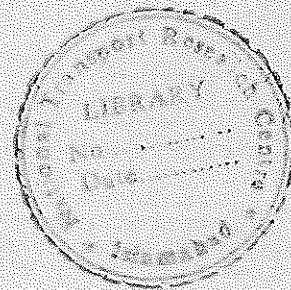


NATIONAL TRANSPORT RESEARCH CENTRE

REVIEW OF PORT TRAFFIC FORECASTS WITH
PARTICULAR REFERENCE TO FERTILIZER IMPORTS



No. NTRC-45

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REVIEW OF PORT TRAFFIC FORECASTS

Introduction:

A number of port traffic forecasts have been made* in the recent past by agencies concerned with planning and development of ports and shipping facilities, in the country including Planning Division, Port Authorities, international aid giving agencies, etc. Except for the forecasts prepared by the NTRC all other forecasts have been carried out through local and foreign consultanting appointed for carrying out feasibility studies for construction and improvement of port facilities. This leaves scanty residual knowledge with the concerned agency and therefore new forecast has been made for every small or large project.

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- *1. Port of Karachi Master Plan (Traffic Forecast) 1967, Economists Intelligence Unit, London.
 2. Economic and Engineering Feasibility Study for a second Port in Pakistan by Zafar and Associates July, 1967, Karachi-Lahore.
 3. Report of Phitti Creek Construction Project by Overseas Technical Coop. Agency, February 1973, Government of Japan.
 4. Port of Karachi Expansion Feasibility Study, August 1973 by Van Houten Associates, in association with EIU.
 5. Port Traffic Forecasts, 1975, United Consultants Ltd., Pakistan.
 6. Cargo Port Traffic Forecasts for Pakistan, 1976, Planning and Development Division, Islamabad.
 7. Forecast of Seaborne Trade for Pakistan, 1978, Woods Gordon and Co. and National Engineering Services of Pakistan Ltd., commissioned by Swan Wooster Engineering Co. Ltd.
 8. A National Port Policy, 1979, Dr. R.D. Osmers, Adviser to the Government of Pakistan.
The list is not exhaustive.

Most of the forecasts essentially follow the same approach in that they estimate domestic requirements on the basis of such objectives as self sufficiency in food, per capita incomes, etc., and determine production targets envisaged in the development plans for major commodities. On the basis of these magnitudes export/import surpluses/deficits are worked out as constituting port traffic.

Various forecasts made at different times reflect plans and policies as existing at the time each forecast was made. Plans and prospects change from time to time and such changes necessitate review of forecasts. Such a review is also essential for updating the data periodically.

This review has been necessitated by significant increase in the import of fertilizers over the last few years and therefore examines in detail the prospects of consumption, production and import/export deficit/surpluses of fertilizers. However, before doing so, overall traffic forecasts have been reviewed briefly.

Overall Traffic Forecasts.

The most recent work on traffic forecasts has been done by Dr. Osmers who worked with NTRC for 3 years to advise the Government on ports and shipping. His Final Report entitle "A National Port Policy" contains

forecasts up to the year 2020. A brief description of these forecasts particularly covering scope and methodology followed is given below.

These forecasts classify the port traffic into three main categories according to their handling characteristics, as follows.

- (i) Bulk/Semi Bulk, (including wheat, cement, fertilizer/rock phosphate, rice, coal, coke, iron steel.)
- (ii) General Cargo; and
- (iii) Liquid Bulk.

Past trends from 1966-67 to 1979-80 are analysed for individual bulk commodities indicated above and for General Cargo and Liquid Bulk categories. On the basis of these trends, projections of Bulk and General Cargo categories have been made upto the year 2020 at 3.5% p.a growth rate.

The year 1978-79 and 1979-80 for which information was available were not used as base as these years were not normal with regard to port traffic due to large imports of wheat, etc. Instead the most typical values observed in the recent past were used as base for 1978.

The projections for Bulk cargo provide two alternatives. One assumes a constant growth rate of 3.5% p.a while the other assumes higher growth rate in the initial years. The line of higher growth rate takes off from the trend line in the second year which is 1980 and again joins the trend line in the year

2000. Thereafter one trend line proceeds onwards. These forecasts are attached as Annexure I.

The requirements of berths have also been considered by Dr. Osmers. His calculations indicate that given proper utilization of existing facilities, available berths will be more than sufficient for the projected amount of traffic upto the year 2020.

The above referred forecasts are hardly one year old and during this period no significant change in our plans and policies has taken place. It is difficult to improve upon this work at this stage. These forecasts should therefore continue to be followed. The position of specific commodities may, however, be reviewed when so required.

