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Project RAF/78/036: MANPOWER DEVELOPMENT FOR BASIC INDUSTRIES

CHEMICAL INDUSTRIES

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I. INTRODUCTION

1.0 The efficient utilisation of human resources may very well be the most important determiner of success of an enterprise. While everybody recognises that the ultimate success of any organisation - industrial or otherwise - vitally depends upon the calibre, quality and performance of men, little attention has been given in the past to systematic planning of manpower. Of late, there has been a growing recognition of the importance of planning human resources with as much care as other resources like capital, materials, etc. In any Chemical Enterprise the importance of manpower planning will be fully realised when faced with the problem of rapid and massive expansion of the industry with the consequent drain of trained manpower due to flight of personnel to other enterprises. Lot of effort and time has to be devoted in planning the requirement of manpower and training suitable personnel to design, build, operate and maintain the enterprise and the expansion scheme in the future years.

Importance of Manpower Planning

1.1 Human resources are one of the most critical and difficult resources to plan for several reasons. First of all human resources have a far-reaching impact on the profitability of the enterprise. There are many cases where a poor planning on technological, financial and physical fronts have been largely rectified through conscious improvements in the quality of manpower. On the other hand, there are also cases where poor manpower planning have completely washed out the gains of most thorough and careful planning of other resources.

1.2 Importance of manpower planning is increasing because of the size of organisations. Where there are associated increases in manpower requirements and in the complexity of the tasks of managing human resources efficiently, the role of planning is felt more. These tasks range from the basic one of simply keeping track of the people in an organisation to the much more sophisticated task of keeping them on jobs appropriate to their skills, interests and aspirations.

1.3 Manpower constitutes an area of management where the results of actions are not seen immediately. There is a considerable time lag between action and response. Any poor job of planning will not be reflected immediately but will surely have effect on long term basis. When these defects are discovered, it would have been too late to make corrections. Even if corrections are made at a later stage, they will be sluggish, invoke considerable resistance and reaction and will at best be only suboptimal.

1.4 A company ought to have a clear idea of what its manpower needs are and what they will be in the future. A 'Manpower Plan' should exist which will assure that the right numbers and kinds of people will be at right places at the right times to carry the company's operations forward.

1.5 While several new techniques of manpower planning have been developed in recent years, it still remains an imprecise art. The process of manpower assessment and manning largely continues to be empirical. Further, the execution of a manning plan takes considerable time in recruitment, training etc. All these make manpower planning all the more critical, necessary and important.

2.0 BACKGROUND AND CURRENT STATUS OF DEVELOPMENT OF CHEMICAL INDUSTRIES

African Nations' Policy Towards Industrialisation

Newly and rapidly emerging sovereign States in Africa have emerged less than three decades now. By early 1980, there were 50 independent countries. Generally, the countries are rich in resources but the people are poor. Nature of development in the past has followed patterns that have contributed to rising living standards for people outside of the African Region. Educational infrastructure facilities are gradually only being developed now. Industrial infrastructure and industries - except for rare notable exceptions - are generally poor.

2.1 Attempts to promote development of chemical industries were initiated in 1963; this was followed by studies on Chemical Industries. Conferences/meetings in 1964 and 1967; between 1968-76, some chemical documents were updated and new ones prepared.

The Second Conference of Ministers of Industry of the African Countries in 1973 adopted the Declaration on Industrialization in Africa and set the priority. This was prior to the Lima declaration. In the third and the fourth meetings, the Conference came to the agreed conclusions to accord high priority to basic industries including Chemical industries. Objectives towards attainment of self-reliance and self-sufficiency were emphasised.

All African countries, despite their low per capita income are attaching relatively high priority to pharmaceutical supplies. Among all the imported chemicals, pharmaceutical products rank first, and ahead of fertilizers and plastics. In consequence, there are phases for pharmaceuticals production in some countries - either basic, or formulations, or packaging from bulk imports - at the national, subregional and regional levels.

The fourth meeting in Kaduna, Nigeria in 1977 directed ECA in co-operation with UNIDO and OAU to pursue measures to attain these objectives.

2.2 Resources for Chemical Industries Development

In the Chemical Sector, as a first step, ECA mounted a mission along with UNIDO for Chemical Industries Development Programme between May and August 1978. The mission visited six 1/ typically representative countries on such parameters as Geographical spread, state of development, size of the country, existing resource base etc. Priority areas were identified as below:

1. Basic chemicals, pesticides, fertilizers
2. Petrochemicals
3. Pharmaceuticals

The priorities identified were need based. Food production and agricultural development logically receives highest priority in economic development; emphasis

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1/ Cameroon, Egypt, Gabon, Nigeria, Tanzania, Upper Volta.

on social services and public health leads to emphasis on availability of drugs in abundance at reasonable prices for the poor; the availability of petroleum resources in many countries led to formulation of projects for petrochemicals production to provide for supply of consumer goods and rapidly create employment prospects, and for value added exports items.

Forest resources open up prospects for pulp and paper and wood working industries, and in consequence, generate demands for basic chemicals like caustic soda, and resins and adhesives for wood working industries.

African countries are endowed with rich resources in natural gas, crude petroleum in Algeria, Angola, Cameroon, Congo, Egypt, Gabon, Libya, Nigeria, Morocco, Tanzania, Tunisia.

Phosphate rock in Algeria, Angola, Burundi, Egypt, Mali, Mauritania, Madagascar, Malawi, Mauritius, Mozambique Morocco, Tanzania, Tunisia, Upper Volta Seychelles, Western Sahara, Zimbabwe.

Potash in Congo, Central African Republic, Ethiopia, Libya, Morocco, Tunisia.

Iron (Natural Sodium Carbonate) in Kenya and Tanzania, and other minerals.

Despite such rich resources for chemical industries, the present state of development is poor. Imports of chemicals have gone up during recent 10 years from about one billion U.S. dollars in 1968 to nearly 5 billion in 1977. This represents 8.5% of total African imports. Demand for chemicals had increased more rapidly than general development of the economy.

2.3 Population of Countries 2/ with Population Exceeding 10 and 5 Million Each

According to the latest United Nations censeus the total African population as on 1.1.1980 is estimated at 456 million. Of which out of a total of 60 countries, 11 with population of 10 million or more represent 286 million (more than 60% of the total) as below:

	(Rounded off figures) Millions
Algeria	19
Egypt	40
Ethiopia	30
Ghana	10
Kenya	15
Morocco	19
Nigeria	80
Sudan	17
Uganda	12
Tanzania	17
Zaire	27

There are 12 other countries with population 5 millions and above representing 64 millions or 14% of the total. Thus, more than 74% of the people live in the 23 of the 60 countries in Africa.

2/ United Nations Population and Vital Statistics Report.

2.4 MANPOWER CONSTRAINTS FOR CHEMICAL INDUSTRIES DEVELOPMENT

2.4.1 Observations in past studies on chemical industries

One of the major constraints in the rapid development of the chemical industry is availability of adequately qualified and trained personnel and skilled workers. The First Chemical Industry Development Mission 3/ (May-Oct., 1978), the Chemical Task Force 4/ (November 1979), and the First ECA/UNIDO Meeting 5/ of Experts on Chemicals (Nov. 26-Dec. 1, 1979 Addis Ababa) have all identified the constraints, and recommended that priority be given to build up trained manpower for the chemical industries.

2.4.2 Observations relating to manpower by the Chemical Task Force (November 1979)

In their report, the Chemical Task Force 6/ has observed in paragraph 6, as below:

> "Training of skilled manpower is a policy of utmost importance. Inplant training in existing industries, participation of suitably qualified persons in seminars, symposia and workshops organised by the United Nations system, utilisation of United Nations 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."

The Task Force 6/ has suggested - among the strategies - (paragraph 8) "To increase employment" and ... "develop technical manpower and institutions"; and amongst constraints (paragraph 10) the Task Force has identified:

> "Lack of adequate trained manpower at all levels from inception to operation of chemical projects" and goes on to record (paragraph 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 sub-regions not only in the well organised disciplines but also in contracting, marketing, maintenance, etc. Inplant training in existing units, fellowship training using United Nations 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.

The Task Force further amplifies, the constraint of technical manpower as below (paragraph 67 (ii):

3/ Report of the First ECA/UNIDO Chemical Industry Development Programme Mission (May-Oct. 1978) - ECA M 79-757

4/ Report of the Chemical Task Force ECA/INR/CHEM/W.P.1 Nov. 26, 1979

5/ Report of the First ECA/UNIDO Meeting of Experts on Chemical E/CN.14/INR/232 - Dec. 13, 1979

6/ Report of the Chemical Task Force ECA/INR/Chem/W.P.1 - Nov. 26, 1979

The constraints of technical manpower should be solved by a systematic approach to manpower planning, institutions building, training in existing sectors, polytechnics and universities and availing of bilateral and United Nations 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 specialised jobs. Short-term training and up-dating 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.

In respect of higher technical training and research, the Task Force observes (paragraph 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."

The various observations of the Chemical Task Force are indeed significant. These concepts must be given full consideration in detailing any plan for specialised manpower development and training programme.

For the highly specialised reqirement of trained manpower for the Pharmaceutical Sector, the Task Force notes (paragraph 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."

2.4.3 Observation of the ECA/UNIDO Meeting of Experts (Dec. 1979)

The first ECA/UNIDO Meeting of Experts on Chemicals 7/ took note of the observations of the Chemical Task Force. The meeting further reviewed the reports on the chemical industries from the representatives of the various countries, which high-lighted among major constraints.

7/ Report of the First ECA/UNIDO Meeting of Experts on Chemicals. E/CN.14/INR/232 December 13, 1979.

"Lack of Skilled Manpower" and further, "Absence of suitable programmes resulting in under-utilisation of the newly trained entrants in the Chemical Industry". This observation is of particular significance and must be taken note of to ensure that implementation of the specialised manpower development plan are in keeping with the development of the chemical industries in respect of timing, and generally, the number of such trained personnel.

2.4.4 Observations of the First ECA/UNIDO Chemical Industry Development Programme Mission (May-Oct. 1978)

The First ECA/UNIDO Chemical Industry Development Programme Mission 8/ makes the following observation (paragraph 33):

"Non-availability of national qualified manpower seemed to be a typical problem in most African countries. This could act as a serious constraint in their future development programmes. African countries should pay special attention to this problem and develop a cadre of national manpower, suitably qualified and trained in important technical fields."

The first chemical industry mission observes specifically in case of Tanzania.

"Trained and qualified national manpower is a serious problem in the country, and it would be well for the Government of Tanzania to pay attention to the development of this important resource".

The First Chemical Industry Mission makes the following recommendations in respect of qualified manpower problem (paragraphs 102 and 103):

(a) Exploit fully all the possibilities for training, including those resulting from the existing co-operation with leading exporters of pharmaceuticals to the country;

(b) Include in all contracts for pharmaceutical installations or licenses, a firm provision for the training of personnel on production technology, maintenance and quality control at the licensor's facilities;

(c) Utilise the possibilities offered by UNIDO in training of specialists for the pharmaceutical industry, e.g. those held at the University of Ghent, Belgium with the co-operation of Belgium authorities; and

(d) Arrange that at faculties of pharmacy which exist in African countries emphasis is made on industrial aspects of pharmaceutical knowledge (e.g. processing technique, science of mechanics, maintenance technique elements of design work, etc.).

International organisations, especially ECA/UNIDO should intensify their assistance in implementing training programmes, through:

8/ The Report of the first ECA/UNIDO Chemical Industry Development Programme Mission (May-Oct. 1978), ECA M79-757.

(a) Organisation of training centres for individual subregions: Training facilities similar to the first training centre being organised jointly by UNIDO and CEAO should be established in east African subregion up to 1980; and

(b) Procurement of qualified lecturers for training centres for short term courses, faculties of pharmacy, and research institutes. At least 50 specialists should reinforce the training facilities in Africa within the next 3-5 years.

In dealing with the "Development Problem in Africa", the First Chemical Industry Mission observes in respect of manpower as follows (paras. 230, 242, 243, 244):

Lack of operation and maintenance experience in chemical plants: As most African countries are rather new to the field of chemical industry, it is understandable that there is lack of experience in areas relating to the operation and maintenance of chemical plants. As a consequence of this, plant breakdowns and operational problems in plants, were found to be responsible for an appreciable loss of production.

Non-availability of suitably qualified and trained national manpower: This is, of course, a problem which is common to most developing countries in Africa, and the governments of the countries are also generally aware of it. The object of mentioning it here, is just to highlight this problem and to stress its importance and bearing on the industrial development plans of the countries.

Qualified and trained manpower is a very crucial factor in achieving successful implementation of a country's development programmes and the lack of this resource can act as a serious constraint in achieving development objectives. Expatriate assistance is at best a temporary palliative and must be looked upon as such. The permanent requirement of expertise in a country and also its future growth can be met only by training and developing a cadre of suitably qualified and trained persons in the country, in all important fields.

African developing countries should, therefore, pay special attention to this important area of development to ensure the success of their future development programmes.

In respect of petrochemical industries, the First Chemical Mission observes (paragraphs 376, 377):

The present number of highly qualified, specialised and trained personnel working in petroleum refining in African countries and who could potentially be suitable to operate petrochemical plants is not sufficient. Efforts should be intensified to overcome the lack of managerial and technical personnel so as to build up a national cadre of skills for developing the petrochemical industry (as well as other basic industries). The main problem in providing the skilled manpower for the development of the petrochemical industry in African countries is the structure disproportions between graduates supply and demand, which is due to the lack of sufficient specialisation in chemical and mechanical engineering and all kinds of skilled manpower, including graduates of vocetional education institutes. There is also a lack of qualified trainers and adequate training programmes and facilities and institutes.

Thus, the main policies for manpower development aimed at meeting the growing requirements for the development of the petrochemical industry in African countries, should include the following areas of activities:

(a) manpower planning;

(b) co-operation and co-ordination of activities between the petrochemical industry and the educational system;

(c) training policy and development of the institutional training;

(d) assistance of ECA/UNIDO and other United Nations agencies as well as industrialised countries in manpower development.

2.5 Complex and Unique Nature of the Chemical Industry

An understanding of the nature of the Chemical industry is an essential pre-requisite to have a proper appreciation of the level, quality, experience and the skill of the manpower requirements.

The chemical industry is characterised by highly complex, sophisticated technology involving inter-dependant multi-stage operations. The industry is capital intensive, further, large-scale operations are generally the rule in basic chemical industries to derive the economies of scale. As a consequence, in order to derive the optimum return from such large capital outlay, operation of plants at high capacity becomes an essential feature. This is a function of experienced and qualified technical management and skilled operators and maintenance technicians. In other words, in an otherwise well designed and well built plant, this is dependant largely on experience and skill of the men operating the plant. The necessity also imposes an additional burden in as much as a high percentage of highly qualified and experienced personnel become necessary.

Chemical industries use hazardous gases and chemicals; the operations under extremes of pressures and temperatures contribute to additional hazards of fire, explosion and exposure to toxic and poisonous environment. The gassous emissions and liquid effluents require rigid operating controls involving complex technologies for reduction of pollutant levels, and for continuous monitoring and control. These requirements are becoming increasingly important as an essential obligation to society to preserve and protect the environment.

All such requirements on the whole are unique to chemical industries; as such institutional systematic training of qualified personnel becomes inescapable. Of the total manpower employed, a high percentage of highly qualified trained and experienced personnel is generally the pattern.

2.5.1 Special Requirements of Manpower for the Chemical Industries for the Developing Countries

Requirement of institutional and systematic training of well qualified personnel from universities and high level engineering colleges for managers and supervisors, and personnel with good technical and science background for further training for skilled operators and technicians must be emphasised. For developing countries, in particular, this procedure becomes all the more essential as unlike in developed countries, there are no traditions and culture. Young nationals are drawn from families and environment where a career in chemical industries is often unknown. This is in sharp contrast to the chemical factory workers in Germany, for example, where the existing personnel are drawn from families where several generations are often, chemical plant operators and managers.

