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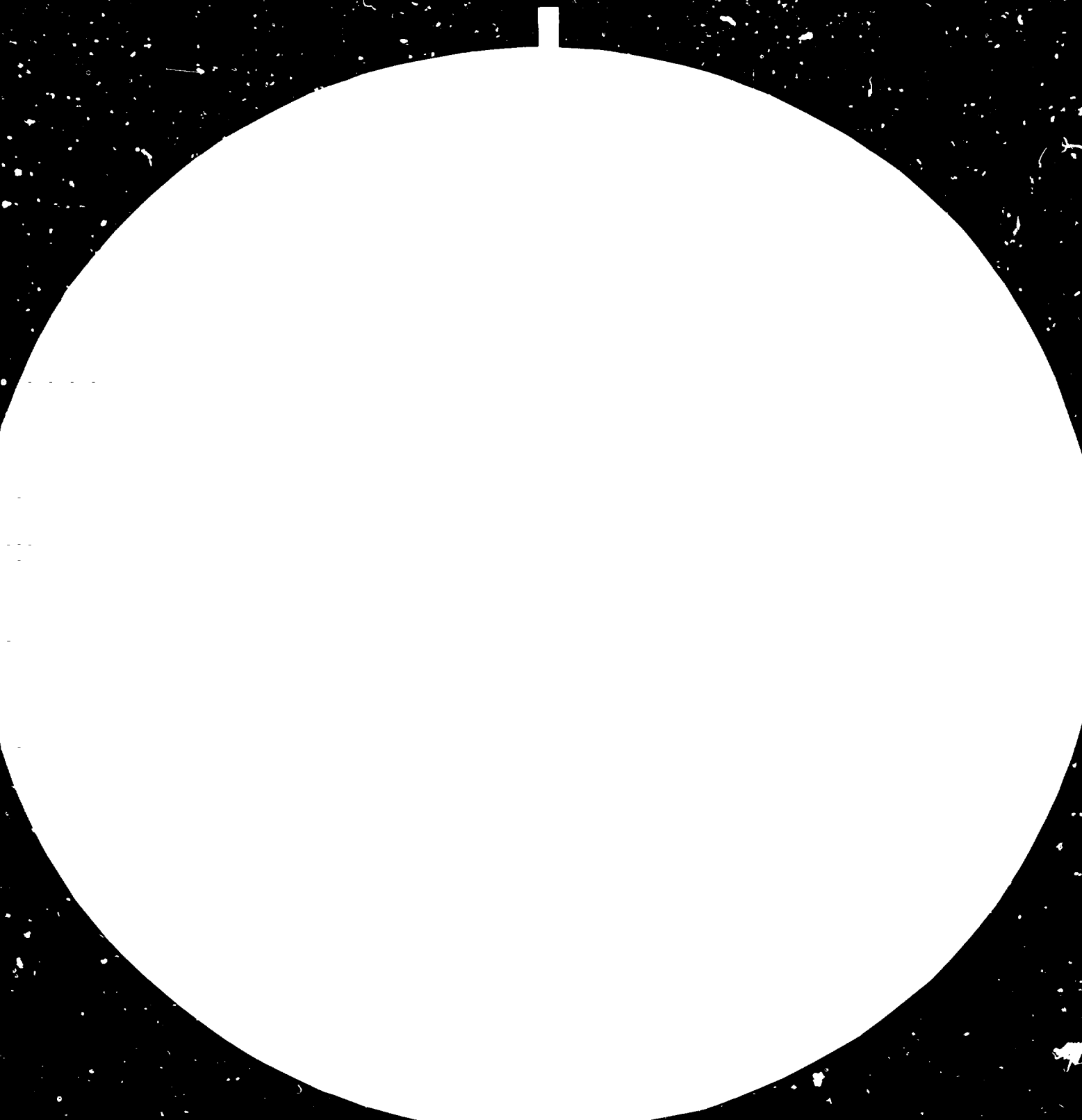

