aspects of demand and supply, the planning of production of fertilizers, full utilization of existing capacities and further expansion would be more logically ensured. A specific study should be undertaken and workshop should be organized on the aspects of fertilizer marketing and distribution infrastructure in African countries especially within the subregional groupings of the countries.

101. A regional workshop should be convened to exchange experiences of plant management in existing fertilizer and other plants, with case studies on efficient and lower-output plants as well as on plants with different scales of production.

#### Institutions

103. For industrial development in a country, subregion or region, it is essential to build up institutions to carry out certain pre-determined functions such as manpower training, technology transfer, management and contracting, design and engineering and

sector planning, etc. All these could be done in separate institutions or under an umbrella institution such as a Development Centre. UNIDO has been trying to promote a Fertilizer Development Centre in North Africa. It will be worthwhile for ECA to support this Centre and help in its early establishment.

### (b) Petrochemicals

#### Meetings

103. It is recommended that a petrochemical seminar be held on an annual basis, starting with North Africa in 1980, West Africa in 1981, East Africa in 1982 for technical, financial, management and policy-makers to review the progress of the industry in the subregion and to formulate plans for the future. In the fast changing technology of petrochemicals, such meetings will help participants keep abreast of recent developments in the world, price trends and new technologies.

#### Studies

104. A feasibility study should be conducted for an ethylene cracker of about 150,000 tpy in Gabon using ethane or naphtha as feedstock and then converting the ethylene to low density or high density polyethylene for the subregion. Similarly, a study for a smaller unit of about 10,000 tpy of ethylene from alcohol (based on molasses) in some countries is essential; the ethylene is to be converted to LDPE.

105. Feasibility studies should be conducted in Nigeria and other countries to produce PVC from imported monomer till such time as V.C.M. becomes available from local petrochemical complexes. In this connexion, the feasibility of converting the Nigerian ethylene project into a subregional project should be examined.

106. For urea formaldehyde (U.F.) and phenol formaldehyde (P.F.) synthetic adhesives there is scope for establishment of small units in Cameroon the Ivory Coast, Congo Tanzania, etc. Feasibility studies should be undertaken and capacities determined after making market studies for adhesives in the particleboard, veneer and plywood industries in countries where forest industries have scope and are coming up or already set up.

107. In the East African region, scope exists for development of plastics conversion units for PVC, LDPE, HDPE, etc. A market study in these countries will be of utmost significance.

#### Field projects

108. An independent evaluation by UNIDO/ECA experts will help countries like Egypt, Algeria, Libya and Nigeria in deciding on the capacity, product mix, capital, investment and markets for petrochemical complexes. Proposals submitted by multinationals need scrutiny in the light of local circumstances. Particularly if the products are export-oriented, 'buy-back' or some other arrangements must be made even before the projects are executed. Price structure of products and raw materials have to be fixed with suitable escalations to safeguard against possibilities of 'dumping' and other unfair practices.

109. Projects for plastics fabrication in East, West and Central Africa needs special investment studies. Infrastructure and institutions are needed for development of petrochemicals as indicated under fertilizers.

### Institutions

110. Those described under fertilizers apply to petrochemicals as well.

### (c) Pharmaceuticals

#### Meetings

111. It is imperative that in the pharmaceutical subsector, necessary nucleus of trained manpower be provided in all African countries by starting training centres for pharmacists, chemists, engineers and technicians. Quality control and standardization are the problems facing any country in the field of imported or locally made drugs. UNIDO, WHO and ECA should take active steps to set up training centres in all the subregions of Africa. The one that UNIDO is setting up in CEAO area could be the first step in this direction and other subregions could benefit from its experience and follow-up.

#### Studies

112. Feasibility studies regarding formulation and packaging of drugs: Except Egypt and Algeria, all other African countries depend for more than 90 per cent of their needs on imported drugs. To reduce the import bill after starting repackaging of imported active ingredients, formulation of imported drugs should be undertaken in all countries. Studies could be conducted in one typical country of each region to determine capacity, costs, cost-benefit ratio and training potential of such projects. Formulation units are neither capital-intensive nor technical-manpower-intensive but should be supported by or incorporated together with quality control laboratories.

113. Africa abounds with plants which are rich in extracts of great therapeutic value and have been used for hundreds of years in local systems of health care and disease prevention. Countries like Congo, Cameroon, Senegal, Ethiopia, Kenya and Tanzania should be subjected to studies to evaluate this great potential.