2.5.2 Training needs and timing for training

Manpower requirements and training needs for a chemical industry in the developing countries must be identified at the early stage of project formulation. Arrangements are also required to be made for early recruitment and systematic institutional training of all such personnel concurrently with the project construction. The plan has to be drawn up such that trained personnel are available on the job towards the end of the construction period and ahead of the initial commissioning operations. The costs of such personnel and training is generally a charge on the capital cost of the project and could amount to 2-4% of the total project capital outlay. In India, for the chemical fertilizer industry personnel had been kept on payroll and provided with systematic institutional training even before the projects are approved and financial commitments are made. Once the project is approved, such training costs are appropriately transferred to the project account. This example is cited here to indicate the importance and the emphasis that is placed on systematic training of manpower. This aspect has been dealth with in more details in part 6.0 of this report.

3.0 BACKGROUND MATERIAL USED IN THIS STUDY FOR ASSESSMENT OF MANPOWER NEEDS AND TRAINING FACILITIES

The assessment of manpower needs and training facilities has been based largely on the studies undertaken by ECA/UNIDO on the plans, prospects and possibilities of chemical industries in the African countries. Specifically the following reports are relevant:

3.1 Reports

(i) Reports of the First ECA/UNIDO Chemical Industry Development Programme Mission (May-Oct. 1978) ECA M79-757;

(ii) Country Report ECA/UNIDO Chemical Industry Development Programme Mission (July 20 - Aug. 8, 1978), Egypt ECA M79-1503;

(iii) Country Report ECA/UNIDO Chemical Industry Development Programme Mission (June 4-13, 1978) GABON ECA M79-577,

(iv) Country Report ECA/UNIDO Chemical Industry Development Programme Mission (June 23 - July 11, 1978) NIGERIA ECA M79-1444

(v) Country Report ECA/UNIDO Chemical Industry Development Programme Mission, TANZANIA (May 20 - June 2, 1978) ECA M79-1443

(vi) Report of the Chemical Task Force ECA/INR/CHEM/W.P.1 Nov. 26, 1979

(vii) Report of the First ECA/UNIDO E/CN.14/INR/232 Meeting of Experts on Chemicals - Dec. 13, 1979

(viii) Integrated Development of the Pharmaceutical Industry in the ECA North African Region M79-716

3.2 Visits to Countries

The Consultant has also visited four countries Cameroon (May 15-17), Nigeria (May 7-14), Egypt (May 3-6), Tanzania (April 29 - May 2) during April-May 1980 and had opportunities to discuss plans and programme of the Chemical industries, and availability of manpower and training facilities.

The consultant obtained general briefing in ECA secretariat between April 18-28; and thereafter, briefly reported during the five days of the Mission May 18-26, 1980.

3.3 Questionnaire issued to countries to elicit information

Manpower profiles and training schedules for the typical African countries for chemical fertilizer industries plans have been drawn up on the basis of the date available in the above mentioned reports and collected by the consultant during the brief mission to some of the countries. Prior to proceeding on mission, a comprehensive questionnaire (Annexure - 1) 1/ along with a statement of project objectives (annexure - 2) were mailed to the governments (through the concerned Resident Representatives of UNDP).

4.0 - COUNTRY REPORTS

4.1 Tanzania

The mission visited Dar-es-Salaam in Tanzania between 29 April and 2 May, 1980. During this brief visit, the mission held discussions with the following:

1. Mr. E.I.M. Hanti
   Head of Training & Technology Development
   Ministry of Industries

2. Mr. Sokolovic' Vojim
   UNIDO Expert with Petroleum and Refining
   Industry

3. Mr. B.J.M. Stedman
   Manpower Adviser to the National Development Corporation
   (From Overseas Development Agency - U.K.)

4. Mr. Saad K. Henein
   Senior Industrial Development Field
   Adviser, UNDP

1/ Annexure - 1 is available in the ECA files; this is to be annexed to the Report in appropriate place.

The mission also met Dr. F.S. Mujuni, Director, Division of Industrial Operations, Ministry of Industry. The mission was not able to meet Mr. B.S. Mochomvu, Senior Industrial Officer, Ministry of Industry, as he was away in Mexico.

4.1.1 Chemical Industries and Related Activities under Planning

Natural Gas

Tanzanian Petroleum Development Corporation has established proved reserves of 20-30 billion cubic meters of natural gas off-shore in two wells near Sango Sango island, 30 km from the coast at Masoko, which is 300-350 km south of Dar es Salaam. Exploration contracts have now been terminated, and a new exploration contract is proposed to be given for confirmation of reserves for two drillings in the two proposed wells under a World Bank financed project. The estimated cost of development of the gas field for the two wells including cost of pipe lines to the shore is about 100 million US dollars. The gas price has been computed at US$1.5 per 1000 standard cubic feet at Dar es Salaam. The gas is more than 94% methane, and the rest higher C_2/C_3 hydrocarbons. There is no CO_2 and nitrogen content is low, and the sulphur content is exceedingly low (less than 100 ppm of sulphur).

Petroleum Refinery

There is an existing petroleum refinery with 750,000 tonnes per year of crude through-put capacity. This is a joint venture of Tanzanian Government (50%) with Agip (ENI) of Italy (50%). The refinery is proposed to be expanded to 1.8 million tonnes per year, i.e. an additional one million tonnes crude through-put for the production of traditional petroleum products.

There is no petrochemical industry. The Government is giving attention to the importance of establishing a petrochemical industry. A project for the production of PVC has been included in the Five Year Plan. The ECA/UNIDO Chemical Industries Development Mission (May 20 - June 2, 1978) had estimated the 1977 consumption at 6,910 tonnes for rigid pipes, shoes, and other miscellaneous uses. The consumption of polyethylene (LDPE and HDPE) is 2,200 tonnes (1977) and polypropylene 689 tonnes.

These quantities are too small to consider installation of a major olefine complex from petroleum resources.

Natural Gas Utilisation

Plans for utilisation of natural gas call for production of ammonia. There are no plans for methanol or Oxo-alcohols production.

A comprehensive study has been completed by Swedish interests to set up a fertilizer plant as below:

Ammonia	1150 metric tons per day
Urea	1750 metric tons per day

20,000 - 25,000 tonnes per year of ammonia is proposed to be supplied to the existing fertilizer plant at Tanga to replace imports. The total estimated cost of the fertilizer complex, inclusive of all on-site facilities has been placed at US$ 400 million. The proposed capital structure envisages 30% Swedish equity participation and 70% Tanzanian Government but this has, until now, not been discussed with the Tanzanian Government authorities. Loan financing arrangements are still open. The intended time schedule calls for establishment of production by 1985 at about 70-75% of rated capacity. The plant is proposed to be located either at Masoko (30 km off-shore from the gas fields) or at Dar es Salaam, about 350 km away from Masoko. The plans also call for deputing 300-350 persons on training abroad.

The present level of consumption of Nitrogen fertilizers in Tanzania is 20,000 - 25,000 tonnes Nitrogen, but the present consumption is restricted due to inadequate supplies and dependence on imports. The estimates indicate the consumption to go up to 66,000 tonnes Nitrogen by 1985, and 87,000 tonnes by 1990, against the likely production capacity of 225,000 - 240,000 tonnes Nitrogen per year. The project is being planned with the export market in view.

The manpower profile and the total manpower requirements for typical fertilizer projects for operation in a developing country has been given in Annexures 3 and 4. These manpower estimates are substantially higher than would normally be planned for a similar factory in a highly industrialised developed country. It is based on the experience of developing countries manning of fertilizer plants, such as those in India. For a variety of reasons, many of the plants in India are manned liberally. Apart from other factors, a liberal manning takes care of possible wastage due to rapidly expanding opportunities of trained manpower in a developing country. The attainment of levels of skill after training period is also not uniform; a significant percentage normally does not always come up to the requirements of job. Newness of the operations in isolated environment with often inadequate infra-structure facilities calls for providing more training manpower for operations and maintenance than what are normally practised in the industrialised developed countries.

Phosphate Rock

In 1979-80, the actual import of phosphate rock from Jordan to operate the existing phosphoric acid plant in the fertilizer complex at reduced load due to various reasons is 20,000 tonnes, the 1980-81 imports are placed at 60,000 tonnes of rock at an estimated cost of 35 million Tanzanian shillings (1 US$ = about 8 T. Shillings).

Deposite of phosphate rock have been established at Minjingu in the Arusha region. According to a statement in the Tanzanian Parliament (Daily News 16th April, 1980 - Dar es Salaam), Government has now decided to exploit the phosphate rock deposits which will be used by the Tanzanian Fertilizer Company. Negotiations are reported to be currently on between Stamico and a Finnish Company (Kowe) for mineral exploitation.

Pharmaceuticals

During the last ten years, considerable empahsis has been placed for the development of the pharmaceutical industry. In 1978, there were three manufacturing

enterprises, and one vaccine institute. The industry in 1978 could be considered to be in an infant stage.

However, the Tanzanian Government have decided to establish a modern pharmaceutical plant in the country. A feasibility study has been completed by a Finnish company by end 1975. An agreement has been signed between the Finnish Company and National Development Corporation of Tanzania. The agreement provides for the Finnish company to provide the technical know-how and detailed designs.

The production programme for the pharmaceutical formulations has been identified. It includes a wide range, and the capacities of each have been determined. The factory is to be located at Arusha.

The following man-power needs for the factory have been envisaged:[1/]

	1st Year	6th Year
Technical	46	51
Administrative and Clerical	41	42
Labour	85	170
	172	263

The initial number of 11 ex-patriates is planned to be reduced to 4 by the 6th year.

The Finnish company (Orion) is reported to be training managers and technicians.

Through the good offices of UNDP in Dar es Salaam, the mission had an opportunity to meet Mr. B.J.M. Stedman, Manpower Adviser of the National Development Corporation, from the Overseas Development Agency of the Government of U.K. Mr. Stedman had been an adviser on Manpower Planning to the Ministry/National Development Organisation, and more particularly concerned with the Director of Manpower Planning and Development Division. Mr. Stedman's observations (Feb/Jul., 1979) on Tanzanian experience indicate an ever increasing shortage of skills and inability of the existing formal training institutions to meet the demand. This experience is not unique as this had been the case in the developing countries and in many instances, in the developed countries. It has been well recognised that to meet the demands of the industry, a formal education of the univerwity is not always adequate. A second spell of induction training becomes essential for industry to supplement the academic background that the individual had acquired in the university/technical institutions. An industrial training institute designed to cater to the specific needs of the specific industry is thus called for. In other words, a training institute established for training managers, and engineers

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1/ ECA/UNIDO Chemical Industry Development Mission Report on Tanzania, ECA 79-1443.

for the fertilizer industry is not suitable for one designed for training of technicians for automobile industry; even within a chemical industries group, training needs and emphasis differ and, therefore, the training institute has to develop expertise in a specified field. The faculty of the training institute is also provided accordingly.

Mr. Stedman's preliminary findings indicate manpower requirements of a total of 1,500 management, technical, technician and skilled artisan grades of personnel for 1979-83. The details are given in Annexure 5. The training needs and the periods have also been summarised in a note in Annexure 6. The Manpower Planning and Development Division can effectively provide the functions related to manpower planning and development. The policies, strategies that are required for manpower planning are outlined in Section 7. A critical review of the features presented in Section 7 might be useful to the manpower planning and development division of the National Development Organisation in Tanzania.

4.2 Nigeria

4.2.1 The mission visited Lagos, Nigeria between May 7 - 14, 1980. Discussions were held with the following:

1.	Planning and Policy Division Ministry of Industry	Mr. Durojaiye, Under Secretary (Mr. Obero, Dy. Secretary was on tour)
2.	Chemicals and Pharmaceuticals Division, Ministry of Industry	Mr. F.A. Adun, Officer-in-Charge of the Division Mr. S.C. Iwichukwu Senior Asst. Secretary (Mr. C. Nwaeku, Dy. Secretary was on tour)
3.	Investment Information and Promotion Division, Ministry of Industry	Mr. Lawal, Asst. Director Mr. Eddy E. Nwaezeapu Under Secretary
4.	Projects Implementation Division, Ministry of Industry	Mr. R. Adeyeye Fertilizer Project
5.	Pulp & Paper Division, Ministry of Industry	Mr. J.O. Ajibole Under Secretary
6.	Nigerian National Petroleum Corporation	Dr. E.I. Onyia Manager, Projects and Engineering Division
7.	UNDP	Mr. Wolfgang Scharms Junior Professional Officer

4.2.2 Fertilizer Project

4.2.2.1 Nigeria's plan to set up a fertilizer plant has made significant progress. As on May 12, 1980, the negotiations for Engineering, Procurement and Construction (EPC) contract are in progress, and expected to take a final shape within one week. The contracts are expected to be finalised within 4-5 months thereafter.

The negotiations for management contract in order to arrive at a management agreement will take place immediately after the current negotiations on EPC are concluded.

4.2.2.2 Under the contemplated arrangements, a U.S./Japanese consortium comprising of M.W. Kellogg, International Minerals and Chemicals Corporation, both of USA, and Kawasaki of Japan, is involved in the following manner.

I. EPC contract will be principally the responsibility of Kellogg and Kawasaki; the contract involves a lumpsum fixed fee for engineering and project management services, and all off-shore supplies. Kawasaki apparently will be the vendor for off-shore supplies including high pressure boilers and heat exchangers etc. They will also co-ordinate supplies of other off-shore items, e.g. compressors, convertors, etc. All local supplies and costs are on reimbursable basis. The contract is to be completed in 32 months.

II. There will be a management agreement with the consortium, in which presumably IMC will have the principal role to play.

III. The US/Japanese consortium will take 30% of equity, and 70% will be held by the Nigerian Government.

4.2.2.3 The total estimated cost of the project is U.S.$500 million; the Ex-Im Bank will provide the loan financing, and perhaps co-financed by Japanese loan.

4.2.2.4 The plant is based on Natural gas. It will be located at port Harcourt. The plant capacities are:

Ammonia	1000 metric tons/day
Urea	1500 metric tons/day
NPK (19-19-19) 28-28-8 etc.	1000 metric tons/day

Kellogg technology will be used for Ammonia; urea plant will be based on stamicarbon technology and Jacob Engineering are entrusted with the NPK project. IMC will supply the intermediate phosphate material, possibly phos acid/MAP.

4.2.2.5 Marketing studies have earlier been done by IFDC. The product pattern and NPK formulations and grades have been based on the advice of the Nigerian Ministry of Agriculture.

4.2.2.6 The project authorities expect to have expatriates from developing countries. A senior management team is expected to tour several countries to find out the prospects.

4.2.2.7 If everything goes well as planned, the project should become operational in 42 - 48 months from now or say, early/mid 1984.

4.2.2.8 A typical manpower profile, and total manpower requirements are given in Annexures 3 and 4. This has been drawn up for conditions of operation in a developing country. The numbers are significantly higher than what might be the practice in industrialised developed countries.

Experience has shown that there are many factors which lead to a different pattern of manning in developed countries. The proposed manpower profile and manpower requirements are derived from actual experience of operation, maintenance and materials management of similar plants with similar technologies that are being built in Nigeria.

4.2.2.9 Manpower Planning: Recruitment and Training

Planning for provision of required manpower for the project involves timely recruitment and training. The project schedule calls for the plants becoming operational by early/mid 1984. It, therefore, becomes necessary to plan training of manpower in such a manner that the personnel at different levels are available for induction, on the job training and assuming responsibility for the duties appropriate for each and at the time required.

Broadly, speaking, the top management and technical personnel could be classified as below:

1.	General Manager/Dept. Heads Chief Engineers/ Chief Chemist	Top management
2.	Plant managers/Plant Engineers	Middle Management
3.	Foreman/General Foreman	Senior Supervisory Level
4.	Assistant Foreman/Chargeman	Junior Supervisory Level
5.	Production Operators/Chemists	
6.	Maintenance Technicians	
	6.1 Instrument Technicians	
	6.2 Mechanical Maintenance Technicians	
	6.3 Welders	
	6.4 Electricians, etc.	

