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SECTORAL REVIEW OF CHEMICAL INDUSTRY IN ALBANIA

SOCIALIST PEOPLE'S REPUBLIC OF ALBANIA

Prepared for the Government
of the Socialist People's Republic of Albania and
the United Nations Industrial Development Organization,

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Vienna

TABLE OF CONTENT

1. ABSTRACT 3

2. INTRODUCTION 4

3. GENERAL CHARACTERISTICS OF THE COUNTRY 5

4. CHEMICAL INDUSTRY IN ALBANIA 7
   - 4.1. Chemical Works, Tirana 7
   - 4.2. Detergent Factory, Qyteti Stalin 10
   - 4.3. Chemical Works of Gogo Nushi, Fier 11
   - 4.4. Chemical and Metallurgical Complex, Laq 14
   - 4.5. Chemical Works, Durres 16
   - 4.6. Soda and PVC Factory, Vlora 19

5. ANALYSIS AND DISCUSSION 23

6. CONCLUSIONS 28

7. RECOMMENDATIONS 31

8. SUMMARY 34

9. ACKNOWLEDGEMENT 34

10. ANNEXES 35
    - 10.1. Allocation of Natural Resources - Chart 36
    - 10.2. Allocation of Chemical and Metallurgical Industry; Crude Oil and Natural Gas Processing Industry 37
    - 10.3. Typical Organizational Diagram of Industrial Enterprise 38
    - 10.4. Institutions Visited and Persons Met 39

1. ABSTRACT

Personal visits and inspections of individual factories of the chemical industry along with consultations of actual problems and potentials of further technical development as well as systematic information and data collecting have been carried out during the author's mission from 10th January to 26th January, 1990 in Socialist People's Republic of Albania.

Assesment of the present state and analysis of the compiled data and available information have allowed to draw the general conclusion that the country has all major prerequisites for effective development of the sector, mainly raw materials and energetics.

Recommendations formulated in 10 items stimulate the further development basicly towards the exploitation of the natural resources as natural gas, coal, limestone, dolomite, rock salt, and of chromium, copper and iron ores.

Upon the agreement of the author and technical staffs of factories several opportunity and pre-feasibility studies will be elaborated in the first half of the year to set out objectives of technical development that can be solved by own means.

The technical assistance of UNIDO has been streamlined in the first stage towards the items 7.6; 7.4; 7.1; 7.10 of the recommendations, see Chapter 7.

The elaborated sectoral review of chemical industry in Albania is to be discussed and considered in connection with paralelly prepared reviews of metallurgical and food industry, as they may point out some important requirements or suggestions.

2. INTRODUCTION

The Government of Albania and its Committee of Science and Technology being interested in strengthening the technical cooperation with UNIDO have expressed their wish and interest in the preparation of industrial survey for Albania, which would facilitate an identification of the most important and urgent needs of further technical development and investment policy.
The Ministry for Industry and Energetics and Ministry for Foodstaff have required and have been interested primarily in experts missions for three sectors : chemical industry, metallurgical industry and food industries. Brief studies should include an analysis of the present structures and outputs of the industries and potentials for further development.
As the result of the above requirements, the mission of the author on three weeks assignment from 8th January, 1990 to 27th January, 1990 has been effected as the first of the proposed series.

The UNIDO work assignment :
Undertake mission to Albania to collect data on the chemical sector and individual plants/enterprises. Prepare the sectoral review for chemical sector with conclusions and recommendations for streamlining technical assistence in this sector.

An agreement upon the outline of the report was made at the briefing that took place on 8th and 9th January, 1990 in Vienna under the guidance of the Backstopping officer Mr. Donocik.

The rather short actual stay in Albania from 11th January to 26th January, 1990 was completely devoted to the visits of factories and institutions, data collecting and consultancy.

3. GENERAL CHARACTERISTICS OF THE COUNTRY

Only the available data that could be of any importance in relation to the further technical development of the chemical industry have been included into the chapter. Cited data refer to the fiscal year 1988.

3.1. Geography

Area : 28 489 sq.km. **Cities** : Capital - Tirana 363 (population in thousands of inhabitants), Durres 242, Fier 239, Elbasan 238, Shkodar 233. **Terrain** : 77 % mountainous; 23 % fertile river valleys.

3.2. People

Population : 3,138 million, urban population 1,111 million, rural population 2,026 million, employees and workers 0,811 million, engineers 13 807, agronomists 6 496, percentage of female workers 46.8. **Density** : 110 per sq.km; annual growth rate 2.0 %, life expectancy : male 69.4 years, female 74.9 years.

3.3. Natural Resources

Oil, gas, coal, chromium, copper, iron, nickel.

3.4. Main Industrial Products

Lignite 2 184 (in thousands of tons), chromium ore 1 087, iron-nickel ore 1 067, chromium concentrate 160, copper concentrate 55, blister copper 15, copper wires 11.6, carbonic ferrochrome 38.7, metallurgical coke 291, rolled wrought steel 96, phosphatic fertilizer 165, ammonium nitrate 96, urea 77, sulphuric acid 81, caustic soda 31, soda ash 22, cement 746, machinery 496 million Leks, spare parts 493 million Leks; electric power 3 984 GWh.

3.5. Agriculture

Area of arable land 714.2 (in thousands of hectares), field crops 589.8 of which wheat 199, maize 72.1, rice 3.2, vegeta-

bles 23.2, potatoes 12.9, dried beans 24.2, tobacco 32.0, cotton 14.5, sunflower 25.6, sugar-beet 7.4, other crops 143.9, orchards 59.6, olive groves 44.5, vineyards 20.3; pastures 403, forests 1 047.

3.6. Economy

Income of the state budget 8 585 million Leks; per capita income 2 727 Leks; export 2 709 million Leks; import 3 218 million Leks; exchange rate : 7 Leks = US Dollar 1.

4. CHEMICAL INDUSTRY IN ALBANIA

Practically only after the second World War and the Liberation in 1944 were gradually created conditions for industrialization of the country, originally almost exclusively agricultural. Along with constructing other industrial branches and mainly energetics, the chemical industry has been developed, priority being given to the most important products for the country's economy. At the present six chemical factories are manufacturing a relatively large assortment of products.

4.1. Chemical Works, Tirana

4.1.1. General

Locality : North-east periphery of the town; area : 5 ha; employees : total 500, management and staff 55, engineers 25, workers 420; capacity of engineering nets : steam 15 000 t/y, fuel oil 1 200 t/y, water 200 000 m^3/y, electric power 2 GWh; manufacturing : enamel and oil paints, marine paints, anti-corrosion primers, lacquers, printing inks, inorganic pigments, detergents, shoe creams, bakelite.

4.1.2. Technology estimation

The technological process of enamel and oil paints manufacturing is based on chinese know-how and also the main parts of equipment are of chinese provenience and supply.

Enamel paints consist of oil modified alkyd resin, xylene, mineral spirits, driers and pigments (titanium dioxide, lead chromate, iron blue, carbon black, toluidine red, etc.,) containing 24 % of pigments, 36 % of vehicle and 40 % of solvent whereas the pigment-binder ratio is 1:1,5. The products are intended to be used for wood, metal and wall protection and decoration. The whole plant capacity 1 000 t/y

is for inland market; production costs 10 200 Leks/t; price 12 000 Leks/t.

