OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

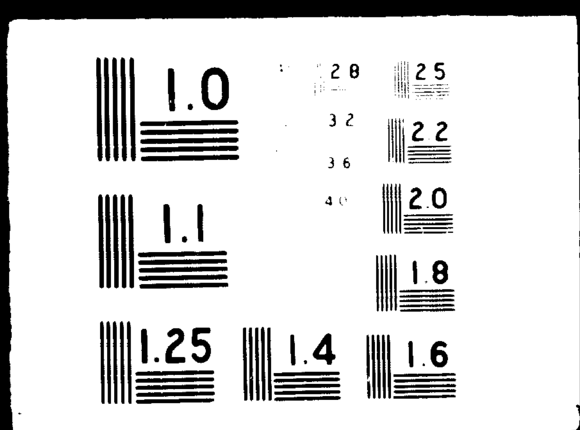
For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

I OF I

DO

2769



D02769

Distribution: LIMITED

ID/WG.99/33
6 August 1971

Original: ENGLISH

United Nations Industrial Development Organization

Second Interregional Fertilizer Symposium

Kiev, USSR, 21 September - 1 October 1971
New Delhi, India, 2 - 13 October 1971

Agenda item IV/3

PHOSPHATE ROCK: TRENDS IN SUPPLY AND DEMAND IN RELATION TO WORLD FERTILIZER REQUIREMENTS[1]

by

K.L.C. Windridge

International Superphosphate & Compound Manufacturers Association Ltd. - ISMA
London UK

[1] The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

id.71-6259

Distribution:
LIMITED

ID/WG.99/3 SUMMARY
6 July 1971

United Nations Industrial Development Organization

Original: ENGLISH

Second Interregional Fertilizer Symposium

Kiev, USSR, 21 September - 1 October 1971
New Delhi, India, 2 - 13 October 1971

Agenda item IV/3

SUMMARY

PHOSPHATE ROCK: TRENDS IN SUPPLY AND DEMAND IN RELATION TO WORLD FERTILIZER REQUIREMENTS[1]

by

K.L.C. Windridge

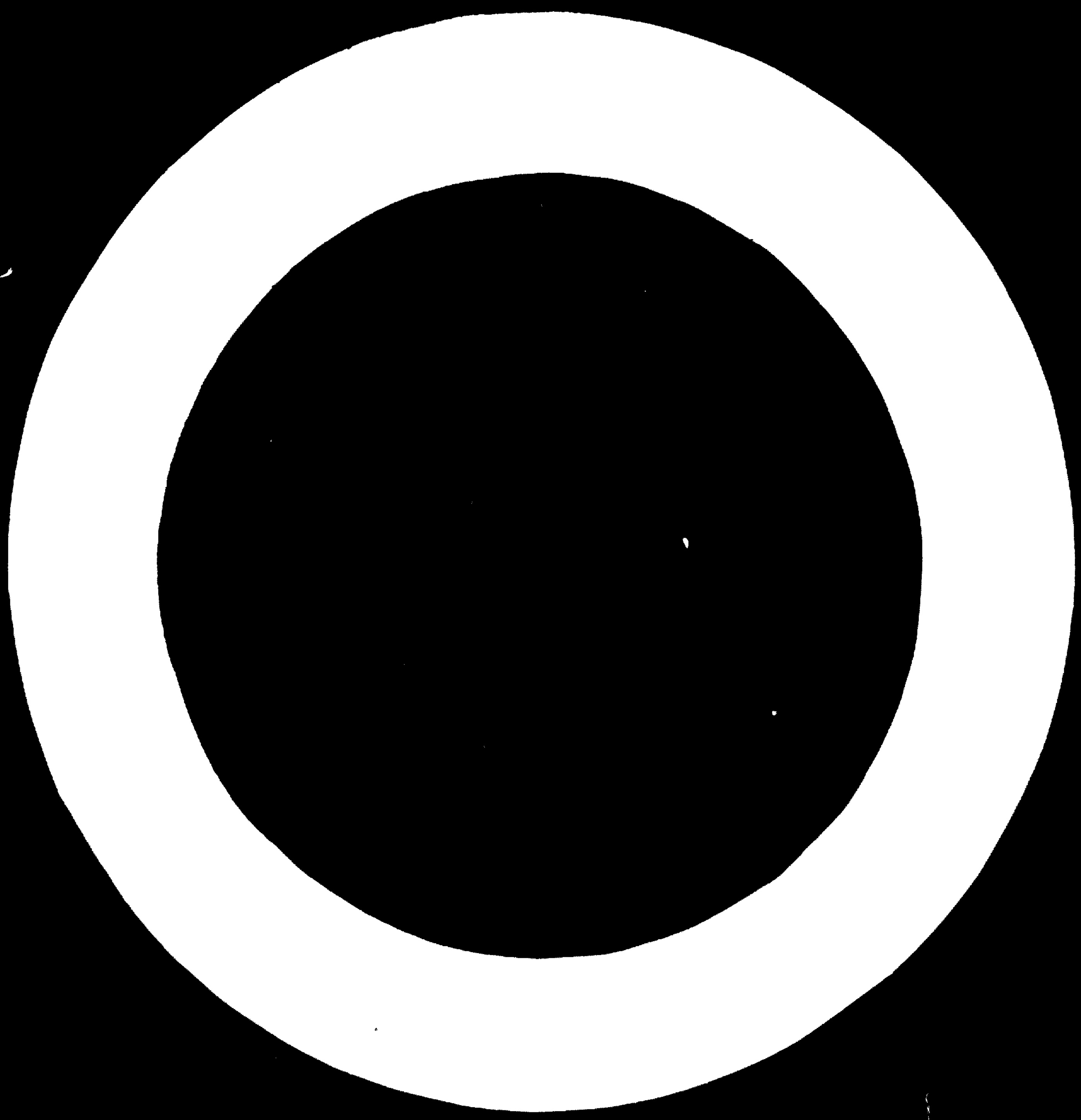
International Superphosphate & Compound Manufacturers Association Ltd. - ISMA
London UK

The fertilizer industry uses 85 per cent of world phosphate rock production. Elemental phosphorus accounts for most of the rest. 90 per cent of this phosphorus is then converted to phosphoric acid, mainly for detergent manufacture. Thus, in 1969, phosphoric acid alone accounted for 45 per cent of total phosphate rock consumption. This proportion is increasing rapidly, owing to the trend towards high analysis fertilizers. These now account for nearly 60 per cent of world phosphate rock consumption for fertilizer manufacture, compared with 24 per cent in 1955.

However, the rapid, steady growth of phosphate fertilizer consumption has slackened significantly since 1967. The increase in phosphate rock used in fertilizer production between 1965/1970 was no more than between 1960/1965. The optimism of fertilizer manufacturers in 1965 was reflected in forecasts of phosphate rock consumption presented at the first UNIDO fertilizer seminar. This optimism resulted in a 60 per cent increase in phosphate rock production capacity between 1965/1971, compared with only a 35 per cent rise in deliveries. Much of this increase in capacity occurred in USA between 1965/1967,

[1] The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

id.71-6454



precipitating world wide over-production and declining prices.

Between 1966/1970, US production, accounting for 42 per cent of the world total, was 3 million tons more than deliveries, necessitating restrictions on output. In 1970, this was less than in 1966.

Inevitably, this produced an export drive concentrated on western Europe, where US exports have increased by 70 per cent since 1965. Western Europe takes 46 per cent of international phosphate rock deliveries. Eastern Europe takes almost 20 per cent. In addition to increased US deliveries, the USSR and west African producers have doubled deliveries to western Europe between 1965/1970. This competition has diverted north African sales towards eastern Europe. Morocco and Tunisia now account for 37 per cent of deliveries to eastern Europe (excluding USSR) and Russian deliveries account for only 53 per cent.

Declining prices affected most producers. US exports in 1970 were worth $8 million less than in 1966. Moroccan deliveries in 1969 were worth less than in 1965, despite an increase of 1 million tons in deliveries. Tunisian foreign exchange earnings from phosphate rock sales in non-communist countries are extimated to have decreased by 50 per cent since 1965.

Consequently, phosphate rock producers in developing countries are increasingly concerned to improve their position by manufacturing and exporting phosphoric acid and finished fertilizers rather than phosphate rock. By 1975, new export oriented phosphoric acid capacity of 1.3 million tons P_2O_5 is expected to be in operation in various developing countries. Some will go to India and Philippines. Most will be aimed at western Europe, half of it being located in north Africa.

So far, north African phosphate fertilizer exports have not increased as fast as might have been expected and still account for only 8 per cent of phosphate rock production.

Various technical and economic aspects of phosphoric acid production and trade affect the phosphate rock market. Apart from the properties of individual phosphate sources - P_2O_5 content, grindability, filterability, impurities - these include:

a) Increasing size of plants and producing companies. Half American phosphoric acid plants are over 150,000 tpa P_2O_5, whereas over half the plants in Belgium, France, Netherlands and West Germany are below 40,000 tpa P_2O_5. As small plants become less viable, the hope of north Africans and others is that fertilizer producers in western Europe, disillusioned with the return on capital invested in this industry, will increasingly opt to import phosphoric acid.

b) Ratio of raw materials costs to total maufacturing costs: greater capital requirements, compared with single superphosphate, reduce this ratio and thus make economies of scale and the cost of labour and capital more important. This works against developing countries where local markets are small, trained labour is scarce, capital is relatively dear and equipment replacement is slow.

c) Sulphur requirement: phosphoric acid requires about 50 per cent more sulphur per ton P_2O_5 than single superphosphate. Ammonium phosphates are increasingly the end product and do not reduce the total sulphur requirement. Thus the price of sulphur becomes more important in relation to that of phosphate rock. However, sulphur is once more in abundance, prices are low and this situation may continue. This, too, works in favour of the developed countries where, apart from Mexico and the Arabian Gulf, the bulk of sulphur is located. The freight element in total delivered sulphur costs becomes more important with low sulphur prices.

This also applies to phosphate rock. North African producers, for example, are adversely affected by a fall in freight rates, because this makes a smaller difference to landed costs than in the case of US deliveries.

Freight rates have fluctuated considerably in recent years. Some of this can be attributed to different vessel sizes. However, phosphate rock requires covered storage in many countries, and cargoes in excess of 50,000 tons, which are now starting between USA and Japan, will require considerable co-ordination of different plant requirements, probably between different producers. The cost of secondary movement can more than offset the gain from use of the large vessel. Thus phosphate rock importers may be unable to benefit from larger vessel sizes as much or as rapidly as importers of other bulk commodities. Ship operating costs are rising very rapidly, and increased transportation costs for phosphate rock would work in favour of the phosphoric acid trade, although not necessarily on an inter-continental basis or from developing countries.