General Manager is the Chief Executive for full time responsibility for continuous supervision of all activities and ensuring compliance and implementation of all policy guidelines and directives laid down by the Board of Directors. He is assisted by a Deputy and ten Departmental Heads as follows:

1. Chief of Production Division
2. Chief of Maintenance Division
3. Chief of Technical Services Division

4. Chief Chemist, inclusive of Quality Control and Environmental Protection

5. Chief of Materials Management - Purchase, Stores, Product Despatch, and Transport Co-ordination, Materials Handling and all Procurement functions

6. Chief of Finance Division

7. Chief of Marketing Division

8. Chief of Personnel and Industrial Relations

9. Chief of Public Relations Division

10. Chief of Manpower Training

As far as possible, the General Manager should be recruited and should assume the position of responsibility as early as possible, and preferably as soon as a conclusion in principle is reached on the investment decision. From then on, the General Managers should be the central, key officer to co-ordinate all activities with various concerned authorities, and under appropriate guidance and direction. For the Nigerian project, this stage had already reached, as in May, 1980. It would be advisable, therefore, to identify the individual now and name him for the post and put him in responsible position. It is likely that such a person has already been identified and assigned the task to co-ordinate the activities although he might not have been named as such.

As far as possible, the four Departmental Heads, viz.

Chief of Finance
Chief of Production (Chief Chemical Engineer)
Chief of Maintenance (Chief Mechanical Engineer)
Chief of Manpower Planning

should be recruited immediately thereafter. The Chiefs of Finance, production and maintenance should be associated as active participants in all contract negotiations.1/

1/ It is possible that initially for a period of one to three years or so, counterpart expatriates might be appointed as Chiefs of Production and Maintenance. In that event, the nationals who are intended to assume the responsibility on permanent basis, should be recruited and asked to participate in the contract discussions. Expatriates are not required at the stage of contract negotiations - and obviously, will only be appointed much later in the project construction stage. However, selection of those personnel is indeed very critical, and advise of appropriate expatriates/consultants should be sought in evaluation of the background of the likely candidates for these two very critical jobs prior to their selection for the posts.

The Chief of Manpower Training should be recruited more or less concurrently with the contract negotiations and should be in position by the time the contract has become effective. It would be advisable to recruit an expatriate with appropriate experience of successful operation and maintenance of similar fertilizer plants from a developing country. It is important to emphasise this essential pre-requisite as the experience of developing countries for a continuous period of about 10 years or so in responsible position is indeed relevant for this position. The Chief of Manpower Training, and his counterpart expatriate (as adviser) constitute the key personnel for successful recruitment and training of manpower for the project. The Chiefs of Production and Maintenance will participate in the recruitment of personnel, formulation of training schedules, and evaluation of performance during the training period along with the Chief of Manpower Training (and the counterpart expatriate).

Within 3-6 months from the effective date of the contract (this shall from now on be referred to as the zero date of the project), the second group of key personnel-in the level of Chiefs - should be in position. These are the -

Chief of Technical Services
Chief Chemist
Chief of Materials Management

These six key personnel, viz. Chiefs of Production, Maintenance, Manpower, Technical Services, Chief Chemist, Materials Manager or as many of them as are recruited by then and inclusive of the General Manager as far as possible preferably as one group (failing which in not more than two groups) should visit at least four similar successfully running organisations in at least two developing countries and similarly, four such plants in two industrialised developed countries. Each of these visits should be for a period of at least two weeks in the developing countries, and at least for half week each (say 3 working days) in the developed countries. The visits to the developing countries should take place first, and thereafter to the developed countries. This will involve 12-15 weeks of a study tour in four to five countries by the top technical management team. This study tour is intended to give the team a broad experience of the problems of managing on enterprise of the type that they will be called upon to handle. It is important that the study is undertaken preferably as a team or at worst, in two teams. Institutional expertise could be absorbed most effectively when the different heads of divisions meet their counterparts as teams in joint meetings and thereafter, individually to seek further details. The management style and philosophy could also be absorbed by the visit of the team as such. It is not possible to absorb these by six different visits by six persons on six different occasions. It is also not always practicable to organise an effective programme by the management of these undertakings if many visits are planned by the same institution.

For Nigeria, the visits to the developing countries might be to Egypt (or Indonesia) and India, and to the developed countries to U.S.A. and either in some European country or Japan. In selecting the specific plants in these countries, as far as possible, visits should be undertaken in similar plants with similar capacities, and adopting some technologies, and as far as possible, similar key machinery and equipment.

This 12-15 weeks study tour will give this management team a first hand orientation to the tasks ahead of them. It will equip them to understand and appreciate the follow-up steps that are required to develop the organisation and build up manpower systematically. Subsequently, it will be necessary for the individuals to visit one or more of these plants for a more detailed study during the second or the third year of the project construction phase. The Chief of Manpower Training, however, might have to visit at least one typical model of a Training Institute for in-plant training for a more detailed exposure and study of the facilities required, type of curricula to be developed, the type of training aids and instructional manuals, and background experience of the faculty members of such a training establishment. The major fertilizer factories in India have developed excellent training facilities in the Training Institutes which are part of the factory and under the management of the General Manager of the factory. It would be advisable to visit some of these training institutes in India.

The task for detailed manpower planning and systematic recruitment and training should begin from the sixth month of the zero date of the project. By this time, the top management team should normally have come back to the Headquarters after the study tour and is in a position to exercise their judgement more effectively as to the requirements of manpower, and their training needs.

The recruitment and training for the middle management (Plant Managers; Chemical Engineers, Plant Engineers - for Maintenance Mechanical, Electrical and Instrumentation) and senior supervisory level (viz. General Foreman and Foreman) should be taken up. Their recruitment should take place between 6-10th month of the zero date, and their training period should start from the 9th to the 24th month of the project schedule.

The total number of Managers and Supervisors might be as below:

	Plant Manager	Plant Engineer	Foreman/ General Foreman
1. Ammonia plant	1	1	4
2. Urea plant	1	1	4
3. NPK plant	1	11	4
4. Water treatment (technologist)	1		
5. Utilities: Steam/power generation	1	1	4
6. Materials handling	1		4
7. Mechanical maintenance	-	2	3
8. Electrical maintenance	-	1	2
9. Instrument maintenance	-	2	3
	6	9	27

The total number works out to 42. Of these, the personnel to be trained plant-wise are as below:

1.	Ammonia plant	6
2.	Urea plant	6
3.	NPK plant	6
4.	Water treatment (technologist)	1
5.	Utilities - steam/power	6
6.	Bagging	6

The 4 instrument maintenance personnel are to be trained in all the plants; their time roughly could be subdivided into:

Ammonia plant	65% of the time
Urea plant	20% of the time
NPK plant	10% of the time
Others	5% of the time

The electrical and mechanical (general) maintenance personnel might be trained in all the plants.

The personnel could be divided into:

Group	I	Ammonia plant personnel	6	
		Water treatment technologist	1	
		Instrument	3	11
		Mechanical maintenance (Foreman)	1	
Group	II	Urea plant personnel	6	
		Instrument	2	9
		Mechanical maintenance (Foreman)	1	
Group	III	NPK plant personnel	6	
		Bagging plant	2	9
		Mechanical maintenance	1	
		(Foreman)	1	
Group	IV	Utilities: Steam and power	6	
		Bagging	3	
		Mechanical maintenance (plant engineer)	1	13
		Electrical maintenance	3	
		Total		42

Group - I should spend 9 months in two Ammonia plants and 3 months in one urea plant.
Group - II should spend 9 months in two urea plants, and 3 months in one ammonia plant.
Group - III should spend 9 months in two NPK plants and 3 months in one urea plant.
Group - IV should spend 9 months in two plants.

As far as possible, the fertilizer factory for training should be as chosen as to represent more or less the type of plant that is to be built in the Nigerian complex, i.e. the fertilizer complex should have -

1. Ammonia plant
2. Urea plant
3. NPK plant

At least one such complex could be chosen for training of all the Groups I, II, III and IV.

4.2.2.10 Manpower Profiles for Different Stages of Fertilizer Project

Manpower requirements are different during the project stage and during the normal operation phase. The types of organisation and attitudes and approaches of the management for the two different spheres of activities are totally different. It is important to appreciate this in order to ensure success of the project. Accordingly, the organisations are to be developed in terms of manpower needs, skills organisational pattern and structural relationships etc. for the project phase as different from the one in the operational phase.

In Annexure 4 a typical model of ammonia and urea complex for the project stage has been given. The annexure provides the basis for the organisational needs. In other words, the scope of the work and responsibility for the success of the organisation are to be carefully delineated and the organisation manned and structured accordingly. It is important to critically evaluate these assumptions to interpret the organisation that has been suggested for the project implementation phase.

In Annexure 4A an organisational pattern has been given for the manpower requirements for the project in the operational stage. The basic assumptions have also been spelt out in the annexure and the number of staff that ought be provided are to be interpreted in the light of these assumptions. It is important to particularly appreciate that the manpower requirements and the manpower profile will vary from plant to plant even for the fertilizer plants. There are a large number of variables involved which are to be taken into account in determining the manpower requirements. Each case has to be analysed separately and for its specific requirements. To illustrate, manpower profiles for four typical fertilizer plants have been compared in annexure 3. These four different complexes vary in product pattern, in technology, in the number of equipment that are available, relation to the infrastructure facilities that are available to each facility, etc. etc. The manpower requirement has, therefore, varied between 713 in one case to 1957 in another. These figures are only illustrative to indicate the complexities that are only illustrative to indicate the complexities that are involved in formulating the specific manpower plans for each factory. Section VII describes considerations relating to strategies to build manpower for chemical industries towards attainment of self reliance and to reduce in the short run, dependence on expatriates and eliminate them in the shortest possible time.

4.2.2.11 Status of Pharmaceuticals Project

Although there were expectations that this sector might expand during the plan period 1975-79, in actual fact, there was hardly any progress. Presently, 90% of the pharmaceuticals requirements are being imported, and the remaining 10% is being imported by some local industries and joint ventures, and practically only tablet making and packing operations are being done in Nigeria.

A report on the pharmaceutical industry has recently been completed by the Nigerian Institute for Social and Economic Research (NISER). This report is under the consideration of the government (May, 1980). The Government has given very high priority to this sector - and a decision on this report is likely to be taken early. There are indiscriminate imports and the Government has expressed concern. The multi-nationals from the developed countries are currently showing interest in new projects in Nigeria but specific decisions are only expected after a view on the report is taken by the Government. The report envisages production of antibiotics, and general purpose drugs, dressings and hospital requirements.

4.2.2.12 Status of Pesticides Industry

The present requirements are based on imports. There are some minor formulation facilities.

4.2.2.13 Plywood Industry

Two woodworking industries were being set up with Rumanians as joint venture partners (with 10% equity). The equity contribution is being made with raw materials required for the plywood, e.g. adhesives.

The internal demand for plywood is expanding fast and there is scope for setting up additional units. There are no problems for the supply of timber.

4.2.2.14 Pulp and Paper Industry

Three factories are being set up; of which one is in operation with a small capacity and this factory is being expanded. Two others are currently under construction.

4.2.2.15 Status of Petrochemical Industry

Details of planned petrochemical complex are given in annexure 7. The progress on the planned petrochemical complex as reported by the ECA/UNIDO Chemical Industry Development Mission consequent on a visit to Nigeria in July, 1978 has not been adequate. Nigerian National Petroleum Corporation (NNPC) who are entrusted with implementation of this project had been busy in planning expansion of the refining industry. Apart from the refinery at Port Harcourt (3 million tonnes per year through-put), two additional plants are under construction, each of 5 million tonnes per year capacity, and located at Warri and Kaduna.

Discussions with NNPC top executives revealed that the petrochemical complex, including olefine crecker and down-stream units, would be taken up for implementation by end 1980/early 1981. The plans include an ethylene plant (250,000 tonnes per year) to be expanded to 350,000 tonnes per year), a PVC plant (90,000 tonnes per year), LDPE plant (120,000 tonnes per year) and HDPE plant (60,000 tonnes per year). There are also projects contemplated for arometics for production of base materials for synthetic fibres, particularly polyester.

Technical Manpower: According to an ECA study 1/ Nigerian economy employed over 20,000 expatriates in 1974 and the number appears to be increasing. The National Manpower Board had made a study of the status of Engineers in Nigeria in 1977, inclusive of the vacancies in various disciplines of engineering and the expatriates employed. This study indicates a large number of vacancies in practically all disciplines of engineering - annexure 9. Basic facilities for production of engineers appear to be inadequate in Nigeria and further expansion of the capacity is called for. There are educational facilities for -

- Degree level at universities for engineers;
- Diploma level in polytechnics, and
- Craftsman level in trade schools and vocational centres for training of skilled workers

Diploma level courses appear to be expanding. To illustrate, Sokoto State College of Technology at Brinin Kebbi in Nigeria has expanded facilities for Diploma level facilities as below:

Civil Engineering and Building Technology

1. Diploma in civil engineering
2. Diploma in building technology
3. Final certificate in construction technology
4. Intermediate certificate in construction technology
5. Intermediate certificate in land surveying

Mechanical Engineering

6. Diploma in mechanical engineering
7. Intermediate certificate in mechanical engineering

Electrical Engineering

8. Diploma in electrical engineering
9. Final certificate in electrical engineering
10. Intermediate certificate in electrical engineering

Agricultural Mechanisation and Irrigation Engineering

11. Diploma in agricultural mechanisation
12. Diploma in irrigation engineering
13. Certificate in agricultural mechanics
14. Certificate in irrigation engineering

1/ Dr. M.K. Khanijo's report, October 79/Feb. 80.

Material Science Division

15. Certificate in soils and concrete testing

Technical Education

16. Nigerian certificate in Education

Business and Management Studies

17. Diploma in Business studies
18. Diploma in accounting

Nigerian National Petroleum Corporation (NNPC) has developed in-plant training facilities for petroleum refining industry. Plans call for expansion of these facilities for petrochemical industries. A petroleum training institute has been set up at Warri for training of skilled operators and technicians. Nearly 700 operators and technicians have been trained in the operating refinery for the new refineries. The Petroleum Training Institute is separately managed and is intended for training of skilled technicians for the refineries and petrochemicals. No provision has been made for training of managers and supervisors.

The training of managers and supervisors is intended to be done in two ways. First, there will be provision in the contracts for (i) technology supply and engineering; and (ii) for major equipment supply for training of personnel.

Besides, there might be management agreement with operating companies for training of personnel.

Nigerian government has appreciated that technical and management support to indigenous business is essential for their development. A number of institutions have been established which Nigerians can make maximum use of. For instance, there are the Industrial Training Fund (ITF) which is responsible for promoting and encouraging the acquisition of skills in industry and commerce with a view to generating a pool of trained indigenous manpower sufficient to meet the need of the economy, and the Centre for Management Development, which is charged with formulation and execution of policies on management education, training and development. A list of management and skills development institutes in the country is at annexure 8.

In-plant Training: Besides, the Petroleum Training Institute at Warri, the National Electric Power Authority has provision for training the personnel required by the Power Authority in the commercial, distribution, engineering and operations divisions.

The two year training programme is a multi-disciplinary induction course, comprising of mechanical maintenance, electrical maintenance, power-line maintenance, protection, control, metering and basic management sciences. Traineees are attached to the various divisions in rotation. Outstanding trainees are also provided opportunities for overseas training.