Qualitative parameters :	hiding power	< 140 g
	particle size	< 25 microns
	viscosity (Ford 4)	60-90 sec.
	drying time	< 15 hours
	flexibility	1 mm
	impact resistance	50 kg/cm^2

Oil paints consist of modified cholophonic resins, oleoresinous vehicle, mineral spirits, driers and pigments containing 48 % of pigments, 34 % of vehicle, 18 % of solvent; pigment-binder ratio 1,5:1; use for wall, wood and metal protection and decoration; plant capacity 500 t/y; the whole production is for inland market; production costs 8 300 Leks/t; price 8 500 Leks/t.

Qualitative parameters :	hiding power	80-200 g/m^2
	particle size	< 40 microns
	viscosity (Ford 4)	70-100 sec.
	drying time	< 24 hours
	flexibility	1 mm
	impact resistance	50 kg/cm^2

Anti-corrosion primers containing extenders are suitable for metal and wood protection. The annual output is 350 t/y production costs 8 000 Leks/y; price 8 500 Leks/y.

Marine paints as boottoping paints with excellent resistance to seawater and marine atmosphere, deck paints applied as priming coat, topside paints for protection and decoration of ship hulls above the water line, cabin enamel and anti-corrosion primer for different metal surfaces including aluminium, represent special coatings with an annual output 100 t/y. Production costs 11 500 Leks/t; price 13 000 Leks /t.

Printing inks have an annual output of 60 t/y. Production costs : offset inks 14 700 - 41 500 Leks/t, newspaper inks

10 900 Leks/t, book inks 13 400 Leks; prices : offset inks 16 400 - 44 600 Leks/t, newspaper inks 11 400 Leks/t, book inks 14 400 Leks/t.

Lacquers based on medium oil modified alkyd resin, butylated melamine resin and bitumen are used mainly as insulating and impregnating varnish; output 200 t/y; production costs 9 600 Leks/t, 12 500 Leks/t; price 10 800 Leks/t, 14 000 Leks/t.

Water dispersion paints based on dispersions of polyvinyl acetate homopolymer (Mowilith) applicable on concrete, wood and metal surfaces have an annual output of 100 t/y. Production costs 14 - 18 000 Leks/t; price 16 - 20 000 Leks/t.

The above mentioned products are manufactured in a multipurpose plant. Start of production 1970; initial value of funds 8,2 million Leks; actual value of funds 4 million Leks; useful service life 5-10 years; employees : total 84, management and staff 2, engineers 2, workers 80.
Average consumption figures of utilities :

steam	3-4 t/t
fuel oil	0,3 t/t
water	50 m^3/t
el.power	400 kWh/t

Inorganic pigments manufacturing includes iron oxide red, iron oxide yellow, iron oxide black, lead chromate, zinc chromate, zinc oxide. The technological process consist of basic reactions of raw materials with acids and washing, filtration, drying, grinding and packing operations. Waste materials of metallurgical industry as raw materials are processed mainly.
Qualitative parameters of main products :

iron oxide red :	content of iron oxide	> 95 %
	hiding power	< 8 g/m^2
lead chromate :	content of lead chromate	> 55 %
	hiding power	< 60 g/m^2

zinc oxide :	content of zinc oxide	> 90 %
	hiding power	< 130 g/m^2
common parameters :	particle size	< 100 microns
	water content	< 1 %

Plant capacity 200 t/y, 170 t/y processed in paints manufacturing, 20 t/y sales, 10 t/y export; production costs : lead chromate 14 000 Leks/t, iron oxide red 9 000 Leks/t, zinc oxid 7 000 Leks/t;

Consumption figures of utilities :	steam	17,5 t/t
	water	200 m^3/t
	el.power	4 000 kWh/t

Indigenous know-how; start of production 1976; initial value of funds 1 million Leks; actual value of funds 0,4 million Leks; useful service life 10 years; employees : total 21, management 1, workers 20.

4.2. Detergent Factory, Qyteti Stalin

4.2.1. General

Locality : central part of the country; initial value of funds 1,1 million USD; actual value of funds 0,9 million USD; employees : total 170, management and staff 9, engineers 1, workers 160; manufacturing : detergent-washing powder.

4.2.2. Technology estimation

Technological process : dodecyl benzene is sulfonated with oleum at the temperature of 95 - 100°C, separated and neutralized with sodium hydroxide, then water and all components (sodium silicate, sodium carbonate and sodium tripolyphosfate) are added and mixed at 60°C; suspension is dried and formulated with sodium perborate and addition of optical brightener and fragrance. Technology is based on Italian know-how and licence, fa Balestra, turnkey plant; useful service life 25 years. Capacity 10 000 t/y, production of 5 000 t/y for inland market, 5 000 t/y reserve.

Composition of the product :	surfactant	12 - 14 %
	sodium tripolyphosfate	14 %
	sodium carbonate	25 - 30 %
	sodium perborate	8 %
Consumption figures of utilities :	steam	1,4 t/t
	water	16 m^3/t
	gas	240 Nm^3/t
	el.power	unknown

Production costs 5 900 Leks/t, price 6 500 Leks/t.

4.3. Chemical Works of Gogo Nushi, Fier

4.3.1. General

Locality : Fier, 120 km southwards from Tirana; distance from port 40 km; initial value of funds 564,8 million Leks; actual value of funds 58,4 million Leks; area : 13 ha; employees : total 1 000, staff 12, engineers 30, workers 900; engineering nets : all kinds of utilities without reserves; transport : railway, road; manufacturing : liquid ammonia, nitric acid, ammonium nitrate, urea; emissions : ammonia gas, dinitrogen oxide; liquid waste : small quantities under control.

4.3.2. Technology estimation

Ammonia plant I : The technological process is based on the processing of natural gas by purification of sulphur compounds on zinc oxid and Co-Mo catalyst; steam is added to the purified gas in proper ratio and the mixture is reformed in two steps on Ni catalyst; after the middle and low shift conversion, carbon dioxide removal and methanation at temperatures of 400-450^{o}C and pressures up to 60 MPa, the gas passes to the synthesis loop. Synthesis is carried out on Fe catalyst at higher temperature and pressure. Ammonia gas is condensed and stored.

Capacity : 60 000 t/y, the whole production is processed in urea plant; production costs : 693.8 Leks/t; price : 1 020 Leks/t;

Qualitative parameters : ammonia 99.85 %, water 0.15 %, oil 50 ppm.

Consumption figures : natural gas 680 Nm^3/t for the synthesis, natural gas 368 Nm^3/t as fuel, air 946 Nm^3/t, boiler feed water 2.7 m^3/t, water 0.64 m^3/t, el. power 690 kWh/t.

Employees : management 2, staff 2, engineers 2, operators 65;

Start of production 1976, initial value of funds 116,6 million Leks; actual value of funds 47,2 million Leks; useful service life 20 years. Chinese know-how and complete supply of turnkey plant.