114. Active ingredients from animal wastes in countries like Kenya, Tanzania, Nigeria and others where organized slaughter houses exist could be safely extracted. Systematic feasibility studies are required.

115. In the Western and Eastern subregions, scope exists for setting up two multinational companies entrusted with promoting and developing projects in:

- (i) formulation and packaging,
- (ii) production of infusions,
- (iii) extraction of active ingredients from medicinal plants and animal by-products,
- (iv) production of packing materials, glass and plastics containers, and
- (v) promoting training and quality control establishments.

Studies should be made and active efforts put in by ECA, UNIDO and WHO to assist in promoting these two companies.

116. In view of Egypt's capability to produce basic and intermediate drugs locally and a wide variety of packing materials, it is recommended that an indepth study be made as to the need for Egypt still importing formulated products of pharmaceuticals worth 60 millions of dollars per year. A team of experts may study the feasibility for setting up more formulation and packaging plants in Egypt.

117. Detailed studies are recommended to be carried out by ECA, UNIDO and interested countries to convert existing national plants and projects into multinational or subregional projects such as the fermentation based anti-biotic project in Algeria.

### Institutions

118. In the case of pharmaceuticals, the institutions would more or less be as described under the fertilizers.

### C. Modalities for Co-operation among member States and between them and other developing countries

119. Co-operation at subregional or regional level is crucial for the successful implementation of large projects, particularly in mining of chemical industry raw materials, and in the production, marketing and distribution of fertilizers, petrochemicals, basic chemicals, etc. Also, some projects such as pesticides (bulk active substances), pharmaceuticals (e.g. anti-biotics, big chemo-therapeutics), organic and inorganic industrial chemicals and intermediates, plastics, rubbers, etc., can be efficiently implemented only at the multinational level. One or a combination of the following modalities of co-operation can be considered:

- (i) Elaboration of sectoral and/or sub-sectoral plans at multinational, subregional and regional levels; harmonization of national plans and investment codes, etc.;
- (ii) Exploitation of natural resources;
- (iii) Joint ventures for industrial projects;
- (iv) Development of infrastructural facilities;
- (v) Promotion of projects, mobilization and allocation of financial resources (including joint financing);
- (vi) Supply/purchase of raw materials;
- (vii) Market research, marketing and distribution;
- (viii) Technological research and acquisition, adaptation and development of technology;
- (ix) Subregional consultancy, engineering, design and project construction organizations; and
- (x) Manpower development, training centres, exchange of professional personnel.

120. Institutional framework for subregional co-operation: It is felt that it would be necessary to have a suitable institutional framework for co-operation amongst member countries, in order to implement successfully the concept of sub-regional co-operation among them.

121. For this purpose, it is suggested that African multinational corporations should be set up with financial participation of each of the member countries involved in a subregion, and such corporations be charged with the complete responsibility of executing major chemical projects and operating them subsequently. It will be the responsibility of such corporations to carry out all functions relating to the project management and operational stages of the chemical industry and the Chief Executive of the Corporation would report on its activities to its Board of Management on which all the participating countries would adequately be represented.

122. The corporation would also be responsible for the future growth and development of its business i.e. for setting up additional chemical plants in the same or related sub-sectors of industry, as it may deem necessary. Its functions would in all respects, be exactly identical to those of the Transnational Corporations operating in different regions of the world.

123. Inter-regional Co-operation: It is in the interest of African development to learn and benefit from the experience of development in Latin America and Asia. Active contacts, exchange of information and expertise, visits and joint industrial ventures are necessary.

124. Africa can learn from the developments in the Andean Group, the Central American and Caribbean Free Trade Association in Latin America and the ASEAN Group in Asia.

125. UNIDO-sponsored visit of an Indian team on pharmaceuticals was undertaken to North Africa and to Latin America. An Engineering team from India also visited Latin America. These visits are reported to have been very fruitful. It is recommended that a Mexican team be organized to visit ECA and certain African countries on technology transfer and Indian team on the fertilizer industry.

126. Joint industrial ventures in fertilizers, pesticides, basic chemicals, petrochemicals and pharmaceuticals should be encouraged. Starting with mixing and granulation in fertilizers to formulations and packing in pesticides and pharmaceuticals and end-products, fabrication in petrochemicals are first steps which will give experience and training.