The pre-requisite for entry is university degree or higher technician diploma in:

Mechanical engineering
Electrical/electronic engineering
Civil/structural engineering

However, training facilities for training manpower for the massive fertilizer plant that is being contracted, until now, have not been specifically created. The authorities are fully appreciative of the needs for setting up of facilities for training manpower for the fertilizer industry. In this context, Nigerian authorities might be well advised to review facilities of training in other developing countries, e.g. Egypt, India, Indonesia, and come to agreement for providing training facilities in well organised aspects in any of these countries and depute suitably selected Nigerian candidates for extended training in such facilities. Apart from this, it would also be desirable to consider to enter into a contract with any organisation which has extensive training facilities (e.g. the fertilizer plants in the public sector in India). Such a contract should provide for establishment of training institutes on the lines described in Section 5 of this report. The contract services for establishment of the training facilities might include:

1.0

- 1.1 Design of physical facilities
- 1.2 Design of workshops
- 1.3 Design of laboratories
- 1.4 Design of simulators

2.0 Preparation of Training Manuals

- 2.1 Operation
- 2.2 Instrument
- 2.3 Mechanical
- 2.4 Electrical

3.0 Design of Chemical Control Manuals

- 3.1 Sampling
- 3.2 Analytical methods
- 3.3 Instrument analysis, calibration
- 3.4 Pollution monitoring system

4.0 Development of Training Curriculum

- 4.1 Engineers
- 4.2 Supervisors
- 4.3 Operators
- 4.4 Instrument technicians
- 4.5 Technicians

4.3. Egypt

4.3.1. The mission visited Egypt between 4 and 6 May 1980 and met the following:

1. Mr. Salah Roushdy
   Chairman of Board
   Chamber of Chemical, Cosmetics
   and Pharmaceuticals Industries

2. Mr. Saad E.I. Imam
   Director
   Head of Chemical Projects Dept.
   General Organisation for Industrialisation

3. Eng. Fouad Gabriel
   Director General of Training Centre
   (appointment fixed but later cancelled)

4. Mr. Prem Bhatnagar
   Project Manager
   Central Metallurgical Research
   and Development Institute

5. Mr. AshafShams-el-Din
   Project Officer
   UNDP

4.3.2 Egypt in North Africa is well advanced in industrial development and in manpower planning and training. In the chemical industries, more particularly in the fertilizer industry, Egypt has been operating major fertilizer plants since early 1960. In recent years, two modern fertilizer complexes have gone into production at Abuquir and at Talkha. In phosphatics, Egypt has a plant in operation at Abu Zaabal which is planned to be expanded by installation of a Triple Superphosphate plant. Extensive new deposits of phosphate rock identified at Abu Tartur have to be developed over a period of next 6-7 years.

Egypt is expected to be self-sufficient in fertilizers, both nitrogenous and phosphatics, in the next 4-5 years. No further nitrogen fertilizer plants are contemplated.

4.3.3 Petrochemicals: Although plastic processing facilities have been developed both in the public and private sectors, Egypt, until now, has no major petrochemical industry. There are plans to manufacture petrochemical products like PVC and polyethylene; initially, the projects might be based on imported ethylene, but discussions on this have not been finalised. Similarly, PVC production is contemplated with imported (VCM) Vinyl Chloride Manomer.

4.3.4 Pharmaceuticals: The domestic market for pharmaceutical products might be the biggest in the middle east. The Chemical Industries Mission (ECA/UNIDO Mission) reported a total consumption of pharmaceuticals in Egypt alone in excess of 100 million $ in 1975. More than 80% of the pharmaceuticals consumed in 1975, however, were formulated from imported and locally produced bulk pharmaceuticals. Production, control and administration of the industry, inclusive of drug administration, has been well developed in Egypt.

The pharmaceutical and related industries in the public sector in Egypt is represented by 9 State owned companies.

4.3.5 Technical Manpower

In Egypt, there is a highly qualified body of scientific and technological personnel (Annexure 10). The manpower available comprises pharmacists, chemists, technicians, skilled labourers as well as workers who could be employed efficiently in the pharmaceutical industry. Similarly, there is adequate manpower for the fertilizer and the plastic processing industries. In effect, the production of graduate engineers in Egypt appears to be in excess of the requirements that the industrial expansion within Egypt could conveniently absorb.

A training institute for chemical industries in general but largely for the fertilizer industry is being built at Talkha. The World Bank is assisting the setting up of this institute with a loan of US$ 1 million. The institute is, however, not a part of the management of the Talkha fertilizer factory. There is no training institute established at Abuquir factory.

The training institute, for the fertilizer industry, when developed, could provide a suitable facility for training of operators and technicians for the fertilizer industry in the African region. It might be desirable to review the scope of the training institute and the facilities that are being provided with some institutions that have been established in other developing countries such as those in India. The training institute model outlined in Section 5 might also be studied to review if the facilities that are being developed conform to the model outlined in Section 5.

4.4 Cameroon

The mission visited Cameroon between May 15 and 17, 1980. The mission met the following:

1. Mr. Seunkam Rqugois (Follow up of Programme General Organisation
   Deputy Director for Scientific and Technical Research)

2. Mr. Oyono Jean-Marc
   Ingenieure, Statistician Economist
   Direction de la Planification
   Ministry of Economic Planning (MINEP)
   Yaounde

4.4.1 Cameroon is a young republic. The Planning Commission of Cameroon has set its objective to transform Cameroon's own materials into useful products. Natural gas has been found near Douala. A fertilizer plant has been recently started but there are a number of problems. There is also a tyre factory near Douala. The Planning Commission is also deeply concerned with health problems and the newer type of tropical diseases that are existent in the republic. Cameroon is largely an agricultural country and exports rubber, coffee, cocoa and cotton. The Planning Commission is conscious of the systematic development of training facilities to provide manpower for the industry. Of the new major industries planned are:

(i) Caustic Chlorine Plant
Pesticides Formulation Unit and later integrated for production of active materials

(ii) Restarting of fertilizer plant

(iii) Urea Formaldehyde and Phenol Formaldehyde type of resins and for use as adhesives

The consultant constituting the mission had the background experience for the development of training institute for fertilizer industry. Such training institutes have proved quite effective for training of managers, technologists, engineers, technicians, craftsmen and for commercial establishments. A model of the training institute that is being described below is adopted from a successfully run training establishment as part of a major fertilizer complex in India.

The activities of the Training institute might be divided into three fields:

(1) Apprentices Training - For new employees at the operator/technician, supervisory and junior executive level;

(2) Staff Training - For existing employees in the form of:

(i) Theoretical classes in the evening, up to the standard of the degree course,

(ii) Development courses for all categories of employees; and

(iii) Refresher courses.

(3) Training facilities to:

(i) Educational institutes,

(ii) Other industrial organisations.

The following table provides the details of various training activities.

A. APPRENTICESHIP TRAINING

	Category	Basic Qualifications	Period of Training	Post Offered at the end of Training
1.	Jr. Executive Trainees (Technical) (Commercial) (Administration)	B.E. in chemical, mechanical, electrical, or instrumentation, M. Com., M.B.A., M.A. (Economics) etc.	2 years	Junior Engr. Junior Officer
2.	Senior Technician/ Operative Trainees	Diploma in mechanical, electrical, chemical, instrumentation or B.Sc.	3 years	Senior Technician/ Senior Operator
3.	Craftsman Trainees	S.S.C./Matric with Science and Maths	2 years	Technician Operator Gr. II

B. APPRENTICES UNDER THE ACT

Category	Basic Qualifications	Period of Training	Post Offered at the end of Training
1. Engineering Trainees	Degrees in mechanical, chemical, electrical or instrumentation	1 year	-
2. Technician Trainees	Diploma in mechanical, electrical, instrumentation or chemical	1 year	-
3. Trade Apprentices	S.S.C. with Science and Maths	3 years in case of Fressher. 1 to 2 yrs. for I.T.I.	Technician/ Operator Gr. III

C. FOR OTHER ORGANISATION

Category	Period
1. Engineers/Officers/Supervisors	As desired by the sponsoring organisation
2. Operator/Technician	

D. DEVELOPMENT COURSES

I. Short Term Courses

	Category	Internal Training	External Training	Total
1.	Non-supervisory	2 weeks		2 weeks in a period of 3 years
2.	Supervisors	3 weeks	1 week	4 weeks in a period of 3 years
3.	Middle managers	4 weeks	2 weeks	6 weeks in a period of 3 years
4.	Senior managers	2 weeks	6 weeks	8 weeks in a period of 3 years

II. Career Development Classes

	Course	Qualifications for eligibility	Period	Equivalent to	No. of increments granted on passing
1.	Pre-basic	Non-matric	1½ years Approx.	Matric/S.S.C.	1
2.	Basic	Matric/pre-basic	1½ years Approx.	I. Sc./B.Sc. Part I	1
3.	Advance	Basic/I.Sc./ B. Sc. Part I	1½ years Approx.	B.Sc./Diploma	1
4.	A.M.I.E. (India) A.M.I.I.	Advance (Mech) (Elec), (Inst) (Chem)	1 to 3 years	B.E. (Mech) (Elec) (Inst), (Chem)	2
5.	I.C.W.A.	Intermediate	3 years		2

The Training Institute has to be equipped well with training facilities such as class room, drawing hall, conference hall, assembly hall, etc.

The various facilities for training may be given under the following categories:

(A) Workshop: The Training Institute has to be equipped with workshop for the following trades:

(i) Fitters
(ii) Welders
(iii) Machnists
(iv) Electricians
(v) Instrument mechanics

(B) Audio-Visual Aids: The Training Institute might provide film projectors, a film strip projector, a slide projector, an overhead projector, epidiascope and various materials for better understanding of equipments and processes. The institute should be equipped a large number of films and film strips not only on technical objects but also on managerial topics. The institute might develop slides for understanding of the maintenance and operation of critical equipment.

(C) Library: The Training Institute must possess a library which should have adequate number of books on engineering, technology and management subjects. The library should have adequate capacity to seat about 50 persons at a time.

(D) Apprentices Hostel: In order to accommodate various apprentices under training, the Institute might provide hostels with adequate capacity. The hostel should have facilities such as auditorium with indoor games - Badminton, Table Tennis, Carrom Boards, Chess, etc. and reading room.

(E) The Training Institute should possess a very specialised type of simulator such as those of Carmody Corporation of U.S.A.

(F) The Training Institute should have laboratories - one for conducting chemistry practicals and the other for the physics practicals. Another laboratory for meteorology might also be useful in the Institute.

TRAINING OF PROCESS OPERATORS

The training of process operators is rather complicated and poses the following problems:

(i) A chemical process by nature is a continuous process and for the purpose of teaching the trainees, it can neither be stopped nor can any risk can be taken to allow the new comers to learn by practising in existing plants. Thus, "On-the-Job Training" degenerates into "Look but don't touch" method.

(ii) A chemical process is extremely interdependent and hence a small change at one place manifests itself in a number of places disturbing the temperatures, pressures, flows, levels, etc. Hence, unless a trainee is fully aware of all the corelations of all the process variables, he is unable to diagnose from the "symptoms" what is the cause of the disturbance.

In or .er to overcome these difficulties, in the training of process operators, specialised training facilities for the training of process operators are required by installing:

(a) Carmody Process Simulator; and

(b) Chemical process workshop

The process simulator and the chemical process workshop do not replace the traditional training methods such as institutional training and in-plant training, which are essential but these only supplement them to make the training more effective.

CARMODY PROCESS SIMULATOR

Carmody Process Trainer is an electro-mechanical device which simulates the work environment in a classroom as would be produced by an actual "on stream" process. The simulator consists of the following three main parts:

1. Graphic Magnetic Display Panel: On which the process can be laid out by magnetically sticking to it equipments, symbols, and flow lines.

2. Instrument Panel: Which is a replica of the control room panel from which an operator controls the process.

3. Remote Control Console: From where the instructor can control all instruments and alarms. The instructor can then create any conditions on the model which actually occur in an "on stream plant".

The simulator is programmed for "alarms" and "tripping devices" as they exist in a chemical process plant. As the trainees operate the valves on the "control panel" or in the "field", appropriate changes in the process variables are simulated by the instructor from his master console.

Normal process variables as well as abnormal conditions can be presented to the trainees and their correct or erroneous responses are reflected through changes on the panel. Thus, a trainee becomes familiar with the start up, shut down, normal operations and emergencies of a plant within 30 or 40 hours which would otherwise require years in "on the job training".

Another advantage of the simulator training technique is the high retention attained by this technique.

Psychological studies tend to prove that average people generally retain:

10% of what they read
20% of what they hear
30% of what they see
50% of what they hear and see
70% of what they say
90% of what they say as they do

The simulator then helps in the retention of 90% of what trainees learn.

CHEMICAL PROCESS WORKSHOP

A process simulator helps in understanding the corelation of various process variables and their control. However, for an operator, it is necessary to get a "feel" of the plant and equipment, e.g. he must be able to recognise a "knocking" sound in a compressor or vibrations in the bearing by touching it. The chemical process workshop is designed to meet this need by providing facilities for operation of various equipments such as heat exchangers, reactors, evaporators, filters, driers, absorbers, distillation columns, cooling towers, pumps, compressors, etc. In this workshop, the operators learn by actual operation of process equipments.

The following important equipments might be erected in the workshop:

1. Reaction Unit: Reaction vessel, evaporator crystalliser, heater-pumps, barometric condenser, vaccum pump, steam ejector, exhauster blower;

2. Absorption Unit: Absorber, Double pipe cooler, recycle pumps, compressor/ blower;

3. Distillation Unit: Distillation column, reboiler, condenser, separator, feed pump, reflux pump, recycle pump, feed tank;

4. Cooling Tower: Reservoir tank, structure with packing, pumps, I.D. fan;

5. Steam Boiler: Burshane gas fired;

6. Adsorption Unit: Compressor, cooler, separator, adsorbers;

7. Refrigeration Unit:

8. Rotary Drier and Rotary Filter:

The Chemical Process Workshop is useful not only in training the process operators, but it is also useful in training maintenance trainees, such as maintenance technicians, instrument technicians, electricians and welders as this is a miniature plant which is to be maintained like any other plant on stream.

ADVANCED TRAINING IN WELDING

Due to highly sophisticated technology and growing need to cope up with changes in welding of very sophisticated alloys and plastics, the Training Institute might provide for "Advanced Welding Shop". This is to impart specialised training to its welders, supervisors and engineers. The Welding Shop might be provided with the following equipments:

1. D.C. Motor Generator sets
2. Welding transformers sets
3. T.I.G. welding sunits
4. M.I.G. welding unit
5. Submerged arc welding unit
6. Eutectic welding equipment
7. Spot welding machine
8. P.V.C. welding equipment
9. Gas welding and cutting equipment
10. Metal spraying equipment
11. Plasma cutting equipment
12. Universal cutting equipment
13. Slides and films on welding processes techniques

The following welding courses are typical for such an Institute:

Name of the Course	Duration	Participant Specification
1. High pressure welding course	8 weeks	Industrial training with 2 years practical experience
2. Welding course for supervisors and engineer	2 weeks	Diploma or degree in engineering
3. -do-	2 weeks	School leaving certificate or industrial training with at least 5 years experience as a supervisor
4. Specialised course in tig welding and plasma cutting	2 weeks	Industrial training with an experience of 5 years
5. Specialized course in MIG welding	2 weeks	-do-
6. Specialised course in submerged arc welding	2 weeks	-do-
7. Specialised course in spot welding	1 week	-do-
8. Inspection and testing of welding	1 week	-do-

IN-PRACTICE SCHOOL TRAINING

In-practice school training is a part of the syllabus for the chemical engineering post graduate students from academic institutes. It is a full pledged course of six months designed to give students a practical orientation. The main objective of the course is to get the students exposed to the industrial environment particularly of the chemical industries so that they can apply their technical knowledge within the constraints of industrial environment. They have to undergo intensive training in all plants and have to complete a number of project works on actual problems existing in the plants.

CAREER DEVELOPMENT COURSES

In order to prepare existing personnel for higher responsibilities, it is essential to assist them in overcoming their handicaps in terms of insufficient educational background. This could be done through the part-time classes in the evening, which help the employees in acquiring more knowledge and higher qualifications without disturbing their normal duties. Each course in the part-time classes continues for 16 to 18 months. Those who complete these courses successfully are treated on part with the persons having standard educational qualifications. Thus, even if a person is non-matric when he starts his career, he can become a qualified engineer in 8 to 10 years by hard work, perseverance and intensive studies through part time classes.

Various career development courses and their equivalent qualifications are shown in the preceding Table I under 'Career Development Courses'. The pre-basic and basic examinations are common to all disciplines. The advance course is a specialised course, separate for chemical, mechanical, electrical and instrumentation disciplines.

DEVELOPMENT COURSES

TECHNICAL DEVELOPMENT COURSES

This course is designed to equip the technicians with recent development in the field of maintenance and refresh their knowledge. An attempt is made to improve their skill by arranging demonstrations of maintenance procedures under the guidance of experts, taking the participant to visit other factories and by using film strips and films on correct maintenance techniques. The participants are also introduced to other skills such as communication, human relations, motivation, etc. Use of games and case studies is also made to improve their understanding in these fields.