Urea plant : The technological process is based on the synthesis of carbon dioxide and liquid ammonia at the temperature of 190°C, pressure 20 MPa and molar ratio 1:4. Reaction mixture is distilled to remove the superfluous ammonia and carbon dioxide that are absorbed in ammonia water and recycled into the process. Urea solution after water evaporation is processed by spraying in granulation tower.

Capacity : 85 000 t/y; the whole production is used as fertilizer in the inland agriculture; production costs 820 Leks/t; price 2 000 Leks/t.

Qualitative parameters : content of N_2 46 %, biurea 2 %, water 0.3 %.

Consumption figures of raw materials :

	ammonia	0.590 t/t
	carbon dioxide	0.780 t/t
Consumption figures of utilities :	steam	1.7 t/t
	water	25 m^3/t
	el.power	144 kWh/t

Employees : management 2, staff 2, engineers 1, operators 39;

Start of production 1976; initial value of funds 67,5 million Leks, actual value of funds 16,7 million Leks; useful service life 15 years. Chinese know-how and complete supply of turnkey plant.

Nitric acid plant : Process is based on classical ammonia oxidation on Pt-Rh (10:1) catalyst at a temperature of 840°C and pressure of 0.34 MPa.
Capacity : 89 000 t/y; further processing for ammoniom nitrate 79 000 t/y; inland market 10 000 t/y; production costs 302.9 Leks/t; price 410 Leks/t.
Qualitative parameters : content of nitric acid 53 % ;
Consumption figures (calculated for 1t of of 100 % nitric acid) : ammonia 0.297 t/t, boiler feed water 0.070 m^3/t, water 7.700 m^3/t, electric power 65 kWh, platinum catalyst 0.140 g/t.
Employees : management 2, staff 2, engineers 1, operators 18;
Start of production 1967; initial value of funds 53,6 million Leks, actual value of funds 3.2 million Leks; useful service life 15 years. Know-how and complete supply of turn key plant from Montecatini, Italy.

Ammonia plant II : Full automatic and remote controlled process based on partial oxidation of natural gas at the temperature of 1350°C, high shift conversion of synthesis gas followed by decarbonation, compression, purification and synthesis.
Capacity : 40 000 t/y, further processing to ammoniom nitrate 35.000 t/y, inland market 5 000 t/y for metallurgical industry; production costs 1 020 Leks/t, price 1 020 Leks/t.
Qualitative parameters : ammonia 99.85 %, water 0.15 %, oil 5 ppm.
Consumption figures : natural gas 870 Nm^3/t, steam 0.56 t/t boiler feed water 2.6 m^3/t, water 10.2 m^3/t, electric power 1.600 kWh/t; employees : management 2, staff 2, engineers 2, operators 62; start of production 1967; initial value of funds 225 million Leks, actual value of funds 13,4 million Leks; useful service life 15 years; know-how and complete supply of turnkey plant from Montecatini, Italy.

Ammonium nitrate plant : Classical full autamatic and remote controlled technology based on processes of neutraliza-

tion, evaporation, granulation, cooling, screening and coating.

Capacity : 110 000 t/y, inland market 110 000 t/y used as fertilizer and raw material for explosives; production costs 660 Leks/t, price 1 500 Leks/t.

Qualitative parameters : ammonium nitrate 99.30 %, water 0.50 %, calcium carbonate 0.20 % .

Consumption figures : ammonia 0.211 t/t, nitric acid 0.776 t/t, steam 0.41 t/t, boiled feed water 0.05 m^3/t, water 1.21 m^3/t, el.power 24 kWh.

Employees : management 2, staff 2, operators 29;

Start of production 1967; initial value of funds 60,3 million Leks; actual value of funds 3,5 million Leks; useful service life 15 years; know-how and complete supply of turn-key plant from Montecatini, Italy.

4.4. Chemical and Metallurgical Complex, Laq

4.4.1. General

Locality : North Albania, 44 km from Tirana; initial value of funds : 206 million Leks; area 3.27 ha; employees : total 350, management 5, staff 33, engineers 12, workers; transport : railway, road; manufacturing : sulphuric acid, single superphosphate, concentrated nitric acid, sodium fluorosilicate, nickel sulphate.

4.4.2. Technology estimation

Sulphuric acid plant I : Source of sulphur dioxid containing gases is roasting of pyrites in fluidized bed followed by dry and wet cleaning, singl-contact and singl-absorption processes; vanadium oxid catalyst.

Capacity : 52 500 t/y; 30 500 t/y further processed in superphosphate plant; 22 000 t/y for inland market; production costs 255 Leks/t; price 270 Leks/t.

Qualitative parameters : content of sulphuric acid 93-98 %, content of iron < 0.1 % .

Consumption figures : pyrites 0.950 t/t, el.power 80 kWh/t, water 50 m^3/t.
Employees : management - , staff 7, engineers 2, workers; Start of production 1960; initial value of funds 54 million Leks; useful service life 20 years; Chinese know-how and supply of machinery.

Sulphuric acid plant II : Source of sulphur dioxide containing gases is processing of copper ore; gases from smelter furnaces containing 4-6 % and gases from convertors containing 6-7 % of sulphur dioxide are separated of dust in cyclones and mixed. Gases passing to further processing contain 4-5 % of sulphur dioxide.
Capacity : 35 000 t/y; the whole production processed in superphosphate plant; production costs 271 Leks/t; price 270 Leks/t.
Qualitative parameters : content of sulphuric acid 92.5-93 %, content of iron 0.2 % .
Consumption figures : sulphur dioxide 300 Nm^3/t, el.power 275 kWh/t, fuel oil 0.084 t/t.
Employees : management -, staff 7, engineers 2, workers 88; start of production 1979; initial value of funds 74 million Leks; useful service life 20 years; Chinese know-how and supply of machinery.

Single superphosphate plant : Finely ground phosphate rock containing 28-29 % of P_2O_5 is mixed with sulphuric acid diluted to 66-68 % in mixer at the temperature of 130°C. The fluid material goes to the den where it solidifies. The superphosphate is excavated, removed from the den and conveyed to storage piles for final curing, which requires 2 - 3 weeks.
Capacity : 165 000 t/y; the whole output used in inland agriculture as fertilizer; production costs 380 Leks/t; price 500 Leks/t.
Qualitative parameters : content of P_2O_5 15-16 %, water 14 %, free phosphorous acid 5 % .
Consumption figures : phosphate rock (28 % P_2O_5) 0.624 t/t,

sulphuric acid (98 %) 0.375 t/t, el.power 16 kWh/t.
Employees : management -, staff 7, engineers 2, workers 80; start of production 1966; reconstructed in 1989; initial value of funds 75,1 million Leks; useful service life 20 years; Chinese know-how and supply of machinery.

Nitric acid concentrated : Nitric acid 50-53 % and sulphuric acid 93 % are dosed into distillation column; gaseous nitric acid is condensed and whitened; capacity 5 000 t/y, the whole production is used for explosives manufacturing; content of nitric acid 99 %; full automatic and remote controlled unit; know-how of Rhôn-Poulenc, France.