The Problem:

The specific problem at hand relates to development of bulk handling facilities at Qasim Port for fertilizer imports. The position with regard to fertilizer imports may therefore be examined in detail, at this stage.

Fertilizer Imports:

The imports of fertilizers including rock phosphate have increased four-fold over the last five years rising from 0.35 million tons in 1974-75 to more than 1.5 million tons in 1978-79. The imports in 1979-80 have slightly declined to 1.4 million tons. Details are given in Annexure II.

NFDC Preliminary Estimates.

The preliminary estimates of fertilizer import requirements, 1978-79 to 1989-90, prepared by the National Fertilizer Development Centre (NFDC) in December 1979* provided five alternatives. These are shown in Annexure III. The following points may be noted concerning these projections.

- (i) The base year figures for 1979-80 for all the alternatives, except alternative IV, are less than actual imports during the year. The alternative IV is however quite near to actual imports during 1979-80.
- (ii) Projections for 1989-90 under alternative II and III are slightly above the current years actuals. Alternatives I, IV, V envisage imports of 2.88 million 2.67 million and 1.95 million tons respectively. These projections result in growth rates of 7.4%, 6.5% and 3.3% over actual imports during 1979-80.

* National Fertilizer Development Centre, "Fertilizer Situation Report 3 - Estimates of Pakistan's Imports requirements of fertilizer, 1978-79 to 1989-90.

NFDC FINAL ESTIMATES:

The NFDC have now come out with their final estimates* of fertilizer requirements of indigenous supply and shortfall upto 1989-90. These are shown in Annexure IV. It would appear that the shortfall to be met by imports will increase from 1.94 million tons in 1979-80 to 3.75 million tons in 1984-85 and 5.833 million tons in 1989-90.

The following important points may be noted with regard to NFDC projections:

- (i) The short fall to be met by imports is based on difference between the domestic production capacity and most desirable level of fertilizer inputs technically possible. They reflect desires based on potential requirements rather than effective demand.
- (ii) The projections bear no relation to availability of resources. The cost of imports for 1989-90 is nearly equal to present export earnings. If the export earnings double up

* National Fertilizer Development Centre, Fertilizer Situation Report - 6 proposed Targets for Fertilizer consumption in Pakistan and supply/demand by 1989-90, May, 1980.

over the next 10 years, the fertilizer import bill will still consume 50% of the export earnings which is a very high proportion. The last five year's average bill of fertilizer imports was less than 10% of export earnings.

(iii) Physical constraints have also not been taken into account. If the import target of 5.833 million tons is accepted, it is estimated that at least 20 additional goods trains will be required from Karachi to up country daily. This is more than the existing level of overall traffic from Karachi and not within the capacity of the Railways in the near future. These will thus be need for not only increase in handling facilities at the port, but also increase in inland transport facilities.

(iv) The projections suffer from the usual drawback of not taking into account cost and price aspects. The demand for fertilizers is a function of its own price, prices of other inputs, resulting outputs and income levels. Rapid changes in these variables are not likely to take place. As such sudden increases in the import of fertilizers may be difficult to realise.

In view of the above the NFDC projections appear quite ambitious and difficult to realise within the given time horizon due to physical, financial and economic constraints.

Actually, the NFDC projections are not intended to be the estimates of port traffic. These are only the "proposed targets" which have yet to be considered and accepted. They are rather indicative of deficiency with respect to the most desirable and technically possible level which could be aimed at for the development of domestic production capacity, etc.

In view of the above it would be reasonable to project imports on the basis of past trends in consumption and production of fertilizers. These are examined below.

Past Trends.

The production, imports and consumption of fertilizers from 1962-63 to 1978-79 are shown in Annexure V. The difference between consumption and production is made up by imports. However, production and imports do not add up to consumption for each year partly due to time lags and partly due to changes in stocks. However, taking one year with another, production and imports would add up to consumption. The underlying trends in production, consumption and imports have been analysed below.

Production:

Production increased from 41 thousand nutrient tons in 1962-63 to 133 thousand nutrient tons by the turn of the decade in 1969-70, 327 thousand nutrient tons in 1974-75 and is estimated at 439 thousand nutrient tons during 1979-80.

The projects at various stages of implementation are expected to increase production from 439 thousand nutrient tons in 1979-80 (Urea 391 and phosphate 48) to 1045 thousand nutrient tons in 1984-85 (Urea 971 and phosphate 74). From 1984-85 to 1989-90, no increase in production has been assumed although there will be large demand and considerable potential exists for further increase in production. Nevertheless in view of the fact that project have long gestation period, it is assumed that production of 1845 thousand nutrient tons resulting from completion of projects in hand will continue upto 1989-90.