OPERATOR DEVELOPMENT COURSE

The Training Institute should plan to conduct operator development course of 8-10 days' duration, designed to meet the following requirements:

1. To equip new operators with essential skills of operation;

2. To prepare operators for emergency operations;

3. To refresh and update their related knowledge;

4. To foster desirable attitudes in them;

5. To educate them in safety;

6. To broaden their understanding about the organisation;

7. To train them for:
   (a) altered/new process installed;
   (b) changed product pattern;
   (c) fresh plant; and

8. To develop senior operators for supervisory positions.

The course might make use of lecture method for theoretical aspects, simulation on process trainer for understanding corelation of various process variables, and management games and case studies for improving the attitudes of persons.

MANAGEMENT DEVELOPMENT PROGRAMMES

The Training Institute might be equipped with organising various types of management development programmes for all levels of supervisory and managerial staff. The areas covered in the programmes include functional disciplines, like marketing management, financial management, materials management, etc. and general and behavioural disciplines like general management, project planning, managment by objectives (MBO), communication, finance for non-financial executives, management of human resources, organisational behaviour and human performance, etc. The following chart will illustrate the various levels of management and programmes:

MANAGEMENT DEVELOPMENT PROGRAMMES
FOR VARIOUS LEVELS OF
SUPERVISORY & MANAGERIAL STAFF

Level	Functional Programme	General and Behavioural Programme
Junior Offrs/ Managers	Marketing Management and fertilizer marketing Production management Financial management Materials management	General management Industrial relations Communications Group dynamics and personality growth Quantitative techniques in management
Middle Managers	Advance marketing management and fertilizer marketing Production planning and control Management control systems Advance materials management	Management of human resources Organisational behaviour and human performance Industrial relations Quantitative techniques in management finance for non-finance executives Project planning and control Philosophy of public sector
Senior Managers	Marketing strategy Production planning and strategy Management information and control systems	Corporate planning Management by objectives Investment analysis Organisational development and management growth Managerial styles Participative management Decision making process

APPRENTICE TRAINING - Duration: 2 years

Junior Executive Trainees

The aim of the course is to train engineering graduates to become able engineers/managers.

Eligibility qualifications: A degree in engineering or technology or a Master's Degree in applied physics. The table below outlines the training programme for Junior Executive Trainees in all the above branches of engineering for two years from the date of their joining.

Stages	Nature of Training	Period/ Weeks	Specialised Courses during Training
1. Induction	General study of organisation and process of manufacture	2	1. Induction course
2. General Training	(a) two weeks in each of the plant and major shops (b) Project work	22	2. Fertilizer technology course
3. Intensive Training 1st Phase	Intimate first hand knowledge of one particular plant or section under direction of plant staff and supervision by training staff	38	3. Course of mechanical engineering, electrical engineering and instrumentation 4. Effective public speaking course
4. Miscellaneous Training 1st Phase	Training in service departments such as Lubrication, Stores, Chemical Control, Water Services, etc., Colloquim	6	5. Effective report writing course 6. Course in management and supervisory functions
5. Intensive Training 2nd Phase	Holding charge of plants or sections under the production engineers, picking up of routine administration under plant manager/engineer, special studies	30	7. Specialised lectures on technical subjects 8. Group discussions 9. Course in first aid, fire fighting and safety
6. Miscellaneous 2nd Phase	Supervisory, training, lectures on personnel, purchase, etc. Special study, colloquium, problem solving, exercises.	6	

Progress Record

Throughout their training, the trainees are to be frequently interviewed and examined. Confidential reports are to be collected from the plant and training staff. The apprentices might also submit a quarterly report on theoretical and technical aspects of the plants and machinery.

Commercial and Administrative

The aim of the course is to train personnel to become executives in the commercial and administrative branches.

Eligibility Qualifications: A post graduate degree in economics, social sciences, commerce, business administration, industrial management, industrial psychology, etc.

Duration: 2 years

Senior Operator/Technician Trainees

This course is meant for training science graduate and those holding a diploma in different branches of engineering to take up positions at junior levels.

Eligibility Qualifications: Science degree or engineering diploma.

Duration: 2 years.

Candidates are attached to different units for inplant training according to their qualifications.

Progress Record: Throughout their training, there has to be frequent interviews and examinations. Confidential reports are to be collected from the plant and training staff. The apprentices might be required to submit a quarterly technical report on theoretical and technical aspects of the plants and machinery.

Stages	Nature of Training	Period/ Weeks	Specialised Courses During Training
1. Induction Training	General study of the layout of the factory and process of manufacture	2	1. Induction Course 2. Fertilizer technology course
2. General Training	Two weeks in each of the plants and major shops	22	3. Course on mechanical technology, electrical technology and inst. technology
3. Intensive Training 1st Phase	Intimate first-hand knowledge practical work in the plant or sections. They work in between the supervisors and the workers under direction of plant staff and supervision by training staff. After group discussion, Carmody classes and special lectures in training centre		4. Course in chemical engineering, and machine drawing (only for B.Sc.) 5. Specialised lectures on technical subjects 6. Course on supervisory effectiveness 7. Group discussions 8. Course in first aid, fire fighting, safety and civil defence
4. Miscellaneous Training	Training in service departments such as lubrication, stores, chemical control, water services, etc. and special lectures on supervision	6	
5. Intensive Training 2nd Phase	Holding charge of plants or sections under process/maintenance engineer. Picking up of routine work. Special studies	30	

CRAFTSMAN TRAINEES

This course is meant for training candidates to make skilled artisans and operators after completion of the training.

Eligibility Qualifications: S.S.C. or equivalent.

Duration: 3 years

Age Limit: Between 15 to 18 years in case of candidates without a technical background. This is relaxable up to 20 years in case of those with a technical background.

After successful completion of their training, they are equipped as Grade II operators/technicians in the factory.

The following table (next page) outlines the programme of training during the 3 years.

Progress Record: Throughout their training, the trainees are to be frequently interviewed and examined, and confidential reports might be collected from the plant and training staff.

Stages	Nature of Training	Period/ Weeks	Specialised Courses during Training
1. Induction Training	Introductory lectures about organisation, plant process, discipline and safety. Acquaintance with tools and main equipments in the plants	3	1. Induction course 2. Institutional training 3. Course in specialist discipline 4. Refresher course I
2. Workshop Training and theoretical instruction	Practical training in fitting, electrical, welding machine shops, etc. and theoretical instructions in relation with the above trades, physics, chemistry and engineering drawing	40	5. Refrehser Course II 6. Refresher course III 7. Course in first aid, fire fighting, safety and civil defence
3. Intensive Training in Training Centre	Advanced instructions and practical training in the designated trade	20	
4. In-plant Training	Intensive training under the technical staff and supervision by training staff on actual job which they will be required to do in the plants. For chemical operators, Carmody Process Trainer is utilised	93	

Stages	Nature of Training	Period/ Weeks	Courses during Training
1. Induction	Introductory lectures about organisation, plant process, acquaintance with tools and main equipments	2	1. Induction course 2. Institutional training 3. Refresher courses
2. Institutional Training	Practical training in basic shops and trade theory, Physics, chemistry, engineering, drawing and exercises in mechanical shops	50	4. Course in first aid, fire fighting, safety and civil defence
3. In-plant Training	Intensive training under the technical staff on actual jobs which they would be required to do in the plants		

N.B. The commercial trainees are directly put on the job training and several hours of institutional training might be given every week.

TRADE APPRENTICES

The Training Institute might also be equipped to train trade apprentices in the following trades:

1.	Attendant operator	3 years
2.	Mechanical maintenance - Chemical plant	3 years
3.	Instrument mechanics - chemical plants	3 years
4.	Electrician	3 years
5.	Welders	2 years
6.	Machinists (shaper, slotter and palner)	3 years
7.	Draftsman mechanical	1 year
	Commercial Trades	
8.	Book-keeping and accountancy	1 year
9.	Store/purchase Assistant	1 year
10.	Sales Assistant	1 year
11.	Clerk (General)	1 year

Progress Record: Throughout the training of all categories of trainees, there must be frequent examinations and interviews. During in-plant training, there must be regular plant follow up to look after the difficulties of the trainees and to see that they are working on right lines. The apprentices have also to submit weekly diaries about the work they have done. Confidential reports must also be obtained from the plant every 2 months. In addition to the above records, the trade apprentices have to appear for an examination conducted and a certificate, duly recognised by authorities, might be awarded.

TECHNICIAN TRAINEES

Stages	Nature of Training	Period/ Weeks	Courses During Training
1. Induction	General study of organisation and process of manufacture with guided studies	2	1. Induction training
2.			2. Fertilizer technology course
2. General Training	Two weeks in each plant and major shops	10	3. Mechanical, electrical, instrumentation technology course
3. First intensive Training	Intimate first hand knowledge of plant under the guidance of plant staff and supervision of training staff	20	4. Principles of supervision
			5. First aid, fire fighting and safety course
4. Second Intensive Training	-do-	20	

N.B. In the intensive training, the trainee has to take charge of small sections under guidance of plant staff.

ENGINEERING TRAINEES

Stages	Nature of Training	Period/ Weeks	Courses During Training
1. Induction	General study of organisation and process of manufacture with guided visits to plants/departments	2	1. Induction training 2. Fertilizer technology course 3. Mechanical, electrical, instrumentation technology course 4. Course in management and supervisory functions 5. First aid, fire fighting and safety course
2. General Training	Two weeks in each plant and major shops	10	
3. Intensive Training 1st Plant	Intimate first hand knowledge of the particular plant under direction of plant staff and supervision of training staff	18	
4. Intersive Training 2nd plant	-do-	18	
5. Project Work	To make a study under the guidance of training and plant staff of some actual problems	4	

N.B. During intensive training, the trainees have to take charge of small units.

6.0 POLICIES, STRATEGIES, AND MEASURES REQUIRED TO BUILD MANPOWER FOR CHEMICAL INDUSTRIES TOWARDS ATTAINMENT OF SELF-RELIANCE

Despite wide-spread recognition that the ultimate success of an enterprise depends upon the calibre, quality and performance of men, little attention is normally given to systematic planning in manpower. There are cases where poor planning on technological, financial and physical fronts have been largely rectified through conscious efforts to improve the quality and deployment of manpower. On the other hand, there are also cases where poor manpower planning have completely nullified the gains of most thorough and careful planning of other resources. With growth in volume and complexity of an undertaking, the sophisticated task of putting the right man on a job appropriate to their skills, interests and aspirations calls for planning in depth, utilising new techniques that have been developed in recent years and managerial competence to judge the potential of an individual. For, manpower constitutes an area of management where the results of gain are not seen immediately. The process of manpower assessment and manning continues largely to be empirical and takes considerable time in recruitment and training, and opportunity to gain the right quality of experience on the job etc. All these make manpower planning an important, critical and continuous task of management.

Element of Manpower Planning

Manpower planning ought not to be considered as a mere estimate of the number of persons required at a certain future date but a complete system of decisions governing all facets of future personnel administration. A comprehensive manpower planning of this kind involves the following elements:

1. Organisation: Organisational structure, position descriptions, responsibility and authority, delegation etc.

2. Skill and trades: Qualitative and quantitative assessment of skills and trades required at various points of time in future.

3. Productivity and performance: Utilisation control, performance appraisal, productivity development etc.

4. Working conditions and facilities: Working environment, safety, health, fatigue, rest and worker facilities both inside and outside the factory.

5. Salary and wages: Worker classification, wage structure, salary administration, service conditions and fringe benefits.

6. Recruitment: Recruitment, training, placement, phasing of recruitment and blending of varying requirements at different stages of construction, operation and growth.

7. Motivation: Employee development, promotion, incentives, morals, satisfaction and attitudes.

8. Industrial Relations: Trade unionism; discipline; social, economic and political environment; group dynamics; etc.

6.1 Some of these elements are traditional and others original. The traditional elements ought to be particularly watched. In every planning process, there is the temptation of adopting the easier method of transplanting the practices of the parent or sister organisations. In forecasting from historical data, there is a built-in incapacity to optimise the utilisation of human resources. This perpetuates the weakness and sets in processes of degeneration. Thus, the opportunity of starting with a clean slate is often lost. What is good for one organisation need not necessarily be good for the other. Changes in technology, innovation in products, process, plant equipment, work methods, layout and working conditions, modernisation of organisation and management style and the social, economic and political environment of the new location, demand complementary changes in the manpower patterns and practices.

6.2 The Process of Manpower Planning

The process of manpower planning begins with conception of an enterprise and thereafter never ceases. It is a dynamic and continuing process, suitably changing in its content and emphasis as the enterprise advances from conception to completion to steady operation and the subsequent stages of further development. A typical process of initial planning will involve the following steps:

(i) List the various functions involved;

(ii) Develop an organisation chart showing the relative position of the various functions in the organisation;

(iii) Prepare functional breakdown indicating the various sub-functions (up to the lowest level) for each function;

(iv) Develop descriptions for each major job listing the key duties and responsibilities;

(v) Determine the number of positions required for each job on the basis of estimates of work volume and work load;

(vi) Classify the jobs into categories and develop a wage structure;

(vii) Prepare specifications for each class of positions indicating the skill or trades, education, experience, physical capabilities etc., required;

(viii) Develop the basic personnel policies and procedures;

(ix) Plan recruitment, training and placement sources, methods, procedures, facilities and schedules;

(x) Plan employee facilities and amenities required both inside and outside the factory;

(xi) Plan systems for ensuring efficient work methods and optimum utilisation of manpower and for controlling productivity and performance;

(xii) Execute the plan according to a pre-determined time schedule which dovetails all requirements and makes available the right types of persons, at the right time and in the right numbers.

6.3 Shortrun and Longrun Manpower Planning

In a growing organisation like a fertilizer complex both short range 0 - 3 years and long range, beyond 3 years, planning is needed. Short range planning is principally a matter of matching present employees to their present jobs and filling vacancies arising out of turnover, addition of new products, facilities, expansion or due to technological and administrative changes, with the available manpower to the best possible extent.

6.3.1 Manpower planning for the long-run is concerned with all jobs and all employees at a point in time, with matching a complete roster of personnel to total job requirement of a new enterprise. Management would mostly be concerned with forecasting organisational needs and designing activities for recruiting new employees and developing personnel already employed with the help of 'inventory of talent' and 'gap sheets' which contain the information regarding potential and development needs of individuals.

6.4 Factors influencing Manpower

Manpower is a function of technology, extent of mechanisation and automation, nature and magnitude of operations, organisation and work methods, quality of persons and their productivity. The number and types of persons engaged must necessarily depend upon these factors. The implication of these factors in a given situation must be carefully assessed and translated into the plan. Failure to do this will lead us into a complex of problems which will be very difficult to get rid of later. Problems of overstaffing, improperly trained manpower, low productivity, misfits and disgruntled individuals etc. are all symptoms of defective planning and failure to recognise the impact of the various factors governing manpower.

6.4.1 The above point will be clear from the following analysis which shows how the modern technology and newer concepts in organisation, constitution of skills and trades, method of work etc. have changed not only the requirement of manpower per unit of output but also the pattern of employment and structure of trades and skills.

Fertilizer Manpower Units Index	A	B	C	D	E	F	G
No. of employees per 100 ts of plant nutrient	6.6	4.1	1.7	0.7	0.5	0.5	0.4
No. of production worker per major equipment	8.8	9.2	6.8	6.2	4.0	3.6	3.8
Ratio of maintenance staff to production staff	1.0	1.1	1.0	1.2	1.4	1.2	1.3
Ratio of all services staff to prod. & maint. staff	0.71	0.65	0.60	0.53	0.37	0.38	0.31

6.4.2 One very important element in manpower planning and scheduling is the consideration of changing work volume and requirement of skills at various points of time in the development and growth of an enterprise. For example, in a chemical plant of our type, the requirement of skills and trades arecompletely different at the time of construction and commencement of production. Some of the skilled and unskilled persons required at the time of construction could be absorbed in maintenance and materials handling on commencement of operations, but a large number of construction staff will be redundant and need retrenchment. The problem of retrenchment can be greatly minimised by proper planning of manpower, cautious recruitment and phasing of personnel and getting work done on contract or by specialised agencies who move from one job to another maintaining their manpower at almost steady level.