4.5. Chemical Works, Durres

4.5.1. General

Locality : central part of the country at the seaside; value of funds unknown; area 17 ha; employees : total 741, management 11, staff 57, engineers 25, workers 648; transport : road and sea; manufacturing : thiram, sodium metham, zineb, formulation of pesticides (lindane, dipterex, sevin, zincosevin, zineb), ground sulphur, aluminium sulphate, sodium dichromate, copper oxychloride, bordeau paste, calcium polysulphide, sodium bisulphite, sodium sulphite, sodium thiosulphite, chemical reagents.

4.5.2. Technology estimation

Zineb, chemical name : [(1,2-ethanediylbiscarbamodithioato) (2-)] zinc; Manufacture : mixture of ethylene diamine and aqueous sodium hydroxide solution is stirred and cooled while carbon disulphite is added below the surface of the mixture at the temperature of 25°C, then hydrochloric acid is added and zinc chloride; the product is separated, dried and packed.
Capacity : 600 t/y, 200 t/y are used in agriculture as fungicide, 400 t/y are further processed for fungicidal formulation; production costs 8 736 Leks/t; price 9 630 Leks/t.

Qualitative parameters : content of active ingredient 60 %, rest on 63 micron sieve max.15 % .
Consumption figures : ethylene amine 0.224 t/t,carbon disulphide 0.631 t/t, sodium hydroxide 0.745 t/t, zinc chloride 0.500 t/t, hydrochloric acid 0.034 t/t, sulphite cellulose 0.125 t/t, steam 1 t/t, el.power 3 000 kWh/t, water 30 m^3/t
Employees : management 1, staff 1, engineers 1, workers 43.
Start of production 1989; useful service life 14 years; technological process developed in the factory.

Thiram, chemical name : tetramethyl thioperoxydicarbonic di amide; Manufacture : mixture of dimethylamine and aqueous sodium hydroxid solution is stirred and cooled while carbon disulphide is added; the intermediate is oxidatively coupled using sodium nitrite and sulphuric acid solutions; the product is separated, dried and packed.
Capacity : 400 t/y; the whole production is used in agriculture as fungicide mainly for seed treatment; production costs 15 097 Leks/t, price 14 900 Leks/t;
Qualitative parameters : content of active ingredient 75 %, rest on 63 micron sieve max.15 %;
Consumption figures : dimethylamine 1.015 t/t, carbon disulphide 0.793 t/t, sodium hydroxide 1.010 t/t, sodium nitrite 0.390 t/t, sulphuric acid 0.980 t/t, sulphite cellulose 0.055 t/t, steam 28 t/t, water 308 m^3/t, el.power 300 kWh/t.
Employees : management 1, staff 2, engineers 1, workers 32.
Start of production 1974, useful service life 14 years; technological process developed in the factory.

Metham, chemical name : methylcarbamodithioic acid sodium salt. Manufactured by reacting methylamine, sodium hydroxide solution and carbone dioxide.
Capacity : 400 t/y, the whole production is used in agricul ture as soil fungicide and nematocide; production costs 3 494 Leks/t, price 3 590 Leks/t.
Qualitative parameters : content of active ingredient 30 %;
Consumption figures : methylamine 0.240 t/t, carbon dioxide 0.200 t/t, sodium hydroxide 0.240 t/t, trimethylamine 0.005

t/t, steam 28 t/t, water 308 m^3/t, el.power 300 kWh/t.
Employees : the crew is common for both Thiram and Metham plant.
Start of production 1974; useful service life 14 years; technological process developed in the factory.

Sulphur; bulk sulphur is crushed by teethed rollers to 10 mesh size in inert atmosphere of carbon dioxide and bagged for shipment.
Capacity : 10 000 t/y; 2 000 t/y used in agriculture as fungicide and acaricide; 8.000 t/y is exported; purity min.99 %, rest on 63 micron sieve max.15 %; production costs 1 208 Leks/t, price 1 250 Leks/t.
Consumption figures : sulphur 1.006 t/t, water 6 m^3/t, el. power 40 kWh/t;
Employees : management 1, staff 1, engineers 1, workers 54.
Start of production 1988; useful service life 20 years; process developed in the factory.

Pesticide formulation plant; calcium carbonate as inert carrier and active ingredients are separately ground and mixed together, the premix is milled and blended.

Product	Content of a.i. [%]	Production costs [Leks]	Price [Leks]
Lindane	2.5	1 420	1 890
Sevin	5.0	1 148	1 260
Zincsevin	25.0 *)	3 607	3 710
Zineb	20.0	-	-
Dipterex	5.0	2 175	2 400

Capacity : 13 000 t/y, the whole production is used in inland agriculture; particle size : rest on 44 micron sieve less than 5 %; consumption figures : calcium carbonate 1.100 t/t, el.power 230 kWh/t;
Employees : management 2, staff, engineers 3, workers 115;
Start of production 1986; useful service life 20 years; technological process developed in the factory.

*) Zincsevin contains 3 active ingredients : sevin 5 %, zineb 10 %, copper oxichloride 10 % .

Less important technologies and plants :
Copper chloride hydroxide, capacity 150 t/y, price 15 200 Leks/t;
Copper sulphate, capacity 150 t/y, price 11 200 Leks/t;
Calcium polysulphide, capacity 700 t/y, price 1 950 Leks/t; all products are used as pesticides, manpower 44; start of production 1975, useful service life 20 years.

Sodium hydrogensulphite, capacity 2 000 t/y, price 2 056 Leks/t;
Sodium sulphite, capacity 600 t/y, price 4 600 Leks/t;
Sodium thiosulphite, capacity 300 t/y; export 300 t/y, price 5 900 Leks/t; manpower 48, start of production 1967, useful service life 20 years.

Sodium dichromate, capacity 85 t/y, production costs 23 453 Leks/t; price 24 000 Leks/t; content of chromium trioxide 65 %; manpower 40, start of production 1968, useful service life 20 years.

Aluminium sulphate, capacity 1 800 t/y, production costs 1 929 Leks/t, price 2 200 Leks/t, content of aluminium oxide 13.5 %, content of iron oxide less than 1 %; manpower 47 Start of production 1978, useful service life 15 years.

4.6. Soda and PVC Factory, Vlora

4.6.1. General

Locality : South Albania, distance from sea 2 km; initial value of funds 135,5 million Leks; actual value of funds 303,1 million Leks; area 31 ha; employees : total 1 600, management 30, staff 87, engineers 61, workers 1 422; transport : road, railway, sea; manufacturing : sodium carbonate, caustic soda, calcium carbide, acetylene, chlorine, hydrogen, hydrochloric acid, calcium oxychloride, sodium

oxychloride, PVC resin.

4.6.2. Technology Estimation

All products are manufactured by classical technological processes of inorganic chemistry.

Soda ash; capacity 36 000 t/y, 23 800 t/y used in chemical and glass industry, 12 200 t/y for further processing in the factory; content of sodium carbonate more then 98 %, content of sodium chloride less then 1.2%; production costs 1 250 Leks/t, price 1 300 Leks/t; consumption figures : calcium carbonate 1.400 t/t, coke 0.086 t/t, rock salt 2.900 t/t, ammonia 0.015 t/t, steam 3.3 t/t, water 50 m^3/t; employees : management 8, engineers 3, workers 241; start of production 1967, useful service life 20 years, actual value of funds 54,8 million Leks; Chinese know-how.