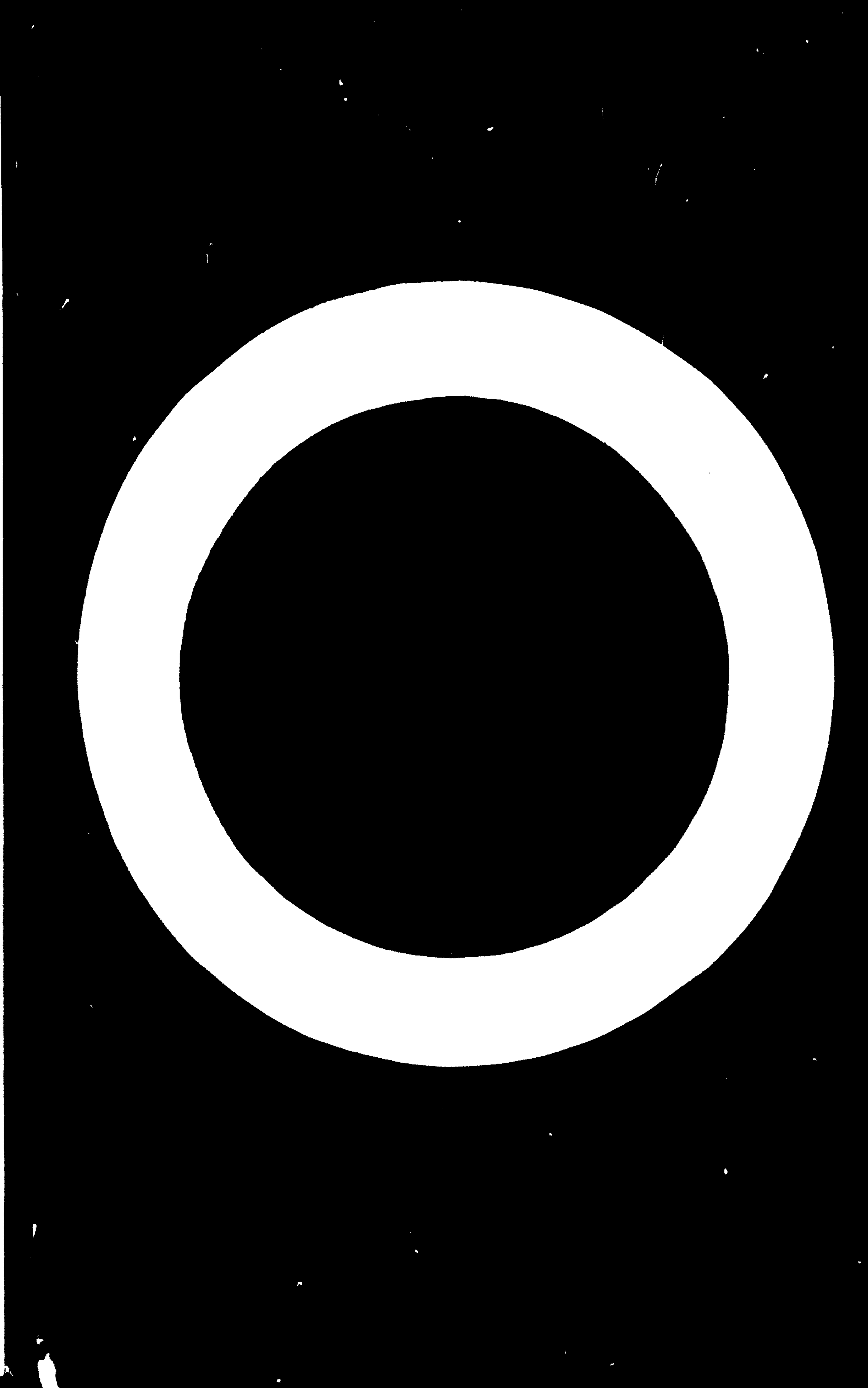
Recent projections of world P_2O_5 consumption in fertilizers reflect a need for phosphate rock production of 90/100 million tons in 1975 and 120/130 million tons in 1980. To this must be added the rock required for other industrial purposes, estimated at 15/20 million tons in 1975 and 20/25 million tons in 1980. Total world phosphate rock requirements are therefore estimated as:

1975:	105/120 million tons
1980:	140/155 million tons

A recent OECD forecast (115.7 million tons in 1975 and 154.4 million tons in 1980) representing a 54 per cent increase between 1969/1975, may be too high, as preliminary results of a TVA/ISMA survey of production capacity indicate an increase of only 22 per cent between 1969/1975, whilst a phosphate fertilizer consumption forecast by the Sulphur Institute envisages only a 32 per cent increase in this period. In the case of western Europe, OECD figures offer little encouragement to those who would export phosphoric acid or its products to this area. However, wet process acid requirements in western Europe are estimated to rise by 63 per cent between 1969/1975, compared with an increase in capacity of only 24 per cent. This would give an operating rate of 96 per cent for western Europe as a whole, and, moreover, some small plants may close. Thus, imported phosphoric acid will certainly be playing a part by 1975, but how big a part is at present difficult to determine.

In any case, phosphate rock supply will amply meet even the higher levels of the ranges indicated above. The OECD envisages world phosphate rock production capacity in 1975 as 143 million tons. More cautiously, the TVA indicates 121 million tons with a further 17 million tons as 'indefinite'. This relates mostly to new potential sources where considerable investment has already been made. When prospects for the phosphate fertilizer industry improve, these new sources will be progressively developed. Some are definitely being developed, e.g. Spanish Sahara, and there will be continuing pressure on rock prices.

Greater uncertainty surrounds the phosphate mining industry in 1971 than at any previous time since the last world war. On the other hand, phosphate rock producers and their customers are increasingly inter-dependent throughout the world and should accordingly make serious attempts to co-ordinate their interests. Studies such as those of the TVA and OECD, and representative bodies such as ISMA, should serve as the basis for such co-ordination.



CONTENTS

I Introduction

Greater uncertainty surrounds the phosphate mining industry in 1971 than at any previous time since the last world war. Over-capacity and over-production among producers outside the U.S.S.R. and communist Asia have led to severe price competition and a serious loss of earnings and profitability. In 1969, these producers exported 24% more phosphate rock than in 1965 for an increase in earnings of only 12%. These 1969 exports represented a 3% decrease in volume over 1968, but the decrease in value was nearly 8%. Although the volume of trade recovered in 1970, the price situation remains unchanged, and this is particularly serious not only for developing countries like Morocco and Tunisia, where phosphates (including fertilisers) account for 20 - 25% of total export earnings, but also for private producers in countries like the U.S.A., where the extent of government support enjoyed by phosphate producing organisations in some developing countries and in the U.S.S.R. is not available.

This situation is rendered worse by the reduced prospects of the fertiliser industry in many parts of the world and by the possible restriction of other industrial phosphate uses as a result of environmental protection controls.

In addition, there is the natural wish of several prospective producers, particularly in Spanish Sahara, Peru and Australia, to begin as soon as possible the already delayed exploitation of their massive phosphate discoveries, in which they have already made substantial investments.

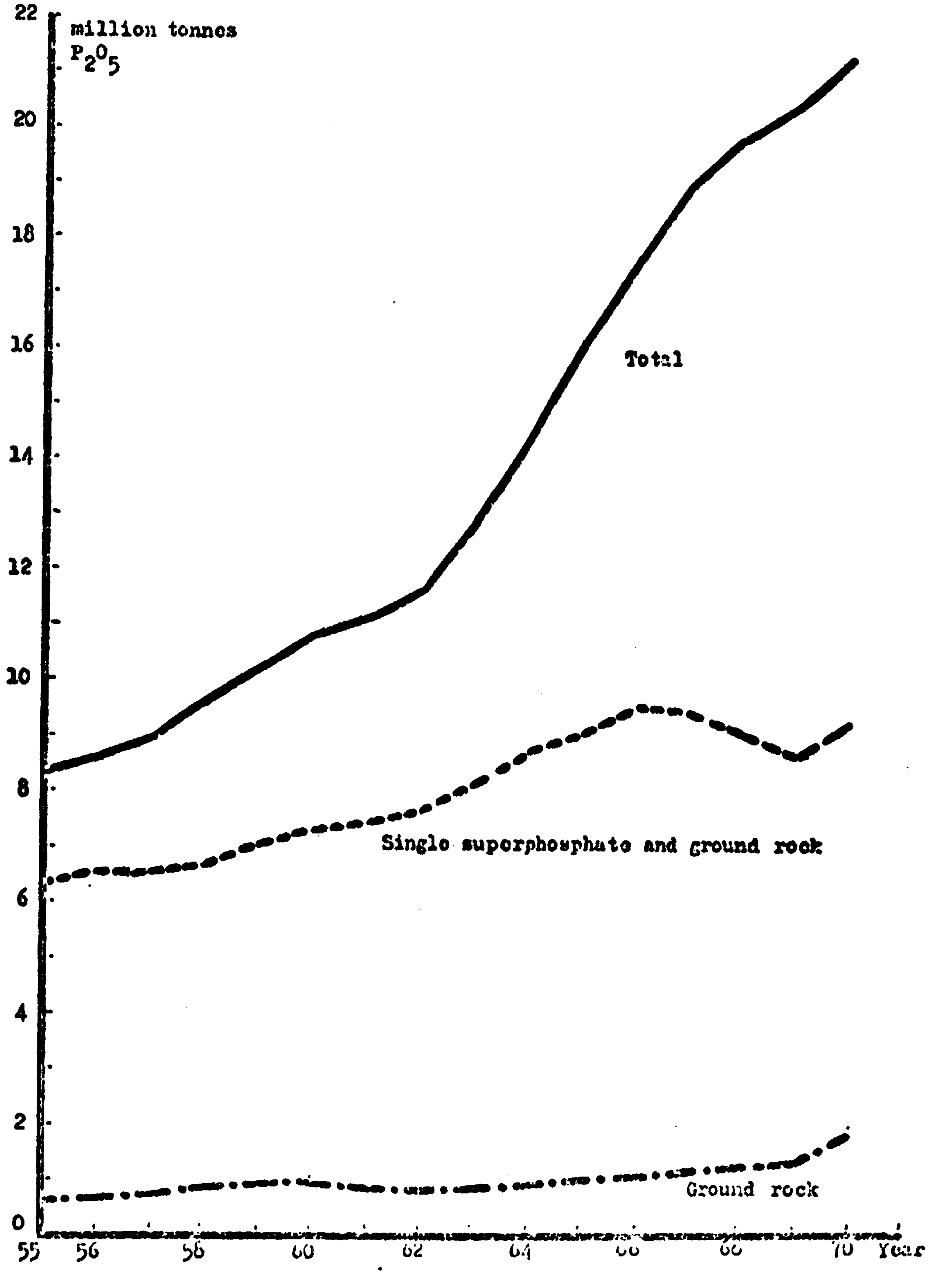
Finally, there are the problems created by the trend towards the production of fertiliser materials - particularly phosphoric acid and ammonia - at the source of the primary raw materials rather than further towards the point of ultimate consumption. For phosphate rock producers in developing countries, the chance to maximise foreign exchange earnings by making and exporting phosphoric acid or its products - mono-ammonium phosphate for intermediate use, for example - is certainly tempting. The danger for all concerned is that, through lack of co-ordination and of appreciation of the international situation, this major revolution in the world fertiliser trade could be accompanied by further deterioration in prices and profitability - at least among the primary and intermediate producers - which would only increase the disillusionment which investors of all descriptions currently feel with the fertiliser industry.