## CHAPTER III

ECA/UNIDO WORK PROGRAMME PROPOSALS FOR CHEMICAL  
INDUSTRY DEVELOPMENT (1980-1986)Origin:

127. OAU Assembly of Heads of State and Government's resolution Q1/ST.12(XXI) of May, 1973 embodying African Declaration and Co-operation, Development and Economic Independence; Lima Declaration and Plan of Action on Industrial Development and Co-operation; adopted by the Second General Conference of UNIDO in March 1975; Agreed Conclusions of successive Conferences of African Ministers of Industry held in 1975, 1977 and 1979; Revised Framework of Principles for the implementation of the New International Economic Order in Africa 1976-1981-1986 adopted by the ECA Conference of Ministers in 1977; Strategy for the African region endorsed for the Third United Nations Development Decade, at Rabat in March, 1979.

Programme objectives:

128. To assist African countries in the development of chemical industry by evolving suitable policies and strategies, formulating plans and programmes based on identification of potential project opportunities in the chemical sector and achieving integrated development of the chemical sector through regional and subregional co-operation among member countries, in order to enable them to meet the targets set by the Lima Declaration and Plan of Action for African countries.

(a) Work content129. Assistance to be provided to countries and territories include:

- (i) Formulation of appropriate plans, policies and strategies for the development of chemical industry;
- (ii) Identification of specific opportunities for establishing chemical industries and the technical and economic feasibility evaluation of each such industry;
- (iii) Identifying, suggesting and promoting complementarity among selected African countries for supplying production inputs for the production of chemicals and thus promoting subregional co-operation between member States;
- (iv) Evaluating customs, excise and other fiscal and non-fiscal barriers and introducing relaxations in them for facilitating trade between member States in chemical products;
- (v) Developing national and subregional capabilities in project analysis, planning, design/engineering, implementation and management;
- (vi) Studying the existing institutional set up for the development of chemical industry and suggesting a suitable institutional framework modifications and improvements conducive to the promotion and development of chemical industry;



- (vii) Critically examining the technical manpower requirements in member countries and subregions and undertaking necessary measures for fully meeting the manpower needs for the chemical industry sector;
- (viii) Surveying the existing position of infrastructural and support services available in different African countries and suggesting ways and means for the formulation of an integrated approach towards the development of infrastructures and support services for chemical industry;
- (ix) Estimating financial investment requirements for chemical industry development and suggesting ways and means for meeting these needs; and
- (x) Elaborating the modalities for effective co-operation among member States for the development of chemical sector.

130. Studies to be undertaken comprise the following:

- (i) Studies for identification of potential project opportunities for chemical industries development for planning and programming, fixing priorities and targets, for undertaking integrated development of the chemical sector;
- (ii) Market surveys and studies and techno-economic feasibility studies on identified projects and project ideas particularly suggested by the 1978 chemical mission;
- (iii) Techno-economic studies on existing projects which may be facing operational difficulties, to suggest remedial solutions; and
- (iv) Follow-up studies on pharmaceuticals with a view to co-ordinating the work being undertaken by WHO/ADB/UNIDO by the Task Force on pharmaceuticals partially completed as mandated by the Non-aligned Nations for the integrated development of pharmaceutical industry in Africa and other regions.

131. Collection and dissemination of information on project ideas and pre-feasibility studies to potential investors with the object of interesting them in participating in industrial ventures in the chemical field.

132. Conferences, meetings, seminars, training courses and expert working groups to be organized include the following:

- (i) Expert working groups on planning, programming, and fixation of targets and priorities, for the integrated development of chemical industry;
- (ii) Intensive training courses on market analysis and preparation of demand projections for chemicals;
- (iii) Workshops and seminars on technology transfer and contract negotiations as applicable to chemical industry;
- (iv) Workshop and seminars on manpower development;
- (v) Exchange of inter-regional missions of expert groups to stimulate exchange of information and co-operation among developing countries for the development of chemical industry; and
- (vi) Workshop in standardization, quality control and operation.