Calcium carbide manufactured as coproduct from the limestone burning with coke in the kiln and further processing of lime and coke in electric furnace.
Capacity : 10 000 t/y, the whole production is further processed into acetylene; qualitative parameters : litrage 220-270 l/kg; production costs 2 880 Leks/t, price 2 900 Leks/t; consumption figures : limestone 2 600 t/t, coke 500 t/t, water 65 m^3/t, el.power 3.4 MWh/t; employees : management 6, engineers 2, workers 2; start of production 1977, actual value of funds 33,6 million Leks; Chinese know-how.

Hydrochloric acid; cleaned, compressed and demercurized hydrogen is reacting with cleaned, dried and compressed gaseous chlorine in a graphite furnace; hydrogen chloride is absorbed in water.
Capacity : 21 845 t/y, 4 965 t/y is for sale on inland market, 2 000 t/y for export, 14 880 t/y is processed in the plant of PVC; quality : content of hydrogen chloride 31 %; production costs 450 Leks/t, price 1 500 Leks/t; consumption of chlorine 0.321 t/t; employees : management 5, engi-

neers 1, workers 67; start of production 1977, actual value of funds 11,9 million Leks; Chinese know-how.

Polyvinyl chloride plant. Hydrogen chloride desorbed from hydrochloric acid is mixed with cleaned and compressed acetylene, dried, preheated and synthesized; cleaned, compressed and refracted vinylchloride is polymerized using isobutylnitril as iniciator.
Capacity : 6 000 t/y; the whole production is processed into composite plastic materials; the quality is characterized by Fikencher's constant which value for 3 products is :

PVC - S72 $K = 72 \pm 2$
PVC - S69 $K = 69 \pm 1$
PVC - S65 $K = 65 \pm 2$;

consumption figures : calcium carbide 1.750 t/t, hydrochloric acid 2.440 t/t, steam 4.5 t/t, water 300 m^3/t, el.power 310 kWh/t; employees : management 5, engineers 1, workers 58; start of production 1977; Chinese know-how.

Caustic soda in plant I is manufactured of soda ash and milk of lime by caustification, decantation and concentration operations; capacity 15 000 t/y, the whole production is intended for inland market; qualitative parameters: content of sodium hydroxide 46-48 %, content of sodium chloride less then 0.5 %; production costs 1 360 Leks/t, price 1 400 Leks/t; consumption figures : limestone 1.400 t/t, coke 0.080 t/t, soda ash 0.700 t/t, steam 5 t/t, water 25 m^3/t, el.power 94 kWh/t; employees : engineer 1, workers 35; start of production 1967, actual value of funds 3,8 million Leks; Chinese know-how.

Caustic soda in plant II is manufactured from sea salt by electrolysis with mercury cathode, chlorine and hydrogen being coproducts processed into hydrochloric acid.
Capacity : 20 500 t/y, 18 000 t/y is intended for inland market, 2 500 t/y is further processed in the factory; qualitative parameters : content of sodium hydroxide 47-49 %, content of chlorides 50 ppm, content of mercury 40 ppm;

production costs 820 Leks/t, price 1 400 Leks/t; consumption figures : sea salt 0.900 t/t, steam 0.725 t/t, mercury 0.100 t/t, el.power 1 620 kWh/t; employees : management 6, engineers 1, workers 66; start of production 1977, actual value of funds 20.2 million Leks; know-how from De Nora - Permeke, Italy.

5. ANALYSIS AND DISCUSSION

Technology level varies from very simple processes and equipments to standard manufacturing units worldwide constructed in the last two decades. On the highest level in general is the whole factory in Fier including the new urea plant under construction, polyvinyl chloride unit in Vlora, oil paints unit in Tirana, zineb unit in Durres, nitric acid concentration unit and sulphuric acid plant under construction in Laq. Some of these are remote controlled and fully automated.

Machinery for special operation units is greater part imported, mainly from China, but also from Japan, Italy and other European countries. Indigenious industry supplies simple equipment and storage tanks of the own design. Instrumentals and electrical installation are imported.

Engineering nets are in the most factories well dimensioned with some reserves facilitating intensification of processes and construction of new manufacturing units.

Transport by rail and roads to all factories, except Durres, where construction of railway line is a prerequisite of further development. Transport by sea is an advantage of favourably situated factories in Vlora and Durres.

Construction of all new plants except chief assembly of special equipments, instrumentals and electrical installation is provided on a good level by indigenious enterprises.

Raw materials. Except the general data included in Chapter 3 the author has not been given any quantitative and qualitative data.

Manpower. State university provides the highest qualified personnel for chemical industry with 60-80 graduates yearly and 2-3 postgraduates; 7 high schools of 4-classes prepare for chemical and food industry 270-300 middle qualified personnel. Operators and

workers are schooled in factory courses. After appropriete schooling and instruction operators, for most demanding processes are available of own sources. The country has a reserve of unskilled workers.

Organizational structure and management. Planned economy of enterprises is directed by Ministry of Industry and Energetics, by its Department for Chemical Industry. On the head of each factory is the director. In principal, the organizational structure of all factories is based on chief engineers system with preferential operation power directed towards smooth manufacturing. Administrative activities are directed by deputy directors. The role of technical development in this structure is supressed to certain extent. Typical organizational structure of an industrial enterprise is illustrated by diagram, see Annexe 3.

Research and development. Institute in Tirana founded in 1982 is the only one responsible for research, engineering and designing in the chemical industry. Although with limited facilities and only 60 employees, the institute has delivered a good performance and reached considerable results. In favourable conditions, the relatively talented team of engineers and research workers could represent a core of a future complex development centre of the sector. Nevertheless, also in the factories the role of technical development should be stressed by the organizational structure, postgraduate studies and special courses, improved flow of technical information and supply of literature. Great reserves are in technology assesment, data recording and evaluation, feasibility studies preparation, know-how and licence policy. Attention ought to be devoted to the study of activities connected with construction of new plants, engineering, erection, commissioning and start up planning and execution.

Linkages. For a country whose economy is based entirely on self-sufficiency and internal sources of development is an advanced and complex agriculture well supplied by chemical products an indispensible necessity. Long term plant nutrition and plant protection programmes should be elaborated with explicitly defined claims for

products of chemical industry. It is supposed that having put on stream four new production capacities of urea, sulphuric acid, single superphosphate and superphosphate granulation plant in the period 1990-91, the needs of inland agriculture will be covered for the next decade except a relatively small deficit of 25 000 t of P_2O_5. A certain disadvantage of the present state is the manufacturing and application of solid straight fertilizers exclusively. Also the economy of single superphosphate manufacturing and application is questionable. No micronutrients and concentrates of mineral additives to feed-stuffs are available on the inland market.