Yet fertilisers continue to be vital in the struggle to avoid starvation and malnutrition. The massive growth in the quantities required is indicated in various forecasts. It is therefore extremely important for all of us - but particularly for the developing countries with high population densities and growth rates - that the world fertiliser industry should be restored as soon as possible to a state of reasonable health and stability, and that financial resources should be used where they can be most economically effective. Unfortunately, at the international level the latter rarely happens, because political factors intervene. The weight of these political factors is usually more difficult to assess and accept than the weight of economic factors and is particularly strong in the case of an industry as basic as the fertiliser industry. Yet the political obstacles to the rational international development of the fertiliser industry according to the most internationally economic allocation of resources may often be more excessive than would be the case if there were a better appreciation of these economic factors. The present paper is presented as a small contribution towards a better appreciation of the present situation and prospects of the phosphate mining industry. It represents a personal view, not that of ISMA, and any opinions should be attributed solely to the author unless otherwise stated.

II Present world consumption of phosphate rock

The fertiliser industry uses 85% of world phosphate rock production. This proportion has not changed significantly in recent years. The production of elemental phosphorus accounts for most of the remainder, and 90% of this elemental phosphorus is converted to phosphoric acid for a variety of industrial purposes, principally detergent manufacture.

Figure I : World consumption of phosphate rock for fertiliser production, 1955-1970



An estimated division of world phosphate rock consumption in 1969 is given in Table 1.

Table 1 : World Phosphate Rock Consumption, 1969

	Million tonnes product	% of total
Fertiliser uses	62.50	84.6
Fertiliser grade phosphoric acid	25.33	34.3
Single superphosphate	22.55	30.5
Ground phosphate rock	5.55	7.5
Nitrophosphates	3.22	4.4
Concentrated superphosphates (a)	2.94	4.0
Other phosphate fertilisers	2.91	3.9
Non-fertiliser uses	11.35	15.4
Elemental phosphorus (b)	7.67	10.4
of which thermal phosphoric acid	(5.70)	(7.7)
Industrial grade wet-process phosphoric acid	2.33	3.2
Other non-fertiliser uses	1.35	1.8
Total	73.85	100

(a) secondary rock only

(b) excluding quantities used to produce fertiliser grade phosphoric acid

Source : ISMA Annual Phosphate Rock Statistics, 1969.

It can be seen from Table 1 that the production of phosphoric acid alone accounts for over 33 million tonnes of phosphate rock, or 45% of total consumption. This proportion has been increasing rapidly during the last 15 years, mainly as a result of the trend towards high-analysis fertilisers requiring phosphoric acidulation. Table 2 and Figure I illustrate this point. High-analysis fertilisers now account for well over half the world consumption of phosphate rock for fertiliser manufacture, compared with only one quarter 15 years ago. Moreover, because the USSR and other communist countries continue to meet most of their phosphate fertiliser requirements with single superphosphate and ground phosphate rock (in common with numerous non-communist countries), the corresponding proportion attributable to high-analysis fertilisers in the non-communist countries as a whole is much higher - 68% - and in North America the figure is 54%. This trend will continue rapidly during the present decade, particularly in those countries where single superphosphate is still predominant.

Table 2 : World phosphate rock consumption for fertiliser manufacture [(a)]
(million tonnes P_2O_5)

Year	For production of :- Single superphosphate and ground rock		High-analysis[(b)] fertilisers		Total fertilisers
1955	6.3	(76%)	2.0	(24%)	8.3
1960	7.3	(68%)	3.5	(32%)	10.8
1965	9.0	(56%)	7.1	(44%)	16.1
1970	8.8	(41%)	12.5	(59%)	21.3

(a) all figures include 10% estimated losses in rock handling and processing.

(b) figures include small quantities of low-analysis materials, e.g. fused phosphates, dicalcium phosphate, etc.

Source : calculated from ISMA and FAO annual fertiliser production statistics.

Demand for different sources and grades of phosphate rock is therefore increasingly affected by the technical requirements and economic situations of phosphoric acid producers; and these are considerably more varied and complicated than those of the single superphosphate manufacturers. These aspects will be discussed later. Meanwhile, it is apparent that, in general, demand for phosphate rock is governed largely by the growth of phosphate fertiliser consumption. If this fails to grow at the rate expected by the fertiliser industry or its raw materials suppliers, they are left in a difficult situation. As can be seen from Figure I, the rapid, steady growth of world phosphate fertiliser consumption, to which we became so accustomed that we almost began to take it for granted, has slackened significantly since 1967, in common with fertilisers in general. Table 2 shows that the increase in P_2O_5 in phosphate rock used in fertiliser production between 1965 and 1970 was no more than the corresponding increase between 1960 and 1965.

The reasons for this reduced rate of growth in world fertiliser consumption have been variously ascribed to bad weather in some parts of the world, good weather in other parts, together with the impact of high-yielding cereals varieties, lack of foreign exchange, inadequate infrastructural, marketing and credit arrangements in developing countries, and the approach to optimum rates of application on certain crops in certain areas of Western Europe and North America. It is interesting to note, however, that forecasts of fertiliser consumption in 1969/70, presented at the time of the 1st UNIDO Interregional Fertiliser Seminar in 1965, were not generally too high (1) (2). A forecast of phosphate rock consumption in 1969 was also presented at that seminar (3), and a comparison with actual consumption in 1969 is given in Table 3.

Table 3 : Phosphate rock : forecast and actual consumption in 1969

(million tonnes product)

Region	Forecast	Actual
Western Europe	18.0	17.2
Eastern Europe and USSR	25.5	16.4
North America	25.0	24.7
Oceania	4.9	3.6
Asia (a)	9.7	8.0
Africa	3.5	2.6
Latin America	1.3	1.3
Total	87.9	73.8

(a) including estimates for mainland China, North Korea and North Vietnam.

Sources : ISMA Annual Phosphate Rock Statistics, 1969; ISMA survey of members' estimates of national phosphate rock consumption in 1969 (1965); UN Economic Survey of Europe, 1963 (for E. Europe and USSR forecasts), calculations from national fertiliser targets.

In this case, the forecast figures were, indeed, generally too high, particularly where government targets were concerned, as for the USSR. It was, however, stated that "the total of nearly 88 million tons of rock must be viewed more as a target than a probability" and that "world demand for rock-phosphate in 1970 seems likely to be at least 70 million tons...and there is a clear possibility that it will be in the region of 80 million tons or even more." The important point

Figure II : World phosphate rock production capacity, production, and deliveries; and consumption for fertiliser production 1955 - 1970.

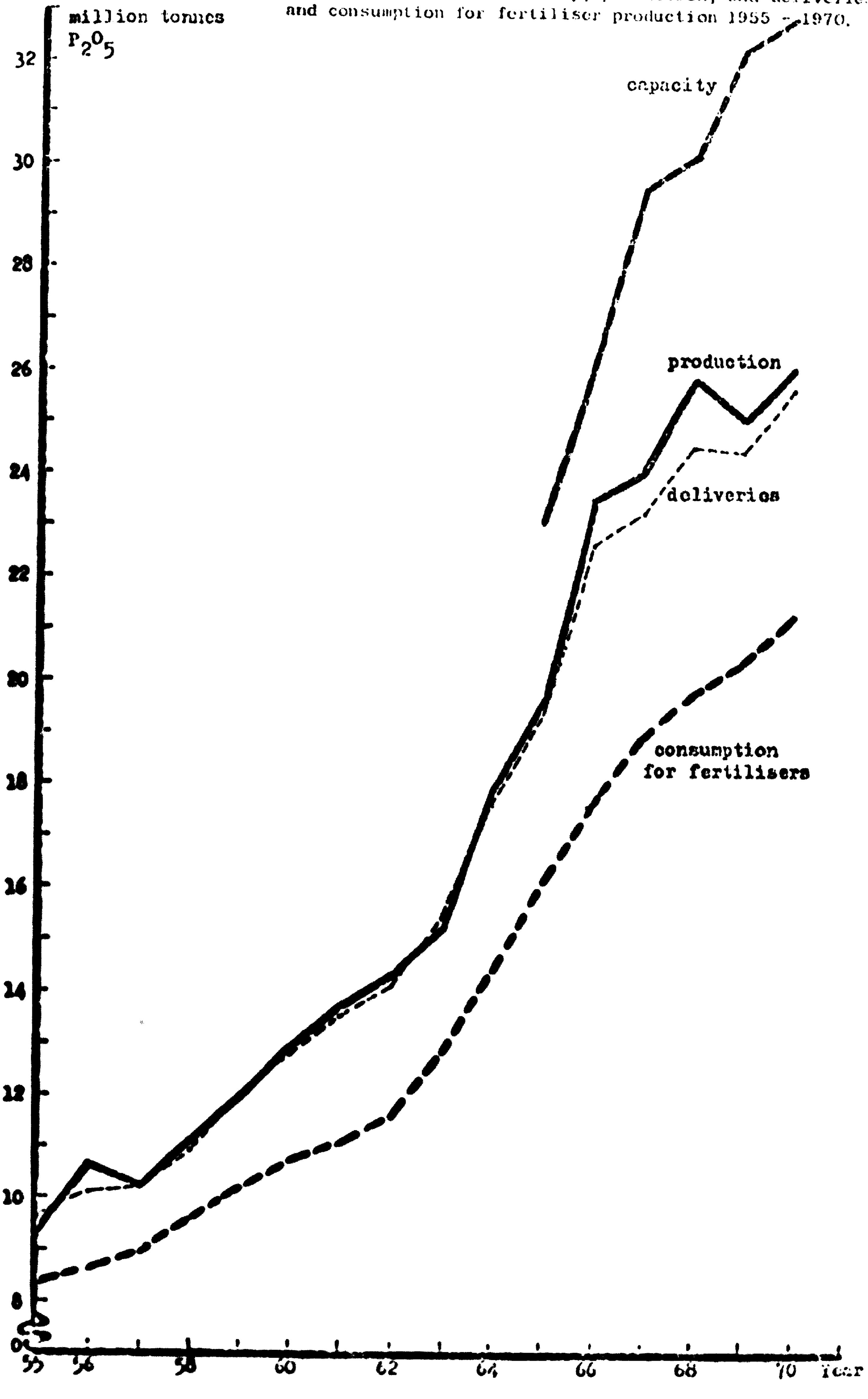


Figure III : U.S.A. - Phosphate rock production, deliveries and capacity, 1955 - 1970.