6.4.3 With the advancement in technology, the manpower mix is fast changing. We would be increasingly concerned with high talent manpower, which would be expensive and for which there is a long lead time for training and education. The source of supply of trained manpower, the decision on providing training within the organisation and the replenishment of manpower on continuing basis are some of the other factors which should find appropriate place in the system of manpower planning.

Newer Concepts in Manpower Planning

6.5 Some of the newer concepts in manpower planning which tend to reduce the requirement and make the organisation more effective and efficient and which we are attempting to introduce are:

(i) Lowering decision making level by introducing the officer-oriented organisation;

(ii) Introducing multiple trades and reconstitution of traditional jobs through job integration and job enlargement. Craftsman will be interchangeable within the concepts of time, tools and ability. He will retain his basic craft element and will perform additional duties of which he is capable of;

(iii) Reducing the number of levels or heirarchy without impairing salary advancement opportunities by introducing the concept of multiple grades for the same job or position;

(iv) Curtailment of "Insurance Work Force" by redistribution of work and proper evaluation of risk. In every organisation, there are certain groups of people (such as shift maintenance crew) who are kept to attend to emergencies if and when they happen. The need for these persons should be critically evaluated. Often, they could be reduced by taking calculated risks, distributing emergency work to regular staff and increasing the reliability of equipment o decreasing the probability of emergency;

(v) Providing for high organisational mobility of persons from one area to another area of operation to most fluctuating workloads;

(vi) Strengthening and improving the calibre of supervision to ensure high level of performance and high standards of expectation from the very beginning;

(vii) Adequate stress on productivity and cost consciousness through suitably devised incentive scheme;

(viii) Establishment of efficient work methods, systems and procedures from the very beginning.

Techniques fof Manpower Planning

6.6 Several techniques are now available to make manpower planning more quantitative and realistic. Of these, I would like to make particular mention of the following two important techniques:

(i) Manpower indices

(ii) Network scheduling techniques (PERT/CPM)

Systematically developed indices of manpower are of great help in planning manpower requirement. In fact, in operations, which do not lend themselves to direct work measurement, the indices are the only means of assessing the requirement. However, indices have to be used with great care and caution. Often, they could mislead. In every index, the extent of correlation should be determined and significant influences of uncommon factors should be eliminated. As far as possible, indices should be in terms of certain measureable physical characteristics of the plant. A few examples of such meaningful indices in respect of chemical fertilizer industry are given below:

(i) Number of major unit processes and operations per operator per stream;

(ii) Number of major equipment per maintenance man;

(iii) Ratio of operation to maintenance staff;

(iv) Ratio of skilled to unskilled staff;

(v) Ratio of supervisors and officers to men;

(vi) Number of transactions per person (in stores, purchase, accounts activities).

These are simple indices and are being further refined through enlarged date and statistical analysis.

6.6.1 The network techniques of PERT/CPM have been adopted by many organisations for planning and scheduling manpower recruitment and training activities and synchronising trained manpower availability with actual field requirements. Advanced network techniques are also being used for "levelling" manpower and optimum allocation of manpower resources.

6.6.2 Computer based simulation models have been developed in U.S.A. which could yield projections of manpower needs for each of ten years in the future for given input parameters. The constraints on such simulation models are, however, numerous, such as the size of the organisation, the assumptions regarding individual attributes, growth rates and many other factors.

6.6.3 Mathematical models based on replacement theory are being used by few air-lines for problems connected with recruitment and promotion of staff. With particular regard to available manpower supply within an organisation, computers are being widely used in the West. For example, the automated Air Force personnel Data System in U.S.A. yields demographic, training, career, progress and quality analysis of 135,000 officers for assignment, promotion and retirement. In India also, computerised services are now available for matching the objectives of employers and job seekers which are programmed that are likely to result in mutually satisfying employment agreements.

Conclusion

6.7 Manpower planning is a specialist function. Adequately trained and experienced industrial engineers are required to provide this very vital service to project planners. In spite of all the development in industrial engineering and work measurement techniques, manpower planning is still based on empirical and subjective elements. New and more efficient quantitative techniques and reliable standards of manning have to be developed and perfected. There is a tremendous scope of work and improvement in this area.

6.7.1 Techniques alone are not enough. Modern concepts of manning still remain largely unsold to persons in authority. Every effort of this nature largely depends upon the support of the top management and willing co-operation of managers at all levels. With the good work being done by organisations like the Institute of Applied Manpower Research in New Delhi, we earnestly hope and trust that manpower planning will receive the acceptance and the vital importance which it deserves.

7.0 SPECIFIC ACTION PROGRAMME TOWARDS REDUCING PROBLEMS RELATING TO MAN-POWER CONSTRAINTS

7.1 Specific action required towards reducing problems relating to manpower constraints has been classified broadly under three headings as below:

1. Suggested Action Programme to be initiated by member States;
2. Suggested Action Programme to be initiated by ECA;
3. Suggested Action Programme to be initiated by ECA and/or other international agencies.

7.2 Suggested Action Programme to be Initiated by Member States

7.2.1 Member States might consider setting up an Institute of Manpower Research. Such an Institute will continuously study and identify manpower needs and constraints in the area of manpower planning, e.g. constraints relating to:

(i) Manpower planning;

(ii) Institutional constraints;

(iii) Training opportunities constraints; and

(iv) Curriculum/syllabus constraints, etc.

Such an institute would assist national planning authorities and inter-act with them to assess manpower needs, to recommend reorientation of policies and to formulate new policy guidelines.

7.2.2 Member States might consider enacting suitable legislation to provide for existing industries taking in apprentices in excess of the industry's need; the number of such apprentices would depend on the total number employed in each discipline and a percentage has to be employed in each discipline. To illustrate with the category of welders, if the industry is having 20 welders, they might take two welders/apprentices more and provide training to them. Such apprentices would be provided with stipend during the apprenticeship period. The enactment will make it mandatory on each industry to employ a certain number of apprentices. The objective of such an enactment is to enlarge the trained manpower pool in the category of technicians/craftsmen.

Such an Act, called the Apprentices Act, 1961, has been enacted by the Government of India. Under the provision of this Act, it is mandatory on the part of the industry to induct Act Apprentices, provide them training opportunities, and pay them a stipend during the training period but not necessarily employ them at the end of the training period. The objective is to enlarge the national manpower pool.

7.2.3 Member States might consider setting up training institutes for imparting elements of industrial training to young men in the age group of 17 - 22 years. Such an institute will provide training to craftsmen in various trades. Such industrial training institutes will, after a specified term of say, two years, provide a diploma to the youngmen. Such trainees would get job opportunities in the industries and these trainees might have to undergo another course of training specific to the requirements of that particular industry in which they would be employed. Such craftsmen training institutes are useful to absorb a large number of young men who could look towards building up careers as tradesmen/craftsmen/technicians.

7.2.4 In approving major projects, such as for example, a large chemical or petrochemical project, the contracts with overseas firms/joint sector agreements might provide for training facilities for nationals as mandatory. The components and contents of such training programmes should be specified and an officer employed exclusively to ensure compliance with these provisions in such contracts.

7.2.5 As a matter of policy, member States might formulate guidelines to use expatriates only under contractual provisions and for special maintenance requirements; and in each case, provide counterpart nationals for each expatriate. The contract provisions relating to expatriate services should provide for effective technology transfer at the operating level from such expatriates.

The use of such expatriates should be considered as supplementary to the national experts and not substitutes for building up of nationla expertise.

7.2.6 As a matter of policy, member States must develop local experts and motivate them by delegating authority as a positive act of trust and assign them positions of responsibility.

7.2.7 As a matter of policy, member States might formulate guidelines to ensure that project authorities train manpower for specific projects and such manpower is employed by the project without any time lag between completion of training and regular employment.

In fact, a more desirable approach will be to specifically recruit necessary manpower well in advance/commencement of operation of the project and provide training facilities during the construction of the project.

Special budget provisions should be made to meet the costs incurred on such trainees and training facilities, inclusive of costs for employing them in advance of requirements and for costs for limited number of trainees for exposure to overseas operations. Such costs should be considered as an essential adjunct and a part of the project cost to build up trained manpower for the project from the conceptual stage in order that there need not be any gap at the time the project construction begins to taper off and pre-commissioning and commissioning operations begin.

7.2.8 Member States might formulate suitable guidelines for the project authorities to establish facilities for training-within-the-industry. Such a model training institute has been described in section 5 and this might be taken as a typical model for fertilizer/chemical/petrochemical projects.

It is important to appreciate that training within industry scheme succeeds only when training begins from the top, i.e. the top management personnel must subject themselves to systematic training in order to understand and appreciate more of the jobs and duties of all categories of personnel. Such a background provides a thorough understanding of the entire business. This is the only way the top management will learn how and why problems have occurred and will be able to tackle the problems effectively.

Managerial and supervisory personnel must go through actual operations and duties of the workers from the lowest levels and step by step higher up to their level. This direct exposure provides effective training for the managers/ supervisors to have a full appreciation of the various jobs which the subordinates are required to perform.

7.2.9 Project authorities should make more liberal use of simulated training for refresher and review training for chemical plant operators. Project authorities should provide for periodic proficiency tests for maintenance workers and design suitable incentive schemes to maintain proficiency standards.

7.2.10 Managers of projects should be periodically exposed to outside seminars/ workshops etc. for interaction with similar other industry managers and to expand their vision.

7.2.11 Developing countries might provide guidelines to provide additional manpower deliberately to take care of wastages, employment expansion and for improving opportunities for other industries both within the country and outside the country.

7.2.13 Member States might consider to constitute productivity councils for each industry to bring in productivity consciousness and continually take such measures to improve productivity and thereby ensure improved quality of manpower.

7.2.13 Specifically, the success of fertilizer projects is no less dependent on effective marketing and fertilizer use development. Extension workers are to be trained specifically in fertilizer use development in developing countries. This is a specialised aspect and a special training programme requires to be constituted for training of extension workers to work in the rural environment and to work in the fields with the farmers on fertilizer use development.

For petrochemical industries, similarly, it is important that technical services organisations are built up and personnel specifically trained to provide technical services to the potential users of the products.

Annexures to this report provide for certain manpower profiles which are to be regarded as illustration only. For any specific industry, the employment requirements need to be specifically studied for each case and there cannot be any standards or norms and each case has to be dealt with separately. In Annexure 3 this point has been illustrated by showing four typical fertilizer plants in India employing manpower which are widely different from one another. Such differences arise due to the technology adopted, the number of equipment, the lay-out of the plant, the floor area, the skill/productivity of workers, policies in regard to leave, practices of absenteeism, sickness, etc., presence/absence of incentive payments schemes, attendance bonus, and the like.

7.2.14 Member States and the project authorities would be well advised, therefore, to stdy each case and take all relevant factors to formulate manpower requirements for a specific project.

7.2.15 Member States might consider giving special emphasis on training of scientists and technologists and personnel for research and development. The mere fact that the State is under development/developing and, therefore, research needs would appear to be non-existent in the initial phases at least is not a realistic position. For success of any industrial enterprises research and development ought to be considered as an inseparable programme with industrial operations.

7.3 Suggested Action Programme to be initiated by ECA

7.3.1 UNECA might consider initiating steps to organise workshops on a regional basis to provide forums for exchange of information and opportunities for interaction between those concerned with development of manpower.

Such workshops may be of two different types:

(a) For general problems relating to manpower planning; and

(b) For training of personnel for each industry, e.g. for fertilizer industry, for petrochemical industry, etc.

It should be recognised that the training needs even within the different branches of chemical industry are different. To illustrate, training needs for the pharmaceutical industry would be different from that of the fertilizer industry and therefore, the design of the training programmes for the two would be different.

7.3.2 UNECA might develop on panels of experts from other developing countries on matters relating to establishment of training institutes and development of training programmes. Members from such panels could be invited as and when required to give specific assistance for development of training institutes for specified industries.

7.3.3 UNECA might develop panel of experts of African nationals and identify potential experts from amongst African nationals and expose them to environment in overseas training establishments for specific industries.

7.3.4 UNECA might initiate action to establish management development institutes on regional basis to train young professionals as managers for industries.

7.4 Suggested Action Programme to be initiated by ECA and/or other international agencies

7.4.1 UNECA and/or other international agencies might recognise the special needs for development of trained manpower for African nations and provide liberal financial support for specific action programme.

7.4.2 Organisation of Petroleum Exporting Countries (OPEC) and various special funds constituted by the oil exporting countries are currently giving emphasis on training programme for developing countries. UNECA might help to develop specific projects for establishment of training institutes and seek financial support for their establishment in consultation with the member States.

7.4.3 In specific terms, Tanzania proposes to build a fertilizer plant. It would be desirable to establish a training institute as part of the fertilizer plant. For this purpose, a project for the training institute could be formulated and financial assistance sought to establish such an institute.

7.4.4 A Training Institute might be established in Nigeria as a part of the Nigerian fertilizer project. International agencies might provide necessary assistance to establish such an Institute.

7.4.5 In looking for expertise in the field of training, the experience of other developing countries ought to be considered more relevant for the developing African member States. Countries such as Indonesia, Egypt, Pakistan and India etc. could provide training facilities and experts in the fertilizer industry; India could provide training facilities and experts in chemical industries in general, petrochemical industries and pharmaceutical industry in addition to fertilizer industry. UNECA and/or other international agencies might take initiative to establish contacts with member States in these countries, i.e. Egypt, Indonesia,

Pakistan and India etc., and seek their co-operation in setting up of training institutes and training programmes for African countries. International agencies such as World Bank might assist not only with finances but also with expertise for setting up management development institutes on regional basis for the African countries.

Manpower Analysis and Training

Project Objectives

1. Assess manpower requirements for the planned chemical projects by level and type, and time of requirement, in the light of possible technology mix.

2. Formulation of training schedules.

3. Appraise local industrial training capability and facilities.

4. Recommend measures to create/expand/upgrade training facilities to meet the requirements of the chemical industry both in terms of quality and level of training required, and for approximate numbers to be trained.

5. Priority training needs for the chemical industry for which multi-national/ regional training programmes could be designed.

6. Policies, strategies and measures required to building manpower for chemical industries towards attainment of self-reliance.

7. Specific action programme where member States/ECA/other international organisations could initiate activities towards reducing problems relating to manpower constraints.

Annexure 3

COMPARISON OF MANPOWER DEPLOYMENT BY DIFFERENT ORGANISATIONS

An analysis of the total manpower provided and the manpower breakdown by types for four typical fertilizer plants in India makes interesting study.

Manning

For the four plants, the total staff employed is as under:

M/s A = 1890 (staff for fertilizer plants only excludes industrial chemicals)

M/s B = 713

M/s C = 802

M/s D = 1957 (excl. staff of industrial products plants)

Plants and Capacities

Productwise comparison of the plants, capacities, processes and number of equipment is given in annexure 3.1 .

There is wide variation in the total staff employed by different organisations. This is mainly due to the different in technology used in the plants, number of streams and number of moving equipment. The table below gives the capacities, equipment and staff of the organisation covered under the study:

Organisation	CAPACITY		NO. OF EQUIP.		STAFF		
	Tonnage	Nutrients (In MT)	Total	Moving	Oper. & Maint.	Services	Total
A	621,000	266,000	801	443	1,274	606	1,890
B	396,000	182,000	NA	76	445	268	713
C	570,000	288,200	422	253	558	244	802
D	429,000	192,000	1,693	895	1,448	509	1,957

Ratios

The major ratios comparing the staff deployment in these organisations are given below:

Organisation / Ratio	A	B	C	D
Operation Staff/stream section	5.34	NA	6.52	6.35
Operation staff/equipment	0.37	NA	0.32	0.33
Operation staff/running equipment	0.67	NA	0.54	0.63
Operation/maint. staff	1.39	1.43	1.23	1.18
Operation/maint. including officers	1.41	1.34	2.06	1.15
Mech. staff/moving equipment	0.51	1.33	0.31	0.37
Elec./mech.	0.31	0.16	0.15	0.35
-do- including officers	0.36	0.16	0.14	0.37
Inst./tech.	0.18	0.18	0.12	0.21
-do- including officers	0.20	0.19	0.13	0.22
Civil/mech.	0.07	0.09	-	0.16
-do- including officers	0.08	0.09	-	0.14
Service staff/operations and maint.	0.48	0.60	0.43	0.30
Service staff/total employees	0.32	0.38	0.30	0.23

General Observations

(i) Though in absolute terms D is employing more staff in comparison to other organisations, considering the vital ratios as indicated above, the staffing is generally comparable except for electrical, instrumentation and civil departments. The reason for civil department is the additional requirement of township maintenance;

(ii) As can be seen from annexure 3.1, the basic reason for employing more persons by D in production and maintenance departments is due to the larger number of moving equipment used in the plants;

(iii) Area-wise also, the plants D are spread over larger areas thereby increasing the need of operation staff.