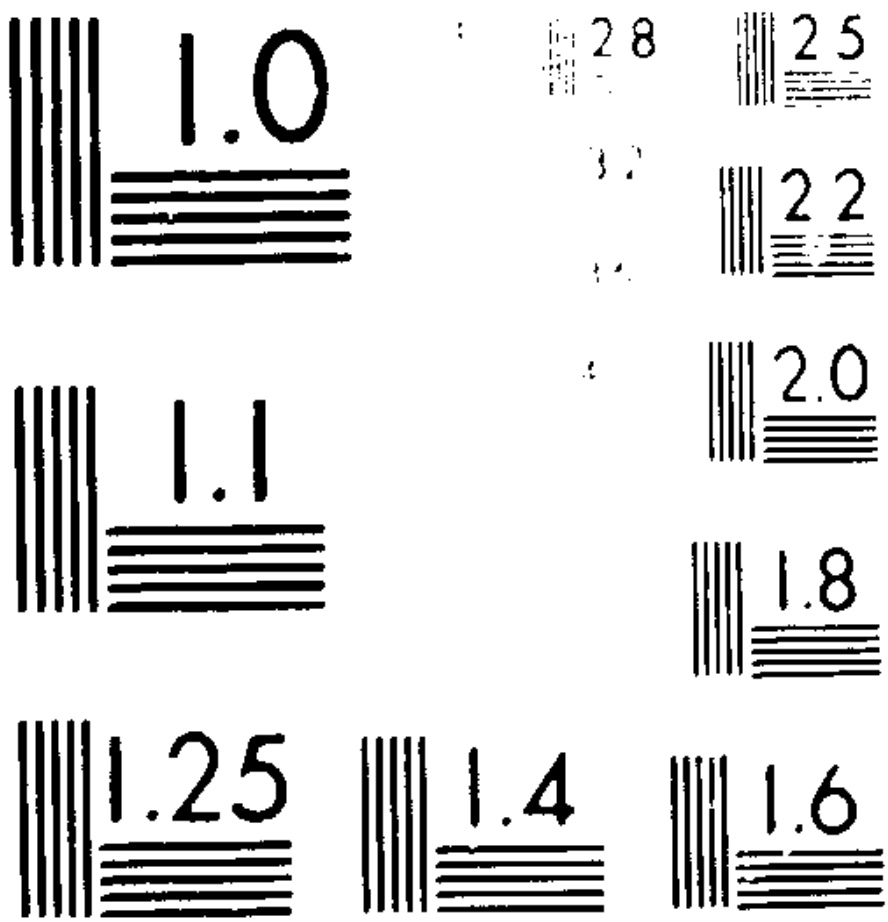
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Distr.
LIMITED

ID/WG.318/12
11 September 1980

ENGLISH

United Nations Industrial Development Organization

Third Consultation on the Fertilizer Industry
São Paulo, Brazil, 29 September - 4 October 1980

ISSUES AFFECTING DEVELOPMENT OF THE FERTILIZER INDUSTRY IN THE 1980s *

prepared by the UNIDO secretariat

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CONTENTS

I. THE PROGRESS MADE BY DEVELOPING COUNTRIES TOWARDS SELF-SUFFICIENCY IN FERTILIZER PRODUCTION AND PROSPECTS TO 1990

Objectives established by the First Consultation

1. As regards the growth of fertilizer production in developing countries, the First Consultation suggested the following objectives:

(a) The achievement by the developing countries of self-sufficiency in fertilizer production as soon as possible and in any case by 2000;

(b) The production by the developing countries of a surplus for export;

(c) The maintenance of a reasonable balance between supply and demand in the world market.

The First Consultation emphasized that the term "self-sufficiency" should be interpreted with reference not to the present low levels of fertilizer consumption but to a stimulated optimum level of consumption.[1/]

Progress achieved in the production of nitrogen fertilizers

2. Between 1970 and 1980[2/] the consumption of nitrogen fertilizers in developing countries[3/] doubled to about 11.2 million metric tons;[4/] production increased from about 2.4 million tons to 7.6 million tons,[5/] raising the level of self-sufficiency to almost 70 per cent. (See Table 1).