In our previous forecasts of 1974-75, production was estimated at 1.2 million nutrient tons in 1979-80 increasing to 2.4 million tons in 1989-90. Our present production level and plans in hand are much below this level. Production is now expected at 1.045 million tons in 1984-85, and plans for further increase are not yet in hand. It may therefore be assumed that increase in in production upto 2.4 million nutrient tons will now

be achieved by year 1994-95/1999-2000.

Consumption:

The consumption of fertilizers which was less than 100 thousand nutrient tons upto 1965-66, increased to more than 300 thousand tons in 1969-70. After slightly declining to 283 thousand nutrient tons in 1970-71, the consumption again increased to 425 thousand nutrient tons in 1974-75 and stood at 880 thousand nutrient tons during 1978-79.

The increase in consumption from 1969-70 to 1978-79 provides a growth rate of 12.2 percent per annum. However, due to year to year fluctuations, the growth rate will very depending upon the base year chosen. The variation will however be on the higher side in most of the cases.

In absolute terms the increase over the period 1969-70 is less than 600 thousand nutrient tons. The consumption of fertilizer in the country as compared to other countries is still very low.

Imports:

A major proportion of increase in consumption has been provided for by imports which have increased from an insignificant amount of 3000 nutrient tons in 1962-63 to 703 thousand nutrient tons in 1978-79. During 1965-70 and 1970-75 periods average annual imports stood at 150 and 175 thousand tons respectively.

However, during the last four years imports have increased nearly fourfold from 183 thousand nutrient tons in 1975-76 to 702 thousand nutrient tons in 1978-79.

The fluctuations in imports are greater than in consumption or production. The growth rates would therefore differ widely depending upon the choice of base year. However, taking three years moving average the growth rate for 1969-70/1977-78 comes to about 12% p.a. The increase in production over 1969-70/1977-78 from 133 to 365 thousand tons also provides a growth rate of 12% p.a. approximately.

In absolute terms imports increased from 350 thousand tons in 1974-75 to 636 thousand tons in 1977-78 and 1536 thousand tons in 1978-79. In 1979-80, imports have slightly declined to 1413 thousand tons.

Projections:

Forecasts can be made, among other things, by projecting past growth rates, by fitting a trend line or by providing for a constant increase. Each of these methods have been tried and their results evaluated, adopting the one that appears more reasonable.

The methodology followed is the usual one i.e., first consumption of fertilizers for future years has been estimated by alternative methods. Then by deducting domestic planned production, the import requirements have been worked out.

Growth Rates:

One of the problems for determining the growth rate is the choice of base year particularly when there are year to year fluctuations. For example, the consumption of fertilizers during 1969-70 is higher than during the preceding or succeeding years. Thus the use of 1969-70 as base year would provide a lower growth rate (12.4% p.a) than over 1968-69 (13.6% p.a) or 1970-71 (15.2% p.a). This difficulty can be overcome by taking a moving average. Thus the growth rate in fertilizer consumption over the period 1969-70/1977-78 on the basis of three years moving average on both sides come to 13% p.a. Similarly, increase in imports and production over the same period and on the basis of three years moving average amounts 12.3% p.a and 13.8% p.a. respectively.

Even if year to year fluctuations are smoothed out, the problem for projecting past growth rates continues. It will be noted that consumption, production and import of fertilizers have increased from a very small base. This results in high growth rates which, if applied to a base which has been enlarged, will result in very

large increases. Thus, the growth rate of 13% p.a. will increase the consumption of fertilizers from 880 thousand nutrient tons in 1978-79 to 3.375 million nutrient tons in 1989-90. This will result in an import deficit of 2.33 million nutrient tons which when converted into physical quantities would amount to 8.8 million tons.

This is certainly a very high and un-realistic estimate. The quantities are more than what has been estimated by NFDC on the basis of potential requirements for each acre and every crop. The projection of base growth rate achieved in the past over a small base is not worth further consideration and is therefore discarded.

Trend Line.

A more formal and systematic method of forecasting is by fitting a trend line statistically. Accordingly, a straight line of a form $Y=a+bx$

Where Y = Consumption in any one year.

X = Time period years.

a = Intercept.

b = Coefficient.

was fitted by method of least squares using consumption data for the last nine years from 1970-71 to 1978-79 contained in Annexure IV. The data for earlier years has not been used as quantities in these years are very small and would have depressed the coefficients.