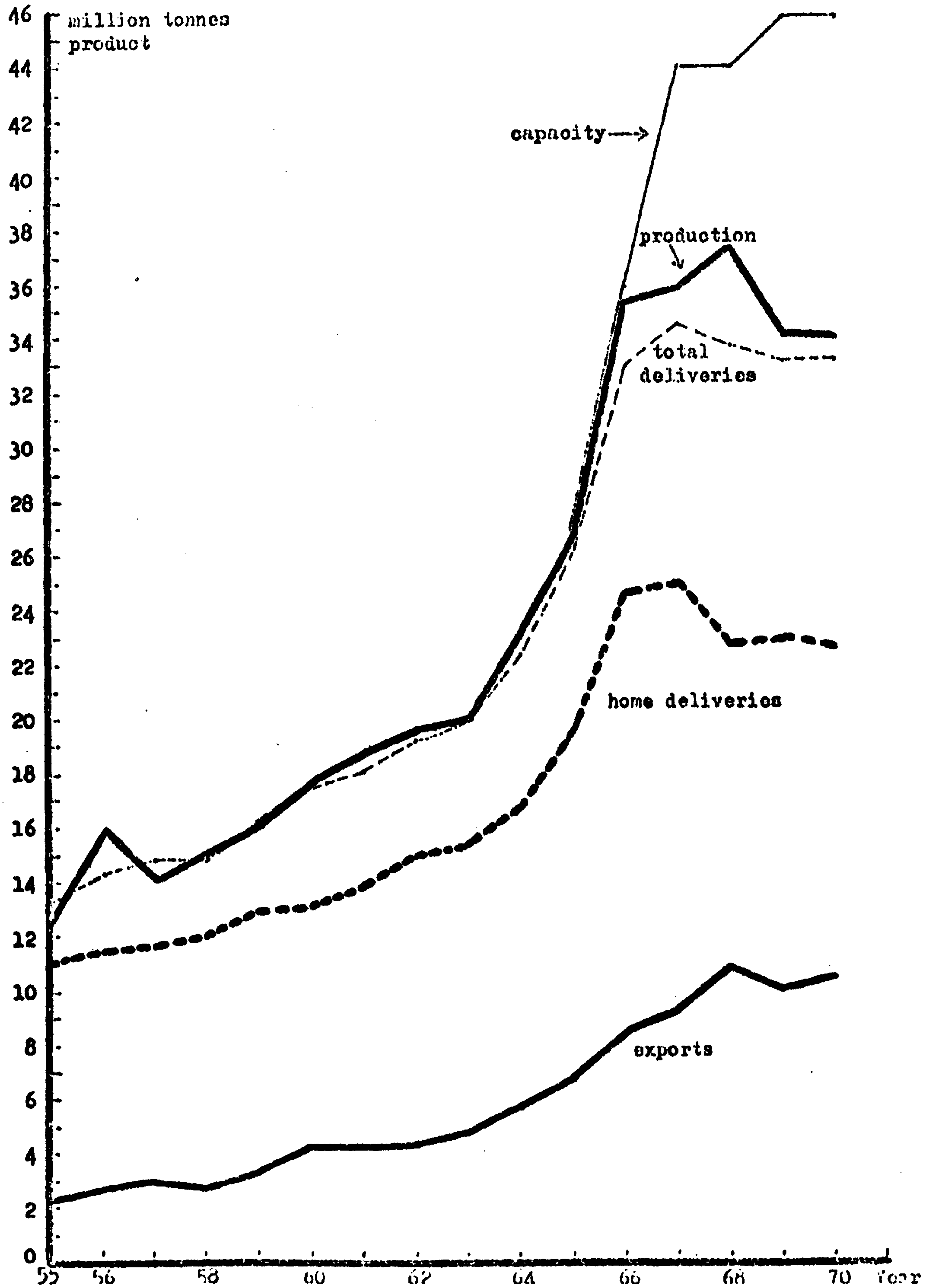


Figure IV : U.S.S.R. - Phosphate rock production, deliveries and estimated capacity, 1955 - 1970.

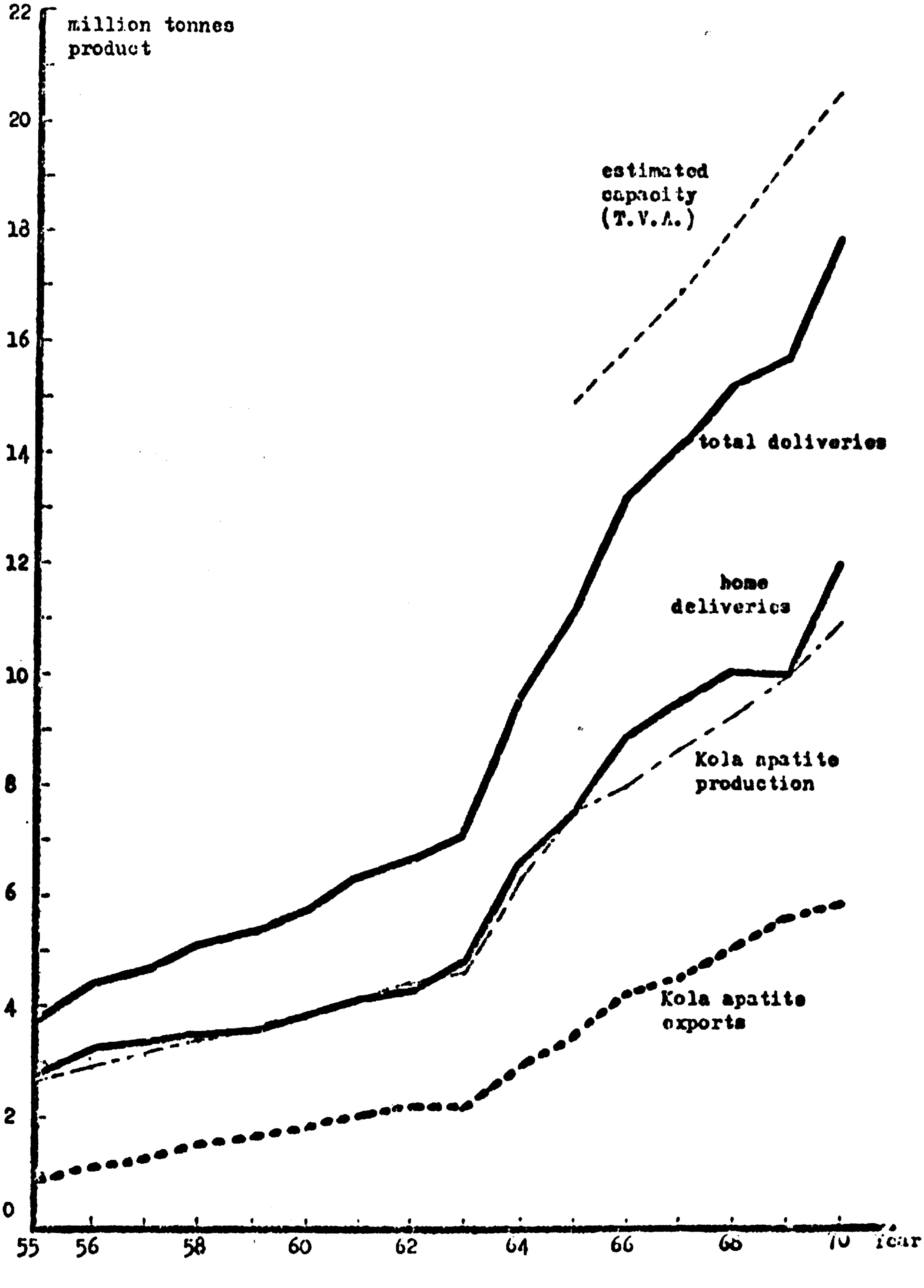
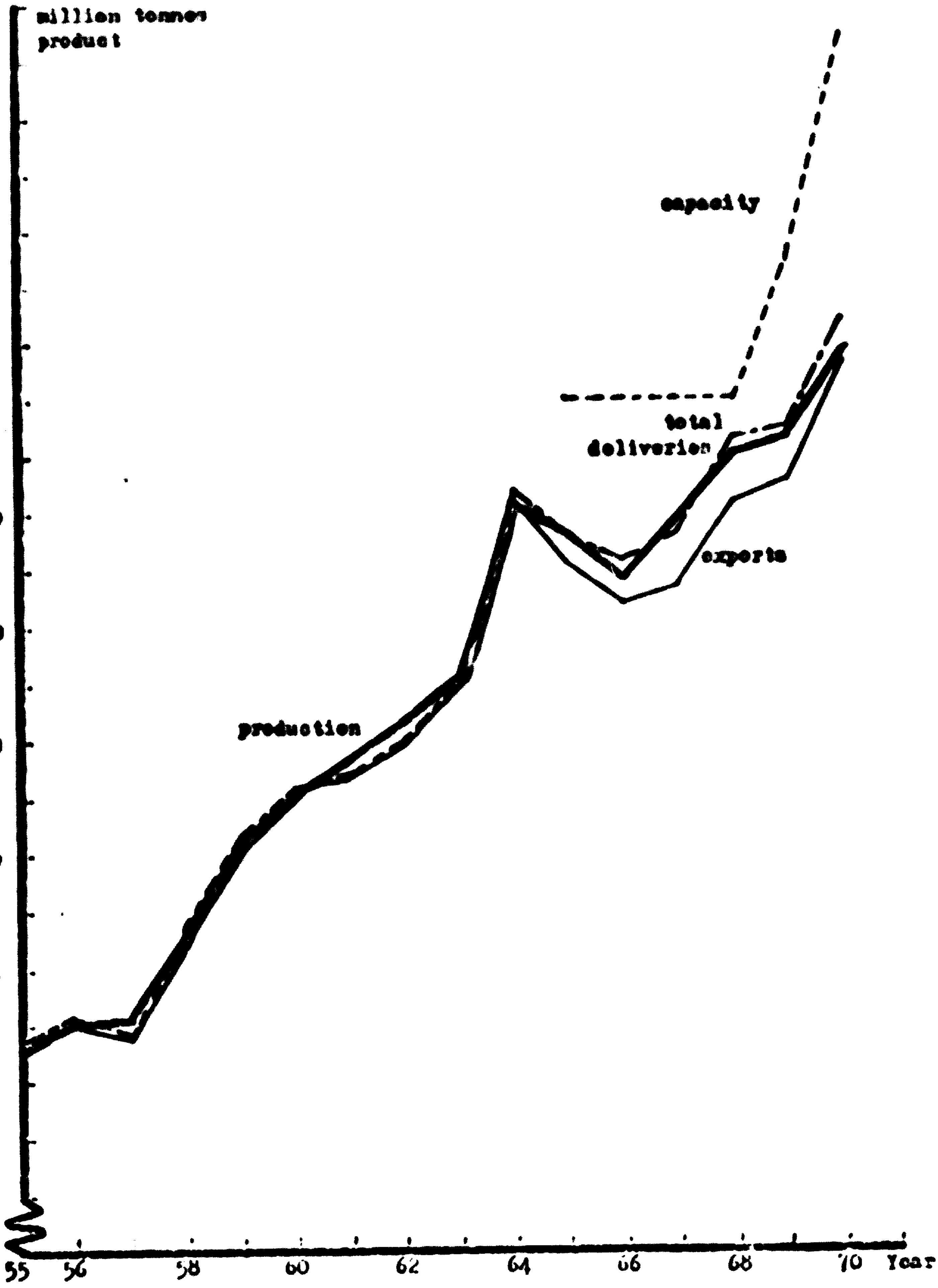