1/ Report of the First Consultation, ID/WG.242/8/Rev.1, para. 17.

2/ 1970 means the fertilizer year July 1969 to June 1970, which is referred to as 1969/70 by FAO.

3/ Developing countries refer to countries with market economies as defined by FAO. Thus China and other Asian centrally-planned economies are excluded.

4/ The paper will refer to million metric tons N throughout.

5/ Past data on consumption and production are taken from FAO Monthly Bulletin of Statistics, March 1980 and earlier years from FAO Annual Fertilizer Reviews.

Table 1: SELF-SUFFICIENCY IN THE PRODUCTION OF FERTILIZERS IN DEVELOPING COUNTRIES, 1970-1990
(million metric tons of N, P_2O_5 and K_2O)

		Fertilizer year ending 30 June	Consumption	Production	Imports	Net trade -- Imports less exports	Self-sufficiency (Production divided by consumption)	Imports reliance (Imports divided by consumption)
NITROGEN	Actual	1970	4.70	2.42	2.74	2.39	51	58
		1976	7.34	5.22	3.44	2.74	71	47
		1979	10.17	7.11	4.73	3.48	70	34
	Estimates	1980	11.20	7.60	n/a	3.60	68	n/a
		1985	15.87	13.63	n/a	2.14	86	n/a
		1990	20.74					
PHOSPHATE	Actual	1970	2.20	1.19	1.12	0.82	54	51
		1976	3.81	2.63	1.89	1.62	69	50
		1979	5.57	3.98	2.49	1.76	71	45
	Estimates	1980	6.17	4.47	n/a	1.70	72	n/a
		1985	8.95	7.89	n/a	1.06	88	n/a
		1990	11.98					
POTASH	Actual	1970	1.20	0.08	1.09	1.08	7	91
		1976	1.77	0.29	1.39	1.38	16	78
		1979	2.89	0.01	2.87	2.88	1	99
	Estimates	1980	2.99	0.02	2.97	2.97	1	n/a
		1985	4.24	0.63	n/a	3.61	15	n/a
		1990	6.07					

Sources: FAO Monthly Bulletin of Statistics, March 1980 and UNIDO/FAO/World Bank Working Group on Fertilizers, May 1980 as reported in the FAO document FERT 80/3, Current Fertilizer Situation and Outlook.

3. Between 1980 and 1990, consumption is expected to increase from 11 million tons to almost 21 million metric tons.[6/] Hence, if developing countries are to be self-sufficient by 1990, they will need to increase their production to almost three times the level achieved in 1980. (See Table 1).

4. UNIDO estimates that almost two tons of ammonia capacity are required to produce a ton of nitrogen fertilizer (see Table 2). Hence to produce about 21 million tons of nitrogen fertilizers in 1990 would require an ammonia production capacity of about 38 million tons in 1990. This compares to a capacity of about 17 million tons already installed in mid-1980.

5. What are the prospects of achieving this? Between 1974 and 1980, ammonia capacity increased by 9.0 million tons. Between 1980 and 1985, the Working Group estimates that ammonia capacity will increase a further 8.5 million tons. This means that to achieve self-sufficiency by 1990, about 12 million tons of new ammonia production capacity would need to come on stream between 1985 and 1990.[7/]

6. In May 1980, the Working Group's estimates showed that 38 ammonia plants were expected to come on stream between June 1980 and June 1985 (see Table 3). Because of cancellation of postponement of plans announced prior to May 1978, the ammonia capacity of 26 million tons which the Working Group originally forecast for mid-1983 is now expected to be achieved in June 1985.[8/]

6/ Unless otherwise stated, all data and forecasts are those of the UNIDO/FAO/World Bank Working Group on Fertilizers whose May 1980 Report is submitted to the Consultation as FAO document FERT 80/3, Current World Fertilizer Situation and Prospects.