Regression Analysis:

Separate regressions were run for each type of fertilizer, i.e Nitrogenous, Phosphatic and Potassium varieties. Details are shown in Annexure VI. The summary of results is as follows:

Results of Regression Analysis.

$$\begin{aligned}
 Y_{\text{Nit.}} &= 431 + 45 X \quad \dots (R^2 = .80) \\
 Y_{\text{Phos.}} &= 89 + 19.5X \quad \dots (R^2 = .92) \\
 Y_{\text{Pot.}} &= 3 + 0.72 X \quad \dots (R^2 = .74)
 \end{aligned}$$

By putting the values of X with 1974-75 as zero. Projections for any of the years can be made. Accordingly, using the above equations, forecasts of consumption for 1989-90 for each type of fertilizer have been arrived at. Then by deducting the planned domestic production, import requirements have been worked out in the following table. Forecasts of consumption for 1995-2000 have also been indicated.

Forecasts of Consumption and Import Requirements for 1989-90.

(000 Nutrien Tons)

| <u>1989-90</u> | <u>Nit.</u> | <u>Phos.</u> | <u>Potash</u> | <u>Total</u> |
|---------------------|-------------|--------------|---------------|--------------|
| Consumption | 1106 | 382 | 28 | 1516 |
| Planned Production | 971 | 74 | - | 1015 |
| Import Deficit | 134 | 308 | 28 | 470 |
| Physical quantities | 291 | 1339 | 60 | 1690 |
| <u>1999-2000</u> | | | | |
| Consumption | 1556 | 577 | 100 | 2233 |

The above forecasts provide an increase in consumption from 880 thousand nutrient tons in 1978-79 to 1516 thousand tons in 1989-90, resulting in a growth rate of 5% p.a. The forecasts for the year 2000 are quite close to projections made in 1974-75 forecasts for 1989-90. Since our present consumption is much below the level envisaged in 1974-75 targets for 1989-90, set before may now be expected to be achieved ten years later. Production targets have however not been assumed upto the year 2000 as it is assumed that future production will keep pace with domestic requirements.

Constant Increase.

Projections can also be made by assuming an increase of a constant amount which may be determined on the basis of past trends or some other indications. This method provides increase in arithmetic progression which is the case with agriculture and industrial production. When the base is small, a constant increase provides a higher growth rate which tapers off as the base is enlarged.

Alternate Projections.

Accordingly, alternate estimates of fertilizer consumption up to 1989-90 have been made by assuming a constant annual increase based on past average. However, due to year to year fluctuations, the base year figures have been taken as three years average. Then, as in the

preceding case, by deducting the planned domestic production from estimated requirements, the estimates of imports for 1989-90 have been worked out as follows.

Alternate Projections and Import requirements for 1989 - 90:

| | <u>Nit.</u> | <u>Phos.</u> | <u>Total.</u> |
|-------------------------------------|-------------|--------------|---------------|
| 1968-69 (3 years average) | 220 | 30 | 250 |
| 1978-79 (Actual) | 692 | 188 | 880 |
| Increase | 472 | 158 | 630 |
| Proportionate Increase upto 1989-90 | 519 | 174 | 693 |
| Consumption 1989-90 | 1211 | 362 | 1573 |
| Domestic Production | 971 | 74 | 1045 |
| Import Deficit | 240 | 288 | 528 |
| Physical Quantity | 522 | 1252 | 1774 |

The above estimates provide increase in consumption from 0.88 million nutrient tons in 1978-79 to 1.573 million nutrient tons in 1989-90. This is slightly higher than the amount provided by trend line method (1.516) million nutrient tons). The resulting import deficit converted into physical quantities works out to 1.774 million tons as compared to 1.69 million tons provided by the trend line.

The difference between the two methods is insignificant. The trend line method is a formal way of projecting past trends into the future. However, the alternate method of providing increase of constant amount

is more simple and straight forward. It works well when the base is small.

Forecasts of Fertilizer Imports:

Accordingly, using the alternative method, the following forecasts have been made. These are also shown in the graph at Annexure VII.

Forecasts of Fertilizer Imports
(000 nutrient tons)

| <u>Year</u> | <u>Consumption</u> | | | <u>Production</u> | | | <u>Imports</u> | | | <u>Product Tons</u> |
|-------------|--------------------|-------------|--------------|-------------------|--------------|--------------|----------------|-------------|--------------|---------------------|
| | <u>Nit.</u> | <u>Phos</u> | <u>Total</u> | <u>Nit.</u> | <u>Phos.</u> | <u>Total</u> | <u>Nit.</u> | <u>Phos</u> | <u>Total</u> | |
| 1979-80 | 740 | 204 | 944 | 390 | 48 | 438 | 350 | 156 | 506 | 1430 |
| 1980-81 | 786 | 220 | 1006 | 548 | 64 | 612 | 238 | 156 | 394 | 1196 |
| 1981-82 | 833 | 236 | 1069 | 674 | 69 | 743 | 159 | 167 | 326 | 1072 |
| 1982-83 | 880 | 252 | 1132 | 850 | 74 | 924 | 30 | 178 | 208 | 839 |
| 1983-84 | 928 | 268 | 1196 | 911 | 74 | 985 | 17 | 194 | 211 | 880 |
| 1984-85 | 975 | 284 | 1259 | 966 | 74 | 1040 | 284 | 210 | 494 | 933 |
| 1985-86 | 1022 | 300 | 1322 | 971 | 74 | 1045 | 51 | 226 | 277 | 1093 |
| 1986-87 | 1069 | 316 | 1385 | 971 | 74 | 1045 | 98 | 242 | 340 | 1265 |
| 1987-88 | 1116 | 332 | 1448 | 971 | 74 | 1045 | 145 | 258 | 403 | 1437 |
| 1988-89 | 1137 | 347 | 1484 | 971 | 74 | 1045 | 166 | 273 | 439 | 1548 |
| 1989-90 | 1211 | 362 | 1573 | 971 | 74 | 1045 | 240 | 288 | 528 | 1773 |