A separate study ought to be elaborate to discuss the problems of plant protection. The factual quantities of pesticides applicated at present indicate no economic reason for constructing a new plant, as capacities under 1 000 - 2 000 tons of either herbicidal or insecticidal active ingredients are unprofitable. As gradual increase of pesticides application is realistic, construction of a multipurpose formulation plant may bring considerable economic effect in the future. Owing to the products manufactured in the country as intermediates and export possibilities an enlargement of oxychloride and sulphur production capacities would be recommendable.

Based on own natural resources of limestone, rock salt and production of coke and ammonia, the construction of a new soda ash plant with a capacity of 100 000 t/y can be considered along with the rehabilitation of the present plant.

For the need of glass industry a small scale plant of 1 000 t/y capacity of sodium nitrate can be built on the base of nitric acid and caustic soda.

Based on the own production of calcium carbide and resources of limestone, the construction of a new plant of a capacity 10-20 000 t/y of polyvinyl chloride is recommendable. The intention should be supported by a serious market study. Invitation of know-how for a high level technology is necessary. With expert assistance the present plant capacity could be intensified from 6 000 to 7000 t/y Further processing can be considered.

Further development of the natural gas processing can be directed via desulphurization, partial decarbonation and methanol synthesis

gas preparation towards methanol, formaldehyde and acetic acid syntheses and possibly urea formaldehyde resins, vinyl acetate, polyvinylacetate and polyvinylalcohol manufacturing. The first stage should represent a complex with methanol unit of 20 000 t/y capacity as a core and appropriate capacities of formaldehyde and acetic acid manufacture. Complete supply of know-how and turnkey plant is to be supposed.

Considerable deposits of chromium ore containing 40-47% Cr_2O_3, deposits of dolomite, as well as electric power sources offer favourable inputs for a large scale plant up to the capacity of 20 000 t/y of sodium dichromate. Identification of potential markets must be carried out thoroughly to prove the estimated capacity well-founded. Agreement has been made that the Institute of Technology Tirana will elaborate a study material and pass the results and conclusions to UNIDO. Technical assistence at the preparation of a feasibility study, know-how invitation and offers evaluation would be a significant support.

There is a great demand on inland market for all kinds of paints, coatings, primers and resins. The need is estimated up to 5000 t/y Approximately the same quantity of inorganic pigments can be processed and marketed. The branch deserves an overriding attention and assistance.

Manufacturing of catalysts based mainly on copper, nickel, cobalt as specialty chemicals can be considered for the further period of development.

Actual technological problems and constraints of all factories were discussed at the occasions of authors visits, who initially intended to include them into the report. As the greater part of technological processes and machinery is of older date and several processes have been developed in limited circumstances, the range of problems surpassed the scope of the report and objectives of the mission.

Information. The scope of information has been limited and the author has not received all required informations, for instance the data concerning natural resources, products manufactured by crude oil processing industry, the products of metallurgical industry

and the needs of industrial explosives for ore mining. Generally, data concerning the needs of chemical products were not available. So the original author's concept of the review, which he intended to base on a complete analysis of major factors characterizing the needs of national economy, natural resources, the products manufactured in the country, prognosis of development of other branches and foreign trade activities had to be changed and it has been elaborated only on the data given in Chapter 3 and 4. Consequently the derived conclusions and recommendations cannot aspire to be exhaustive and covering the problems of chemical industry to the utter limits. Nevertheless, the analysis and review may claim to characterize the present state and identify the most important streamlines of further development of the chemical industry in Albania. The conclusions of the following sectoral reviews of metallurgical and food industry are to be considered, for they may give stimulant impulses or requirements.

6. CONCLUSIONS

On the base of compiled data, received information, personal inspection and consultations with the technical staff of the visited factories the following conclusions can be drawn :

1. The country has significant natural resorces enabling rational development of some basic branches of the chemical industry. Adequate energetic sources are available and primary transport system has been constructed. Present education system provide the industry with a certain number of university graduates and middle qualified personnel. The supply of workers is sufficient and the present state of some factories and plants shows that even the most demanding processes can be operated by well trained and schooled personnel.

2. The most important technological processes have been introduced and plants have been constructed mainly on borrowed know-how and turnkey plant supplies.
   Some processes with complete engineering developed in the country have indicated the possibility and proved the rightfullness of a generously conceived research institute's foundation in next years.

3. The chemical industry disposes of qualified assembly enterprises that have erected the greater part of the present plants.

In general it can be concluded that the country has the necessary prerequisites for the further development of the chemical industry

4. The technical development of the chemical industry in the first stage has been aimed to cover the basic requirements of the country's economy, consequently the inorganic chemistry and fertilizers manufacturing have been preferred.

5. The increased output of both nitrogene and phosphate fertilizers will cover the forseen need of agriculture for the next ten years. Nevertheless, possible economization of the phospha-

te fertilizer production by introducing triple superphosphate manufacturing must be thoroughly studied.

6. As liquid fertilizers may bring many advantages and certainly have their place in modern intensive agriculture, construction of a small scale plant possibly of multipurpose character might play a dicisive role in introducing new progressive types of fertilizers.

7. The micronutrient elements - boron, copper, iron, manganese, molybdenum and zinc are just as essential to plant growth as the primary (nitrogen, phosphorus, pottassium) and secondary (calcium, magnesium, sulphur) elements. Micronutrient elements and mineral additives manufacturing and application must be incorporated into the system of plant nutrition and animal production in the next future.

8. Further exploitation of the natural resources and their processing is recommendable for the next stage of the chemical industry's development as the most economic way. Some reference should be given to the organic chemistry. The recommendations in the next chapter forsee as raw materials mainly natural gas, copper, chromium and iron ore. The products of crude oil processing industry should also be taken into consideration as well as the needs and outputs of the metallurgical and agro-processing industry.

9. Upon the agreement of the author and chief engineers of the factories several opportunity or pre-feasibility studies will be elaborated in the first half of the year. The aim of these studies is to define the objectives of development and investment projects in individual factories. The studies should incorporate and evaluate all relevant and important data and parameters and should serve as a base for further detail expertise and feasibility studies preparation respectively.

10. Finally it must be pointed out that a number of serious technical problems and constraints in individual factories deserve

the highest attention and concern and their solution may bring considerable effects in economy of processes, environmental protection and labour hygiene.

7. RECOMMENDATIONS

Taking into account the perspective need of the country, available natural resources and other major factors of technical development conditions as well as the present state of the chemical industry, the following projects can be suggested and considered :

7.1. Construction of a complex plant with methanol unit of 20 000 t/y capacity and appropriate output of formaldehyde and acetic acid. Manufacturing of these products based on exploitation of natural gas resources as basic raw material would pro vide intermediates for the further stage of organic chemistry development towards vinyl acetate, polyvinyl acetate and conceivably urea formaldehyde resins, phenol and cresol resins. The factory in Fier has the most convenient construction conditions including pipeline for natural gas, good technical staff and experience. UNIDO assistance would be welcomed in providing know-how and turnkey plant offers, evaluation of offers and feasibility study preparation.

7.2. Utilizing the very pure sulphur from natural gas and crude oil processing, the construction of a large scale plant of 20 000 t/y capacity of finely ground sulphur would be recommendable mainly from the point of view of favourable export conditions. Location into the factory in Durres, which has some experience in manufacturing, is conditioned by railway line construction to the factory. Turnkey plant, or at least import of grinding and milling equipment is recommendable.