7/ This requirement could be reduced by about 2 million tons if the developing countries were able to raise the utilization of all available capacity from 75 per cent (assumed in the UNIDO calculations) to 80 per cent.

8/ UNIDO's analysis shows that whilst 10 new ammonia plants have been planned in the last two years, plans for 10 other plants have been cancelled or indefinitely postponed; furthermore there have been considerable delays in completing 12 plants.

Table 2: AMMONIA CAPACITY REQUIRED IN DEVELOPING COUNTRIES IN 1990

(million metric tons N)

	1980	1985	1990 Case A	1990 Case B
1. Demand for nitrogen fertilizers	11.20	15.87	20.74	20.74
2. Self-sufficiency (per cent)	68	86	100	85
3. Production of nitrogen fertilizers	7.60	13.73	20.74	17.62
4. Utilization of ammonia in nitrogen fertilizer production (per cent) a/	79	83	85	85
5. Ammonia needed for fertilizers	9.65	16.41	24.40	20.70
6. Ammonia for other uses (15 per cent)	1.75	2.82	4.30	3.60
7. Total ammonia production (supply capability)	11.40	19.23	28.70	24.30
8. Ammonia capacity utilization (per cent)	68	74	75	75
9. Ammonia capacity	16.71	26.02	38.26	32.40

a/ This includes average plant operation rates, phasing-in factors for new plants and conversion losses.

Table 3: NEW AMMONIA PLANTS IN THE DEVELOPING COUNTRIES IN THE 1980s

(million metric tons N)

Region	Capacity at June 1980	Additions 1980-1985	Capacity in 1985	Plans announced for 1985-1990 confirmed	Plans announced for 1985-1990 expected	Capacity in 1990
Africa	0.66	0.65	1.31		1.14	2.45
Near East	4.17	2.34	6.51	0.27	-	6.79
Far East	7.90	4.00	11.90	2.19	-	14.09
Latin America	3.99	2.65	6.64	1.76	0.27	9.21
	16.72	9.64	26.36	4.22	1.41	32.53

7. However since May 1980, plans have been confirmed or are expected for a further 18 ammonia plants which it is assumed will come on stream after June 1985.[9/] These plants have a total capacity of 5.6 million tons, compared to the 12 million tons that UNIDO estimates will be required in the period 1985-90 to achieve self-sufficiency in 1990.

8. Hence progress towards the goal of self-sufficiency in nitrogen fertilizer production by 1990 is encouraging but not yet adequate. Even if all the new plants that have been announced in recent months are implemented as planned, the momentum of plant construction needs to be stepped up so that additional capacity equivalent to about 45 new ammonia plants of 1000 tpd capacity are completed between 1985 and 1990 compared to additional capacity equivalent to 30 such plants likely to be completed in the period 1980-85.

Progress achieved in the production of phosphate fertilizers

9. Between 1970 and 1980, the consumption of phosphate fertilizers in developing countries increased 2.8 times from 2.2 million tons to 6.2 million tons.[10/] In the same period, production increased from about 1.2 million tons to 4.0 million tons, raising the level of self-sufficiency to over 70 per cent.

10. Between 1980 and 1990, consumption of phosphate fertilizers is expected to double from about 6 million tons to 12 million tons. Hence if developing countries are to be self-sufficient by 1990, they will need to increase their production to three times the level achieved in 1979, namely from 4 to 12 million tons (see Table 1).

11. UNIDO estimates that about 20 per cent of the phosphate fertilizers produced in 1990 could be produced without phosphoric acid; to produce the other 80 per cent of the 12 million tons would require about 15.2 million tons of phosphoric acid compared to a production capacity of 5.4 million tons already installed in mid-1980 (see Table 4).

9/ The confirmed plants are located in India (6), Mexico (2), Brazil (2), Colombia, Abu Dhabi, Argentina; the expected plants are located in Morocco (2), Tunisia (2), Peru.