Figure V : Morocco - Phosphate rock production, deliveries and capacity, 1955 - 1970



here is that, unlike the latter statement and the above-mentioned fertiliser forecasts, which were individual appreciations of the global situation and were therefore free to discount the over-optimism of government targets and private industry by reference to the probability of resulting totals in the global context, the phosphate rock forecasts in Table 3 largely represented the sum of what individual governments and private industrialists actually thought would be achieved in their own countries. It was based mainly on a world-wide survey of ISMA members and the known targets of the Communist countries. It is, after all, what individual, independent investors think will happen, which governs their investment.

In fact, the over-optimism of fertiliser manufacturers 5 years ago was probably less related to their assessment of the overall market than to their hopes for their own individual market shares. Phosphate rock producers simply followed suit. As a result, world phosphate rock production capacity rose from 71 million tonnes in 1965 to 113 million tonnes in 1971 - a 60% increase in 6 years, compared with only a 35% rise in deliveries. As far as can be ascertained, however, this imbalance occurred almost entirely in the non-Communist countries, where there was the same 60% increase in capacity, but with only 28% more deliveries, including the substantial tonnage now going to Eastern Europe and China. This situation of over-supply will be examined in the next section.

III Present world supply of phosphate rock

The development of world phosphate rock production capacity, production and deliveries since 1955 is shown in Figure II. That of the three leading countries - U.S.A., U.S.S.R. and Morocco - is shown separately in Figures III, IV and V. These three countries continue to account for nearly 80% of world production, as can be seen from Table 4.

Table 4 : Proportions of world phosphate rock production attributable to each of the main producing regions in 1965 and 1970.

	1965	1970
	%	%
U.S.A.	44.4	42.3
U.S.S.R.	18.4	22.3
Morocco	16.2	14.1
Other North and West Africa	8.0	7.7

Table 4 - continued

	1965	1970
	%	%
Nauru/Ocean/Christmas Island	4.4	4.5
Near East	3.1	3.1
Others (a)	5.5	6.0
	100	100

(a) includes estimates for mainland China, N. Korea and N. Vietnam.

Source : ISMA Annual Phosphate Rock Statistics.

The period from 1957 to 1965 must be considered a "golden age" for the phosphate rock industry. Not only was the growth of production and deliveries remarkably regular and rapid - averaging over 8% p.a. - but prices stood higher at the end of the period than at the beginning (3). Sulphur - that raw material on which the phosphate fertiliser industry depends so heavily - was in cheap and abundant supply. Industrial phosphate use was growing even faster than fertiliser use; and the prosperity of the phosphate fertiliser industry seemed assured, as the world became increasingly aware of fertilisers as "the spearhead of agricultural development" in the fight against malnutrition and the threat of famine. The time seemed ripe for expansion in the mid-1960's. Only the possibility of a sulphur shortage seemed likely to stop the regular trend - and this seemed unlikely to trouble America which was, after all, sitting on 70% of the world's brimstone supply. Thus, with complete lack of co-ordination between the numerous companies and organisations involved, world phosphate rock production capacity leapt from 71 million tonnes in 1965 to 91 million tonnes in 1967. (4) 17 million tonnes of this 20 million tonnes increase was in the U.S.A., and this represented about 60% of the entire U.S.A. production of 1965. How to dispose of this enormous increase became an immediate and urgent problem and has continued so ever since. The course of U.S.A. production capacity, production and deliveries is shown in Figure III and Table 5.

Working at about 100% of capacity in 1965, the U.S. phosphate rock operating rate had decreased to 74% by 1970. Moreover, between 1966 and 1970 production was 9 million tonnes more than deliveries, or 5% of total production in this period. Taking this and resulting price decreases into account, the gross profits of the U.S. phosphate mining

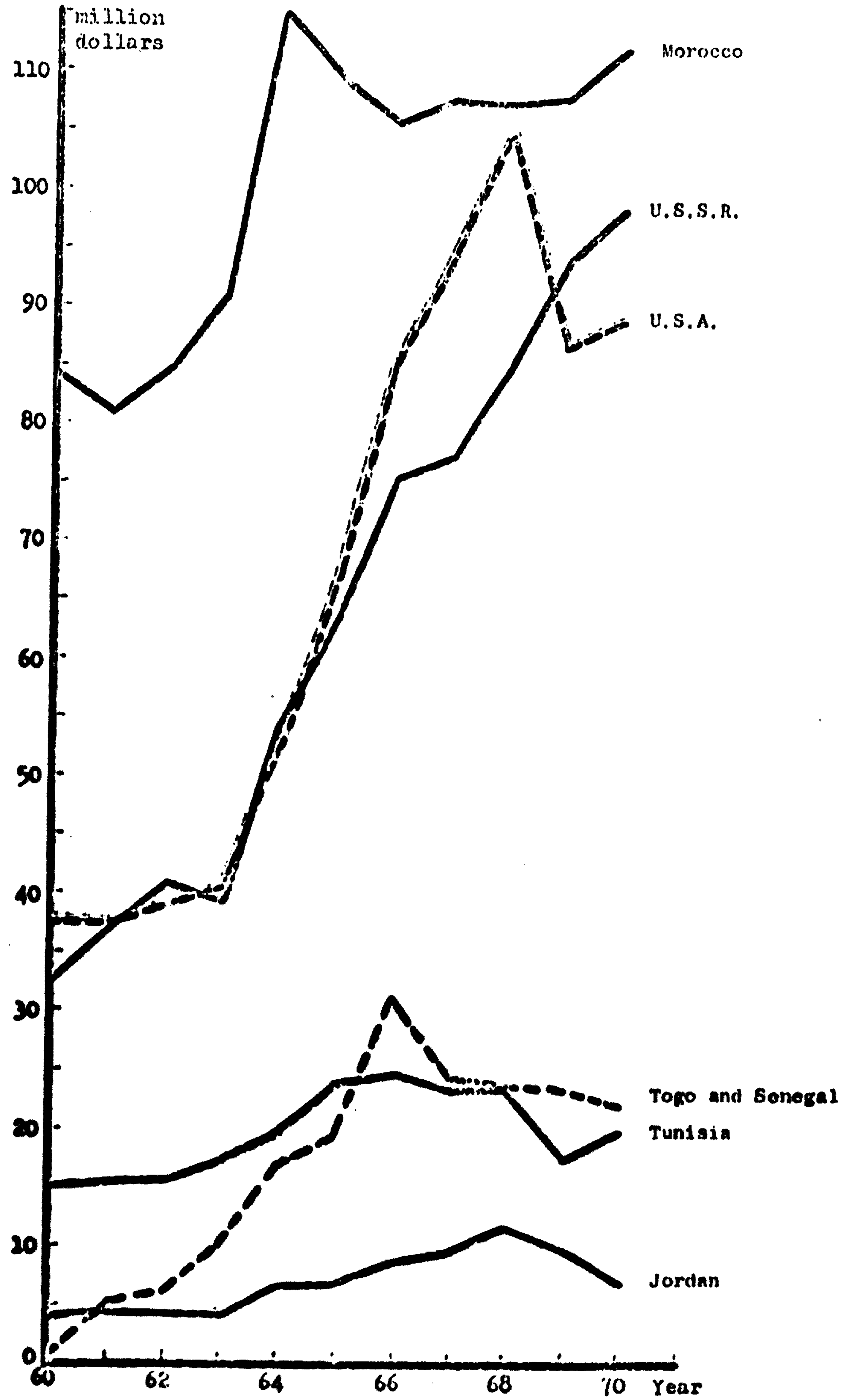


Figure VI: Value of phosphate rock exports of some leading countries, 1960-7 industry in 1970 must be very much less than in 1965, despite the larger tonnage. Production has had to be restricted and was less in 1970 than in 1966. Likewise, home deliveries in 1970 were 2 million tonnes less than in 1966. This has been compensated by increased exports, which have risen by 50% since 1965; but the value of these exports was $8 million less in 1970 than in 1966 (see Figure VI).

Table 5 : U.S.A. phosphate rock production capacity, production and deliveries in 1965 and 1970.

(million tonnes product)	1965	1970
Production capacity	26.8	45.9
Production	26.8	34.1
Deliveries	26.5	33.3
of which home deliveries	19.6	22.7
exports	6.9	10.6
Production as % of capacity	100	74
Deliveries as % of production	99	98
Exports as % of deliveries	26	32

Sources : "World phosphate fertilizer production capacities" by J.R. Douglas and E.A. Harre, T.V.A., presented to the ISMA annual conference, May 1971. ISMA Annual Phosphate Rock Statistics.