The above forecasts envisage an increase in consumption from 0.944 million nutrient tons in 1979-80 to 1.259 million nutrient tons in 1984-85 and 1.573 million nutrient tons in 1989-90. This provides a growth rate of 5.9% p.a. over 1979-80/1984-85 and 4.5% p.a. over 1984-85/1989-90.

Production is planned to increase more than three fold from 0.438 million nutrient tons in 1979-80 to 1.034 million nutrient tons in 1984-85 and 1.045 million nutrient tons in 1989-90. Most of the projects in hand will be completed by 1984-85 and there will be no increase over the next five years unless new projects are taken up in the meantime.

The production of nitrogenous fertilizers will catch up with consumption requirements upto 1984-85. Thereafter a deficit will again develop due to increase in demand and production remaining constant. The production of phosphatic fertilizers will increase from 48000 nutrient tons in 1979-80 to 74,000 nutrient tons in 1982-83 and is assumed to remain at the same level upto 1989-90 as no further increase in production is yet planned. Accordingly, the import requirements will first decrease from 0.506 million nutrient tons in 1979-80 to 0.208 million nutrient tons in 1982-83 but will again increase to 0.528 million nutrient tons upto 1989-90. This is about the present level.

In physical terms imports will decrease from 1.44 million tons in 1979-80 to 0.839 million tons in 1982-83 but will increase to 1.774 million tons upto 1989-90. This is quite near the present level. The obvious reason are that there will be a substantial increase in production capacity in the near future which will meet a large part of demand. Most of the deficit is projected in phosphatic varieties which will constitute 2/3rd of imports in 1989-90.

There is discrepancy in figures of fertilizer imports contained in the Pakistan Economic Survey issued by the Ministry of Finance and Port Traffic Statistics compiled by the KPT. The Economic Survey indicate, imports of 0.702 million nutrient tons (0.481 million Nitrogen and Potash 0.221 million phosphate). These figures converted into physical quantities at the rate of 46% and 23% nutrient content add up to more than 2.0 million tons. On the other hand, The Port Traffic show imports of 1.536 million tons in 1978-79. The difference may be due to differences in methodology. For example, one figures might be based on orders, while the other on quantities handled and there can be considerable difference between the two. The two sets of figures need to be reconciled.

Long Term Prospects.

Beyond the year 1989-90, it is assumed that demand will further increase to 2.4 million nutrient tons

by the year 2000. It is also assumed that production will also increase to meet the requirements. There is great potential for increase in production of nitrogenous fertilizers. The out put of phosphate varieties are likely to remain deficient. There is also possibility of exporting Nitrogenous fertilizers in the long run. It is however difficult to predict local production capacity. However, it is assumed that by the year 2000 imports of phosphatic fertilizers will be slightly higher than the present level while there will be exports of nitrogenous varieties in the long run. The physical quantities may remain between 2.00 and 2.5 million tons.

Comparison with Earlier Forecasts:

A comparison between the present forecasts and those made earlier by the Planning Division in 1974-75 is given below.

Comparison with Previous Forecasts.

| | <u>Previous Forecasts</u> | | | <u>Present Forecasts</u> | | |
|-----------------------------|---------------------------|--------------|--------------|--------------------------|--------------|--------------|
| | <u>Nit.</u> | <u>Phos.</u> | <u>Total</u> | <u>Nit</u> | <u>Phos.</u> | <u>Total</u> |
| <u>Consumption:</u> | | | | | | |
| 1979-80 | 900 | 300 | 1200 | 660 | 220 | 880 |
| 1989-90 | 1800 | 600 | 2400 | 1120 | 382 | 1573 |
| <u>Production:</u> | | | | | | |
| 1979-80 | 1164 | 180 | 1344 | 337 | 29 | 365 |
| 1989-90 | 2000 | 600 | 2600 | 971 | 74 | 1045 |
| <u>Exports:</u> | | | | | | |
| 1979-80 | 250 | - | 250 | - | - | - |
| 1989-90 | 435 | - | 435 | - | - | - |
| <u>Imports:</u> | | | | | | |
| 1979-80 | - | 770 | 770 | 435 | 221 | 702 |
| 1989-90 | - | - | - | 240 | 288 | 528 |
| <u>Physical Quantities:</u> | | | | | | |
| 1989-90 | - | - | - | 522 | 1252 | 1774 |

The differences between the two forecasts are self evident. However, the main features are briefly described below.