7.3. Based on processing of inland intermediates (copper sulphate, soda ash and rock salt) a new plant of 2 000 t/y capacity of oxychloride could be constructed. Improved technology (mainly machinery) including data for engineering can be developed in the country. Competitive qualitative parameters would allow favourable trade or foreign markets.

7.4. Rich resources of chromium ore provide prerequisites for

chromium compounds manufacturing, where mainly for chromium dichromate the potentials of foreign markets can be estimated up to 20 - 25 000 t/y. Construction of a modern plant would represent a significant economic effect. Compiete supply of a turnkey plant is recommendable. The assistance of UNIDO in inviting know-how suppliers, offers evaluation and feasibility study preparation is recommended.

7.5. Discussed possibility of constructing a soda ash complex of the capacity 100 000 t/y, processing inland raw materials must be backed up by a qualified feasibility study which will answer mainly the marketing conditions, investment requirements and pay-back period. The same is recommended for the project of a 20 000 t/y capacity plant for polyvinyl chloride manufacturing.

7.6. Gradually the development in the chemical industry should also orientate towards specialty chemicals manufacturing, where construction of a plant of capacity 5 000 t/y of primers, paints and laquers and 5 000 t/y of inorganic pigments would correspond to the needs of the country and a reserve of 3 000 t/y pigments for export. Direct technical assistence and consultancy in preparation of the feasibility study and connected activities will be of great value.

7.7. A complete system of integrated plant protection for the country should be elaborated as a basic material on which the conception of indigeneous pesticides manufacturing in a reasonable scale should be set out with a rational scope of absiding import. A well prepared expertise along with a set of lectures and schooling of the Plant Protection Station's staff is recommended. To achieve the highest effect of the expertise a complex study of the present state in the country with detailed data and specification of the required assistance should be elaborated and passed to UNIDO.

7.8. The alternative manufacturing and use of triple superphosphate in agriculture should be considered. A thorough study com-

paring the economics of raw materials transport, distribution and application costs and mainly the effects of alternative raw materials costs (phosphate rock, sulphuric acid, phosphoric acid) ought to be elaborated. For this purpose a particular market research and analysis of prices is to be carried out. The machinery modifications and additional investments costs are not demanding.

7.9. The advantages of fluid compound fertilizers are well known and they will certainly find their rightful position in the country's plant nutrion system in the next future. Technological processes of simple types of clear liquid NP and NPK fertilizers, liquid micronutrient concentrates and mineral additives to feed-stuffs can be the subject of indigeneous research and engineering.

7.10. The actual state of development of the chemical industry, the need of continual innovation, numerous problems connected with possible rationalization and intensification of the present technological processes and potentiality to develop some new simple technologies by own means call for a complex research centre. It is recommended to enlarge the Institute in Tirana up to 120-150 employees in the first stage, with effective organizational structure, universal pilot plant, adequate equipment and instruments. A well functioning scientific-technical information centre as a part of the institute is an indispensible necessity. A generously conceived institute may bring considerable effects to the country's economy.
UNIDO's assistance and support will be of great importance and a meaningful contribution to the country's chemical industry development.

As the funds and potential range of UNIDO's assistance are limited an order of above recommended activities has been set out. Several criteria but mainly the state of new plant construction and need of further development in individual factories have been taken into account.

The technical assistence of UNIDO should be focused preferentially on items 7.6; 7.4; 7.1; 7.10.

8. SUMMARY

Sectoral review of chemical industry has been elaborated on the request of the Government of Albania. The review is based on information acquired at personal visits and inspections of individual factories and institutions, consultancy with technical staffs of factories and data collected by the author personnally during his mission in Albania from 10th January to 26th January, 1990.

The review contains general characteristics of the country, characteristics of individual factories, technologies estimation, assortment of products and basic technological and economic data.

The analysis of the received information and collected data have resulted into conclusions characterizing the present state and potentials of further development. The general conclusions has been made out that the country has all necessary prerequisites for the further development of the chemical industry.

Consequently the most prosperous recommendations have been formulated in 10 essential items along with a suggestion of streamlining the technical assistence of UNIDO in the sector of chemical industry of Albania preferentially towards 4 items.

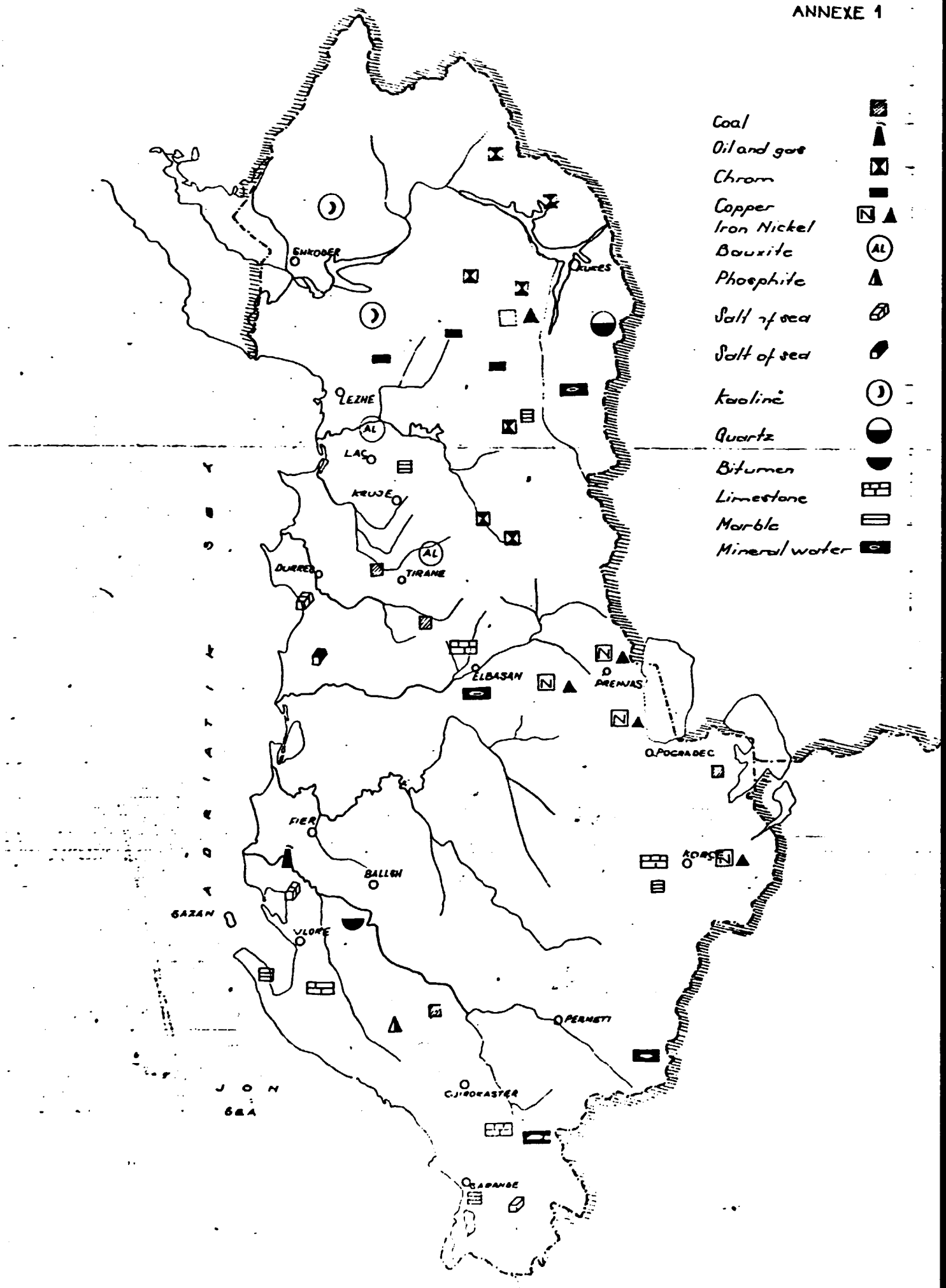
Conclusions and recommendations referred to in Chapter 6 and 7 have been discussed in general at the Commitee of Science and Technology at the occasion of author's closing visit.