Much of this export effort has been devoted to the traditional battlefield of Western Europe, where U.S. exports have increased by 70% since 1965. The other main U.S. markets - Canada, Latin America, Japan and South Korea - are more protected from competition from other leading producers, particularly Morocco and the U.S.S.R., by their geographical position and their commercial and political links with the U.S.A. It is true that Morocco and Nauru in particular have made inroads into the U.S. share of the Japanese market. This share has fallen from 67% in 1965 to 60% in 1970. However, this decline is relatively unimportant when compared with the reduction from 54% to 45% in the Moroccan share of the much larger West European market during the same period.

Western Europe accounts for about 46% of the international phosphate rock trade. Eastern Europe accounts for almost 20%, and so Europe as a whole takes two thirds of this trade and, lying centrally between U.S.S.R., U.S.A. and Morocco, is inevitably the main focus of competition. Table 6 shows deliveries to Western Europe in 1965 and 1970.

Table 6 : Phosphate rock deliveries to Western Europe in 1965 and 1970.
(thousand tonnes product)

Country of origin	1965		1970	
Morocco	7800	(54%)	8124	(45%)
U.S.A.	2350	(16%)	4009	(22%)
Tunisia	1712	(12%)	982	(6%)
Togo and Senegal	1181	(8%)	2264	(13%)
U.S.S.R.	947	(7%)	2015	(11%)
Others	509	(3%)	593	(3%)
Total	14499	(100%)	17987	(100%)

Source : ISMA Annual Phosphate Rock Statistics

Tunisian exports to Western Europe have declined dramatically in this period, and the Tunisian share of this market has been halved. On the other hand, the high-grade phosphate rock producers of Togo, Senegal and U.S.S.R. have doubled their exports to this area. Thus the U.S.A. was by no means alone in reducing the market share of the North Africans. Moreover, the trends shown in Table 6 did not start with the great increase in U.S. capacity after 1965 : they go back to 1946, when North Africa accounted for 95% of Western Europe's requirements, with U.S.A. and U.S.S.R. accounting for only 4% and 1% respectively.

However, the success of U.S.A., U.S.S.R. and the West African group in Western Europe has had the effect of diverting North African sales towards Eastern Europe. In 1965, Russian sales to Western Europe and North African sales to Eastern Europe were roughly in balance. In 1970, the North Africans sold 700,000 tonnes more to the East than the U.S.S.R. sold to the West. Between 1965 and 1970, international phosphate rock deliveries to Eastern Europe rose by 2.8 million tonnes, and 1.8 million tonnes of this increase came from Morocco and Tunisia. Thus the share of this market attributable to these two countries rose during this period from 19% to 37%, whilst that of U.S.S.R. fell from 65% to 53%. This, of course, excludes the requirements of the U.S.S.R. itself which continue to be drawn exclusively from domestic resources. Much of the North African sales to Eastern Europe are, in fact, part of barter deals which are said to deprive the North Africans of the opportunity of spending the respective earnings in the most efficient way, but which at least provide outlets where none might otherwise be available without a significant price reduction. In any case, the foregoing figures seem to indicate that the U.S.S.R. prefers the foreign exchange it can earn in Western Europe to alternative earnings in Eastern Europe; and in the circumstances the barter deals are probably convenient for all concerned.

As shown in Figure V, Morocco did not expand its production capacity much between 1965 and 1969, although a substantial expansion was originally planned for this period. This expansion is now rapidly taking place, but the effect of its delay was to protect Morocco from the worst effects of the over-supply situation in America and generally throughout the international trade. It enabled Morocco to produce at close to capacity, and for most of the period deliveries even slightly exceeded production.

Nevertheless, the pressure on export prices resulting from U.S. excess capacity, the Russian export drive in Western Europe and the rise of Togo and Senegal, coupled with the failure of demand to rise as quickly as some may have expected, had a serious impact on the earnings of all producers with the possible exception of the U.S.S.R. As shown in Figure VI, the value of Moroccan deliveries was slightly less in 1969 than in 1965, despite an increase in deliveries of 1 million tonnes. In the case of Tunisia, it was 26% less for a 20% drop in deliveries. But if deliveries to Communist countries are excluded, then in this period Moroccan foreign exchange earnings for phosphate rock sales in non-Communist countries fell by 10%, and in the case of Tunisia, by 50%. It is small wonder that phosphate rock producers in developing countries are increasingly concerned to improve their position by manufacturing and exporting phosphoric acid and finished fertilisers rather than phosphate rock.

This trend towards the establishment of export-oriented phosphoric acid and phosphate fertiliser production facilities at or near the site of raw materials production has already begun to gather momentum. The major interest lies in the possibility of persuading fertiliser manufacturers in Western Europe and certain developing countries to import phosphoric acid rather than phosphate rock and sulphur. Phosphoric acid trade within America is already substantial and well-established. It is growing rapidly within Europe, particularly in Belgium and the Netherlands. Now several new companies have been created in North Africa and the Middle East specifically to export phosphoric acid. This is shown in Table 7. It indicates that by 1976 there could be a total export capacity of over 1 million tonnes P_2O_5 as phosphoric acid from these plants. This would account for about 3.4 million tonnes of phosphate rock, or nearly 9% of the present world phosphate rock export market. Other plans may possibly materialise by 1976, but the proportion of world phosphate rock trade likely to be displaced by phosphoric acid before then would seem to be rather small.

Table 7 : Export-oriented phosphoric acid plants.

Producers	Start-up	Capacity ('000 tonnes P_2O_5)
Existing :		
Fertilizantes Fosfatados Mexicanos, Mexico.	1969	370
Arad Chemical Industries, Israel	1971	165
Shahpur Chemical Co., Iran	1971	100
Industries Chimiques Maghrebines, Tunisia	1971	120
Planned :		
Office Chérifien des Phosphates, Morocco	1974/75	330
Algeria	1975	198
Total		1283

Source : O.E.C.D. (11)

Three of the new phosphoric acid plants listed in Table 7 - those in Iran, Mexico and Israel - are well-placed to supply the next largest regional phosphate export market after Europe, viz. Asia. The companies in Mexico and Iran already have contracts to supply India and the Philippines. No doubt the opening of the Suez Canal would increase competition in this area.

Meanwhile, Jordan and Egypt have a natural advantage in the Asian phosphate rock market, shipping respectively 63% and 70% of their 1970 exports to this region. However, this still accounted for only

10% of deliveries to Asia, Morocco and the U.S.A. taking the overwhelming share - 70% - as in the case of Western Europe. Three countries - Japan, China and India - import 60% of deliveries to Asia. Morocco accounts for the bulk of deliveries to China, although its share of this market has also been decreasing. As already mentioned, the U.S.A. dominates the Japanese market, although again with a decreasing share. The situation in India fluctuates according to aid procurement and foreign exchange availability. In 1970, for example, the U.S.A. accounted for 64% of India's phosphate rock imports, compared with only 37% in 1969.

As far as Australia and New Zealand are concerned, the depression in international wool and wheat prices has been reflected by a dramatic fall in phosphate rock deliveries from a peak of 4.7 million tonnes in 1966 to 3.3 million tonnes in 1970. In 1966, well over 1 million tonnes came from producers other than the traditional sources of Christmas, Ocean and Nauru islands. In 1970, deliveries from these other sources - mainly U.S.A. and North and West Africa - were negligible; and Nauru was able to ship 360,000 tonnes to Japan.

In Africa, there is now no single country which imports significant amounts of phosphate rock. The growth of production in South Africa has made this country more than self-sufficient. Home deliveries by African producers have risen from 1.6 million tonnes in 1965 to 2.7 million tonnes in 1970, but over half this increase has been in South Africa, which nevertheless accounts for no more than 40% of total African phosphate rock consumption. In other words, the rate of growth in the developing African countries has not been so rapid in general. Despite efforts to build up a phosphate fertiliser export trade, the North African producers have raised home deliveries from 950,000 tonnes in 1965 to only 1.2 million tonnes in 1970, accounting for only 8% of their production.

In Latin America, phosphate rock deliveries have risen rapidly from 700,000 tonnes in 1965 to 1.5 million tonnes in 1970, but two countries - Brazil and Mexico - use 88% of these deliveries, and one country - U.S.A. - is the source of 84% of them.

In 1970, phosphate rock deliveries to and within the developing countries of Latin America, Africa and Asia (excluding communist Asia) amounted to 5.7 million tonnes, compared with 3 million tonnes in 1965, but this is still only 7% of total world deliveries.

IV **Technical and economic aspects of phosphoric acid production and trade**

As mentioned previously, the demand for different sources and grades of phosphate rock is increasingly affected by the technical and economic situations of phosphoric acid producers. The ideal phosphate rock would include the following properties :

- it would have a high P_2O_5 content, requiring a relatively small amount of acid to react it ;
- it would be soft enough and sufficiently finely divided to require no grinding before chemical reaction and it would flow properly through handling and feed systems ;
- it would have a relatively low content of the common impurities - oxides of iron and aluminium, fluorine, and various organic materials. The oxides of iron and aluminium reduce the proportion of water soluble P_2O_5 in the finished fertiliser and adversely affect the quality of the phosphoric acid, often necessitating the expense of clarification. Fluorine is toxic and must be scrubbed out of effluents leaving the factory. Organic matter also adversely affects the acid and tends to create foaming problems during manufacture ;
- it would not produce scaling in the reaction tanks and feed lines and would produce phosphoric acid which could be easily, rapidly and totally filtered away from the co-product gypsum and which would not block filter cloths.

There is, of course, no such thing as the ideal phosphate rock. Each factor is more or less important, depending on the delivered cost of the rock, its use, the use of its products, the process adopted and the cost of other variables such as sulphur, electricity, etc. Thus the choice of a source of phosphate rock depends on a complex combination of local circumstances. However, the trend towards phosphoric acid and high-analysis fertilisers, away from single superphosphate, has been accompanied by several other related trends which have affected the phosphate rock market :

a) Size of plants and producing companies :

The small single superphosphate plant producing a few thousand tonnes annually is disappearing from most of the industrialised countries and is being replaced by large phosphoric acid plants. 600 - 1000 t.p.d.

is now considered a normal production capacity for phosphoric acid plants in North America, whereas 200 t.p.d. was thought very large 10 years ago. Mergers within the industry have led to fewer and larger producers. Consequently, quantities of phosphate rock purchased by individual companies, whether grouped within a purchasing organisation or not, have been growing larger, and producers of fertilisers have greater bargaining power and can also benefit from lower freights on larger vessels. Also, in order to be independent of particular sources of phosphate rock, fertiliser producers have often installed grinding equipment. In this case, fixed costs on such equipment reduce the natural benefit from soft rock, and this has tended to work against the North Africans, for example.