(i) Requirements.

The previous forecasts envisaged consumption in 1979-80 at 1.2 million nutrient tons and 2.4 million nutrient tons in 1989-90. The latter figure is any slightly lower than requirements worked out by NFDC which are 2.96 million nutrient tons.* As compared to the above, the actual consumption during 1978-79 was 0.88 million nutrient tons. The target for 1979-80 was 1.0 million nutrient tons. The projections for 1989-90 now made are 1.573 million tons.**

It may also be added that estimates of requirements made under by NFDC for 1989-90 stand at 2.63 million nutrient tons#

(ii) Production.

The difference in production estimated before and envisaged now is more significant. Earlier forecasts estimated production in 1979-80 at 1.344 million tons. However, actual production during the year is estimated at 0.439 million nutrient tons.

* Annexure - VI.

** Table on P.17 Row 2.

Annexure-IV - Add Nitrogen and Phosphate.

Most of the projects under implementation when the previous forecasts were made, have still not been completed. Production in 1980-81 which in the previous forecasts was envisaged at 2.6 million nutrient tons is now expected to be 1.045 million nutrient tons only. This include only on-going projects which will be completed by 1985-86. No new projects have been taken in hand.

(iii) Port Traffic:

It would be evident from the above that previous forecasts envisaged production in 1989-90 at 2.6 million nutrient tons and consumption at 2.4 million nutrient tons. This resulted in an export surplus of 0.2 million nutrient which converted into physical quantities amounted to 0.435 million product tons.

The production of fertilizers not having increased according to original plans, the present forecasts provide for import of 0.528 million nutrient tons in 1979-80 inspite of the fact that consumption is now projected at much lower level.

In conclusion it can be said that earlier forecasts ambitiously projected a desirable course .

of action for substantial increase in agricultural production in general and self-sufficiency in food in particular. However, the resource constraints and other bottlenecks do not appear to have been fully taken into account. The increase in production has not taken place as originally planned. The on-going projects have been delayed for several reasons. Consequently, the consumption of fertilizers is much below the expected level.

The present forecasts, on the other hand, project past trends.

Limitations:

It may be emphasised at this stage that production, import and distribution of fertilizers is controlled by the Government and depends upon its policies which are difficult to predict. For example, agricultural production may command higher priority and the Government may decide to import much larger quantities next year on the imports may be constrained by limitations of foreign exchange. In such circumstances, forecasts based on statistical probabilities may not hold. It may, therefore, be preferable to follow plans and policies of the Government.

Unfortunately, the concerned Government agency namely, NFDC have not yet provided firm estimates of their requirements or have not translated

their requirements into effective demand which could form basis for planning port capacities. Therefore, a close contract and coordination with the NFDC is called for. The present forecasts should be reviewed as and when more realistic targets of fertilizer imports become available.

It would also not be out of place to mention here that normally forecasts provide long term trends and do not predict year to year fluctuations. The actual observations would normally oscillate around the trend line. It would therefore not be fair to expect any long term forecasts to tally with year to year changes.

Significance of Forecasts.

Before concluding, the level of accuracy needed for our forecasts may be explained. This will depend upon the problem in hand. Our main purpose is to determine the port capacity. This is a discontinuous variable i.e. capacity increases in large indivisible amounts.

The capacity of a berth without mechanical handling equipment at Karachi Port for semi bulk cargoes like rice and fertilizers is 2,500 tons per berth per day which on the basis of 75% occupancy amounts to about 0.7 million tons per year. This figure can be doubled by partial mechanisation like

conveyor belts, mechanical bagging etc. and out put can be increased to 2.5 to 3.0 million tons per year. More automation can further increase the through put.

In view of the above, it would not matter much if the forecast port traffic is 1.8 million tons or 2.8 million tons. The same type of facilities will be sufficient to handled the out put in this range.

However, much reliance should not be placed on absolute figures. The instalation of a particular type of handling equipment should depend upon savings in handling costs over the most likely alternative forgone it would therefore be necessary to carry out proper cost benefit analysis and sensitivity tests for various types of equipment at different traffic levels. This should rather reserve as guide for investment.