9. ACKNOWLEDGEMENT

It is the author's earnest wish to express his sincere gratitude to all who cooperated during his activity in Albania and his high appreciation to the whole-hearted welcome and hospitality proved at several occasions.

10. ANNEXES

ANNEXE 1


Coal
Oil and gas
Chrom
Copper
Iron Nickel
Bauxite
Phosphite
Salt of sea
Salt of sea
Kaoline
Quartz
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Mineral water
SHKODER
KUKES
PEZHE
LAC
KRUJE
DURRES
TIRANE
ELBASAN
PRENJAS
POGRADEC
FIER
BALLSH
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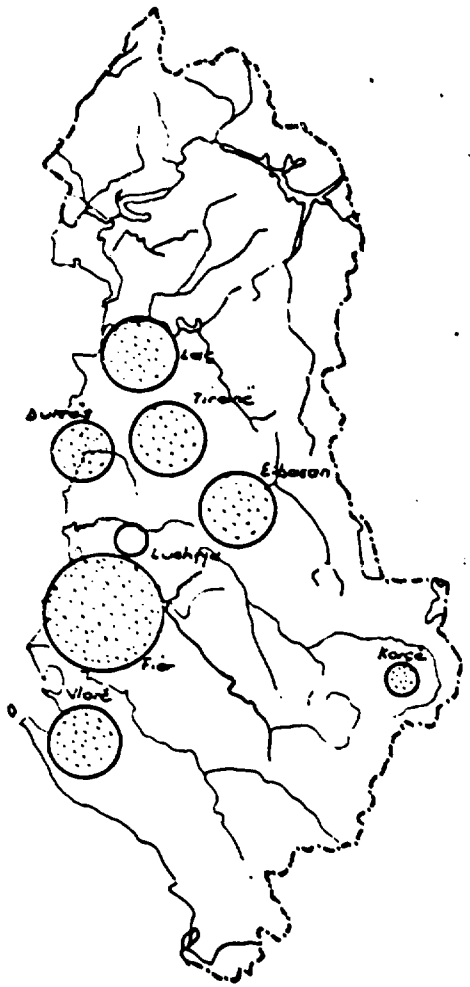
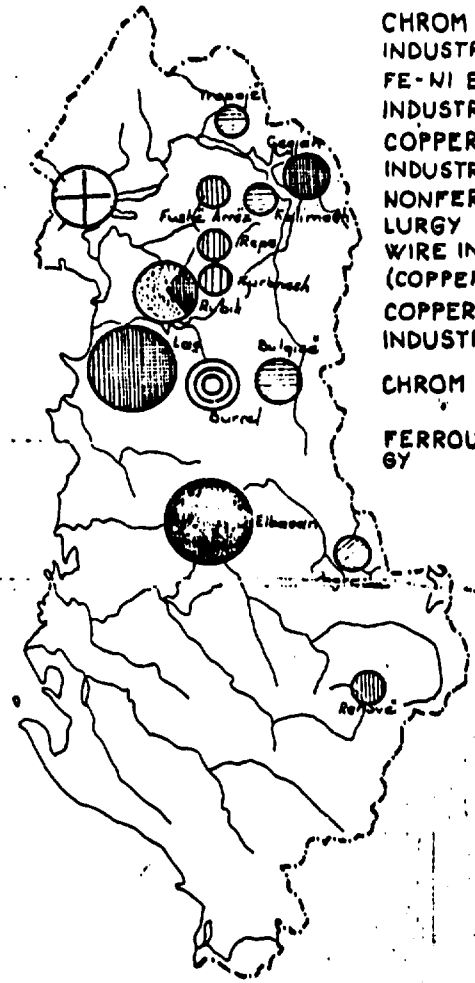
GAZAN
VLORE
PERMETI
GJIROKASTER
SARANDE
J O N
SEA

CHEMICAL INDUSTRY



METALLURGICAL INDUSTRY



CHROM ENRICHMENT INDUSTRY

FE-NI ENRICHMENT INDUSTRY

COPPER ENRICHMENT INDUSTRY

NONFERROUS METALLURGY

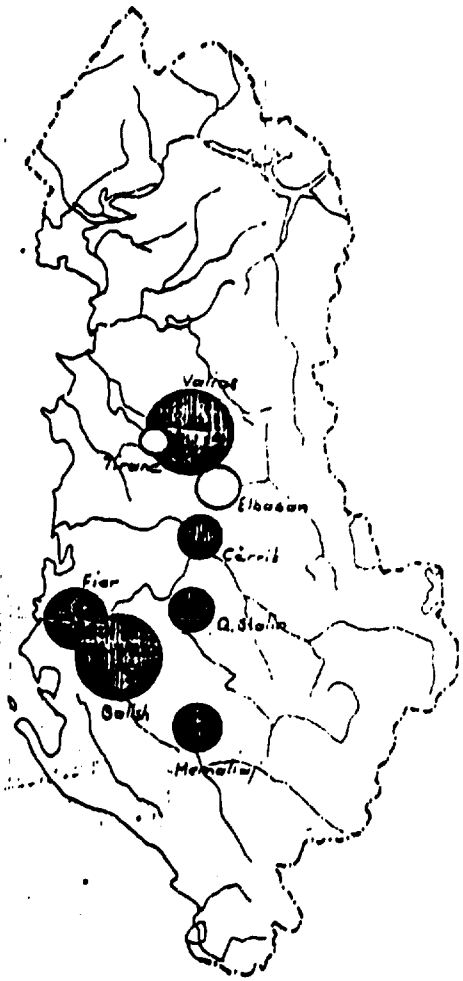
WIRE INDUSTRY (COPPER)

COPPER REFINERY INDUSTRY

CHROM METALLURGY

FERROUS METALLURGY

CRUDE OIL, NATURAL GAS AND STONE COAL PROCESSING INDUSTRY



ANNEXE 2

TYPICAL ORGANIZATIONAL DIAGRAM OF INDUSTRIAL ENTERPRISE