10/ This paper will refer to metric tons P_2O_5 throughout.

Table 4: PHOSPHORIC ACID CAPACITY REQUIRED IN DEVELOPING COUNTRIES IN 1990

(million metric tons P_2O_5)

	1980	1985	1990 Case A	1990 Case B
1. Demand for phosphate fertilizers	6.17	8.95	11.98	11.98
2. Supply from non-phosphoric acid sources	1.57	2.01	2.57 a/	2.57 a/
3. Net demand from phosphoric acid sources	4.60	6.94	9.41	9.41
4. Production self-sufficiency (in per cent)	63	85	100 b/	90 b/
5. Production of phosphate fertilizers	2.90	5.88	9.41	8.47
6. Utilization of acid in phosphate fertilizer production (in per cent) c/	77.5	80.2	80.2	80.2
7. Phosphoric acid needed for fertilizers	3.74	7.33	11.73	10.56
8. Phosphoric acid for non-fertilizer uses (10 per cent) d/	0.37	0.73	1.17	1.06
9. Total phosphoric acid production	4.11	8.05	12.90	11.62
10. Utilization of acid capacity (per cent) c/	76	85	85	85
11. Total wet phosphoric acid capacity	5.41	9.47	15.18	13.67

Source: UNIDO/FAO/World Bank Working Group on Fertilizers, May 1980.

a/ Assumes the same proportion of total demand as in 1985.

b/ Hypotheses on self-sufficiency in production.

c/ The Working Group does not break down the transformation from phosphoric acid production to phosphate fertilizer production. This factor was split between acid production and phosphate fertilizer production. On phosphate fertilizer production, the factor includes plant operation rates (between 85 per cent to 88 per cent), conversion losses 6 per cent, and discrepancies such as over-formulation, products in transit, etc. at 3 per cent. On acid production the factor includes only average plant operation rates.

d/ The Group usually deduces the non-fertilizer uses from the published figures. This item is estimated at 10 per cent in the developing countries for uses mainly in detergents.

12. What are the prospects of achieving this? Developing countries' capacity to produce phosphoric aci increased from 2.25 million tons in 1974 to 4.9 millior tons in 1980. Between 1980 and 1985 their phosphoric acid capacity is expected to increase by 3.7 million tons to 8.6 million tons (see Table 5). To achieve self-sufficiency by 1990, a further 6.6 million tons of new phosphoric acid capacity will need to come on stream between 1985 and 1990.[11/]

13. In May 1980, the Working Group's estimate was that 22 phosphoric acid plants will come on stream in developing countries between June 1980 and June 1985. Although plans for two plants in addition to those announced before May 1978 were included, there were delays in implementing projects in six countries and the total capacity of 8.6 million tons predicted for June 1985 represents no increase on the capacity forecast for June 1983 in June 1978. These figures refer to fertilizer needs.

14. Since May 1980, when the Working Group estimates were prepared, plans have been announced for additional phosphoric acid capacity which should come on stream in the period 1985 to 1990. These plants have a total capacity in excess of 4 million tons (see Table 5) compared to the 6.6 million tons that UNIDO estimates will be required in the period 1985 to 1990 to achieve self-sufficiency in 1990.

15. Hence progress towards the goal of self-sufficiency in production by 1990 is encouraging but not adequate. Even if all the new plans that have been announced in recent months are implemented as planned, the momentum of new plant construction still needs to be increased so that additional capacity equivalent to 29 new 600 tpd phosphoric acid plants are completed in the 1985-1990 period compared to additional capacity equivalent to 21 such plants likely to be completed in the 1980-1985 period.

Progress achieved in potash production

16. Between 1970 and 1980, the consumption of potash in developing countries doubled to about 3 million tons K_2O; it is expected to double again and reach 6 million tons in 1990.