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PROTECTION OF DRY-CARGO THROUGHPUT, BERTH REQUIREMENT
 BERTH AVAILABILITY IN PAKISTAN - 1978-2020
 (TONNAGE FIGURES : IN MILLION METRIC TONS

| YEAR | G E N E R A L C A R G O E S | | | | | | | | | | | | | |
|------|-----------------------------|----|-----------------------------|-------|------------------|----|-----------------------------|---------------|------------------|------------------|---------------------|---------------------|---------------------|--|
| | Total Conventional | | | | | | | Containerized | | | | | | |
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | |
| | thru- put per year | % | thru- put per year | % | No. of berths | % | thru- put per year | % | No. of planes | No. of berths | tons per year | tons per year | tons per year | |
| 1978 | 2.5 | 92 | 2.3 | 0.150 | 15 | 8 | 0.2 | 0.250 | - | 1 | 3.3 | 3.3 | 0.800 | |
| 1980 | 2.7 | 88 | 2.4 | 0.170 | 14 | 12 | 0.3 | 0.500 | 1 | 1 | 3.5 | 5.0 | 0.850 | |
| 1985 | 3.2 | 78 | 2.5 | 0.190 | 14 | 22 | 0.7 | 0.750 | 2 | 1 | 4.2 | 5.5 | 0.925 | |
| 1990 | 3.8 | 68 | 2.6 | 0.205 | 13 | 32 | 1.2 | 0.750 | 3 | 2 | 4.9 | 6.0 | 1.000 | |
| 1995 | 4.5 | 58 | 2.6 | 0.220 | 12 | 42 | 1.9 | 0.750 | 4 | 3 | 5.9 | 6.5 | 1.100 | |
| 2000 | 5.3 | 48 | 2.6 | 0.235 | 11 | 52 | 2.7 | 0.750 | 6 | 4 | 7.0 | 7.0 | 1.200 | |
| 2005 | 6.3 | 38 | 2.4 | 0.250 | 10 | 62 | 3.9 | 0.750 | 8 | 6 | 8.3 | 8.3 | 1.250 | |
| 2010 | 7.5 | 28 | 2.1 | 0.250 | 9 | 72 | 5.4 | 0.750 | 11 | 8 | 9.8 | 9.8 | 1.250 | |
| 2015 | 8.9 | 18 | 1.6 | 0.250 | 7 | 82 | 7.3 | 0.750 | 15 | 11 | 11.7 | 11.7 | 1.250 | |
| 2020 | 10.6 | 08 | 0.8 | 0.250 | 4 | 92 | 9.8 | 0.750 | 20 | 13 | 13.9 | 13.9 | 1.250 | |

- Figures do not include cargoes for the Steelmill (ore, coal, coke) which are ha
 - "General Cargoes" : Cargoes usually transported in Liner vessels.
 - "(Semi-) bulk cargoes" : Cargoes usually transported in full shiploads (rice, w
 - Cargo volumes in column 2 and 12 are based on an average growth rate of 3.5% pe
 - Column 13 is an adjustment to column 12 to allow for rapid increase in volume

Annexure II

Fertilizers Import
000 tons.

| <u>Y e a r</u> | <u>Fertilizer</u> | <u>Rock Phos</u> | <u>Total.</u> |
|----------------|-------------------|------------------|---------------|
| 1970-71 | 261 | 28 | 299 |
| 1971-72 | 195 | 19 | 214 |
| 1972-73 | 398 | 45 | 447 |
| 1973-74 | 690 | - | 690 |
| 1974-75 | 339 | 11 | 350 |
| 1975-76 | 318 | 34 | 352 |
| 1976-77 | 510 | 26 | 536 |
| 1977-78 | 578 | 58 | 635 |
| 1978-79 | 1400 | 136 | 1536 |
| 1979-80 | 1237 | 176 | 1413 |