On the other hand, phosphoric acid plant sizes in Western Europe are generally much smaller than in U.S.A. As shown in Table 8, 19 plants out of 33 in Belgium, France, Netherlands and West Germany in 1971 have a capacity below 40,000 t.p.a. P_2O_5, compared with only 5 out of 32 in U.S.A. Half the American plants are over 150,000 t.p.a. With increasing international economic integration in Western Europe and with resulting rationalisation within the industry, this situation must change; and the hope of the North Africans and others is that fertiliser producers in Western Europe, disillusioned with the return on capital invested in this industry, will increasingly opt to import phosphoric acid rather than make it themselves. The rate at which this trend will develop will depend on how quickly the demand for phosphate products, particularly fertilisers, outstrips existing and committed future capacity in Western Europe, and on the economics of importing acid versus making it locally. The latter is beyond the scope of this paper, but the future growth of phosphoric acid capacity is examined later.

Table 8 : Number of wet phosphoric acid plants by size, in U.S.A. and in Belgium, France, Netherlands and West Germany, in April, 1971.

Annual Capacity (short tons P_2O_5)	U.S.A.	Belgium, etc.
0 - 39,999	5	19
40,000 - 99,999	7	9
100,000 - 149,999	4	4
150,000 - 199,999	3	1
200,000 - 249,999	8	-
250,000 - 349,999	1	-
350,000 and over	4	-
	32	33

Source : (5)

b) Ratio of raw materials costs to total manufacturing costs :
Because of the substantially greater capital requirement for phosphoric acid production, compared with single superphosphate, raw materials costs are only 50 - 60% of total phosphoric acid manufacturing costs, compared with 60 - 70% for single superphosphate (including sulphuric acid manufacture). Economies of scale and the cost of labour and capital thus become more important, and the labour itself must be more highly trained to deal efficiently with the more sophisticated plant. This works against the establishment of plants in developing countries, where local markets are often small, trained labour is sometimes difficult to obtain, capital is relatively dear (unless forthcoming through foreign aid) and maintenance, repair and replacement of equipment is often slow. Moreover, the original cost of a plant is considerably higher in developing countries generally. It is estimated, for example, that the fixed capital cost of a phosphoric acid plant with a design capacity of 1000 short tons per day P_2O_5 and with strict minimum investment in phosphate unloading, storage and handling facilities, would be likely to average $28 millions in Europe or Florida but $35 millions in developing countries. This 25% difference adds $4 - 6 per ton P_2O_5 to total manufacturing costs.

c) Sulphur requirement :
The sulphur needed to produce a tonne of P_2O_5 in wet process phosphoric acid is approximately 940 kg, compared with only 620 kg for single superphosphate (6), i.e. 50% more. If triple superphosphate is the end product, the sulphur/P_2O_5 ratio is reduced again to almost the level of single superphosphate, but increasingly the trend has been towards ammonium phosphates which do not reduce the total sulphur requirement. Thus the price of sulphur becomes more important in relation to that of phosphate rock. As shown in Table 7, two of the new phosphoric acid producers in developing countries - those in Mexico and Iran - are located at the source of the sulphur rather than the phosphate rock, whilst a third - that in Israel - operates a process which requires no sulphur.

Although sulphur was in short supply between 1965 - 67, it is now in abundance, and prices are low. This situation may continue through the present decade, in view of the increasing proportion of sulphur production attributable to purification of natural gas, oil, and stack gases, and to anti-pollution measures in general. As far as phosphoric acid production is concerned, this trend also tends to favour the industrialised countries over developing countries with phosphate rock but no sulphur, because, apart from the fact that "anti-pollution" sulphur arises in the industrialised countries, the freight element in total delivered sulphur costs becomes more important with low sulphur prices, and freights to the developed countries are, in any case, often lower than to developing countries. Moreover, apart from Mexico and the Arabian Gulf, it is the industrialised countries where the bulk of sulphur resources are located. Low phosphate rock prices re-inforce this situation.

V Freight rates and delivered costs

The incidence of freight rates on the delivered cost of phosphate rock has been examined in detail in a previous paper (3). In the case of North African phosphate deliveries to Europe it is usually a relatively minor element - approximately 20 - 30% - whereas in the case of U.S. deliveries to Europe it is usually 35 - 45%. Thus North African producers are adversely affected by a fall in freight rates, because this makes a smaller difference to landed costs than in the case of U.S. deliveries. Conversely, U.S. producers are likely to suffer when freight rates rise.

Freight rates have fluctuated considerably in the last few years. They rose in 1967, fell back in 1968 and 1969 and rose again - very substantially - in 1970. In mid 1971 they are once more at the lowest levels of 1969. These fluctuations make a difference of up to $3.50 in the landed cost of U.S. phosphate rock in Western Europe, but of only about $1.50 in the case of North African rock to the same destination. For deliveries to Japan, rates from Florida have varied from $7 to over $15 per ton of rock between 1965 and 1970, and for Moroccan deliveries to China there is an even greater range.

Some of this fluctuation can be attributed not so much to general changes in freight levels as to different vessel sizes. In June, 1971, for example, the ISMA monthly freight market report noted two potash fixtures from Vancouver to Europe - one of 18,000 tons to Sicily at $10 per ton, the other of 40,000 tons to Rotterdam at $3.75.

The future course of freight rates is extremely difficult to predict. Ship operating costs have risen particularly rapidly in the last few years, and many shipowners would find it difficult to continue at the present low level of freights throughout the 1970's. Nevertheless, some experts think this may be the case, in view of the large volume of tonnage on order, the increasing vessel size and the accompanying economies of scale, and also the possibility of opening the Suez Canal. Another important factor is the substantial level of government-sponsored financial and tax support enjoyed by most shipowners (7). Phosphate rock accounts for less than 8% of world seaborne trade in the main bulk commodities and therefore has a relatively minor influence on freight levels. It requires covered storage wherever there is a risk of rain and, at present, cargoes of 20 - 25,000 tonnes often provide quite a disposal problem for fertiliser factories. Amounts in excess of 50,000 tonnes, which are now starting to be shipped between U.S.A. and Japan, will require considerable coordination of different plant requirements, probably between different producers, and storage and handling may become more costly as a result. Moreover, not many ports can take these very large vessels, and experience shows that in many cases the prime freight on a large bulk carrier can at present be quite easily doubled as a result of secondary movement, and the gain from using the larger ship is cancelled out. In conclusion, therefore, fertiliser producers importing phosphate rock may not be able to benefit from larger vessel sizes as much or as rapidly as importers of other bulk commodities, and their transportation costs may tend to rise faster than in other trades. Rising transportation costs for phosphate rock would work in favour of the phosphoric acid trade, although not necessarily on an inter-continental basis or from developing countries.

VI Future world phosphate rock requirements

Recent projections of world fertiliser consumption of P_2O_5 range between 25.5 and 28.5 million tonnes in 1975/76 and between 33.5 and 37.5 million tonnes in 1980/81 (8,9,10), including estimates for the communist countries. These projections exclude ground phosphate rock but include basic slag. The use of ground phosphate rock continues to increase in the U.S.S.R. and a few other countries, more than offsetting decreases in other parts of the world. Basic slag consumption, on the other hand, is likely to decrease, and since this is mainly in Europe, European phosphate rock requirements may increase more rapidly than fertiliser P_2O_5 consumption.

Assuming that world use of ground phosphate rock and basic slag will develop as follows :

(million tonnes P_2O_5)	1969/70	1975/76	1980/81
Ground phosphate rock	1.4	1.8	2.0
Basic slag	1.2	0.9	0.6

and then including ground rock but excluding basic slag in the above projections, we can calculate a range of P_2O_5 consumption in fertilisers which relates to actual phosphate rock requirements for this purpose. Allowing 1½% for losses in handling between fertiliser production and consumption, 10% for handling and processing losses between the mine and the finished fertiliser, and 6 months as the time between rock production and consumption, we calculate that the equivalent phosphate rock production would need to be between 90 and 100 million tonnes in 1975 and between 120 and 130 million tonnes in 1980.

To this must be added the rock requirement for other industrial purposes. As shown in Table 1, this amounted to 11.35 million tonnes rock in 1969, or 3.7 million tonnes P_2O_5. Growth in this sector has suffered recently from the general industrial slow-down in North America and Western Europe and may continue to suffer as a result of impending restrictions on phosphate detergents in some countries. This is an area of considerable uncertainty, but in order to arrive at a total world phosphate rock requirement, we have adopted a linear arithmetic projection of the 1955-1969 trend and estimate a rock production requirement for non-fertiliser uses of 15 - 20 million tonnes in 1975 and 20 - 25 million tonnes in 1980.

In this way, total world phosphate rock requirements are estimated as follows :

1975	:	105 - 120 million tonnes
1980	:	140 - 155 " "

These figures may be compared with an O.E.C.D. forecast (11) shown in Table 9. The O.E.C.D. totals are at or near the upper levels of the ranges indicated above. In the light of a recent forecast of phosphate fertiliser consumption prepared as a consensus of industry views (8), and also in view of the doubtful prospects for phosphate detergents, the O.E.C.D. figures may be generally too high, at least for Western Europe and North America. This view is supported by surveys of the development of phosphate fertiliser production capacity to 1975, carried out by T.V.A. and ISMA. Table 10 compares these forecasts as follows :

A – The preliminary results of an ISMA member survey of phosphate fertiliser production capacity in 1975 in conjunction with a similar T.V.A. study (5), less estimated basic slag demand. It should be noted that single superphosphate and basic slag capacity in North America and Western Europe is taken to be merely an extrapolation of the decreasing production trend in these regions, rather than peak capacity. This was considered more realistic than the inclusion of capacity, some of which is unlikely to be used in any foreseeable circumstances. In fact, there is considerable excess capacity in the single superphosphate industry, but any excess capacity indicated by Table 10 would occur largely in the complex fertiliser and wet phosphoric acid industries.

B – The O.E.C.D. phosphate rock consumption forecast for 1975, less estimated consumption for uses other than chemical fertilisers (i.e. also excluding ground phosphate rock used as such), and omitting the U.S.S.R. and communist Asia because they are not included in A and C. A 10% reduction is made to allow for handling and processing losses in order to make the figures comparable with A.

C – The Sulphur Institute forecast of phosphate fertiliser consumption extrapolated from 1974/75 to 1975/76 by applying the growth rates indicated for 1969/70 – 1974/75, less estimated basic slag consumption, plus 1½% for losses between production and consumption in order to make the figures comparable with A and B.