11/ Since UNIDO assumes that the utilization of phosphoric acid capacity will increase from 76 per cent in 1979-80 to 85 per cent by 1985, it does not seem appropriate to assume that a contribution would be made by raising the rate of capacity utilization.

Table 5: NEW PHOSPHORIC ACID PLANTS IN THE DEVELOPING COUNTRIES IN THE 1980s

(million metric tons P_2O_5)

Region	Capacity at June 1980	Additions 1980-1985	Capacity in 1985	Plans announced for 1985-1990 confirmed	Plans announced for 1985-1990 expected	Capacity in 1990
Africa	1.88	1.16	3.04	0.20	2.85[a/]	6.01
Near East	0.84	1.14	1.98	-	-	1.98
Far East	1.23	0.37	1.60	0.33	-	1.93
Latin America	0.95	1.05	2.00	-	0.61[b/]	2.61
	4.90	3.72	8.62	0.53	3.46	12.61

a/ The announced intention of Morocco is to locally transform 10 million tons of rock, equivalent to 2.98 million tons of phosphoric acid (100 per cent P_2O_5), by 1985 or beyond. The announced intention of Tunisia is to locally process 6.7 million tons of rock, equivalent to 2 million tons of phosphoric acid, by 1990. The figure estimated assumes that only part of these goals will be implemented by 1990.

b/ It is expected that Mexico will set up at least two new 600 MTD phosphoric acid plants, and Peru one new 600 MTD plant during 1985-1990.

17. There was no production of potash in developing countries in 1980. By 1985, production in Jordan is expected to reach 0.6 million tons, equivalent to 15 per cent of developing countries needs. No plans have been announced for the 1985-1990 period, but worth-while deposits are known to exist in Ethiopia, Thailand and Latin America.

18. Any further progress towards self-sufficiency in potash production will require a joint effort by developing countries to develop these deposits and to discover additional deposits.

II. SUPPLIES OF AMMONIA, PHOSPHATE, SULPHUR AND POTASH IN THE PERIOD 1980-1990

19. The production of nitrogen and phosphate fertilizers in developing countries is expected to treble between 1979 and 1990 if they are to become self-sufficient by 1990. Hence the main increase in world demand for ammonia, sulphate, phosphate and potash will be for fertilizer production in developing countries in the period 1980 to 1990.

20. Developing countries need to take action, mainly by establishing co-operation among themselves, in order to satisfy these very large requirements for raw materials for their growing fertilizer industry. Such co-operation would be in their own interest and help to insulate them for any general world shortage of these raw materials which might occur in the future if sufficient investment projects are not realized in due time.

21. To tackle this issue of the 1980s, UNIDO might, in co-operation with FAO, UNCTAD and the United Nations Centre for Natural Resources and other international organizations such as ISMA:

(a) Prepare an estimate of the developing countries' requirements in the period 1980 to 1990 for ammonia, phosphate, sulphur and potash;

(b) Review and consolidate existing and planned studies of the world-wide availability of these raw materials up to the year 1990;

(c) Identify specific projects which might be established involving the co-operation of several countries to develop the necessary supplies of these raw materials;

(d) In co-operation with the developing countries concerned, undertake feasibility studies of such projects;

(e) Discuss with Governments of developed countries their possible interest in financing the projects whose feasibility has been examined.

III. THE PRICE OF FERTILIZERS AND THE COST OF FERTILIZER IMPORTS

22. The price of nitrogen and phosphate fertilizers has increased sharply since the Second Consultation. As a result the cost to developing countries for imports of fertilizers in 1980 is likely to have increased by about one third to $US 4 billion.

23. There are several views about the increased cost of fertilizers. The developing countries, who are the main purchasers of fertilizers traded internationally, expressed concern about the recent price increases at the FAO Commission on Fertilizers when it met in Rome in June 1980.

24. The World Bank, on the other hand, has produced estimates which show that higher fertilizer prices were required to stimulate investment in new projects.