MANPOWER COMPARISON

Plant	Company	Capacity	PROCESS			MECHANICAL MAINTENANCE			ELECTRICAL MAINTENANCE		INST. MAINTENANCE	
			Process	Control point	Workmen	No. of moving Equipment	No. of workmen	Moving Egypt/ Workmen Ratio	Workmen	Elec/Mech Workmen Ratio	Workmen	Inst/Mech workmen Ratio
Ammonia	A	1050 (3 plants)	Steamm Reformation	26	106	97	43	2.26	19	0.44	5	0.12
	B C	910	-	6	32	10						
	D	350	Partial oxidation	36	146	156	64	2.44	21	0.33	16	0.25
Urea	A	1125	Total recycle	17	71	148	33	4.48	15	0.45	7	0.21
	B	1200		7	30	18						
	C											
	D	300		17	60	136	33	4.12	17	0.55	10	0.3
Ammonium Sulphate I	A	470	Gypsum Ammonium Carbon-dioxide	15	62	94*	36					*Common for ASI a& DAP
DAP	A	240	TVA Process	6	28	38**	31	2.7				** Common for DAP & AS
Phosphoric Acid	A	165	Chemico	7	32	66		3.14				
	D	100	Nissan		51	104	31	3.34				
Overall	A					443	143	3.10	93	0.65	49	0.34
	B					76	101	0.75	16	0.15	18	0.18
	C											
	D					858	264	3.25	119	0.45	75	0.28

Annexure 3.1

PLANT CAPACITIES

Plant	Organisation	Capacity in Metric Tonnes	Process	No. of Plants	No. of Stream in each Plant	No. of Streams Sections (Strms x Secns)	No. of Equipments Running	No. of Equipments Total	Floor Area in Sq. M.
Ammonia	A	1,050	ICI steam Reformation	3	1	19	97	182	NA
	B	910	MW Kellogg	1	1	6	10	NA	7000
	C	750	Steam Reformation	1	1	6	55	143	9000
	D	350	Shell Gasification	1	2	24	156	399	37000
Urea	A	1,125	Toyo Recycle	2	1	12	148	210	NA
	B	1,200	Stemicarbon	1	NA	NA	18	NA	2650
	C	900	Chemico	1	1	3	43	91	2340
	D	300	Chemico	1	3	12	136	208	6800
Granular NPK	A (DAP)	240	TVA	1	2	8	38	66	NA
DI-Ammonium Phosphate (DAP)	B (AS)	470	ICI	2	1	12	94	144	
	C (NPK)	1,800	Dorr-Oliver	1	3	12	155	188	15750
Aluminium Phosphate (A.S)	D (NPK)	1,200	PEC Modified	2	4/2	18	222	275	24000

DEPARTMENT WISE/GRADEWISE NUMBER OF POSITION OF B

Designation	Name of the Departments						
	Production	Maintenance	Technical	P&A	Fin.& Acc.	Total	Remarks
General Manager	-	-	-	-	-	1	Officers
Managers	1	1	1	-	-	3	
Superintendents	3	4	2	1	1	11	
Senior Engineers	3	7	4	1	2	17	
Shift Engineers	10	6	2	2	-	20	
Engineers	9	9	6	2	5	31	
Senior operators/technicians	14	20	5	6	9	54	
Operators/technicians and office assistants	67	64	16	9	14	170	
Junior operators/junior technicians and stenographers	13	59	7	22	12	113	
Clerical staff Asst. opert./tech.	1	8	1	10	4	24	Workers
Drivers/security guards	-	2	-	26	-	28	
Fire guards/attendants Mazdoors	114	30	23	75	-	242	
TOTAL	235	210	67	154	47	714	

PLANT AMMONIA

Grade	Category of Staff	Manning Point	Staff/ Shift	Total
	Supervisory			
9/10	1. Ammonia superintendent	Overall	-	1
7	2. Shift Engineer	Overall	1	4
6	3. Chief Operator	Overall	1	5
	Non-Supervisory			
4/5	1. Operator	Hydro desulphurisation and naphtha storage	1	
		Reformer and co-conversion	1	
		CO_2 purification	1	
		Compressors	1	
		Synthesis, refrigeration, storage, ammonia loading	1	
		Control room (front end and back end)	2	
		Process condensate boiler	1	
	Workers		8	31
	Workers		1	4
	Total			45

ENCLOSURE TO ANNEXURE 3

MANPOWER DETAILS OF PLANT C

MACHINERY IN WORKSHOP (C)

1.	Lathes	5
2.	Horizontal Boring machine	1
3.	Milling machine	1
4.	Shaper	1
5.	Surface grinder	1
6.	Cylindrical grinder	1
7.	Lapping machine	1
8.	Expander	1

UREA PLANT

Grade		Category of Staff	Manning Point	Staff/Shift	Total
		Supervisory			
9/10	1.	Urea superintendent	Overall		1
7	2.	Shift Engineer	Overall	1	4
6	3.	Chief Operator	Overall	1	5
		Non-Supervisory			
4/5	1.	Operator	Control panel	1	
			Compressors and pumps	1	
			Synthesis and Decomposition	1	
			Evaporation and prilling	1	
				4	17
3	2.	Worekrs		5	20
			Total		47

GRANULAR COMPLEX FERTILIZER PLANT (NPK)

Grade	Category of Staff	Manning Point	Staff/Shift (A&B) Train	Staff/Shift (C) Train	Total
	Supervisory				
9/10	1. NPK supdt.				2
7/8	2. Shift Engineer	Overall	1	1	6*1
	3. Chief Operator	Overall	2	2	14
	Non-supervisory				
4/5	1. Operator	Panel control	2	1	
		Scrubber section	2	1	
		Recycle section	2	1	
		Quality control	1	1	
		Pay Loader	1	1	
		Solid raw-material handling	1	-	
		Liquid raw-material handling	1	-	
		Port terminal	1	-	
		Operator			
		Bagging streams	-	1	
		Warehouse	-	1	
		Loading point	-	1	
			11	8	43
	Bagging (C Train Only)				
3	2. Truck drivers		3		
	3. Technician	Bagging	-	2	
		Stitching	-	2	
	4. Check weigher		-	2	
	5. Belt tender		-	1	
	6. Workers		4	-	
		Total	7	7	21

OLD BAGGING PLANT (UREA AND NPK A & B TRAINS)

Grade	Category of Staff	Manning Point	Staff/Shift	Total
	Supervisory			
9	1. Bagging supdt.			1
7/8	2. Shift Engineer	Operation	1	3
6	3. Chief Operator	Streams	1	
		Warehouse	1	
			2	7
	Non-Supervisory			
4/5	Operator	Streams	1	
		Warehouse (NPK & Urea)	2	
		Loading	2	
			5	17
3	Technician	Steam NPK (3 slats)	9	
		Steam Urea - (2 slats)	6	
	Chief Weigher	Urea	2	
		NPK	2	
	Clerk		1	
	Belt Tender		2	
	Loco Operator		2	
			24	102
	GRAND TOTAL		32	130

UTILITIES

Grade	Category of Staff	Manning Point	Staff/Shift	Total
9	Utilities supdt.			1
7/8	Shift Engineer		1	5
6	Chief Operator		1	4
4/5	1. Operator	Hydrotreater, cooling tower and raw material receipt	1	
		D.N. water plant + utility compressor and dryer (Air) + inert gas generator	1	
		Boiler	1	
		Analysis issue of raw material	1	
			4	19
3	2. Workers		4	20
	GRAND TOTAL		10	49

PRODUCTION PLANNING

Grade	Category of Staff	No.
12	Operating superintendent	1
11/10	Production planning superintendent	1
11/10	Nitrogen superintendent	1
11/10	NPK superintendent	1
11/10	Utilities superintendent	1
7/8/9	Shipping co-ordinator	1
7/8/9	Yield supervisor	1
7/8/9	Plant traffic officer	1
7/8/9	Night superintendents	6
7/8/9	Stenos	4
	Total	18

TECHNICAL SERVICES DEPARTMENT

Grade	Category	Number
12	Technical service supdt.	1
11	Dy. technical supt.	1
11	Engineering Supdt.	1
		2
9/10	Sr. process engineer	1
9/10	Chief chemist	1
9/10	Sr. Inspection Engineer	1
9/10	Sr. design engineer	1
		4
8	Process engineer	2
8	Fire and safety officer	1
8	R & D dengineer	1
8	Inspection engineer	3
8	Design engineer	5
8	Chemist	1
		13
7	Technical services engineer	5
7	R & D engineer	1
7	Chief draughtsman	1
		7
6	Chemists	3
6	Fire and safety inspector	1
6	Inspection assistant	1
6	Draughtsman	3
		8
4/5	Sr. Analyst	7
	Analyst	19
	Fireman	1
	Stenos	4
		31
1/2	Fireman	4
1/2	Workers	12
		16
	Total	82

DEPARTMENTWISE REQUIREMENT

Annexure 4A.1

Dept./Sect.	GM	DGM	C.E.	A.C.E.	DY.CE	PE/PM	APE/ APN	JE/ APN	Sr. T/O	O/T I	O/T II/III	Stenos	Mazdoors	Total	Remarks
Production			1	1	1	3	18	18	45	45	46	4	24	207	
Mechanical			1	2	2	4	11	34	79	82	78	8*	30	331	* 3 GK
Electrical			-	1	1	3	7	12	21	21	21	3*	16	106	* 1 GK
Instrument			-	1	2	2	7	14	17	17	17	3*	10	90	* 1 GK
Civil			-	-	1	1	3	-	9	9	9	2*	10	44	* 1 GK
Purchase			1	-	1	-	2	5	-	-	-	4	-	13	
Store			-	-	1	-	-	5	6	1	-	2	12	27	
T & C			-	-	1	-	-	3	2	4	-	1	8	19	
Bagging			-	-	1	-	5	5	8	12	13+28	1	85	158	
Fire			-	-	-	-	1	-	5	-	8	-	16	30	
Safety			-	-	-	1	1	3	-	-	-	1	1	7	
T.S.			1	-	1	1	5	-	10	8	4	3	3	36	
M.S.			-	1	1	2	6	-	-	-	-	6*	-	16	* 4 EDP Asst.
Personnel			-	-	1	-	4	3	1	-	-	4	-	13	
Finance			1	-	1	2	5	11+19*	8	-	-	8	-	55	* AAOs
Adm.			-	-	1	-	2	7	1+3*	10	7	2	21	54	* 3 Rece.
Hospital			-	1	-	3	4	1	4	4	11	2	18	48	
Canteen			-	-	-	-	1	4	4+1	-	-	-	15	25	
P. Relations			-	-	-	1	-	1	-	-	-	1	-	3	
Training			-	-	-	1	-	2	2	2	-	1	1	9	
GM & DGM's Office	1	2	-	-	-	-	-	4*	-	1**	-	-	3	11	* 1 A.S. ** TPN/Tel.
Total	1	2	5	7	16	25	82	151	226	215	242	56	273	1302	

G.M. = General Manager
DGM = Deputy General Manager
CE = Chief Engineer
ADE = Additional Chief Engineer
Dy.CE = Deputy Chief Engineer
PE/PM = Plant Engineer/Plant Manager
JE/AFM= Junior Engineer/Asst. Finance Manager Asst. Foreman
Sr.T.O = Senior Technical Operator
O/T I = Operator/Technician Grade I
O/T II & III = Operator/Technician Gr. II & III
Steno = Stenographer
Mazdoor

MATERIALS MANAGEMENT

Grade	Category	Number
10	Materials manager	1
9	Purchase	1
7 & 8	Purchase Officers	2
7 & 8	Expenditor	1
7 & 8	Stores Officer	1
		4
6	Stores supervisor (Disposal)	1
6	Materials Engineer (Inspector)	1
		2
4 & 5	Store Keepers re. - 2 in. - 2 Condex - 1	5
4 & 5	Steno Clerk	6
		11
1	Workers	10
	Total	29

PERSONNEL AND PUBLIC RELATIONS

Grade	Category	Number
12	Manager Personnel and Public Relations	1
9/8	Doctor	1
9/8	Industrial relations officer	1
9/8	Public Relations Officer	1
9/8	Training Officer and Security	1
9/8	Labour Welfare Officer	1
		5
6	Personnel Supervisor	1
	Secretary	1
4	Receptionist	1
4	Steno Pool	5
4	Canteen Supervisor	1
4	Nurses	2
		10
3/2	Drivers	16
3/2	Medical Attendant	3
		19
	Total	36

SECRETORIAL

Grade	Category	Number
10	Secretary	1
6/7	Engineering Asst.	1
6/7	Asst. Law Officer	1
6/7	Accounts Officer	1
		3
4	C S to Secretary	1
4	Telephone Operators	4
4	Telex Operator	1
		6
3	Mail Clerk	4
1	Peons	5
	Total	19

FINANCE AND ACCOUNTS

Grade	Category	Number
9	Accounts Manager	1
9	Finance Manager	1
9	Internal Auditor	1
9	Manager Mis	1
	Asst. Accounts Manager	3
	Asst. Finance Officers	4
	Budget Finance Officer	1
	Asst. Manager (Info. System)	1
	Senior System Designer	1
	Asst. Manager Data Processing	1
	Asst. Internal Auditor	1
	Data Processing Officer	1
	System Analyst	1
	Accountant	4
	Cashier	1
	Asst. Accountant	27
	Asst. Cashier	1
	Senior Analyst	1
	Analyst	2
	Senior Data Processing Operator	1
	D.P. Operator	8
	Accounts Clerk	2
	D & C Control Clerk	1
	Stenos	5
	Time Keeper	5
	Total	76

MANPOWER FOR PROJECT STAGE FOR AN AMMONIA, UREA, STEAM GENERATION AND UTILITIES A GRASS ROOTS COMPLEX

The manpower for project implementation has been worked out on the basis of mode of implementation of project as detailed below:

Ammonia and Urea Plants - Foreign process consultants will be appointed who will be responsible for design, basic engineering and procurement of critical equipment. Engineering consultants will carry out detailed engineering and prepare specifications for procurement of other items. Issue of enquiries, receipt of quotations and placement of orders will be done by owner. The consultant will be responsible for erection start up and commissioning and proving performance guarantees. Owner has to ensure the quality of work during civil construction and mechanical, electrical and instrumentation erection.

Off-sites - Engineering consultants for preparing detailed schemes of various off-sites and facilities. It is expected that the jobs will be executed on turnkey basis. The owner has to ensure the quality of work.

Township: Architect will be appointed for design and layout of the township and construction will be carried out under owner supervision.

Scope of work for owner's staff

The main activities and responsibilities under various sections can be broadly classified into hthe following:

(i) Preparation of Notice inviting tender, receiving quotations, evaluation of bids and appointing main eng. consultatns/contractors;

(ii) Approval of drawings;

(iii) Co-ordination and followup of progress of work of consultant;

(iv) Issue enquiries, receive quotations and placing orders for all equipment and materials;

(v) Certifying the progress of work for periodic release of money;

(vi) Monitoring the progress of work for ensuring timely completion;

(vii) Overall supervision to ensure quality of work;

(viii) Monitory and control on project expenditure.

In addition to above vigorous follow up of the progress of work to be done by external agencies like state government agencies, railways, raw materials utilities supplies agencies, etc. will also be required.

I have been assumed that the work with regard to personal accounts, personnel and public relation etc, will be handed separately by an organisation which is already existing.