"A" is thus production capacity in each region; "B" is the production in each region; and "C" is the proportion of this production plus imports used in each region – or at least it would be, if total "B" was not over 2 million tonnes P_2O_5 greater than total "C", representing the inevitable inconsistency between the forecasts of two different bodies rather than an implied growth in P_2O_5 fertiliser exports to the U.S.S.R. and communist Asia.

In fact, the generally high level of the O.E.C.D. figures is reflected by the fact that, in relation to the actual situation in 1969, they indicate a 54% increase in the regions included, compared with a 32%

Table 9 : O.E.C.D. forecast of world phosphate rock consumption

(million tonnes of rock)	Actual 1969	Forecast 1975	1980
North America	24.7	32.0	40.0
Western Europe (a)	18.1	27.2	32.0
Eastern Europe	5.5	9.3	12.0
U.S.S.R.	10.1	18.0	26.0
Oceania	3.6	5.0	7.0
Latin America	1.3	4.5	8.0
Africa	2.5	5.5	8.5
Asia (non-communist)	5.1	10.2	14.5
Asia (communist)	3.0	4.0	6.5
Total	73.9	115.7	154.5

(a) includes Yugoslavia and Turkey

Source : (11)

Table 10 : Comparison of three forecasts for 1975 (1975/76):
A - T.V.A./ISMA : Phosphate fertiliser production capacity.
B - O.E.C.D. : Phosphate rock consumption.
C - Sulphur Institute : Phosphate fertiliser consumption.

(million tonnes P_2O_5)	1975 A	1975 B	1975/76 C
North America	6.70	6.97	6.06
Western Europe (a)	5.86	6.40	5.18
Eastern Europe	3.70	2.55	2.97
Oceania	1.88	1.42	1.24
Latin America	1.18	1.22	1.35
Africa	[illegible]	1.56	0.97
Asia (non-communist)	4.68	2.74	3.03
Total	26.34	22.86	20.80

(a) "B" includes Yugoslavia and Turkey. "A" and "C" include these countries in Eastern Europe and Asia respectively.

Sources : calculated from (4), (8) and (11) as explained in the text.

Table 11 : Estimated wet-process phosphoric acid production capacities.

(million tonnes P_2O_5)	1970	1975	Proportion of total phosphate fertiliser capacity 1970 %	1975 %
North America	5.83	5.71	79	82
Western Europe	2.91	3.61	42	50
Eastern Europe	0.59	1.20	21	31
Oceania	0.16	0.16	8	8
Latin America	0.55	0.74	45	50
Africa	0.49	1.28	42	62
Asia (non-communist)	1.57	2.56	47	53
Total	12.10	15.26	49	54

Source : (4)

increase in phosphate fertiliser consumption indicated by the Sulphur Institute figures, and only a 22% increase in production capacity indicated by the T.V.A./I.S.M.A survey. Even if the assumption that the proportion of phosphate rock consumption for non-fertiliser uses will remain steady proves incorrect, the possible growth of this proportion could hardly be so rapid as to reduce the O.E.C.D.'s 54% increase to the level of the other figures.

Since the O.E.C.D. figures relate to primary consumption of phosphate rock, they do not appear to offer much encouragement to those who would export phosphoric acid to Western Europe. Taken in conjunction with the T.V.A./IS.MA production capacity figures, they imply that the industry in North America and Western Europe will be operating at over 100% of capacity in 1975, quite apart from any extension of effective capacity resulting from the use of imported phosphoric acid. Taken in conjunction with the Sulphur Institute consumption forecast, they also imply that net exports from Western Europe will grow to 1.2 million tonnes P_2O_5 by 1975 - three times their present level. Unless greatly increased foreign aid is devoted to fertiliser purchase in Western Europe, this is unlikely to happen. Theoretically, therefore, the capacity envisaged in Western Europe in 1975 would be able to account for this region's projected phosphate fertiliser consumption and its present level of net exports <u>without</u> imports of phosphoric acid. In practice, however, the wet process phosphoric acid industry in this region would then be operating at about 96% of capacity, including non-fertiliser use, and at this level it is certain that local shortages would arise which would most easily and economically be met by imports. Moreover, the continued use of relatively small old plants, which are numerous in Western Europe, may prove increasingly uncompetitive, and some may close. Thus, although Table 12 shows our best present estimate of the development expected in Western Europe and North America between 1969 and 1975, the situation in Western Europe is particularly liable to change.

Nevertheless, certain implications to be derived from Table 10 seem valid and reasonable :

- that the phosphate fertiliser industry in North America and Western Europe will be operating, in general, considerably closer to full capacity in 1975 than at present and will have a continuing margin for export to the developing countries;

- that Asia, Africa and possibly Eastern Europe will have a much less satisfactory operating rate;
- that Asia and possibly Latin America and Eastern Europe will be areas to which exporters should direct their attention, if only financial restrictions will permit;
- that Africa will have become a major net exporter by 1975, not only of phosphoric acid but, potentially even more economically interesting, of mono-ammonium phosphate for intermediate use in compound fertiliser manufacture;
- that Oceania will have a continuing over-supply situation and will still be unable to make full use of its small phosphoric acid capacity (see Table 11).

As can be seen from Table 11, only Oceania and Eastern Europe (and also U.S.S.R. and communist Asia) will have a wet phosphoric acid capacity of less than 50% of total phosphate fertiliser capacity by 1975; and in Eastern Europe, between 1970/1975, phosphoric acid capacity is expected to double. In Asia it is expected to rise by 60% and in Africa, by 160%.

Table 12 : Estimated development of phosphate fertiliser and wet process phosphoric acid capacity and production in North America and Western Europe, 1969 - 1975.

(million tonnes P_2O_5)	North America 1969	North America 1975	Western Europe 1969	Western Europe 1975
(1) Total capacity (a)	7.25	7.00	6.48	7.17
(2) Capacity less SSP and slag	6.50	6.60	4.17	5.57
(3) Wet phos. acid capacity (b)	5.67	5.71	2.53	3.61
(4) Total production	5.12	6.50	5.26	6.50
(5) Production less SSP and slag	4.37	6.10	2.95	4.90
(6) Wet phos. acid production (b)	3.89	5.25	2.13	3.48
(7) (4) as % of (1)	71%	93%	81%	91%
(8) (5) as % of (2)	67%	92%	71%	88%
(9) (6) as % of (3)	69%	92%	84%	96%

(a) single superphosphate (SSP) and basic slag capacity taken to be equivalent to estimated demand.

(b) includes capacity and production used for non-fertiliser purposes. In North America this is balanced almost exactly at present by the amount of thermal phosphoric acid used for fertilisers. In Western Europe this does not occur and the estimated use of wet acid for non-fertiliser uses in 1969 and 1975 is 0.34 and 0.48 million tonnes P_2O_5 respectively.

VII Future world phosphate rock supply

It is apparent from announcements to date that the probable expansion of phosphate rock supply will easily cover even the maximum levels of demand forecast in the previous section, at least until 1975 and probably until 1980. The O.E.C.D. (11) suggests that phosphate rock capacity will increase by 38% between 1969/70 and 1975 to a total of 143 million tonnes. Half of the 40 million tonnes increase is expected from expansion in the U.S.S.R. and North Africa, and one quarter from new sources such as Peru and Spanish Sahara. More cautiously, the T.V.A. shows (4) an increase of only 21 million tonnes in the same period, giving a 1975 total of only 121 million tonnes. 18 million tonnes of this increase is envisaged in the U.S.S.R. and Africa. However, a further 17 million tonnes is shown as "indefinite". In view of current phosphate rock prices, this degree of doubt is understandable and relates largely - although not only - to the potential new sources.

Nevertheless, substantial investments have already been made in several of these locations, particularly in Spanish Sahara where production is definitely expected in 1973, and in Peru and Australia. In India, production has already started and should provide the country with roughly half a million tonnes of rock per year in the next few years, with the possibility of modest eventual expansion. There is little doubt that, as soon as prospects for the phosphate fertiliser industry begin to recover, there will be further corresponding expansion of phosphate rock supplies. This will entail continuing pressure on rock prices and may tend to retard the trend towards processing the phosphate at its point of origin or at the site of sulphur production, because it may prolong the viability of small phosphoric acid plants - and also single superphosphate plants - particularly in Western Europe. Alternatively, it will favour the creation of large phosphoric acid plants at locations in the industrialised countries, such as the Rotterdam area, where manufacturers can benefit from low freights on large vessels to import raw materials.

VIII Conclusion

There is a degree of uncertainty about the present rapidly changing situation which demands close, continuous study. Phosphate rock producers and phosphate fertiliser manufacturers share the common problem of how to improve profitability, never lower than in the last few years, and they are increasingly aware of their world-wide interdependence. They must undoubtedly make serious attempts to co-ordinate development internationally, not by the formation of restrictive cartels and commercial groupings - although these may have a part to play - so much as by promoting a commonly recognised assessment of market possibilities, a mutual understanding of regional problems and differences, and a common approach to international problems such as aid to developing countries, import tariffs, and environmental questions. Willingness to co-operate must involve much greater international consultation and communication. Studies such as those of the T.V.A. and O.E.C.D., and the world-wide forum provided by a representative body such as ISUA, should serve as the basis for such co-ordination.

-.-.-.-.-.-.-.-.-.-.-.-.-.-.-

References

1. R. Ewell
"World Survey of Fertilizer Production, Consumption and International Trade"
UN Interregional Seminar on the Production of Fertilizers, 1965

2. R. Coleman
"Projected World Use of Plant Nutrients"
TVA Symposium, 1965

3. K.L.C. Windridge
"Rock Phosphate: Trends in Supply and Demand in Relation to World Requirements in 1970"
UN Interregional Seminar on the Production of Fertilizers, 1965

4. J.R. Douglas and E.A. Harre
"World Phosphate Fertilizer Production Capacities"
ISMA/Sulphur Institute Symposium, May, 1971

5. G.R. Allen
"The Marketing and Distribution of Fertiliser"
ISMA Annual Conference, May, 1971

6. T.P. Hignett
"Characteristics of the World Fertiliser Industry - Phosphate Fertilisers"
UN International Symposium on Industrial Development, 1967

7. J.P. von Suchtelen
"Sea Freights and other Transport Costs affecting the Fertiliser Industry"
ISMA Annual Conference, May, 1971

8. R. Coleman
"Future World Phosphate Consumption"
ISMA/Sulphur Institute Symposium, May, 1971

9. Tennessee Valley Authority
"Estimated World Fertiliser Production Capacity as Related to Future Needs"
June, 1970

10. UNIDO
"Second Development Decade Report - Fertiliser Industry"
1971

11. OECD
"World Production, Consumption and Trade in Rock Phosphate and Phosphate Fertilizers - the Role of International Aid"
1971

10. 2. 72