25. Bearing in mind (a) that low fertilizer prices are needed to stimulate fertilizer use, and (b) the growing cost to Governments of developing countries of subsidizing fertilizers, it appears that the price of fertilizers will be an important issue in the 1980s.

IV. THE HIGH COST OF FERTILIZER PLANTS

26. The high cost of fertilizer plants was identified by the First Consultation as a subject needing further examination. UNIDO convened a Working Group on this subject in February 1980 and reported to the Second Consultation on its findings. But although the Second Consultation asked UNIDO to continue its examination of this subject, little further work was done.

27. In the two years since the Second Consultation, the cost of fertilizer plants has increased about 20-30 per cent.[12/] Further increases of 10-20 per cent per year are expected over the next few years.[13/]

12/ See Progress report on action recommended by the Second Consultation, ID/WG.318/7, paragraph 24.

13/ See The next step in costs - how big? Chemical Week, 30 July 1980. The estimate is for costs in the United States.

28. The problem was clearly stated in a paper presented at a recent meeting of ISMA by a senior executive of the fertilizer industry in the United States.14/ He said:

> "The biggest problem we all face today is higher capital costs.
>
> Just this week I took a look at today's capital investment requirements to build new fertilizer facilities. In every case ... whether it be for phosphate rock, phosphate chemicals, nitrogen, or potash ... costs for new mines or plants have increased five times over the past ten years. A 4 million ton-per-year rock mine today will cost you 70 dollars a ton ... That's 280 million dollars, compared to 60 million dollars only ten years ago. A new phosphate chemicals plant producing 500 P_2O_5 tons of DAP annually will cost you 200 million dollars, compared to 40 million dollars ten years ago. A new 500,000 ton-per-year ammonia plant will cost you 150 million dollars today, compared to 30 million dollars ten years ago. And, a new 2 million ton-per-year potash mine will cost you 350 million dollars today, compared to about 80 million dollars 10 years ago. How are we going to get prices for our products that will support these kinds of capital investment requirements?
>
> I know that part of these exaggerated costs are due to inflation ... but not all. Construction costs, for example, have risen faster than inflation. Equipment costs have also increased faster than inflation. Strangely enough, labor costs have probably risen slower than any other contributing factor." 14/

29. Farmers in industrialized countries, who share in the general increased standards of living of those countries, may be willing to pay the higher fertilizer prices which expensive plants require; but developing countries can see no justification for such high plant costs. Indeed, since fertilizer prices had to be kept at a low level, Governments in developing countries have subsidized fertilizers - imported as well as locally manufactured - and thereby subsidized the rising living standards in industrialized countries that derive from selling fertilizer plants at such high costs.

30. UNIDO's previous examination of this subject suggests that costs can be reduced in the following areas: equipment costs, detailed engineering, plant erection, supervision of construction. All the above relate to the cost of a so-called "battery limits" plant, but in developing countries the cost of associated infrastructure adds enormously (up to 100 per cent) to the cost of the project. Ways to reduce the impact of infrastructure costs were considered at the Second Consultation. But a further effort is needed to produce a solution to the problem of plant costs that would be more equitable for

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14/ Mr. S. Keel, Senior Vice President, International Minerals Cooperation, in his paper North American Fertilizer Outlook presented to the Council Meeting of ISMA, 19-20 November 1979.

for developing countries. And if fertilizer plant costs cannot be reduced by very much, perhaps Governments should assist, even subsidize, such exports more than others.

31. It has also been suggested that since developing countries purchase at least half of the new fertilizer plants being built in the world, uniform standard sizes could be agreed with a corresponding reduction in equipment costs. Is there any reason why four sizes of ammonia plant (say, 300, 600, 900 and 1,350 metric tons per day) could not suit the requirements of most developing countries.