Staff Requirement

In order to efficiently handle the project 193 persons will be required during the peak construction period. Apart from General Manager and Deputy General Manager, the balance of 191, will consist of 115 officers 76 supporting staff. Departmentwise, gradewise break up is given in annexure 4A.1. The gradewise summary is as under:

Designation	Grade	No. of Post
Chief Engineer/Finance Manager		2
Addl. Chief Engineer/Deputy Chief Engineer		11
Asst. Chief Engineer		17
Project Engineer		28
Junior Engineer		47
Junior Officer		10
Senior St. Asst/Senior Draftsman		11
Assistant/Draftsman/ASK/Dr.		17
St. Cl/Driver		13
Messengers, Mazdoor/Fireman		33
Total		191

It can be seen from annexure 4.1 that staff has been provided for manning a Guest House, Fire Station, First Aid and five vehicles plying at site. The actual positions could be done progressively with the gradual increase of workload after careful assessment. Care has to be taken that staff in each discipline is much less than the requirement after project completion except in case of Civil Department, where it is desirable to take persons on loan from other organisations who will go back to their parent organisations after completion of the project.

STAFF REQUIREMENT FOR PROJECT

Annexure 4.1

Disceipline	Chief Engineer	Addl.C.E./ Dy. C.E.	Asst. C.E.	Pro. Engr.	Jr. Engr.	Jr. Officer	Sr. St. Asst.	St. Asst.	St. Clerk	Messenger/ Mazdoor	Total
Chemical	-	2	2	5	-	-	-	-	-	-	9
Mechanical	-	1	3	4	10	-	-	1*	-	-	19
Electrical	-	1	2	3	7	-	-	1*	-	-	14
Instrumentation	-	1	2	2	5	-	-	1*	-	-	11
Civil	1	2	2	3	10	-	-	-	-	-	18
Drawing Officer	-	-	-	-	-	1	-	2@	2@	2@	7
Safety & Fire	-	-	-	1	1	-	4@@	-	-	16**	22
M.S.	-	1	1	2	-	-	-	-	-	-	4
Finance	1	1	1	2	4	4	-	-	-	-	13
Material (Pur. St., MH)	-	1	2	5	6	-	-	3	-	4	21
Transport & Clearance	-	1	-	-	1	-	-	-	-	-	2
Estate & Adm. (Incl. Guest House & Transport)	-	-	1	-	1	-	1 (Cook-Caretaker)	3 (1 Cook 2. Dr.)	4 (1 Cook 3 Dr.)	9 (7 Waiter 2 Maz.)	19
Personnel & Welfare	-	-	1	-	1	-	-	-	-	-	2
Medical	-	-	-	1	-	-	1	-	1 (Amb.Dr.)	1	4
GM's, DGM's & Pro. Office	-	-	-	-	1	5	5	6	6	3	26
Total	2	11	17	28	47	10	11	17	13	35	191

*A.S.K. @Draftsman @@F. Sup. **F. man

MANPOWER REQUIREMENT FOR NORMAL OPERATION AND MAINTENANCE

The Basis for Proposed Manning

The proposal made here is based on the following considerations:

1. Activities of loading in wagons and trucks, stacking of bags and conservancy jobs will be done through contract and the schools will be managed by private institutions.

2. The mechanical workshop will have a section for repair of autovehicles as good garages are not likely to be available in that area.

3. A separate centralised group for preventive maintenance planning and execution has been considered in case of mechanical, electrical and instrumentation maintenance departments. There will be another group to look after the breakdowns, modifications and other jobs not covered under preventive maintenance plan for each department.

4. Shift maintenance (mechanical) will also be centralised with a Junior-Engineer-in-Charge. This group is expected to carry out the emergency jobs which are otherwise minor in nature. In case of big jobs, the general shift staff will assist.

5. To look after power generation and electrical supply receiving station and distribution, the Shift-in-Charge will be of the level of Asst. Plant Engineer.

6. In Production Department each plant (Ammonia and Urea) will be looked after by Asst. Plant Managers.

7. Computer services will be availed from outside.

8. Services of liaison office under corporate services will be availed for material procurement and obtaining import licence, government clearance, etc. as and when required.

9. It may be adequate to have only one canteen for factory and administrative building.

10. Bagging plant requirement is based on 21 slat shifts (i.e. 7 slats per shift) and two siloes.

11. Main facilities for training will be availed from training institute outside. There will be a small group to take care of the needs of in-plant training at site and library.

12. The functions of co-ordination managers will be looked after by the following:

Annexure 4A

MANPOWER REQUIREMENT FOR THE PROJECT AT OPERATING STAGE

Group	Designation
Ammonia I & II	Additional Chief Engineer (Chemical)
Urea I & II	Deputy Chief Engineer (Chemical)
S.G., W.T., Coal and Ash Handling	Deputy Chief Engineer (Mechanical)
Bagging and Material Handling	Deputy Materials Manager (M.H.)

13. Officer oriented organisation has been considered for Finance, Personnel and Administration Departments.

Annexure 5

BREAKDOWN OF ADDITIONAL TRAINING REQUIREMENTS NDC - 1979-1983

				By 1981
A.	Professional Degree or equivalent for management posts	Mechanical	40	
		Electrical	30	
		Chemical	25	
		Production	45	
			150	100
B.	Technician	Production management	50	
	Supervisor or Diplomats	Maintenance Mechanical	75	
		Maintenance Electrical	50	
		Maintenance Chemical	50	
		Labour Supervision	25	
			250	200
C.	Skilled Craftsmen	Metal Cutting M/C Operators	150	
		Toolroom fitters	50	
		Mechanical fitters	200	
		Pipe fitters	150	
		Instrument fitters	75	
		Automotive machine mechanics	50	
		Diesel mechanics	50	
		Fabricators (including welders and blacksmiths)	100	
		Carpenters painters	50	
			1000	700
D.	Misc.	Specialists including foundrymen	100	
			100	
			1500	1000

Annexure 6

	5-Year Requirement	Duration Full Time Certificate	Upgrading Part Time or Full Time
1. Metal Cutting M/C Operators General m/c shop operators not engaged on production, but in one off or small batch production for repairs, tool room, etc.	150	3 years	6 months
2. Tool Room Fitters Bench workers and sometime m/c operators for tool & die shops, tool maintenance & machine repair	50	3 years	6 months
3. Mechanical Fitters Craftsmen engaged on plant maintenance, or site repairs, on site make up of spares, for all mechanical equipment (excluding electrical or chemical plant and fabrication)	200	2 years	9 months
4. Pipe Fitters Craftsmen engaged on chemical hydraulic, steam or other services equipment, involving pipework, pumps, valves, gauges, etc.	125	2 years	6 months

	5-year Requirement	Duration Full Time Certificate	Upgrading Part Time or Full Time
5. Electrical Fitters			
Craftsmen engaged in maintenance of electrical motors, generators, switch gears, control boards, internal distribution systems and installation of same	150	2 years	6 months
6. Instrument Fitters			
Craftsmen engaged in installation, servicing & repairing of instruments used in control systems on mechanical, electrical and chemical process equipment including electronic control panels	75	3 years	12 months
7. Automotive Mechanics			
Mechanics capable of and maintaining repairing servicing transport (both road and internal) particularly high performance i/c engines, but excluding stationery, diesel, or heavy diesel equipment	50	2 years	6 months

	5-year Requirement	Duration Full Time Certificate	Upgrading Part Time or Full Time
8. Diesel Mechanics Mechanics capable of maintaining, repairing and servicing diesel equipment associated with generation, services transport, and assembly or dissembly on site	50	2 years	6 months
9. Fabricators Craftsmen engaged in metal forming, structural or equipment fabrication and assembly, welding and cutting, welding repairs to pipes, pressure vessels, mechanical parts	100	2 years	6 months
10. Carpenters & Painters Craftsmen engaged in working all forms of wood, including laminates and plastic impregnated materials and compressed synthetic materials and repairs to buildings, furnishings, etc. The applications of protective finishes, dipping, maintenance of wood products and the protection of metal or plastic equipment in industrial and domestic or administrative premises	50	2 years	6 months
	1,000		

	5-year Requirement	Duration Full Time Certificate	Upgrading Part Time or Full Time
11. Miscellaneous Specialists			
Including foundreman, metallurgical and plastic process workers for operation of plant on production	100		

Annexure 7

PETROCHEMICALS : NIGERIA

Nigeria has a very ambitious plan for the development of the petrochemical industry during 1980-90. Currently, there are no basic petrochemical plants in operation.

According to the report of the ECA/UNIDO Chemical Industry Programme Mission (June 23 - July 11, 1978) the consumption of major petrochemical products has been as below:

	1975	1976	% Increase
PVC	21,000	29,500	40
LDPE	20,000	27,150	35
HDPE	10,000	12,500	25
POLYPROPYLENE	3,000	4,000	33

The end use of PVC are for shoes, cables, leathercloth, pipes, floor tiles etc. LDPE has been used largely as films for packaging (85%), and HDPE for injection and blow moulding products. Polypropylene has been used for woven sacks and bands for heavy duty packaging.

1980-1990 Plans

The plans for the 10 years period are in three phases as below:

Phase I

1. Polypropylene — 35,000 tons per year
2. Linear alkyl benzene sulphonate — 30,000 tons per year
3. Carbon black — 35,000 tons per year
4. Benzene

These projects have been planned with feedstocks from the refineries i.e. propylene, N-paraffins from kerosine fraction, and FCC recycle product for carbon black. The contract for the polypropylene project is with tecnimont, and for other projects with lummus, and courbus from engineering.

These projects are planned to be operational by 1983.

The refinery programme is as below:

1. 3 million tons crude throughout (Port Harcourt) - In Operation
2. 5 million tons crude throughout (Port Wani) - In Operation
3. 5 million tons crude throughout (Port Kaduna) - To become operational by July 1, 1980

Besides, contract negotiations are currently on for the construction of a 9 million tons per year refinery to meet internal demands by 1987.

A 350,000 barrels per day (17 million tons per year) - refinery is being planning primarily for export of petroleum products.

Phase II

The Phase II of the plan is as below:

1. Olefine cracker for 300,000 tons/year euyelen
2. A caustic chlorine plant for 100,000 tons/year chlorine

These two are basic projects. Both of these are to be owned 100% by NNPC. The down-stream projects are:

LDPE	110,000 tons per year
HDPE	70,000 tons per year
(VCM	145,000 tons per year
(PVC	140,000 tons per year
(Ethylene oxide	35,000 tons per year
(Ethylene glycol	

The down-stream projects might be set up as Joint Ventures primarily to obtain technology, and for export of surplus products in the interim period. The objectives are, however, clear. These projects are being set up to develop resources for the Nigerian economy and the products are intended to be all used in the domestic market.

The location is at Port Harcourt. Intensive discussions have already started (May 1980), and the schedule calls for all commitments to be finalised by June 1981.

It is also intended to start one line of PVC (70,000 tons per year) with imported manomer VCM by 1983.

Phase III

The Phase III of the project will be aromatics. The studies will be taken up in 1982 (i.e. after the Phase II discussions and commitments are completed), and the commitments are expected to be completed by 1982-84.

Manpower Training

A Petroleum Training Institute has been set up at WARRI for training of skilled operators and technicians. Nearly 700 skilled operators and technicians have been trained in the operating refinery for the new refinery.

Annexure 8

SOME MANAGEMENT EDUCATION AND TRAINING INSTITUTIONS/INSTITUTES IN NIGERIA

1. Institute of Administration
   University of Ife
   Ife

2. University of Lagos
   Lagos

3. Yaba College of Technology
   Yaba, Lagos

4. Auchi Polytechnic
   Auchi

5. College of Science and Technology
   Port Harcourt

6. Continuing Education Centre
   University of Lagos
   Lagos

7. Polytechnic Institute
   Ibadan

8. Institute of Management and Technology
   Institute of Administration
   P.M.B. 1079
   Enugu

9. College of Technology
   Ilorin

10. Co-operative Management Institute
    Calabar

11. Institute of Administration
    Ahmadu Bello University
    Zaria

12. Ministry of Trade
    Co-operative College
    Enugu

13. Faculty of Business Administration
    University of Nigeria
    Nsukka

14. Polytechnic Institute
    Kaduna

15. Nigerian Institute of Management
    Adelabu
    Surulere, Lagos

16. Centre for Management Development
    Ikorodu Road
    Lagos

17. Industrial Training Fund
    Jos

18. Institute of Personnel Management
    of Nigeria
    Lagos

Annexure 9

STATUS OF ENGINEERS IN NIGERIA 1977
(NATIONAL MANPOWER BOARD)

	Total Position	No. of Position	Vacancies %	No. of Expatriates %
Civil and ST	17,685	8,069	54.3	4.6
Electric and Electronic	2,497	1,567	37.2	30.6
Aero	354	343	3.1	31.8
Marin	493	371	24.7	23.7
Other mech.	1,753	1,170	33.4	24.4
Chem.	219	165	24.6	3.6
Petro. Eng.	140	100	28.5	18.0
Mining	54	25	53.7	28.0
Metallurgy	26	11	57.6	9.1
Others	1,249	1,197	4.1	17.4

DEVELOPMENT OF EDUCATION INFRASTRUCTURE IN EGYPT 1/

EGYPTIAN UNIVERSITY GRADUATES: 1976-77
(SELECTED DISCIPLINES)

Engineering	4674
Agriculture	5970
Sciences	2321
Technology	2096
Electronics	329
Petroleum and mining	197

HIGH INSTITUTES GRADUATES: 1974-75
(SELECTED DISCIPLINES)

Commerce	1787
Agriculture	242
Industry	2292

TECHNICAL INSTITUTE GRADUATES: 1976-77
(SELECTED DISCIPLINES)

	MALE	FEMALE	TOTAL
Commerce	2701	2425	5126
Technical	2600	129	2729

1/ Statistics Yearbook (1952-1977) July 1978 Central Agency for Public Mobilization and Statistics Arab Republic of Egypt.

Annexure 11

COUNTRIES WITH MORE THAN 10 MILLIONS POPULATION IN AFRICA 1/

	Millions
Algeria	19
Egypt	40
Ethiopia	30
Ghana	10
Kenya	15
Morocco	19
Nigeria	80
Sudan	17
Uganda	12
Tanzania	17
Zaire	27
(Mozambique 9.44)	
Africa - Total	456

1/ United Nations: Population and Vital Statistics Report. January 1, 1980. Figures have been rounded off.

Annexure 12

SOME SELECTED MANPOWER STUDIES

1. Survey of High Level Manpower in Ghana, Accra - 1961

2. A Study of Nigeria's Professional Manpower in Selected Occupations - 1964
   National Manpower Board Nigeria, Apapa 1964

3. High Level Manpower Requirement and Resources in Tanganyika, Dar-es-Salaam 1963

CONSUMPTION OF CHEMICAL FERTILIZERS [1] IN AFRICAN COUNTRIES WITH MORE THAN 10 MILLION POPULATION

1976 - FAO DATA

	KG/HA of ARABLE LAND AND PERMANENT CROPS		KG/CAPITA	
	N	P_2O_5	N	P_2O_5
WORLD 1976	30.3	17.8	11.2	6.6
AFRICA 1975	6.8	4.3	3.5	2.2
ALGERIA	9.8	13.0	4.3	5.7
EGYPT	17.16	3.72	13.4	2.5
ETHIOPIA	0.8	0.7	0.4	0.3
GHANA	4.4	1.9	1.2	0.5
KENYA	10.4	12.6	1.6	2.0
MOROCCO	10.5	8.9	4.6	3.9
NIGERIA	2.1	1.9	0.8	0.7
SUDAN	14	-	6.7	-
UGANDA	0.1	-	0.2	0.1
TANZANIA	2.3	1.7	0.9	0.7
ZAIRE	1.0	0.8	0.2	0.2

1/ FAO Fertilizer Year Book.

IMPORT OF CHEMICALS INTO DIFFERENT AFRICAN REGIONS: 1977

	U.S. $ (000)
North Africa	1,806,985
West Africa	1,538,841
Central Africa	352,780
East Africa	558,060
Others	134,445
Total	4,391,111