Projects(b) Short-term programme: (1980-1982)

133. The short-term programme for the period 1980-1982 comprises two components:

Regional and Subregional Programme

134. Project identification component aiming at:

- (i) Forecasting requirements of major chemicals by country, subregion and region on the African continent;
- (ii) Assessing local production capabilities to determine the extent to which these requirements could be met from local production;
- (iii) Planning a phased programme of establishment of new production capacity, based on gaps in local demand/supply situation and also taking into account export potentials in each case;
- (iv) Making an assessment of future manpower needs for the chemical industry and suggesting training facilities for their development;
- (v) Estimating financial investment requirements for items (iii) and (iv);
- (vi) Formulating policies and strategies for implementation of items (iii) and (iv); and
- (vii) Planning modalities for co-operation among member States for implementing items (iii) and (iv).

135. Pre-investment studies, training and consultancy services: Under this programme component, it is envisaged that pre-investment studies, training and consultancy services on the following subregional projects which were identified by the chemical mission will be carried out:

- (i) A pre-feasibility study on PVC manufacture in Gabon (UDEAC);
- (ii) A pre-feasibility study on an ammonia plant in Gabon (UDEAC);
- (iii) An evaluation of an anti-biotic feasibility study for ACDIMA (Egypt);
- (iv) A consultant service in the setting up of the Regional Pharmaceutical Centre in CEAO;
- (v) Pharmaceutical factory operatives training in CEAO; and
- (vi) Pharmaceutical factory operatives training in Tanzania and neighbouring countries.

The total estimated cost of the short-term programmes as outlined above is \$US 1,556,100.

National programmes

136. In complementarity to the subregional programme outlined above it is planned that a programme of pre-investment studies at a national level will be undertaken on a number of projects identified by the chemical mission and others on different sub-sectors of chemical industry with major inputs from UNIDO, during 1980-1982. The estimated cost of these programmes is expected to be of the order of \$US 2 million.

(c) Medium-term programme (1982-1986)

137. The medium term programme is based upon the following component activities for the development and promotion of the identified sub-sectors of chemical industry by the chemicals mission:

- (i) Pre-feasibility and feasibility studies;
- (ii) Investment promotion programmes;
- (iii) Institutional programmes - meetings, working groups, etc; and
- (iv) Training programmes.

138. An outline description of the medium-term programme (estimated to cost \$US 5.5 millions and to involve over 384 man-months) on a year to year basis from 1982-1986 is as follows:

	m/m	\$US (1000)
<u>1982</u>		
<u>Studies and investment promotion</u>		
(a) Fertilizers (pre-feasibility)	48	343
(b) Fertilizers centre (feasibility)	8	57
(c) African Regional Chemical Industry Development Centre (ARCIDC)	8	57
<u>Institutions and training</u>		
(a) Technical working group on African Multinational Corporations for chemical industries (10 participants, 10 days)		41
(b) Training: workshop on planning and programming of selected branches of chemical industry (25 participants, 20 days)		100
	64	598
<u>1983</u>		
<u>Studies and investment promotion</u>		
(a) Pesticides (pre-feasibility)	48	370
(b) Pesticides centre (feasibility)	8	62
(c) Fertilizers (promotion) 1/	24	185
<u>Institutions and training</u>		
(a) Fertilizers centre (meetings, establishment) 2/		89
(b) Fertilizer multinational corporations (meetings, establishment) 2/		89
(c) African Regional Chemical Industry Development Centre (ARCIDC)		
- Expert meeting )		150
- Plenipotentiary meeting)		
(d) Training: preparation and evaluation of contracts (25 participants, 20 days)		105
	80	1,050

1/ This includes assistance in conducting feasibility studies and negotiations and in the preparation and evaluation of bids and contracts with respect to specific projects.

2/ Based on pre-feasibility and feasibility studies undertaken in the preceding year-two meetings, one expert meeting (10 days) and one plenipotentiary meeting (7 days).

1984

Studies and investment promotion

	n/m	\$US (1000)
(a) Pharmaceuticals (pre-feasibility)	48	400
(b) Pharmaceuticals centre (feasibility)	8	67
(c) Pesticides (promotion) <u>1/</u>	24	200

Institutions and training

(a) Pesticides centre (meetings, establishment) <u>2/</u>		94
(b) Pesticides multinational corporations (meetings, establishment) <u>2/</u>		94
(c) Training: in-plant training (30 participants, 60 days)		300
	80	1,155

1985

Studies and investment promotion

(a) Petrochemicals (pre-feasibility)	48	432
(b) Petrochemicals centre (feasibility)	8	72
(c) Pharmaceuticals (promotion) <u>1/</u>	24	216