PRODUCTION, IMPORTS AND CONSUMPTION

| Year | PRODUCTION | | Total | IMPORTS | |
|---------|------------|-------|--------|---------|--------|
| | N | P | | N | P |
| 1962-63 | 39.95 | 1.07 | 41.02 | 3.11 | - |
| 1963-64 | 43.82 | 1.18 | 45.00 | 5.12 | - |
| 1964-65 | 46.61 | 1.44 | 48.05 | 3.20 | - |
| 1965-66 | 46.20 | 1.41 | 47.43 | 36.05 | - |
| 1966-67 | 50.75 | 0.71 | 51.46 | 106.40 | 16.40 |
| 1967-68 | 49.65 | 2.44 | 52.50 | 103.72 | 49.81 |
| 1968-69 | 78.60 | 2.44 | 81.14 | 118.12 | 32.57 |
| 1969-70 | 129.27 | 4.15 | 133.42 | 292.19 | 11.45 |
| 1970-71 | 140.13 | 4.41 | 144.64 | 107.81 | 38.55 |
| 1971-72 | 215.14 | 4.46 | 220.00 | 73.02 | - |
| 1972-73 | 274.52 | 6.22 | 282.74 | 115.59 | 72.11 |
| 1973-74 | 300.07 | 4.19 | 304.26 | 224.94 | 104.30 |
| 1974-75 | 320.60 | 6.30 | 326.90 | 105.53 | 21.88 |
| 1975-76 | 314.97 | 11.80 | 326.70 | 72.28 | 103.91 |
| 1976-77 | 312.30 | 13.40 | 325.70 | 132.81 | 139.16 |
| 1977-78 | 312.89 | 15.00 | 327.80 | 341.82 | 204.77 |
| 1978-79 | 336.60 | 28.90 | 365.50 | 471.09 | 221.40 |

Various alternatives to meet fertilizer short
by import. (Preliminary figures from NEDC)
(000 product tons)

| Year | First alternative | | | Second alternative | | | Third alternative | | | |
|---------|--------------------|-------|--------------------------|--------------------|-------|--------------------------|-------------------|-------------|--------------------------|-----|
| | SOP NY 23.23 | Urea | Total product tons | SOP 18.46 | Urea | Total product tons | SOP 11.45 | MAP Urea | Total product tons | |
| 1979/89 | 36 | 852 | 426 | 36 | 426 | 685 | 1,147 | 36 | 408 | 755 |
| 1980/81 | 50 | 1,000 | 115 | 50 | 500 | 420 | 970 | 50 | 479 | 501 |
| 1981/82 | 60 | 1,148 | 74 | 60 | 574 | 275 | 909 | 60 | 550 | 368 |
| 1982/83 | 70 | 1,330 | - | 70 | 665 | 143 | 735 | 70 | 637 | 35 |
| 1983/84 | 80 | 1,543 | - | 80 | 772 | - | 852 | 80 | 740 | - |
| 1984/85 | 96 | 1,757 | - | 96 | 878 | - | 974 | 96 | 842 | - |
| 1985/86 | 116 | 1,970 | - | 116 | 985 | - | 1,101 | 116 | 944 | - |
| 1986/87 | 138 | 2,122 | - | 138 | 1,061 | - | 1,199 | 138 | 1,017 | 72 |
| 1987/88 | 162 | 2,287 | - | 162 | 1,143 | - | 1,305 | 162 | 1,096 | 149 |
| 1988/89 | 184 | 2,465 | - | 184 | 1,233 | 28 | 1,445 | 184 | 1,181 | 228 |
| 1989/90 | 206 | 2,657 | - | 206 | 1,328 | 93 | 1,627 | 206 | 1,273 | 309 |

Based on November 1979 NEDC shortfall esti-
mated by computer as percent P₂O₅ Rock 33, MAP/DAP
import of rock phosphate required for Pak-
isthan included.

ANNEXURE-VI

REGRESSION ANALYSIS
FERTILIZER OFF-TAKE 000/NUTRIENT TONS

| <u>YEAR</u> | <u>X</u> | <u>NITROGEN</u> | <u>Y₂ PHOS</u> | <u>Y₃ POTOSH</u> |
|----------------------|----------|-----------------|---------------------------|-----------------------------|
| 1970-71 | -4 | 252 | 30 | 1.2 |
| 1971-72 | -3 | 344 | 37 | 0.7 |
| 1972-73 | -2 | 386 | 49 | 1.4 |
| 1973-74 | -1 | 342 | 58 | 2.7 |
| 1974-75 | 0 | 363 | 61 | 2.1 |
| 1975-76 | 1 | 445 | 103 | 2.8 |
| 1976-77 | 2 | 511 | 118 | 2.4 |
| 1977-78 | 3 | 550 | 156 | 6.0 |
| 1978-79 | 4 | 684 | 188 | 7.0 |
| Total | 0 | 3877 | 800 | 26.7 |
| Average | - | 430.7 | 88.9 | 2.9 |
| Sum of Sq | 60 | 1809071 | 95968 | 122.95 |
| Xy | - | 2699 | 1172 | 43.6 |
| Y=a+bx | | 431 | 89 | 372 |
| a=y | | | | |
| $b = \frac{XY}{X^2}$ | | 45 | 20 | 1 |
| R ² | | .87 | .92 | .72 |
| Projections: | | | | |
| 1989-90 | 15 | 1106 | 389 | 18 |

FORECASTS OF FERTILIZER IMPORTS

(000 NUTRIENT TONS)

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Annexure - VII