V. MINI FERTILIZER PLANTS

32. In many developing countries, and in particular the least-developed countries, the demand for fertilizers is not sufficient to warrant a large-scale size nitrogen or phosphate fertilizer complex. In land-locked countries or land-locked regions of a country, high transport costs also favour a plant located near the market. In such circumstances, a mini fertilizer plant is needed, that is one with a production capacity of between 10 and 100 metric tons per day of ammonia (with matching urea or ammonium nitrate plant) and phosphate fertilizer plants with capacities of up to 30,000 metric tons per year (SSP, TSP or DAP).

33. The cost of such plants ordered today is very high because plants of such capacities were built many years ago in most countries; however, in some countries, for example China, there are many such plants in operation today. Therefore the Consultation might consider (a) how co-operation between countries could develop and transfer the technology and plant engineering design to those developing countries that need mini fertilizer plants and (b) whether such projects would warrant assistance from the Governments in the supplying and/or recipient country.

VI. ASSISTANCE FOR THE FERTILIZER INDUSTRY FROM GOVERNMENTS OF DEVELOPED COUNTRIES

34. The main theme of this chapter is that in the 1980s, Governments of developed countries should give preference to helping developing countries to build and operate fertilizer plants rather than provide food aid or supply fertilizers on concessional terms.

35. UNIDO could identify the developing countries that plan to build new fertilizer plants in the 1980s and require assistance with financing either the plant itself, the associated infrastructure or the development of raw material resources.

36. The first priority might be given to implementing the guidelines adopted by the Second Consultation on the terms and conditions appropriate for financing the associated infrastructure of fertilizer plants. UNIDO has not yet been informed of any cases where the financing of infrastructure associated with fertilizer plants has been requested and provided on the favourable terms recommended.

37. The second priority might go to financing the supply of fertilizer plants on favourable terms and conditions.

38. Developing country representatives at the First and Second Consultations stressed the importance of international competitive bidding for fertilizer plants because fertilizer plants tend to cost more when procurement is tied to one country. Those developed countries who do not follow this policy already, might consider implementing this request in the 1980s.

39. So far, two consultations have discussed ways to ensure the successful construction of fertilizer plants. In the 1980s the emphasis might switch attention to ways and means to achieve the successful operation of fertilizer plants. A three-fold increase in capacity will place demands on the capacity of the developing countries to train managers and operators. Some assistance from developed countries, as well as greater co-operation among developing countries, will be required.

VII. THE OPTIMUM LEVEL OF FERTILIZER CONSUMPTION IN DEVELOPING COUNTRIES IN 1990 and 2000

40. There is a large difference between the various estimates of the likely requirements for fertilizers in developing countries in the year 2000.[15/]

41. It therefore appears necessary to examine in detail before the next consultation what is "the optimum stimulated level of consumption of fertilizers" in each developing country.

42. The FAO study "Agriculture Towards 2000" has collected much of the information required. It has estimated that fertilizer use on irrigated land should increase from 26 kg nutrients per ha in 1975 to 118 kg per ha in 2000. As shown in the table, two thirds of the fertilizer used in developing countries is expected to be applied on fully or partially irrigated land.

FAO estimate of fertilizer requirements of developing countries

(million tons of NPK)

	1975	2000
Low rainfall	0.2	0.4
Good rainfall	4.4	16.8
Problem areas	3.6	12.3
Naturally flooded	0.3	3.8
Fully irrigated	8.1	50.8
Partially irrigated	2.4	8.6
	19.0	92.7

43. This issue is not of direct concern to UNIDO. But the Third Consultation might recommend that FAO request each developing country to prepare its own estimates of the optimum level of fertilizer consumption in 1990 and 2000. For this purpose a uniform methodology might be worked out in co-operation with IFDC, ISMA and the World Bank in the UNIDO/FAO/World Bank Working Group on Fertilizers. The results of the survey could be reviewed by the Working Group and published six months before the next UNIDO Consultation.

15/ See UNIDO/ICIS.81/Add.1, Supplement to the Second World-Wide Study of the Fertilizer Industry, pages 32 and 33, which explains why UNIDO estimates requirements of 49 million tons in 2000 compared to FAO's estimate of 93 million tons of all nutrients.