Institutions and training

(a) Pharmaceuticals centre (meetings, establishment) <u>2/</u>		100
(b) Pharmaceuticals multinational corporations (meetings, establishment) <u>2/</u>		100
(c) Training: in-plant training (30 participants, 60 days)		325
	80	1,245

1986

Studies and investment promotion

(a) Other chemicals (pre-feasibility)	48	467
(b) Other chemicals centre (feasibility)	8	73
(c) Petrochemicals (promotion) <u>1/</u>	24	233

Institutions and training

(a) Petrochemicals centre (meetings, establishment) <u>2/</u>		105
(b) Petrochemicals multinational corporations (meetings, establishment) <u>2/</u>		105
(c) Training: in-plant training (30 participants, 60 days)		350
	80	1,338

1/ This includes assistance in conducting feasibility studies and negotiations and in the preparation and evaluation of bids and contracts with respect to specific projects.

2/ Based on pre-feasibility and feasibility studies undertaken in the preceding year — two meetings, one expert meeting (10 days) and one plenipotentiary meeting (7 days).

(d) Long-term programme (1986-2000)

139. The long-term programme for the development of chemical industry in the African region is expected to follow the guidelines set by the Lima Declaration and would aim at achieving at least 2 per cent of the world's total production of chemicals in the African region.

140. For the purposes of identification of priority areas, and formulation of detailed planning and programming for the period 1986-2000, it is proposed that during the period 1982-1983, subregional (MULPOCs) meetings be organized, followed by a Regional Meeting in 1983 at ECA headquarters to finalize the long-term development programme for the chemical industry sector and draw up a blueprint. The total cost of the six meetings during 1982-1983 is estimated at \$US 600,000.

TERMS OF REFERENCE FOR A TASK FORCE ON  
THE CHEMICAL INDUSTRY DEVELOPMENT PROGRAMME

(5-23 November 1979)

Based on experience of the members of the Task Force in the sector as well as in their respective countries and geographical areas, the Task Force should:

1. Review and critically examine the regional report of the mission and the draft project document submitted for UNDP financing;
2. Elaborate on the constraints, conclusions and recommendations of the report with a view to:
  - (a) Formulating policies, strategies and targets required to develop the sector taking into consideration development potentials,
  - (b) Identifying priority areas within the sector taking into account backward and forward linkages and the need for achieving increasing measure of self-reliance, self-sufficiency, and self-sustaining sectoral development by the year 2000 in accordance with the Lima Targets, specifically:
    - (i) The required multinational and subregional institutional framework for project development from inception to operation of physical plants including:
      - Sectoral institutions for R & D, design, studies, technology transfer and training centres,
      - Consultancy services,
      - Project engineering and construction organizations,
      - Institutional mechanism for consultation meetings,
      - Project implementation institutions such as African multinational industrial corporations,illustrating the relationships within the institutions and with those of similar and related national institutions and ministerial bodies (existing, planned and proposed);
    - (ii) Industrial projects including conversion of existing national production facilities and projects into multinational or subregional projects and new project proposals, particularly those which are based on the exploitation and utilization of the region's natural resources and those with maximum impact to the economy of the region;
3. Work out proposals for an ECA/UNIDO implementable programme for the sector during the period 1980-1986 and indicate manpower and financial resources required;
4. Identify and elaborate alternative modalities for co-operation among member States in the implementation of multinational, subregional and regional projects.

Composition of the Chemical Task Force

1. Mr. Maliyil C. Verghese, Consultant -- Team Leader  
Ex-Head Chemical Industry Section, UNIDO  
Specialist in Basic Chemicals, Fertilizers,  
Pesticides, Petrochemicals and Pharmaceuticals
2. Mr. Autar K. Bhatnagar, Consultant -- Member  
Specialist in Basic Chemicals,  
Fertilizers and Pesticides  
(Team Leader -- Chemical Mission)
3. Mr. A. Dotsenko -- Member  
Economic Affairs Officer  
ESCAP Staff Member
4. Dr. Edward H. Zawada -- Member  
Senior Industrial Development Officer  
UNIDO Staff Outposted to ECA  
(Member -- Chemical Mission)
5. Mr. Leif Hinderesson -- Member  
Associate Expert in Economics  
( Research and Evaluation)
6. Mr. Makonnen Alemayehu -- Project Officer  
Chief, Industrial Operations Section  
(Member -- Chemical Mission)